



**Maintenance Performance Index (MPI)
and
Performance Based Maintenance Index (PBMI)
Field Assessment Manual**

Version 1.2, Updated 07/26/24

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Version History

Version	Date	Comments
1.0	06/18/2024	
1.1	07/08/2024	• Section 3.1 QA Inspections: Added • Section 4.3.6 Rating Segment Along a Divided Highway: Clarified evaluation guidance • Section 4.3.4 Rating Segments on a Ramp: Clarified evaluation guidance • Section 5.1.3.4 Joint Material: Clarified evaluation guidance • Section 5.4.1.2 Vertical Clearance: Deleted • Section 5.4.1.6 Road Offset: Modified criteria
1.2	07/26/2024	• Section 5.2.1.2 Drop-Off: Modified inspection guidance. • Section 5.6.1.11 Installation (Breakaway Support): Clarified inspection guidance. • Section 5.5.2 Guardrail: Clarified criteria • Section 5.6.1.2 Visibility (Damage): Clarified evaluation guidance • Section 5.2.2.2 Erosion: Clarified evaluation guidance • Section 5.1.1 Flexible Pavement Travel Lane: Clarified evaluation guidance • Section 5.1.3 Paved Shoulders: Clarified evaluation guidance • Section 5.5.4 Control Access Fence: Clarified evaluation guidance • Section 5.4.1.2 Vertical Clearance: Added • Section 5.4.1.6 Road Offset: Modified criteria

SECTION 1: PREFACE

This manual is designed to assist personnel responsible for conducting field assessments for the Maintenance Performance Index (MPI) and Performance Based Maintenance Index (PBMI) Programs. Instructions on the collection and reporting of assessment data are provided, as well as detailed descriptions, examples, and illustrations of the assets to be evaluated.

The MPI and PBMI are methods of conducting assessments of maintenance assets to determine the overall condition of assets within the roadway network. The information obtained from these assessments is used to plan and prioritize maintenance activities. The aim of these programs is to provide a uniform level of service across the state and to meet established departmental policies. Annual training is strongly recommended for anyone who is involved in conducting condition assessments.

The programs consist of condition assessments along randomly generated 10th mile (528 feet) segments along the roadway. Segments will be generated in sufficient quantity to ensure samples represent overall asset condition throughout the maintenance area.

The criteria provided in this manual is used to evaluate each individual asset. If an asset meets the criteria, it is coded as “PASS”. If it does not meet the criteria, it is coded as “FAIL”. PASS/FAIL results are aggregated across a common 0 to 100 Level of Service (LOS) scale and used to derive maintenance performance of individual assets within the network. Maintenance performance is captured at the characteristic, i.e., an individual asset, level, the element, i.e., a group of related assets, level, and system level, i.e. interstates or state routes within established boundaries.

The assessments are divided into six (6) maintenance element groups:

1. Pavement
2. Unpaved Shoulder and Ditch
3. Drainage
4. Roadside
5. Roadside Appurtenances
6. Traffic

Each of the six (6) maintenance element groups are subdivided into a collection of related characteristics. For example, the “Drainage” element group consists of the following characteristics:

1. Pipes
2. Inlets
3. Miscellaneous Drainage Structures
4. Curb and Gutter

The MPI and PBMI Assessment Forms list each characteristic that is to be evaluated in the condition assessments. This manual details the specific criteria to be used when conducting maintenance assessments on each asset.

SECTION 2: TERMINOLOGY

REGION – The TDOT Region where the segment is located.

DISTRICT – The District within the Region where the segment is located.

SEGMENT ID – The number that uniquely identifies the roadway segment that is to be inspected.

INSPECTOR – The name of the lead inspector performing the condition assessment.

SYSTEM TYPE – Classification of the roadway based upon the type of maintenance that is applied to the roadway segment.

INSPECTION PERIOD – The month and year within which the assessment must be performed.

DATE OF INSPECTION -The month/day/year that the segment was inspected.

COUNTY – Identifies the county in which the segment to be rated is located.

ROUTE – Identifies the state route or interstate on which the segment is located. Interstates begin with the letter “I” and state routes begin with the letters “SR”. The last three digits are the route number.

BEGIN ML – Beginning mile log of the segment to be inspected.

END ML – Ending mile log of the segment to be inspected.

MAINTENANCE ELEMENT – A part of the highway system that requires maintenance (e.g., Pavement, Unpaved Shoulder and Ditches, Drainage)

CHARACTERISTIC – Part of a maintenance element that, when combined with other characteristics, composes the maintenance element. Each characteristic has a performance threshold that determines the deficiency status. Not all characteristics may be present in every roadway segment.

LEVEL OF SERVICE – Ranking classification given to a specified asset.

CONSTRUCTION WORK ZONE – A part of the roadway that is under construction and is defined as follows: from the “Work Begins 500 ft. Ahead” or “Road Work Next X miles” sign to the “End Work Zone” sign. Construction zones are considered active until all construction signs and construction barrels have been removed.

INTERSECTION – A portion of the roadway in which a stopping condition is present for all routes.

INVENTORY – The total quantity of a specified roadway characteristic that is represented in the evaluation.

DEFICIENCY – The total quantity of a specified roadway characteristic that does not meet the established criteria.

SECTION 3: ASSESSMENT SAMPLE COLLECTION

Each year, a current inventory of state-maintained roadway segments is extracted from the Tennessee Roads and Highways Linear Referencing Database and broken into 0.10-mile (528 feet) segments. Sample segments that are not compatible with the inspection programs are excluded from selection, such as segments containing a bridge that exceeds 250 feet in length along the roadway centerline. If a roadway segment is expected to be under construction for an extended period, it may also be excluded from selection at the request of the District Operations Supervisor by notifying the HQ Asset Management Office. The remaining segments are populated with location and facility information and checked to ensure there is no overlap between segments, ensuring assets are not double counted. A sample of the generated segments are selected for inspection at random by the TDOT Asset Management Office. The results of this generation are posted each year in the application.

All inspections should be completed via the TDOT MPI and PBMI applications. Maintenance Assessment Forms should be fully completed and uploaded to the application by the final day of each inspection period. Upon completion of the inspection form, calculations are performed by the database and the results are published on the program summary Power BI dashboard.

3.1 QA INSPECTIONS

For PBMI, a subset of segments will be randomly flagged for quality assurance (QA) inspections. These QA segments will be distributed to TDOT QA inspectors for re-inspection. The QA segments are used to verify the accuracy of the information being provided to TDOT and are conducted during every inspection period.

TDOT will notify contractors 2 day prior to QA inspections occurring, however, contractors will not be given advanced notice of the specific segments undergoing QA inspections.

While contractors may attend QA inspections to ensure all staff agree on the inspection outcome, they are not permitted to fix any issues that are present during the QA inspection. If the contractor is not present at the QA inspection, they waive their right to dispute the inspection outcome.

SECTION 4: DATA COLLECTION

4.1 CREW ORGANIZATION AND RESPONSIBILITIES

Individuals that conduct maintenance assessments should be knowledgeable in all highway maintenance activities and must have completed the relevant inspection training.

Maintenance Assessment Forms should be completed via the mobile electronic form accessed in TDOT's MPI and PBMI Applications, which are in TDOT's ArcGIS environment. The form must be accurate and fully completed according to the condition standards in this manual. Personnel should only use the paper version of the inspection forms when the application is not accessible.

4.2 SAFETY

The safety of inspection personnel and the motoring public shall be the highest priority for all staff involved in maintenance programs. **Under no circumstance shall the inspector enter a travel lane to evaluate an asset.** All inspection activities shall be conducted from the shoulder. Personnel shall conduct all condition assessments while facing traffic to ensure safety and awareness.

On occasion, it may be necessary to schedule the inspection of high-traffic roadway segments during low-traffic periods to ensure safety. When necessary, appropriate traffic control procedures should be arranged during inspections.

4.3 LOCATING, MARKING, AND MEASURING SEGMENTS

Segments are located using the Field Maps Application within TDOT's ArcGIS Online Environment. The map contains an aerial imagery base map and shows the real-time location of the user in relation to the segments. Inspectors will use the mapping feature to identify the exact location and direction of the segment to be inspected. Mile posts should not be used to locate segments.

Once a roadway segment is properly located in the field, it should be clearly marked with white spray paint from the beginning log mile to the ending log mile. Segments should be marked on the outside shoulder.

Under no circumstances should an inspector cross travel lanes to mark the segment on both sides of a roadway.

The beginning and ending points should be marked appropriately, at the edge of pavement, to designate the boundaries of the inspection. The roadway segment should be clearly identified by including the Segment ID Number and directional arrows indicating the direction the assessment is to be conducted.

Once the beginning of a segment has been clearly marked in white spray paint along the roadway with appropriate directional arrows, the segment is to be measured 0.10 mile (528 feet) with the use of a measuring wheel. Vehicle odometers **should not** be used as they do not provide sufficient accuracy to ensure the segment has been measured properly. Once the ending point of the segment is reached, it should be marked in the same manner as the beginning point.



Figure 1: Segment Identification Marking

4.3.1 INCORRECTLY MARKED SEGMENTS

If a segment has been previously identified and marked by TDOT or the QA consultant, the person who arrives and finds existing markings should verify the segment is correctly marked before performing his/her condition assessment within the existing markings.

If the previously rated segment is not located at the proper designated location (within 200 feet), then the inspector should properly locate, mark, and rate the correct segment. In the event of a previously incorrectly marked segment, the inspector should notify TDOT Asset Management Headquarters at TDOT.Maint.AssetManagement@TN.gov and provide the following information: Segment ID, county, route, begin/end log miles, and improper location of previously rated segment.

If the segment has been previously rated and begins at the correct location but is marked at a length other than 528 feet, the following steps should be taken:

1. Check the appropriate box in the application to indicate that, upon arrival, there are previously painted MPI markings.
2. If the previously marked segment measures between 500 and 600 feet (inclusive), indicate the segment marking in the application and inspect the previously marked segment. No additional steps are required.
3. If the previously marked segment measures less than (<) 500 feet or greater than (>) 600 feet, then perform the following steps:
 - a. Spray paint the correct beginning and/or ending location on the edge of pavement and inspect the segment in its entirety (528 feet).
 - b. Record the actual length of the previously marked segment in the application and take a photo depicting the corrected segment length.

- c. Notify TDOT Asset Management Headquarters (TDOT.Maint.AssetManagement@TN.gov) and provide the following information: Segment ID, county, route, begin/end log miles, and the incorrect field recorded length. Attach the photo(s) to the email.
- d. If the segment is greater than 600 feet in length, inspect the previously marked segment, but follow the instructions in step (c) and report the issue to TDOT Asset Management Headquarters.

Upon notification of an incorrectly marked segment, TDOT Asset Management Headquarters will contact the QA Consultant or the TDOT District Office to inform them of the discrepancy. The individual in error will then conduct a re-assessment of the segment in the MPI application.

4.3.2 INVALID SEGMENTS

The segment generation process is designed to filter out invalid segments, however, an inspector should always verify that a segment meets the criteria for a valid segment upon arrival in the field. A selected segment which meets one or more of the following conditions **should not be evaluated**:

- The total cumulative length of bridge(s) within the segment is equal to or greater than 250 feet. Bridges include box culverts greater than (>) 20 feet in length along the centerline. Bridges are considered to begin where the bridge deck starts.
- The segment is partially or fully within a construction zone. A construction zone is defined as the length of roadway from the “Work Begins 500 feet Ahead” or “Road Work Next X Miles” sign to the “End Work Zone” sign. Construction zones are considered active until all construction signs and construction barrels have been removed.
- If the segment is deemed hazardous by the inspector, he/she can exercise “Stop Work Authority”. This may apply to situations where there are high speeds combined with limited sight lines or where traffic control is prevented from being set up.

If one of the above conditions applies to a segment, the inspector should use the application to provide a reason for the segment being invalid and request an alternate segment. Once an alternate segment has been loaded into the application, the inspector should move on to conduct a condition assessment at the new location.

4.3.3 INSPECTION AREA

Inspectors must evaluate all field assets located within the designated segment boundaries. Should a characteristic not be present within the segment, the inspector should indicate this in the application.

When a portion of an asset is located within the segment area and a portion of the same asset extends outside the segment area, the inspector must rate the entire asset. **NOTE:** Close drainage systems are exempt from this rule.

4.3.4 RATING SEGMENTS ON A RAMP

Ramp segments should not extend beyond the gore area. Deceleration and acceleration lanes are considered part of the mainline travel pavement and should **NOT** be included in a ramp inspection.

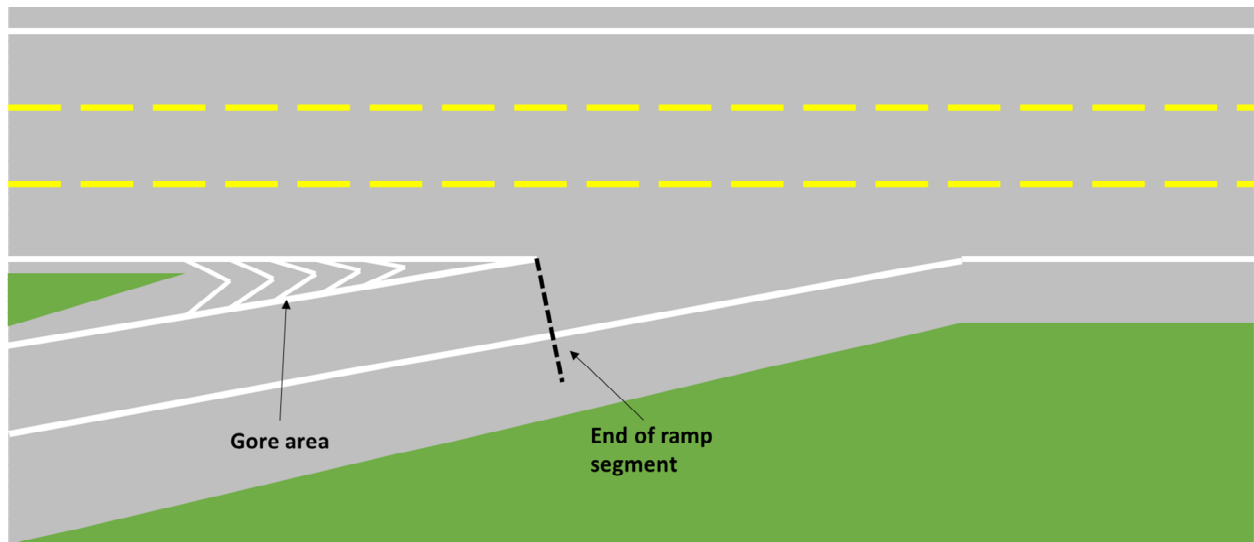


Figure 2: Gore Area

A common ditch between a ramp and mainline segment shall be inspected with the mainline segment only.

4.3.5 RATING SEGMENTS CONTAINING A BRIDGE

When evaluating a segment that contains a portion of one or more bridges, the inspector must determine the cumulative length of the bridge(s) inside the segment limits. If the total cumulative length of the bridge(s) is less than 250 feet, the segment is valid and should be inspected. However, if the total cumulative length of bridge(s) within the segment is equal to or greater than 250 feet, the segment is invalid and an alternate segment should be requested.

When a segment is invalid (total cumulative bridge length within the segment is equal to or greater than 250 feet), **do not move to the next tenth mile segment beyond the bridge.** Instead, select the “Alternate Site Required” button in the application. This will generate a new, random tenth mile segment for inspection. Move to the alternate segment that is provided.

4.3.6 RATING SEGMENTS ALONG A DIVIDED HIGHWAY

Segments located on divided highways are generated for each direction of travel. For these segments, the inspector only needs to mark and inspect segments in the direction of travel the segment is designated on. For assets located within a grassed median, the **center ditch line** of the grassed median will be the dividing line between the positive and negative directions of travel.

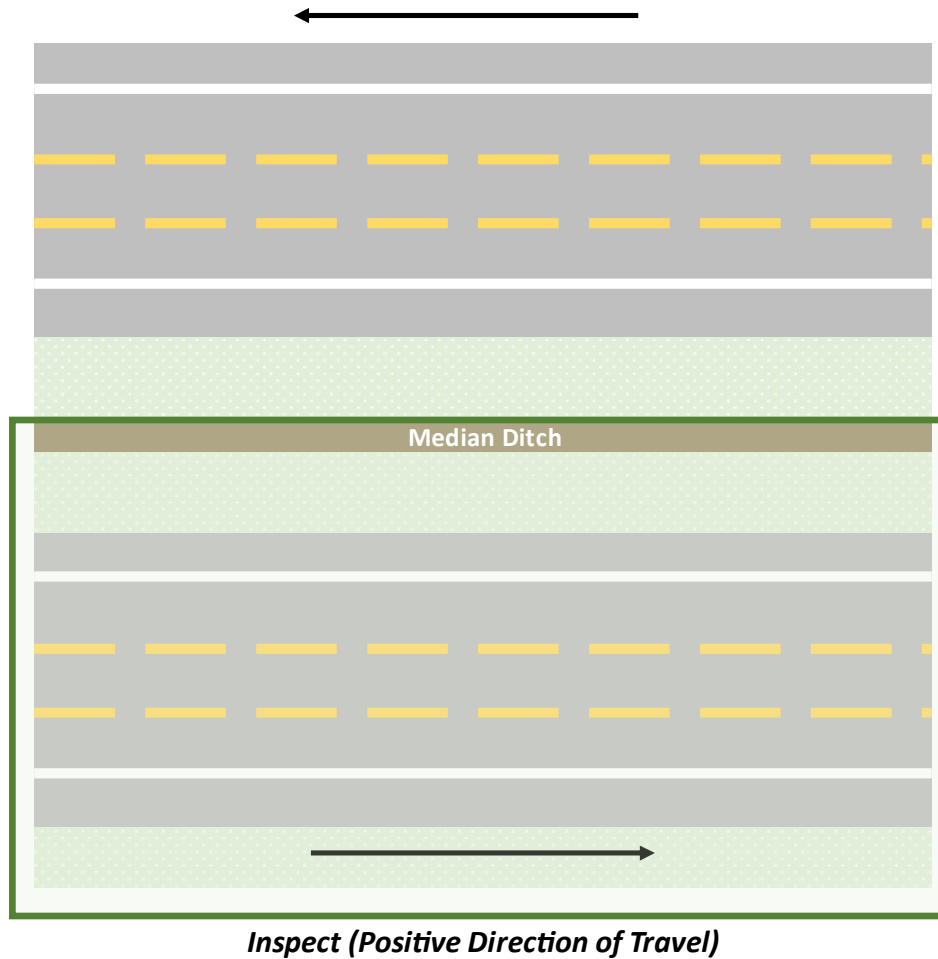


Figure 3: Divided Highway Segment

All assets located along the center ditch line shall be inventoried and assessed with segments in the positive direction of travel only. Assets frequently located in the center ditch may include median drain inlets, unpaved ditches, and pipes.

Assets located in the median of a divided highway that are not within a center ditch, such as concrete barrier walls, are inspected in both directions of travel. Inspectors should only evaluate the side of a median asset facing the side of the divided highway being inspected (i.e., only the side of the concrete barrier wall facing the segment).

4.4 EQUIPMENT AND SUPPLIES

The following equipment and supplies may be required and/or recommended for the efficient and safe collection of inspection data:

- TDOT-approved safety vest
- Flashing amber lights for vehicle roof or strobes in vehicle lights
- Distance measuring wheel
- 4-foot carpenter's level
- Small measuring tape (3' to 12') or small measuring ruler (6" to 12")
- 15-foot rod or pole
- Flashlight
- White marking paint
- Mobile device with built-in camera, GPS capability, and applications with preloaded segment for inspection
 - If mobile device is not available, inspector should bring a paper version of the survey form for each segment to be inspected. If using paper forms, it is recommended that the inspector also brings a clipboard, pencils, eraser, pocket calculator, digital camera, and tally counter.
- Field Assessment Manual
- First Aid kit

An inspector should verify all equipment and supplies is functional before conducting an inspection.

4.5 ASSESSMENT FORM

Each segment is pre-selected with the appropriate identification information.

A unique Segment ID Number is automatically generated for each segment and appears on the mobile assessment form in the application. This number should be referenced to identify the segment that is being rated. PBMI segments are identified by a combination of the contract number, fiscal year, quarter, and a sequential number. The naming convention for the MPI segments will be determined during the build out of that program.

NOTE: All interstate routes and some special cases are logged by continuous mile markers. The continuous Beginning Mile Marker and Ending Mile Marker have been used in place of the Beginning Log Mile and Ending Log Mile on these routes.

There are six maintenance element groups listed in the Assessment Form: Pavement, Unpaved Shoulder and Ditch, Drainage, Roadside, Roadside Appurtenances, and Traffic. Each element group consists of individual characteristics (assets) that are to be inspected and rated. The data collected is used to assess the condition of the total asset inventory relative to the performance criteria.

No field should be left blank in the application. A comments box is provided in the Application for the inspector to include any important notes pertinent to the assessment. Asset performance criteria can be found in Section 5 of this manual.

In the event the paper form is used for the MPI assessment, personnel conducting the assessment must use a pencil when marking the assessment form and should use only block type letters and numbers. The survey information must be entered into the mobile application in a timely manner.

4.5.1 ACCESSING THE FORM

For information on accessing and using the assessment forms for TDOT's MPI and PBMI mobile applications, see the associated Application Manual.

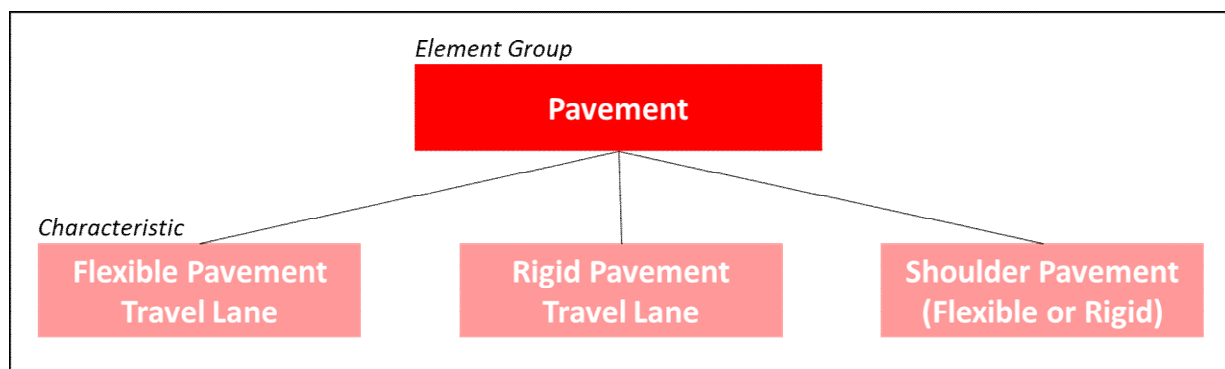
SECTION 5: CONDITION STANDARDS AND HOW TO MEASURE DEFECTS

This section contains the guidance needed to conduct a maintenance assessment of the designated roadway segment. The information presented in this section should be used to assist inspections and ensure compliance with maintenance requirements defined by TDOT.

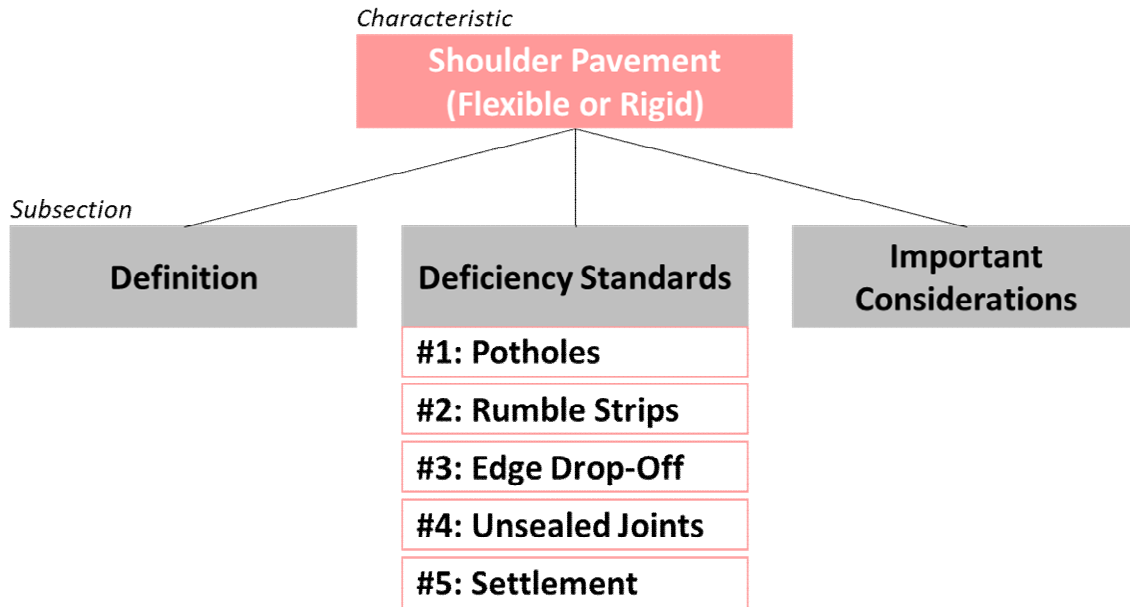
Maintenance inspections consist of six element groups: Pavement, Unpaved Shoulders and Ditches, Drainage, Roadside, Roadside Appurtenances, and Traffic.



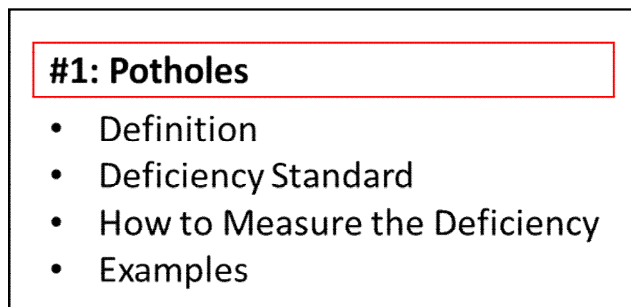
Each element group consists of a varying number of characteristics. Characteristics are the assets within a segment that warrant inspection, such as shoulder pavement, unpaved ditches, or inlets. As an example, the Pavement element group is shown below.



This section is systematically organized such that each subsection has the same structure. Each characteristic subsection consists of a definition, a summary of the deficiency criteria associated with that characteristic, and important considerations to be aware of during inspection. Characteristic subsections provide an overview of how a characteristic should be inspected. For example, the Shoulder Pavement (Flexible or Rigid) subsection is outlined below.



