MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

MDOT State Highway Administration

Asphalt Pavement Distress Repair Guidelines

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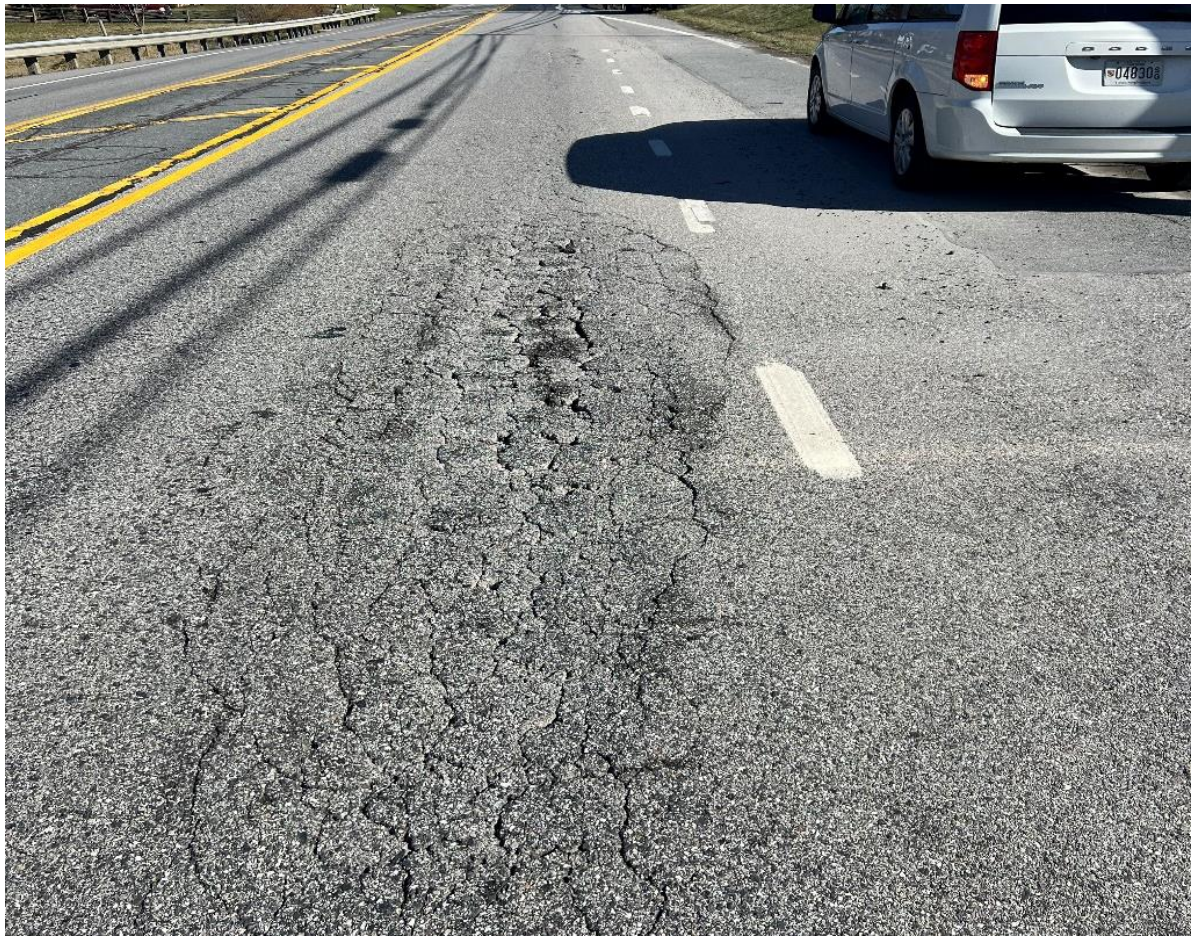
Use these guidelines in conjunction with:

- Section 505 – Asphalt Patches
- Section 510 –Sealing Cracks and Joints in Asphalt Pavements

- Standard No. MD 578.03 for patching flexible pavements (no concrete)
- Standard No. MD-578.03-01 for patching composite pavements (concrete covered by asphalt)



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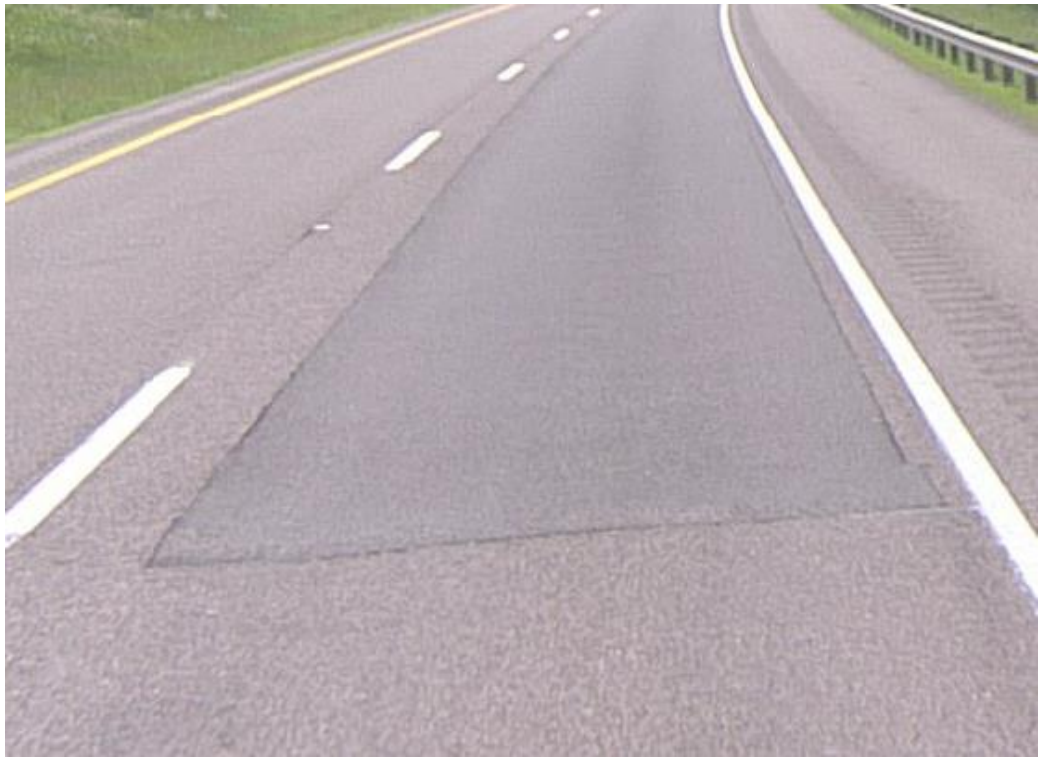
Organization

- This document is organized by pavement distress type. For each distress type, pictures of various severity levels are provided, along with instructions of whether to:
  - **Do Nothing,**
  - **Use crack seal,**
  - **Use mastic, or**
  - **Patch (Full or Partial-Depth).**



In addition, summary tables are provided directing whether to use Crack Sealing, Mastic, and Patching for each distress and severity type.

Notes:

- 1. Crack seal and mastic should be placed during the spring and fall.
- 2. Crack seal and mastic shall be placed at least 2 months before micro-surfacing is applied.
- 3. Patches that are NOT resurfaced within 3 months should be crack sealed.
- 4. Use crack seal for crack widths between 1/8" and 1". Use mastic for crack widths only between 1" and 3".
- 5. Cracks do not need to be sealed for Superpave asphalt resurfacing projects.
- 6. For longitudinal patches, connect distressed areas that are less than 50' apart.
- 7. Minimum patch size is generally 6' x 6' for projects where milling and/or overlay will follow.
- 8. Generally, for situations where:
  a. Patching up to 3" in one lift: Minimum patch width shall be 2'.
  b. Patching on Primary Roads (Interstates, Principal Arterials): Minimum patch width shall be 6'.
  c. Patching on Secondary Roads (all other functional classes): Minimum patch width shall be 4'.
- 9. For Patch-Only projects, the minimum length should be 6'.
- 10. If a distress exists on the mainline and spills over to the shoulder, the patch thickness shall be the thicker of the two pavement sections, unless the mainline and shoulder patching will be done in separate passes.
- 11. In considering width, do not leave a relatively small sliver (perhaps 2') between the patch and an existing longitudinal joint. Avoid putting a joint in the wheelpath.
- 12. Additional information regarding crack sealing can be found in the Pavement and Geotechnical Design Guide.

Commonly Seen Distress Types

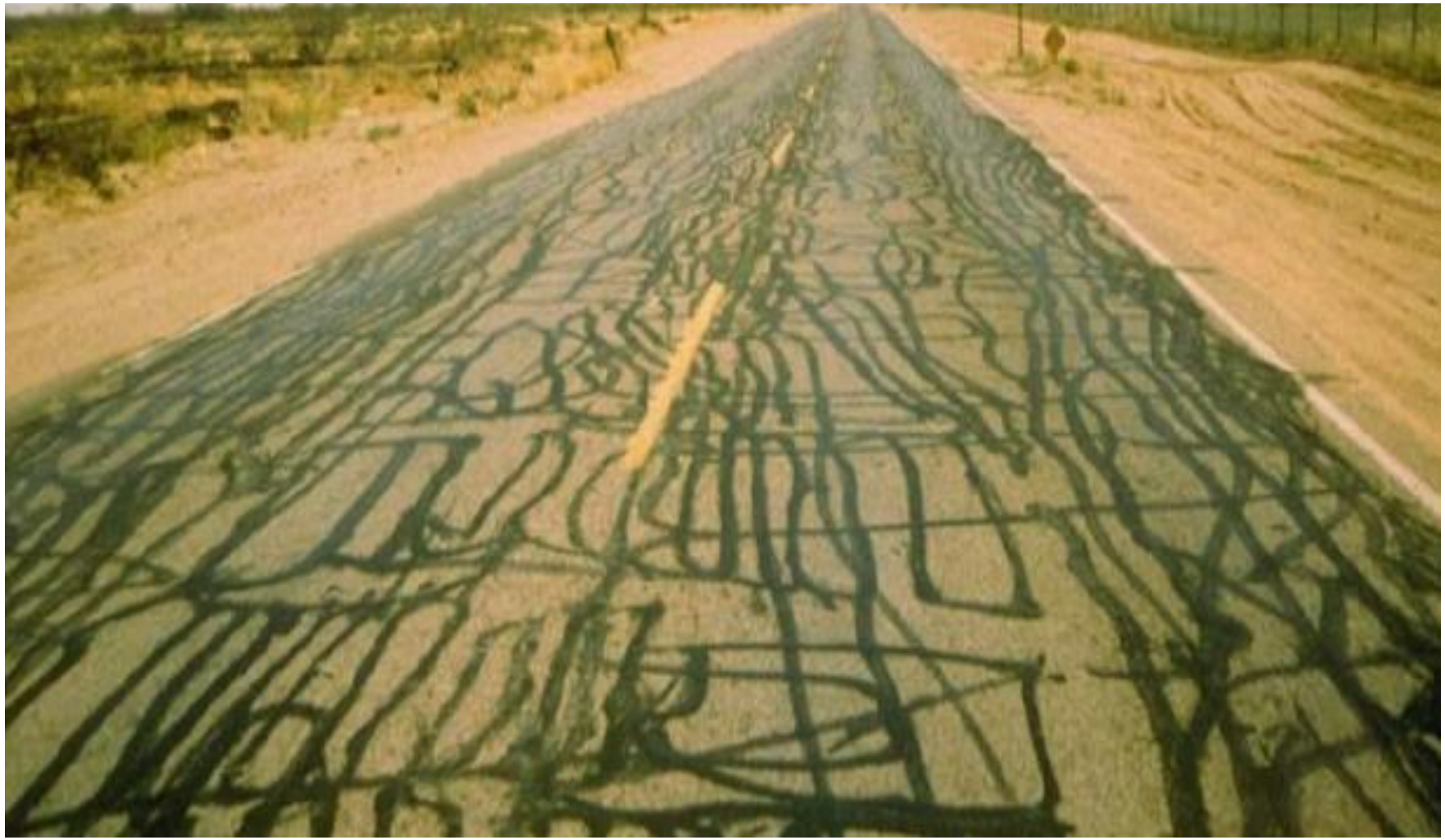
1. Alligator (Fatigue) Cracking
2. Edge Cracking
3. Joint Reflection Cracking
4. Non-wheelpath Cracking
5. Potholes/Failures
6. Previously existing Patches

Less Common Distress Types:

1. Bumps and Sags
2. Corrugation
3. Depressions
4. Shoving
5. Slippage Cracking
6. Swells

Summary tables to repair these are provided.

