Level of Service Condition Assessments

Data Collection Manual

January 2021

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Revision History**:**

Revision date:	Revised By:	Description of Change:
12/28/2009	Dye Management Group, Inc.	**Version 1.0**
01/08/2010	Dye Management Group, Inc.	**Version 1.01:** Minor wording changes
01/15/2010	Dye Management Group, Inc.	**Version 1.02:** Minor wording changes
01/18/2010	Dye Management Group, Inc.	**Version 1.03:** Added QA sample column to Exhibit II-1; removed Exhibit II-2 (Division level data samples); Revised Exhibit II-3 (removed reference to Division level samples); Revised Appendix A.
01/25/2010	Dye Management Group, Inc.	**Version 1.04:** Minor wording changes and clarifications
10/20/2010	Dye Management Group, Inc.	**Version 2.0:** Deleted references to rutting and cracking for asphalt and concrete pavement. Added cable rail data collection criterion.
10/01/2016	ALDOT	**Version 3.0:** Expanded Delineator category to include separate catagories for Guardrail/Cable Rail/Barrier Wall Delineators and Other Delineators. Combined the Brush Control and Tree Removal catagories. Removed Mowing and Highway Lighting from data collection. Updated measurements of deficiency for Curb and Gutter and Cross Drains.
08/26/2019	ALDOT	**Version 3.2:** Updated Data Collection Procedures and Sample Counts to reflect a 90% confidence level on the NHS and OSH routes.

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Alabama Department of Transportation

Data Collection Manual

Table of Contents

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I.   Introduction

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A. Purpose

The purpose of this Data Collection Manual is to describe the procedures for collecting road inventory and condition assessment data for assets maintained by the Alabama Department of Transportation (ALDOT). The condition data will be used to develop customer-oriented, performance-based work plans and budgets and to assess results. This exercise is part of a broader project to develop a Maintenance Management System (MMS) based on condition ratings and levels of service.

B. Project Background

Prior to drafting this manual, strategic meetings were conducted with several of the ALDOT division and district personnel as well as with the project steering committee members to accomplish the following:

- Document the as-is processes,

- Define the future maintenance management process, and

- Develop a method for evaluating and reporting LOS for individual asset classifications and their associated maintenance features.

For all the features whose LOS measures were developed, this manual outlines the procedures for collecting their inventory and condition data in the field.

C. General Approach

The general approach for collecting and processing road inventory data consists of the following steps:

- Identify the features and types of measurements or observations needed to establish a complete inventory of all maintainable roadway assets of ALDOT and their condition.

- Develop field and office procedures for collecting and maintaining the inventory and condition data, and establish a process for keeping the data up-to-date.

- Conduct office and field training for road maintenance personnel.

- Collect measurements and observations in the field and record the data.

- Collect data that currently exists in office records.

- Establish a database to maintain the data in a readily retrievable format.

- Provide reporting tools to summarize data on existing roadway assets.

- Periodically, at least annually, repeat the collection and processing of condition data.

- Follow procedures for keeping the inventory data up-to-date.

The Alabama State Highway System consists of approximately 12,000 miles of roadway, for which ALDOT has maintenance responsibility. To the extent possible, inventory and condition data will be obtained from preexisting sources, including office records, application databases, and the mainframe feature inventory. Any field data collection that is required will be done on a statistically significant sampling basis, using randomly selected 0.1-mile sample segments. The maintenance feature condition data to be collected is described in detail in Section III.

II.   Data Collection Procedures

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A. Organizational Considerations

The field data is most efficiently collected by three-person teams. Three-person teams are desirable for the following reasons:

- One person can drive while the other two are recording data.
- One person can watch for oncoming traffic while the other two are recording data.
- One person can be taking measurements or counting while the other is recording data.
- A second opinion may be advantageous where a judgment call is necessary.
- Three people are less likely to be accosted by evildoers than one person acting alone.

It is desirable to collect all the data in as short a time period as possible so that observed quantities and conditions will be a true representation of the road network at the time the analysis is done for planning and budgeting purposes. For this reason it may be desirable to have a two-person team mark the required sections ahead of the data collection team. This approach has been shown to greatly reduce the time required to cover the required number of samples.

B. Field Sample Segments

Statistical methods will identify randomly selected data sample sites along state-maintained highways. The sites are 0.1-mile segments (528 feet) selected in the 12,033 miles of roads (interstate and non-interstate) maintained by ALDOT. For divided highways, both road directions will be sampled as separate roadways.

The following equation was used to determine the minimum sample size necessary to achieve the desired confidence and precision for LOS measures:

$$n = \frac{(z)(p)(1-p)}{e^2 + \frac{(z^2)(p)(1-p)}{N}}$$

where:

n = Sample size (for example, number of 0.1-mile increments)
N = Population size (for example, total number of 0.1-mile increments)
z = Standard normal deviate (that is, number of standard deviations for desired level of confidence)
p = Proportion of the population that meets a specified criteria, expressed as a decimal value from 0.0 to 1.0
1 - p = Remaining proportion of the population
e = Allowable sampling error (or precision), expressed as a decimal

A sampling error of 8 percent and confidence level of 95 percent were used for all roads.[1] It was also assumed that Interstates are in better condition than the rest of the roads in the state. Therefore, the proportion of the samples that meets a passing criterion is assumed to be higher for interstate roads. Thus, for interstate, a value of p = 80% was used while a value of p = 70% for the NHS, other state non-NHS and Institution roads was used. It was assumed that Interstates and NHS Non-Interstate routes are divided, requiring separate samples for the northbound and southbound or eastbound and westbound directions. This assumption effectively doubles the number of miles required to sample these road classes. The rest of the roads were not assumed to be divided.

The distribution of these samples by district is shown in Exhibit II-1, and the distribution of samples at the division level is detailed in Exhibit II-2. **Note that in practice the number of samples should be increased by approximately 10 percent to allow for sites that must be rejected due to bridges, construction zones, or unsafe traffic conditions.** As an example, shown below are the calculations carried out to determine the number of samples along Interstate roads for Area 1, District 1:

Area 1, District 1 consists of 55.43 miles, or 111 miles counting both northbound and southbound sides of interstate roads.

Using 0.1-mile sample sections, the population consists of 1110 potential sample sites. For a sample size that will give 95 percent confidence that the LOS average rating will be within 8 percent of the true value, if the pass/fail rate is 80 percent, then the values for the above equation are: $z = 1.96$, $p = 0.8$, $e = 0.08$, and $N = 1110$. Using these values, the required sample size is:

$$n = \frac{(1.96)^2(0.8)(1-0.8)}{(0.08)^2 + \frac{(1.96)^2(0.8)(1-0.8)}{1110}} = 88$$

In this case, 44 samples will be collected in each travel direction. These sample sites will be selected in a random fashion by generating 44 numbers between 0.0 and 1.0. By multiplying these numbers by the total number of miles in each district, the milepoints of the field sample segments will be obtained. For convenience, the roads in each Area (or District) will be arranged in numerical order, with each road length noted.

All identified features within each field sample segment will be evaluated. The survey is intended to assess the current condition that exists at the point in time when the evaluation takes place. In the future, two or more surveys per year could be conducted to account for seasonal variations.

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[1] Originally, ALDOT used a 95 percent confidence level on all roads. In 2019, ALDOT determined there were no drastic changes in LOS grades for each asset feature from year to year. ALDOT decreased the confidence level to 90 percent on non-interstate NHS and non-NHS other state routes only, and kept the higher 95 percent confidence level on all interstate routes due to their extreme importance and priority.

In every case, the primary concern of data collectors should be the safety of the team and of the road users (safety responsibilities are identified later in this section). Following are the general procedures for collecting field data:

- Using intersections or state boundaries and the vehicle DMI or GPS device, locate and mark the starting and ending milepoint for each field sample segment. These sample segments will be identified by spray paint at the edge of the shoulder so that they can be located again if needed. Placing a traffic cone on the starting and ending mile points also may help identify the limits of the field sample segment while collecting data.

- If any portion of the field sample segment falls on a bridge, move the sample segment forward or backward as necessary to avoid the bridge. Note any adjustments on the data collection input form, laptop, or PDA.

- Field sample segments falling within construction zones should not be evaluated. Relocate the sample segment outside of the construction area but as close to the original segment as possible. Note any adjustments on the data collection input form, laptop, or PDA.

- If some sample locations that fall on bridges or construction zones, and cannot be relocated due to the proximity of other sample locations, the sample location in question may be rejected. Also, if the working conditions at the site are unsafe for any reason, the sample location may be rejected. The required number of samples was increased by 10 percent to allow for such rejections.

- All linear measurements should be rounded up to the nearest foot. Do not use fractions or increments less than one foot.

- From the starting milepoint, rate all identified features on one side of the roadway in the field sample segment. Return to the starting milepoint and rate the other side from start to end. For safety reasons, walk in the direction facing traffic whenever possible. Distance measurements should be taken from the starting milepoint of the field sample segment in the direction of increasing milepost numbers. The starting and ending milepoints of linear features located within the field sample segment should be measured as distance from the feature's starting milepoint.

