

# Louisiana DOTD

## Distress Identification Protocols

### For Asphalt & Composite Pavements

## Introduction

This protocol defines the general guidelines and terminology used to evaluate and summarize the pavement distresses and data requirements for Asphalt Pavements (ASP) & Composite Pavements (COM) to support the pavement management requirements of Transportation Asset Management. This includes both the LADOTD's Pavement Management System and the Federal 23 CFR Part 490 requirements.

This protocol is one part of a three-part group of protocols. It shall be used in conjunction with "*Louisiana DOTD Distress Identification Protocols for Concrete Pavements*" and "*Louisiana DOTD Distress Identification Protocols General Guidelines for All Pavements*".

## Terminology

### Cracking

1. **Crack** – a fissure or discontinuity of the pavement surface not necessarily extending through the entire thickness of the pavement.
2. **Sealed Crack** – A crack that has a sealing material applied at the pavement surface.
3. **LADOTD Index** – An index is a unit-less measure used to allow the comparison of non-similar measures such as Rutting, Cracking, IRI, Patching, etc. The DOTD indexes are based on a scale from 1 to 100, with 100 being perfect.
4. **LADOTD Pavement Condition Index** – A unit-less measure resulting from the combination of several indexes into a single "pavement condition" index for each different pavement type.
5. **LADOTD Alligator "Fatigue" Cracking** - All cracking located in both 36-inch wheel paths on Asphalt Pavements (ASP) only.
6. **Federal Part 490 Fatigue Cracking** - All cracking located in both 39-inch wheel paths on Federal Part 490 Asphalt Pavements (ASP-F). Note ASP-F includes both LADOTD ASP and LADOTD COM pavements.
7. **LADOTD Alligator Cracking Index** – The unit-less cracking index for Alligator "Fatigue" Cracking.
8. **Longitudinal Crack** - Cracks in pavements that are predominantly parallel to the direction of traffic and are not defined as Alligator Cracks.
9. **Transverse Crack** - Cracks in pavements that are predominantly perpendicular to the direction of traffic and are not defined as Alligator Cracks.

10. **LADOTD Random Cracking** – The combination of Longitudinal and Transverse Cracks, specifically excluding Alligator (Fatigue) cracking, in a defined pavement zone.
11. **LADOTD Random Cracking Index** – The unit-less cracking index for Random Cracking.
12. **Reflection Cracking at Joints** —A crack in a Composite Pavement (COM) that is the result of an underlying JCP construction joint “reflecting” through the asphalt layer.

## Patching

1. **Patch** – An area of pavement surface that has been repaired, with the addition of new material to correct an irregularity in the pavement surface, which has not been performed as part of the original construction.
2. **Patching Index** – The unit-less index for Patching.
3. **Patch Deterioration** – A patch that has begun to crack or show other measureable distresses. The patch should be rated, as per the type/severity of the distresses on the patch. The distresses on the patch should also be rated.

## Pothole

- A bowl-shaped hole in a flexible pavement surface, greater than 4 inch (100mm) in diameter, and more than 1 inch (25mm) in depth.

## Rutting

1. **Rut** - A contiguous longitudinal depression, deviating from a surface plane defined by the transverse cross slope and the longitudinal profile, in either wheel path.
2. **Rutting Index** – The unit-less index for Rutting.

## Blow Up

- An isolated area where a bump or upward movement of the pavement surface has occurred. Although the blowup may have been repaired, cracks may still be evident. See EXHIBIT 2 for an example.

## High/Low Shoulders

- The elevation difference between the right-side shoulder and pavement edge, regardless of the shoulder type.

## Shim Quantity

- The volume of Asphalt, in cubic feet, required to fill ruts and restore the transverse cross slope for the tenth (0.100) mile (528 foot) segment.

## Roughness

1. Roughness is defined by the current ASTM E867 as "The deviation of a surface from a true planar surface with characteristic dimensions," also known as the longitudinal profile, "that affect vehicle dynamics and ride quality" or its replacement.

2. **International Roughness Index (IRI)** - The standard measure, reported in units of inches/mile, which is used to determine the longitudinal profile of a pavement surfaces. Roughness data is currently acquired using a Class II laser type profiler calibrated using the Quarter Car Simulation approach.
3. **LADOTD Roughness Index** – The unit-less index for pavement Roughness.

## Macrotexture

- Macrotexture is a measure the frictional properties of a pavement surface, using noncontact technologies. With respect to these protocols, DOTD only uses macrotexture for friction purposes.

## Condition Ratings and Classifications

### Sealed Cracks

1. The Sealed Crack flag, Sealed Crack, will be coded with a value of “1” for each tenth (0.100) mile segment containing sealed cracks.
2. Cracks that have been sealed shall not be rated for the PMS, except where the sealant has failed.
3. Any crack that extends beyond the sealed area shall be treated as a crack and rated.
4. The lengths of visible Sealed Cracks will be measured and reported per Federal Part 490 requirements.
5. See Exhibit 1.

### Alligator (Fatigue) Cracking

1. **DOTD Alligator “Fatigue” Cracking** is the combination of both longitudinal and transverse cracking contained within each LADOTD 36-inch wheelpath. It is exclusive to LADOTD Asphalt Pavement (ASP) pavements only.
2. **Federal Part 490 “Fatigue” Cracking** is the combination of both longitudinal and transverse cracking contained within each Federal Part 490 39-inch wheelpath. It is Federal Part 490 Asphalt Pavement (ASP-F) pavements which are comprised of both LADOTD Asphalt Pavements (ASP) and LADOTD Composite Pavements (COM).
3. Any cracking that exist outside of the analysis lane width shall not be rated, quantified, or reported.
4. For DOTD Alligator “Fatigue” Cracking, when transverse cracks extend into each wheel path from the other zones, these cracks shall be rated as random cracking for that other zone and shall not be included in the alligator cracking measure.
  - a. For Federal Part 490 Alligator “Fatigue” Cracking, this extended transvers crack exception does not apply. All cracks found in the Federal Part 490 39-inch wheel path shall be measured and reported.
5. Any Alligator cracking that is found within a patch, within the wheel path, shall be rated, quantified, and reported as alligator cracking.

- 6 Report Alligator cracking in square feet per each severity level. Summarize for each tenth (0.100) mile, with a maximum combined reported total extent of 3,168 square feet.
- 7 Classify LADOTD Alligator “Fatigue” Cracking as one of the severity levels listed below.

**a. No Severity (Level 0):**

- i. Cracks that have no depth as determined by the new 3-D laser crack measuring technology.
- ii. Note these cracks are not included in the Federal Part 490 reporting requirement.

**b. Low Severity (Level 1):**

Either of the following two cases:

- i. One or more longitudinal cracks, of any width, that occurs solely in the wheel paths with few or no intersecting transverse cracks. These cracks can occur within patches or pop outs.
- ii. Intersecting longitudinal and transverse cracks that form large polygons or blocks greater than one square foot and occur solely in the wheel paths. Any cracking that extends outside of the wheel paths shall not be rated as alligator cracking.
- iii. See EXHIBITs 13, 14 and 15.

**c. Medium Severity (Level 2):**

- i. Interconnected longitudinal, diagonal, and short transverse cracks, that occur solely in the wheel paths, with crack widths that range from hairline to 0.25 inches.
- ii. These cracks form a network of polygons or blocks with an average size of less than one square foot.
- iii. Some spalling may be observed; however, there will be no loose pieces of asphalt, nor any indications of potholes.
- iv. See EXHIBITs 16, 17 and 18.

**d. High Severity (Level 3):**

- i. Interconnected longitudinal, diagonal, and short transverse cracks, that occur solely in the wheel paths, with crack widths that are generally greater than 0.25 inches.
- ii. These cracks form a network of polygons or blocks with an average size of less than 1 square foot.
- iii. These cracks are generally spalled and some potholes may be present.
- iv. See EXHIBITs 19, 20 and 21.

## LADOTD Alligator Cracking Index

- The formula for the Alligator Cracking Index, and the Deduct table are as follows:

$$ALCR = \text{MIN} (100, \text{MAX} (0, 100 - \text{ALGCRK\_L DEDUCT} - \text{ALGCRK\_M DEDUCT} - \text{ALGCRK\_H DEDUCT}))$$

**Update with new 3D extents**

| <b>ALLIGATOR CRACKING DEDUCTS<br/>(ASP Only)</b> |                             |               |                 |                  |                  |                  |
|--|-----------------------------|---------------|-----------------|------------------|------------------|------------------|
| <b>SEVERITY</b>                                  | <b>EXTENT (Square Feet)</b> |               |                 |                  |                  |                  |
|  | <b>0-51</b>                 | <b>51-701</b> | <b>701-1301</b> | <b>1301-2401</b> | <b>2401-3168</b> | <b>&gt; 3168</b> |
| <b>LOW</b>                                       | 0                           | 1-16          | 16-21           | 21-25            | 25-28            | 28               |
| <b>MED</b>                                       | 0                           | 1-21          | 21-29           | 29-36            | 36-49            | 49               |
| <b>HIGH</b>                                      | 0                           | 1-29          | 29-43           | 43-50            | 50-61            | 61               |

### LADOTD Random Cracking

1. Random cracking is all cracking, longitudinal and transverse, found on LADOTD Composite (COM) pavements and all cracking found outside the LADOTD 36-inch wheelpath on LADOTD Asphalt (ASP) pavements.
2. Any cracking that exist outside of the analysis lane width shall not be rated, quantified, or reported.
3. Reflective transverse cracking and reflective longitudinal cracking on LADOTD Composite (COM) pavements shall be classified as random cracks.
  - a. Sawed and sealed joints, placed over a JCP construction joint, in a LADOTD Composite Pavement (COM) shall not be considered reflective cracks unless they show signs of failing to maintain their integrity.
4. Any random cracking that is found within a repaired patch shall be rated, quantified, and reported as random cracking.
5. Report Random Cracking in linear feet, per severity level, for each tenth (0.100) mile, with a maximum combined reported extent of 6,001 linear feet.
6. Classify Random Cracking as one of the severity levels listed below.
  - a. **No Severity (Level 0):**
    - i. Cracks that have no depth as determined by the new 3-D laser crack measuring technology.
  - b. **Low Severity (Level 1):**
    - i. Longitudinal and/or Transvers cracks, less than 0.250 inches wide, with no interconnected cracks.
    - ii. See EXHIBITs 22, 23 and 24.
  - c. **Medium Severity (Level 2):**

Either of the following two cases:

    - i. Longitudinal and/or Transvers cracks that are greater than or equal to 0.25 inches wide but

less than 0.50 inches wide, with no interconnecting cracks of the same width;

- ii. A network of polygons or blocks whose density is as shown in EXHIBITs 25, 26, 27 and 28.