Example of what road SHOULD NOT look like after Crack Sealing



Summary Tables: Crack Sealing, Mastic, Patch

Crack Sealing	Severity		
Distress	Low	Medium	High
Alligator Cracking	No	No	No
Edge Cracking	Yes	Yes	No
Joint Reflection Cracking	Yes	Yes	No
Non-wheelpath Cracking	Yes	Yes	No
Potholes/Failures	No	No	No
Previously existing Patches	Yes	No	No
Bumps and Sags	No	No	No
Corrugation	No	No	No
Depressions	No	No	No
Shoving	No	No	No
Slippage Cracking	No	No	No
Swells	No	No	No

Mastic	Severity		
Distress	Low	Medium	High
Alligator Cracking	No	No	No
Edge Cracking	No	Yes	No
Joint Reflection Cracking	No	Yes	Yes
Non-wheelpath Cracking	No	Yes	Yes
Potholes/Failures	Yes	Yes	No
Previously existing Patches	No	No	No
Bumps and Sags	No	Yes	Yes
Corrugation	No	No	No
Depressions	No	Yes	Yes
Shoving	No	No	No
Slippage Cracking	No	No	No
Swells	No	No	No

Patch	Severity		
Distress	Low	Medium	High
Alligator Cracking	No	Yes	Yes
Edge Cracking	No	No	Yes
Joint Reflection Cracking	No	Yes	Yes
Non-wheelpath Cracking	No	No	Yes
Potholes/Failures	Yes	Yes	Yes
Previously existing Patches	No	Yes	Yes
Bumps and Sags	No	Yes	Yes
Corrugation	No	Yes	Yes
Depressions	No	Yes	Yes
Shoving	No	Yes	Yes
Slippage Cracking	No	Yes	Yes
Swells	No	Yes	Yes

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Note: Go to specific distress pages for clarifications and **exceptions**.

Alligator (Fatigue) Cracking

- **Description:** Structural cracking that when severe enough looks like an alligator's back. The pavement is not strong enough to support traffic loads.
- **Typical Cause:** Inadequate thickness, poor subgrade support, or debonding between asphalt layers.
- **Typical Location:** The wheelpaths.

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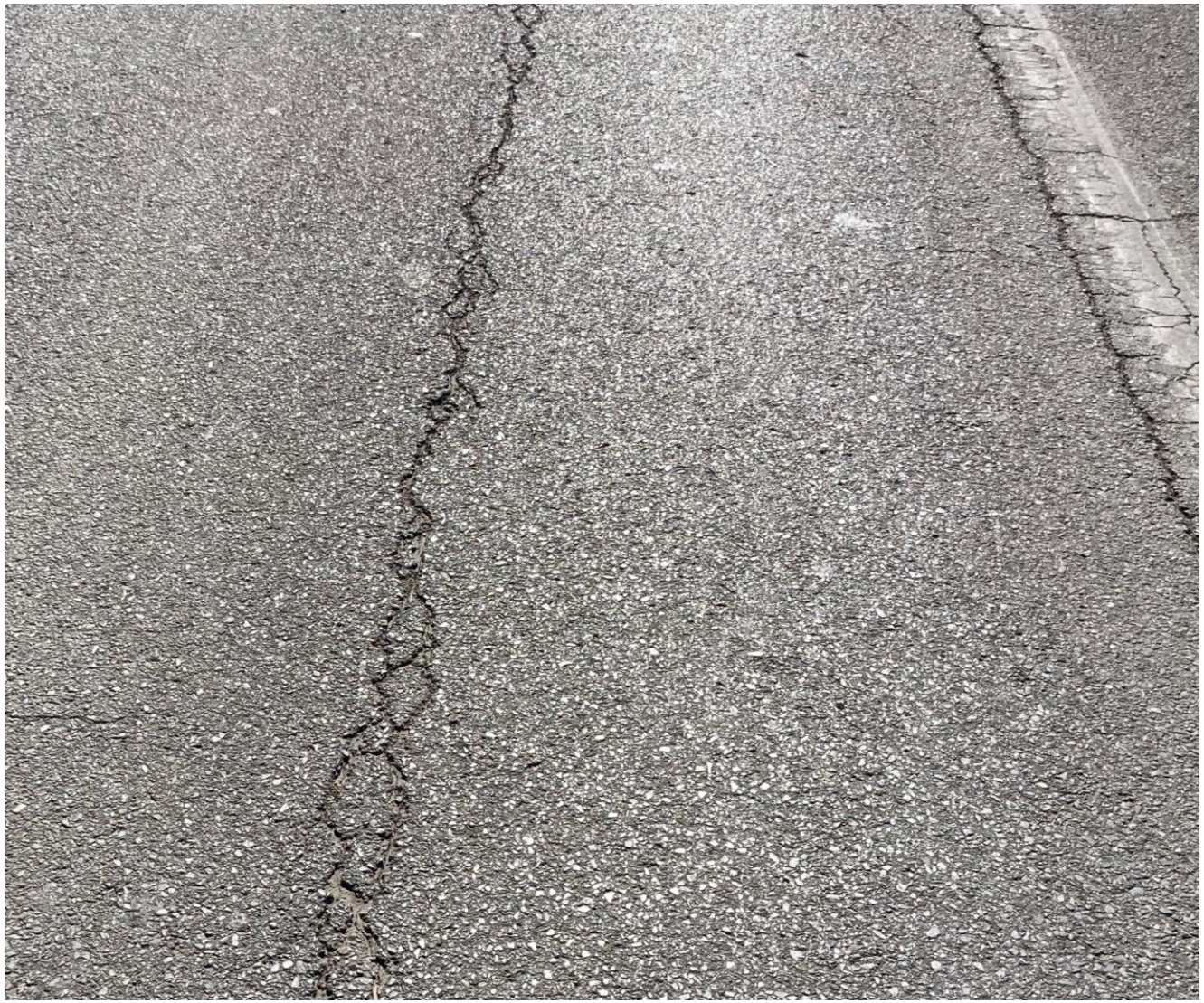
Alligator Cracking: Low Severity

Typically a meandering, longitudinal crack in the wheelpath. When this is consistently present in a pavement, it usually occurs because of debonding between the top one or two asphalt layers and the underlying base asphalt layer.

Crack Seal	No
Mastic	No
Patch	See Repair Guidelines



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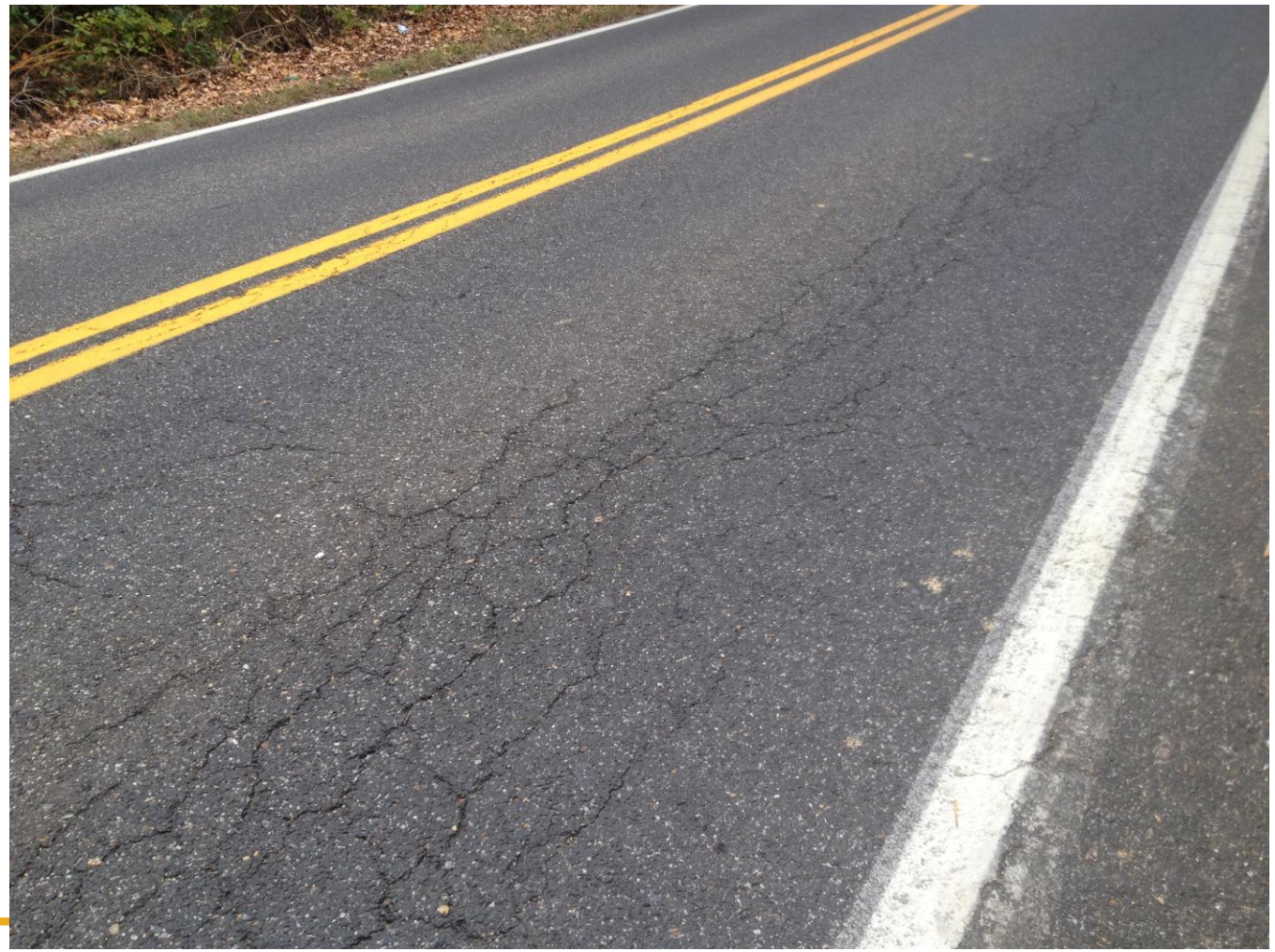
Alligator Cracking: Medium Severity

Typically a series of occasionally interconnected cracks in a fairly tight pattern in the wheelpath. No pavement has spalled out, and there isn't much effect on ride quality.



Crack Seal	No
Mastic	No
Patch	See Repair Guidelines

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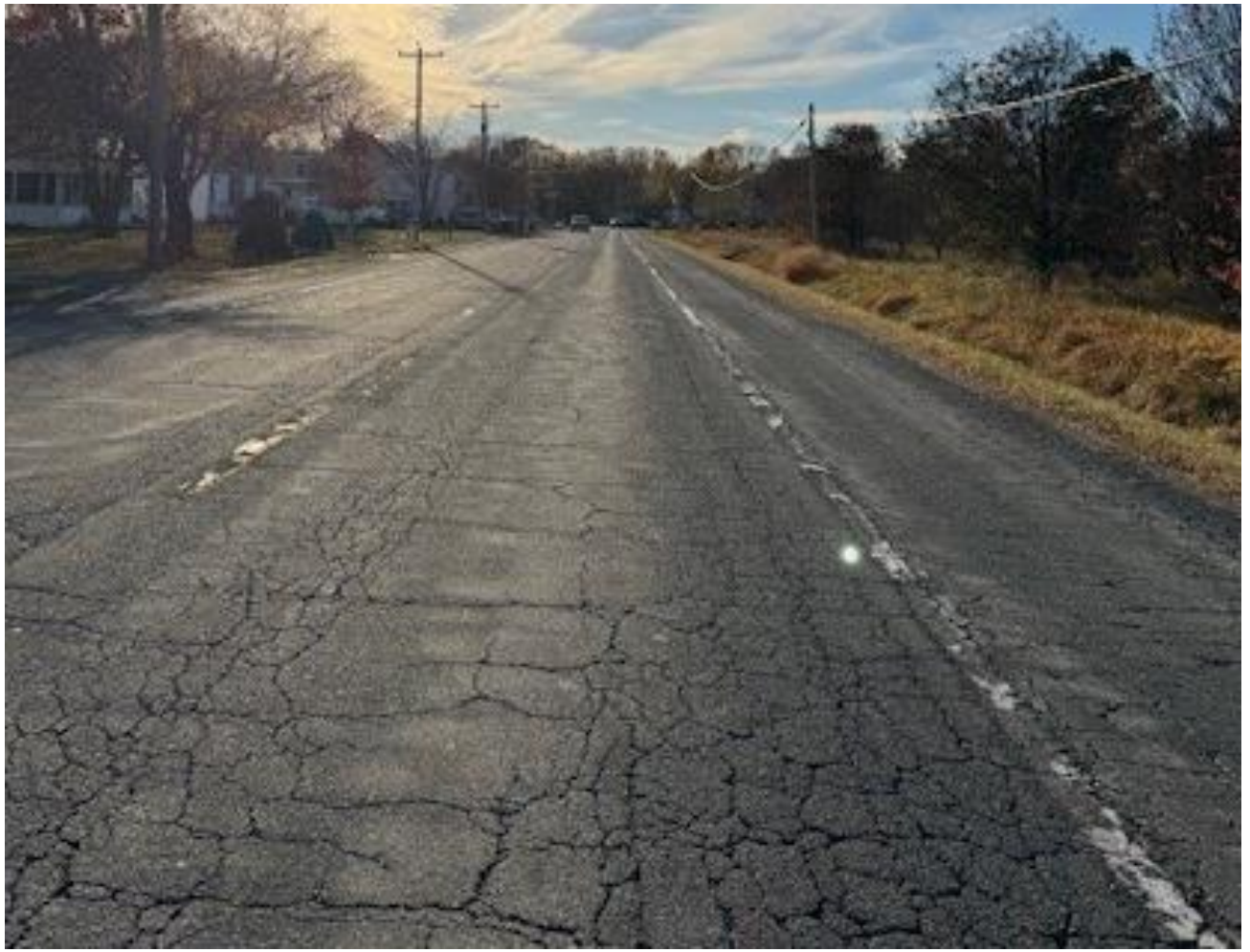
Alligator Cracking: High Severity

Typically well-defined series of interconnected cracks in the wheelpath. Pavement pieces may have spalled out, and there is a noticeable effect on ride quality.