- Input each day's condition ratings into the database file.

**Exhibit II-1: Number of Samples Required to be
Statistically Significant at the District Level**
(For 95% Confidence (INT), 90% Confidence (NHS/OSH), +/- 8% Precision - QA at 90% Confidence)

Area	District	Type	Samples	Total	QA Samples
1	2	Interstate	72	205	21
		NHS Non-Interstate	65		
		Other State, Non-NHS	68		
	3	Interstate	86	236	24
		NHS Non-Interstate	64		
		Other State, Non-NHS	86		
	4	Interstate	81	230	23
		NHS Non-Interstate	64		
		Other State, Non-NHS	85		
	5	Interstate	81	228	23
		NHS Non-Interstate	64		
		Other State, Non-NHS	83		
2	1	Interstate	0	146	15
		NHS Non-Interstate	65		
		Other State, Non-NHS	81		
	2	Interstate	0	147	15
		NHS Non-Interstate	65		
		Other State, Non-NHS	82		
	4	Interstate	87	231	23
		NHS Non-Interstate	65		
		Other State, Non-NHS	79		
3	1	Interstate	92	238	24
		NHS Non-Interstate	64		
		Other State, Non-NHS	82		
	2	Interstate	87	231	23
		NHS Non-Interstate	59		
		Other State, Non-NHS	85		
	5	Interstate	78	221	22
		NHS Non-Interstate	61		
		Other State, Non-NHS	82		

Area	District	Type	Samples	Total	QA Samples
4	1	Interstate	0	145	15
		NHS Non-Interstate	62		
		Other State, Non-NHS	83		
	2	Interstate	67	210	21
		NHS Non-Interstate	63		
		Other State, Non-NHS	80		
	3	Interstate	66	208	21
		NHS Non-Interstate	59		
		Other State, Non-NHS	83		
	4	Interstate	77	219	22
		NHS Non-Interstate	58		
		Other State, Non-NHS	84		
	5	Interstate	75	214	21
		NHS Non-Interstate	63		
		Other State, Non-NHS	76		
5	2	Interstate	86	232	23
		NHS Non-Interstate	64		
		Other State, Non-NHS	82		
	4	Interstate	81	226	23
		NHS Non-Interstate	62		
		Other State, Non-NHS	83		
	5	Interstate	0	143	14
		NHS Non-Interstate	59		
		Other State, Non-NHS	84		
	6	Interstate	82	225	23
		NHS Non-Interstate	61		
		Other State, Non-NHS	82		
6	1	Interstate	77	222	22
		NHS Non-Interstate	62		
		Other State, Non-NHS	83		
	2	Interstate	82	211	21
		NHS Non-Interstate	44		
		Other State, Non-NHS	85		

Area	District	Type	Samples	Total	QA Samples
6	3	Interstate	84	228	23
		NHS Non-Interstate	65		
		Other State, Non-NHS	79		
	4	Interstate	87	171	17
		NHS Non-Interstate	0		
		Other State, Non-NHS	84		
	5	Interstate	0	146	15
		NHS Non-Interstate	64		
		Other State, Non-NHS	82		
	6	Interstate	78	224	22
		NHS Non-Interstate	64		
		Other State, Non-NHS	82		
7	1	Interstate	0	145	15
		NHS Non-Interstate	64		
		Other State, Non-NHS	81		
	2	Interstate	0	145	15
		NHS Non-Interstate	60		
		Other State, Non-NHS	85		
	3	Interstate	0	144	14
		NHS Non-Interstate	62		
		Other State, Non-NHS	82		
	4	Interstate	0	146	15
		NHS Non-Interstate	62		
		Other State, Non-NHS	84		
	5	Interstate	0	143	14
		NHS Non-Interstate	61		
		Other State, Non-NHS	82		
	6	Interstate	0	145	15
		NHS Non-Interstate	61		
		Other State, Non-NHS	84		
8	2	Interstate	0	146	15
		NHS Non-Interstate	62		
		Other State, Non-NHS	84		

Area	District	Type	Samples	Total	QA Samples
8	3	Interstate	0	136	14
		NHS Non-Interstate	51		
		Other State, Non-NHS	85		
	4	Interstate	0	148	15
		NHS Non-Interstate	65		
		Other State, Non-NHS	83		
9	1	Interstate	88	231	23
		NHS Non-Interstate	64		
		Other State, Non-NHS	79		
	2	Interstate	88	236	24
		NHS Non-Interstate	64		
		Other State, Non-NHS	84		
	3	Interstate	88	233	23
		NHS Non-Interstate	63		
		Other State, Non-NHS	82		
10	1	Interstate	0	135	14
		NHS Non-Interstate	50		
		Other State, Non-NHS	85		
	3	Interstate	81	223	22
		NHS Non-Interstate	59		
		Other State, Non-NHS	83		
	8	Interstate	86	227	23
		NHS Non-Interstate	59		
		Other State, Non-NHS	82		
	9	Interstate	85	232	23
		NHS Non-Interstate	62		
		Other State, Non-NHS	85		
Total			**7,952**	**7,952**	**800**

C. Data Collection Equipment

The necessary equipment for completing field assessments is as follows:

- Data Collection tools. Can include a tablet, or a notebook/note pad with clipboard, and several extra pens for recording any pertinent notes about data collection (if using a tablet, pens are not necessary).

- Flexible metal measuring tape, ¾ inch to 1 inch wide by 25 feet long, or a 6-foot folding ruler, graduated in feet and tenths.

- 100-foot cloth or metal measuring tape.

- Measuring wheel, with a capacity of at least 528 feet, for measuring distances longer than the length of the flexible tape.

- Vehicle equipped with:

  - Flashing yellow/orange safety lights on top of vehicle.

  - Distance Measuring Instrument (DMI) capable of recording to the nearest 0.01 mile and calibrated for less than 1.0 percent error under normal operating conditions (i.e., temperature, tire pressure, vehicle load, etc.).

- Handheld laser or infrared range finder (e.g., the type commonly used for hunting or golfing) – Optional.

- Flashlight, for examining the interior of catch basins.

- 12-volt socket "splitter" to allow more than one device to be plugged into the cigarette lighter (available at most automotive supply stores).

- Traffic cones (three minimum).

- Several cans of orange spray-paint to mark sample locations.

- Protective clothing, such as field boots, jeans, hat, safety glasses, and other outdoor wear appropriate for the season.

- Reflective orange or green safety vests, according to ALDOT policy.

D. Safety Responsibility

In every circumstance, the primary concern of data collectors shall be the safety of the team and of the road users. The survey teams shall conduct the work to ensure the least possible obstruction to traffic. The team vehicle and team members must be properly outfitted with safety equipment, including flashing lights, traffic cones, and safety vests.

When collecting data and while driving at less than the posted speed limit, the survey vehicle should be in the right lane or on the shoulder with all lights flashing. When parked, the survey vehicle should be off the paved surface whenever possible and, if not,

at least as close to the outer edge of the shoulder as possible, with all lights flashing and traffic cones in place to warn approaching traffic.

Perhaps the best safety practice is "situation awareness" (i.e., being aware of where other vehicles and pedestrians are and what they are doing). Then, if necessary, appropriate action can be taken in time to avoid an unpleasant incident.

If any unsafe roadway condition is observed while the team is in the field, the team will immediately notify the nearest maintenance crew by radio or telephone. The team will describe the problem and request that the appropriate maintenance section respond. The team is not expected to perform maintenance functions while conducting the inventory. However, if debris that constitutes a safety problem is encountered on the roadway, it should be removed as a matter of courtesy and safety for motorists.

E. Overview of Maintenance Condition Assessment Criteria

As ascertained by discussions held with the project steering committee, Exhibit II-2 illustrates the asset classifications, maintenance features, and types of measurements and observations needed to assess the condition of each feature.