**d. High Severity (Level 3):**

Either of the following two cases:

- i. Longitudinal and/or Transvers cracks that are greater than 0.50 inches wide, with no interconnecting cracks;
- ii. A network of polygons or blocks whose density is as shown in EXHIBITs 29 and 30.

**LADOTD Random Cracking Index**

1. Note: Longitudinal and Transverse Cracking Indexes do not apply to ASP or COM pavements. These Indexes are only used for JCP and CRC pavements.
2. The formulas to convert Longitudinal and Transverse cracking low, medium and high severity levels into Random cracking severity levels are as follows.

$$RNDM\_L = LNGCRK\_L + TRNCRK\_L$$

$$RNDM\_M = LNGCRK\_M + TRNCRK\_M$$

$$RNDM\_H = LNGCRK\_H + TRNCRK\_H$$

3. The formula for the Random Cracking Index, and the Deduct tables are as follows:

$$RNDM = \text{MIN} (100, \text{MAX} (0, 100 - RNDM\_L \text{ DEDUCT} - RNDM\_M \text{ DEDUCT} - RNDM\_H \text{ DEDUCT}))$$

**Update with new 3D extents**

| <b>RANDOM CRACKING DEDUCTS<br/>(ASP)</b> |                             |               |                 |                  |                  |                  |
|--|-----------------------------|---------------|-----------------|------------------|------------------|------------------|
| <b>SEVERITY</b>                          | <b>EXTENT (Linear Feet)</b> |               |                 |                  |                  |                  |
|  | <b>0-31</b>                 | <b>31-301</b> | <b>301-1601</b> | <b>1601-5001</b> | <b>5001-6001</b> | <b>&gt; 6001</b> |
| <b>LOW</b>                               | 0                           | 1-3           | 3-16            | 16-18            | 18-20            | 20               |
| <b>MED</b>                               | 0                           | 1-16          | 16-21           | 21-30            | 30               | 30               |
| <b>HIGH</b>                              | 0                           | 1-26          | 26-28           | 28-42            | 42-48            | 48               |

| <b>RANDOM CRACKING DEDUCTS<br/>(COM)</b> |                             |               |                |                 |                  |                  |
|--|-----------------------------|---------------|----------------|-----------------|------------------|------------------|
| <b>SEVERITY</b>                          | <b>EXTENT (Linear Feet)</b> |               |                |                 |                  |                  |
|  | <b>0-51</b>                 | <b>51-326</b> | <b>326-901</b> | <b>901-2001</b> | <b>2001-6001</b> | <b>&gt; 6001</b> |
| <b>LOW</b>                               | 0                           | 1-3           | 3-5            | 5-16            | 16-33            | 33               |
| <b>MED</b>                               | 0                           | 1-16          | 16-26          | 26-35           | 35-46            | 46               |
| <b>HIGH</b>                              | 0                           | 1-32          | 32-40          | 40-55           | 55-70            | 70               |

## Potholes

1. The total square footage of potholes shall be added to the square footage recorded in the **High Severity (Level 3) Patching**.
  - a. Report the area of potholes, in total square footage, for each tenth (0.100) mile.
  - b. Report the count of all potholes for each tenth (0.100) mile.
  - c. See EXHIBIT 10 for an example of pot holes.

## Patching

1. Patching that exist outside of the analysis lane zones shall not be rated.
2. A patch that has an area of at least one (1) square foot shall be rated, quantified, and reported.
3. When rating patching, the rating shall not overlap different areas to be rated, to prevent patching quantities from being double counted.
4. Patching may also occur within the area where a Blowup has been repaired. Although the Blowup may have been repaired, patching may be evident. The patching, not the repair itself, shall be rated, quantified, and reported according to the appropriate distress level.
5. An existing Blowup, that has not been repaired, is quantified as high severity patching.
6. For an example of a repaired Blowup, please see EXHIBIT 2.
7. Report Patching in square feet, per severity level, for each tenth (0.100) mile.
8. Report number, or total count of patches for each tenth (0.100) mile.
9. Classify Patching as one of the severity levels listed below.
  - a. **No Severity (Level 0):**
    - i. Existing patch show no distress of any type.
    - ii. Existing patch may have sealed cracking where the sealant has not failed.
    - iii. An existing patch that has been applied in a seamless manner.
  - b. **Low Severity (Level 1):**

- i. Existing patch has low severity distress of any type.
  - ii. An existing patch has had additional patching material added by removing some existing patch material and applying new material in a nearly seamless manner.
  - iii. See EXHIBITs 4, 5 and 6.
- c. Medium Severity (Level 2):**
- i. Patch has medium severity distress of any type.
  - ii. An existing patch has had additional patching material added on top of the existing patch material with a slight transition bump to the new material.
  - iii. See EXHIBITs 7, 8 and 9.
- d. High Severity (Level 3):**
- i. Patch has high severity distress of any type.
  - ii. An area that has been patched using material that is not consistent with the existing pavement surface, e.g., concrete patch on an asphalt pavement or gravel patch on an asphalt pavement.
  - iii. An existing patch has had additional patching material added in a random manner that creates a generally uneven or lumpy surface.
  - iv. All potholes are to be considered High Severity (Level 3) patching. Include the area in square feet to the patching area and apply via the extent show below.
  - v. See EXHIBITs 11 and 12.

## LADOTD Patching Index

- The formula for the Patching Index, and the Deduct table are as follows:

$$PTCH = \text{MIN} (100, \text{MAX} (0, 100 - \text{PATCH\_L DEDUCT} - \text{PATCH\_M DEDUCT} - \text{PATCH\_H DEDUCT}))$$

## Update with new 3D extents

| PATCHING DEDUCTS<br>(ASP & COM) |                      |       |        |         |         |          |        |
|---------------------------------|----------------------|-------|--------|---------|---------|----------|--------|
| SEVERITY                        | EXTENT (Square Feet) |       |        |         |         |          |        |
|                                 | 0-31                 | 31-81 | 81-151 | 151-251 | 251-501 | 501-6336 | > 6336 |
| LOW                             | 0                    | 1-2   | 2-21   | 21-23   | 23-27   | 27-30    | 30     |
| MED                             | 0                    | 1-4   | 4-23   | 23-27   | 27-31   | 31-41    | 41     |
| HIGH                            | 0                    | 1-11  | 11-27  | 27-30   | 30-47   | 47-65    | 65     |



## **Roughness – (IRI) International Roughness Index**

1. Conformance to the current ASTM E950-09 Standard Test Method for Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference, or its replacement, is expected.
2. Conformance to the current AASHTO R43-13 Standard Practice for Quantifying Roughness of Pavements, or its replacement, is expected.
3. The lowest allowable speed at which the Data Collection Vehicle (DCV) can accurately capture valid IRI measurements shall be provided.
4. The longitudinal profile of a pavement surface shall be captured in both wheel paths, for 100% of all Analysis Lane Miles. Roughness data shall be acquired using a Class II laser type profiler supplied and calibrated using the Quarter Car Simulation approach.
5. In LADOTD protocols, International Roughness Index (IRI) and Mean Roughness Index (MRI) are the same the same thing, and these terms are used interchangeably. The term IRI is predominately used.
6. International Roughness Index (IRI) shall be reported in units of inches/mile.
7. Longitudinal profile data should be provided for every one (1) inch of pavement, while the computed IRI values shall be summarized and retained for every four (4) inches of pavement in the left wheel path and the right wheel paths, along with the standard deviations of the left and right wheel paths.
8. IRI values will be summarized in section lengths of 0.004 miles (21.12 feet).
9. Computed IRI values shall be averaged and reported for each tenth (0.100) mile segment (528 feet) for both the left and right wheel paths. These reports shall include an average IRI for the tenth (0.100) mile segment.