Crack Seal	No
Mastic	No
Patch	See Repair Guidelines

Alligator Cracking: Repair Guidelines

Severity	Low	Medium	High
Crack Seal			
Mastic			
Patching (Travel Lanes) - asphalt thickness greater than 6"		Partial	Full
Patching (Travel Lanes) - asphalt thickness less than 6"		Full	Full
Patching (Shoulders)			Full
Notes	1	1, 2	2

Notes:

1. Contact OMT-PAGD to investigate whether the surface has debonded from the base and whether cracking is limited to the surface; if so, remove surface rather than patch.
2. Contact OMT-PAGD for guidance on patch thickness. Matching existing pavement thickness may be structurally insufficient, leading to repeated failure. A thicker-than-existing patch may be needed.

Edge Cracking

- **Description:** A structural distress near the outer edge of the pavement, in that the pavement is not strong enough to support traffic loads.
- **Typical Cause:** Inadequate thickness or subgrade support
- **Typical Location:** Pavement edge.

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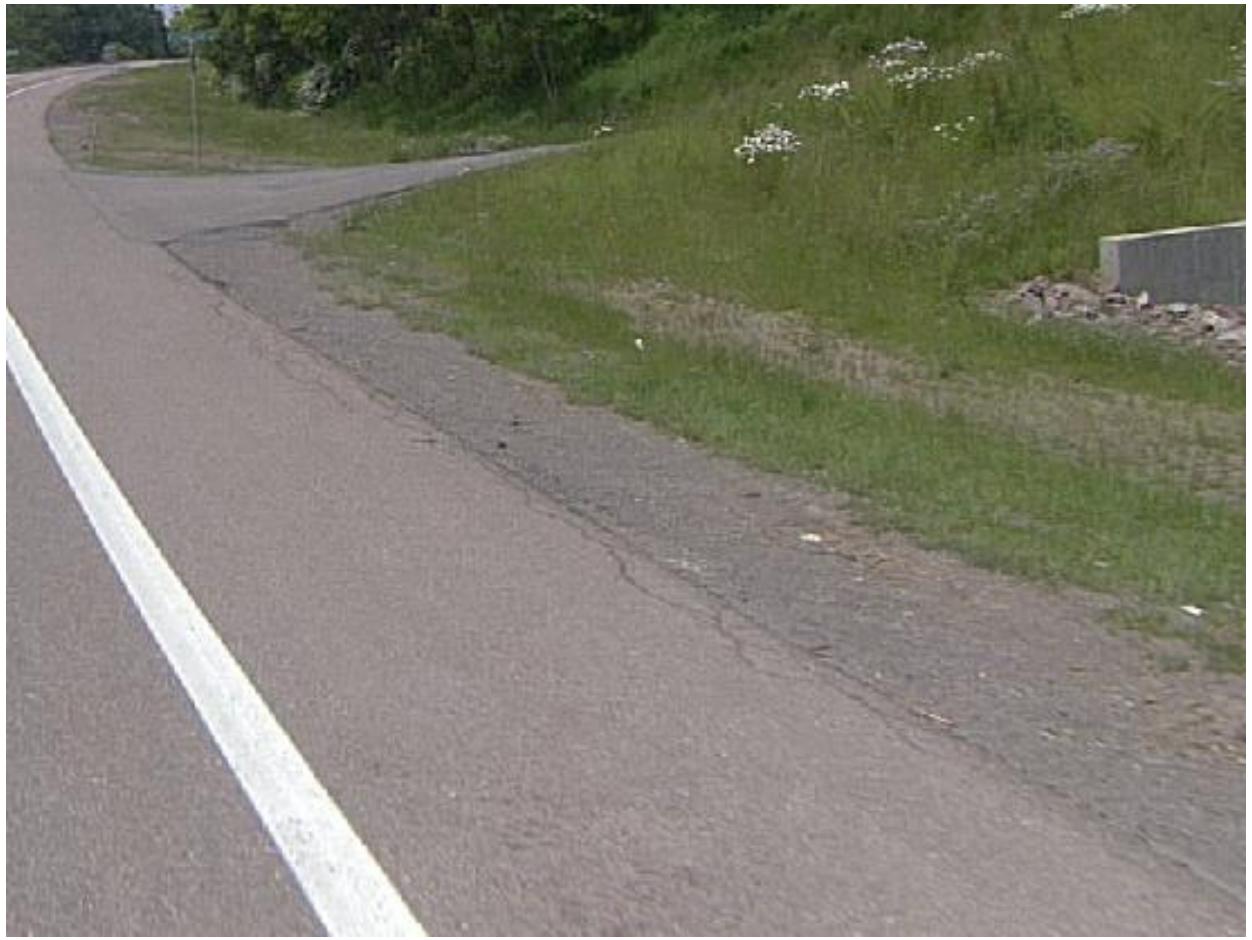
Edge Cracking: Low Severity

Typically low to medium cracking with no breakup or raveling.

Crack Seal	Yes
Mastic	No
Patch	No



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Edge Cracking: Medium Severity

Typically medium cracks with some breakup and raveling.

Crack Seal	Yes
Mastic	Yes
Patch	No

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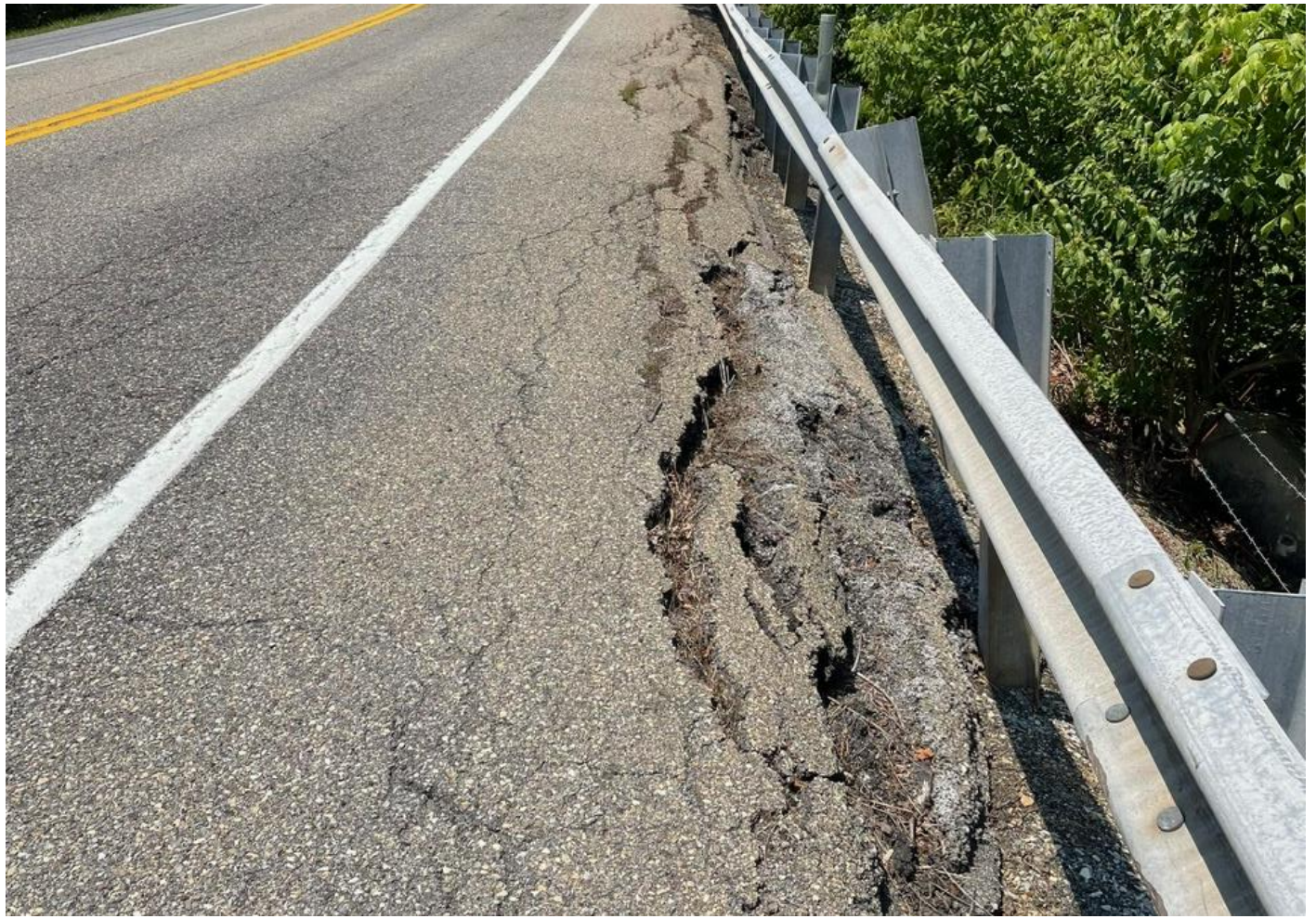
Edge Cracking: High Severity

Typically considerable breakup or raveling along the edge.



Crack Seal	No
Mastic	No
Patch	See Repair Guidelines

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Edge Cracking: Repair Guidelines

Severity	Low	Medium	High
Crack Seal	Yes	Yes	
Mastic		Yes	
Patching - asphalt thickness greater than 6"			Partial
Patching - asphalt thickness less than 6"			Full
Notes			1

Notes:

1. Contact OMT-PAGD for guidance on patch thickness. Matching existing pavement thickness may be structurally insufficient, leading to repeated failure. A thicker-than-existing patch may be needed.

Joint Reflection Cracking

- **Description:** A functional distress, in that the cracks in the asphalt are caused by movement at the joints in underlying concrete slabs which reflects through to the surface.
- **Typical Cause:** Poor load transfer between concrete slabs. It can also be caused by shattered concrete slabs that were not previously patched, or it can be caused by previous patches constructed with full-depth asphalt.
- **Typical Location:** Transverse, usually spaced every 30’ to 40’. It can also be found longitudinally in locations where the original concrete roadway was later widened with full-depth asphalt.

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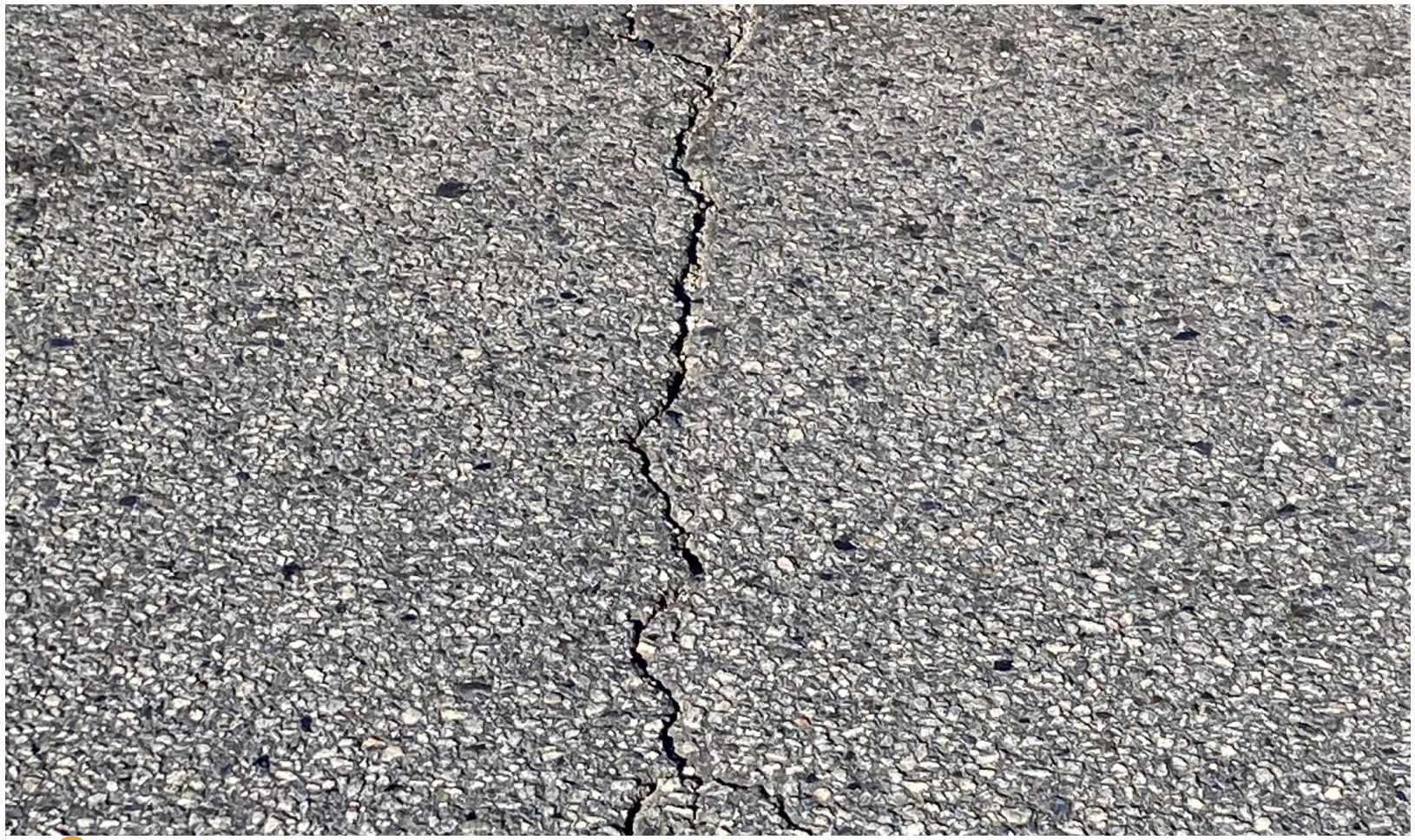
Joint Reflection Cracking: Low Severity