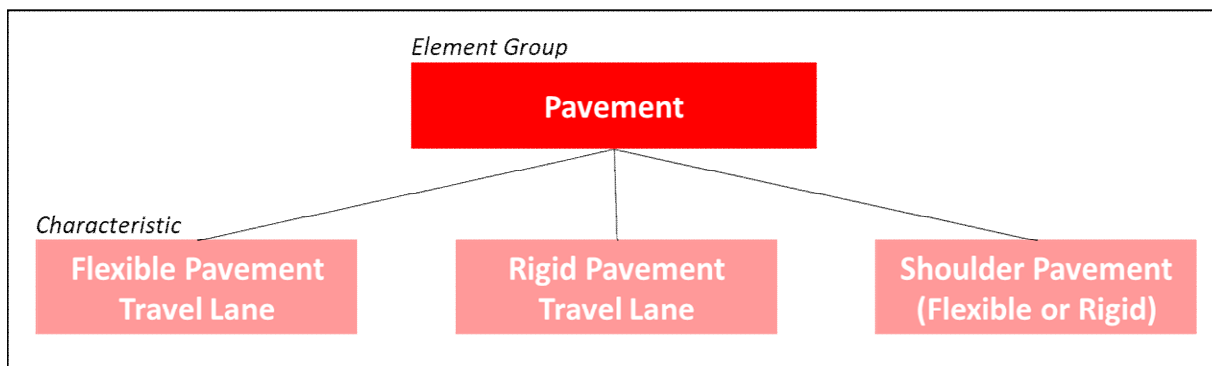
A subsection for each deficiency standard is provided with more details and examples to assist the inspector. Each deficiency standard subsection provides a definition, a step-by-step guide for how to measure the deficiency in the field, and useful example photos to assist inspectors. This structure is shown below, using the “Potholes” deficiency for the Shoulder Pavement (Flexible or Rigid) characteristic.



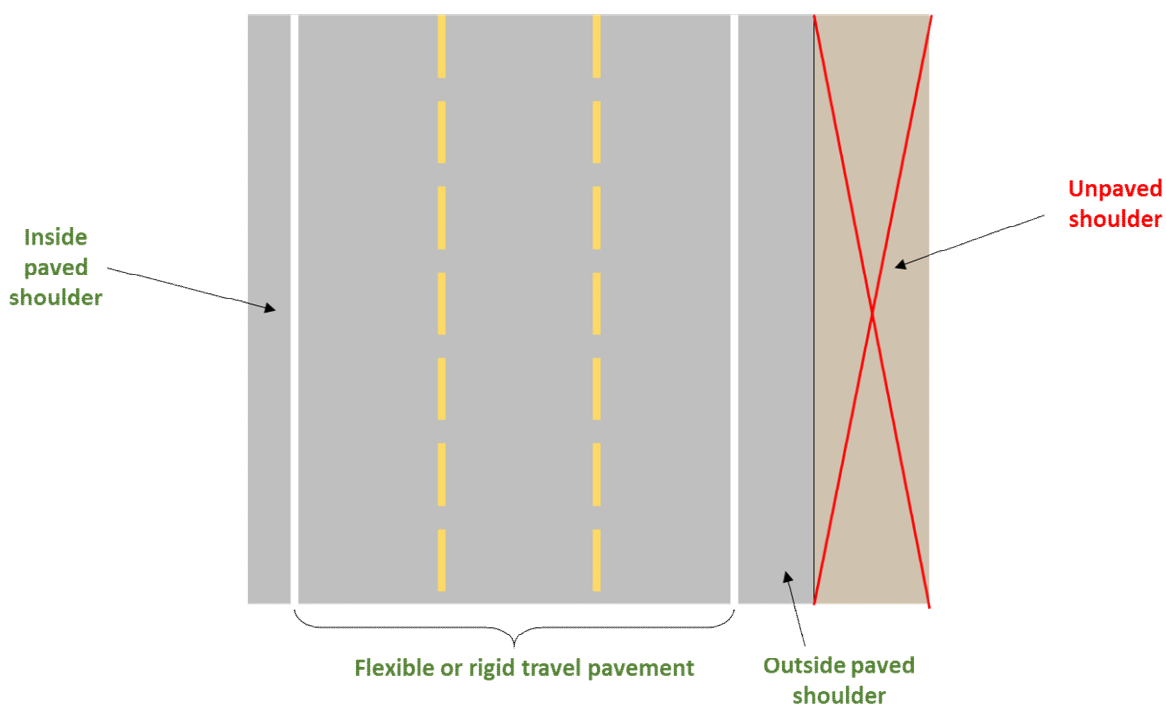
The information provided in this chapter has been systematically organized for ease of use. Detailed instructions are supplemented by high-level guidance to adapt to the information needs of the user.

5.1 PAVEMENT ELEMENTS

The Pavement element group consists of the following characteristics: Flexible Pavement Travel Lane, Rigid Pavement Travel Lane, and Paved Shoulder (Flexible or Rigid).



This section shall be used to assist inspection of the pavement within a segment. This includes the paved travel lanes and any paved shoulder, as shown below.



Refer to the characteristic subsections for an overview of the deficiency standards and important considerations. For more detailed information, refer to the individual deficiency standard subsections.

5.1.1 FLEXIBLE PAVEMENT TRAVEL LANE

Definition	Flexible pavement travel lanes are any asphalt travel lanes.
Deficiency Standards	Flexible pavement travel lanes are considered deficient if: • Potholes (Size): Any number of potholes are present within the mainline travel pavement that are greater than 6 inches in diameter and 1.25 inches or greater in depth. • Potholes (Permeable Base): Permeable base is exposed within the mainline travel pavement. • Exposed Longitudinal Joint: Longitudinal joints along the mainline travel pavement are larger than 0.25 inches for more than 50 cumulative feet and are unsealed.
Important Considerations	Included in flexible pavement travel lane inspections: • Flexible (asphalt) pavement within the travel lane edge lines • Longitudinal joints within the mainline travel lanes Not included in flexible pavement travel lane inspections: • Rigid (concrete) pavement travel lanes • Paved shoulder outside of the travel lane edge line • Signage

5.1.1.1 POTHOLES

Definition	Potholes are bowl-shaped depressions in the pavement caused by pavement weaknesses on the surface or within the base. Potholes are exacerbated by cumulative wear from traffic and weather. Deep potholes may expose the permeable base layer underneath the pavement surface. NOTE: There are two deficiency standards associated with potholes: Pothole Size and Exposed Permeable Base.
POTHOLES - SIZE	
Deficiency Standard	Flexible pavement travel lane potholes are considered deficient if: • Any number of potholes are present within the mainline travel pavement that are greater than 6 inches in diameter and 1.25 inches or greater in depth.
How to Measure the Deficiency	Step 1: Evaluate the segment for potholes within the travel lane. DO NOT ENTER THE TRAVEL LANE TO INSPECT A POTHOLE. Estimate the size of a pothole from the shoulder.

NOTE: To estimate the size of a pothole, use your outstretched flared hand as a guide. The distance from the tip of your middle finger to your wrist is approximately 6 inches.

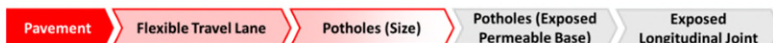
Step 2: If the pothole is greater than 6 inches in diameter and at least 1.25 inches in depth, record the deficiency in the application.

Examples

FLEXIBLE PAVEMENT TRAVEL LANE POTHOLES (SIZE)

- Minimum dimensions: Greater than **6 inches in diameter** and at least **1.25 inches in depth**.
- Do not include deficiencies such as:
 - Alligator cracking
 - Raveling
 - Depressions
 - Spalling

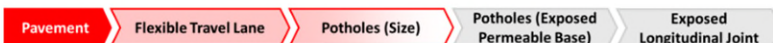
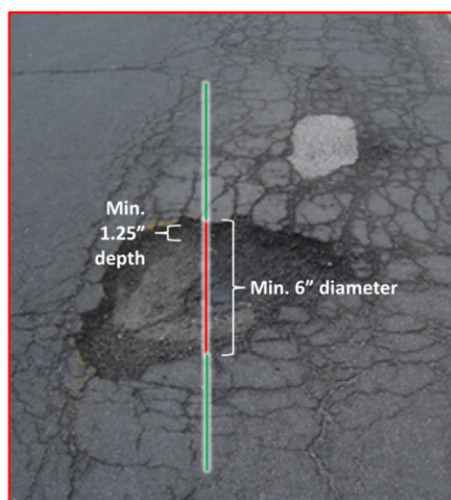
EXAMPLE



FLEXIBLE PAVEMENT TRAVEL LANE POTHOLES (SIZE)

- To estimate pothole size, use your outstretched flared hand as a guide. The distance from the tip of your middle finger to your wrist is approximately 6 inches.

EXAMPLE



POTHOLES – EXPOSED PERMEABLE BASE

Deficiency Standard

Flexible pavement travel lane potholes are considered deficient if:

- Permeable base is exposed within the mainline travel pavement.

How to Measure the Deficiency

Step 1: Evaluate the segment for exposed permeable base within the travel lane. **DO NOT ENTER THE TRAVEL LANE TO INSPECT.** Observe safely from the shoulder.

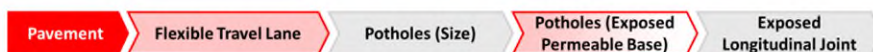
Step 2: If permeable base is exposed within the mainline travel pavement, record the deficiency in the application.

Examples

FLEXIBLE PAVEMENT TRAVEL LANE
POTHoles (EXPOSED PERMEABLE BASE)

EXAMPLE

This exceeds the failure threshold for potholes (exposed permeable base).



5.1.1.2 EXPOSED LONGITUDINAL JOINT

Definition

Exposed longitudinal joints are joints that are missing rubber sealant, allowing water and sediment to enter the joint and degrade the pavement. Along segments with flexible pavement, joints will appear longitudinally within the mainline travel lanes.

NOTE: This characteristic only applies to longitudinal joints within the mainline travel lanes. Longitudinal joints between the outside travel lane and the paved shoulder should be inspected according to the guidance for the Paved Shoulder characteristic.

Deficiency Standard

Flexible pavement travel lane joints are considered deficient if:

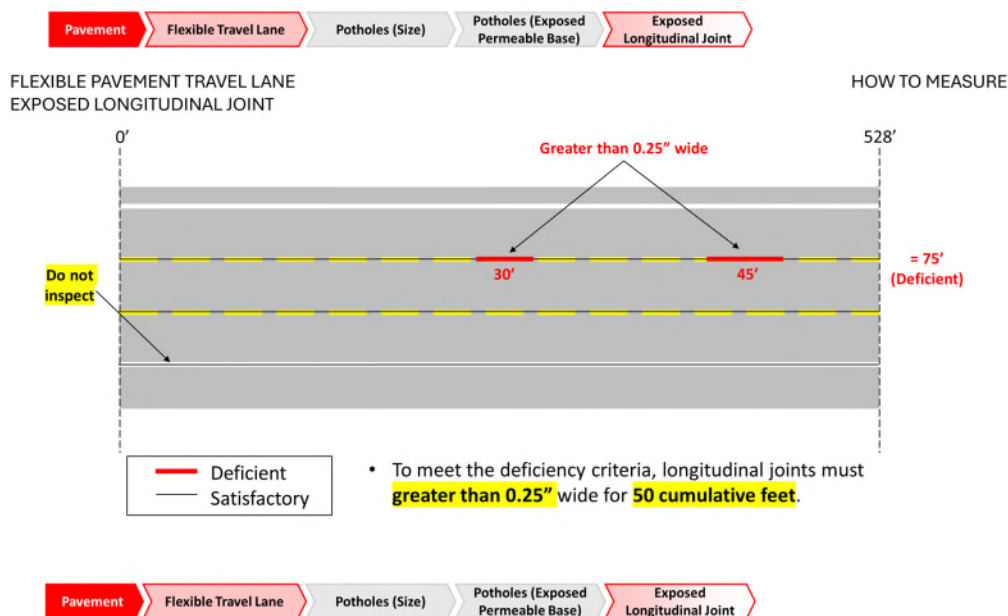
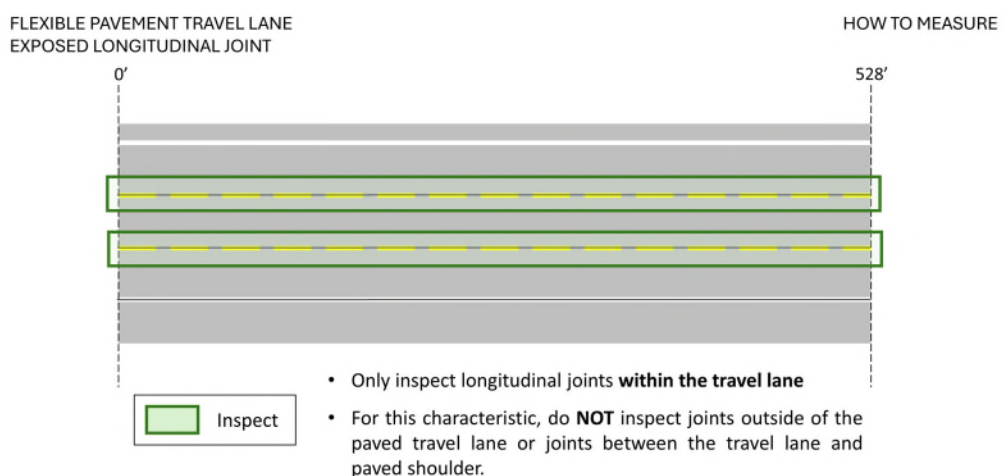
- Longitudinal joints within the mainline travel pavement are larger than 0.25 inches for more than 50 cumulative feet and are unsealed.

How to Measure the Deficiency

Step 1: Evaluate the mainline travel pavement for joint sealant that is missing or significantly damaged. **DO NOT ENTER THE TRAVEL LANE TO INSPECT.** Observe safely from the shoulder.

Step 2: If the exposed joint is over 0.25 inches in width or significantly damaged, use a measuring wheel along the shoulder to measure the cumulative length of the pavement where the joint meets the deficiency standard.

Step 3: If the deficiency standard is met, record in the application.

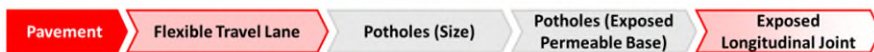
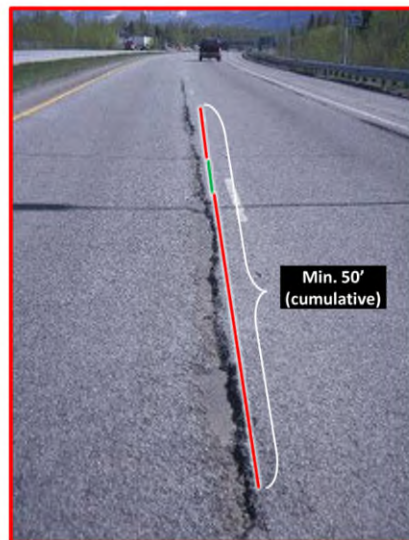


Examples

FLEXIBLE PAVEMENT TRAVEL LANE
EXPOSED LONGITUDINAL JOINT

EXAMPLE

- Longitudinal joints must be greater than **0.25 inches wide** for at least **50 cumulative feet** to be considered deficient.
- Unsealed joints are often missing rubber sealant, allowing water and sediment to degrade the pavement.



5.1.2 RIGID PAVEMENT TRAVEL LANE

Definition	Rigid pavement travel lanes are any concrete travel lanes.
Deficiency Standards	Rigid pavement travel lanes are considered deficient if: • Potholes (Size): Potholes are present within the mainline travel pavement that are greater than 6 inches in diameter and 1.25 inches or greater in depth. • Joint Material: More than 25% of joint material is missing or detached along the mainline travel pavement. • Spalling: More than 10% of the mainline travel pavement surface area exhibits spalling greater than 1 inch in depth. • Vertical Deviation: Vertical deviation along the mainline travel pavement is greater than 1 inch in depth.
Important Considerations	Included in rigid pavement travel lane inspections: • Rigid (concrete) pavement within the travel lane edge lines • Joints between slabs within the mainline travel lanes Not included in rigid pavement travel lane inspections: • Flexible (asphalt) pavement travel lanes • Paved shoulder outside of the travel lane edge line • Longitudinal joints between the outside travel lane and the paved shoulder • Signage
5.1.2.1 POTHOLE	
Definition	Potholes are bowl-shaped depressions in the pavement caused by pavement weaknesses on the surface or within the base. Potholes are exacerbated by cumulative wear from traffic and weather. Deep potholes may expose the permeable base layer underneath the pavement surface.
Deficiency Standard	Rigid pavement travel lane potholes are considered deficient if: • Potholes are present within the mainline travel pavement that are greater than 6 inches in diameter and 1.25 inches or greater in depth.
How to Measure the Deficiency	Step 1: Evaluate the segment for potholes within the travel lane. DO NOT ENTER THE TRAVEL LANE TO INSPECT A POTHOLE. Estimate the size of a pothole from the shoulder. NOTE: To estimate the size of a pothole, use your outstretched flared hand as a guide. The distance from the tip of your middle finger to your wrist is approximately 6 inches.

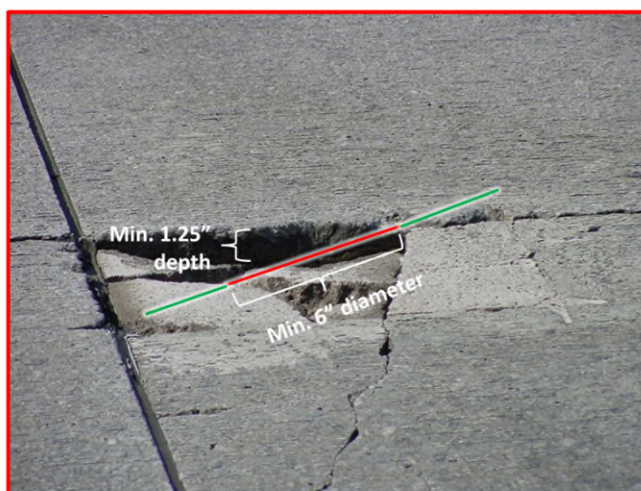
Step 2: If the pothole is greater than 6 inches in diameter and at least 1.25 inches in depth, record the deficiency in the application.

Examples

RIGID PAVEMENT TRAVEL LANE POTHOLES (SIZE)

EXAMPLE

- Minimum dimensions: Greater than 6 inches in diameter and at least 1.25 inches in depth.



5.1.2.2 JOINT MATERIAL

Definition

Joint material is rubber sealant that prevents water and sediment from entering the joint. If joint material is damaged or missing, water and sediment may enter the joint and degrade the pavement. Along rigid pavement segments, joints may exist between slabs longitudinally and between slabs laterally across the width of the mainline travel pavement.

NOTE: This characteristic only applies to joints within the mainline travel lanes. Longitudinal joints between the outside travel lane and the paved shoulder should be inspected according to the guidance for the Paved Shoulder characteristic.

Deficiency Standard

Rigid pavement travel lane joint material is considered deficient if:

- More than 25% of joint material is missing or detached between slabs within the mainline travel pavement.

How to Measure the Deficiency

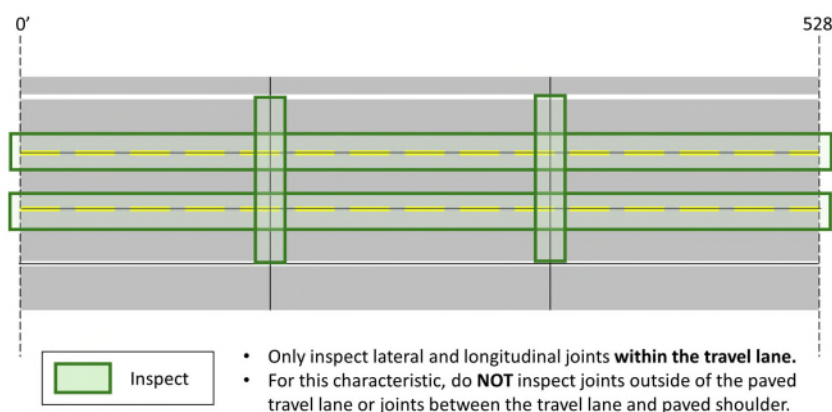
Step 1: Determine the total cumulative length of longitudinal joints within the segment.

Step 2: Identify the sections of longitudinal joints with missing or detached joint material. From the shoulder, use a measuring wheel to estimate the cumulative length of deficient longitudinal joint.

Step 3: If at least 25% of the cumulative length of longitudinal joints within the segment contains missing or detached joint material, record the deficiency in the application.

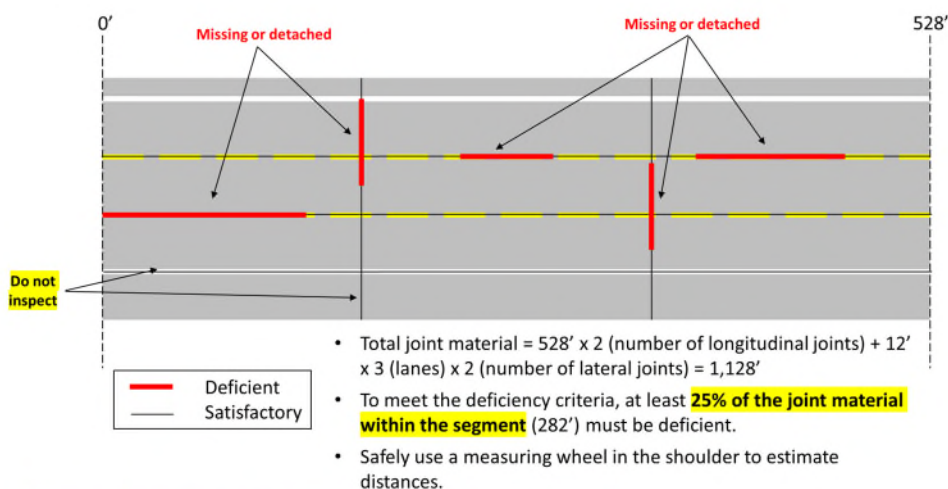
RIGID PAVEMENT TRAVEL LANE
JOINT MATERIAL

HOW TO MEASURE



RIGID PAVEMENT TRAVEL LANE
JOINT MATERIAL

HOW TO MEASURE

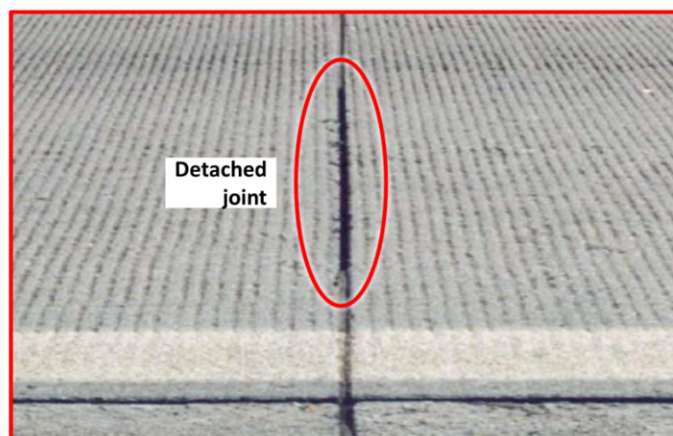


Examples

RIGID PAVEMENT TRAVEL LANE
JOINT MATERIAL

EXAMPLE

- At least **25% of cumulative joint material** within a segment must be **missing or detached** between slabs to be recorded as deficient.



5.1.2.3 SPALLING

Definition:

Spalling is the flaking, chipping, or separation (but not full detachment) of the pavement surface. It is commonly characterized by the appearance of cracks (or similar surface-level deterioration) and is caused by cumulative wear from weather and traffic loading.

Deficiency Standard

Rigid pavement travel lane spalling is considered deficient if:

- More than 10% of the mainline travel pavement surface area exhibits spalling greater than 1 inch in depth.

How to Measure the Deficiency

Step 1: Evaluate the segment for spalling within the travel pavement. **DO NOT ENTER THE TRAVEL LANE TO INSPECT.** Use the example photos to determine if the deficiency standard is met.

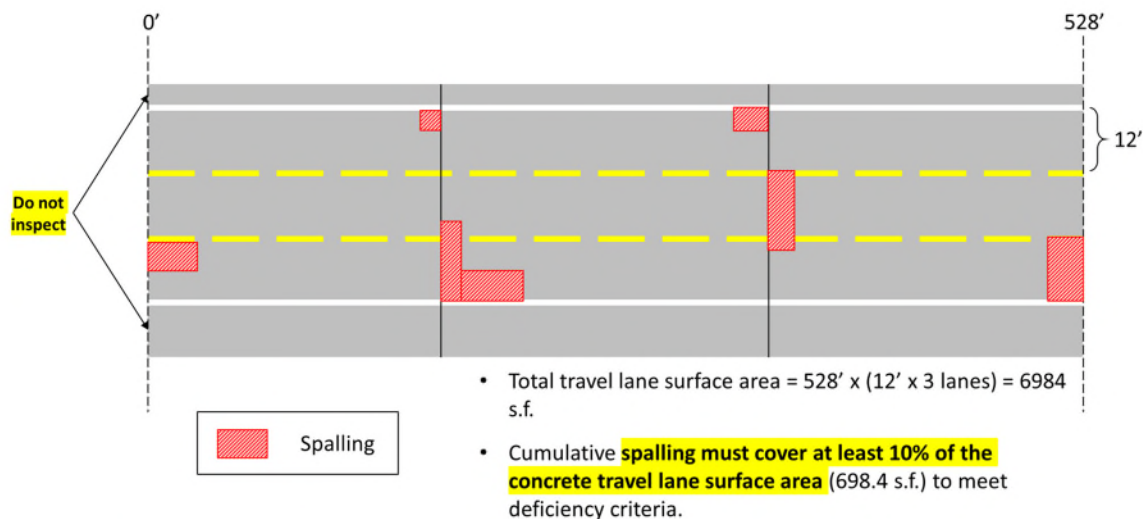
Step 2: Calculate the total surface area of the travel pavement by multiplying the length of the segment by the width of the travel pavement (assume 12-foot travel lanes).

Step 3: From the shoulder, observe any instances of spalling within the travel lane. If necessary, use a measuring wheel along the shoulder to estimate the cumulative area of spalling greater than 1 inch in depth within the travel pavement.

Step 5: If more than 10% of the mainline travel pavement surface area exhibits spalling greater than 1 inch in depth, record the deficiency in the application.

RIGID PAVEMENT TRAVEL LANE SPALLING

HOW TO MEASURE



Examples

RIGID PAVEMENT TRAVEL LANE SPALLING

EXAMPLE

More than 10% of the mainline travel pavement surface area must exhibit spalling greater than 1 inch in depth to be recorded as deficient.



5.1.2.4 VERTICAL DEVIATION

Definition

Vertical deviation is the sudden change in pavement height due to cracking, joint damage between slabs, or other deterioration. It is commonly seen between slabs of rigid pavement.

Deficiency Standard

Rigid pavement travel lane vertical deviation is considered deficient if:

- Vertical deviation along the mainline travel pavement is greater than 1 inch in depth.

How to Measure the Deficiency

Step 1: Evaluate the segment for vertical deviation between slabs of pavement. **DO NOT ENTER THE TRAVEL LANE TO INSPECT.** Use the example photos to help determine if the deficiency standard is met.

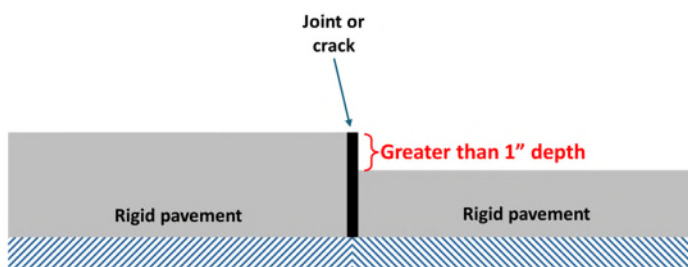
Step 2: Observe the vertical deviation from the shoulder. If the vertical deviation is greater than 1 inch in depth, record the deficiency in the application.