Exhibit II-2: Maintenance Features to Determine Condition Ratings

Asset Classification	Maintenance Feature	Maintenance Feature Condition Measure
Asphalt Pavement	• Potholes (≥ 6" x 6" x 1")	• Number of potholes per lane mile
	• Raveling	• % of surface area distressed
	• Shoving (Upheaval/Depression)	• Square feet of shoving per lane mile
Concrete Pavement	• Spalling (≥ 6" x 6" x 1")	• Number of spalls per lane mile
	• Faulting (≥ ¼" high)	• Number of faulted slabs per lane mile
	• Joint sealing (≥ ¼" wide)	• Linear feet of joints requiring sealing per lane mile
	• Pumping	• Number of slabs deficient per lane mile
	• Punchouts (≥ 6" x 6" surface area with full depth failure)	• Number of punchouts per lane mile
Shoulders	• Potholes (≥ 6" x 6" x 1")	• Number of potholes per shoulder mile
	• Edge Raveling (Edge Failure)	• Linear feet per shoulder mile

Asset Classification	Maintenance Feature	Maintenance Feature Condition Measure
	• Sweeping	• Linear feet of paved shoulder needing sweeping
	• Non- paved – Drop off (≥ 2") (Low shoulder)	• Linear feet per shoulder mile
	• Non- paved – High shoulder (> 1") (Built-up shoulder)	• Linear feet per shoulder mile
Drainage	• Side drains	• % of pipes "not functioning as intended" or > 25% blocked
	• Cross drains	• % of pipes "not functioning as intended" or > 25% blocked
	• Unpaved ditches	• % of ditch length "not functioning as intended" (erosion or blockage)
	• Paved ditches	• % of ditch length "not functioning as intended" or blocked
	• Drop Inlets, Slotted Drains, & Catch basins	• % of inlets "not functioning as intended" or blocked
	• Curb and Gutters	• % of length "not functioning as intended" or damaged or broken
Roadside	• Front slope – Erosion control	• % of shoulder miles deficient – washouts > 12"
	• Back slope – Erosion control	• % of shoulder miles deficient – washouts > 18"
	• Vegetative Roadside	• % shoulder miles with undesirable vegetation
	• Brush/Tree Removal	• % shoulder miles with undesireable brush and/or trees
	• ALDOT Fence	• % of fence miles damaged (functionally deficient - requiring repair)
	• Litter control	• Number of equal to or greater than fist-size objects per shoulder mile
Traffic Services	• Pavement Markings and Legends (non-visible, missing, faded, chipped)	• % of symbols and legends deficient
	• Pavement Striping (non-visible, missing, faded, chipped)	• % of total length deficient
	• Raised Pavement Markers (RPMs)	• % of RPMs missing or damaged per center line mile
	• Delineators — Barrier	• % of delineators deficient

Asset Classification	Maintenance Feature	Maintenance Feature Condition Measure
	• Delineators — Other	• % of delineators deficient
	• Object Markers	• % of markers missing or damaged
	• Signals (bulbs malfunctioning, structurally deficient, facing wrong direction, etc.)	• % of signalized intersections deficient
	• Signs — Warning and Regulatory (damaged, missing, illegible, retro-reflectivity)	• % of signs deficient
	• Signs — Other (damaged, missing, illegible, retro-reflectivity)	• % of signs deficient
	• Guardrail	• % of guardrail length deficient
	• Cable rail	• % of cable rail length deficient
	• Impact attenuators	• % of impact attenuators deficient
	• Barrier walls	• % of barrier length deficient

F. Inventory Gap

As mentioned earlier, a comprehensive inventory of the existing highway assets maintained by ALDOT is needed in order to determine the condition rating. The first column in Exhibit II-2 lists the inventory needed to develop the condition ratings and work plans, and the second column shows the currently inventoried items. Thus, based on (a) Exhibit II-2 (i.e. the features required to determine condition ratings); and (b) current inventory maintained by ALDOT (i.e. Column II in Exhibit II-3), column III of Exhibit II-3 identifies the gaps in the existing data and lists the additional features whose inventory has to be collected and maintained.

Exhibit II-3: Inventory Gap

Column I	Column II	Column III
Inventory Needed	**Inventory Currently Available**	**Inventory to be Collected**
Asphalt Pavement		X
Concrete Pavement		X
Paved Shoulder	X	
Unpaved Shoulder	X	
Side Drain		X
Cross Drain		X
Unpaved Ditch	X	
Paved Ditch	X	
Drop Inlets, Catch Basins, & Slotted Drains		X
Curb & Gutter		X
Front Slopes		X
Back Slopes		X
Vegetative Roadside	**?**	
Brush/Trees	**?**	
Fences	X	
Litter	X	
Pavement Markings & Legends		X
Pavement Striping	X	
Raised Pavement Markers		X
Delineators — Guardrail/Cable Rail/Barrier Wall		X
Delineators — Other		X
Object Markers		X
Signals	X	
Signs	X	
Guardrail	X	
Cable Rail		X

Column I	Column II	Column III
Inventory Needed	**Inventory Currently Available**	**Inventory to be Collected**
Impact Attenuators	X	
Barrier Walls	X	

III. Road Maintenance Feature Inventory and Condition Rating – Data Collection Criteria

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Following is a list of maintenance features and the exhibit number where the definition and inspection procedures for each can be found.

Note that if condition data on a feature exists in any of the current ALDOT systems, the preferred approach would be to extract it from that system. If such data does not exist, then the field data collection procedures outlined in the following exhibits are to be followed. Also, note that road classification and other "header" data must be collected for each sample, such as District, Division, Road Class, Route Number, Starting Milepoint of Sample, Type of Surface, Number of Lanes, Divided Roadway (if applicable), GPS Location of Starting Milepoint (if required), Date of Collection, Name of Team Leader.

Additionally, the sample segment route, starting milepost, and direction of travel will also be recorded.

Asset Classification and Maintenance Feature	Exhibit
Asphalt Pavement	
Potholes	A-1
Raveling	A-2
Shoving (Upheaval/Depression)	A-3
Concrete Pavement	
Spalling	A-4
Faulting	A-5
Joint Sealing	A-6
Pumping	A-7
Punchouts	A-8
Paved Shoulders	
Potholes	A-9
Edge Raveling	A-10
Sweeping	A-11
Non-Paved Shoulders	
Drop Off	A-12
High Shoulder	A-13
Drainage	
Side Drains	A-14

Asset Classification and Maintenance Feature	Exhibit
Cross Drains	A-15
Unpaved Ditches	A-16
Paved Ditches	A-17
Drop Inlets, Slotted Drains & Catch Basins	A-18
Curb & Gutters	A-19
Roadside	
Erosion Control – Front Slopes	A-20
Erosion Control – Back Slopes	A-21
Vegetative Roadside	A-22
Brush/Tree Control	A-23
ALDOT Fences	A-24
Litter Control	A-25
Traffic Services	
Pavement Markings and Legends	A-26
Pavement Striping	A-27
Raised Pavement Markers	A-28
Delineators — Barrier	A-29
Delineators — Other	A-30
Object Markers	A-31
Signals	A-32
Signs—Regulatory & Warning	A-33
Signs—Other (Including Guide, Service & Attraction)	A-34
Guardrails	A-35
Cable Rails	A-36
Impact Attenuators	A-37
Barrier Walls	A-38

Exhibit A-1: Asphalt Pavement, Potholes

Asset Group: Asphalt Pavement
Maintenance Feature: Potholes
Definition: Potholes are bowl-shaped voids or depressions in the pavement surface that are equal or greater than 6 inches by 6 inches by 1 inch deep (6" x 6" x 1"). Potholes are localized failure areas usually caused by weak base or subgrade layers.
Measurement Unit: Inventory: Asphalt lane-miles. Condition: Number of potholes per asphalt lane-mile.
Inspection Procedure: For each sample on asphalt-surfaced pavements, inspect the surface area and count and record the total number of potholes in all lanes.

Sample Pothole (6" x 6" x 1")

To be counted as one (1) **Pothole** if this size or larger.

Exhibit A-2: Asphalt Pavement, Raveling

Asset Group: Asphalt Pavement
Maintenance Feature: Raveling
Definition: Raveling of asphalt pavement is defined as the loss of bond between the asphalt binder and the aggregate through either a cohesion or adhesion failure, usually caused by the action of water. When raveling occurs, the pavement surface appears to be disintegrating.
Measurement Unit: Inventory: Asphalt lane-miles. Condition: Square feet of raveling per asphalt lane-mile.
Inspection Procedure: For each sample on asphalt-surfaced pavements, inspect the surface area for raveling. Measure and record the total square feet of raveling in all lanes. Use the measuring wheel or tape measure, as appropriate; to obtain the length and width of each raveled area.

Asphalt Edge Raveling

Sample Asphalt Raveling

Square feet of **Raveling** to be counted if this condition exists.

Exhibit A-3: Asphalt Pavement, Shoving

Asset Group: Asphalt Pavement
Maintenance Feature: Shoving (Upheaval/Depression)
Definition: An area of the paved surface that is displaced vertically to cause a hump in the roadway, often along the edge of the travel lanes or at intersections where frequent braking with heavy axle loads causes "pushouts."
Measurement Unit: Inventory: Asphalt lane-miles. Condition: Surface area with shoving, expressed as square feet per asphalt lane-mile.
Inspection Procedure: For each sample on asphalt-surfaced pavements, inspect the paved surface for shoving. Measure the total length and average width of each distressed area. Record the total square feet of shoving for all lanes. It will be helpful to have a clipboard and notepad to jot down the size of each distressed area and calculate the total distressed area in the sample section.

Sample Asphalt Shoving

Square feet of **Asphalt Shoving** to be counted if this condition exists.