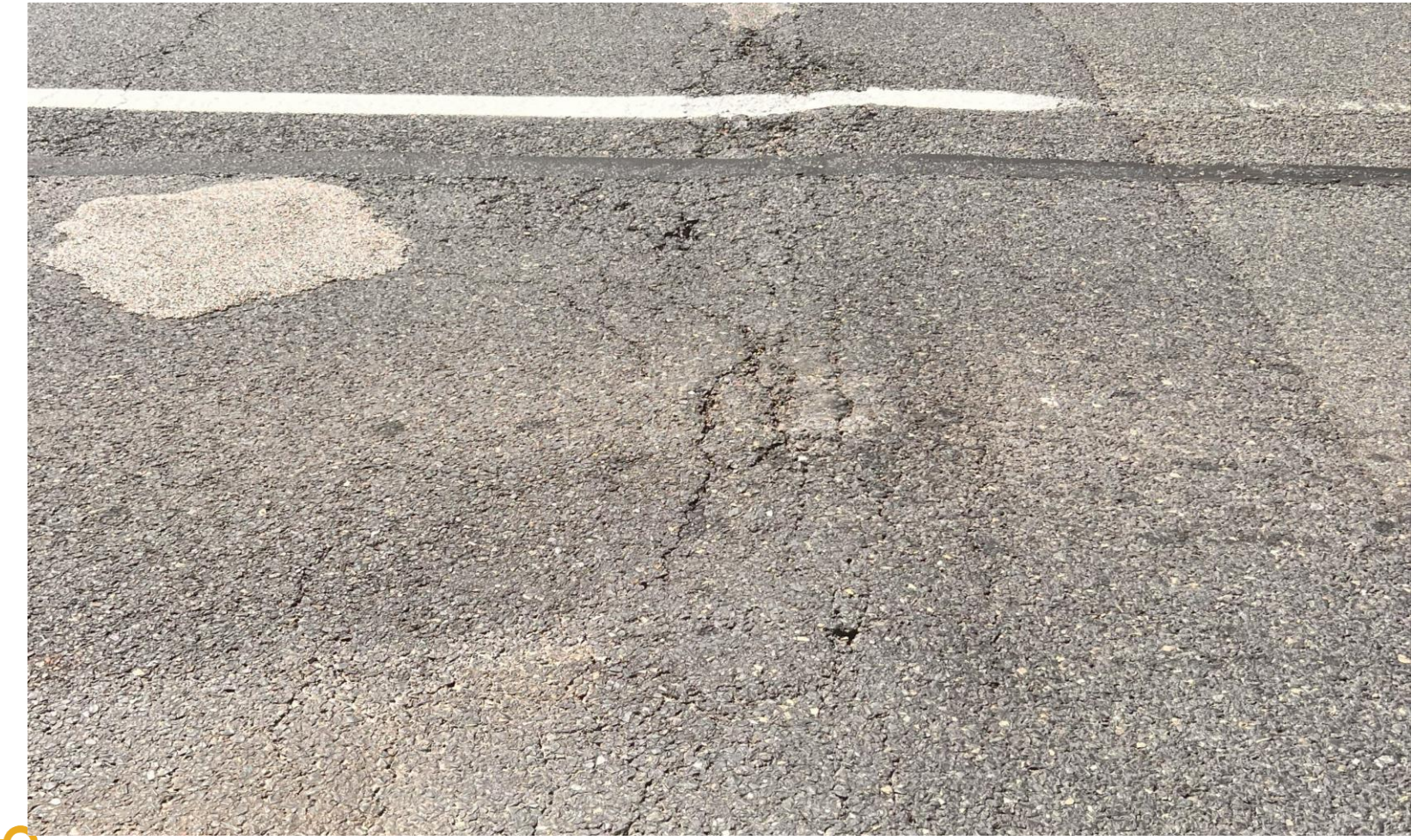
Typically a fairly straight, single transverse or longitudinal crack less than 3/8" wide, and above a concrete joint

Crack Seal	Yes
Mastic	No
Patch	No



Joint Reflection Cracking: Medium Severity

Typically a fairly straight, transverse, or longitudinal crack between 3/8" and 3" wide, and above a concrete joint. This picture also has a bump associated with it.

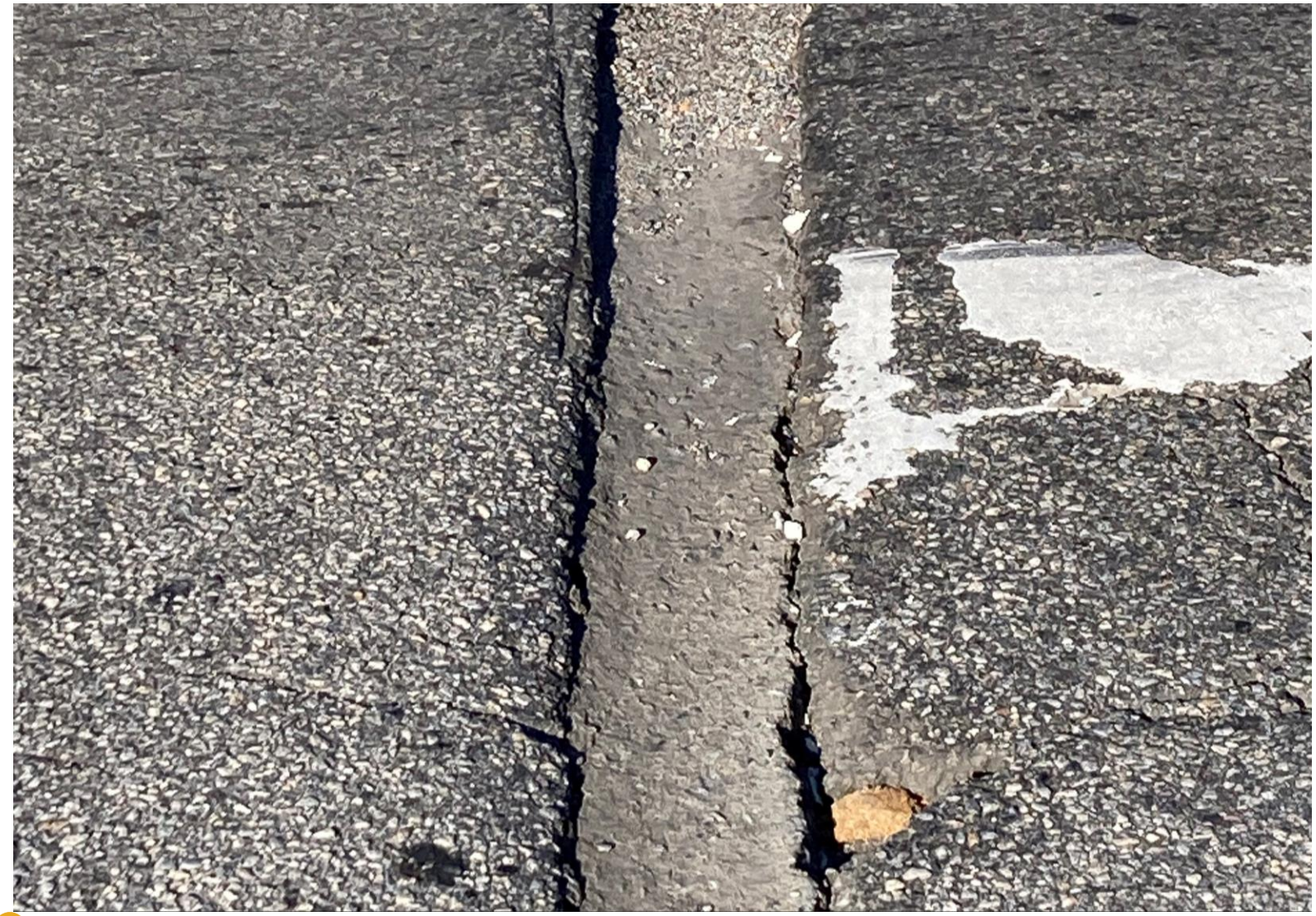


Crack Seal	Yes
Mastic	Yes
Patch	See Repair Guidelines

Joint Reflection Cracking: High Severity

Typically a fairly straight, transverse, or longitudinal crack at least 3" wide, and above a concrete joint.

Crack Seal	No
Mastic	Yes
Patch	See Repair Guidelines



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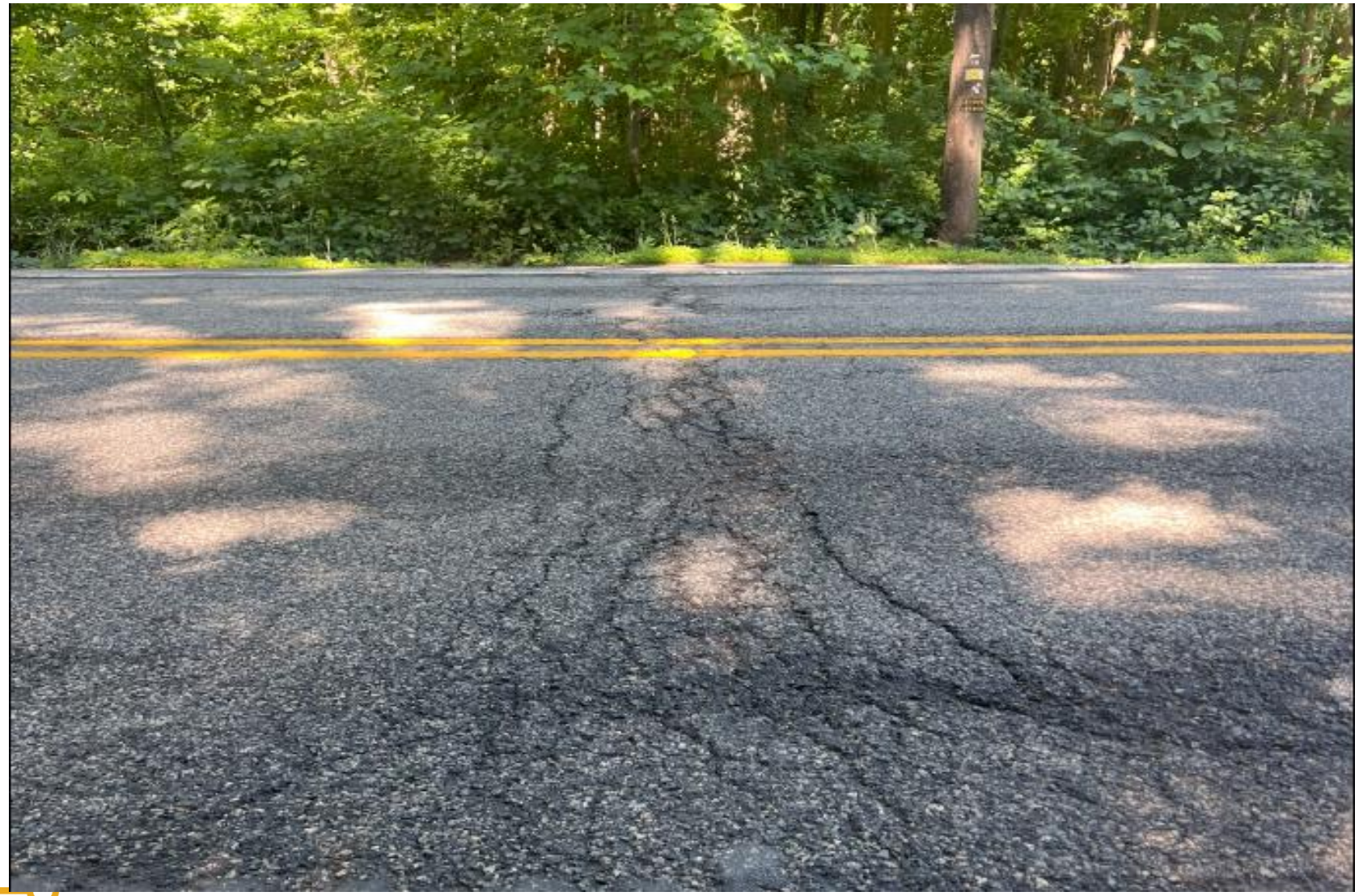
Joint Reflection Cracking: High Severity

Typically a fairly straight, transverse, or longitudinal crack at least 3" wide, and above a concrete joint.