Examples

RIGID PAVEMENT TRAVEL LANE VERTICAL DEVIATION

EXAMPLE

- Vertical deviation is **any sudden change in pavement height** due to cracking, joint damage, or other deteriorations.
- Vertical deviation is commonly found between concrete slabs
- Vertical deviation along the mainline travel pavement must be **greater than 1 inch in depth.**



5.1.3 PAVED SHOULDERS

Definition

Paved shoulders include any paved asphalt or concrete surface outside the travel lane edge line.

Deficiency Standards

Shoulder pavement is considered deficient if:

- **Potholes (Size):** Potholes are present within the shoulder pavement that are greater than 6 inches in diameter and 1.25 inches or greater in depth.
- **Rumble Strips:** Rumble strips are missing, filled with debris, or damaged in a manner rendering them ineffective for greater than 50 continuous linear feet.
- **Edge Differential:** Travel lane edge differential is greater than 2 inches for 25 continuous feet or greater than 4 inches at any location.
- **Joint Material:** More than 25% of the joint material is missing or detached between the mainline travel pavement and the shoulder.
- **Settlement / Heaving:** Settlement or heaving is present within the shoulder and is greater than 2 inches in depth.

Important Considerations

Included in paved shoulder inspections:

- Inside and outside paved shoulder.
- Emergency pull-off areas.

Not included in paved shoulder inspections:

- Business entrances and commercial driveways.
- Signage, guardrail, and other roadside appurtenances in the paved shoulder.
- Gravel or other non-paved shoulder.

5.1.3.1 POTHoles (SIZE)

Definition

Potholes are bowl-shaped depressions in the pavement caused by pavement weaknesses on the surface or within the base. Potholes are exacerbated by cumulative wear from traffic and weather. Deep potholes may expose the permeable base layer underneath the pavement surface.

Deficiency Standard

Shoulder potholes are considered deficient if:

- Potholes are present within the shoulder pavement that are greater than 6 inches in diameter and 1.25 inches or greater in depth.

How to Measure the Deficiency

Step 1: Use a measuring tape to measure the width and length of the pothole.

Step 2: If the pothole is greater than 6 inches in diameter, place a straightedge (i.e., level) across the pothole and use a measuring tape to measure from the deepest point in the pothole to the bottom of the straightedge.

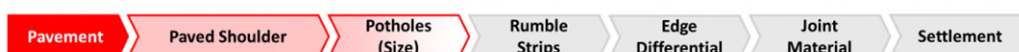
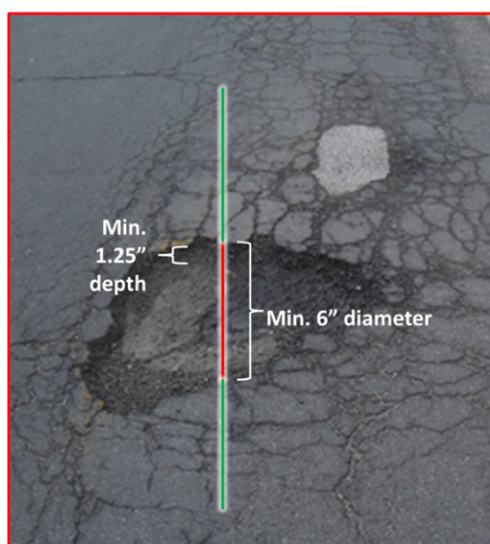
Step 3: If the pothole is greater than 6 inches in diameter and at least 1.25 inches in depth, record the deficiency in the application.

Examples

PAVED SHOULDER POTHOLES (SIZE)

EXAMPLE

- **Inside Shoulder:** To estimate pothole size, use your outstretched flared hand as a guide. The distance from the tip of your middle finger to your wrist is approximately 6 inches.
- **Outside Shoulder:** Use a measuring tape and level to measure the potholes dimensions.



5.1.3.2 RUMBLE STRIP

Definition

A rumble strip is an installed set of grooves or indents in the pavement. Functional rumble strips transmit noise and vibrations to a vehicle and are used as a low-cost safety countermeasure to alert motorists when they are exiting the travel lane.

Deficiency Standard

Rumble strips are considered deficient if:

- Rumble strips are missing, filled with debris, or damaged in a manner rendering them ineffective for more than 50 continuous linear feet.

NOTE: For rumble strip to be classed as “missing”, there must be clear evidence that a section of roadway is meant to contain rumble strip, such as an abrupt stop to existing rumble strip or severe weathering. If rumble strip is not present, use the N/A option in the application.

NOTE: For interstates only, if rumble strip is not present on a mainline segment for more than 50 continuous linear feet, mark as deficient. If rumble strip is not present for 50 continuous linear feet on a ramp segment, mark as N/A.

How to Measure the Deficiency

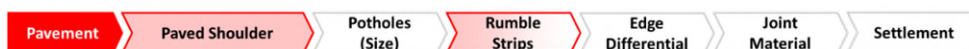
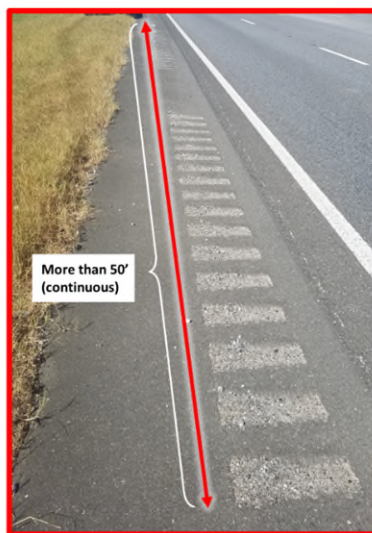
Step 1: Evaluate the segment for rumble strip that is missing, damaged, or filled with debris, such that vibration or sound may be reduced when a tire contacts the rumble strip.

Step 2: Use a measuring wheel to measure the length of paved shoulder containing missing or deficient rumble strip. If the measured distance is greater than 50 continuous linear feet, record the deficiency in the application.

PAVED SHOULDER
RUMBLE STRIP

HOW TO MEASURE

- Rumble strip is considered deficient if it is **missing, filled with debris, or damaged** for more than **50 continuous linear feet**.
- Use a measuring wheel to measure linear feet of deficient rumble strip. To help with measurement, use the skip lanes for reference.

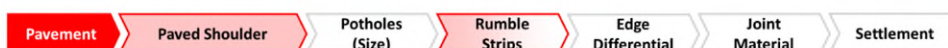


Examples

PAVED SHOULDER RUMBLE STRIP

EXAMPLE

- Rumble strip is considered deficient if it is **missing, filled with debris, or damaged** for more than **50 continuous linear feet**.
 - Damage/Debris:** Vibration or sound must be reduced when contacted by tire.
 - Missing:** Must be clear evidence, such as an abrupt stop or gap.
- Note:** Rumble strips and general pavement "sweeping" must be separately evaluated.



5.1.3.3 EDGE DIFFERENTIAL

Definition

Edge differential is the sudden change in pavement elevation between the travel lane and the paved shoulder. A significant travel lane edge differential is a safety hazard in the event a vehicle leaves the travel lane.

Deficiency Standard

Edge differential is considered deficient if:

- Edge differential is greater than 2 inches for 25 continuous feet or greater than 4 inches at any location.

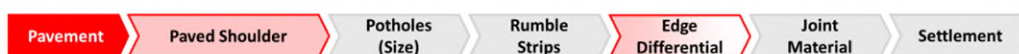
NOTE: Do not confuse Paved Shoulder Edge Differential with Settlement or Unpaved Shoulder Drop-Off.



This is settlement. Note the “sinking” effect in the pavement.



Any change in elevation between the pavement and unpaved shoulder should be evaluated as Unpaved Shoulder Drop-Off.



How to Measure the Deficiency

Step 1: Evaluate the segment for edge differential between the travel lane and the paved shoulder. Use the example photos to help determine if the deficiency standard is met.

Step 2: Place a straightedge (i.e., level) flat on the edge of the travel lane pavement with a section of the straightedge extending over the paved shoulder. **If traffic volumes prevent the safe measurement of edge differential, estimate from a safe distance instead.**

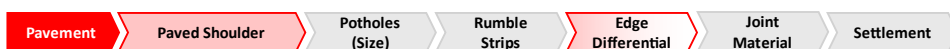
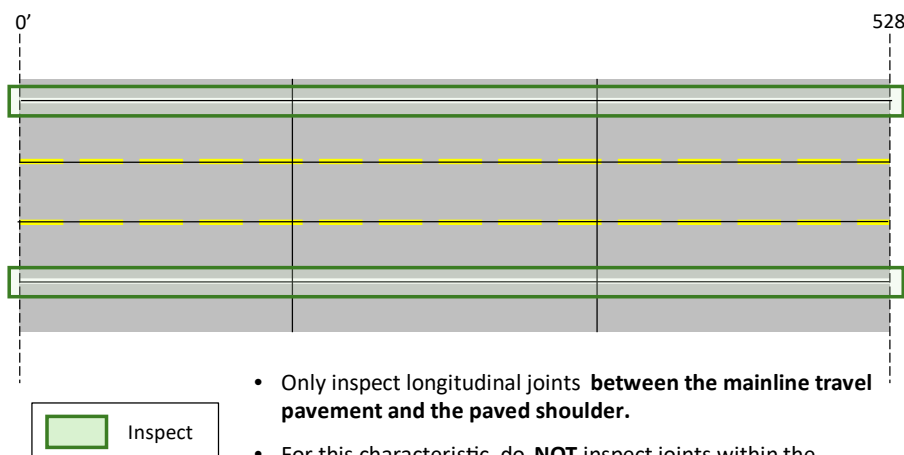
Step 3: Use a measuring tape to measure the distance from the bottom of the straightedge to the pavement underneath.

Step 4: If the edge differential is greater than 4 inches at any location, see Step 5. If the edge differential is between 2 inches and 4 inches, use a measuring wheel to measure the length of travel lane where the edge differential is deficient.

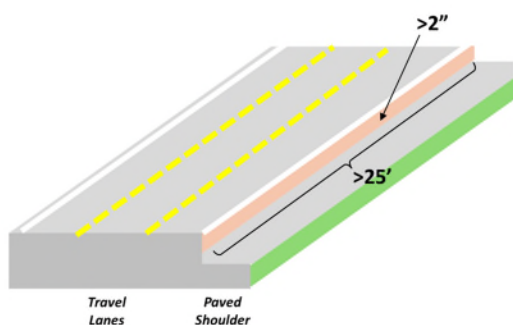
Step 5: If the edge drop-off is greater 4 inches at any location, or if the edge differential is greater than 2 inches for 25 continuous feet, record the deficiency in the application.

PAVED SHOULDER
EDGE DIFFERENTIAL

HOW TO MEASURE

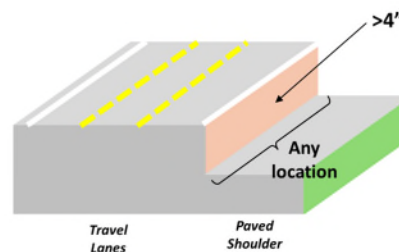


Example

PAVED SHOULDER
EDGE DIFFERENTIAL

Greater than 2" for 25 continuous feet

EXAMPLE



Greater than 4" at any location



5.1.3.4 JOINT MATERIAL

Definition

Joint material is rubber sealant that prevents water and sediment from entering the joint. If joint material is detached, damaged, or missing, water and sediment may enter the joint and degrade the pavement.

Deficiency Standard

Paved shoulder joints are considered deficient if:

- More than 25% of the joint material is missing or detached between the mainline travel pavement and the shoulder.

How to Measure the Deficiency

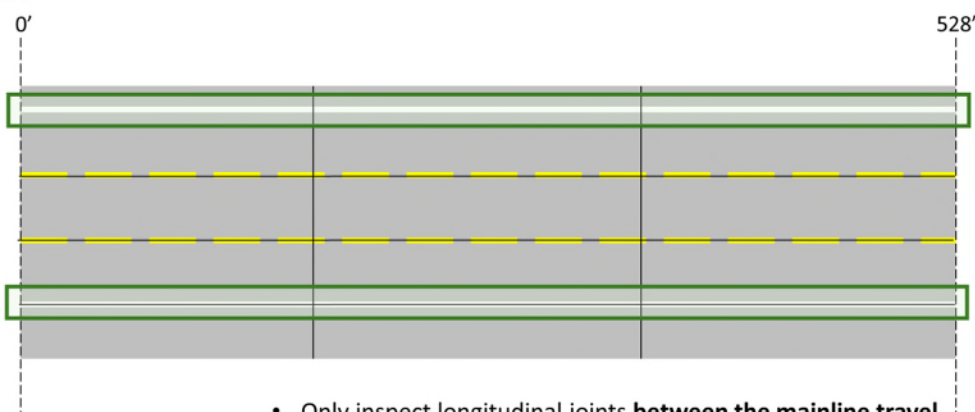
Step 1: Evaluate the segment for missing or detached joints between the mainline travel pavement and the shoulder.

Step 2: Use a measuring wheel to measure the cumulative length of roadway with missing or detached joints. If more than 25% of the segment has a deficient joint, record the deficiency in the application.

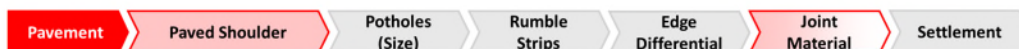
NOTE: Under no circumstances shall the inspector cross the travel lanes to inspect a joint along the inside shoulder. Inspector should evaluate the condition of all joints from the outside shoulder.

PAVED SHOULDER
JOINT MATERIAL

HOW TO MEASURE

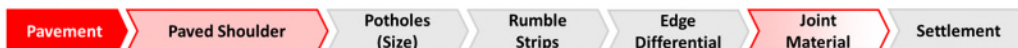
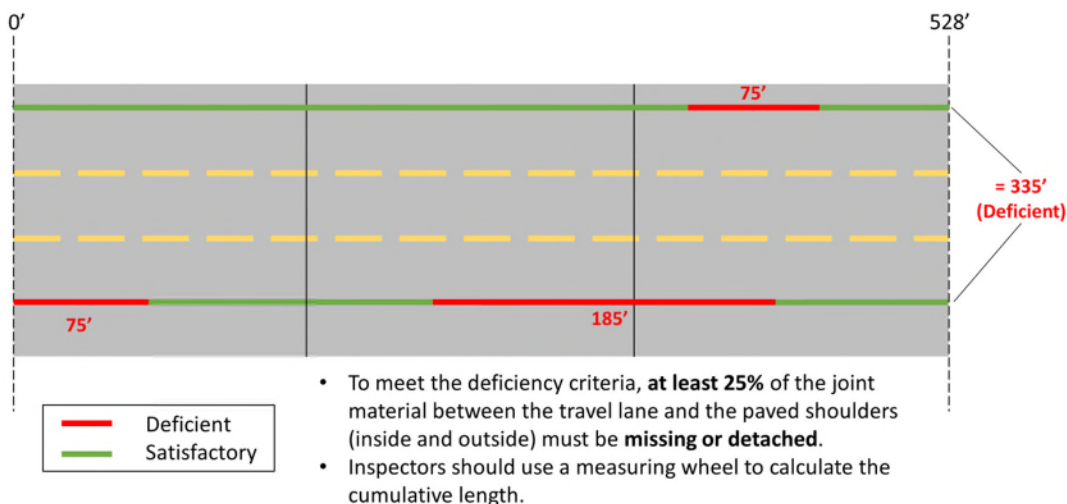


- Only inspect longitudinal joints **between the mainline travel pavement and the paved shoulder**.
- For this characteristic, do **NOT** inspect joints within the mainline travel lanes.



PAVED SHOULDER
JOINT MATERIAL

HOW TO MEASURE

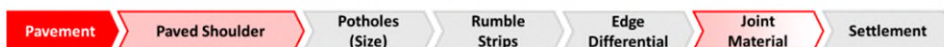


Examples

PAVED SHOULDER
JOINT MATERIAL

EXAMPLE

- More than 25%** of the joint material must be **missing or detached** between the mainline travel pavement and the shoulder to be recorded as deficient.



5.1.3.5 SETTLEMENT / HEAVING

Definition

Settlement or heaving is a depression in the pavement typically identified by collecting water, significant edge differential between slabs, or asphalt breaking away due to poor lateral support.

Deficiency Standard

Shoulder settlement is considered deficient if:

- Settlement is greater than 2 inches in depth is present within the shoulder.

How to Measure the Deficiency

Step 1: Evaluate the segment for settlement within the flexible paved shoulder.

Step 2: Use a measuring tape to measure the depth of any settlement at the deepest point. If the depth is greater than 2 inches, record the deficiency in the application.

PAVED SHOULDER
SETTLEMENT

HOW TO MEASURE

- Settlement or heaving is considered deficient if it is **greater than 2 inches in depth** at any location.



Examples

PAVED SHOULDER SETTLEMENT

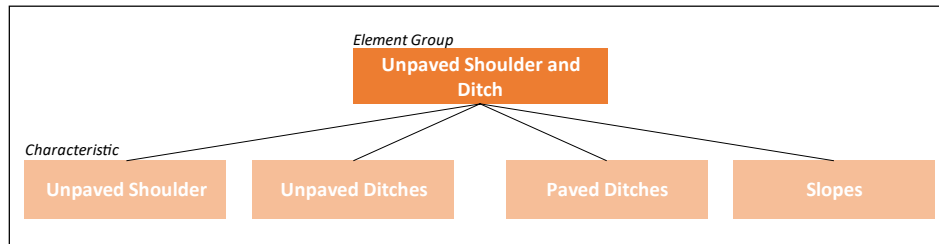
EXAMPLE

- Settlement or heaving is a **depression in the pavement between slabs.**
- Settlement or heaving is considered deficient if it is **greater than 2 inches in depth** at any location.



5.2 UNPAVED SHOULDERS AND DITCHES

The Unpaved Shoulders and Ditches element group consists of the following characteristics: Unpaved Shoulder, Unpaved Ditches, Paved Ditches, and Slopes.



Refer to the characteristic subsections for an overview of the deficiency standards and important considerations. For more detailed information, refer to the individual deficiency standard subsections associated with each characteristic.

5.2.1 UNPAVED SHOULDER

Definition

An unpaved shoulder is an earthen area abutting the edge of roadway pavement (travel lane or shoulder), usually consisting of grass, compacted dirt, gravel, or other materials. Unpaved shoulders are generally designed for a 6-foot width (but may often be less) and a slope of $\frac{3}{4}$ inch per foot (6.25%) away from the pavement edge.

Deficiency Standards

Unpaved shoulders are considered deficient if:

- **Buildup:** Buildup within the shoulder exceeds 2 inches across the design template for 25 continuous feet.
- **Drop-Off:** Drop-off depth is greater than 2 inches within 1 foot of the edge of pavement for 25 continuous feet.
- **Drop-Off:** Drop-off depth is greater than 2 inches within 1 foot of the edge of pavement for 100 cumulative feet.
- **Drop-Off:** Drop-off depth is at least 4 inches at any location along the shoulder.

NOTE: Along guardrail sections, drop-off shall only be failed when it is at least 4" at any location. 2" drop-off directly adjacent to guardrail shall not be considered deficient.

Important Considerations

Included in unpaved shoulder inspections:

- If paved shoulder is present, unpaved ground abutting the shoulder edge of pavement.
- If paved shoulder is not present, unpaved ground abutting the travel lane edge of pavement.

Not included in unpaved shoulder inspections:

- Driveways abutting the travel lane edge of pavement.
- Curb and gutter.
- Guardrail or other roadside appurtenances in the unpaved shoulder.

5.2.1.1 BUILDUP

Definition

Build-up (sometimes referred to as high shoulder) is earthen ground or other material accumulation that is built-up along the edge of pavement (travel lane or shoulder), preventing water from draining off the pavement. Significant buildup can cause ponding on the pavement and be a hazard to motorists.

Deficiency Standard

Unpaved shoulder buildup is considered deficient if:

- Buildup within the unpaved shoulder exceeds 2 inches across the design template for 25 continuous feet.

How to Measure the Deficiency

Step 1: Evaluate the segment for buildup within the unpaved shoulder.

Step 2: Place a straightedge (i.e., level) flat on the unpaved shoulder buildup with a section of the straightedge extending over the edge of pavement.

Step 3: Use a measuring tape to measure the distance from the bottom of the straightedge to the pavement below. (If unable to safely measure, estimate from a safe distance instead.)

Step 4: If the buildup exceeds 2 inches in depth, use a measuring wheel to measure the length of the unpaved shoulder where the buildup is deficient.

Step 5: If the buildup exceeds 2 inches for at least 25 continuous feet, record the deficiency in the application.

UNPAVED SHOULDER BUILDUP

HOW TO MEASURE

- Use a measuring wheel to measure continuous linear feet of deficient buildup.



UNPAVED SHOULDER
AND DITCH

UNPAVED SHOULDER BUILDUP

HOW TO MEASURE

- To measure buildup height, place level firmly across the earthen ground and pavement.
- Measure from pavement to bottom of level.



Examples

UNPAVED SHOULDER BUILDUP

EXAMPLE

- Buildup must exceed **2 inches in height for 25 continuous feet** to be considered deficient.
- Buildup may consist of:
 - Earthen ground (grass or soil)
 - Debris



UNPAVED SHOULDER
AND DITCH



UNPAVED SHOULDER BUILDUP

EXAMPLE

- Excessive buildup may cause ponding along the pavement.



5.2.1.2 DROP OFF

Definition

Drop-off is the sudden change in pavement elevation between the edge of pavement and the unpaved shoulder. A significant edge drop-off is a safety hazard in the event a vehicle leaves the paved surface.

Deficiency Standard

Unpaved shoulder drop-off is considered deficient if:

- Drop-off depth is greater than 2 inches within 1 foot of the edge of pavement for 25 continuous feet, OR
- Drop-off depth is greater than 2 inches within 1 foot of the edge of pavement for 100 cumulative feet, OR
- Drop-off depth is at least 4 inches at any location along the unpaved shoulder.

NOTE: Along guardrail sections, drop-off shall only be failed when it is at least 4" at any location. 2" drop-off directly adjacent to guardrail shall not be considered deficient.

How to Measure the Deficiency

Step 1: Place a straightedge (i.e., level) flat on the pavement with a section of the straightedge extending beyond the edge of pavement.

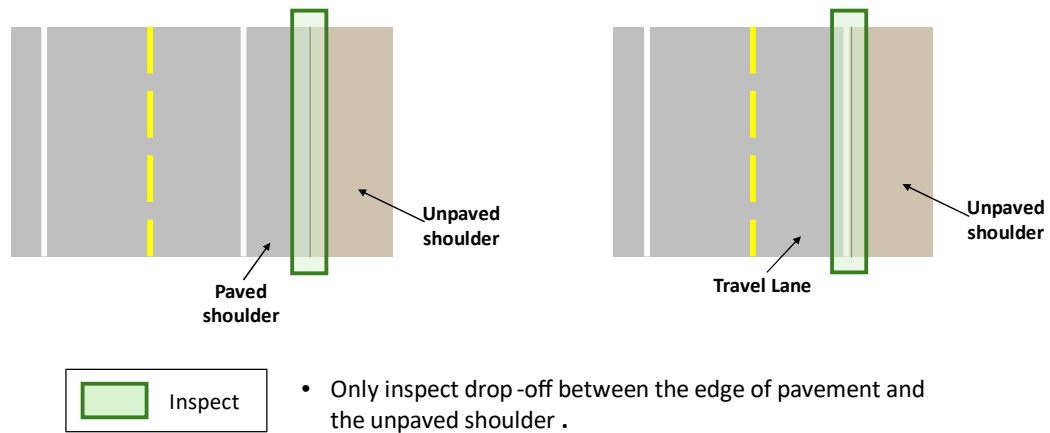
Step 2: Use a measuring tape to measure the distance from the bottom of the straightedge to the unpaved shoulder underneath. This measurement must be taken within 1 foot of the edge of pavement.

Step 3: If the drop-off is greater than 4 inches, see Step 4. If the drop-off is between 2 and 4 inches within 1 foot of the edge of pavement, use a measuring wheel to measure the length of travel lane pavement where the edge differential meets the deficiency criteria.

Step 4: If the drop-off is greater than 2 inches within 1 foot of the edge of pavement for 25 continuous feet, or greater than 2 inches within 1 foot of the edge of pavement for 100 cumulative feet, or at least 4 inches at any location, record the deficiency in the application.

UNPAVED SHOULDER DROP-OFF

HOW TO MEASURE



UNPAVED SHOULDER DROP-OFF

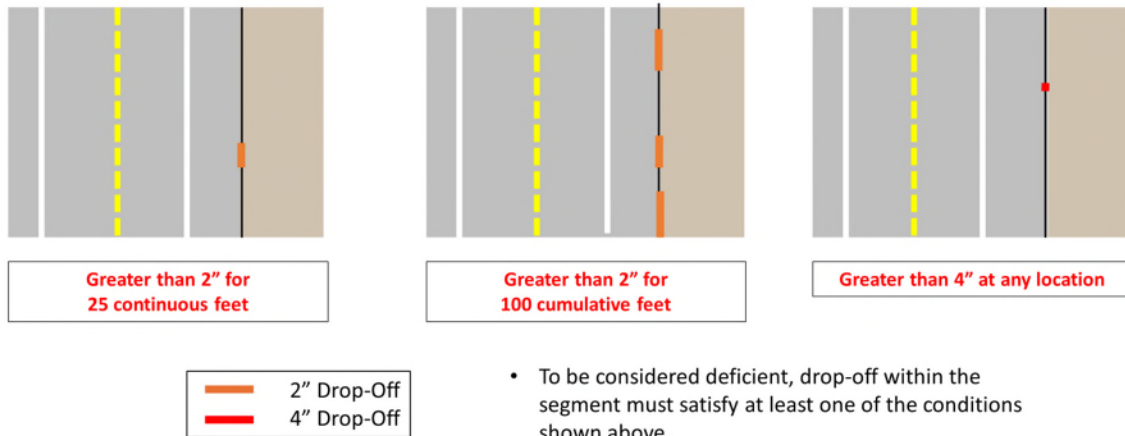
HOW TO MEASURE

- To measure drop-off, place level firmly on the pavement and extend beyond the edge of pavement.
- Drop-off **must be measured within 1 foot** of the edge of pavement.
- Use a measuring wheel to measure the sustained length of deficient drop-off.



UNPAVED SHOULDER DROP-OFF

HOW TO MEASURE



Examples

UNPAVED SHOULDER DROP-OFF

EXAMPLE

- This meets the deficiency standard for drop -off.
- To meet deficiency standard, drop -off must exceed:
 - 2 inches for 25 continuous feet
 - 2 inches for 100 cumulative feet
 - 4 inches at any location



5.2.2 UNPAVED DITCHES

Definition

An unpaved ditch is an earthen roadside channel that conveys water. A roadside ditch must have a front slope and at least a 6-inch back slope to be considered a ditch. Generally, a standard roadside ditch is designed to a minimum depth below the roadway; however, there may be special ditches or exceptions on some older roadways.