Exhibit A-4: Concrete Pavement, Spalling

Asset Group: Concrete Pavement
Maintenance Feature: Spalling
Definition: Spalling is the breakup or disintegration of the concrete surface that are equal to or greater than 6 inches by 6 inches by 1 inch deep (6" x 6" x 1"). A spall normally does not extend vertically through the slab. Often, spalling is the result of durability cracking (D-cracking) of the pavement. D-cracking is a series of fine crescent-shaped cracks in the concrete surface that usually run parallel to a joint or major crack. D-cracking can eventually lead to disintegration and spalling of the concrete near the joints or corners. Some spalls may resemble potholes.
Measurement Unit: Inventory: Concrete lane-miles. Condition: Number of spalls per concrete lane-mile.
Inspection Procedure: For each sample on concrete-surfaced pavements, inspect the paved surface for spalling. Count and record the total number of spalls in all lanes.
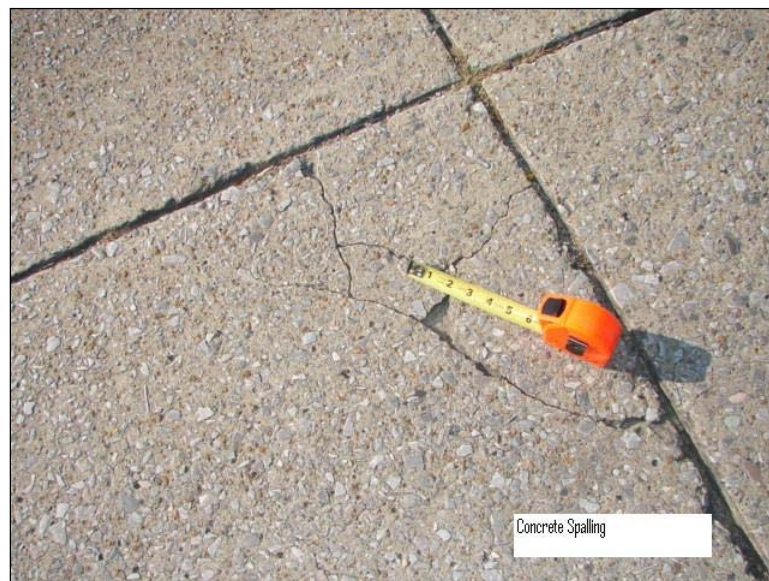
Concrete Spalling

Sample Concrete Spalling (6" x 6" x 1")

To be counted as one (1) **Concrete Spall** if this size or larger.

Exhibit A-5: Concrete Pavement, Faulting

Asset Group: Concrete Pavement
Maintenance Feature: Faulting
Definition: Faulting is the vertical shift of ¼" or more of concrete slabs at a joint or crack.
Measurement Unit: Inventory: Concrete lane-miles.   Condition: Number of faulted slabs per concrete lane-mile.
Inspection Procedure: For each sample on concrete-surfaced pavements, inspect the paved surface for faulting. Count and record the total number of faulted slabs in all lanes.

Sample Concrete Faulting

Faulted slab to be counted if this condition exists.

Exhibit A-6: Concrete Pavement, Joint Sealing

Asset Group: Concrete Pavement
Maintenance Feature: Joint Sealing
Definition: All unsealed joints at least ¼" wide running generally parallel or perpendicular to the direction of travel, including longitudinal, transverse and edge joints.
Measurement Unit: Inventory: Concrete lane-miles. Condition: Linear feet of deficient concrete joints.
Inspection Procedure: For each sample on concrete-surfaced pavements, measure and record the total length of all joints in all lanes. Inspect the surface area for unsealed joints wider than ¼" and measure and record the total length of all deficient joints in all lanes. Use a measuring tape or measuring wheel, as appropriate.

Concrete Joint Seal needed

Sample Concrete Joint Sealing

Linear feet of **Unsealed Joint** to be counted if this condition exists.

Exhibit A-7: Concrete Pavement, Pumping

Asset Group: Concrete Pavement
Maintenance Feature: Pumping
Definition: A concrete slab that moves vertically with respect to one or more adjacent slabs when subjected to traffic loads, often exhibiting water or soil pumping movement along the edges of the slab.
Measurement Unit: Inventory: Concrete lane-miles. Condition: Number of pumping slabs per concrete lane-mile.
Inspection Procedure: For each sample on concrete-surfaced pavements, inspect the surface area for evidence of pumping and count and record the total number of all such slabs in all lanes. It will be helpful to watch joints or edges of slabs when trucks are passing to identify slab movement.

Concrete Pumping

Sample Concrete Pumping

Pumping **Concrete Slab** to be counted if this condition exists.

Exhibit A-8: Concrete Pavement, Punchouts

Asset Group: Concrete Pavement
Maintenance Feature: Punchouts
Definition: Punchouts are holes in the concrete slab that penetrate the entire slab. Punchouts are localized failure areas within the slab, where a block of concrete has failed and punched through, often larger than 6" x 6" surface area in size.
Measurement Unit: Inventory: Concrete lane-miles. Condition: Number of punchouts per concrete lane-mile.
Inspection Procedure: For each sample on concrete-surfaced pavements, inspect the paved surface for punchouts. Count and record the total number of punchouts in all lanes.

Sample Concrete Punchout (6" x 6")

To be counted as one (1) **Punchout** if this size or larger.

Exhibit A-9: Paved Shoulders, Potholes

Asset Group: Paved Shoulders
Maintenance Feature: Potholes
Definition: Potholes are bowl-shaped voids or depressions on paved shoulders that are greater than or equal to 6 inches by 6 inches by 1 inch deep (6" x 6" x 1"). Potholes are localized failure areas usually caused by weak base or subgrade layers.
Measurement Unit: Inventory: Paved shoulder-miles. Condition: Number of potholes per paved shoulder-mile.
Inspection Procedure: For each sample with paved shoulders, measure and record the total linear feet of paved shoulder on both sides of the road. Inspect the shoulder surface area and count and record the total number of potholes on both shoulders.

Pothole (6 inches by 6 inches by 1 inch deep)

Sample Pothole, Paved Shoulders (6" x 6" x 1")

To be counted as one (1) **Pothole** if this size or larger.

Exhibit A-10: Paved Shoulders, Edge Raveling

Asset Group: Paved Shoulders
Maintenance Feature: Edge Raveling (Edge Failure)
Definition: Disintegration of the paved shoulder surface along the edges, usually characterized by a series of irregular cracks, generally oriented with the direction of travel.
Measurement Unit: Inventory: Paved shoulder-miles. Condition: Linear feet of edge raveling per paved shoulder-mile.
Inspection Procedure: For each sample with paved shoulders, inspect the shoulder edges for raveling. Measure and record the total linear feet of raveling along both shoulders. Use the measuring tape or wheel, as appropriate.

Edge Raveling - Paved Shoulder

Sample Paved Shoulder, Edge Raveling

Linear feet of **Edge Raveling** to be counted if this condition exists.

Exhibit A-11: Paved Shoulders, Sweeping

| |
|---|
| **Asset Group:** Paved Shoulders |
| **Maintenance Feature:** Sweeping |
| **Definition:**

Sweeping refers to sections of the roadway that are routinely swept with a power broom to prevent build-up of dirt, sand, or debris. Often, these are curbed sections. |
| **Measurement Unit:**

Inventory: Linear feet of paved surface or curb subject to sweeping.

Condition: Linear feet of paved surface or curb needing sweeping. |
| **Inspection Procedure:**

Inspect the paved surface area in the sample segment for sweepable areas and areas covered with dirt, sand, or debris. Measure and record the total linear feet of the paved surface, on both sides of the roadway, normally subjected to sweeping. Also, measure and record the total linear feet of paved surface that is covered with dirt, sand, or debris and needs sweeping now. A linear measurement is used because one pass along each sweepable edge of pavement is usually sufficient. |

Asphalt Sweeping

Sample Paved Shoulder Sweeping

Linear feet of **Sweeping** to be counted if this condition exists.

Exhibit A-12: Unpaved Shoulders, Shoulder Drop-Off

Asset Group: Unpaved Shoulders
Maintenance Feature: Shoulder Drop-Off (low shoulder)
Definition: Shoulder drop-off includes deformation or loss of material along the edge of the paved surface, where there is a vertical drop in elevation of 2" or more below the edge of the paved surface.
Measurement Unit: Inventory: Linear feet of unpaved shoulders. Condition: Linear feet of drop-off of unpaved shoulders.
Inspection Procedure: For each sample with unpaved shoulders, measure and record the total linear feet of unpaved shoulder on both sides of the roadway in the sample area. Also, inspect the edges of pavement for drop-offs of 2" or more and measure and record the total linear feet of such drop-off along both shoulders. Use the measuring tape or wheel, as appropriate, to measure length and a level or straightedge and metal tape to measure the drop in elevation.

Drop Off (Low Shoulder)

2008 11 3
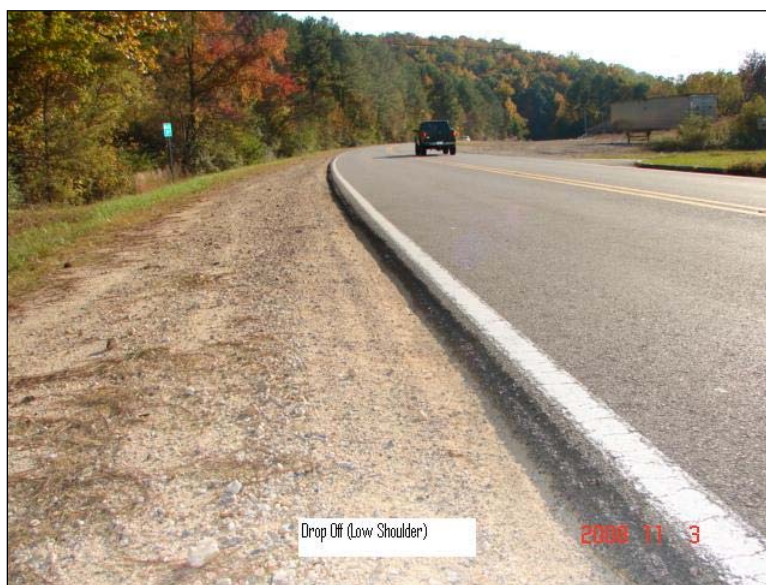
Sample Unpaved Shoulder, Shoulder Drop-Off

Linear feet of **Drop-Off** to be counted if this condition exists.