Crack Seal	No
Mastic	No
Patch	See Repair Guidelines



Joint Reflection Cracking: Repair Guidelines

Severity	Low	Medium	High
Crack Seal	Yes	Yes	
Mastic		Yes	No/Yes
Patching – no noticeable bumps and will be resurfaced			Partial
Patching – patch only project and no noticeable bumps		Partial	Partial
Patching – noticeable bumps and asphalt is 2” to 3” thick		Full	Full
Patching – noticeable bumps and asphalt is 3” to 6” thick		Partial	Full
Patching – noticeable bumps and asphalt is more than 6” thick		Partial	Partial
Notes		1	1

1. Contact OMT-PAGD for guidance on patch thickness. **It is critical that concrete be patched in kind with concrete, per the specifications. Failure to do so will result in a sinking of the asphalt patch, creating two joint reflection cracks.**

Non-wheelpath Cracking

- Transverse
- Longitudinal
- Block
- Construction Joints
- Diagonal

- **Description:** A functional distress, typically limited to the surface.
- **Typical Cause:** Environmental factors as asphalt ages and becomes increasingly brittle and less able to withstand heating and cooling cycles.

  Cracks at construction joints are also put in this category since they are typically limited to the surface and are not load-related, but rather a function of inadequate compaction efforts during paving.
- **Typical Location:** Anywhere except longitudinally in the wheelpath.

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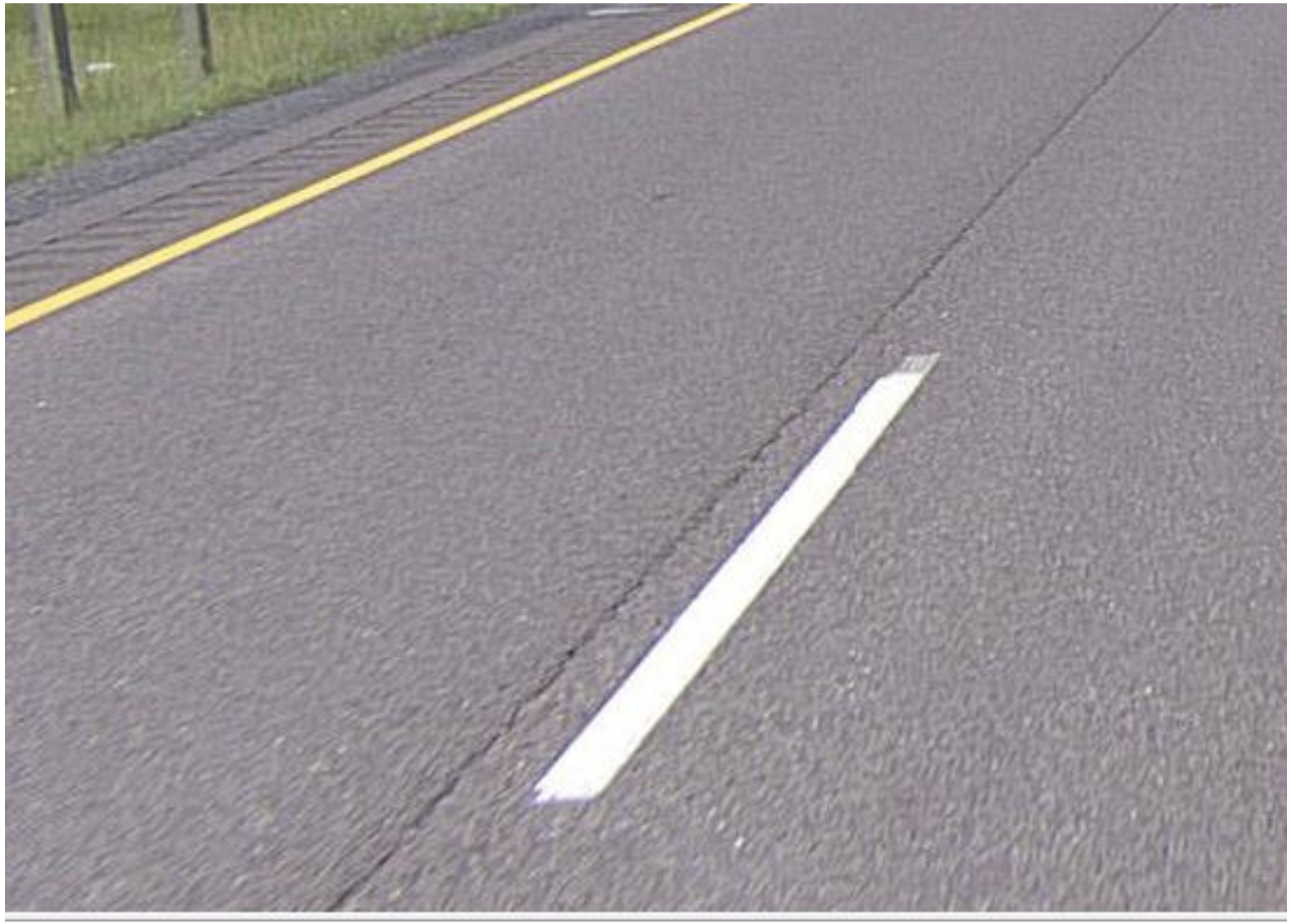
Non-wheelpath Cracking: Low Severity

Typically any meandering crack or construction joint less than 3/8" wide that is NOT longitudinal in the wheelpath nor a joint reflection crack.

Crack Seal	Yes
Mastic	No
Patch	No



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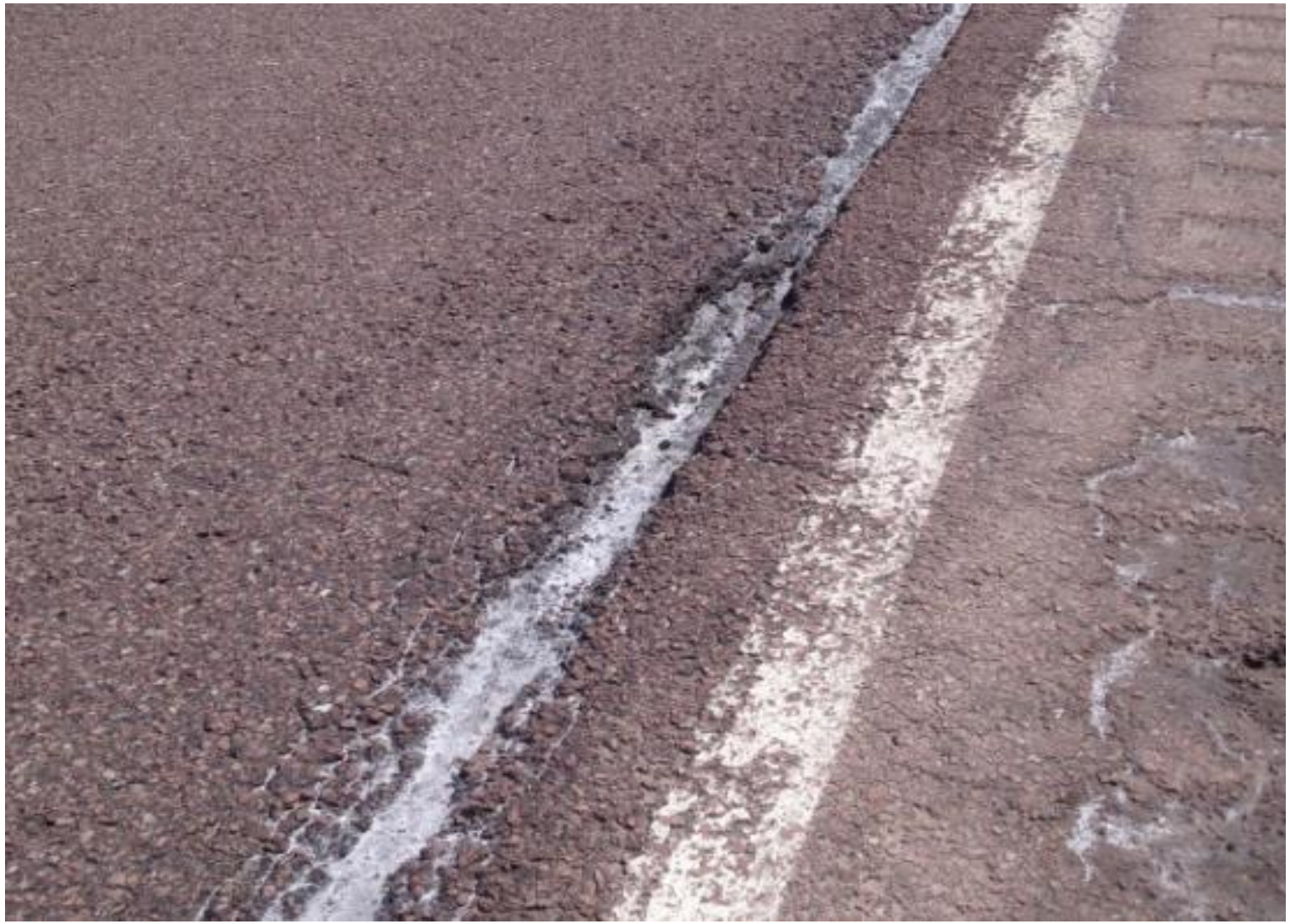
Non-wheelpath Cracking: Medium Severity

Typically any meandering crack or construction joint between 3/8" and 3" wide that is NOT longitudinal in the wheelpath nor a joint reflection crack.

Crack Seal	Yes
Mastic	Yes
Patch	No



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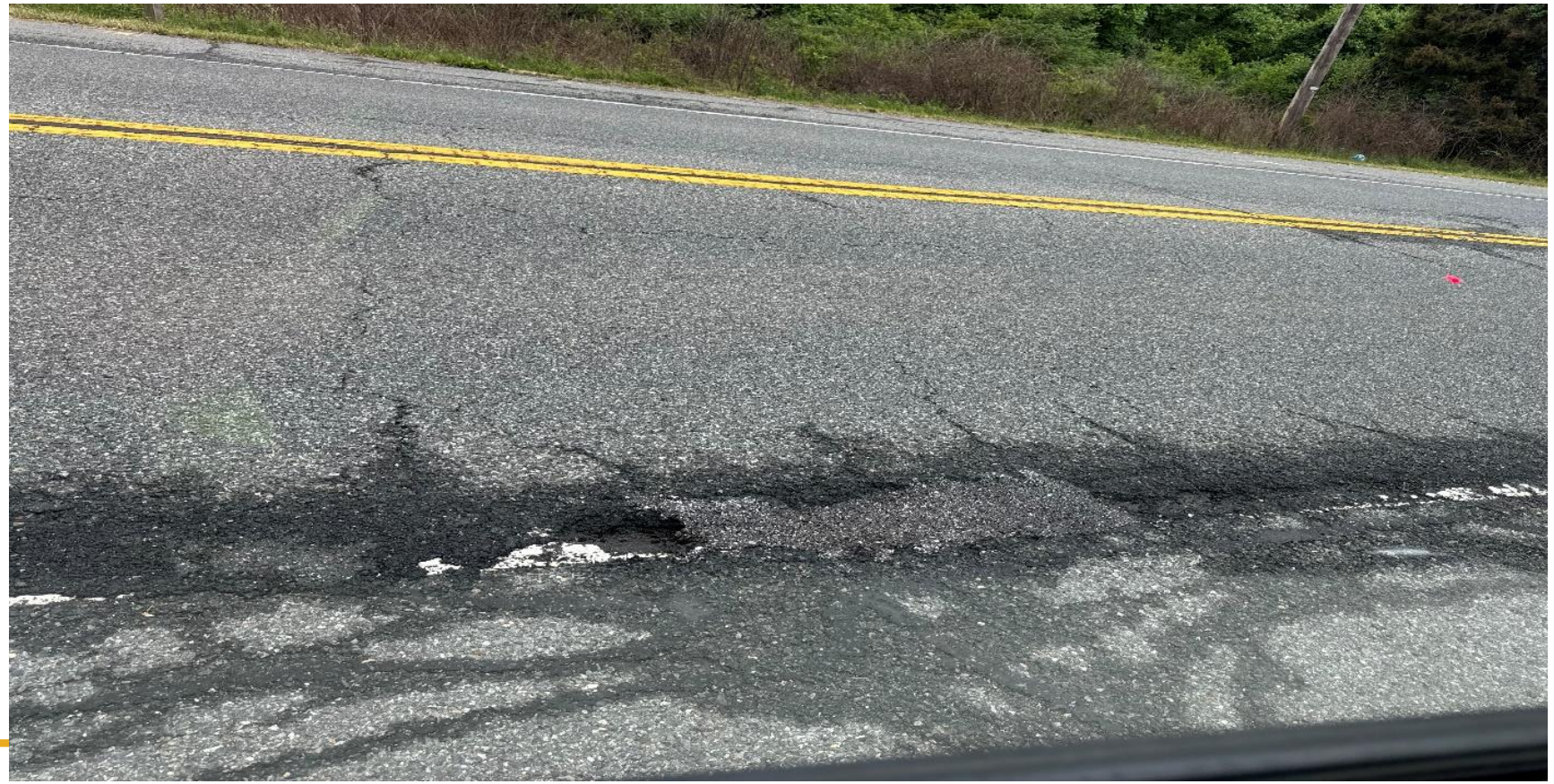
Non-wheelpath Cracking: High Severity

Typically any meandering crack or construction joint at least 3" wide that is NOT longitudinal in the wheelpath nor a joint reflection crack.