Deficiency Standards

Unpaved ditches are considered deficient if:

- **Blocked:** More than 50% of the unpaved ditch cross section is blocked for more than 50 cumulative linear feet, or 100% of the unpaved ditch is blocked at any location.
- **Erosion:** Erosion within the unpaved ditch is greater than 1 foot below the original ditch line.

Important Considerations

Included in unpaved ditch inspections:

- If intersecting ditches are present, inspect the unpaved ditch around the curve within the limits of the segment.

Not included in unpaved ditch inspections:

- Single sloped banks along roadways or fence lines.

5.2.2.1 BLOCKED

Definition

A blockage is any buildup of sediment, large objects, or other material within the unpaved ditch that prevents the normal flow of water.

Deficiency Standard

Unpaved ditch blockages are considered deficient if:

- More than 50% of the unpaved ditch cross section is blocked for more than 50 cumulative linear feet, OR
- 100% of the unpaved ditch is blocked at any location.

How to Measure the Deficiency

Step 1: Evaluate the segment for blockages within the unpaved ditch.

Step 2: If 100% of the unpaved ditch is blocked at any location, see Step 3. If more than 50% of the unpaved ditch cross section is blocked, determine the beginning of the blockage, and use a measuring wheel to measure the total linear feet of blocked ditch.

Step 3: If more than 50% of the unpaved ditch cross section is blocked for more than 50 cumulative feet, or if 100% of the

unpaved ditch cross section is blocked at any location, record the deficiency in the application.

Examples

UNPAVED DITCH BLOCKAGE

EXAMPLE

- Unpaved ditch blockages must meet one of the following criteria to be considered deficient:
 - **More than 50% of the ditch** cross section is blocked for more than **50 cumulative linear feet**, or
 - **100% of the ditch** cross section is blocked **at any location**.
- A blockage is any buildup of sediment, large objects, or other material that prevents the normal flow of water.
- Evidence may include stagnant water.
- Use the inlets and outlets at either end of an unpaved ditch to determine the original flow line.

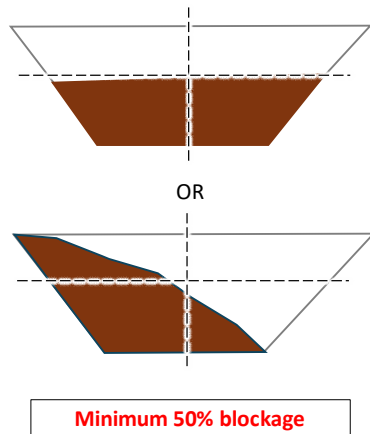


UNPAVED SHOULDER
AND DITCH



UNPAVED DITCH BLOCKAGE

EXAMPLE



5.2.2.2 EROSION

Definition

Erosion is the deterioration of an unpaved ditch. Erosion of an unpaved ditch, if not addressed, may prevent the normal flow of water, cause soil destabilization, and contaminate natural drainage areas.

NOTE: The presence of ruts caused by mowing is not included in Erosion criteria and should not be failed.

Deficiency Standard

Unpaved ditch erosion is considered deficient if:

- Erosion within the unpaved ditch is greater than 1 foot below the original ditch line.

How to Measure the Deficiency

Step 1: Evaluate the segment for erosion within the unpaved ditch that is creating a channel in the ditch below the original ditch line. If possible, use inlets and outlets at either end of the unpaved ditch to determine the original ditch line.

Step 2: If possible, place a straight edge on the bottom of the ditch and use a measuring tape to measure the distance between the lowest point of the erosion channel to the bottom of the original ditch line.

Step 3: If the deepest point of the erosion channel is greater than 1 foot below the original ditch line, record the deficiency in the application.

UNPAVED DITCH
EROSION



HOW TO MEASURE



Examples

UNPAVED DITCH
EROSION

EXAMPLE

- Erosion must be greater than **1 foot below the original ditch line** to meet the deficiency criteria.
- Evidence of erosion includes ponding and/or soil destabilization.



UNPAVED SHOULDER
AND DITCH

Unpaved Shoulder
and Ditch

Unpaved Ditch

Blockage

Erosion

5.2.3 PAVED DITCHES

Definition

Paved ditches are open roadside channels constructed to disperse surface water and prevent erosion. A proper ditch lining helps increase water flow velocity and prevent loss or roadbed support by stabilizing the soil. Paved ditches are often found at the “end” of an unpaved ditch line and near box culverts and cross drains.

Deficiency Standards

Paved ditches are considered deficient if:

- **Blockage:** More than 50% of the paved ditch cross section is blocked for more than 50 cumulative linear feet, OR 100% of the paved ditch is blocked at any location.
- **Erosion:** Erosion is present at either end or along the parallel edges that exposes soil area and threatens the structural integrity of the paved ditch.
- **Settlement / Misalignment:** Settlement or misalignment within the paved ditch is greater than 2 inches.
- **Cracking:** More than 10% of the paved ditch surface area has cracking greater than 0.5 inches in width.

Important Considerations

Included in paved ditch inspections:

- Concrete ditches
- Flumes
- Curb and gutter located behind the guardrail.
- For paved ditches at intersections, inspect around the curve within the limits of the segment.
- For intersecting paved ditches, stop at the point of intersection and begin measuring the additional ditch before proceeding on the main ditch.

Not included in paved ditch inspections:

- Stormwater drains.
- Runoff channels not designed as paved ditches.
- Unpaved or earthen ditches.

5.2.3.1 BLOCKED**Definition**

A blockage is any buildup of sediment, large objects, or other material within the paved ditch that prevents the normal flow of water.

Deficiency Standard

Paved ditch blockages are considered deficient if:

- More than 50% of the paved ditch cross section is blocked for more than 50 cumulative linear feet, OR
- 100% of the paved ditch is blocked at any location.

NOTE: If the paved ditch is less than 50 feet long, the blockage must be 100% of the ditch cross section to be considered deficient.

How to Measure the Deficiency

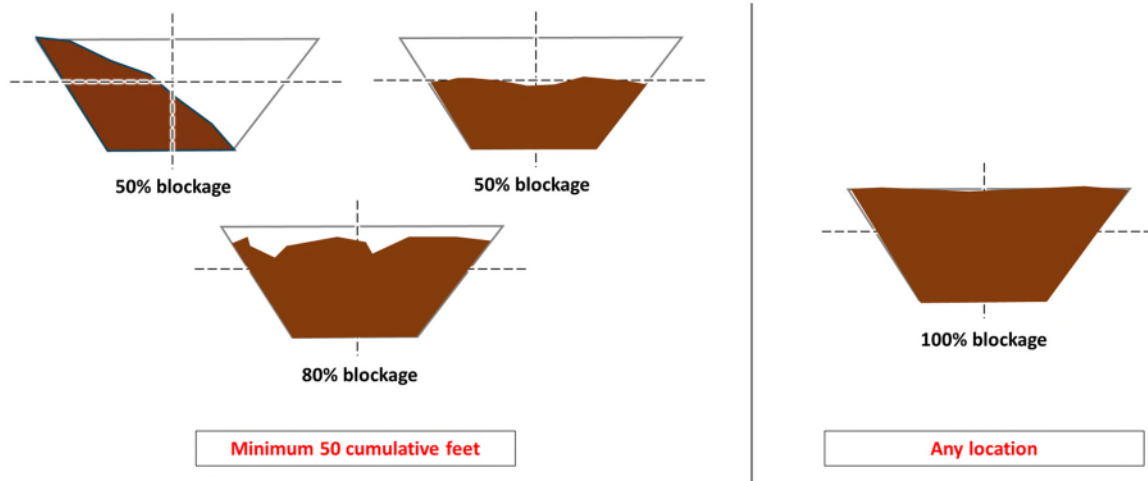
Step 1: Evaluate the segment for blockages within the paved ditch.

Step 2: If 100% of the paved ditch is blocked at any location, see Step 3. If more than 50% of the unpaved ditch cross section is blocked, determine the beginning of the blockage, and use a measuring wheel to measure the cumulative linear feet of blocked ditch.

Step 3: If more than 50% of the paved ditch cross section is blocked for more than 50 cumulative feet, or if 100% of the unpaved ditch cross section is blocked at any location, record the deficiency in the application.

PAVED DITCH BLOCKAGE

HOW TO MEASURE



Examples

PAVED DITCH BLOCKAGE

EXAMPLE

- Unpaved ditch blockages must meet one of the following criteria to be considered deficient:
 - More than 50% of the ditch cross section is blocked for more than 50 cumulative linear feet, or
 - 100% of the ditch cross section is blocked at any location.
- Note:** If paved ditch is less than 50 feet long, blockage must be 100% of the ditch cross section to be considered deficient.
- A blockage is any buildup of sediment, large objects, or other material that prevents the normal flow of water.
- Evidence may include stagnant water.

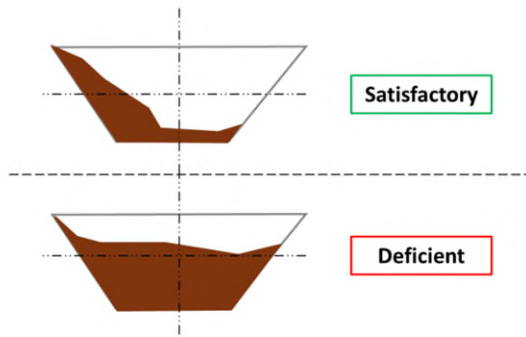


UNPAVED SHOULDER
AND DITCH



PAVED DITCH BLOCKAGE

EXAMPLE



5.2.3.2 EROSION

Definition

Erosion is the deterioration of a paved ditch concrete slab and may consist of various structural degradations, including undermining, joint separation, and cracking. Paved ditch erosion, if not addressed, may prevent the normal flow of water, impact road stabilization, contaminate natural drainage areas, and be a safety hazard for errant motorists.

Deficiency Standard

Paved ditch erosion is considered deficient if:

- Erosion is present at either end or along the parallel edges that exposes soil area and threatens the structural integrity of the paved ditch.

How to Measure the Deficiency

Step 1: Evaluate the segment for erosion within the paved ditch.

Step 2: If erosion is present within the paved ditch that exposes soil area and threatens the structural integrity of the paved ditch, record the deficiency in the application.

Examples

PAVED DITCH EROSION

EXAMPLE

- To meet the deficiency criteria, erosion around the paved ditch must **expose soil area** and **threaten structural integrity**.
- Paved ditch erosion may include undermining, joint separation, cracking, and other deterioration that threatens the structural integrity of the paved ditch.



5.2.3.3 SETTLEMENT / MISALIGNMENT

Definition

Settlement is a depression within the paved ditch pavement typically identified by collecting water or asphalt breaking away due to poor lateral support. Misalignment is the horizontal deviation in a paved ditch structure. Excessive settling or misalignment within the paved ditch may compromise structural integrity and prevent the flow of surface water.

Deficiency Standard

Paved ditch settling is considered deficient if:

- Settlement or misalignment within the paved ditch is greater than 2 inches.

How to Measure the Deficiency

Step 1: Evaluate the segment for settling within the paved ditch.

Step 2: Use a measuring tape to measure the vertical or horizontal deviation within the paved ditch due. If greater than 2 inches, record the deficiency in the application.

PAVED DITCH
SETTLEMENT / MISALIGNMENT

HOW TO MEASURE

- The deficiency criteria is met if **settlement or misalignment within the paved ditch is greater than 2 inches.**
- Use a measuring tape (and a level if necessary) to measure the vertical horizontal deviation.



Unpaved Shoulder
and Ditch

Paved Ditch

Blockage

Erosion

Settlement /
Misalignment

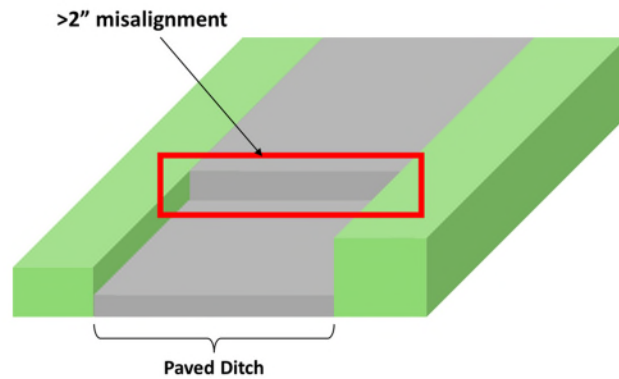
Cracking

Examples

PAVED DITCH
SETTLEMENT / MISALIGNMENT

EXAMPLE

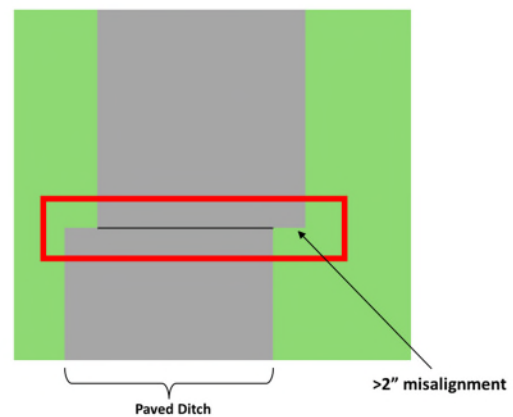
- To be considered deficient, **settlement or misalignment within the paved ditch must be greater than 2 inches.**
- Settling is a depression or sudden vertical deviation within the paved ditch.



PAVED DITCH
SETTLEMENT / MISALIGNMENT

EXAMPLE

- The deficiency criteria is met if **settlement or misalignment within the paved ditch is greater than 2 inches.**
- Misalignment is the horizontal deviation in a paved ditch that may impact water flow.



5.2.3.4 CRACKING

Definition

Cracking is pavement surface distress. Cracking in a paved ditch can be caused by tree roots, improperly cut joints, expansion and contraction, and soil instability.

Deficiency Standard

Paved ditch cracking is considered deficient if:

- More than 10% of the paved ditch surface area has cracking greater than 0.5 inches in width.

How to Measure the Deficiency

Step 1: Use a measuring tape and measuring wheel to measure the width and length of the paved ditch within the segment.

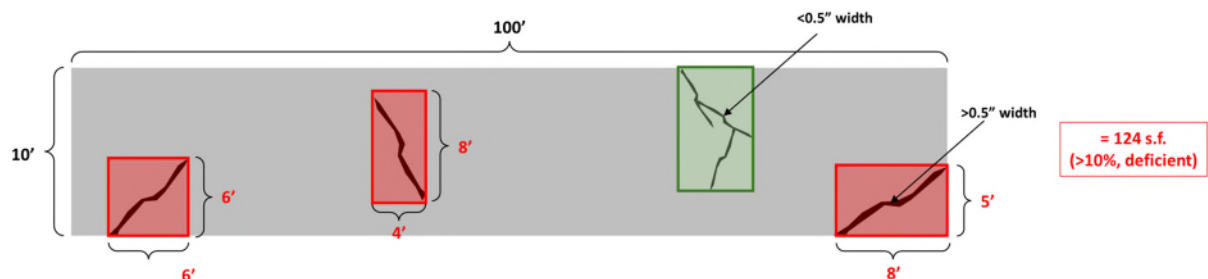
Step 2: Evaluate the segment for cracking greater than 0.5 inches wide within the paved ditch. Use a measuring tape if necessary.

Step 3: If the cracking is greater than 0.5 inches wide, use a measuring wheel and measuring tape to measure the cumulative surface area of each instance of deficient cracking within the paved ditch. Calculate the total cumulative length of paved ditch with deficient cracking.

Step 4: If more than 10% of the paved ditch surface area has cracking greater than 0.5 inches in width, record the deficiency in the application.

PAVED DITCH
CRACKING

HOW TO MEASURE



- Measure the cumulative width and length of the paved ditch that exhibits cracking at least 0.5" in width to estimate the surface area.
- If the cumulative surface area of deficient paved ditch totals at least 10%, the paved ditch should be recorded as deficient for cracking.



Examples

PAVED DITCH CRACKING

EXAMPLE

- To exceed the threshold for failure, more than **10% of the paved ditch surface** area must have cracking **greater than 0.5 inches in width**.



UNPAVED SHOULDER
AND DITCH



PAVED DITCH CRACKING

EXAMPLE



5.2.4 SLOPES

Definition

Slopes are gradients extending out from the roadside. Front slopes provide a gradual and contoured transition from the shoulder edge to the roadside ditch or toe of slope in a fill section. Back slopes provide a gradual and contoured transition from the roadside ditch to the top of slope in a cut section.

Important Considerations

Included in slope inspections:

- Front slopes are evaluated from the shoulder edge to one of the following locations:
 - The roadside ditch bottom,
 - The edge of slope in a fill section, or
 - The limits of the right-of-way.

Not included in slope inspections:

- Unpaved ditches.
- Unpaved shoulder with minimal elevation change.

SLOPES
EROSION

HOW TO MEASURE



Not included in slope inspections:

- Unpaved shoulder with minimal elevation change
- Unpaved ditches

Unpaved Shoulder
and Ditch

Slopes

Erosion

Deficiency Standard

Slopes are considered deficient if:

- **Erosion:** Erosion is present and greater than 6 inches in depth.

How to Measure

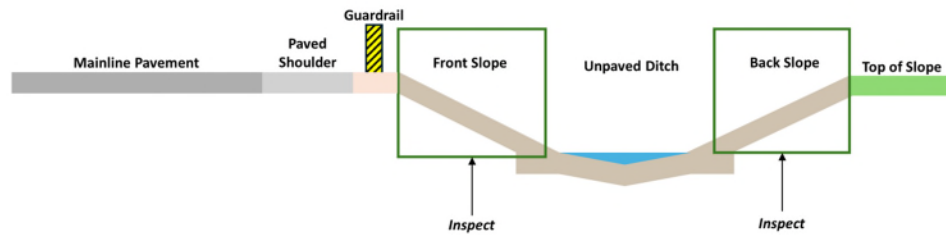
Step 1: Evaluate the segment for slope erosion. This may include ruts or washouts.

Step 2: If possible, use a measuring tape to measure the height of the deviation caused by erosion. If the deviation is greater than 6 inches, record the deficiency in the application.

NOTE: If unable to safely measure, estimate the height of the deviation.

SLOPES EROSION

HOW TO MEASURE



Front slopes are evaluated from the shoulder edge to one of the following locations:

- Roadside ditch bottom,
- Edge of slope,
- Limits of right-of-way.

Back slopes are evaluated from the foot of slope to one of the following locations:

- Top of slope,
- Limits of right-of-way.



Examples

SLOPES
EROSION

EXAMPLE

- To be considered deficient, erosion must be present and **greater than 6 inches in depth.**
- Evidence may include ruts, washouts, or buildups.
- Looking for erosion that may endanger slopes stability.
- Typically found underneath guardrail runs.



UNPAVED SHOULDER
AND DITCH

Unpaved Shoulder
and Ditch

Slopes

Erosion

SLOPES
EROSION

EXAMPLE

- If possible, use a measuring tape or measuring stick to measure the height of the vertical deviation .



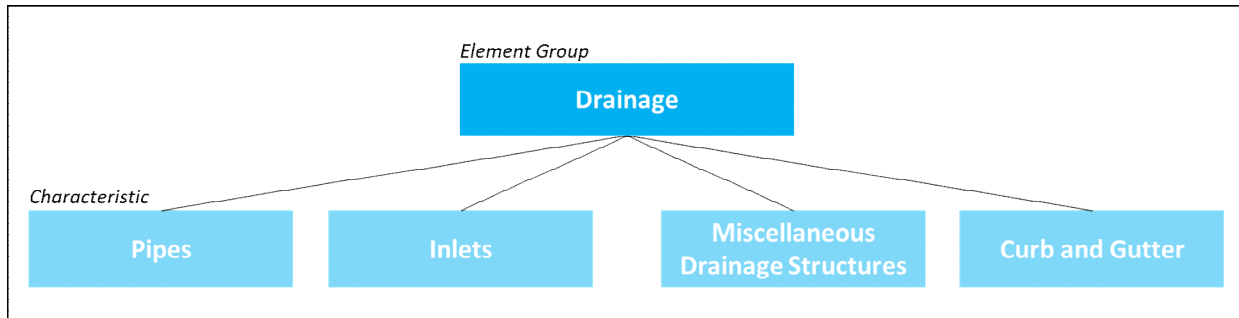
Unpaved Shoulder
and Ditch

Slopes

Erosion

5.3 DRAINAGE ELEMENTS

The Drainage element group consists of the following characteristics: Pipes, Inlets, Miscellaneous Drainage Structures, and Curb and Gutter.



Refer to the characteristic subsections for an overview of the deficiency standards and important considerations. For more detailed information, refer to the individual deficiency standard subsections.

5.3.1 PIPES

Definition

Pipes are conduit channels that allow water to flow under a road, from one side of the road to the other. These normally run perpendicular to the direction of travel and begin or end in an open roadside ditch.

Deficiency Standards

Pipes are considered deficient if:

- **Obstruction:** More than 25% of the structure is obstructed or blocked.
- **Erosion:** Eroded area at the inlet or outlet is longer than 1.5 times the pipe diameter and greater than 6 inches deep.
- **End Protection:** End protection has deteriorations, erosions, washouts, or buildups adversely affecting the natural flow of water.
- **Structural Damage / Corrosion:** Pipe has crushed ends or is rusted through.
- **Roadway Settlement:** Asphalt or concrete roadway over drainage pipe is cracking, sinking, or rising.

Important Considerations

Included in pipe inspections:

- Culverts less than 20 feet as measured longitudinally along the roadway.

Not included in pipe inspections:

- Box culverts that run parallel to the travel pavement (i.e., under a driveway or business entrance)

- Pipes more than 20 feet as measured longitudinally along the roadway. All culverts greater than 20 feet are inspected as part of the NBIS structure inspection program.

5.3.1.1 OBSTRUCTION

Definition

An obstruction is any buildup of sediment, large objects, or other material that prevents the normal flow of water through the pipe. Deficient pipe obstructions should consist of solid material such as soil and rocks, not leaf litter.

Deficiency Standard

Pipe obstructions are considered deficient if:

- More than 25% of the structure is obstructed or blocked.

How to Measure the Deficiency

Step 1: Evaluate the segment for pipe obstructions.

Step 2: Where a pipe obstruction is present, use a measuring tape to measure the opening width of the pipe.

Step 3: Refer to the Pipe Size Chart to determine the allowable depth of the obstruction.

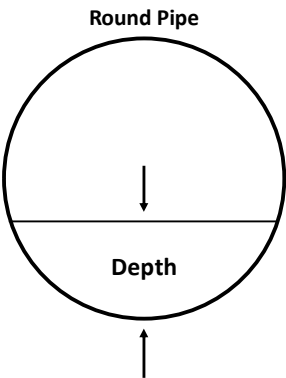
Step 4: Measure the depth of the portion of pipe that is blocked with solid material. Determine the percent of the pipe area that is obstructed.

Step 5: If more than 25% of the pipe is obstructed, record the deficiency in the application.

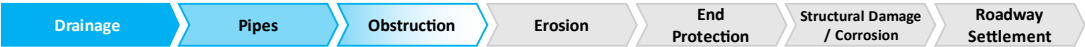
NOTE: TDOT has an Aquatic Organism DOT has an Aquatic Organism Passage (AOP) program for wet stream conveyance through culverts. To define, use the “72 hour” rule: “If water is present after 72 hours from the last rain event, inspector can assume waterbody is a stream.”

Culvert AOP requires stream beds to remain continuous through a culvert. This means the culvert pipe or box structure will be embedded and the culvert bottom should have rocks and material similar to the stream bed. Start the blockage measurement from the top of the embedded material in the bottom of the culvert.

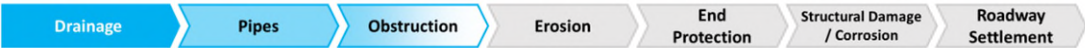
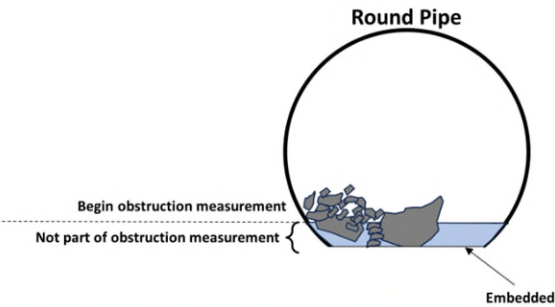
More than 25% of the structure must be obstructed to be considered deficient.



Round Pipe Diameter	Min. Depth of Blockage to Meet 25% Obstruction
4"	1.25"
8"	2.5"
12"	3.75"
18"	5.5"
24"	7.25"
30"	9"
36"	10.75"
48"	14.5"
60"	18"



- **Aquatic Organism Passage:** There may be intentional rock material lining the bottom of the structure to allow for aquatic organism passage.
- When measuring the opening of a pipe, **do not include** the depth of rock material that is even or below the stream's natural flow.

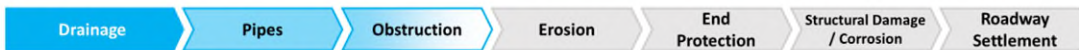


Examples

PIPES
OBSTRUCTION

EXAMPLE

- **More than 25%** of the structure must be obstructed to be considered deficient.
- Pipe obstructions must consist of **solid material** such as soil and rocks, not just leaf litter.



5.3.1.2 EROSION

Definition

Erosion is the deterioration of a pipe inlet. Inlet erosion may threaten structural integrity and disrupt the normal flow of water through the pipe.

Deficiency Standard

Pipe erosion is considered deficient if:

- Eroded area at the inlet or outlet is longer than 1.5 times the pipe diameter and greater than 6 inches deep. (E.g., if the pipe diameter is 2', the eroded area must be at least 3' long for the pipe to be considered deficient.)

How to Measure the Deficiency

Step 1: Evaluate the segment for erosion of inlets and outlets. Use the example photos to help determine if the deficiency standard is met.

Step 2: Use a measuring tape to measure the pipe diameter.

Step 3: Use a measuring tape to measure the erosion around the inlet or outlet. If the erosion is greater than 1.5 times the pipe diameter and greater than 6 inches deep, record the deficiency in the application.

Examples

PIPES
EROSION

EXAMPLE

- To be considered deficient, erosion at the inlet or outlet must be **longer than 1.5 times the pipe diameter** and **greater than 6 inches deep**.
- Pipe erosion may threaten structural integrity and disrupt the normal flow of water.



5.3.1.3 END PROTECTION

Definition

End protection is a flared attachment installed on either side of a culvert pipe to improve water flow efficiency and prevent erosion.

Deficiency Standard

Pipe end protection is considered deficient if:

- End protection has deteriorations, erosions, washouts, or buildups adversely affecting the natural flow of water.

How to Measure the Deficiency

Step 1: Evaluate the segment for deterioration of pipe end protection.

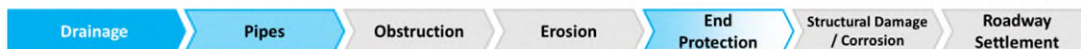
Step 2: If end protection deterioration adversely affects the natural flow of water, record the deficiency in the application.

Examples

PIPES
END PROTECTION

EXAMPLE

Deficient pipe end protection may exhibit **deteriorations, erosions, washouts, or buildups adversely affecting the natural flow of water.**



5.3.1.4 STRUCTURAL DAMAGE/CORROSION

Definition

Structural damage and corrosion is deterioration of a pipe, including excessive rusting, structural collapse, pipe undermining, cracking, or joint separation. Severe structural damage may prevent normal water flow through the pipe and threaten the structural integrity of the roadway above.

