METHODS OF SAMPLING AND TESTING
MT 329-20
PROCEDURE FOR EVALUATING
PLANT MIX SURFACING FAILURES

1 Scope

1.1 This method covers the step-by step procedure for evaluating a plant mix surfacing failure. The procedure describes how to review the types of plant mix failures and the method used for rating the distressed areas.

1.2 After determining the type and extent of the failure, further investigational requirements will include reviewing plant mix production records, visual analysis, deflection analysis, sampling analysis of plant mix, base and subgrade materials and surfacing design analysis. Based upon all the information and data gathered through this procedure, the causes, potential solutions and recommendations to correct the plant mix surfacing failures can be determined.

2 Referenced Documents

AASHTO

M 145 Classification of Soils and Soil–Aggregate Mixtures for Highway Construction Purposes
T 89 Determining the Liquid Limit of Soils
T 90 Determining the Plastic Limit and Plasticity Index of Soils
T 148 Measuring Length of Drilled Concrete Cores
T 164 Quantitative Extraction of Asphalt Binder from Asphalt Mixtures

ASTM

D1856 Recovery of Asphalt from Solution by Abson Method

MT Materials Manual

MT 202 Sieve Analysis for Fine and Coarse Aggregate
MT 230 Moisture-Density Relation of Soils Using a 10 lb Rammer and 18 In. Drop
MT 207 Bulk Sampling of Subsurface Investigations
MT 321 Determining Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures - "Rice Gravity"
MT 328 Establishing Field Target Density for Plant Mix Surfacing Density Control

3 Visual Analysis

3.1 The first step in investigating a pavement failure is to perform a complete and comprehensive visual analysis of the entire project emphasizing the distressed areas in question.

3.2 Determine the approximate milepost and/or stationing and length of each of the distressed areas. The following is a list of pavement distress types and a rating system to be used for the distress.

PAVEMENT FAILURE RATING SYSTEM RATING

Failure Type	Light	Moderate	Severe
Rutting Rut Depth Rate of Rutting Lateral Movement of Rut (Humping)	 0-1/2” 0-1/8”/yr. None Visible	 1/2 – 3/4” 1/8 – 3/8”/yr.	 3/4” & Greater 3/8”/yr.& Greater Visible Bulge
Cracking	Longitudinal Cracks In wheel paths (Load Associated)	Alligator or Block Cracking Tight	Alligator or Block Cracking Edges spaced – pieces loose or missing
*Stripping	Some asphalt material stripped	**Cores	**Cores
Raveling	Fines removed from surface.	1st layer coarse aggregate removed	Pavement removed through one or more lifts.

*Any stripping should be noted.
**If the investigation requires plant mix cores, advanced stages of stripping will be determined at that time.

Note 1 – If dual wheel ruts exist, they should be noted. Measurements should always be taken in both wheel paths with a string line stretched from centerline to the shoulder to obtain the measurements.

4 Report of Visual Analysis

4.1 A summary of the visual analysis should be written immediately after the investigation.

4.2 The report should include date, reviewer, project termini, and detailed information concerning each distressed area. This information should include but not be limited to approximate milepost or station, length, width, relationship to centerline, lane and type of distress. Also, photographs of the typical distress on the project should be included. In addition to recording the types of pavement distress referenced above, record any other problems that are visible (drainage, terrain, frost problems, dips or swells, etc.). Based upon this visual analysis, the course of action and investigational requirements can be determined.

4.3 Copies of the report shall be sent to the District Engineer and the Materials Bureau Chief.

5 Deflection Analysis

5.1 After the visual analysis report has been evaluated, the second step of this procedure will normally require Road Rater testing. The decision to have a Road Rate analysis will be determined based upon the visual analysis. When the decision has been made to use the Road Rater, the following are the steps that will be followed.

5.2 The Road Rater shall be used to determine the in-place strengths of each layer. An elastic modulus for each layer will be determined from the roadway deflections.

5.2.1 Deflection tests will be taken at 200 - 800-foot intervals throughout problem areas to determine the extent of the distress. In addition, the remainder of the project will be tested using the normal testing intervals (six tests per mile).

5.2.2 The deflection analysis will be reviewed for elastic modulus of each layer to determine the nature and extent of the problem. The required design overlay thickness analysis will then be performed.

6 Investigation Requirements

6.1 Determine the investigational requirements depending on the type and extent of the plant mix failure. The following is a list of the distress types and requirements for each.

Distress Type	*Investigation Required
Cracking – Alligator	(1)-(7)
Rutting & Shoving	(1)-(7)
Stripping – Underlying Courses	(1)-(7)
Raveling – Surface	(1),(3),(4)
Segregation	(1),(3),(4)

7 Investigational Requirements

7.1 Physical Data (information already obtained)

Location
Weather
Extent of Failure
Photos

7.2 Deflection Analysis (information already obtained)

Road Rater testing – evaluate good and bad areas of the project.

7.3 Production Records (a review of construction reports)

Note 2 – When reviewing the reports listed below, look for any abnormalities.

Example: The production records generated during construction should be reviewed to determine if any problems during construction can be related to the pavement failure. For example there may have been some density problems in the same area of the failure, late paving, etc.

Mix Design
Plant Reports
Marshall Tests
Aggregate Tests
Compaction Tests
Monitor Samples
Project Diaries

7.4 Core Samples – Plant mix core samples shall be obtained and tested as follows:

Note 3 – Lifts will be identified and tested separately.