Crack Seal	No
Mastic	Yes
Patch	See Repair Guidelines



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Non-wheelpath Cracking: Repair Guidelines

Severity	Low	Medium	High
Crack Seal	Yes	Yes	
Mastic		Yes	Yes
Patching			Partial
Notes			1

1. Contact OMT-PAGD for guidance on patch thickness.

Potholes/Failures

- **Description:** A bowl-shaped depression, usually with sharp edges and vertical sides near the surface, where pavement has spalled out.
- **Typical Cause:** Water infiltrating cracks/joints, thereby weakening the subgrade and any delamination that has occurred, and when the water freezes, the expanding ice causes potholes
- **Typical Location:** Anywhere.

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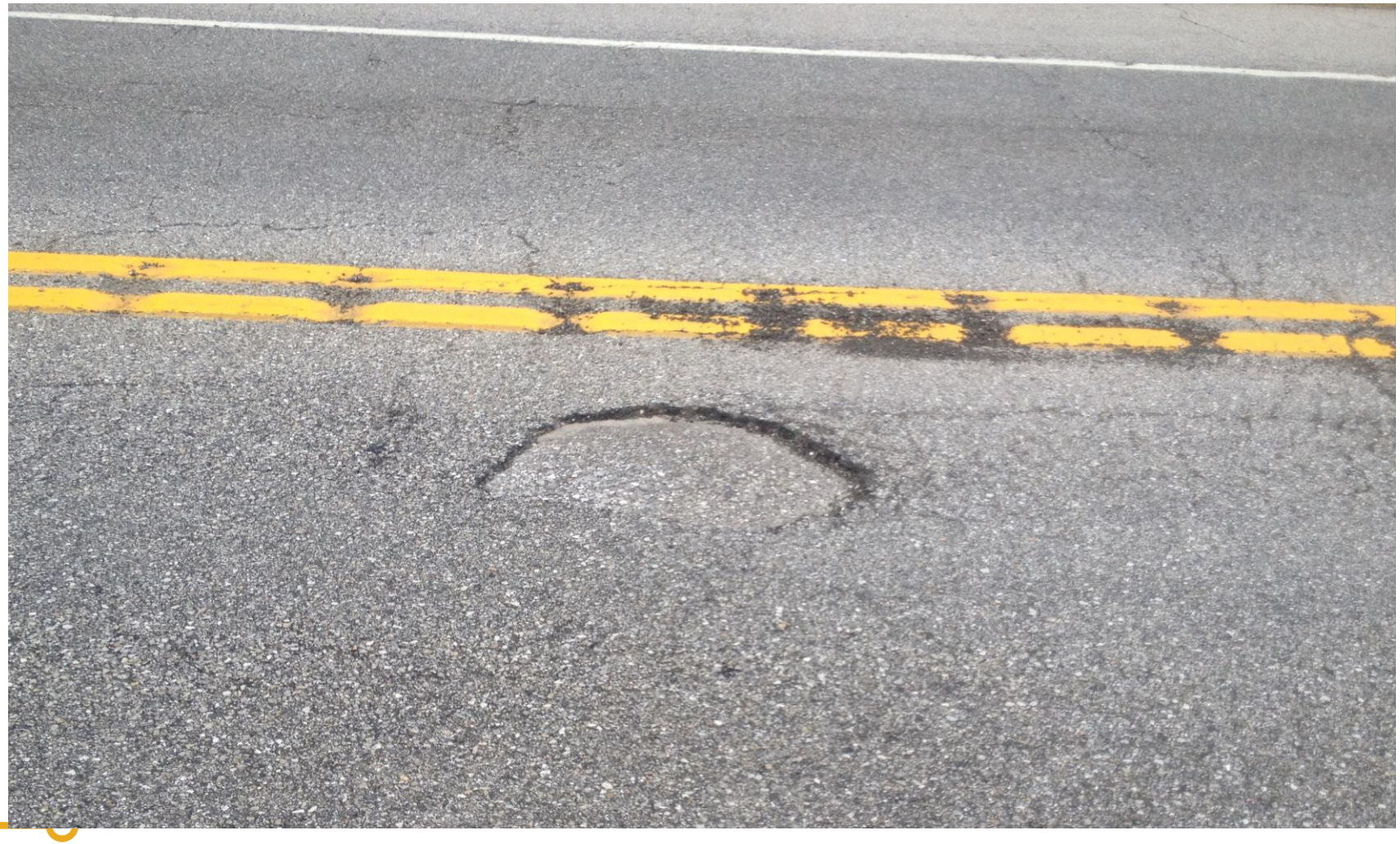
Potholes/Failures: Low Severity

Typically Less than 18" in diameter and up to 1" deep, or less than 8" in diameter and up to 2" deep.

Crack Seal	No
Mastic	Yes
Patch	See Repair Guidelines



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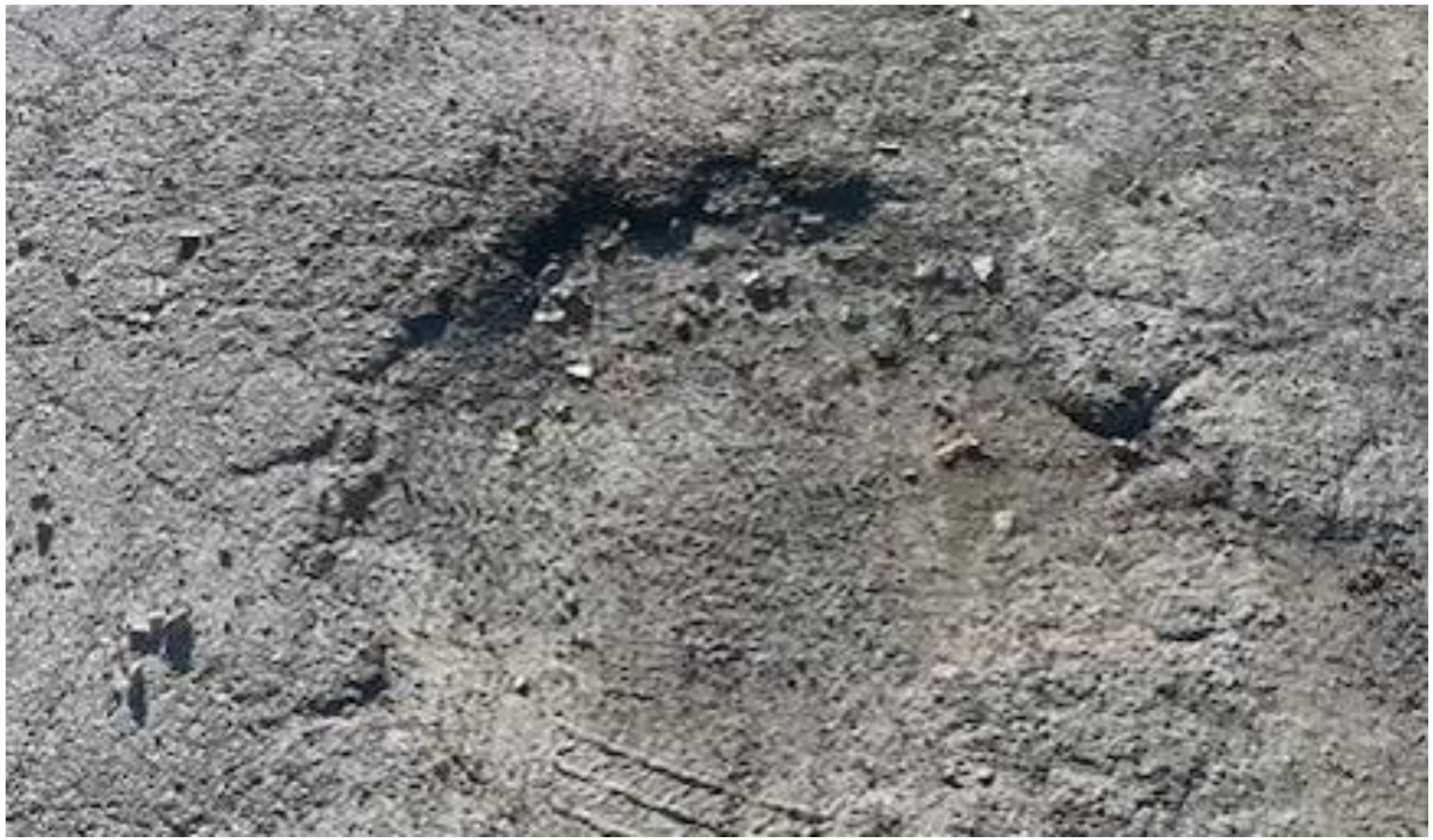
Potholes/Failures: Medium Severity

Typically 18" to 30" in diameter and up to 1" deep, or 8" to 18" in diameter and at least 1" deep, or less than 8" in diameter and more than 2" deep.



Crack Seal	No
Mastic	Yes
Patch	See Repair Guidelines

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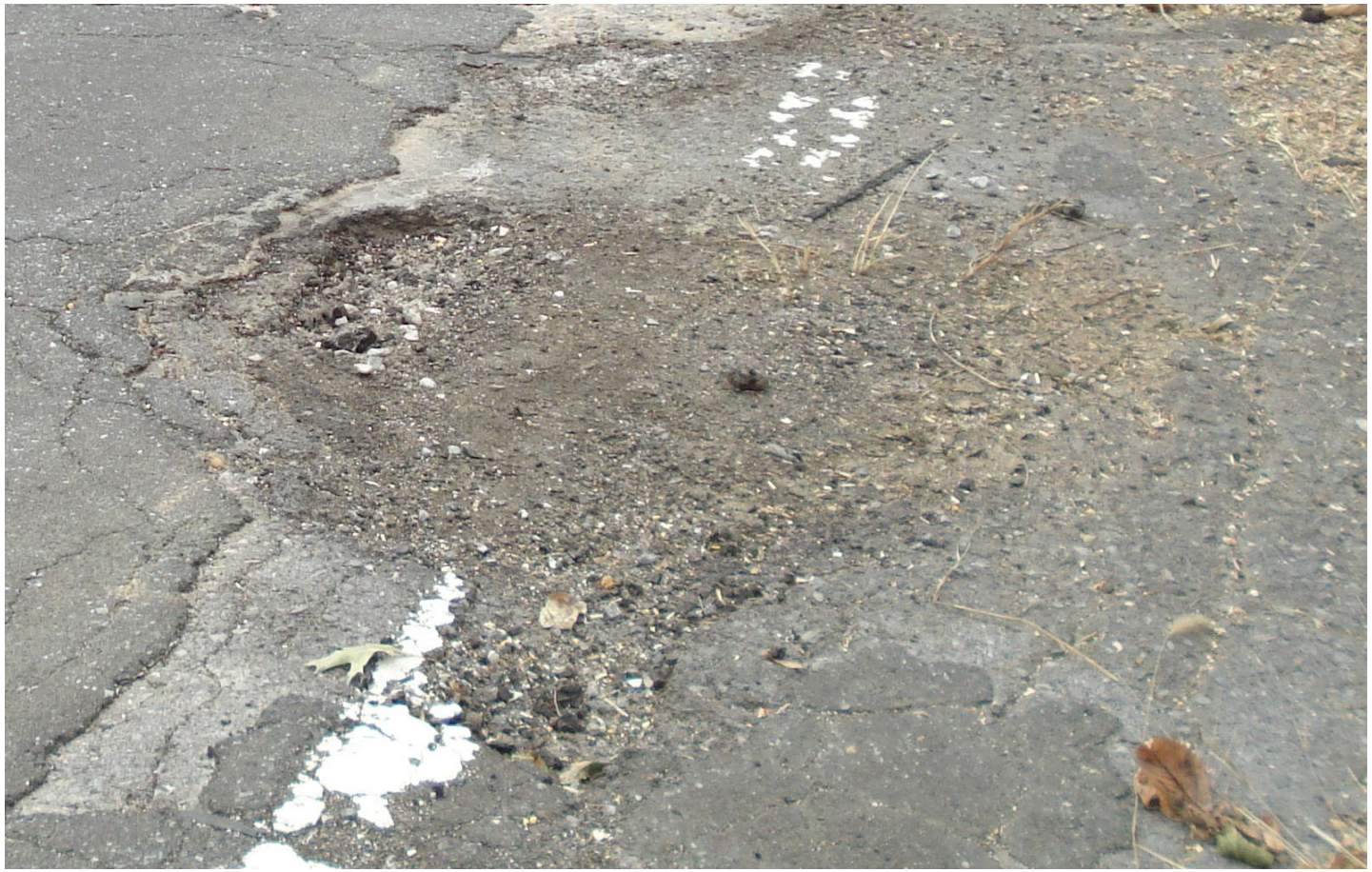
Potholes/Failures: High Severity

Typically at least 18" in diameter and at least 1" deep.