Exhibit A-13: Unpaved Shoulders, High Shoulder

Asset Group: Unpaved Shoulders
Maintenance Feature: High Shoulder (built-up shoulder)
Definition: High shoulder is an increase in elevation of 1" or more of material within 6" of the edge of the paved surface. The build-up of material typically includes soil, gravel, matted vegetation, or other debris that may impede water runoff or present an unsafe condition for motorists.
Measurement Unit: Inventory: Linear feet of unpaved shoulder. Condition: Linear feet of high shoulder of unpaved shoulder.
Inspection Procedure: For each sample with unpaved shoulders, inspect the edges of pavement for high shoulders of 1" or more within 6" of edge of pavement. Measure and record the total linear feet of unpaved shoulder, and measure and record the total linear feet of high shoulders, along both sides of the road. Use the measuring tape or wheel, as appropriate, to measure length and a level or straightedge and metal tape to measure the height of high shoulders.

Sample Unpaved Shoulder, High Shoulder

Linear feet of **High Shoulder** to be counted if this condition exists.

Exhibit A-14: Drainage, Side Drains

Asset Group: Drainage
Maintenance Feature: Side Drains
Definition: Side drains are any drainage structures along the side of the road that are essentially parallel with the roadway alignment, including pipes under driveways and side-roads.
Measurement Unit: Inventory: Number of side drains. Condition: Number of side drains deficient.
Inspection Procedure: Inspect all side drains in the sample area for damage or blockage. If necessary, use a probe rod to locate the bottom of the pipe when obscured with sediment. For the purposes of this survey, a side drain is considered deficient if any one of the following conditions exist: 1. Any portion of the drainage structure is blocked or filled with sediment or debris to more than 25 percent of its diameter. 2. Any portion (of actual drain — not area surrounding drain) is sufficiently damaged to weaken its structural integrity. 3. The flow capacity of the inflow or outflow is impeded by external obstructions such as sediment, rocks, vegetation, or woody debris. 4. Any portion of the grate or trash rack is blocked or filled with debris so that the opening is reduced by more than 25 percent. Count and record the total number of side drains, and the total number deficient, in the sample area.

**Functional Side Drain Condition -
Do Not Count as Deficient**

**Deficient Side Drain Condition -
Count as Deficient**

Exhibit A-15: Drainage, Cross Drains

Asset Group: Drainage
Maintenance Feature: Cross Drains
Definition: Cross drains are any drainage structures that cross under the road, either perpendicular to or skewed from the roadway alignment, including pipes and culverts (**culverts with spans longer than 20 feet are bridges**).
Measurement Unit: Inventory: Number of cross drains.   Condition: Number of cross drains deficient.
Inspection Procedure: Inspect all cross drains in the sample area for damage or blockage. If necessary, use a probe rod to locate the bottom of the pipe when obscured with sediment.   For the purposes of this survey, a cross drain is considered deficient if any one of the following conditions exist: 1. Any portion of the drainage structure is blocked or filled with sediment or debris to more than 25 percent of its diameter.   2. Any portion (of actual drain — not area surrounding drain) is sufficiently damaged to weaken its structural integrity.   3. The flow capacity of the inflow or outflow is impeded by external obstructions such as sediment, rocks, vegetation, or woody debris.   4. Any portion of the grate or trash rack is blocked or filled with debris so that the opening is reduced by more than 25 percent.   Count and record the total number of cross drains, and the total number deficient, in the sample area.

Functional Cross Drain Condition -
Do Not Count as Deficient

Deficient Cross Drain Condition -
Count as Deficient

Exhibit A-16: Drainage, Unpaved Ditches

Asset Group: Drainage
Maintenance Feature: Unpaved Ditches
Definition: Unpaved ditches are water channels that can be parallel or perpendicular to the roadway and that collect water and transport it to, or from, other drainage structures or waterways, or direct water on and off the ROW. They are unimproved, except for shaping the natural soil or fill material to form a drainage channel.
Measurement Unit: Inventory: Linear feet of unpaved ditch. Condition: Linear feet of deficient unpaved ditch. **Note:** Ditch can measure greater than 1056 feet if section of ditch scewed perpendicular to centerline.

Inspection Procedure:
 	
Inspect all unpaved ditches on both sides of the roadway in the sample area.
 	
An unpaved ditch is considered deficient if any of the following conditions exist:
 	
   1. It is more than 50 percent filled with sediment, rocks, vegetation or debris.
 	
   2. It has areas of erosion that are impeding water flow by 50 percent.
 	
Note:
  • Rocks used for riprap should not be considered deficient unless more than 50-percent covered with sediment, vegetation, or debris.
  • Ditches that divide a median on a divided highway should only be included in the sample that is on the side of the roadway in the increasing milepost direction. Otherwise, the feature may be counted and rated twice.
 	
Record the total unpaved ditch length and the total length that is deficient in the sample area.

**Functional Unpaved Ditch Condition -
Do Not Count as Deficient**

**Deficient Unpaved Ditch Condition -
Count Linear Feet of Deficiency**

Exhibit A-17: Drainage, Paved Ditches

Asset Group: Drainage
Maintenance Feature: Paved Ditches
Definition: Paved ditches are water channels that can be parallel or perpendicular to the roadway and that collect water and transport it to, or from other drainage structures or waterways, or direct water on and off the ROW, and have been lined with concrete or asphalt.

Measurement Unit: Inventory: Linear feet of paved ditch. Condition: Linear feet of deficient paved ditch.	**Note:** Ditch can measure greater than 1056 feet if section of ditch scewed perpendicular to centerline.

Inspection Procedure:

Inspect all paved ditches on both sides of the roadway in the sample area.

A paved ditch is considered deficient if any of the following conditions exist:

1. Filled more than 50 percent with sediment, rocks, vegetation, or debris that impedes water flow.

2. Lining is broken, missing, or cracked to the extent that it is not functional or promotes erosion.

Note:

- If rocks are being used for riprap, they should not be considered deficient unless more than 50 percent covered with sediment, vegetation, or debris.
- Ditches that divide a median on a divided highway should only be included in the sample that is on the side of the roadway in the increasing milepost direction. Otherwise, the feature may be counted and rated twice.

Record the total paved ditch length, and the total length that is deficient, in the sample area.

Functional Paved Ditch Condition - Do Not Count as Deficient

Deficient Paved Ditch Condition - Count Linear Feet of Deficiency

Exhibit A-18: Drainage, Drop Inlets, Slotted Drains, and Catch Basins

Asset Group: Drainage
Maintenance Feature: Drop Inlets, Catch Basins, and Slotted Drains
Definition: **Drop Inlets** are openings in ditches (grate covered) and gutters (open or grate covered) that allow water to flow vertically down into a catch basin and be routed into another drainage channel. **Slotted Drains** are similar inlets used to remove surface water and are widely used in parking lots. **Catch Basins** are designed to collect sediment while allowing water to pass through. Periodic cleaning is necessary to keep the grates open and remove excessive sediment build-up.
Measurement Unit: Inventory: Number of drop inlets. Condition: Number of drop inlets deficient.
Inspection Procedure: Inspect the sample area for drop inlets on both sides of the roadway. Drop inlets are considered deficient if any of the following conditions exist: 1. Inlet grate is blocked 50 percent or more (for slotted drains, measure the linear distance of exisiting drain and indicate linear distance blocked – if greater than 50%, indicate as deficient). 2. Inlet grate is damaged (broken or missing) or rusted to the extent that the material cross section has been noticeably reduced. 3. Sediment in the catch basin blocks the outlet pipe opening by 50 percent or more (use a flashlight if necessary to observe the amount of buildup). Record the total number of drop inlets, and the total number deficient, in the sample area.

**Functional Drop Inlet Condition -
Do Not Count as Deficient**

**Deficient Drop Inlet Condition -
Count as Deficient**

Exhibit A-18: Drainage, Drop Inlets, Slotted Drains, and Catch Basins
(Continued)

Functional Slotted Drain Condition -
Do Not Count as Deficient

Deficient Slotted Drain Condition -
Count as Deficient

Functional Catch Basin Condition -
Do Not Count as Deficient

Deficient Catch Basin Condition -
Count as Deficient

Exhibit A-19: Drainage, Curb & Gutter

Maintenance Group: Drainage
Maintenance Feature: Curb & Gutter
Definition: Gutters are roadside drainage features designed to channel rainwater from the roadway surface into drainage structures.
Measurement Unit: Inventory: Linear feet of curb and gutter. Condition: Linear feet of defective curb and gutter (damaged or broken).
Inspection Procedure: Inspect open gutters on each side of the field sample segment. Each segment may contain one or more separate segments of open gutter. Identify the worst condition to be representative of that segment. Record the total length of gutter and the defective length in the sample section.