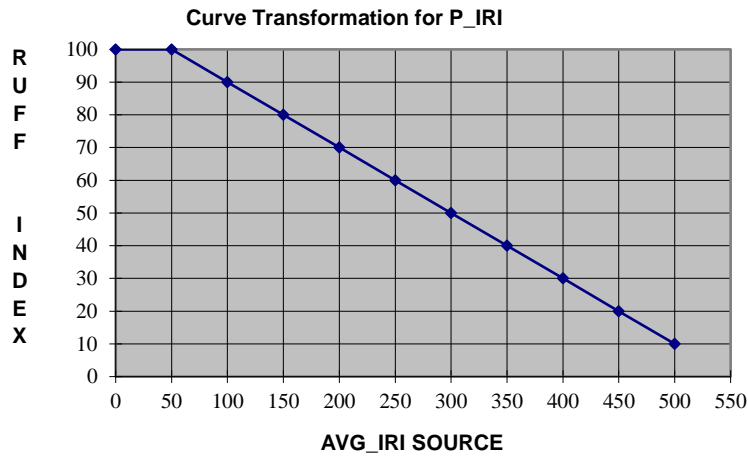
## **PMS Roughness Index**

1. The formula for the PMS Roughness Index is as follows:

$$RUFF = \text{MIN} (100, 100 - ((\text{Avg\_IRI} * (1/5)) - 10))$$

2. The IRI to PMS Roughness Index cross reference is shown in a table format below, and graphically via the curve transformation.

| ROUGHNESS INDEX |            |
|-----------------|------------|
| AVG_IRI         | RUFF Index |
| 0               | 100        |
| 50              | 100        |
| 100             | 90         |
| 150             | 80         |
| 200             | 70         |
| 250             | 60         |
| 300             | 50         |
| 350             | 40         |
| 400             | 30         |
| 450             | 20         |
| 500             | 10         |



## Rutting

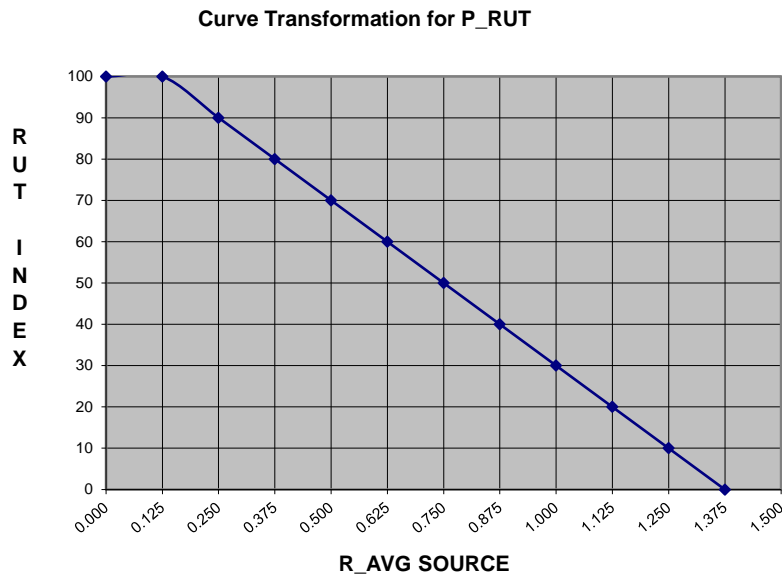
1. Conformance to the current AASHTO PP 38-00 (2006) Standard Practice for Determining Maximum Rut Depth in Asphalt Pavements, or its replacement, is expected.
2. Rutting depth shall be captured and reported in units of inches, to the nearest 0.04 of an inch (1 mm), or to the lowest measure that can be practically or reasonably achieved with the current technology.
3. Computed rutting data shall be summarized in section lengths of 0.004 miles (21.12 feet), for the left wheel path and the right wheel paths.
  - a. Rutting **shall NOT** be identified on the same submitted pavement images supplying the pavement distress data.
4. The average rut depth shall be reported for each tenth (0.100) mile increment.
  - a. The maximum rut depth for each tenth (0.100) mile increment shall also be reported.
  - b. The count of rut depth measures, identified at each 0.004 miles (21.12 feet) measure, that exceed 0.40 inches, summarized for each tenth (0.100) mile increment shall be reported.
  - c. **Fill Quantities** shall be calculated and reported to identify the volume of asphalt necessary to fill ruts for each tenth (0.100) mile increment. These fill quantities shall be reported in cubic feet.

## Rutting Index

1. The formula for the Rutting Index is as follows:  

$$RUT = \text{MIN} (100, 100 - ((R\_Avg * (10 / 0.125)) - 10))$$
2. The Rutting to Rutting Index cross reference is shown in a table format below, and graphically via the curve transformation.

| RUT INDEX |           |
|-----------|-----------|
| R_AVG     | RUT INDEX |
| 0.000     | 100       |
| 0.125     | 100       |
| 0.250     | 90        |
| 0.375     | 80        |
| 0.500     | 70        |
| 0.625     | 60        |
| 0.750     | 50        |
| 0.875     | 40        |
| 1.000     | 30        |
| 1.125     | 20        |
| 1.250     | 10        |
| 1.375     | 0         |



### PMS Pavement Condition Index

1. A Pavement Condition Index is calculated from the other indexes for each pavement type.
2. The formula for the ASP Pavement Condition Index is as follows:

$$\text{ASP Pavement Condition Index} = [\text{MAX} (\text{MIN} (\text{RNDM}, \text{ALCR}, \text{PTCH}, \text{RUFF}, \text{RUT})), (\text{AVG} (\text{RNDM}, \text{ALCR}, \text{PTCH}, \text{RUFF}, \text{RUT}))] - 0.85 (\text{STD} (\text{RNDM}, \text{ALCR}, \text{PTCH}, \text{RUFF}, \text{RUT}))$$

3. The formula for the COM Pavement Condition Index is as follows:

$$\text{COM Pavement Condition Index} = [\text{MAX} (\text{MIN} (\text{RNDM}, \text{PTCH}, \text{RUFF}, \text{RUT})), (\text{AVG} (\text{RNDM}, \text{PTCH}, \text{RUFF}, \text{RUT}))] - 0.85 (\text{STD} (\text{RNDM}, \text{PTCH}, \text{RUFF}, \text{RUT}))$$

### ASP Pavement Condition Index Example Calculation

Note: Use the Standard Deviation, not the sample standard deviation

- Random Cracking Index = 90
- Alligator Cracking Index = 90
- Patching Index = 90
- Roughness Index = 90
- Rutting Index = 60
- Number of Index Measures (N) = 5

**Average (AVG)** of (RNDM, ALCR, PTCH, RUFF, RUT) = AVG (90, 90, 90, 90, 60) =

$$(90+90+90+90+60) / 5 = 420/5 = \mathbf{84}$$

|           | X   | X-AVG | (X-AVG)^2 |
|-----------|-----|-------|-----------|
| Random    | 90  | 6     | 36        |
| Alligator | 90  | 6     | 36        |
| Patching  | 90  | 6     | 36        |
| Roughness | 90  | 6     | 36        |
| Rutting   | 60  | -24   | 576       |
| Σ         | 420 |       | 720       |

$$N = 5$$

$$\mathbf{Standard\ Deviation} = \text{SQRT} \{ [\sum (X-AVG)^2] / N \} = \text{SQRT} \{ 720/5 \} = \mathbf{12}$$

ASP Pavement Condition Index formula = [MAX (MIN (RNDM, ALCR, PTCH, RUFF, RUT)), (AVG (RNDM, ALCR, PTCH, RUFF, RUT))] - 0.85 (STD (RNDM, ALCR, PTCH, RUFF, RUT))

$$\mathbf{ASP\ Pavement\ Condition\ Index} = \text{Max} [\text{min } 60 \text{ or } \mathbf{avg\ 84}] - 0.85(12) = 84 - 10.2 = 73.8 \text{ or } \mathbf{74}$$

## Miscellaneous

### Bridges

- Asphalt Bridge surfaces will always be considered (COM) Composite Pavements shall be rated per this protocol.

### Tunnels

- Asphalt Tunnel surfaces will always be considered (COM) Composite Pavements shall be rated per this protocol.