Crack Seal	No
Mastic	No
Patch	See Repair Guidelines



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Potholes/Failures: Repair Guidelines

Severity	Low	Medium	High
Crack Seal			
Mastic	Yes	Yes	
Patching	Partial	Partial	Full
Notes			1

1. Contact OMT-PAGD for guidance on patch thickness. Matching existing pavement thickness may be structurally insufficient, leading to repeated failure. A thicker-than-existing patch may be needed.

Existing Patches

- **Description:** An area of pavement that has been patched with new material, no matter how well it is performing.
- **Typical Cause:** A previous distress.
- **Typical Location:** Anywhere.

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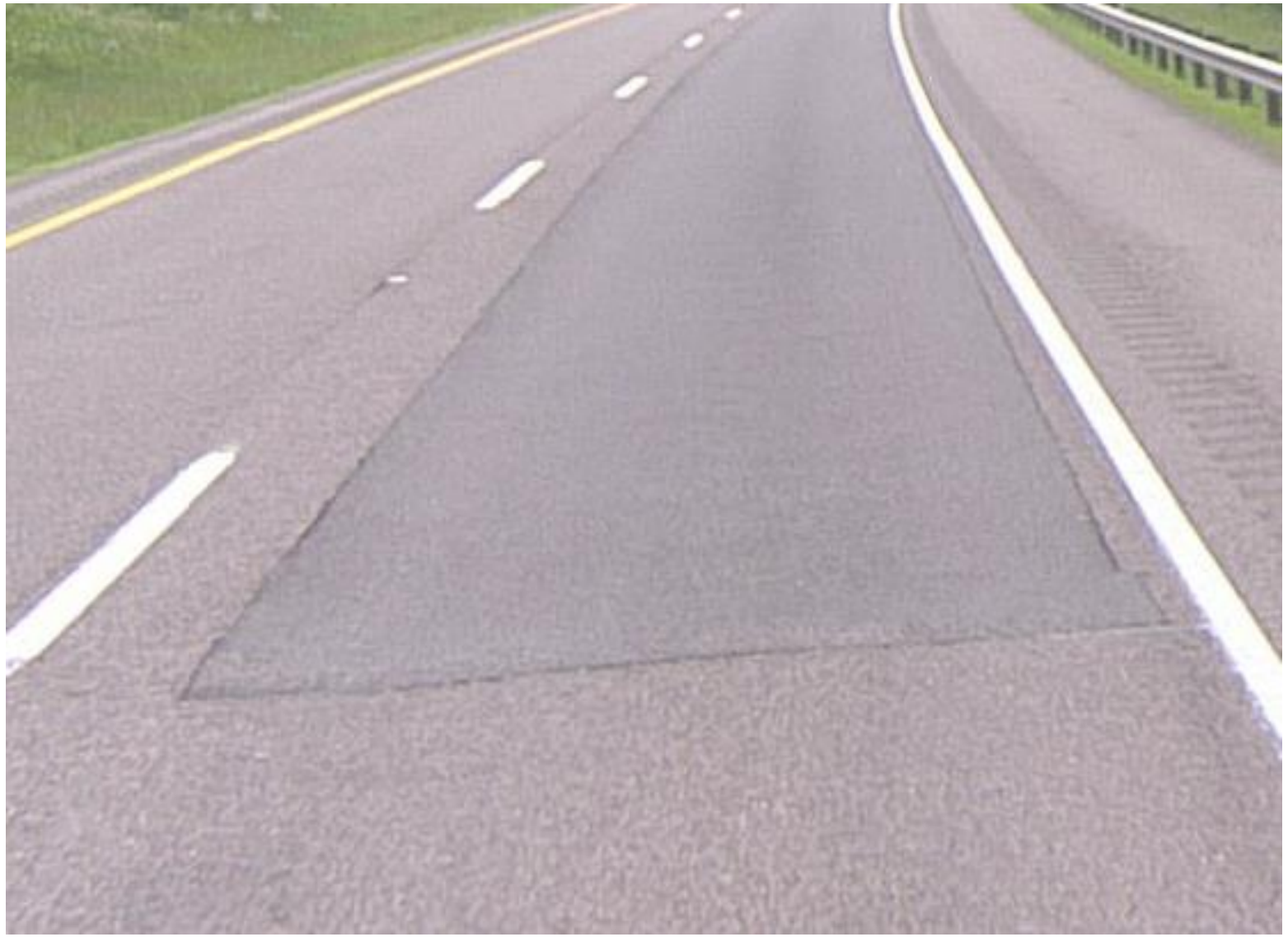
Existing Patching: Low Severity

Typically in good condition and satisfactory. Ride quality is good.

Crack Seal	Yes
Mastic	No
Patch	No



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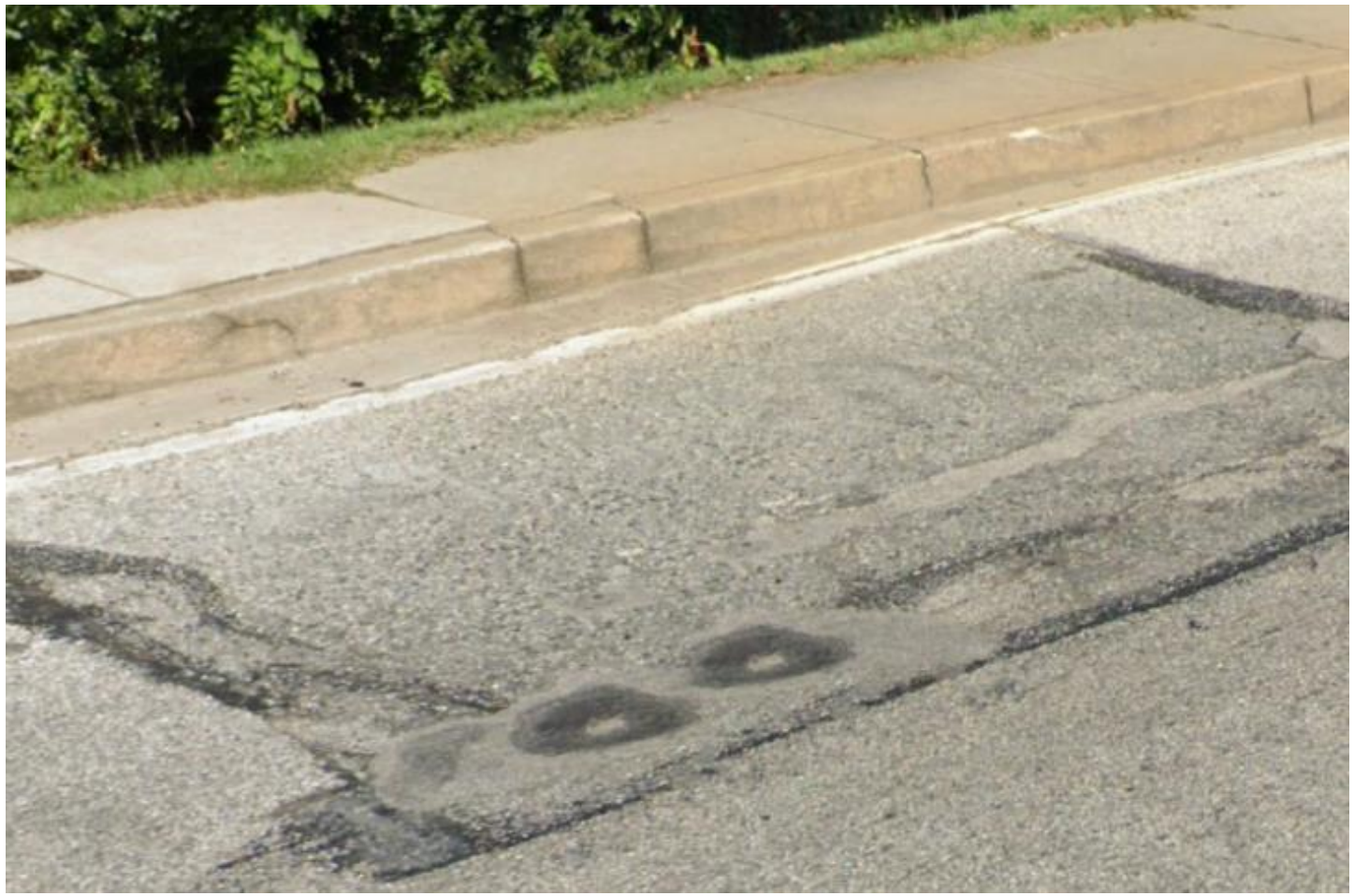
Existing Patching: Medium Severity

Typically moderately deteriorated and/or mediocre ride quality.

Crack Seal	No
Mastic	No
Patch	See Repair Guidelines



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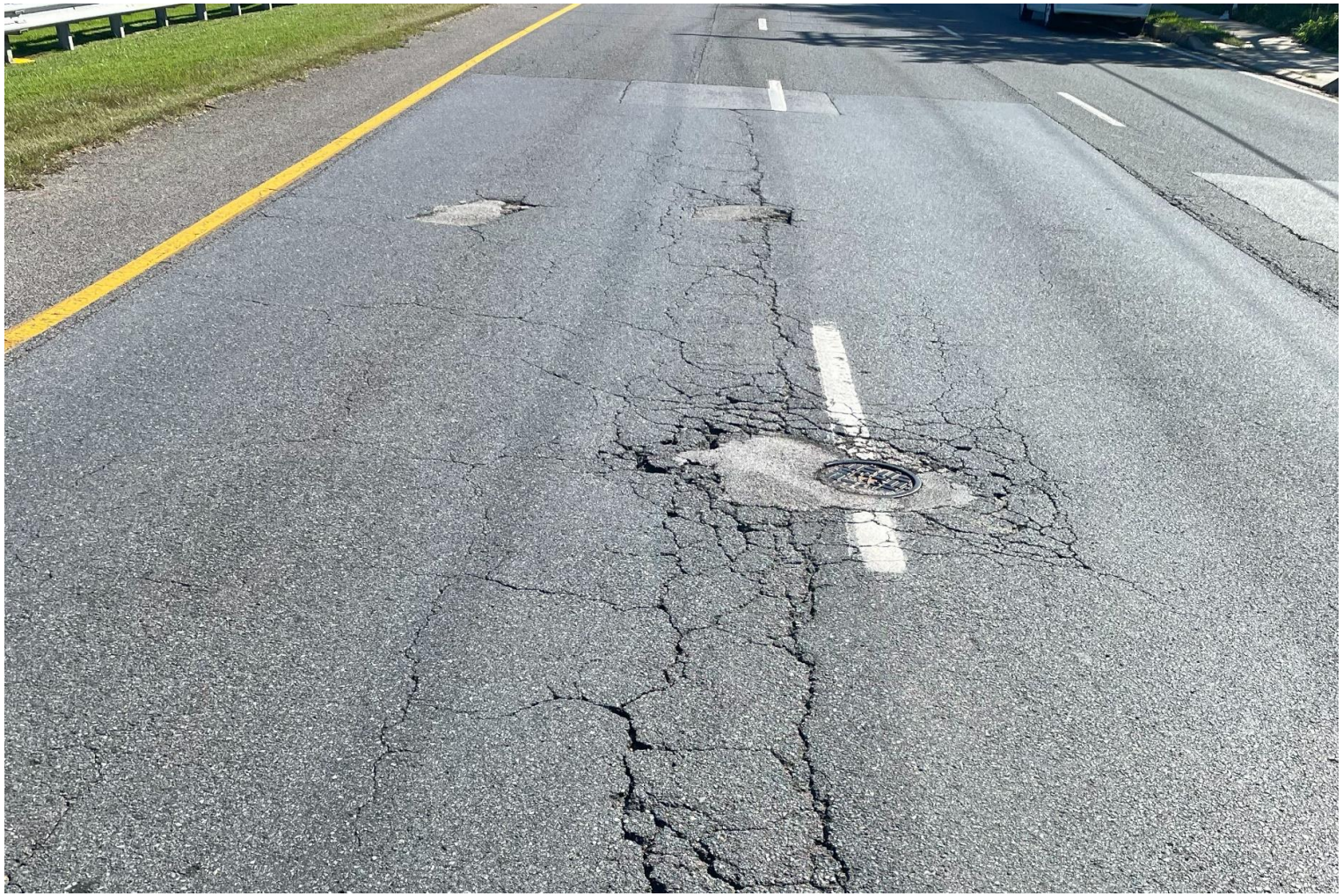
Existing Patching: High Severity

Typically badly deteriorated and /or poor ride quality.

Crack Seal	No
Mastic	No
Patch	See Repair Guidelines



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Existing Patching: Repair Guidelines

Severity	Low	Medium	High
Crack Seal if no resurfacing within 3 months or if to be resurfaced with 1" or thinner preventive maintenance	Yes		
Mastic			
Patching - asphalt thickness greater than 6"		Partial	Full
Patching - asphalt thickness less than 6"		Full	Full
Patching - Shoulders			Full
Notes			1

Notes:

1. Contact OMT-PAGD for guidance on patch thickness. Matching existing pavement thickness may be structurally insufficient, leading to repeated failure. A thicker-than-existing patch may be needed.