Deficiency Standard

Pipe structural damage/corrosion is considered deficient if:

- Pipe has crushed ends or is rusted through.

How to Measure the Deficiency

Step 1: Evaluate the segment for structural damage or corrosion of pipes.

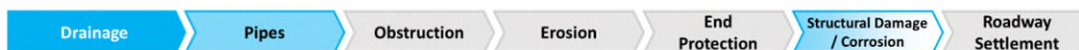
Step 2: If the pipe has crushed ends or is rusted through, record the deficiency in the application.

Examples

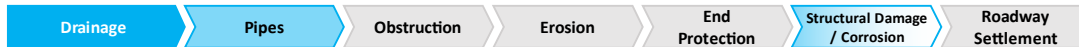
PIPES
STRUCTURAL DAMAGE / CORROSION

EXAMPLE

Pipes are considered deficient for Structural Damage / Corrosion if the pipe has **crushed ends or is rusted through.**



Structural damage may include **excessive rusting, structural collapse, pipe undermining, cracking, or joint separation.**



5.3.1.5 ROADWAY SETTLEMENT

Definition

Roadway settlement is asphalt cracking, sinking, or rising, specifically caused by a pipe underneath the pavement. Significant pavement settlement above a pipe may indicate structural deterioration of the pipe.

Deficiency Standard

Roadway settlement over a pipe underneath road is considered deficient if:

- Asphalt or concrete roadway over drainage pipe is cracking, sinking, or rising.

How to Measure the Deficiency

Step 1: Evaluate the segment for settlement within the sections of roadway above pipes. **DO NOT ENTER THE TRAVEL LANE TO INSPECT ROADWAY SETTLEMENT.**

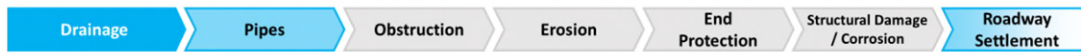
Step 2: If the asphalt or concrete roadway over a drainage pipe is cracking, sinking, or rising, record the deficiency in the application.

Examples

PIPES
ROADWAY SETTLEMENT

EXAMPLE

- Roadway settlement is considered deficient if the asphalt or concrete roadway over a drainage pipe is cracking, sinking, or rising.



5.3.2 INLETS

Definition

Inlets are structures designed to collect surface runoff and deliver it to underground stormwater conveyance systems. Inlets may be found in curbs, paved ditches, unpaved ditches, valley gutters, and at other locations designed to collect water runoff.

Deficiency Standards

Inlets are considered deficient if:

- **Obstruction:** More than 25% of the inlet (or grate, outlet) cross section is blocked or obstructed.
- **Structural Damage (Grates):** Grates are missing, out of place, or broken.
- **Erosion:** Eroded area is within 1 foot of the inlet structure and greater than 6 inches in depth or below the base elevation of the concrete apron.
- **Surface Damage:** Surface damage is greater than 0.5 square feet.
- **Apron Damage:** Cracking is present on over 10% of the apron area and is greater than 0.25 inches.
- **Unsealed Joints:** Unsealed concrete joint separations are greater than 0.25 inches.

Important Considerations

Included in inlet inspections:

- Curb inlets
- Drop inlets
- Junction boxes
- Grated inlets

Not included in inlet inspections:

- Pipes and culverts
- Inlets located on private property

5.3.2.1 OBSTRUCTION

Definition

Obstruction is any buildup of sediment, large objects, or other material that prevents normal collection of surface water runoff by the inlet. Deficient inlet obstructions should consist of solid material such as soil and rocks, not leaf litter.

Deficiency Standard

Inlet obstructions are considered deficient if:

- More than 25% of the inlet cross section is blocked or obstructed.

How to Measure the Deficiency

Step 1: Evaluate the segment for inlet obstructions.

Step 2: Use a tape measure to measure the length and width of the inlet. Multiply the length by the width to calculate the inlet cross section.

Step 3: Kick off any loose debris to verify obstruction. Use a tape measure to measure the length and width of any obstruction that is preventing water collection by the inlet. Multiply the length by the width to calculate the cross section of the obstruction.

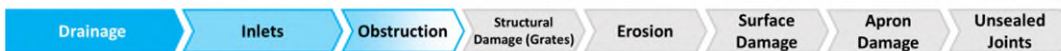
Step 4: If more than 25% of the inlet is obstructed, record the deficiency in the application.

Examples

INLETS
OBSTRUCTION

EXAMPLE

More than 25% of the inlet cross section must be obstructed to exceed the threshold for failure.



5.3.2.2 STRUCTURAL DAMAGE – GRATES

Definition

Grates are slotted structures that cover inlets and prevent large debris from passing through. For a grate to be in place, it must be properly seated in the design cradle and cannot be unseated by normal pedestrian or vehicular traffic.

Deficiency Standard

Inlet grates are considered deficient due to structural damage if:

- Grates are missing, out of place, or broken.

How to Measure the Deficiency

Step 1: Evaluate the segment for grates that are missing, out of place, or broken.

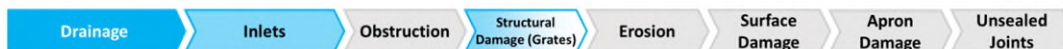
Step 2: If the grate is missing, out of place, or broken, record the deficiency in the application.

Examples

INLETS
STRUCTURAL DAMAGE (GRATES)

EXAMPLE

Grates must be **missing, out of place, or broken** to be considered deficient for structural damage.



5.3.2.3 EROSION

Definition

Erosion is the deterioration of the area around the inlet structure. Significant deterioration of the inlet area may compromise structural integrity and prevent the normal collection of water.

NOTE: The presence of ruts due to mowing is not included in the Erosion criteria and should not be failed.

Deficiency Standard

Inlet erosion is considered deficient if:

- Eroded area is within 1 foot of the inlet structure and greater than 6 inches in depth or below the base elevation of the concrete apron.

How to Measure the Deficiency

Step 1: Evaluate the segment for erosion within 1 foot of inlet structures.

Step 2: Use a measuring tape to measure the distance between the erosion and the inlet edge.

Step 3: If the erosion is within 1 foot of the inlet, use a measuring tape to measure the depth of the erosion.

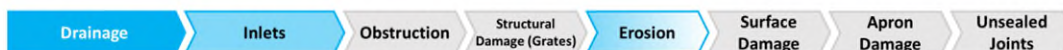
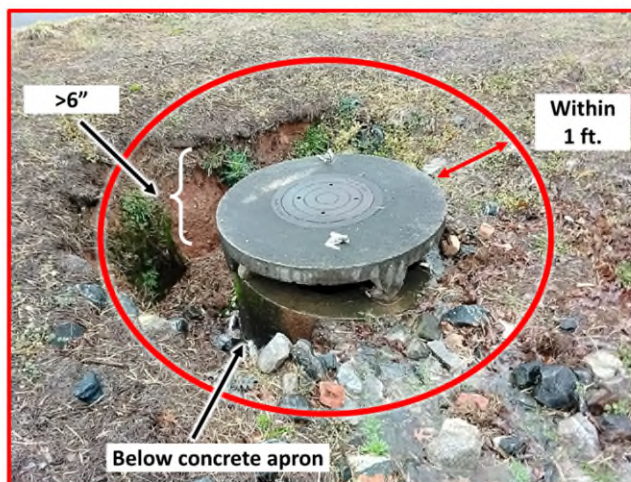
Step 4: If the erosion is within 1 foot of the inlet and greater than 6 inches in depth or below the base elevation of the concrete apron, record the deficiency in the application.

Examples

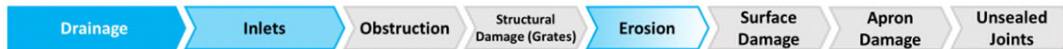
INLETS
EROSION

EXAMPLE

- Eroded area must be within 1 foot of the inlet structure and greater than 6 inches in depth or below the base elevation of the concrete apron.



- Eroded area must be within 1 foot of the inlet structure and greater than 6 inches in depth or below the base elevation of the concrete apron.



5.3.2.4 SURFACE DAMAGE

Definition

Surface damage is the direct deterioration of an inlet and may include any deformation of the inlet that creates a hazard, such as exposed steel.

Deficiency Standard

Inlet surface damage is considered deficient if:

- Surface damage is greater than 0.5 square feet.

How to Measure the Deficiency

Step 1: Evaluate the segment for inlet surface damage.

Step 2: Use a measuring tape to measure the length and width of the surface damage. Multiply the length by the width to calculate the surface area.

Step 3: If the surface damage is greater than 0.5 square feet, record the deficiency in the application.

5.3.2.5 APRON DAMAGE

Definition

Apron damage is the deterioration of the inlet apron structure, usually in the form of cracking. The inlet apron is the concrete surface placed at the mouth of the inlet to increase flow effectiveness.

Deficiency Standard

Inlet apron damage is considered deficient if:

- Cracking is present on over 10% of the apron area and is greater than 0.25 inches.

How to Measure the Deficiency

Step 1: Evaluate the segment for inlet apron damage.

Step 2: Use a measuring tape to measure the length and width. Multiply the length by the width to calculate the inlet apron surface area.

Step 3: Use a measuring tape to measure the width of the cracking.

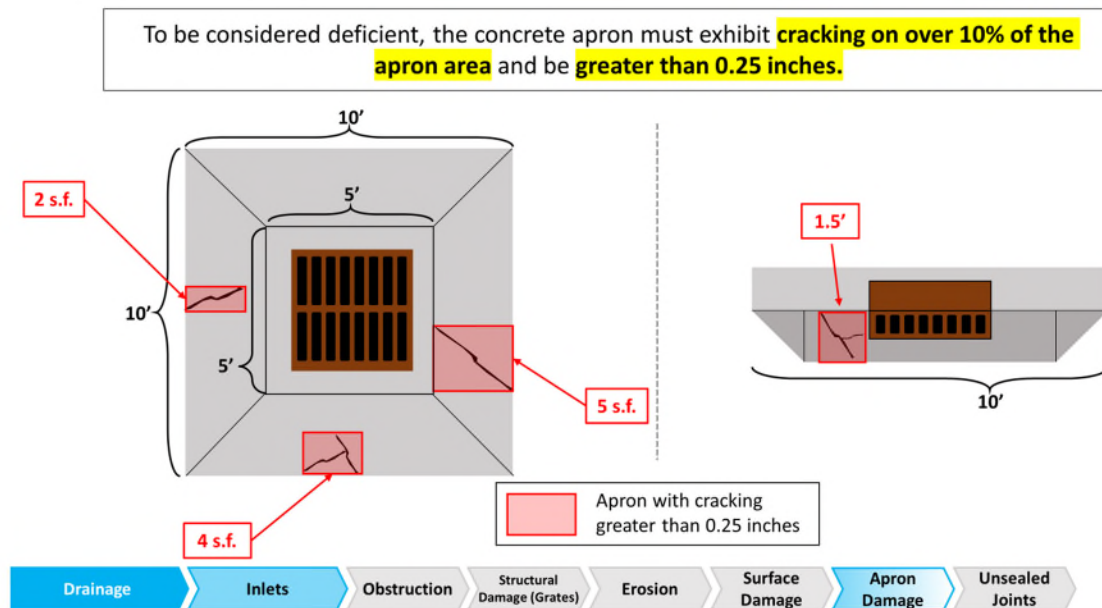
Step 4: If the cracking is greater than 0.25 inches, use a measuring tape to measure the length and width of the surface with cracking. Multiply the length by the width to calculate the inlet apron surface area exhibiting cracking.

Step 5: If cracking is present on over 10% of the apron area and is greater than 0.25 inches, record the deficiency in the application.

Examples

INLETS
APRON DAMAGE

EXAMPLE



5.3.2.6 UNSEALED JOINTS

Definition

Unsealed joints are joints that are missing rubber sealant, allowing water and sediment to enter the joint and degrade the pavement.

Deficiency Standard

Inlet joints are considered deficient if:

- Unsealed concrete joint separations are greater than 0.25 inches.

How to Measure the Deficiency

Step 1: Evaluate the segment for unsealed inlet joint separation.

Step 2: Use a tape measure to measure the width of the unsealed joint.

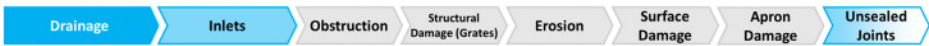
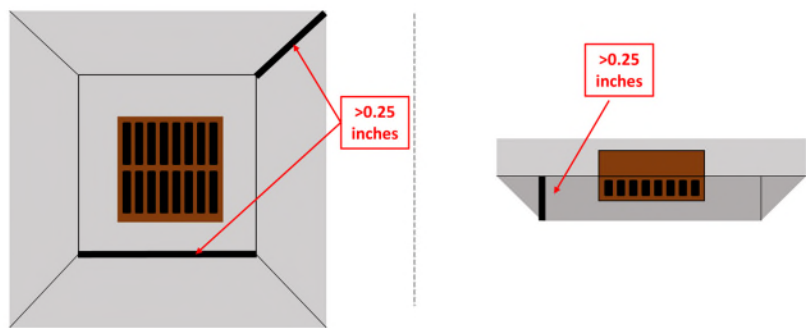
Step 3: If the unsealed concrete joint separation is greater than 0.25 inches, record the deficiency in the application.

Examples

INLETS
UNSEALED JOINTS

EXAMPLE

To be considered deficient, a concrete joint must be **separated** and greater than **0.25 inches**



INLETS
UNSEALED JOINTS

EXAMPLE



5.3.3 MISCELLANEOUS DRAINAGE STRUCTURES

Definition

Miscellaneous drainage structures are any drainage structures that collect or convey water and are not accurately characterized by the other drainage sections.

Deficiency Standards

Miscellaneous drainage structures are considered deficient if:

- **Obstruction:** More than 25% of the structure cross section is obstructed.
- **End Condition:** End protection has deteriorations, erosions, washouts or buildups adversely affecting the natural flow of water.
- **Under Drain Rodent Screen:** Under drain rodent screen is out of place.
- **Illicit Discharge:** Illicit discharge is present.

Important Considerations

Included in miscellaneous drainage structure inspections:

- Flumes
- Spillways
- Trench drains
- Edge drains
- Weep holes (not retaining walls)
- Piped sloped drains

Not included in miscellaneous drainage structure inspections:

- Structures that are better characterized by other drainage sections.

5.3.3.1 OBSTRUCTION

Definition

An obstruction is any buildup of sediment, large objects, or other material that prevents the normal flow of water through the drainage structure. Deficient obstructions should consist of solid material such as soil and rocks, not leaf litter.

Deficiency Standard

Miscellaneous drainage structure obstructions are considered deficient if:

- More than 25% of the structure cross section is obstructed.

How to Measure the Deficiency

Step 1: Evaluate the segment for drainage structure obstructions.

Step 2: Where an obstruction is present, use a measuring tape to measure and calculate the cross section of the structure.

Step 3: Use a measuring tape to measure and calculate the cross section of the structure that is being obstructed. If more than

25% of the structure cross section is obstruction, record the deficiency in the application.

Examples

MISCELLANEOUS DRAINAGE STRUCTURES
OBSTRUCTION

EXAMPLE

More than 25% of the drainage structure cross section **must be obstructed** to be considered deficient.



5.3.3.2 END CONDITION

Definition

An end condition is an attachment installed on either side of a culvert pipe or other drainage structure to improve water flow efficiency and prevent erosion.

Deficiency Standard

Miscellaneous drainage structure end condition is considered deficient if:

- End condition has deteriorations, erosions, washouts or buildups adversely affecting the natural flow of water.

How to Measure the Deficiency

Step 1: Evaluate the segment for deterioration of drainage end conditions.

Step 2: If end condition deterioration adversely affects the natural flow of water, record the deficiency in the application.

Examples

MISCELLANEOUS DRAINAGE STRUCTURES
END CONDITION

EXAMPLE

To exceed the threshold for failure, end conditions must exhibit **deteriorations, erosions, washouts, or buildups adversely affecting the natural flow of water.**



5.3.3.3 UNDERDRAIN RODENT SCREEN

Definition

Underdrain rodent screens are barriers installed to prevent rodents and other small animals from entering the drainage system.

Deficiency Standard

Underdrain rodent screens are considered deficient if:

- Underdrain rodent screen is out of place.

How to Measure the Deficiency

Step 1: Evaluate the segment for under drain rodent screens that are out of place.

Step 2: If the underdrain rodent screen is out of place, record the deficiency in the application.

Examples

MISCELLANEOUS DRAINAGE STRUCTURES UNDER DRAIN RODENT SCREEN

EXAMPLE

- All under drains (like the one shown here) should include a properly installed rodent screen.
- To be considered deficient, the under drain rodent screen must be **missing or out of place.**



5.3.3.4 ILLICIT DISCHARGE

Definition

Illicit discharge is any unauthorized release of material onto TDOT right-of-way. Illicit discharge often originates from outside of TDOT right-of-way and enters through a stream or drainage infrastructure.

Deficiency Standard

Illicit discharge is considered deficient if:

- Illicit discharge is present.

How to Measure the Deficiency

Step 1: Use the example photos to determine if the deficiency standard is met. Check for discoloration and odors.

Step 2: If illicit discharge is present, record deficiency in the application.

Examples

MISCELLANEOUS DRAINAGE STRUCTURES
ILLICIT DISCHARGE

EXAMPLE

- Illicit discharge is any unauthorized release of material onto TDOT right-of-way, usually originating outside of TDOT right-of-way.



5.3.4 CURB AND GUTTER

Definition

Curb and gutter is a concrete or asphalt structure used to collect and channel surface runoffs from paved streets or other impervious surfaces.

Deficiency Standards

Curb and gutter is considered deficient if:

- **Settlement:** Settlement is present in the curb and gutter and is greater than 2 inches in depth.
- **Structural Damage:** Unsealed cracking of at least 0.75 inches is present on 10% of cumulative length of the curb and gutter.
- **Misalignment:** Curb and gutter misalignment is greater than 2 inches at any location.

Important Considerations

Included in curb and gutter inspections:

- Curb and gutter along concrete islands.
- Curb and gutter behind or directly under guardrail.
- Valley gutter

Not included in curb and gutter inspections:

- Curb and gutter that turns into business driveways.

- Curb and gutter that is offset from the pavement line and on private property.
- Catch basin throats and other drainage inlet structures.

5.3.4.1 SETTLEMENT

Definition

Settlement, or a sudden change in elevation of the curb and gutter surface, may be caused by cracking, joint damage between slabs, or other deterioration. Settlement is vertical deviation in the pavement typically identified by collecting water, debris, or asphalt breaking away due to poor lateral support.

Deficiency Standard

Curb and gutter settlement is considered deficient if:

- Settlement is present in the curb and gutter and is greater than 2 inches in depth.

How to Measure the Deficiency

Step 1: Evaluate the segment for settlement within the curb and gutter.

Step 2: Use a measuring tape to measure the depth of any settlement at the deepest point. If the depth is greater than 2 inches, record the deficiency in the application.

Examples

CURB AND GUTTER
SETTLEMENT

EXAMPLE

- Settlement is the sudden vertical deviation in the curb and gutter surface.
- Settlement is often found between concrete slabs.
- Settlement must be **greater than 2 inches in depth** to exceed the threshold for failure.



Drainage

Curb and Gutter

Settlement

Structural
Damage

Misalignment

5.3.4.2 STRUCTURAL DAMAGE

Definition

Structural damage is the deterioration of the curb and gutter pavement surface. Structural damage may include vertical offsets or gaps in the pavement caused by severe cracking, joint separation, and general deterioration of the curb and gutter.

Deficiency Standard

Curb and gutter structural damage is considered deficient if:

- Unsealed cracking of at least 0.75 inches is present on 10% of cumulative length of the curb and gutter.

How to Measure the Deficiency

Step 1: Use a measuring wheel to measure the cumulative length of curb and gutter within the segment.

Step 2: Evaluate the segment for structural damage within the curb and gutter.

Step 3: Use a measuring tape to measure the cracking width.

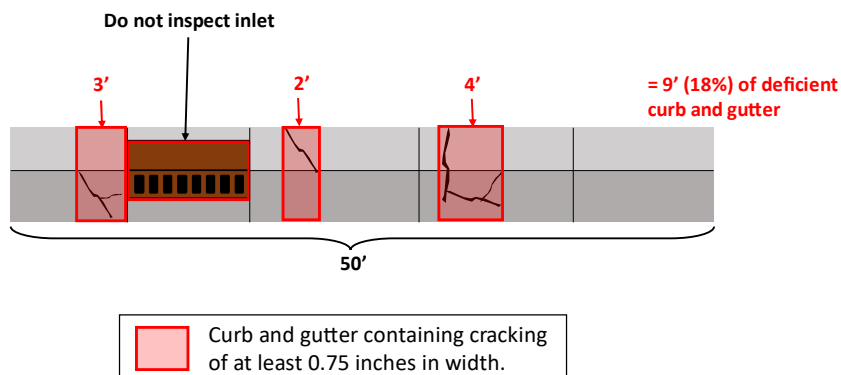
Step 4: If the cracking width is at least 0.75 inches, use a measuring wheel to measure the cumulative length of curb and gutter with deficient structural damage.

Step 5: If unsealed cracking of at least 0.75 inches is present on at least 10% of the cumulative curb and gutter length, record the deficiency in the application.

CURB AND GUTTER
STRUCTURAL DAMAGE

HOW TO MEASURE

- Unsealed cracking of at least 0.75 inches in width must be present on at least 10% of the curb and gutter (cumulative) to be considered deficient.

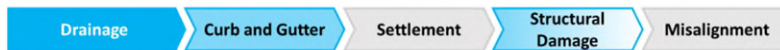


Examples

CURB AND GUTTER STRUCTURAL DAMAGE

EXAMPLE

- Unsealed cracking of at least 0.75 inches in width must be present on at least 10% of the curb and gutter (cumulative) to be considered deficient.



5.3.4.3 MISALIGNMENT

Definition

Misalignment is horizontal deviation of the curb and gutter surface pavement. Misalignment may be caused by cracking, joint damage between slabs, or other deterioration.

Deficiency Standard

Curb and gutter alignment is considered deficient if:

- Curb and gutter misalignment is greater than 2 inches at any location.

How to Measure the Deficiency

Step 1: Evaluate the segment for misalignment within the curb and gutter.

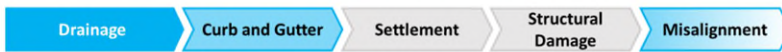
Step 2: Use a measuring tape to measure the misalignment. If the misalignment is greater than 2 inch in depth, record the deficiency in the application.

Examples

CURB AND GUTTER MISALIGNMENT

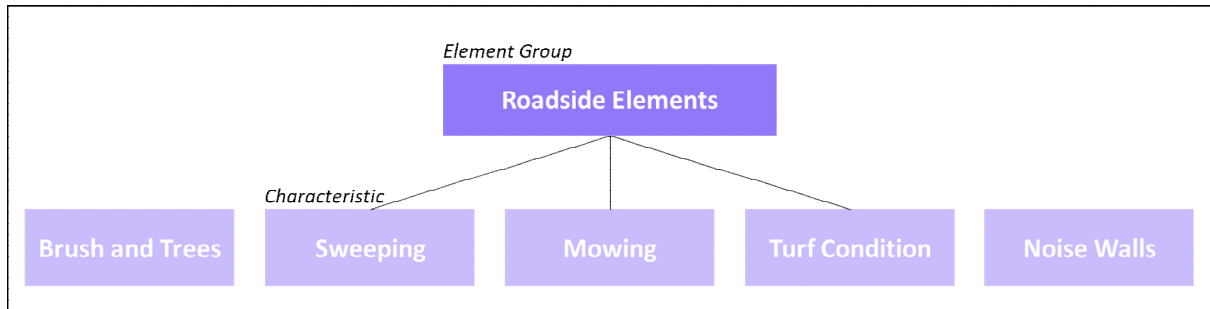
EXAMPLE

- Misalignment is the sudden horizontal deviation in the curb and gutter surface.
- Misalignment is often found between concrete slabs and can disrupt water flow.
- Misalignment must be **greater than 2 inches** to exceed the threshold for failure.



5.4 ROADSIDE ELEMENTS

The Roadside Elements element group consists of the following characteristics: Brush and Trees, Sweeping, Mowing, Turf Condition, and Noise Walls.



Refer to the characteristic subsections for an overview of the deficiency standards and important considerations. For more detailed information, refer to the individual deficiency standard subsections.

5.4.1 BRUSH AND TREES

Definition

Brush and trees refers to any trees, tree limbs, and heavy brush within the right-of-way. The inspector must prevent encroachment of brush and trees that may impact motorists or structures along the segment.

Deficiency Standards

Brush and trees are considered deficient if:

- **Overhang:** Trees or woody growth are overhanging the pavement or shoulder on roadways.
- **Vertical Clearance:** Vertical clearance over the roadway, including any paved shoulder, is less than 16.5 feet.
- **Sight Distance / Sign Visibility:** Sight distance or sign visibility is obstructed at an unacceptable distance (see sight distance subsection for details).
- **Dead or Leaning Tree Hazard:** Trees are overhanging the roadway or shoulder pavement in a manner that presents a hazard to the travel lanes.
- **Woody Vegetation Around Headwall:** Woody vegetation is present around headwalls.
- **Road Offset:** Trees or woody growth of at least 4 inches in diameter (measured 6" from ground) are:
 - Within 50 feet of the travel way on a mainline control access highway
 - Within 15 feet behind guardrail or concrete barriers
 - Within 10 feet back of ditch on ramp sections
 - Only on state routes: Within 5 feet back of ditch or within 5 feet of the shoulder point on fill slopes.

- **Overhanging Branches (Noise Wall):** Woody vegetation / branches greater than 4 inches in diameter are overhanging a noise wall within 10 feet of vertical distance.
- **Leaning Vegetation (Noise Wall):** Woody vegetation greater than 4 inches in diameter is present and leaning against a noise wall.
- **Vegetation Coverage (Noise Wall):** More than 10% of noise wall exposed surface is covered with live vegetation.
- **Vegetation (Retaining Wall):** At least 10% of the retaining wall surface is covered by live vegetation.
- **Woody Vegetation (Retaining Wall):** Branches greater than 2 inches in diameter are overhanging the retaining wall.

Important Considerations

Included in brush and trees inspections:

- Lateral and vertical proximity of trees and woody growths relative to the roadway.
- Line-of-sight issues for motorists.
- Vegetation around structures such as noise walls and retaining walls.

Not included in brush and trees inspections:

- Non-woody vegetation such as grass, weeds, and small shrubs.
- Structural integrity of vertical structures such as noise walls and retaining walls.
- Erosion issues
- Utilities

5.4.1.1 OVERHANG

Definition

Brush and tree overhang is the encroachment of branches and vegetation over the roadway such that if the overhanging growth were to fall it would present a hazard to motorists.

Deficiency Standard

Brush and tree overhang is considered deficient if:

- Trees or woody growths are overhanging the pavement or shoulder on roadways.

How to Measure the Deficiency

Step 1: Evaluate the segment for branches overhanging the pavement or shoulder along the roadway.