## Exhibit 1 - SEALED CRACK

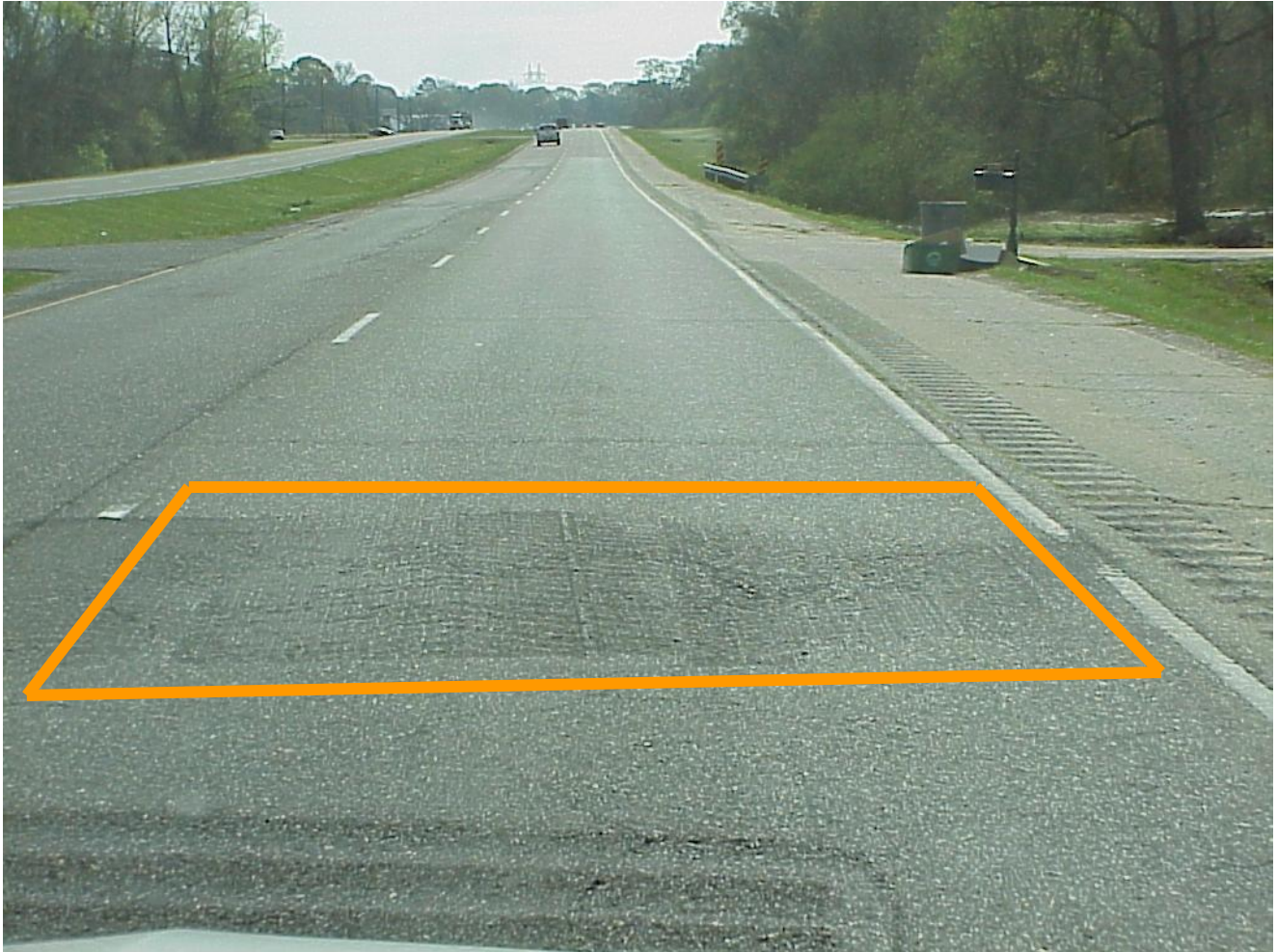


Within the orange shape above are sealed cracks.

**PMS** - Cracks that have been sealed should not be rated, except when the sealant has failed. Any crack that extends beyond the sealed area should be rated, quantified, and reported.

**Federal Part 490** – All sealed cracks in the Federal Part 490 39-inch wheel path shall be measured and reported. Sealed cracks outside of the 39-inch wheel paths shall not be considered.

## Exhibit 2 - REPAIRED BLOWUP



Within the orange shape above is a repaired blowup.

**PMS** - This should not be rated; however, if distresses are present within the blowup, then only those distresses should be rated, quantified, and reported with the appropriate severity level of the apparent distress type.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

## Exhibit 3 - SAWED AND SEALED JOINT



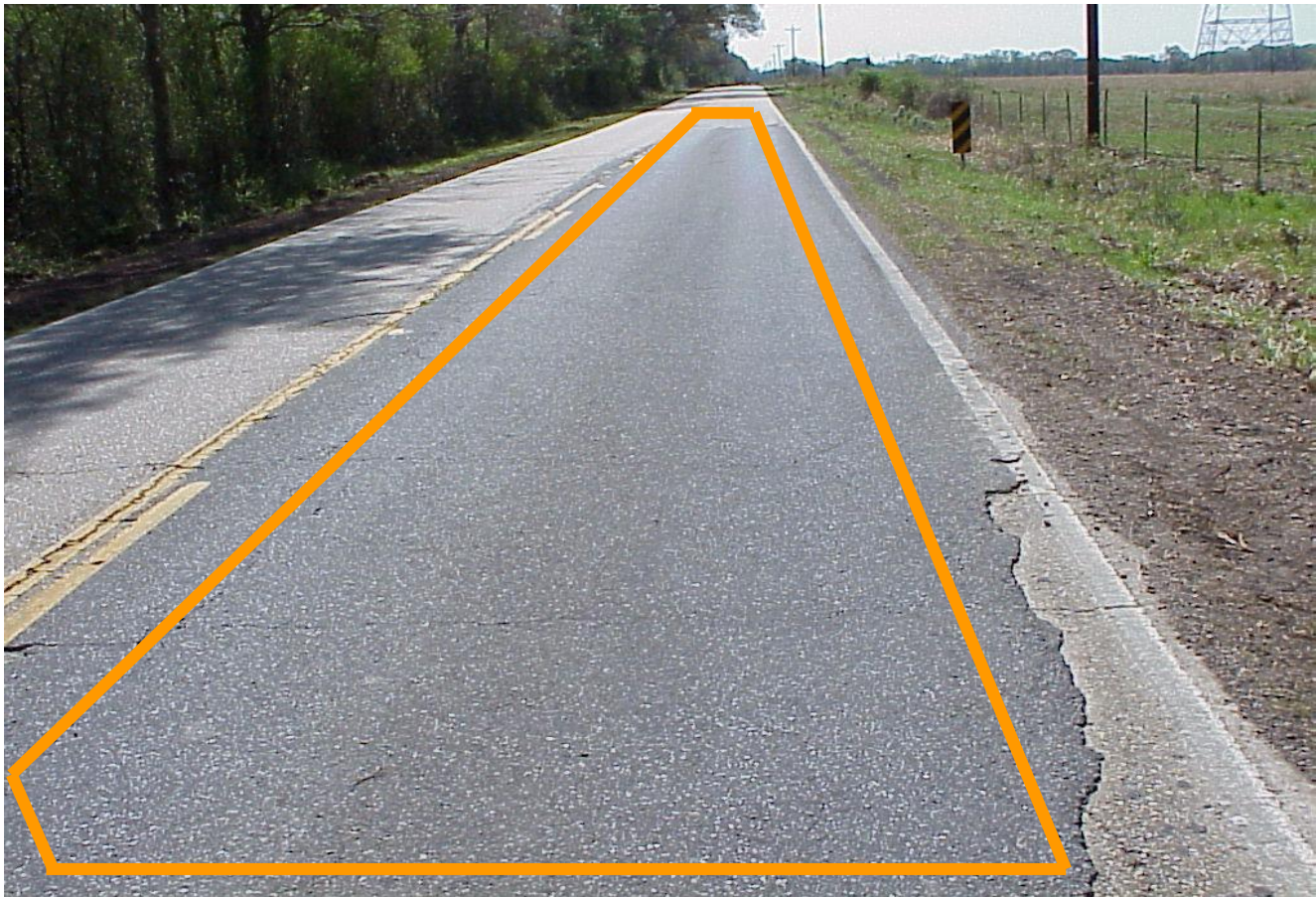
Within the orange shape above is a sawed and sealed joint.

**PMS** - This should not be rated.

**Federal Part 490** – This should be identified as a sawed and sealed joint. It is not a pavement distress.

## Exhibit 4 - ASPHALT PATCHING

### Low Severity (Level 1)



Within the orange shape above is the low severity patching for Asphalt Surface Pavements.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.



## Exhibit 5 - ASPHALT PATCHING

### Low Severity (Level 1)



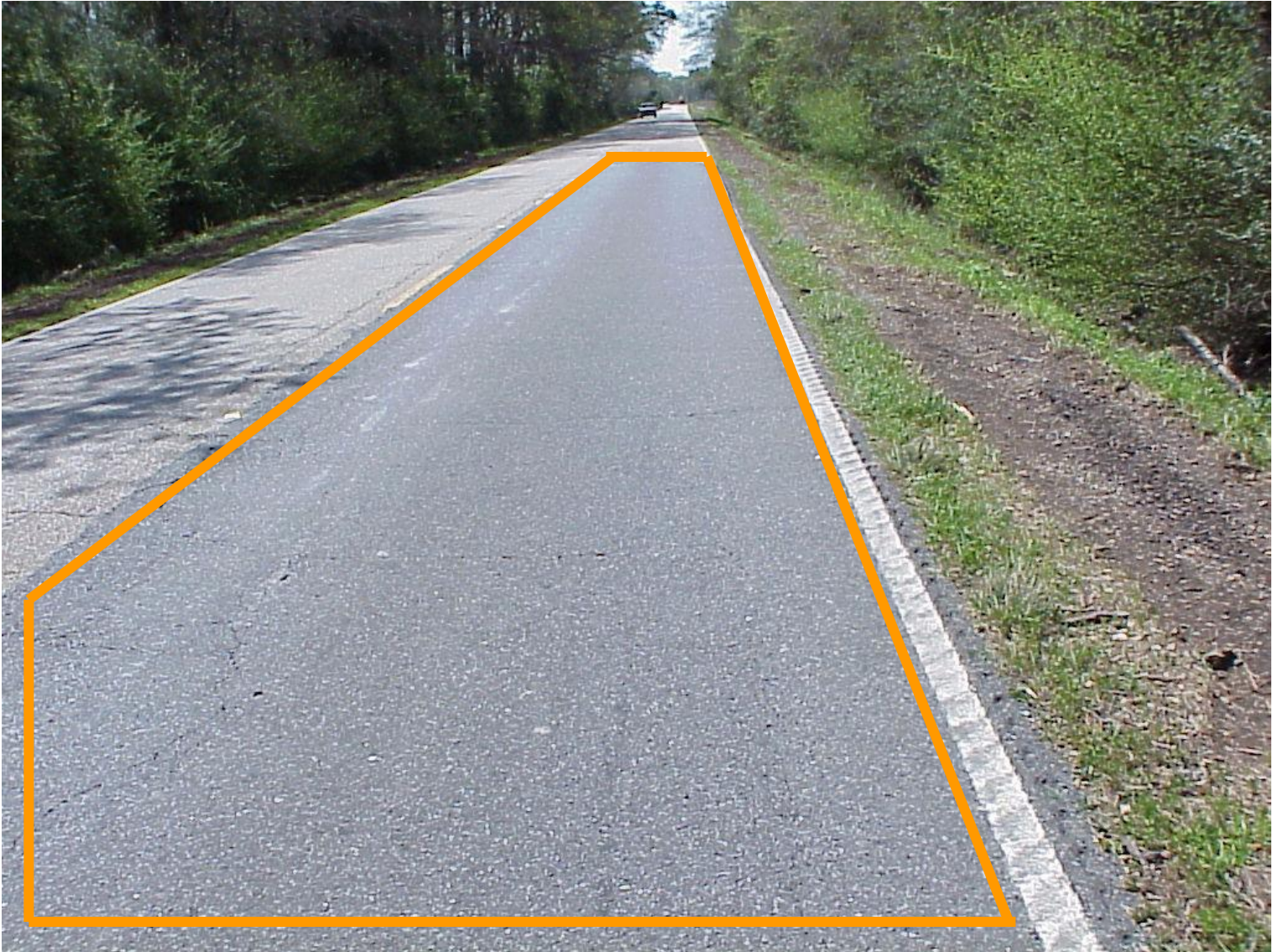
Within the orange shape above is the low severity patching for Asphalt Surface Pavements.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