Tests
Thickness
Density
Rice Gravity
A.C. Content
Gradation
HP-GPC
Abson Extraction – AC Penetration
Petrographic – Geology

Other tests to be determined by the Materials Bureau at the time of testing.

8 Sampling In-Place Material

R Value
Liquid Limit and Plastic Index
Moisture
Gradation
Proctor

9 Traffic Data

Present ADL
Accumulative ADL

10 Structural Properties

Gravel Equivalency – Surfacing Design

11 Samples and Testing Required

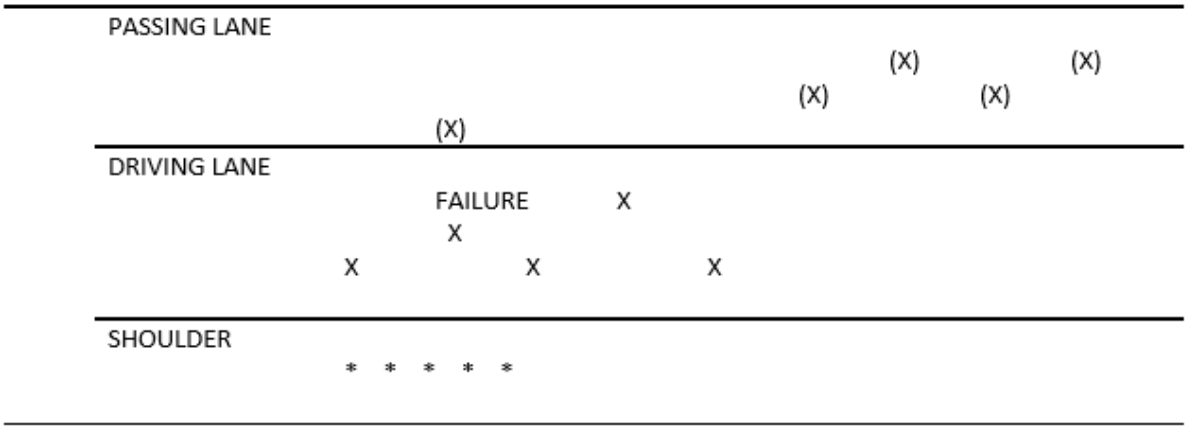
11.1 Samples shall be taken so that the following tests and procedures can be run to evaluate the problem areas. The samples will be submitted to the Materials Bureau for testing unless otherwise specified.

11.2 Plant Mix Surfacing Core Samples

11.2.1 Samples shall be taken of each plant mix layer with at least five 4" cores from a bad area, a shoulder next to bad area, and good area. (See Figure 1 for sampling diagram.) If more than five distressed areas exist on a project, the minimum number of sample locations will be three if all distressed areas appear to be visually identical. If material or geological conditions change between distressed areas, each various condition shall be sampled. If the lifts are still intact they shall be separated using a coring saw if required. Each lift of plant mix shall be evaluated for:

Rice Gravity (MT 321)
Density (MT 328)
Thickness (AASHTO T 148) – Each core should be measured
Extracted Gradation (MT 202)
Extracted Percent Asphalt (AASHTO T 164)
Absen Extraction – Asphalt Penetration (ASTM D1856)
High Pressure – Gel Permeation Chromatography
Petrographic-Analysis

Figure 1. Sampling Diagram



(X) – Samples from good area
X – Samples within area of visible failure
* - Samples within same paver pass but not visibly failed

11.3 Base and Subgrade

11.3.1 When obtaining samples of the base and subgrade materials, a minimum 3-by-3-foot area of plant mix shall be taken in the wheel path at each location. This should allow for adequate testing and sampling of each lift of material.

11.3.2 In-place densities and moisture shall be obtained for each lift using a nuclear gauge.

11.3.3 In-place moisture samples shall be taken of each lift and immediately placed in a sealable plastic sack. The sample size shall be a minimum of 1 lb. (450 grams). These samples shall then be oven dried to obtain a moisture content.

11.3.4 A minimum of two “R” value samples shall be taken from both the base and subgrade for a given problem area. In addition, one sample per mile shall be taken for the remainder of the project. The sample size will be determined in accordance with MT 207.

11.3.5 Samples and size of each lift shall be taken immediately and placed in a sealable plastic bag for soils classification (AASHTO M 145), plastic index (AASHTO T 90) and liquid limit (AASHTO T 89) in accordance with referenced procedures.

11.3.6 Samples of the base and subgrade shall be taken for a proctor test to establish the optimum moisture and density. The sample size shall be determined in accordance with MT 230.

12 Traffic Data

12.1 Traffic data will be requested from the Planning and Statistics Bureau by the Materials Bureau. This data will be used by the Road Rater and Surfacing Design Sections to determine if any structural deficiencies exist. If the traffic section in the Planning Bureau feels traffic data may not reflect the true 18 Kip axle loads, a site specific investigation should be conducted by them.

13 Structural Analysis - Surfacing Design

13.1 The Surfacing Design personnel will check the design of the problem area based on the new “R” Values and the condition of the pavement structure in place.

14 Report

14.1 A summary of the sample tests and other investigational requirements will be submitted upon completion of all testing of all testing and analysis.

PAGE INTENTIONALLY LEFT BLANK