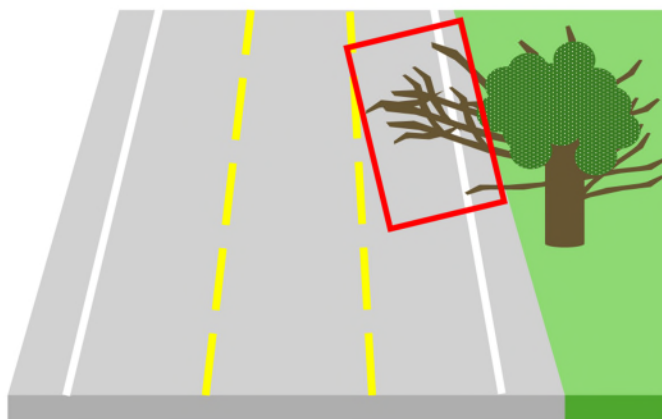
Step 2: If brush and tree overhang is deficient, record the deficiency in the application.

Examples

BRUSH AND TREES
OVERHANG

EXAMPLE

- **Branches** are overhanging the travel pavement or shoulder on roadways.



5.4.1.2 VERTICAL CLEARANCE

Definition

Vertical clearance is the distance from the road surface to the lowest point of the structure or object directly overhead.

Deficiency Standard

Brush and tree vertical clearance is considered deficient if:

- Vertical clearance over the roadway, including any paved shoulder, is less than 16.5 feet.

How to Measure the Deficiency

Step 1: Evaluate the segment for low-hanging vegetation overhanging the roadway.

Step 2: Use a 16.5-foot measuring tool to determine if any part of the vegetation does not allow for at least 16.5 feet of vertical clearance over the travel lane or paved shoulder. DO NOT ENTER TO TRAVEL LANE TO MEASURE VERTICAL CLEARANCE. Always safely measure or estimate vertical clearance from the shoulder.

Step 3: If 16.5 feet of vertical clearance is not met, record the deficiency in the application.

Examples

BRUSH AND TREES VERTICAL CLEARANCE

EXAMPLE

- If vertical clearance over the pavement is **less than 16.5 feet**, it shall be recorded as deficient.
- Pavement includes any **travel lanes and paved shoulder**. Do **not** inspect unpaved shoulder for vertical clearance.



5.4.1.3 SIGHT DISTANCE / SIGN VISIBILITY

Definition

Sight distance is the length of visible roadway ahead of a motorist. Sign visibility is the ability of a motorist to view a sign. Both distances should be long enough for a motorist to have time and space to make a safe maneuver if necessary.

Deficiency Standard

Sight distance / sign visibility is considered deficient if:

- Sight distance / sign visibility does not meet the required distances due to brush and tree obstruction (see table below for details).

How to Measure the Deficiency

Step 1: Evaluate the segment for trees or brush that prevent a motorist from viewing a sign or limit sight distance.

Step 2: If a sight distance or sign visibility is obstructed due to overgrown vegetation, use a measuring wheel to confirm that distances do not meet required thresholds (see table below).

Step 3: If sight distance / sign visibility do not meet required thresholds, record the deficiency in the application.

Examples

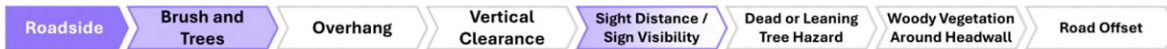
BRUSH AND TREES
SIGHT DISTANCE / SIGN VISIBILITY

EXAMPLE

- Evaluate the segment for sight distance and sign visibility. Ensure the minimum line of sight standard is maintained.

Recommended Minimum Line of Sight		
Speed	Roadway Signs	Major Guide Signs
50 mph	450 ft	800 ft
55 mph	525 ft	
60 mph	600 ft	
65 mph	700 ft	
70 mph	800 ft	

Source: FHWA & AASHTO



5.4.1.4 DEAD OR LEANING TREE HAZARD

Definition

A dead or leaning tree hazard is any branch that is leaning over or near the roadway, such that if the tree were to fall it would impact the roadway or present a hazard to motorists.

Deficiency Standard

Dead or leaning tree hazards are considered deficient if:

- Branches are overhanging the roadway or shoulder pavement in a manner that presents a hazard to the travel lanes.

How to Measure

Step 1: Evaluate the segment for any branches leaning over the roadway that may threaten motorist safety.

Step 2: If the tree is overhanging the roadway or shoulder pavement in a manner that presents a hazard to motorists, record the deficiency in the application.

Examples

BRUSH AND TREES
DEAD OR LEANING TREE HAZARD

EXAMPLE

- Evaluate the segment for **dead or leaning trees** that present **hazards to the travel lanes.**
- Do not confuse with the Overhang characteristic, which only considers *branches* extending over the pavement.



5.4.1.5 WOODY VEGETATION AROUND HEADWALL

Definition

A headwall is a small retaining wall built at the inlet or outlet of a drainage pipe, usually made of concrete. The purpose of a headwall is to reduce erosion to the pipe and surrounding area.

Deficiency Standard

Woody vegetation around headwalls is considered deficient if:

- Woody vegetation is present around a headwall.

How to Measure the Deficiency

Step 1: Evaluate the segment for branch growth around headwalls.

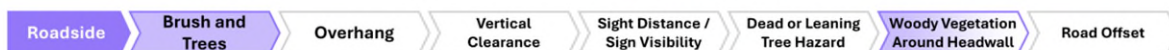
Step 2: If woody vegetation is present around headwalls, record the deficiency in the application.

Examples

BRUSH AND TREES
BRANCHES AROUND HEADWALL

EXAMPLE

- Branches must be **present around a headwall** to be considered deficient.
- Branches that prevent proper evaluation of the drainage area or pose risks to water flow warrant a deficiency.



5.4.1.6 ROAD OFFSET

Definition

Road offset refers to the lateral distance from the edge of the roadway or other specific roadway appurtenance to the nearest trees or woody vegetation. In this case, road offset refers to the nearest branch of at least 4 inches in diameter at least 6" from the ground.

Deficiency Standard

Brush and tree road offset is considered deficient if:

- Trees or woody growth of at least 4 inches in diameter (measured 6" from ground) are:
 - o Within 50 feet of the travel way on a mainline control access highway
 - o Within 15 feet behind guardrail or concrete barriers
 - o Within 10 feet back of ditch on ramp sections
 - o Only on state routes: Within 5 feet back of ditch or within 5 feet of the shoulder point on fill slopes.

Note: At a frequency of no less than annually, heavy woody vegetation shall be kept from repopulating by chemical or mechanical means.

How to Measure the Deficiency

Step 1: Evaluate the segment for branches that encroach on the required offsets specified in the deficiency standard and confirm that any encroaching branches meet the diameter criteria.

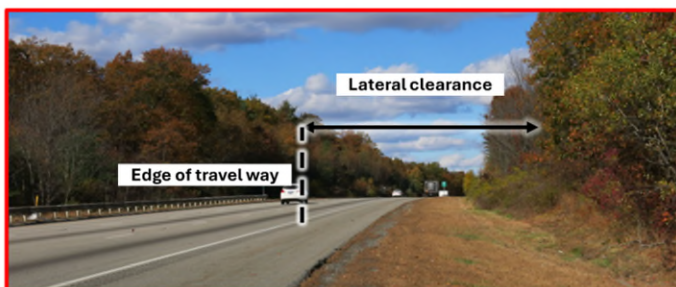
Step 2: If trees of woody vegetation of at least 4 inches in diameter and at least 6 inches from the ground do not meet any of the minimum road offset requirement, record the deficiency in the application.

Examples

BRUSH AND TREES ROAD OFFSET

EXAMPLE

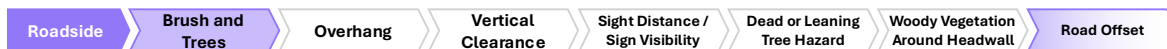
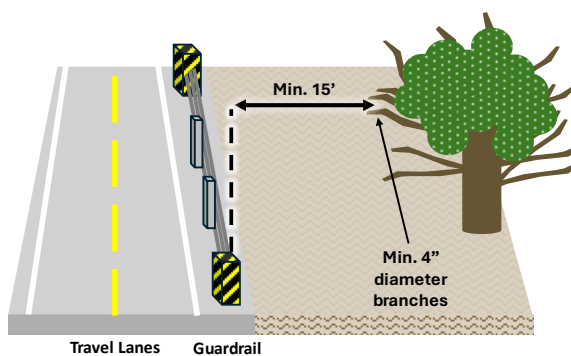
- Road offset is considered deficient if **branches of at least 4 inches in diameter** (at least 6" from ground) are:
 - **Within 50 feet of travel way on mainline control access highway, or**
 - Within 15 feet of guardrail or concrete barriers, or
 - Within 10 feet of ditch on ramps, or
 - Only on state routes: Within 5 feet back of ditch or within 5 feet of the shoulder point on fill slopes.



BRUSH AND TREES ROAD OFFSET

EXAMPLE

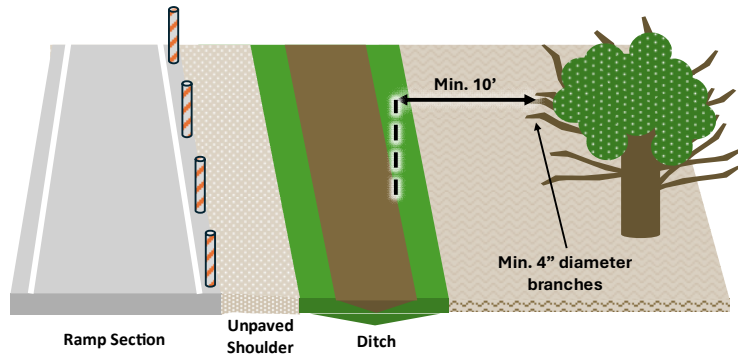
- Road offset is considered deficient if **branches of at least 4 inches in diameter** (at least 6" from ground) are:
 - Within 50 feet of travel way on mainline control access highway, or
 - **Within 15 feet of guardrail or concrete barriers, or**
 - Within 10 feet of ditch on ramps, or
 - Only on state routes: Within 5 feet back of ditch or within 5 feet of the shoulder point on fill slopes.



BRUSH AND TREES ROAD OFFSET

EXAMPLE

- Road offset is considered deficient if **branches of at least 4 inches in diameter** (at least 6" from ground) are:
 - o Within 50 feet of travel way on mainline control access highway, or
 - o Within 15 feet of guardrail or concrete barriers, or
 - o **Within 10 feet of ditch on ramps,** or
 - o Only on state routes: Within 5 feet back of ditch or within 5 feet of the shoulder point on fill slopes.



5.4.1.7 OVERHANGING BRANCHES (NOISE WALL)

Definition

Noise walls are constructed along roadways to reduce noise from traffic and act as a buffer between the roadway and adjacent areas.

Deficiency Standard

Woody vegetation around noise walls is considered deficient if:

- Woody vegetation / branches greater than 4 inches in diameter are overhanging a noise wall within 10 feet of vertical distance.

How to Measure the Deficiency

Step 1: Evaluate the segment for branches overhanging noise walls.

Step 2: If possible, use measuring tools to measure the vertical distance between the noise wall and the overhanging branches and the branch diameter. If inaccessible or unsafe, estimate the measurements from a safe distance.

Step 3: If branches greater than 4 inches in diameter are overhanging a noise wall within 10 feet of vertical distance, record the deficiency in the application.

Examples

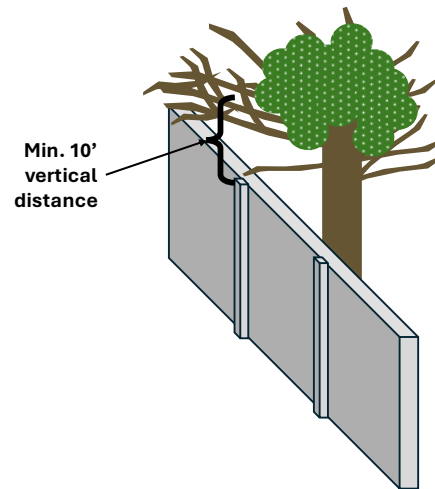
BRUSH AND TREES
OVERHANGING BRANCHES (NOISE WALL)

EXAMPLE

- To be considered deficient, woody vegetation greater than **4 inches in diameter** must be overhanging a noise wall **within 10 feet of vertical distance.**



- To be considered deficient, woody vegetation greater than 4 inches in diameter is **overhanging a noise wall within 10 feet of vertical distance.**



5.4.1.8 LEANING VEGETATION (NOISE WALL)

Definition

Noise walls are constructed along roadways to reduce noise from traffic and act as a buffer between the roadway and adjacent areas.

Deficiency Standard

Noise wall vegetation is considered deficient if:

- Woody vegetation greater than 4 inches in diameter is present and leaning against a noise wall.

How to Measure the Deficiency

Step 1: Evaluate the segment for vegetation leaning against a noise wall. The threshold for failure is exceeded if the woody vegetation is touching the noise wall surface.

Step 2: If possible, use a caliper to measure the diameter of the vegetation. If inaccessible or unsafe, estimate the diameter from a safe distance.

Step 3: If vegetation greater than 4 inches in diameter is present and leaning against a noise wall, record the deficiency in the application.

5.4.1.9 VEGETATION COVERAGE (NOISE WALL)

Definition

Noise walls are constructed along roadways to reduce noise from traffic and act as a buffer between the roadway and adjacent areas.

Deficiency Standard

Noise wall vegetation is considered deficient if:

- More than 10% of noise wall exposed surface is covered with live vegetation.

How to Measure the Deficiency

Step 1: Evaluate the segment for noise wall vegetation coverage.

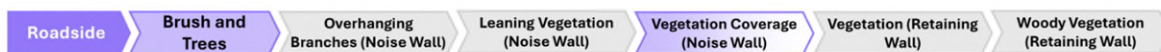
Step 2: If live vegetation covers at least 10% of the noise wall exposed surface, record the deficiency in the application.

Examples

BRUSH AND TREES
VEGETATION COVERAGE (NOISE WALL)

EXAMPLE

- Vegetation coverage is considered deficient if **more than 10% of noise wall exposed surface is covered with live vegetation.**



5.4.1.10 VEGETATION (RETAINING WALL)

Definition

Vegetation refers to any overgrown brush covering the retaining wall surface.

Deficiency Standard

Retaining wall vegetation is considered deficient if:

- At least 10% of the retaining wall surface is covered by live vegetation.

How to Measure the Deficiency

Step 1: Evaluate the segment for live vegetation covering a retaining wall.

Step 2: Measure the total length and height of retaining walls within the segment area to calculate the total retaining wall surface area.

Step 3: Measure the cumulative length and height of live vegetation covering retaining wall surfaces to calculate the total surface area of vegetation. If it is not possible to safely measure retaining wall surface area, estimate measurements from a safe distance.

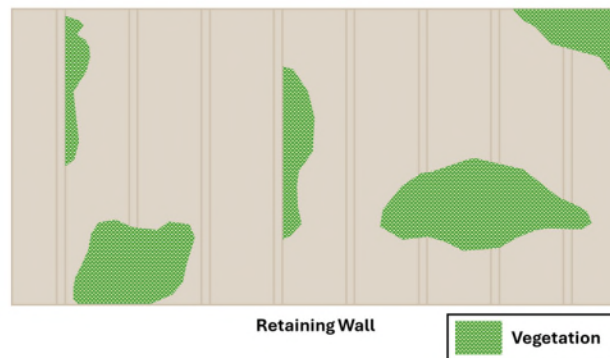
Step 4: If more than 10% of a retaining wall surface is covered by live vegetation, record the deficiency in the application.

Examples

BRUSH AND TREES
VEGETATION (RETAINING WALL)

EXAMPLE

- Vegetation is considered deficient if **at least 10% of the retaining wall surface** is covered by *live* vegetation.



5.4.1.11 BRANCHES (RETAINING WALL)

Definition

Branches refer to any overgrown trees or woody growths overhanging the retaining wall.

Deficiency Standard

Branches around a retaining wall are considered deficient if:

- Branches greater than 2 inches in diameter are overhanging the retaining wall.

How to Measure the Deficiency

Step 1: Evaluate the segment for overgrown branches overhanging a retaining wall.

Step 2: Use a caliper to measure the diameter of overhanging branches. If it is not possible to safely measure branch diameter, estimate from a safe distance.

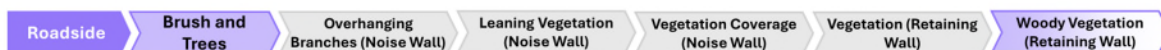
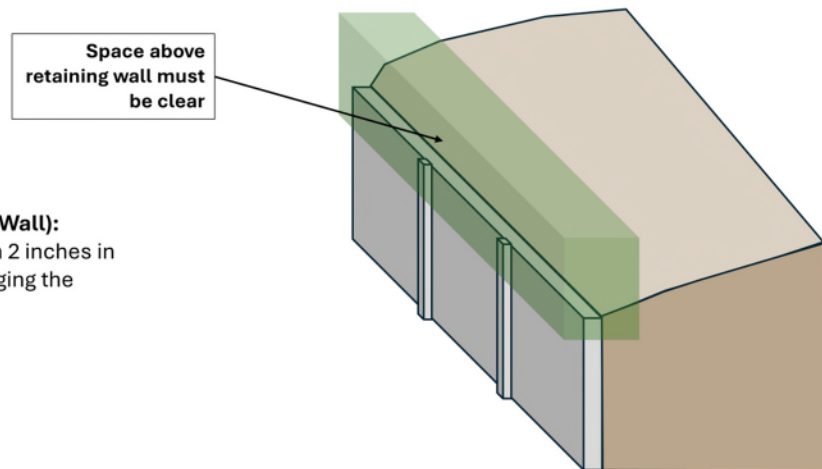
Step 3: If branches greater than 2 inches in diameter are overhanging the retaining wall, record the deficiency in the application.

Examples

BRUSH AND TREES
BRANCHES (RETAINING WALL)

EXAMPLE

- **Branches (Retaining Wall):**
Branches greater than 2 inches in diameter are overhanging the retaining wall.



5.4.2 SWEEPING

Definition

Sweeping is the removal of aggregate particles and small items of debris from designated areas along the roadways.

Deficiency Standards

Sweeping is considered deficient if:

- Material accumulation exceeds 0.25 inches in depth for more than 10 continuous feet in the paved shoulder or paved travel lanes.
- Material accumulation exceeds 0.75 inches in depth for more than 10 continuous feet in the curb and gutter or along a concrete barrier.
- Maximum material accumulation exceeds 4 inches at any point in the curb and gutter or along a concrete barrier.

Important Considerations

Included in sweeping inspections:

- Travel lanes
- Curb and gutter
- Valley gutter
- Bridge deck/curb line
- Concrete barrier rail curb line
- Paved shoulders
- Intersections
- Sidewalk

5.4.2.1 CONTINUOUS ACCUMULATION (NO CURB AND GUTTER)

Definition

Continuous accumulation is the extended buildup of debris along a roadway section.

Deficiency Standard

Continuous accumulation along a non-curbed section is considered deficient if:

- Material accumulation exceeds 0.25 inches in depth for more than 10 continuous feet in the paved shoulder or paved travel lanes.

How to Measure the Deficiency

Step 1: Evaluate the segment for debris accumulation in the paved shoulder or paved travel lanes. **DO NOT ENTER THE TRAVEL LANE TO INSPECT CONTINUOUS ACCUMULATION.** Always safely estimate measurements from the shoulder.

Step 2: Use a measuring tape to measure the depth of the debris accumulation.

Step 3: If the debris accumulation is greater than 0.25 inches in depth, use a measuring wheel to measure the continuous length of the deficient accumulation.

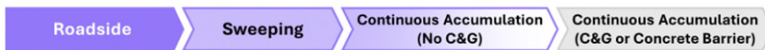
Step 3: If the debris accumulation is greater than 0.25 inches in depth for more than 10 continuous feet, record the deficiency in the application.

Examples

SWEEPING
CONTINUOUS ACCUMULATION (NO CURB AND GUTTER)

EXAMPLE

- To be considered deficient along a non-curb and gutter section, material accumulation must exceed **0.25 inches in depth** for more than **10 continuous feet** in the paved shoulder or paved travel lanes.



5.4.2.2 CONTINUOUS ACCUMULATION (CURB AND GUTTER OR CONCRETE BARRIER)

Definition

Continuous accumulation is the extended buildup of debris along a roadway section.

Deficiency Standard

Continuous accumulation along a curbed section is considered deficient if:

- Material accumulation exceeds 0.75 inches in depth for more than 10 continuous feet in the curb and gutter or along a concrete barrier, OR
- Material accumulation exceeds 4 inches at any point in the curb and gutter or along a concrete barrier.

How to Measure the Deficiency

Step 1: Evaluate the segment for debris accumulation in the curb and gutter or along a concrete barrier.

Step 2: Use a measuring tape to measure the depth of the debris accumulation.

Step 3: If the debris accumulation is greater than 4 inches in depth, see Step 3. If the debris accumulation is between 0.75

inches and 4 inches in depth, use a measuring wheel to measure the continuous length of the deficient accumulation.

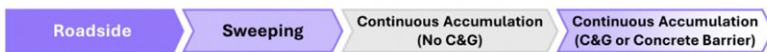
Step 3: If the debris accumulation is greater than 0.75 inches in depth for more than 10 continuous feet, or greater than 4 inches in depth at any location, record the deficiency in the application.

Examples

SWEEPING
CONTINUOUS ACCUMULATION (CURB AND GUTTER OR CONCRETE BARRIER)

EXAMPLE

- To be considered deficient along a **curb and gutter or concrete barrier section**, material accumulation must exceed **0.75 inches in depth** for more than **10 continuous feet**, OR material accumulation exceeds **4 inches at any point**.



5.4.3 MOWING

Definition

Mowing is the recurring maintenance of grass and vegetation to maintain a healthy, neat appearance for all growth within the right-of-way.

Important Considerations

Included in mowing inspections:

- Any grass and weed growth within the right-of-way.
- The inspector should verify whether the current cycle is a full mowing cycle or a swatch mowing cycle. In a full mowing cycle, the full TDOT mowing limits are included in inspections. In a swatch mowing cycle, the limits of inspection are described below.
- Along state routes (swatch mowing cycle):
 - The area adjacent to the roadway up to 5 feet beyond the ditch line, OR
 - Up to 5 feet beyond the shoulder point down a fill slope (including any 5-foot area behind guardrail),

- o Or as directed by TDOT engineer.
- Along interstates (swath mowing cycle):
 - o Up to 15 feet beyond the shoulder edge of pavement,
 - o Minimum 5 feet behind guardrail,
 - o Up to the median ditch,
 - o Full width of entire interchange area,
 - o Or as directed by TDOT engineer.

Deficiency Standard

Mowing is considered deficient if:

- More than 2% of the vegetation exceeds a uniform height of 18 inches, or vegetation is less than 4 inches at any location.

How to Measure the Deficiency

Step 1: Calculate the surface area of grass along the segment by multiplying the total length by the average width.

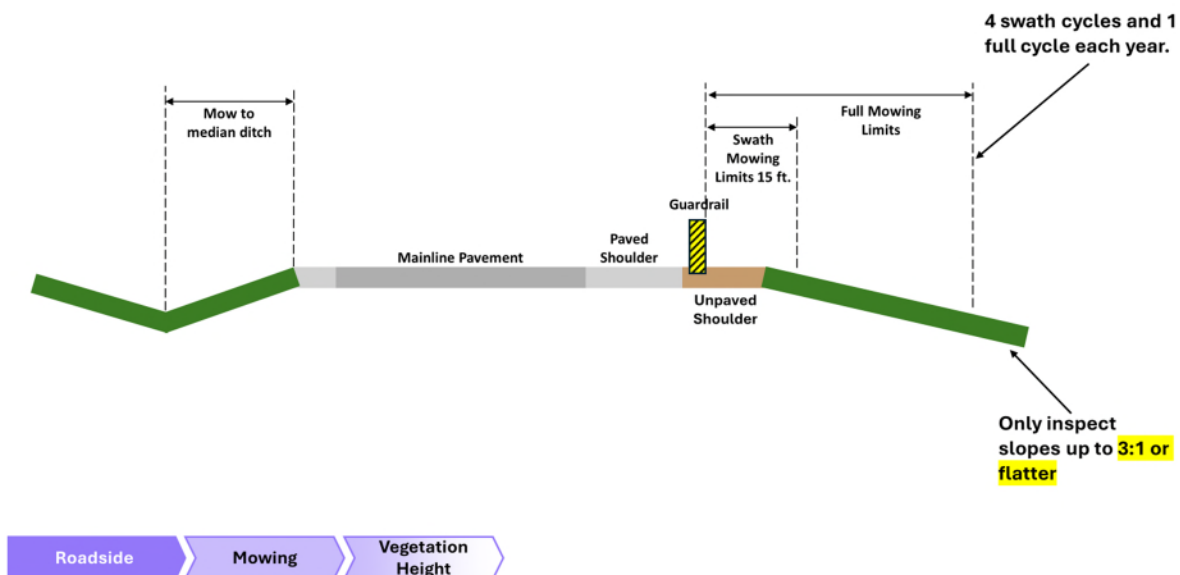
Step 2: Use a tape measure to measure the height of the grass within the segment. Measure grass in its natural state. Do not adjust before measurement. Take measurements at locations where the average grass height is best represented.

Step 3: Observe the grass for areas of abnormally high growth. Calculate the approximate cumulative area of each.

Step 4: If more than 2% of the vegetation exceeds a uniform height of 18 inches, or vegetation is less than 4 inches at any location, record the deficiency in the application.

MOWING
VEGETATION HEIGHT

HOW TO MEASURE



Examples

MOWING VEGETATION HEIGHT

EXAMPLE

- Vegetation height is considered deficient if **more than 2% of the vegetation exceeds a uniform height of 18 inches.**
- Measure vegetation in its natural state, at location where the average grass height is best represented.



Roadside

Mowing

Vegetation
Height

5.4.4 TURF CONDITION

Definition

Turf condition is the appearance and quality of all turf, grass, and weeds within the right-of-way. The inspector must maintain a healthy, neat appearance for all growth within the right-of-way.

Important Considerations

Included in turf condition inspections:

- Any grass and weed growth within the right-of-way.
- Along state routes:
 - The area adjacent to the roadway up to 5 feet beyond the ditch line, OR
 - Up to 5 feet beyond the shoulder point down a fill slope (including any 5-foot area behind guardrail).
- Along interstates:
 - Up to 15 feet beyond the shoulder edge of pavement,
 - If median is greater than or equal to 60 feet, up to 15 feet beyond the inside edge of pavement,
 - If median is less than 60 feet wide, full width of median.
 - Full width of entire interchange area.

Deficiency Standard

Turf condition is considered is deficient if:

- More than 100 continuous square feet of bare ground is present in the turf evaluation area, or more than 10% of cumulative turf evaluation area is bare ground.