## Exhibit 6 - ASPHALT PATCHING

### Low Severity (Level 1)



Within the orange shape above is the low severity patching for Asphalt Surface Pavements.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

## Exhibit 7 - ASPHALT PATCHING

### Medium Severity (Level 2)



Within the orange circle above is medium severity patching for Asphalt Surface Pavements.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

## Exhibit 8 - ASPHALT PATCHING

### Medium Severity (Level 2)



Within the orange shape above is the medium severity patching for Asphalt Surface Pavements.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

# Exhibit 9 - ASPHALT PATCHING

## Medium Severity (Level 2)



Within the orange shape above is the medium severity patching for Asphalt Surface Pavements.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

## Exhibit 10 - ASPHALT PATCHING POTHOLE



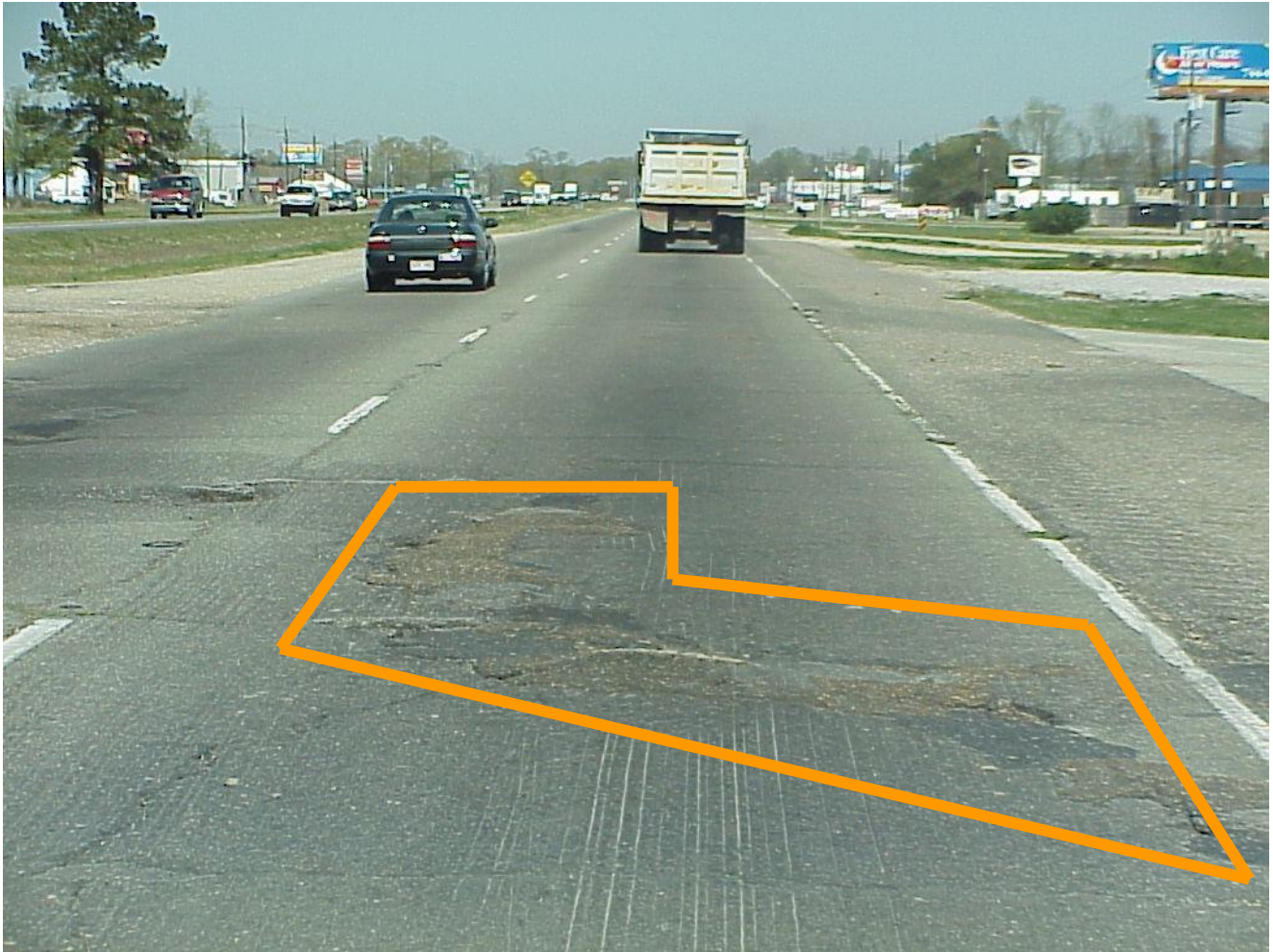
Within the orange shape above is a pothole on an Asphalt Surface Pavement.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

# Exhibit 11 - ASPHALT PATCHING

## High Severity (Level 3)



Within the orange shape above is high severity patching for Asphalt Surface Pavements which is found within a repaired blowup.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

## Exhibit 12 - ASPHALT PATCHING

### High Severity (Level 3)



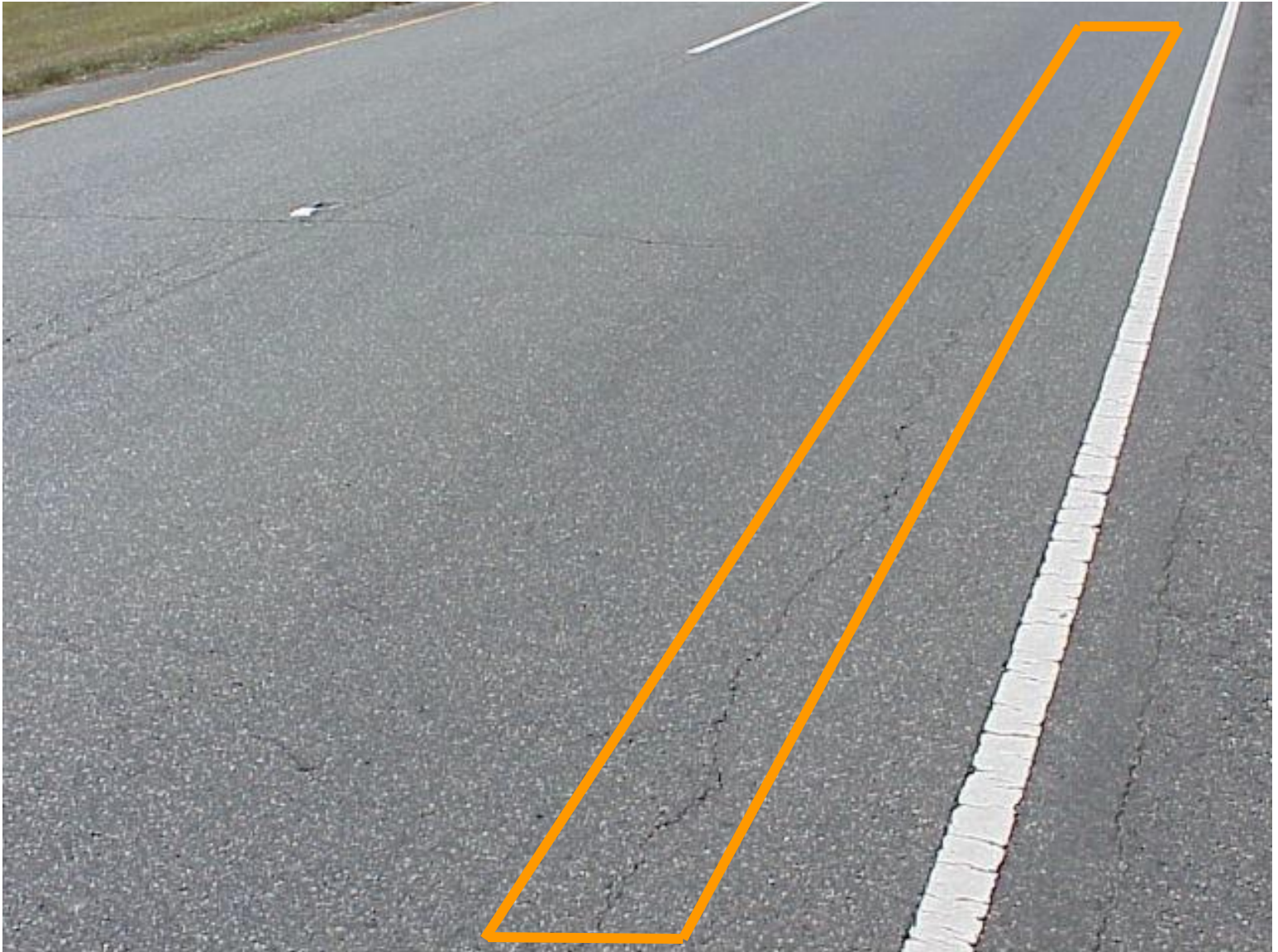
Within the orange shape above is high severity patching for Asphalt Surface Pavements.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.