Functional Curb and Gutter Condition - Do Not Count as Deficient

Deficient Curb and Gutter Condition - Count Linear Feet of Deficiency

Exhibit A-20: Roadside, Erosion Control — Front Slope

Asset Group: Roadside
Maintenance Feature: Erosion Control — Front Slope
Definition: Front slopes are the areas between the shoulder of the road and the drainage channel and may occur on cut or fill sections. Erosion is the downslope movement of soil in response to gravitational stresses and/or water, including slides and washouts (gullies). Re-grading and, in severe cases, additional fill material may be needed to correct erosion problems.
Measurement Unit: Inventory: Linear feet of front slopes, measured along each centerline. Condition: Linear feet of deficient front slopes, measured along each centerline.

Inspection Procedure:
Inspect the front slopes in the sample area for signs of erosion or slides.
 	
Front Slopes are considered deficient if any of the following conditions exist:
   1. Slopes are jeopardzing the structural integrity of the shoulder or traveled lane(s).
   2. Slopes are blocking the shoulder or traveled lane(s).
   3. If slopes are blocking the ditch.
   4. Slopes have gullies deeper than 1 foot.
 	
Measure and record the total length of front slopes, and the total length of deficient front slopes, in the sample area.

**Functional Front Slope Condition -
Do Not Count as Deficient**

**Deficient Front Slope Condition -
Count Linear Feet of Deficiency**

Exhibit A-21: Roadside, Erosion Control — Back Slope

Asset Group: Roadside
Maintenance Feature: Erosion Control — Back Slope
Definition: Back slopes are the areas along the roadway between the drainage channel and the right-of-way line, often occurring on roads with cut sections. Erosion is the downslope movement of soil in response to gravitational stresses and/or water, including slides and washouts (gullies). Re-grading or bank stabilization may be needed to correct erosion problems.
Measurement Unit: Inventory: Linear feet of back slopes, measured along each centerline. Condition: Linear feet of deficient back slopes, measured along each centerline.
Inspection Procedure: Inspect the back slopes in the sample area for signs of erosion or slides. Back Slopes are considered deficient if any of the following conditions exist: 1. Slopes are jeopardzing the structural integrity of the shoulder or traveled lane(s). 2. Slopes are blocking the shoulder or traveled lane(s). 3. If slopes are blocking the ditch. 4. Slopes have gullies deeper than 18 inches. Measure and record the total length of back slopes, and the total length of deficient back slopes, in the sample area.

**Functional Back Slope Condition -
Do Not Count as Deficient**

**Deficient Back Slope Condition -
Count Linear Feet of Deficiency**

Exhibit A-22: Roadside, Vegetative Roadside

Asset Group: Roadside
Maintenance Feature: Vegetative Roadside
Definition: Undesirable vegetation includes noxious weeds, such as johnson grass, thistle and nettle, and all broadleaf weeds with height in excess of native grasses.
Measurement Unit: Inventory: Linear feet of vegetated roadside, measured along the shoulder. Condition: Linear feet with undesirable vegetation, measured along the shoulder.
Inspection Procedure: Inspect both sides of the roadway in the sample area and determine the presence of any undesirable vegetation. Measure along the shoulder on both sides of the roadway and record the total linear feet of vegetated roadside. Measure along the shoulder of both sides of the roadway and record the linear feet of undesirable vegetation. In most cases, the measuring wheel will be the preferred measurement device.

Johnson Grass

Thistle

Cogongrass

Kudzu

Wild Poinsettia

Hemp Dogbane

Exhibit A-23: Roadside, Brush/Tree Control

Asset Group: Roadside
Maintenance Feature: Brush/Tree Control
Definition: Roadside brush/trees needs to be controlled to reduce visibility restrictions and undesirable obstacles for motorists. Brush/Trees that represent a potential safety concern to motorists or adjacent property, including control of just brush, tree branches, or removal of an entire tree. The brush/trees can occur anywhere within the highway right of way, including the right-of-way line.
Measurement Unit (measured along the shoulder)**:** Inventory: Linear feet of roadside with brush/tree growing areas. Condition: Linear feet of roadside with deficient brush/tree control.

Inspection Procedure:
Inspect the roadside within the sample area for any deficiencies in brush/tree control.
Brush/Tree growning areas are considered deficient if any of the following conditions exist:
   1. Restricted visibility of on-coming traffic.
   2. Impaired visibility of signs and signals.
   3. Clusters of brush that could be a safety concern for run-off-the-road vehicles.
   4. Encroachment over the shoulder of the road.
   5. Trees that are dead, diseased, or present a potential safety concern to motorists or adjacent property.
Measure and record the total length of shoulder along brush/tree growing areas, and the total length of shoulder in deficient brush/tree growing areas, on both sides of the roadway in the sample area. Use the measuring wheel to determine the length to the nearest linear foot.

Functional Brush/Tree Control Condition - Do Not Count as Deficient

Deficient Brush/Tree Control Condition - Count Linear Feet of Deficiency

Sample Tree Deficiency for a Dead or Diseased Tree

Trees meeting criteria for a dead or diseased tree should be counted in the total linear feet of deficiency.

Exhibit A-24: Roadside, ALDOT Fence

Asset Group: Roadside
Maintenance Feature: ALDOT Fence
Definition: ALDOT fences are those fences along the right-of-way line of the roadway (usually chain-link) that are maintained by ALDOT. Typically, such fences are found along Interstate highways and other highways with full control of access.
Measurement Unit: Inventory: Linear feet of right-of-way fence. Condition: Linear feet of right-of-way fence with deficiencies.

Inspection Procedure:
Inspect fences along the right of way of the sample area if easily accessible and visible from the shoulder of the road.
 	
A fence panel (from post to post) is considered deficient if any of the following conditions exist:
   1. Any portion of a fence panel or post is missing or broken (e.g., due to vandalism or run-off-the-road accident).
   2. Any portion of a fence panel is less than two-thirds of its original height (e.g., due to fallen tree limb).
   3. A hole is found in or under the fence that has an opening of one square foot or more.
Note: If any portion of a fence panel is deficient, record the deficiency as the length of the panel, since the repair will probably require replacing the entire panel.
 	
Record the total linear feet of all right-of-way fences in the sample area and the total linear feet of deficiencies.

**Functional ALDOT Fence –
Do Not Count as Deficient**

**Deficient ALDOT Fence –
Count Linear Feet of Deficiency**

Exhibit A-25: Roadside, Litter Control

Asset Group: Roadside
Maintenance Feature: Litter Control
Definition: Litter and debris consists of any unwanted objects on the highway right of way that are fist-size or larger, including trash, materials that have fallen off vehicles, and dead animals.
Measurement Unit: Inventory: N/A Condition: Number of fist-size objects.
Inspection Procedure: Inspect the right of way in the sample area for litter and debris. **Note:** • If more than 100 such objects are found in the sample area, stop counting and record 100. • Rocks and tree limbs are not counted here, unless they are on the travel lanes or shoulders, but are included in the Erosion Control and Tree Removal categories Count and record the total number of objects that are fist-sized or larger.

Sample Litter

Each item to be counted as one (1) piece of **Litter** if this size or larger.

Exhibit A-26: Traffic Services, Pavement Markings and Legends

Asset Group: Traffic Services
Maintenance Feature: Pavement Markings and Legends
Definition: Pavement markings and legends are any markings applied to the pavement and gore areas for traffic guidance purposes, including crosswalks, stop lines, turn arrows, railroad crossings, gore areas, and other similar markings.
Measurement Unit: Inventory: Number of markings and legends. Condition: Number of deficient markings and legends.

Inspection Procedure:
Inspect the pavement markings and legends within the field sample area for deficiencies.
 	
A marking or legend is considered to be deficient if any of the following conditions exist:
 	
1. Marking or legend is more than 50 percent:
  ▪ Faded
  ▪ Worn
  ▪ Missing
 	
Note: An entire crosswalk, continuous stop line, or one turn arrow, is considered to be **one marking** and an entire word (e.g., "STOP") is considered to be **one legend**.
 	
Count and record the total number of markings and legends and the total number that are deficient.