How to Measure the Deficiency

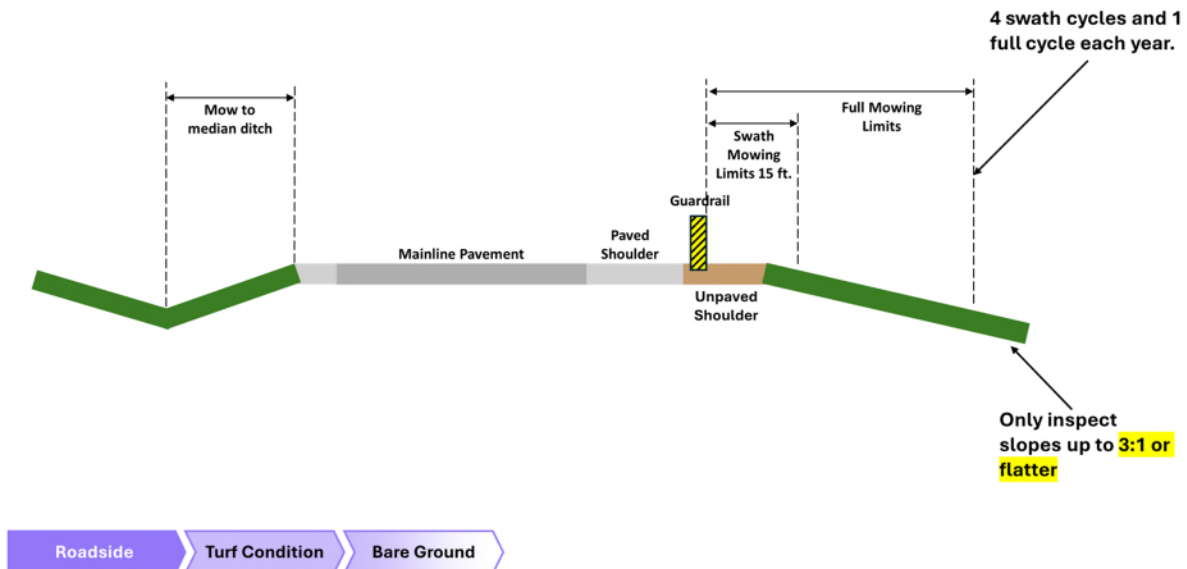
Step 1: Calculate the surface area of grass along the segment by multiplying the total length by the average width.

Step 2: Observe the grass for areas of bare ground. Calculate the approximate cumulative area.

Step 3: If more than 100 continuous square feet of bare ground is present in the turf evaluation area, or more than 10% of cumulative turf evaluation area is bare ground, record the deficiency in the application.

TURF CONDITION
BARE GROUND

HOW TO MEASURE

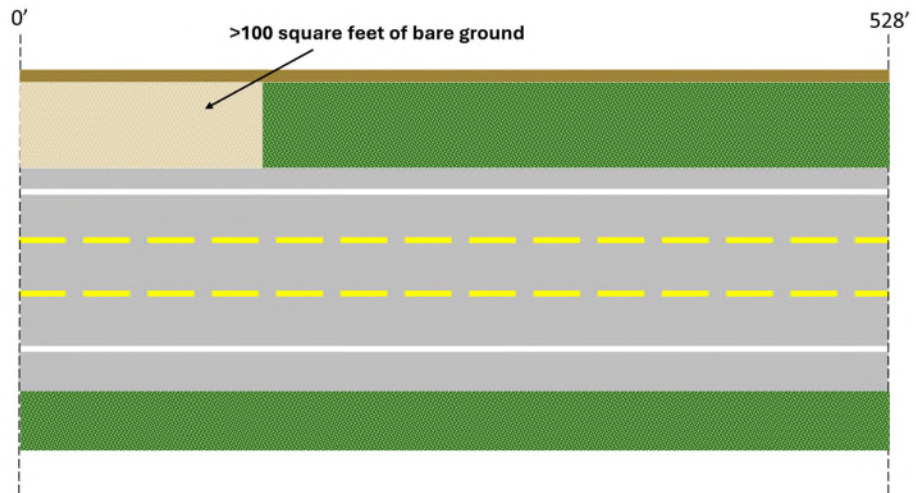


Examples

TURF CONDITION
BARE GROUND

EXAMPLE

- Deficiency: More than 100 continuous square feet of bare ground is present in the turf evaluation area, or more than 10% of cumulative turf evaluation area is bare ground.



Roadside

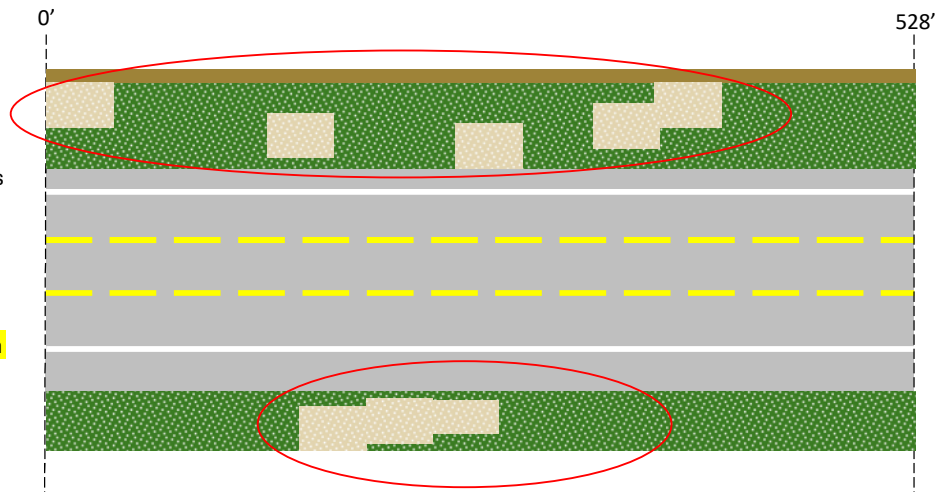
Turf Condition

Bare Ground

TURF CONDITION
BARE GROUND

EXAMPLE

- Deficiency: More than 100 continuous square feet of bare ground is present in the turf evaluation area, or more than 10% of cumulative turf evaluation area is bare ground.



Roadside

Turf Condition

Bare Ground

- Deficiency: More than **100 continuous square feet** of bare ground is present in the turf evaluation area, or more than **10% of cumulative turf evaluation area** is bare ground.



Roadside

Turf Condition

Bare Ground

5.4.5 NOISE WALLS

Definition

Noise walls are structures built alongside highways to reduce the transmission of noise from vehicular traffic to nearby areas. Noise walls are typically constructed of materials such as concrete or wood and are designed to absorb or deflect sound waves away from the protected areas.

Important Considerations

Included in noise wall inspections:

- Any noise wall installed within the roadway segment right-of-way to mitigate traffic noise.

Not included in noise wall inspections:

- Any wall or vertical structure not installed to mitigate traffic noise in adjacent areas.

Deficiency Standard

Noise walls are considered is deficient if:

- Obvious wall damage is present such as leaning or missing panel damage.

How to Measure the Deficiency

Step 1: Evaluate the roadway segment for noise walls.

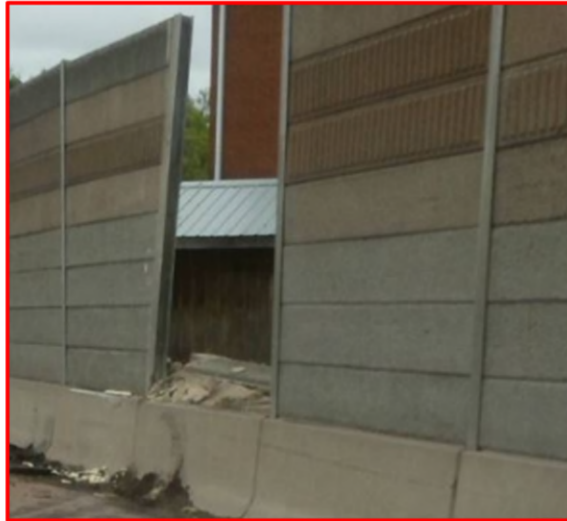
Step 2: If any part of the noise wall exhibits damage such as leaning or missing damage, record the deficiency in the application.

Examples

NOISE WALL DAMAGE

EXAMPLE

- Evaluate the segment for any obvious noise wall damage such as **leaning, cracked, or missing panels.**
- Do not confuse noise walls with other structures such as retaining walls.



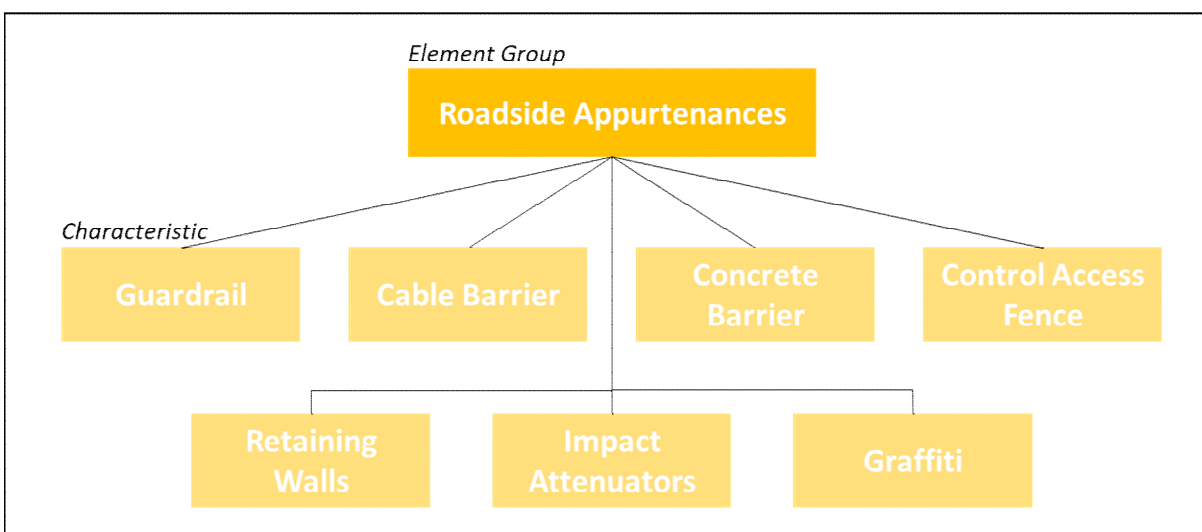
Roadside

Noise Walls

Damage

5.5 ROADSIDE APPURTENANCES

The Roadside Appurtenances element group consists of the following characteristics: Guardrail, Cable Rail, Concrete Barrier, Control Access Fence, Retaining Walls, Impact Attenuators, and Graffiti.



Refer to the characteristic subsections for an overview of the deficiency standards and important considerations. For more detailed information, refer to the individual deficiency standard subsections.

5.5.1 CABLE BARRIER

Definition

A cable barrier is a barrier placed along the edge of a road, bridge, or highway to prevent vehicles from veering off the roadway. Cable barriers consist of a series of high-tension steel cables supported by sturdy posts installed at regular intervals.

Important Considerations

Included in cable barrier inspections:

- Any cable barrier installed along the roadway segment within the established right-of-way.

Deficiency Standard

Cable barrier is considered deficient if:

- The cable barrier exhibits non-functioning damage, including a loss of any tension in the cable rail.

NOTE: Non-functioning damage to cable rail includes any damage from a vehicular hit that causes the cable to lose tension.

How to Measure Deficiency

Step 1: Evaluate the segment for non-functioning damage to cable barrier. Use the example photos to determine if the deficiency standard is met.

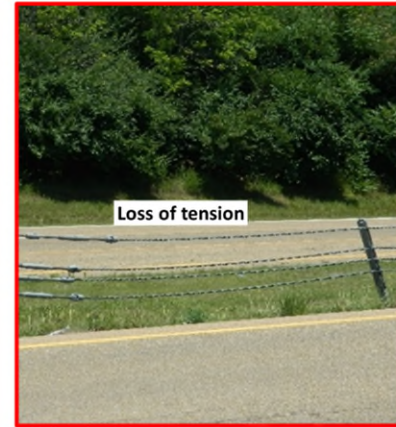
Step 2: If there is non-functioning damage to cable barrier such that the deficiency standard is met, record the deficiency in the application.

Examples

CABLE BARRIER DAMAGE

EXAMPLE

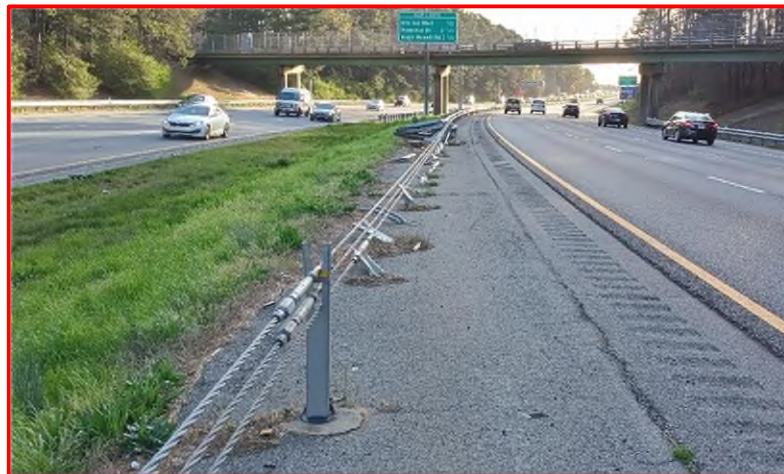
- To exceed the threshold for failure, cable barrier must exhibit **non-functioning damage**, including any **loss of tension** in the cable rail.



CABLE BARRIER DAMAGE

EXAMPLE

- To exceed the threshold for failure, cable barrier must exhibit **non-functioning damage**, including any **loss of tension** in the cable rail.



5.5.2 GUARDRAIL

Definition

A guardrail is a barrier placed along the edge of a road, bridge, or highway to prevent vehicles from veering off the roadway. Guardrails are typically made of metal, concrete, or other sturdy materials and are designed to absorb impact energy and redirect vehicles back onto the roadway in the event of a collision.

Important Considerations

Included in guardrail inspections:

- Any guardrail installed along the roadway segment within the established right-of-way.

Deficiency Standard

Guardrail is considered deficient if:

- The guardrail exhibits, at a minimum, non-functioning damage, such as damaged end-sections, penetrations, or tears.

NOTE: Non-functioning damage of guardrail includes:

- A rail beam has been torn loose,
- A beam is crushed more than 9" out of line, or
- Two or more posts have been separated or one or more posts is broken

Non-functioning damage of end treatment includes:

- One or more broken posts,
- Rail that has been torn loose,
- Crushed bulb or face plate, or
- A damaged cable assembly.

How to Measure Deficiency

Step 1: Evaluate the segment for non-functioning damage to guardrail. Use the example photos to determine if the deficiency standard is met.

Step 2: If there is non-functioning damage to guardrail such that the deficiency standard is met, record the deficiency in the application.

Examples

GUARDRAIL
DAMAGE

EXAMPLE

- To exceed the threshold for failure, guardrail must exhibit **non-functioning damage, damaged end-sections, penetrations, or tears.**



Roadside
Appurtenances

Guardrail

Damage

GUARDRAIL
DAMAGE

EXAMPLE



Deficient guardrail

Roadside
Appurtenances

Guardrail

Damage

ROADSIDE
APPURTENANCES

GUARDRAIL
DAMAGE

EXAMPLE



5.5.3 CONCRETE BARRIER

Definition

Concrete barriers are installed to guide a vehicle away from various hazards within and adjacent to the travel way. Concrete barriers typically consist of precast concrete segments or poured concrete walls that are anchored to the ground or connected to one another to form a continuous barrier.

Important Considerations

Included in concrete barrier inspections:

- Any concrete barrier installed along the roadway segment within the established right-of-way.

Not included in concrete barrier inspections:

- Noise walls, retaining walls, or any other concrete structure not installed for the purpose of guiding vehicles and preventing crossover incidents.

Deficiency Standard

Concrete barriers are considered deficient if:

- The concrete barrier exhibits non-functioning damage, including a loss of cross-sectional area due to a vehicular crash.

NOTE: Non-functioning damage of concrete barrier includes any loss of cross-sectional area.

How to Measure the Deficiency

Step 1: Evaluate the segment for non-functioning damage to concrete barrier.

Step 2: If there is non-functioning damage to concrete barrier such that the deficiency standard is met, record the deficiency in the application.

Examples

CONCRETE BARRIER DAMAGE

EXAMPLE

To exceed the threshold for failure, concrete barrier must exhibit **non-functioning damage**, including a **loss of cross-sectional area** due to a vehicular crash.



Roadside
Appurtenances

Concrete
Barrier

Damage

5.5.4 CONTROL ACCESS FENCE

Definition

A control access fence is a partition installed at the limits of the right-of-way to deter trespassing and channel access and egress.

Deficiency Standards

Control access fences are considered deficient if:

- Compression of the fence is greater than 1/3 of its original height as measured from the natural ground to the top of the fence fabric.
- An opening within the fence fabric is greater than 2 square feet.
- A fence gate is open within the segment area.

Important Considerations

Included in fence inspections:

- Controlled access fences installed along the perimeter of the right-of-way.

Not included in fence inspections:

- Fences not intended for controlled access or security purposed (e.g., decorative, agricultural).
- Fences located entirely on private property.
- Fences that are inaccessible.

NOTE: If a fence is inaccessible, or the inspector is unable to safely evaluate the fence, mark Control Access Fence as not present in the application. Use the general comment box to say the fence is inaccessible.

5.5.4.1 COMPRESSION

Definition

Compression is the leaning or shortening of a fence due to damage or soil erosion.

Deficiency Standard

Fence compression is considered deficient if:

- Compression of the fence is greater than $\frac{1}{3}$ of its original height (i.e., fence is less than $\frac{2}{3}$ the original height) as measured from the natural ground to the top of the fence fabric.

How to Measure the Deficiency

Step 1: Evaluate the segment area for compressions within the control access fence.

Step 2: Use a measuring tape to measure the original height of the fence, then measure the height of the section of the fence that appears to be compressed or leaning.

Step 3: If a section of the fence is greater than $\frac{1}{3}$ of its original height (i.e., fence is less than $\frac{2}{3}$ the original height), record the deficiency in the application.

Examples

CONTROL ACCESS FENCE
COMPRESSION

EXAMPLE

- Control access fence is deficient if current fence height must be **less than $\frac{2}{3}$ of the original fence height.**



5.5.4.2 OPENING

Definition

An opening in the fence may be caused by natural damage or intentionally cut.

Deficiency Standard

Fence openings are considered deficient if:

- An opening within the fence fabric is greater than 2 square feet.

How to Measure the Deficiency

Step 1: Evaluate the segment area for an opening in the fence.

Step 2: Use a measuring tape measure the length and width of the opening. Calculate the square area of the opening by multiplying length by the width.

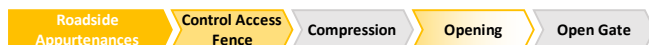
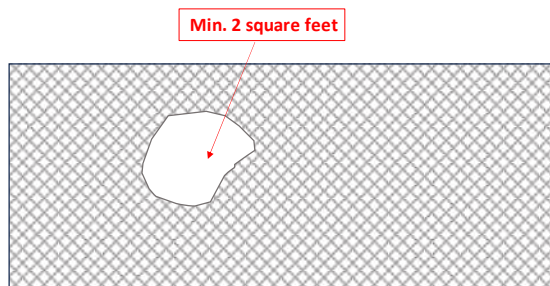
Step 3: If the square area of the opening is greater than 2 square feet, record the deficiency in the application.

Examples

CONTROL ACCESS FENCE
OPENING

EXAMPLE

- Control access fence is deficient if any opening is greater than 2 square feet.



5.5.4.3 OPEN GATE

Definition

Gates are used to safely channel access to the right-of-way.

Deficiency Standard

Fence gates are considered deficient if:

- A control access fence gate is open within the sample area.

How to Measure the Deficiency

Step 1: Evaluate the segment for any open gates along the control access fence.

Step 2: If a gate is open, record the deficiency in the application.

5.5.5 RETAINING WALLS

Definition

A retaining wall is a structure that holds soil or other material behind it to prevent soil erosion, divert or control water, create space, and restrain soil.

Deficiency Standards

Retaining walls are considered deficient if:

- Concrete elements have spalls at least 2 inches in depth.
- Weep holes are dirty, contain foreign material, or are otherwise non-functional.

Important Considerations

Included in retaining wall inspections:

- Any retaining wall within the roadway segment right-of-way to stabilize embankments or steep slopes.

Not included in retaining wall inspections:

- Other specialized walls or vertical structures not installed to stabilize embankments or slopes.
- Retaining walls located on private property.

5.5.5.1 CONCRETE SPALLS

Definition

Concrete spalls are the flaking, chipping, or separation (but not full detachment) of the concrete surface. It is commonly characterized by the appearance of cracks and is caused by cumulative wear from weather and erosion.

Deficiency Standard

Retaining wall concrete spalls are considered deficient if:

- Concrete elements have spalls at least 2 inches in depth.

How to Measure the Deficiency

Step 1: Evaluate the segment for concrete spalls within the retaining wall.

Step 2: If possible, use a measuring tape to measure the depth of the concrete spall. If measurement is inaccessible or unsafe, estimate from a safe distance.

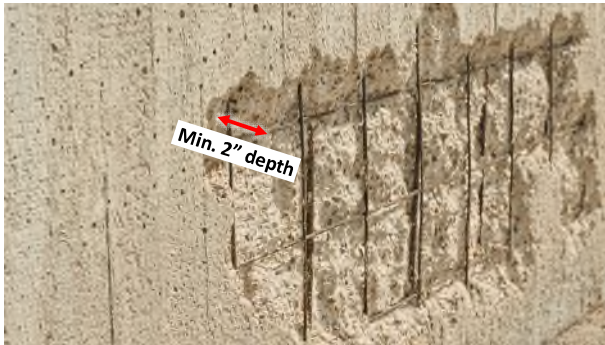
Step 3: If the retaining wall contains spalls at least 2 inches in depth, record the deficiency in the application.

Examples

RETAINING WALLS SPALLING

EXAMPLE

- Retaining walls are deficient if concrete spalls are present and **at least 2 inches in depth.**
- Concrete spalls may be identified by significant flaking, cracking, joint deterioration, or exposed reinforcement.



5.5.5.2 WEEP HOLES

Definition

Weep holes are gaps in retaining walls designed to let excess moisture escape and prevent water from building up in the soil behind the wall, which would otherwise cause increase lateral pressure and threaten structural integrity.

Deficiency Standard

Retaining walls are considered deficient if:

- Weep holes are dirty, contain foreign material, or are otherwise non-functional.

How to Measure the Deficiency

Step 1: Evaluate the segment for dirty, clogged, or non-functional weep holes within a retaining wall.

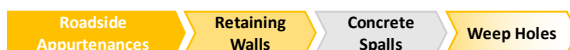
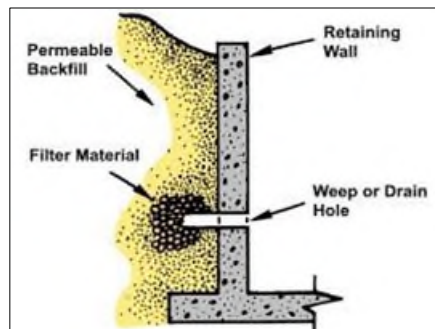
Step 2: If the weep holes are non-functional, record the deficiency in the application.

Examples

RETAINING WALLS
WEEP HOLES

EXAMPLE

- Weep holes are deficient if they are **dirty, contain foreign material**, or are otherwise **non-functional**.
- A functional weep hole allows water to escape from the backfill, reducing lateral pressure on the wall.



5.5.6 IMPACT ATTENUATORS

Definition

Impact attenuators are devices installed along roadways to reduce damage caused by a motor vehicle collision by absorbing or redirecting the kinetic energy of a colliding vehicle.

Important Considerations

Included in impact attenuator inspections:

- All types of impact attenuator systems, including water-filled barrels, sand-filled barrels, crash cushions, support structures, or anchorages.

Not included in impact attenuator inspections:

- Temporary barriers or barricades not intended for long-term permanent installation.

Deficiency Standard

Impact attenuators are considered deficient if:

- Impact attenuator exhibits functional damage; obvious malfunctions, such as water or sand containers that are split, compression of the device, misalignment, missing parts.

How to Measure the Deficiency

Step 1: Evaluate the segment for damaged impact attenuators.

Step 2: If the impact attenuator exhibits functional damage, record the deficiency in the application.

Examples

IMPACT ATTENUATORS
DAMAGE

EXAMPLE

To be considered deficient, an impact attenuator **must exhibit non-functional damage** such as **obvious malfunctions, damage, compression, misalignment, or missing parts.**



Roadside
Appurtenances

Impact
Attenuators

Damage

5.5.7 GRAFFITI

Definition

Graffiti is any illegal writing, painting, or drawing on a structure.

Important Considerations

Included in graffiti inspections:

- Any unauthorized writing or painting on highway infrastructure within the public right-of-way.

NOTE: Hate speech or other messages that are derogatory and/or political must be immediately reported.

Not included in graffiti inspections:

- Graffiti on movable or temporarily installed objects.
- Graffiti on privately owned property.

Deficiency Standard

Graffiti is considered deficient if:

- Graffiti is present on the sample area on any permanent surface within the right of way.

How to Measure the Deficiency

Step 1: Evaluate the segment for graffiti.

Step 2: If graffiti is present, record the deficiency in the application.

Examples

GRAFFITI

EXAMPLE

- **Note:** Hate speech and political messaging must be immediately reported.



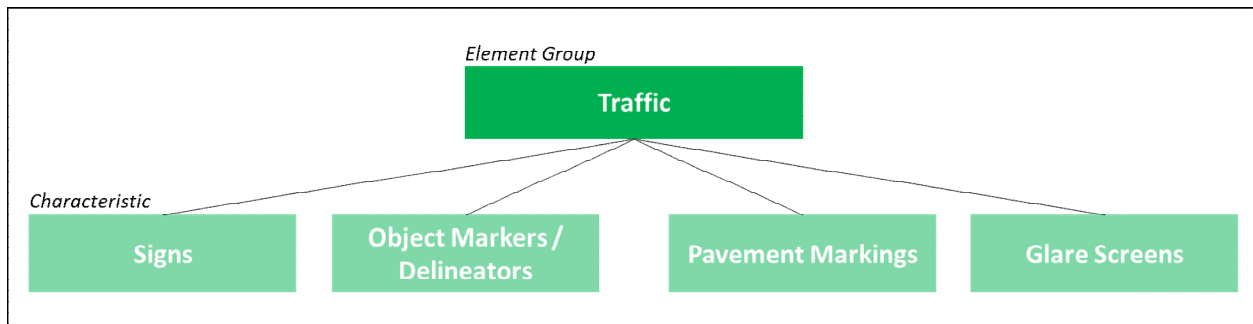
Roadside
Appurtenances

Graffiti

ROADSIDE
APPURTENANCES

5.6 TRAFFIC ELEMENTS

The Traffic element group consists of the following characteristics: Signs, Pavement Markings, Object Markers/Delineators, and Glare Screens.



Refer to the characteristic subsections for an overview of the deficiency standards and important considerations. For more detailed information, refer to the individual deficiency standard subsections associated with each characteristic.

5.6.1 SIGNS

Definition

Signs are used to convey information used by motorists to travel safely and efficiently along a roadway. All signs should be appropriately positioned within the motorist's view and relevant to the location, object, or situation to which they apply. The location and legibility of a sign should provide the motorist with adequate time to make a proper response.