# EXHIBIT 13 - ASPHALT FATIGUE CRACKING - Exception Low Severity (Level 1)



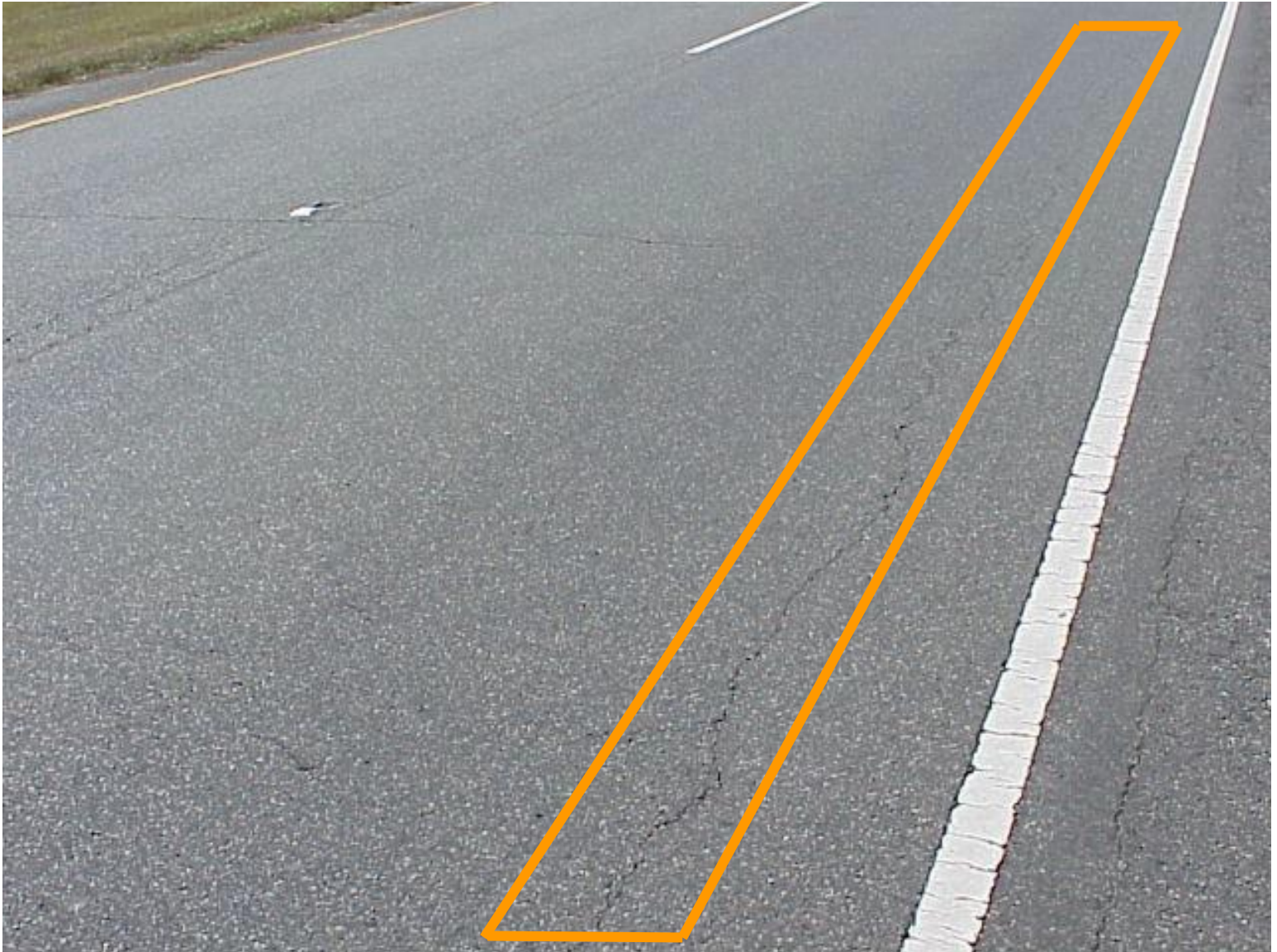
Within the orange shape above appears to be low severity fatigue cracking; however, this is a composite (COM) pavement. Note both ASP and COM pavements are considered Federal Part 490 ASP-F pavements.

**PMS** - This should be rated as low severity random cracking as the longitudinal crack is on a composite pavement. PMS fatigue cracking is only found on ASP pavements.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

## Exhibit 14 - ASPHALT Fatigue Cracking

### Low Severity (Level 1)



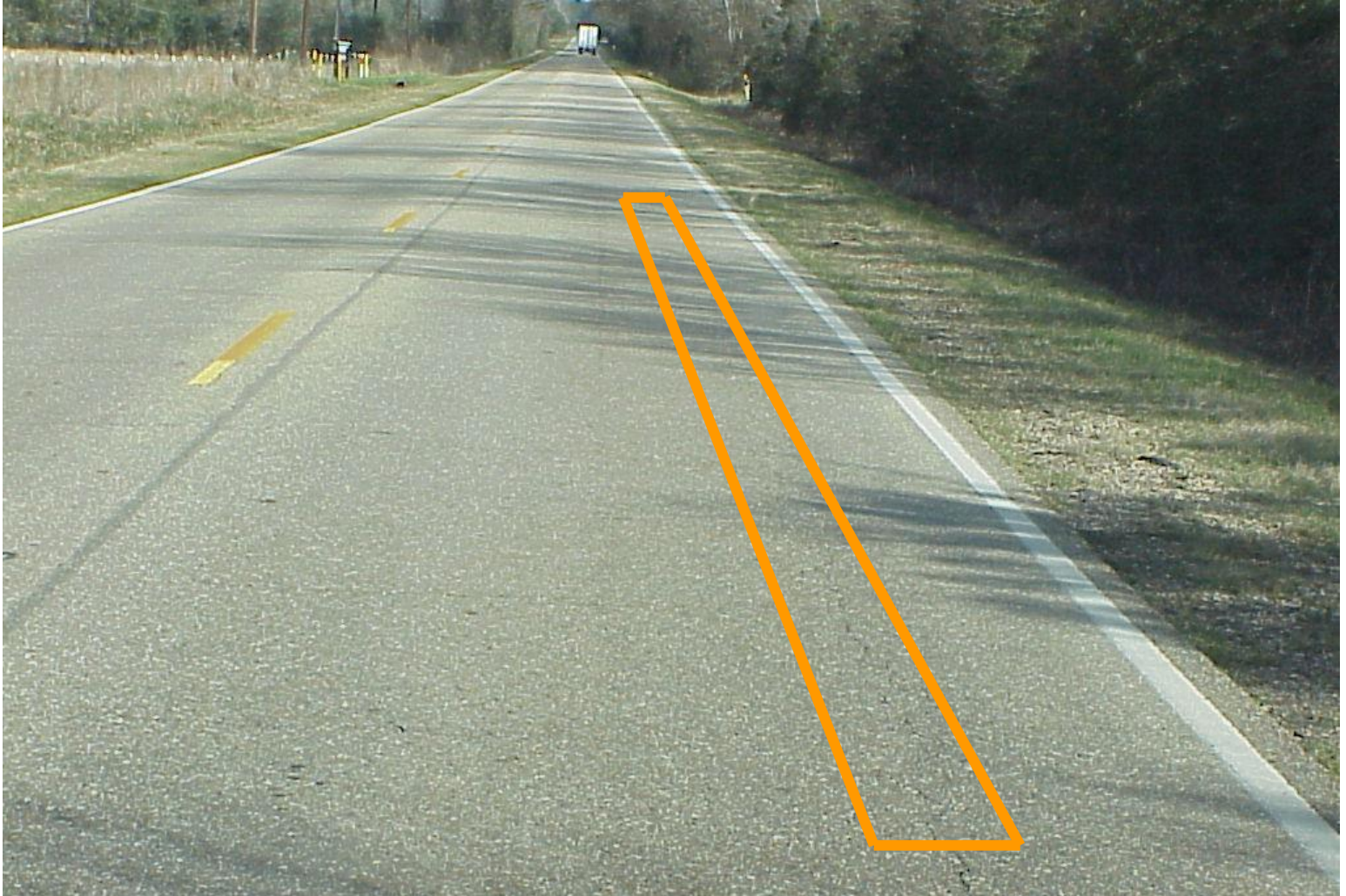
Within the orange shape above is low severity fatigue cracking for Asphalt Surface Pavements.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

# Exhibit 15 - ASPHALT Fatigue Cracking

## Low Severity (Level 1)



Within the orange shape above is low severity fatigue cracking for Asphalt Surface Pavements.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

# Exhibit 16 - ASPHALT Fatigue Cracking - Exception

## Medium Severity (Level 2)



Within the orange shape above appears to be medium severity fatigue cracking; however, this is a composite (COM) pavement. Note both ASP and COM pavements are considered Federal Part 490 ASP-F pavements.