**Functional Pavement Marking Sample –
Do Not Count as Deficient**

**Deficient Pavement Marking Sample –
Count as Deficient**

**Exhibit A-26: Traffic Services, Pavement Markings and Legends
(Continued)**

**Functional Pavement Legend Sample –
Do Not Count as Deficient**

**Deficient Pavement Legend Sample –
Count as Deficient**

Exhibit A-27: Traffic Services, Pavement Striping

Asset Group: Traffic Services
Maintenance Feature: Pavement Striping
Definition: Pavement striping includes all linear markings on the travel lanes, including centerlines, lane stripes, no-passing stripes, and pavement edge lines. Materials may include paint and hot and cold tape applications.
Measurement Unit: Inventory: Linear feet of pavement striping.   Condition: Linear feet of deficient striping.
Inspection Procedure: Inspect the pavement stripes within the sample area for deficiencies. Any length of stripe that is faded, worn, or missing is considered to be deficient.   If a retroreflectometer is available, take two measurements on each of the two edge lines and two measurements on the centerline or the left line of the right lane, if more than two lanes are present.   **Note:**   - The sample area is 528 feet in length.   - In most two-lane samples, there will be two edge lines and one centerline, or a total inventory length of 1,584 feet (skip lines are considered to be continuous for condition rating purposes).   - If the entire sample has a no-passing stripe, then the total inventory would be 2112.   Measure and record the total length of all pavement stripes, and the total length of deficient stripes, in the sample area.

**Functional Pavement Striping Sample –
Do Not Count as Deficient**
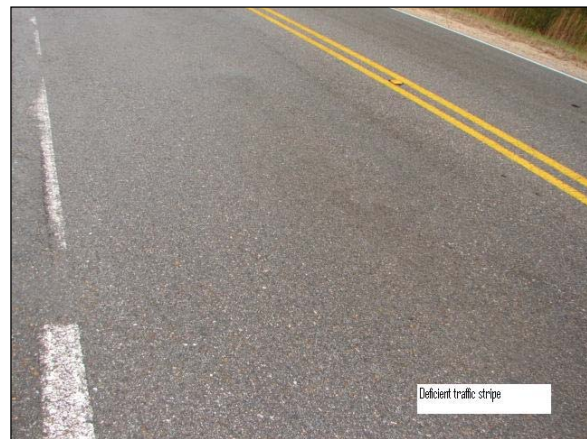
**Deficient Pavement Striping Sample –
Count Linear Feet of Deficiency**

Exhibit A-28: Traffic Services, Raised Pavement Markers

Asset Group: Traffic Services
Maintenance Feature: Raised Pavement Markers (RPMs)
Definition: Reflective devices, typically along the centerline, edge lines, and gore areas, to aid in lane delineation and improve guidance at night and in weather with poor visibility.
Measurement Unit: Inventory: Number of raised pavement markers. Condition: Number of deficient raised pavement markers.
Inspection Procedure: Count and record the total number of raised pavement markers and the total number of missing or deficient pavement markers, where a deficient marker is considered to be any marker that is missing, loose, broken, or non-reflective. **Note:** At 40-foot spacing, there should be 13 or 14 markers in the sample area, depending on where the first marker falls within the 528-foot section.

**Functional Raised Pavement Marker –
Do Not Count as Deficient**

**Damaged Raised Pavement Marker –
Count as Deficient**

**Missing Raised Pavement Marker –
Count as Deficient**

Exhibit A-29: Traffic Services, Delineators — Barrier

Asset Group: Traffic Services
Maintenance Feature: Delineators — Barrier
Definition: Delineators — Barrier are retro-reflective devices mounted on guardrails, cable rails, and barrier walls to indicate the alignment of the road, especially at night or in adverse weather conditions. (Does not include raised pavement markers.)
Measurement Unit: Inventory: Number of delineators mounted on barrier railing (guardrail, cable rail, concrete, etc.). Condition: Number of deficient delineators mounted on barrier railing (guardrail, cable rail, concrete, etc.).

Inspection Procedure:
For each sample area with delineators, conduct a visual inspection and count and record the total number of delineators and the number of delineators that are deficient.
A delineator is considered deficient if any of the following conditions exist:
    1. Delineator is:
        ▪ Non-Reflective
        ▪ Broken
        ▪ Missing
        ▪ Improperly Spaced

Functional Guardrail Delineator
Do Not Count as Deficient

Deficient Guardrail Delineator (missing)
Count as Deficient

**Functional Barrier Wall Delineator
Do Not Count as Deficient**

**Deficient Barrier Wall Delineator (damaged)
Count as Deficient**

Barrier Walll Delineators

Deficient Barrier Wall Delineators

Exhibit A-30: Traffic Services, Delineators — Other

Asset Group: Traffic Services
Maintenance Feature: Delineators — Other
Definition: Delineators — Other are retro-reflective devices mounted on posts on the road shoulder to indicate the alignment of the road, especially at night or in adverse weather conditions. (Does not include raised pavement markers.)
Measurement Unit: Inventory: Number of delineators — other (on road shoulder). Condition: Number of deficient delineators — other (on road shoulder).
Inspection Procedure: For each sample area with delineators, conduct a visual inspection and count and record the total number of delineators and the number of delineators that are deficient. A delineator is considered deficient if any of the following conditions exist: 1. Delineator is: - Non-Reflective   - Broken   - Missing   - Improperly Spaced

**Functional Delineator –
Do Not Count as Deficient**

**Deficient Delineator –
Count as Deficient**

Exhibit A-31: Traffic Services, Object Markers

Asset Group: Traffic Services
Maintenance Feature: Object Markers
Definition: Object markers are used to mark obstructions adjacent to or within the roadway, such as bridge piers and traffic islands. The object marker may be used alone, or mounted below other signs.
Measurement Unit: Inventory: Number of object markers. Condition: Number of deficient markers.
Inspection Procedure: Count and record the total number of obstacle markers and the total number missing or deficient. An object marker is considered to be deficient if any of the following conditions exist: 1. Object marker is: 　▪ Non-Reflective 　▪ Broken 　▪ Missing 　▪ Loose

Functional Object Marker -
Do Not Count as Deficient

Deficient Object Marker -
Count as Deficient

Object Markers from MUTCD

Figure 2C-13. Object Markers

Type 1 Object Markers
(obstructions within the roadway)

OM1-1   OM1-2   OM1-3

Type 2 Object Markers
(obstructions adjacent to the roadway)

OM2-1V   OM2-2V   OM2-1H   OM2-2H

Type 3 Object Markers
(obstructions adjacent to or within the roadway)

OM3-L   OM3-C   OM3-R

Type 4 Object Markers
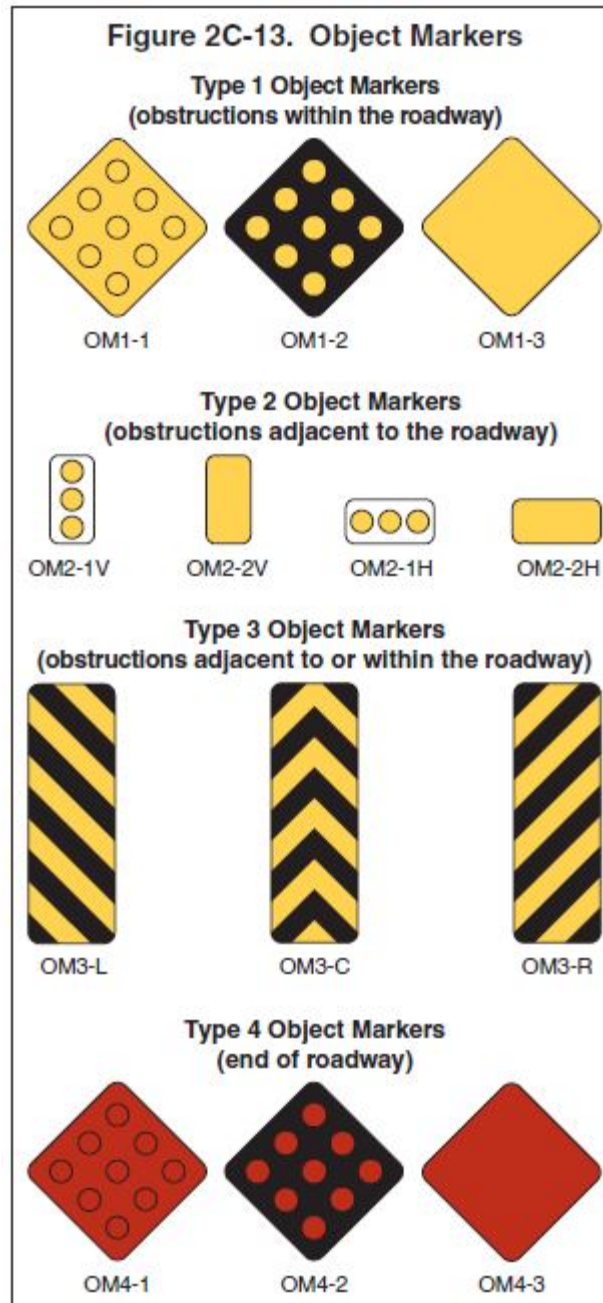(end of roadway)

OM4-1   OM4-2   OM4-3

Exhibit A-32: Traffic Services, Signals

Asset Group: Traffic Services
Maintenance Feature: Signals
Definition: Signals include all electronic devices that control or warn traffic, except variable message signs. Signals include traffic control signals (stop lights), flashing beacons, and lane-use control signals.
Measurement Unit: Inventory: Number of signalized intersections (not signal heads). Condition: Number of signalized intersections (not signal heads) not fully functional.
Inspection Procedure: Signalized intersection condition data will be collected at the sample sites in the field. For each sample with one or more signalized intersections, inspect all signals within the sample area for proper functioning. A signalized intersection is considered to be deficient when any of the following conditions exist: 1. Any two lamps for the same indication and approach are not lit during several cycles. 2. Signal missing or damaged to the extent that traffic is not being effectively controlled. 3. Signal phasing is not cycling properly (e.g., locked into one phase, or displaying conflicting phases). 4. Controller cabinet is damaged to the extent that it affects signal functions. 5. Any signal is misaligned to the point that it may cause confusion to drivers approaching from any direction. Record total number of signalized intersections and total number of nonfunctioning signalized intersections in the sample area. In the case of an intersection on a divided highway, take measures to insure the signalized intersection is only counted in a single sample direction.