Deficiency Standards

Deficiency criteria for signs focuses on sign visibility, position, and installation. Signs are considered deficient if:

- Warning lights on signs, where required, are not functional.
- Damage covers more than 10% of the sign and is affecting sign function, or a word is partially or fully missing.
- Sign is unable to convey intended message due to fading or surface accumulation.
- Sign panel does not meet the minimum sign retroreflectivity standards per the MUTCD.
- Sign rotation causes the sign to become unreadable.
- Sign height is less than 7 feet measured from top of curb to bottom of sign (measure from sidewalk if present).
- Sign height is less than 5 feet measured from edge of driving lane to bottom of sign.
- Sign installation, including panels and posts, is leaning more than 1 inch per foot.
- Connecting hardware, including nuts and bolts, is missing or improperly installed.
- Sign support is damaged and/or bent.

- A slip base or breakaway support is covered with soil or is more than 4 inches above the finished ground as measured at the center.
- U-channel steel posts are heavier than 3 pounds per foot and are installed on a slip base or breakaway support.

Important Considerations

Included in sign inspections:

- Warning and regulatory signs
- Guide signs
- Overhead signs on span wire

Not included in sign inspections:

- Non-TDOT signs
- Overhead structure attached to overhead signs.
- Signs on signal mast arms
- Dynamic message systems (any digital sign)
- Logo signs
- Construction signs
- Food exit signs
- Street name signs
- For sign height criteria, do not assess green mile marker signs.

NOTE: Where there is a sign assembly, consider each sign on the assembly as unique.

5.6.1.1 VISIBILITY (WARNING LIGHTS)

Definition

Warning lights include any lights included on a roadway sign that are used to increase the visibility and/or important the messaging.

Deficiency Standard

Sign warning lights are considered deficient if:

- Warning lights on signs, where required, are not functional.

How to Measure the Deficiency

Step 1: Evaluate the segment for signs upon which warning lights are required. Check to see if warning lights are functional.

Step 2: If warning lights on a sign are not functional, record the deficiency in the application.

Examples

SIGNS
WARNING LIGHTS

EXAMPLE

- Sign is deficient if warning lights, when required, are not functional.



This image depicts functional warning lights



This image depicts functional warning lights



5.6.1.2 VISIBILITY (DAMAGE)

Definition

Damage is any sign degradation that prevents the message from being clearly read or severely degrades the integrity of the sign. Damage may include denting, holes, fading, streaking, cracking, chipping, or bends in the sign structure.

Deficiency Standard

Sign damage is considered deficient if:

- Damage covers more than 10% of the sign and is affecting sign function, or a word is partially or fully missing.

How to Measure the Deficiency

Step 1: Evaluate segment for signs with widespread denting, holes, severe fading, rust streaks, cracking, chipping, or bends in the metal that prevent the message from being clearly read.

Step 2: If damage covers more than 10% of the sign and is affecting sign function, or a word is partially or fully missing, record the deficiency in the application.

NOTE: Sign face damage must impact the function of the sign to be considered deficient (e.g., cracking on the sign face must be significant enough to prevent a motorist from interpreting the intended message).

Examples

SIGNS
DAMAGE

EXAMPLE

- Sign is deficient if **damage covers more than 10% of the sign** and is affecting sign function, or a **word is partially or fully missing**.
- Examples of damage include **denting, holes, fading, streaking, cracking, chipping, or bends** in sign structure.



5.6.1.3 VISIBILITY (CONVEYS MESSAGE)

Definition

Surface accumulation or severe fading that prevents a sign from clearly conveying the intended message.

Deficiency Standard

Sign messaging is considered deficient if:

- Sign is unable to convey intended message due to fading or surface accumulation.

How to Measure the Deficiency

Step 1: Evaluate the segment for signs with surface accumulation or severe fading that prevents the message from being clearly read.

Step 2: If the sign is unable to convey its intended message due to fading or surface accumulation, record the deficiency in the application.

Examples

SIGNS
CONVEYS MESSAGE

EXAMPLE

- Sign is deficient if **fading or surface accumulation** prevents the **intended message** from being conveyed.



5.6.1.4 RETROREFLECTIVITY

Definition

Sign retroreflectivity is a unique form of reflection that is used to ensure sign visibility at night. The retroreflectivity of signs degrades over time and must be maintained to ensure motorist safety.

Deficiency Standard

Sign retroreflectivity is considered deficient if:

- Sign retroreflectivity does not meet the minimum standards set forth by Table 2A-3 in the 2009 MUTCD.

How to Measure the Deficiency

Step 1: Evaluate the segment for sign retroreflectivity.

Step 2: If sign retroreflectivity is deficient, record the deficiency in the application.

Example

SIGNS
RETROREFLECTIVITY

EXAMPLE

- Sign retroreflectivity must meet the minimum standards set forth by Table 2A-3 in the 2009 MUTCD (see Field Assessment Manual).



Table 2A-3. Minimum Maintained Retroreflectivity Levels¹

Sign Color	Sheeting Type (ASTM D4956-04)				Additional Criteria
	Beaded Sheeting			Prismatic Sheeting	
	I	II	III		
White on Green	W*; G ≥ 7	W*; G ≥ 15	W*; G ≥ 25	W ≥ 250; G ≥ 25	Overhead
	W*; G ≥ 7	W ≥ 120; G ≥ 15			Post-mounted
Black on Yellow or Black on Orange	Y*; O*	Y ≥ 50; O ≥ 50			2
	Y*; O*	Y ≥ 75; O ≥ 75			3
White on Red	W ≥ 35; R ≥ 7				4
Black on White	W ≥ 50				—
¹ The minimum maintained retroreflectivity levels shown in this table are in units of cd/lx/m ² measured at an observation angle of 0.2° and an entrance angle of -4.0°.					
² For text and fine symbol signs measuring at least 48 inches and for all sizes of bold symbol signs					
³ For text and fine symbol signs measuring less than 48 inches					
⁴ Minimum sign contrast ratio ≥ 3:1 (white retroreflectivity ÷ red retroreflectivity)					
* This sheeting type shall not be used for this color for this application.					
Bold Symbol Signs					
• W1-1,2 – Turn and Curve • W1-3,4 – Reverse Turn and Curve • W1-5 – Winding Road • W1-6,7 – Large Arrow • W1-8 – Chevron • W1-10 – Intersection in Curve • W1-11 – Hairpin Curve • W1-15 – 270 Degree Loop • W2-1 – Cross Road • W2-2,3 – Side Road • W2-4,5 – T and Y Intersection • W2-6 – Circular Intersection • W2-7,8 – Double Side Roads		• W3-1 – Stop Ahead • W3-2 – Yield Ahead • W3-3 – Signal Ahead • W4-1 – Merge • W4-2 – Lane Ends • W4-3 – Added Lane • W4-5 – Entering Roadway Merge • W4-6 – Entering Roadway Added Lane • W6-1,2 – Divided Highway Begins and Ends • W6-3 – Two-Way Traffic • W10-1,2,3,4,11,12 – Grade Crossing Advance Warning		• W11-2 – Pedestrian Crossing • W11-3,4,16-22 – Large Animals • W11-5 – Farm Equipment • W11-6 – Snowmobile Crossing • W11-7 – Equestrian Crossing • W11-8 – Fire Station • W11-10 – Truck Crossing • W12-1 – Double Arrow • W16-5P,6P,7P – Pointing Arrow Plaques • W20-7 – Flagger • W21-1 – Worker	
Fine Symbol Signs (symbol signs not listed as bold symbol signs)					
Special Cases					
• W3-1 – Stop Ahead: Red retroreflectivity ≥ 7 • W3-2 – Yield Ahead: Red retroreflectivity ≥ 7; White retroreflectivity ≥ 35 • W3-3 – Signal Ahead: Red retroreflectivity ≥ 7; Green retroreflectivity ≥ 7 • W3-5 – Speed Reduction: White retroreflectivity ≥ 50 • For non-diamond shaped signs, such as W14-3 (No Passing Zone), W4-4P (Cross Traffic Does Not Stop), or W13-1P,2,3,6,7 (Speed Advisory Plaques), use the largest sign dimension to determine the proper minimum retroreflectivity level.					

5.6.1.5 VISIBILITY (ROTATION)

Definition

Sign rotation refers to a significant rotation of the sign face that prevents clear reading of the sign by the motorist.

Deficiency Standard

Sign rotation is considered deficient if:

- Sign rotation causes the sign to become unreadable.

How to Measure the Deficiency

Step 1: Evaluate the segment for signs exhibiting significant rotation.

Step 2: If sign rotation causes a sign to become unreadable, record the deficiency in the application.

Examples

SIGNS
ROTATION

EXAMPLE

- Sign is deficient if rotation causes the sign to become unreadable.



5.6.1.6 HEIGHT (CURB AND GUTTER)

Definition

Sign height refers to the height of the sign face along a roadway. Sign height should be at a reasonable height for motorists to clearly view the intended message. This section refers to signs mounted behind curb and gutter.

Deficiency Standard

Sign height along a road with curb and gutter is considered deficient if:

- Sign height is less than 7 feet measured from top of curb to bottom of sign (measure from sidewalk if present).

NOTE: Do not evaluate green mile marker signs for sign height.

How to Measure the Deficiency

Step 1: Evaluate the segment for signs that appear lower than 7 feet. Use a measuring tape or similar measuring tool to measure the distance from the top of curb to the bottom of sign.

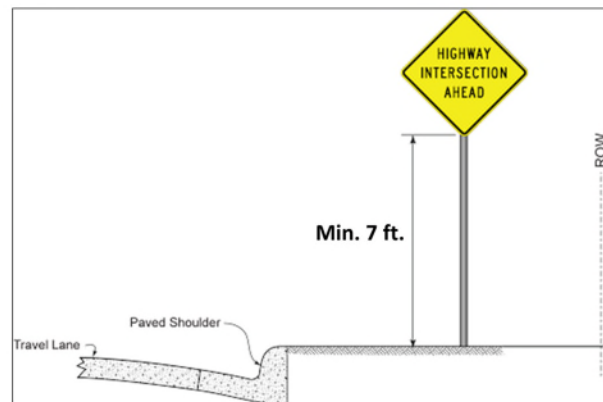
Step 2: If the vertical distance from top of curb to bottom of sign is less than 7 feet, record the deficiency in the application.

Examples

SIGNS
HEIGHT (CURB AND GUTTER)

EXAMPLE

- Signs installed on a curb and gutter section must be **at least 7 feet measured from top of curb to bottom of sign.**
- **Note:** Do not evaluate green mile marker signs for sign height.



5.6.1.7 HEIGHT (SHOULDER)

Definition

Sign height refers to the height of the sign face along a roadway. Sign height should be at a reasonable height for motorists to clearly view the intended message. This section refers to signs mounted directly on a shoulder (no curb and gutter).

Deficiency Standard

Sign height along a road with a shoulder (no curb and gutter) is considered deficient if:

- Sign height is less than 5 feet measured from edge of driving lane to bottom of sign.

NOTE: Do not evaluate green mile marker signs for sign height.

How to Measure the Deficiency

Step 1: Evaluate the segment for signs that appear lower than 5 feet. Use a measuring tape or similar measuring tool to measure the distance from the edge of the driving lane to the bottom of sign.

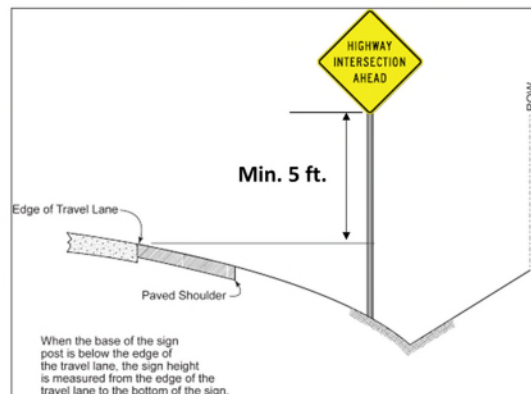
Step 2: If the vertical distance from edge of the driving lane to the bottom of sign is less than 5 feet, record the deficiency in the application.

Examples

SIGNS
HEIGHT (SHOULDER)

EXAMPLE

- Signs installed on a shoulder section (no curb and gutter) must be **at least 5 feet measured from edge of driving lane to bottom of sign.**
- **Note:** Do not evaluate green mile marker signs for sign height.



5.6.1.8 INSTALLATION (LEAN)

Definition

Sign lean is caused by improper installed and may worsen over time. Significant leaning may prevent motorists from clearly viewing the sign message.

Deficiency Standard

Sign lean is considered deficient if:

- Sign installation, including panels and posts, is leaning more than 1 inch per foot.

How to Measure the Deficiency

Step 1: Evaluate the segment for leaning signposts.

Step 2: Plant a measuring stick at the base of the signpost and hold it vertically straight. Use a measuring tape to measure the horizontal distance between the measuring stick and the top of the signpost.

Step 3: Calculate the lean by dividing the distance between the measuring stick and the top of the signpost in inches by the height of the signpost in feet.

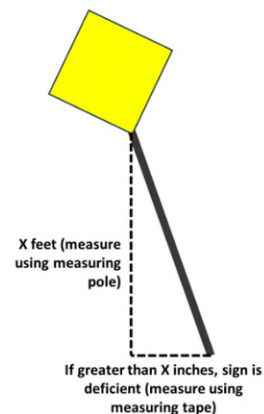
Step 4: If the signpost is leaning more than 1 inch per foot, record the deficiency in the application.

Examples

SIGNS
LEAN

EXAMPLE

- Sign is deficient if sign leans more than 1 inch per foot.



Traffic

Signs

Lean

Hardware

Bent

Breakaway
Support

U-Channel

5.6.1.9 INSTALLATION (HARDWARE)

Definition	Hardware refers to the nuts and bolts that maintain the structural integrity of the sign.
Deficiency Standard	Sign hardware is considered deficient if: • Connecting hardware, including nuts and bolts, is missing, or improperly installed. NOTE: If sign is missing, Installation (Hardware) should be recorded as deficient.
How to Measure the Deficiency	Step 1: Evaluate the segment for signs with improperly installed hardware, such as missing or loose bolts, or missing signs. Step 2: If the sign contains improperly installed hardware, or if the sign is missing, record the deficiency in the application.

5.6.1.10 INSTALLATION (BENT)

Definition	Bent signs refer to any signs with bent or deformed sign faces that prevent clear reading of the intended message by motorists.
Deficiency Standard	Signs are considered deficient if: • Sign support is damaged and/or bent.
How to Measure the Deficiency	Step 1: Evaluate the segment for signs exhibiting significant bending or shape deformities. Step 2: If the sign support is damaged and/or bent, record the deficiency in the application.

Examples

SIGNS
BENT

EXAMPLE

- Sign is deficient if sign support is damaged and/or bent.



5.6.1.11 INSTALLATION (BREAKAWAY SUPPORT)

Definition

Deficiency Standard

Sign breakaway support is considered deficient if:

- A slip base or breakaway support is covered with soil or is more than 4 inches above the finished ground as measured at the center.

NOTE: Breakaway signposts directly behind guardrail shall only be assessed for damage, not soil coverage or installation placement.

NOTE: Evaluate signposts as they are assembled in the field.

How to Measure the Deficiency

Step 1: Evaluate the segment for breakaway supports that are covered with soil. If necessary, use a measuring tape to measure the distance between the finished ground and the breakaway support as measured at the center.

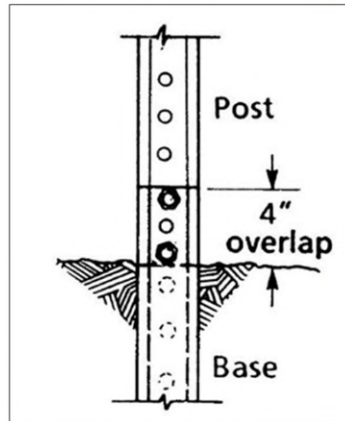
Step 2: If the breakaway support is covered with soil, or if the distance between the finished ground and the breakaway support is greater than 4 inches, record the deficiency in the application.

Examples

SIGNS
BREAKAWAY SUPPORT

EXAMPLE

- Sign is deficient if the breakaway support is covered with soil OR more than 4 inches above the finished ground as measured at the center.



Traffic

Signs

Lean

Hardware

Bent

Breakaway
Support

U-Channel

5.6.1.12 INSTALLATION (U-CHANNEL)

Definition

Deficiency Standard

Sign u-channel steel posts are considered deficient if:

- U-channel steel posts are heavier than 3 pounds per foot and are installed on a slip base or breakaway support.

How to Measure the Deficiency

Step 1: Use the example photos to help determine if the deficiency standard is met.

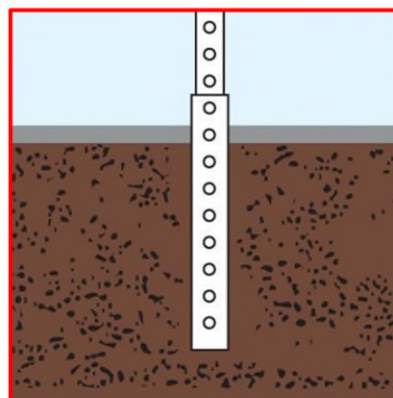
Step 2: If the U-channel steel posts are heavier than 3 pounds per foot and are installed on a slip base or breakaway support, record the deficiency in the application.

Examples

SIGNS
U-CHANNEL

EXAMPLE

Sign is deficient if u-channel post is incorrectly installed on a slip based or breakaway support.



5.6.2 OBJECT MARKERS/DELINEATORS

Definition

Object markers and delineators are vertical structures used to mark obstructions within or adjacent to the roadway. In some cases, object markers may be used as guide devices at location where the alignment may be confusing or unexpected.

Deficiency Standards

Object markers are considered deficient if:

- More than 30% of the object markers or post-mounted delineators lean more than 45 degrees.

- More than 30% of the required markers and delineators are missing, or at least 3 consecutive markers are missing.

NOTE: On ramps, if delineators are present, they shall be replaced based on existing spacing. If delineators are NOT present, determine the number of required delineators based on the following spacing requirements: 100 feet spacing in tangent sections and 50 feet spacing in curves or lane drops (transitions).

NOTE: Only inspect delineators on ramp sections (not mainline).

Important Considerations

Included in object marker inspections:

- Markers on ramps
- Clear or amber “button” type reflective markers
- Markers at major and minor intersections

Not included in object marker inspections:

- Markers on mainline sections
- Markers installed to prohibit unauthorized traffic movements (off-tracking, median crossing, shoulder parking, etc.)

Example

OBJECT MARKERS / DELINEATORS

EXAMPLE PHOTO



- This image shows an example of properly installed object markers.
- To meet the deficiency criteria, one of the following must be true:
 - More than 30% of the object markers lean more than 45 degrees
 - More than 30% of the required object markers are missing
 - At least 3 consecutive object markers are missing.

5.6.2.1 LEANING

Definition

Leaning may confuse motorists and lead to further deterioration over time.

Deficiency Standard

Object marker leaning is considered deficient if:

- More than 30% of the object markers or post-mounted delineators lean more than 45 degrees.

How to Measure the Deficiency

Step 1: Evaluate the segment for leaning object markers or delineators.

Step 2: Plant a measuring stick at the base of the delineator and hold it vertically straight. Use a measuring tape to measure the horizontal distance between the measuring stick and the delineator. Record the vertical distance at which the measurement was taken.

Step 3: If the horizontal distance between the measuring stick and the delineator is greater than half the vertical distance at which the measurement is taken, the delineator is leaning more than 45 degrees.

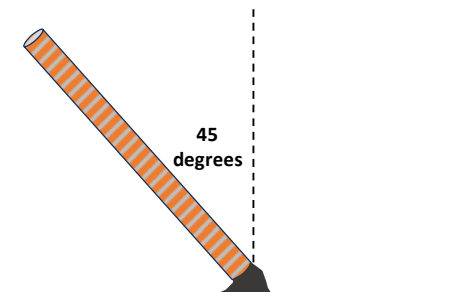
Step 4: Determine the total number of delineators within the segment. If more than 30% are leaning at least 45 degrees, record the deficiency in the application.

Examples

DELINEATORS
LEANING

EXAMPLE

- Delineators are deficient if **more than 30%** of the **lean more than 45 degrees.**



5.6.2.2 MISSING

Definition

Missing object markers may confuse motorists and pose safety risks if not addressed.

Deficiency Standard

Object markers are considered deficient if:

- More than 30% of the required markers and delineators are missing, or at least 3 consecutive markers are missing.

Note: If a ramp has no evidence of delineators, do not evaluate. Use the “N/A” option when using the application.

How to Measure the Deficiency

Step 1: Evaluate the segment for evidence of missing delineators. Evidence may be an extended gap between consecutive delineators, or remnants of a previously installed delineator along the pavement.

Step 2: If delineators are present, determine the total number of delineators originally placed within the segment. If original spacing of delineators cannot be determined, determine the total number of required delineators based on the standard spacing defined in this section (100 feet for tangent sections, 50 feet for curves).

Step 3: If more than 30% of the required delineators are missing or at least 3 consecutive delineators are missing, record the deficiency in the application.

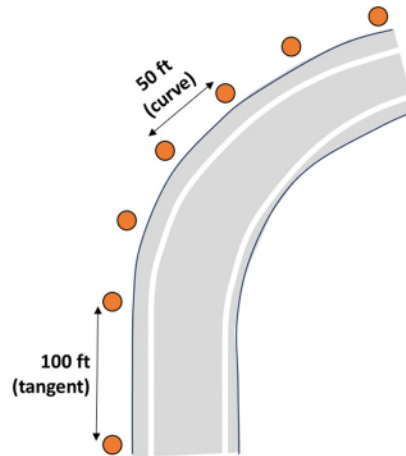
DELINEATORS
MISSING

EXAMPLE

- This image shows an example of properly installed object markers .



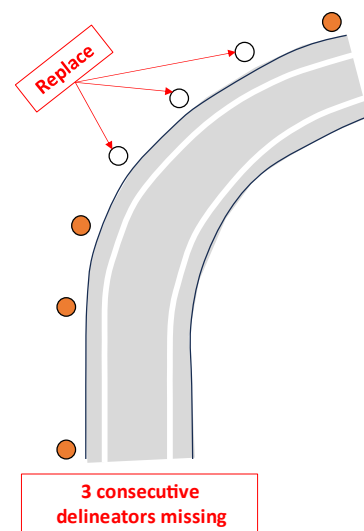
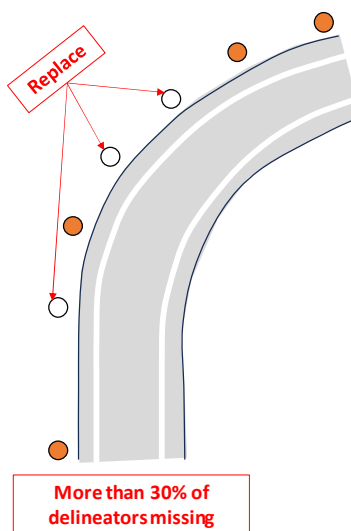
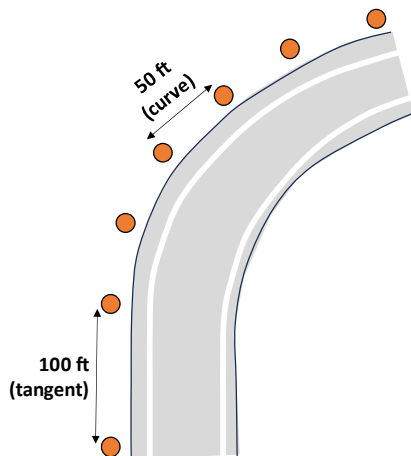
- Correctly installed delineators are spaced **50 feet apart on curves and 100 feet apart on tangent sections.**
- If delineators are already present, they shall be replaced based on existing spacing.
- If there is no evidence of delineators, use the "N/A" option in the application.



Examples

DELINEATORS
MISSING

EXAMPLE



5.6.3 PAVEMENT MARKINGS

Definition	Pavement markings are any striped line, word, or symbol used to guide the direction of motorists.
Deficiency Standards	Pavement markings are considered deficient if: • Longitudinal: More than 10% of the length of any line is missing, or covered in soil, grass, or debris. • Words and Symbols: More than 30% of the symbol area is worn, missing, or not visible.
Important Considerations	Included in pavement marking inspections: • Solid lane lines • Skip lines • Wayfinding or informational symbols painted within the travel lane. • Words painted within the travel lane. Not included in longitudinal pavement marking inspections: • Any marking within the travel lane that wasn't administered by TDOT. • Any marking outside of the travel pavement. • Temporary markings.

5.6.3.1 CLEAR AND VISIBLE (LONGITUDINAL PAVEMENT MARKINGS)

Definition	Longitudinal pavement markings (striping) should be visible to motorists and free of excessive sediment buildup and fading.
Deficiency Standard	Longitudinal pavement marking line visibility is considered deficient if: • More than 10% of the length of any line is missing, or covered in soil, grass, or debris.
How to Measure the Deficiency	Step 1: Evaluate the segment for longitudinal pavement markings with significant sediment building or fading that prevents visibility. Step 2: If more than 10% of the total length of any line is missing, or covered in soil, grass, or debris, record the deficiency in the application.

Examples

PAVEMENT MARKINGS
CLEAR AND VISIBLE (LONGITUDINAL)

EXAMPLE

- More than 10% of the length of any line is **missing, or covered in soil, grass, or debris.**



5.6.3.2 CLEAR AND VISIBLE (WORD AND SYMBOL PAVEMENT MARKINGS)

Definition

Word and symbol pavement marking refer to any pavement markings that convey a written or illustrated message to the motorist.

Deficiency Standard

Word and symbol pavement marking line visibility is considered deficient if:

- More than 30% of the symbol area is worn, missing, or not visible.

How to Measure the Deficiency

Step 1: Evaluate the segment for word and symbol pavement markings with significant sediment buildup or fading that prevents visibility. Use the example photos to help determine if the deficiency standard is met.

Step 2: If more than 30% of a symbol is worn, missing, or not visible, record the deficiency in the application.

Examples

PAVEMENT MARKINGS
CLEAR AND VISIBLE (WORDS AND SYMBOLS)

EXAMPLE

Paved marking symbols are deficient if **more than 30%** of the symbol area is **worn, missing, or not visible.**



5.6.4 GLARE SCREENS

Definition

Glare screens are commonly mounted on top of median barrier walls to provide a 'glare screen' between opposing lanes of traffic. Glare screens are manufactured from a variety of materials (mesh fabric, plastic/metal foils, etc.) and have several mounting techniques.

Deficiency Standard

Glare screens are considered deficient if:

- More than 10% of glare screens along the segment are missing or damaged.

How to Measure the Deficiency

Step 1: Evaluate the segment for damaged or missing glare screens.

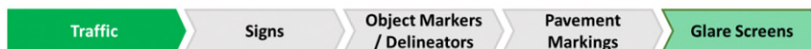
Step 2: If more than 10% of glare screen along the segment are missing or damaged, record the deficiency in the application.

Examples

GLARE SCREENS
DAMAGE

EXAMPLE

- Glare screens are considered deficient if more than 10% of the length along a segment is missing or damaged.



TRAFFIC

ROADSIDE
APPURTANENCES

ROADSIDE ELEMENTS

DRAINAGE

UNPAVED SHOULDER
AND DITCH

PAVEMENT