**PMS** - This should be rated as medium severity random cracking, as the longitudinal crack is on a composite pavement. PMS fatigue cracking is only found on ASP pavements.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

## Exhibit 17 - ASPHALT Fatigue Cracking Medium Severity (Level 2)



Within the orange shape above is medium severity fatigue cracking for Asphalt Surface Pavements.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

# Exhibit 18 - ASPHALT Fatigue Cracking - Exception

## Medium Severity (Level 1)



Within the orange shape above appears to be medium severity fatigue cracking; however, this is a composite (COM) pavement. Note both ASP and COM pavements are considered Federal Part 490 ASP-F pavements.

**PMS** - This should be rated as medium severity random cracking, as the longitudinal crack is on a composite pavement. PMS fatigue cracking is only found on ASP pavements.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

## Exhibit 19 - ASPHALT Fatigue Cracking High Severity (Level 3)



Within the orange shape above is high severity fatigue cracking for Asphalt Surface Pavements.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

# Exhibit 20 - ASPHALT Fatigue Cracking

## High Severity (Level 3)



Within the orange shape above is high severity fatigue cracking for Asphalt Surface Pavements.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.



# Exhibit 21 - ASPHALT Fatigue Cracking

## High Severity (Level 3)



Within the orange shape above is high severity fatigue cracking for Asphalt Surface Pavements.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

## Exhibit 22 - ASPHALT Random Cracking Low Severity (Level 1)

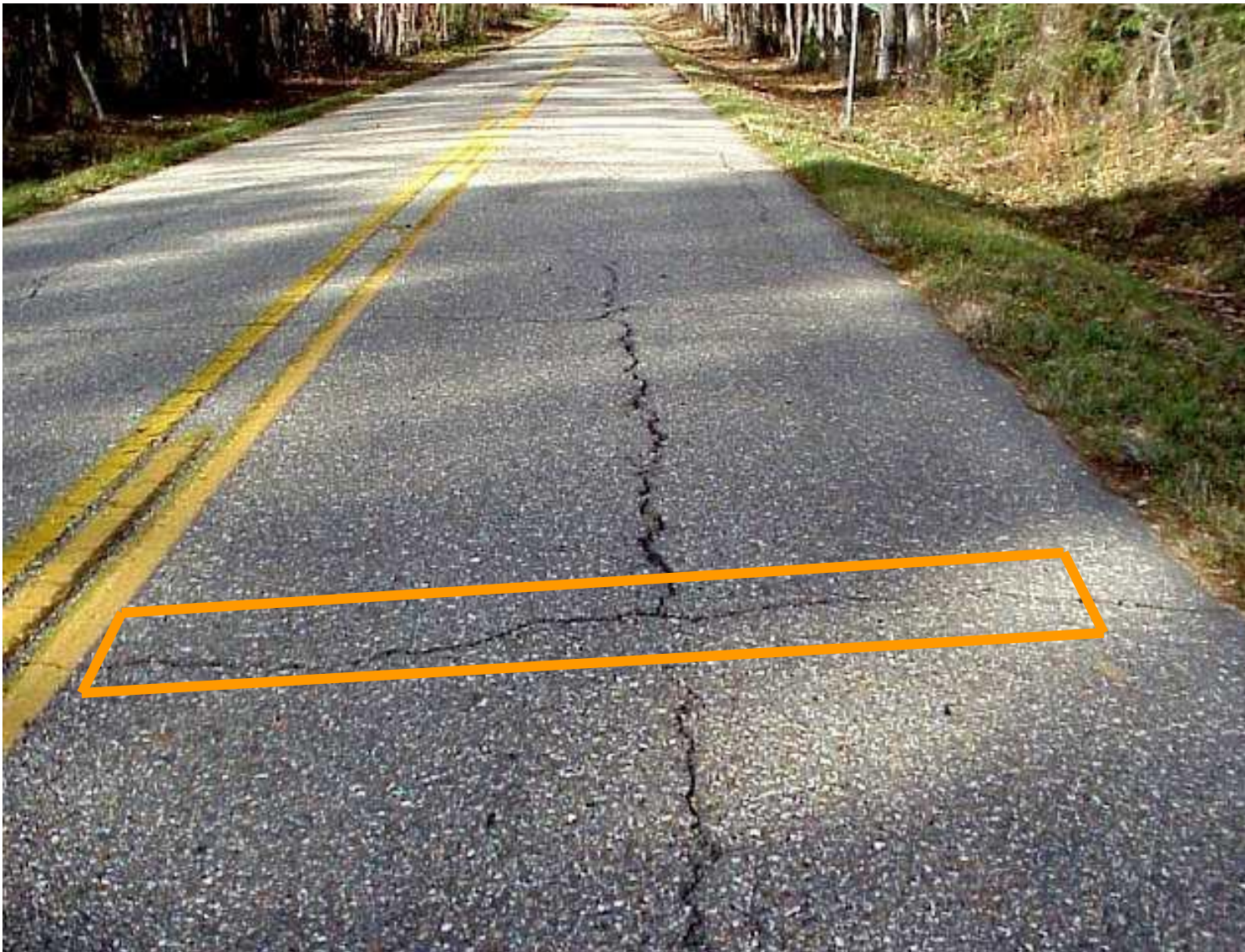


Within the orange shape above is low severity transverse (Random) cracking for Asphalt Surface Pavements.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

## Exhibit 23 - ASPHALT Random Cracking Low Severity (Level 1)



Within the orange shape above is low severity transverse (Random) cracking for Asphalt Surface Pavements.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

# Exhibit 24 - ASPHALT Random Cracking

## Low Severity (Level 1)



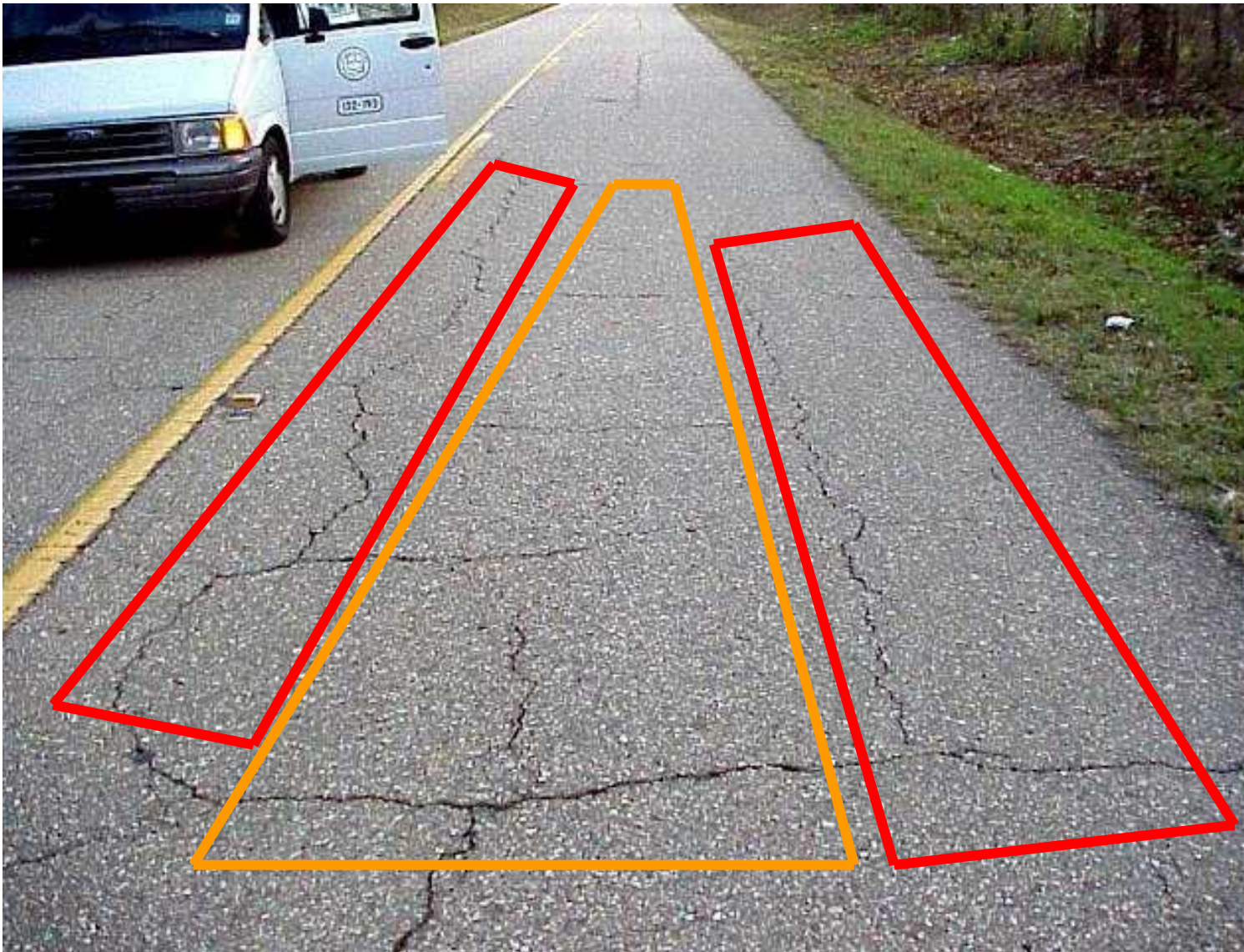
Within the orange shape above is low severity transverse (Random) cracking for Asphalt Surface Pavements.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

# Exhibit 25 - ASPHALT Random Cracking & Fatigue Cracking

## Medium Severity (Level 2)



Within the orange shape above is medium severity random cracking for Asphalt Surface Pavements.

Within the red shape above is medium severity fatigue cracking for Asphalt Surface Pavements.