Traffic Signal Sample

Exhibit A-33: Traffic Services, Signs — Warning and Regulatory

Asset Group: Traffic Services
Maintenance Feature: Signs — Warning and Regulatory
Definition: Warning and Regulatory signs are signs that control a vehicle's movement (e.g., Speed Limit, No Passing, and Do Not Enter) and that caution drivers about obstacles or dangers (Curve, Deer Crossing, etc.). Warning and Regulatory signs may be mounted on posts along the road or mounted on overhead sign or bridge structures. Each sign face is considered a sign.
Measurement Unit: Inventory: Number of warning and regulatory signs.   Condition: Number of deficient warning and regulatory signs.
Inspection Procedure: For each sample with one or more warning and regulatory signs, inspect signs for the following deficient conditions: 1. The informational content of the sign is no longer visible or legible to the passing motorist at the posted speed (including damaged sign faces, spray painted, dirty, non-reflective).   2. Sign posts or mounting structures are bent or damaged.   3. Lighted signs are not lit (may require night inspection or bucket truck).   4. Bottom of sign face is lower than 5 feet above edge of pavement, or lower than 4 feet if two sign faces are mounted vertically.   Record the total number of warning and regulatory signs, and the total number of deficient warning and regulatory signs, in the sample area.   **Note:** Signs that are hidden by vegetation, but otherwise functional, are addressed under Brush/Tree Control.

Functional "Regulatory Sign" Sample – Do Not Count as Deficient

Deficient "Regulatory Sign" Sample – Count as Deficient

**Exhibit A-33: Traffic Services, Signs—Regulatory and Warning
(Continued)**

**Functional "Warning Sign" Sample –
Do Not Count as Deficient**

**Deficient "Warning Sign" Sample –
Count as Deficient**

Exhibit A-34: Traffic Services, Signs—Other

Asset Group: Traffic Services
Maintenance Feature: Signs — Other
Definition: Other signs are any signs with informational messages that are not included in Warning and Regulatory Signs (e.g., Place Name, Route Number, Distance, Exit, Milepost, Services, Attractions). Signs may be mounted on posts along the road or mounted on overhead sign or bridge structures. Each sign face is considered a sign.
Measurement Unit: Inventory: Number of other signs. Condition: Number of deficient other signs.
Inspection Procedure: For each sample with one or more Other signs, inspect signs for the following deficient conditions: 1. The informational content of the sign is no longer visible or legible to the passing motorist at the posted speed (including damaged sign faces, spray painted, dirty, non-reflective). 2. Sign posts or mounting structures are bent or damaged. 3. Lighted signs are not lit (may require night inspection or bucket truck). 4. Bottom of sign face is lower than 5 feet above edge of pavement, or lower than 4 feet if two sign faces are mounted vertically. Record the total number of other signs and the total number of deficient other signs. **Note:** Signs that are hidden by vegetation, but otherwise functional, are addressed under Brush/Tree Control.

"Other Sign" Sample

Exhibit A-35: Traffic Services, Guardrail

Asset Group: Traffic Services
Maintenance Feature: Guardrail
Definition: Guardrail includes W-Beam, Thrie-Beam, and wood, and also includes posts and end treatments.
Measurement Unit: Inventory: Linear feet of guardrail. Condition: Linear feet of deficient guardrail.
Inspection Procedure: Inspect the guardrail within the sample area. A guardrail panel is considered deficient if any of the following conditions exist: 1. Guardrail is broken, missing, detached from the post, or bent to the extent that it cannot re-route errant vehicles back onto the roadway. 2. Guardrail installation's structural integrity is questionable. 3. An end treatment has previously been hit, e.g., bent, loose, collapsed, or missing. 4. A guardrail installation is not at the proper height of 27 inches above edge of pavement. **Notes:** • Guardrail panels are typically installed in 12.5 or 25-foot lengths, which makes it convenient to estimate total length and total deficient length. If any portion of a panel is deficient, report the entire panel length as deficient. • Guardrails that divide a median on a divided highway should only be included in the sample that is on the side of the roadway in the increasing milepost direction. Otherwise, the feature may be counted and rated twice. Measure and record the total length of guardrail, and the total length of deficient guardrail, on both sides of the road in the sample area.

**Functional Guardrail Sample –
Do Not Count as Deficient**

**Deficient Guardrail Sample –
Count Linear Feet of Deficiency**

Exhibit A-36: Traffic Services, Cable Rail

Asset Group: Traffic Services
Maintenance Feature: Cable Rail
Definition: All classes of cable rail are included in this guideline, including line posts and anchor posts.
Measurement Unit: Inventory: Linear feet of cable rail. Condition: Linear feet of deficient cable rail.
Inspection Procedure: Inspect the cable rail within the sample area. A section of cable rail is considered deficient if the any of the following conditions exist: 1. Cable rail has missing or broken line posts or if 1 or more of the cables is broken or slack due to damage to the anchor posts. If line posts have been damaged or are missing, the deficiency length shall be recorded as the distance between the first good posts ahead of and behind the deficient section. 2. The anchor posts have been damaged to the extent that the system cannot re-route errant vehicles back onto the roadway. 3. Cable rail installation's structural integrity is questionable. If so, the cable rail is considered deficient for the entire length up to the next anchor post. The deficiency length in that case would be the total length of cable rail in the section with a maximum length of 528 feet on each side of the section. **Note:** • Cable rails that divide a median on a divided highway should only be included in the sample that is on the side of the roadway in the increasing milepost direction. Otherwise, the feature may be counted and rated twice. Measure and record the total length of cable rail, and the total length of deficient cable rail, on both sides of the road in the sample area. Consider the 3 or 4 cables of the system to be a single unit for length measurements.

**Functional Cable Rail Sample –
Do Not Count as Deficient**

**Deficient Cable Rail Sample –
Count Linear Feet of Deficiency**

Exhibit A-37: Traffic Services, Impact Attenuators

Asset Group: Traffic Services
Maintenance Feature: Impact Attenuators
Definition: An impact attenuator may be a group of plastic barrels filled with sand or water acting as a single unit, or it may be an installation of metal units resembling guardrail in a special shock-absorbing configuration. They are typically placed at toll plazas and at potential gore points, usually at on/off ramps, bridge piers, or other obstacles.
Measurement Unit: Inventory: Number of attenuators. Condition: Number of deficient attenuators.
Inspection Procedure: Inspect any impact attenuators in the sample area (or between sample areas during travel). An attenuator is considered deficient if any of the following conditions exist: 1. Barrel Installations — One or more barrels are broken, tipped over, or missing any filler material. 2. Metal Units — Any portion of the unit has loose or missing parts, or there is any indication of damage (e.g., damaged parts or collapsed sections). Count and record the total number of attenuators and the total number missing or deficient.

Functional Impact Attenuator –
Do Not Count as Deficient

Deficient Impact Attenuator –
Count as Deficient

Exhibit A-38: Traffic Services, Barrier Walls

Asset Group: Traffic Services
Maintenance Feature: Barrier Walls
Definition: Barriers are usually the concrete New Jersey style, used to separate travel lanes from oncoming traffic and to protect traffic from bridge ends and piers, deep fill sections, and other potentially dangerous locations. Note that some institutional or parkway roads may use other shapes and materials, such as masonry barrier walls with a rectangular cross-section.
Measurement Unit: Inventory: Linear feet of barrier wall. Condition: Linear feet of deficient barrier wall.
Inspection Procedure: Inspect the barrier wall within the sample area. A barrier wall is considered deficient if any of the following conditions exist: 　1.　There is structural damage to the barrier wall. 　2.　Barrier wall has displaced, broken, or missing panels. 　3.　Barrier wall has severe cracking or spalling, such that the effectiveness of the barrier is reduced and it cannot redirect a vehicle back onto the roadway. **Notes:** 　•　Most barrier panels are usually installed in standard lengths, making it easy to determine the total length in the sample area by counting the number of panels and multiplying by the length per panel. 　•　Barrier walls that divide a median on a divided highway should only be included in the sample that is on the side of the roadway in the increasing milepost direction. Otherwise, the feature may be counted and rated twice. Measure the total linear feet of all barriers, and the total linear feet of all deficient barriers, on both sides of the roadway in the sample.

**Functional Barrier Wall Sample –
Do Not Count as Deficient**

**Deficient Barrier Wall Sample –
Count Linear Feet of Deficiency**

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