**PMS** - These should be rated as defined in this document. **Note that the transverse cracks extending into the PMS 36-inch wheelpath should be rated as random cracking and excluded from the fatigue cracking rating.**

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

## Exhibit 26 - ASPHALT Random Cracking & Fatigue Cracking Medium Severity (Level 2)



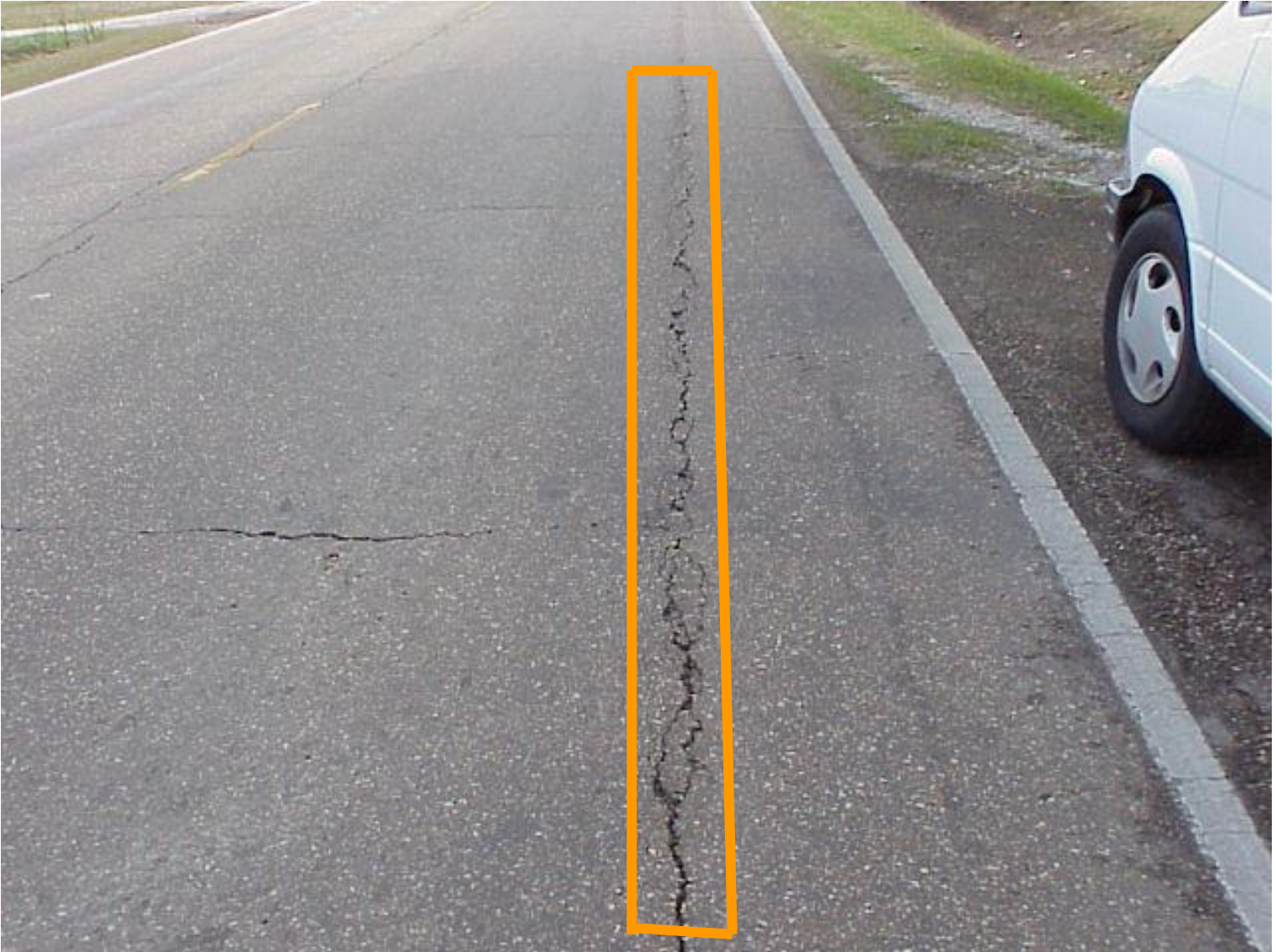
Within the orange shape above is medium severity random cracking for Asphalt Surface Pavements.

Within the red shape above is medium severity fatigue cracking for Asphalt Surface Pavements.

**PMS** - These should be rated as defined in this document. **Note that the transverse cracks extending into the PMS 36-inch wheel path should be rated as random cracking and excluded from the fatigue cracking rating.**

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel paths shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

## Exhibit 27 - ASPHALT Random Cracking Medium Severity (Level 2)



Within the orange shape is medium severity random cracking on a composite (COM) pavement. Note both ASP and COM pavements are considered Federal Part 490 ASP-F pavements.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

## Exhibit 28 - ASPHALT Random Cracking Medium Severity (Level 2)



Within the orange shape is medium severity random cracking on a composite (COM) pavement. Note both ASP and COM pavements are considered Federal Part 490 ASP-F pavements.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.



## Exhibit 29 - ASPHALT Random Cracking High Severity (Level 3)



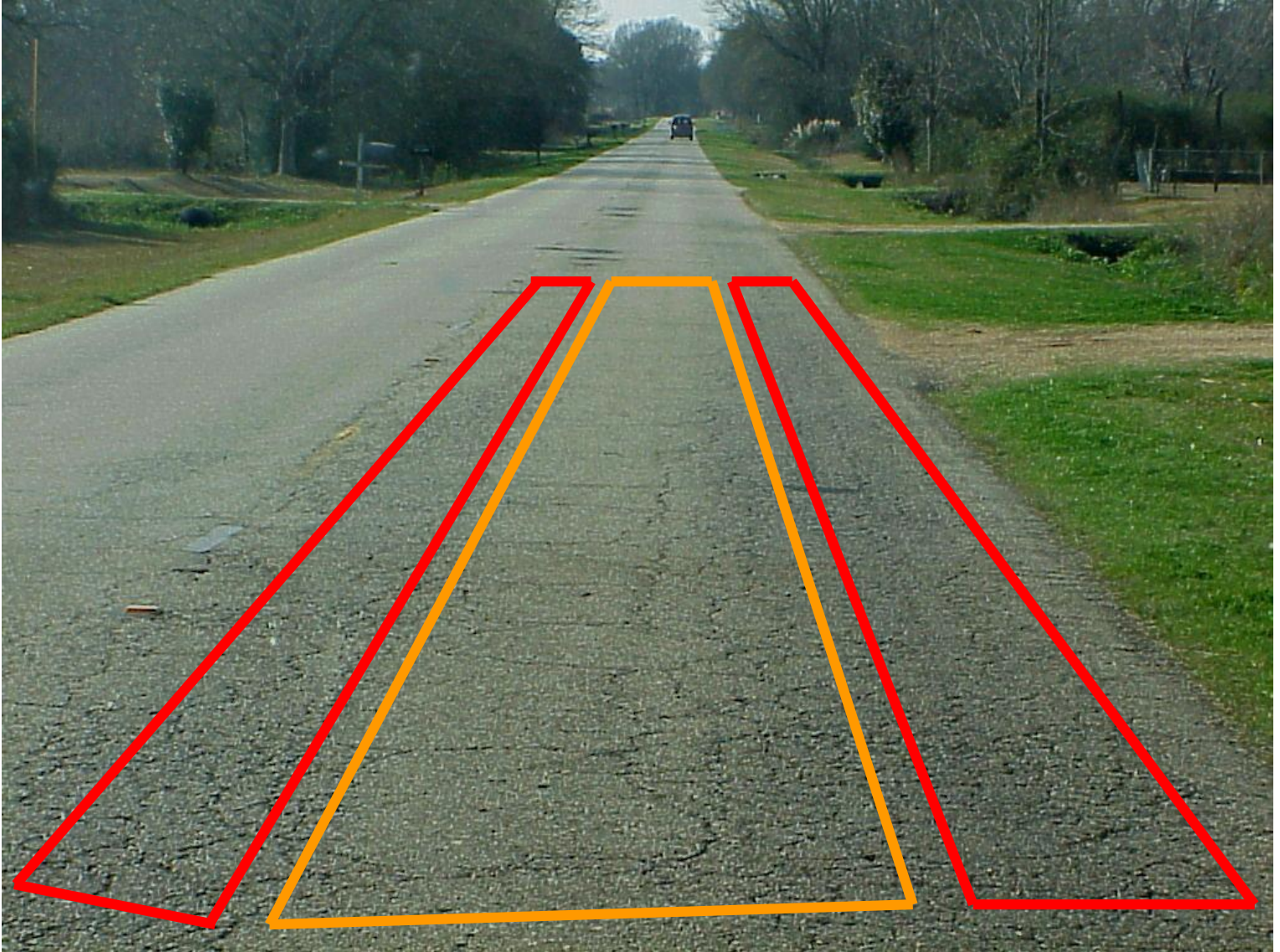
Within the orange shape is high severity random cracking on a composite (COM) pavement. Note both ASP and COM pavements are considered Federal Part 490 ASP-F pavements.

**PMS** - This should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.

# Exhibit 30 - ASPHALT Random Cracking & Alligator Cracking

## High Severity (Level 3)



Within the orange shape above is high severity random cracking for Asphalt Surface Pavements.

Within the red shape above is high severity fatigue cracking for Asphalt Surface Pavements.

**PMS** - These should be rated as defined in this document.

**Federal Part 490** – All distresses found in the ASP-F Federal Part 490 39-inch wheel path shall be measured and reported. Distresses outside of the 39-inch wheel paths shall not be considered.