Bumps and Sags

- **Description:** Bumps are small, localized, upward displacements of the pavement surface. Sags are the opposite. They are both spaced more than 10 feet apart.
- **Typical Cause:** Buckling of underlying concrete, frost heave, or infiltration and buildup of material in a crack.
- **Typical Location:** Transverse locations.

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Bumps and Sags: Low Severity

Typically causes fair ride quality.

Note: no picture available since it is difficult to see low severity bumps and sags in a picture. And, it wouldn't qualify for a repair.

Crack Seal	No
Mastic	No
Patch	No

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Bumps and Sags: Medium Severity

Typically causes mediocre ride quality.

Crack Seal	No
Mastic	Yes
Patch	See Repair Guidelines

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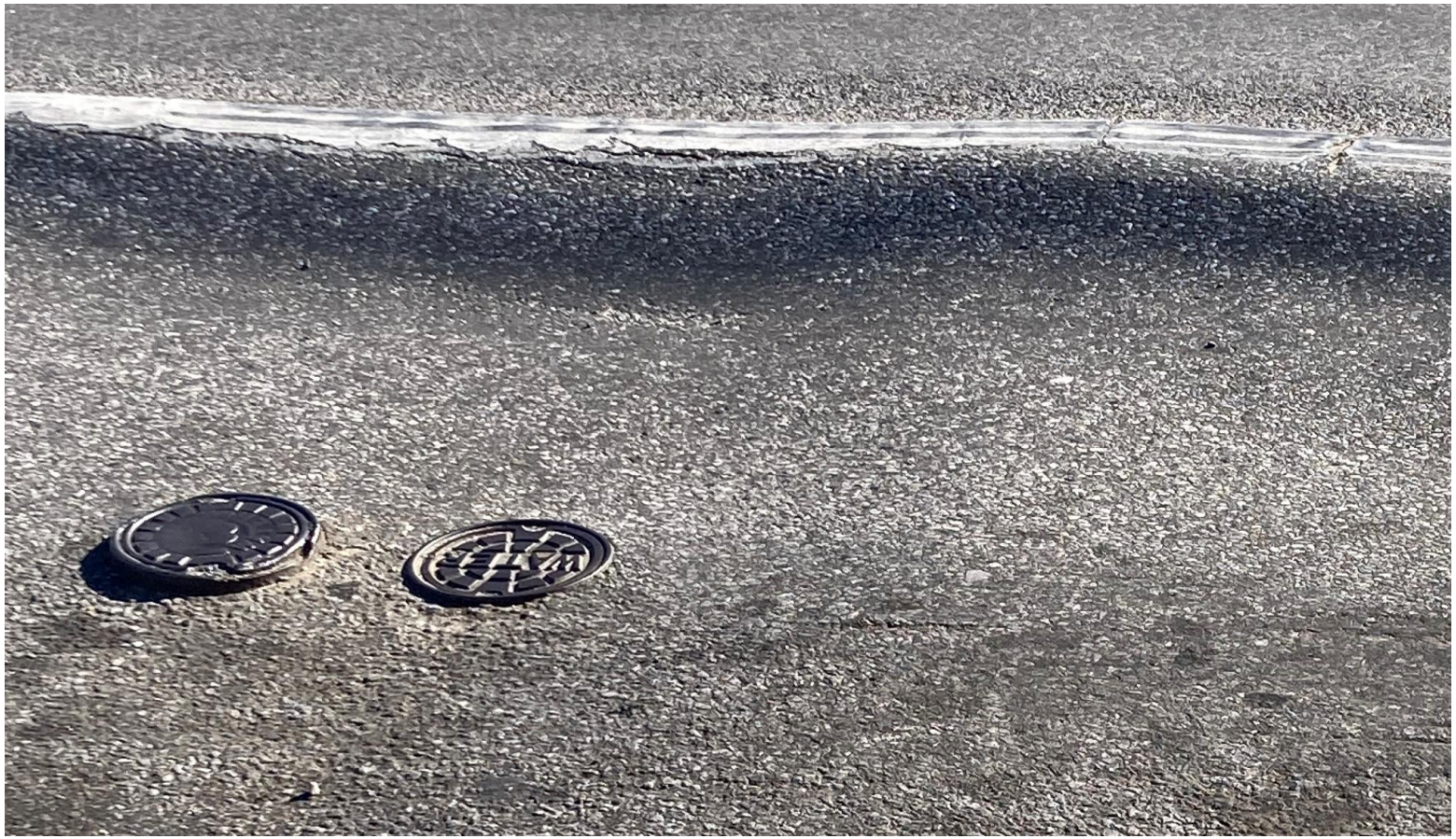
Bumps and Sags: High Severity

Typically causes poor ride quality.

Crack Seal	No
Mastic	Yes
Patch	See Repair Guidelines



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Bumps and Sags: Repair Guidelines

Severity	Low	Medium	High
Crack Seal			
Mastic		Yes	Yes
Patching – if not milling		Partial	Full
Patching – if milling			Full
Patching - asphalt thickness greater than 6"			Partial
Patching - asphalt thickness less than 6"			Full
Notes		1,2	1

1. Contact OMT-PAGD for guidance on patch thickness.
2. Full-depth patching may be needed if the distress is significantly deep (more than half the total HMA thickness).

Corrugation (aka Washboarding)

- **Description:** Looks like a washboard and is a series of closely spaced ridges and valleys.
- **Typical Cause:** Traffic action combined with unstable pavement material.
- **Typical Location:** Wheelpaths, approaching intersections.

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Corrugation: Low Severity

Typically causes fair ride quality.

Note: no picture available since it is difficult to see low severity corrugation in a picture. And, it wouldn't qualify for a repair.

Crack Seal	No
Mastic	No
Patch	No

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Corrugation: Medium Severity

Typically causes mediocre ride quality.

Crack Seal	No
Mastic	No
Patch	See Repair Guidelines

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Corrugation: High Severity

Typically causes poor ride quality.

Picture pending…once we find a good example. If you see one, please send to Geoff Hall at ghall1@mdot.Maryland.gov.

Crack Seal	No
Mastic	No
Patch	See Repair Guidelines

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Corrugation: Repair Guidelines

Severity	Low	Medium	High
Crack Seal			
Mastic			
Patching		Partial	Partial
Notes		1	1

1. Contact OMT-PAGD for guidance on patch thickness. Full-depth patching may be needed if the distress is significantly deep (more than half the total HMA thickness).

Depressions

- **Description:** Localized pavement surface areas with elevations slightly lower than those of the surrounding pavement.
- **Typical Cause:** Settlement of foundation soil, improper compaction, or collapsed or failing pipes.
- **Typical Location:** Transverse locations.

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Depressions: Low Severity

Typically ½" to 1" deep.

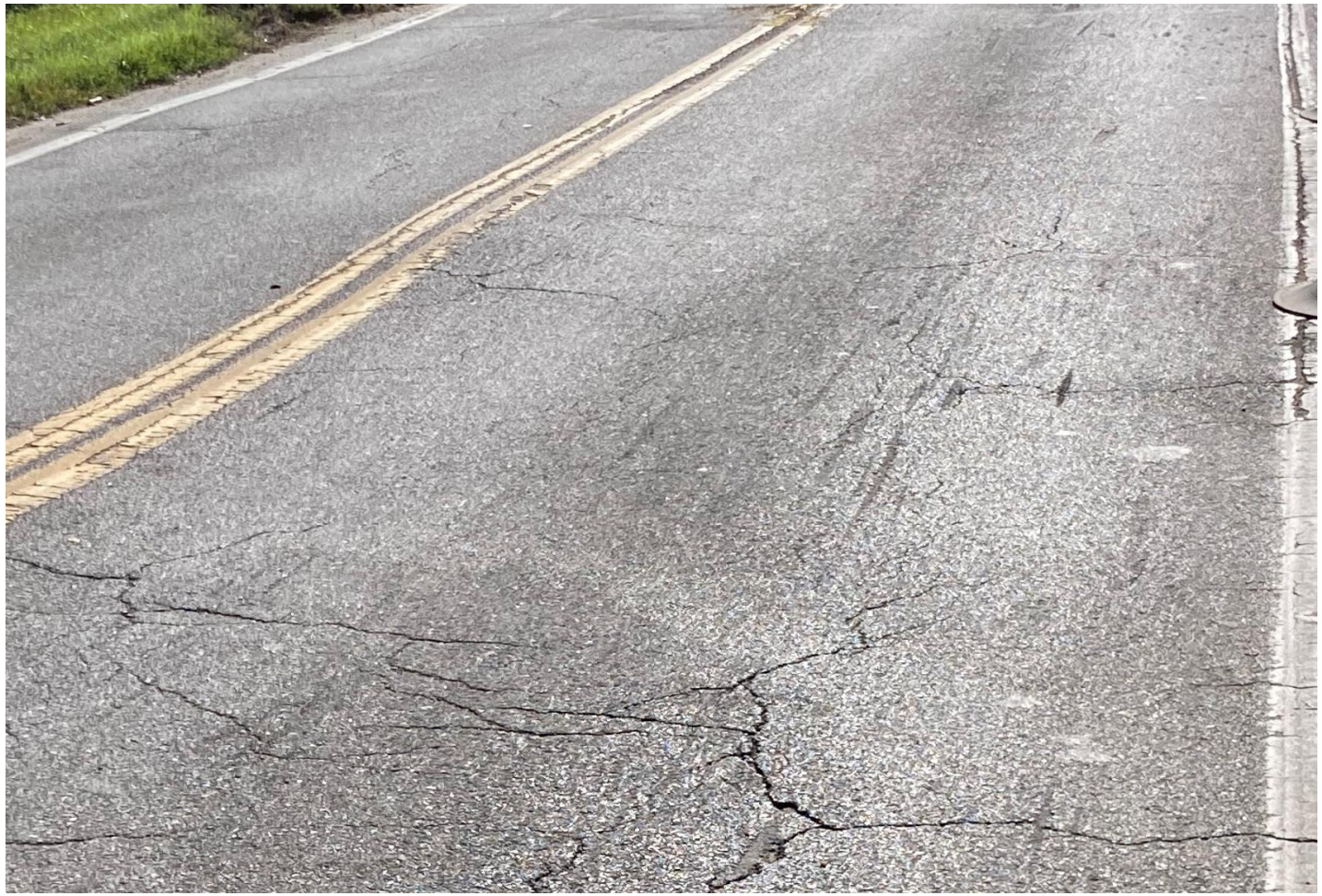
Note: no picture available since it is difficult to see low severity depressions in a picture. And, it wouldn't qualify for a repair.

Crack Seal	No
Mastic	No
Patch	No

Depressions: Medium Severity

Typically 1" to 2" deep.

Crack Seal	No
Mastic	Yes
Patch	See Repair Guidelines



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Depressions: High Severity

Typically more than 2" deep.

Crack Seal	No
Mastic	Yes
Patch	See Repair Guidelines

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Depressions: Repair Guidelines

Severity	Low	Medium	High
Crack Seal			
Mastic		Yes	Yes
Patching – if not milling		Partial	Full
Patching – if milling			Full
Patching - asphalt thickness greater than 6"			Partial
Patching - asphalt thickness less than 6"			Full
Notes		1,2	1

1. Contact OMT-PAGD for guidance on patch thickness.
2. Full-depth patching may be needed if the distress is significantly deep (more than half the total HMA thickness).

Shoving

- **Description:** A short, abrupt wave.
- **Typical Cause:** Traffic pushing against the pavement.
- **Typical Location:** Wheelpaths, where asphalt pavements abut concrete pavements.

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Shoving: Low Severity

Typically causes fair ride quality.

Note: no picture available since it is difficult to see low severity shoving in a picture. And, it wouldn't qualify for a repair.

Crack Seal	No
Mastic	No
Patch	No

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Shoving: Medium Severity

Typically causes mediocre ride quality.

Picture pending…once we find a good example. If you see one, please send to Geoff Hall at ghall1@mdot.Maryland.gov.

Crack Seal	No
Mastic	No
Patch	See Repair Guidelines

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Shoving: High Severity

Typically causes poor ride quality.

Picture pending…once we find a good example. If you see one, please send to Geoff Hall at ghall1@mdot.Maryland.gov.

Crack Seal	No
Mastic	No
Patch	See Repair Guidelines

Shoving: Repair Guidelines

Severity	Low	Medium	High
Crack Seal			
Mastic			
Patching		Partial	Partial
Notes		1	1

1. Contact OMT-PAGD for guidance on patch thickness. Full-depth patching may be needed if the distress is significantly deep (more than half the total HMA thickness).

Slippage Cracking

- **Description:** Crescent or half-moon shaped cracks, typically limited to the surface.
- **Typical Cause:** Debonding between the surface and underlying layers and produced by braking or turning wheels that cause the pavement surface to slide.
- **Typical Location:** Wheelpaths.

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Slippage Cracking: Low Severity

Typically average crack width is less than 3/8" wide.

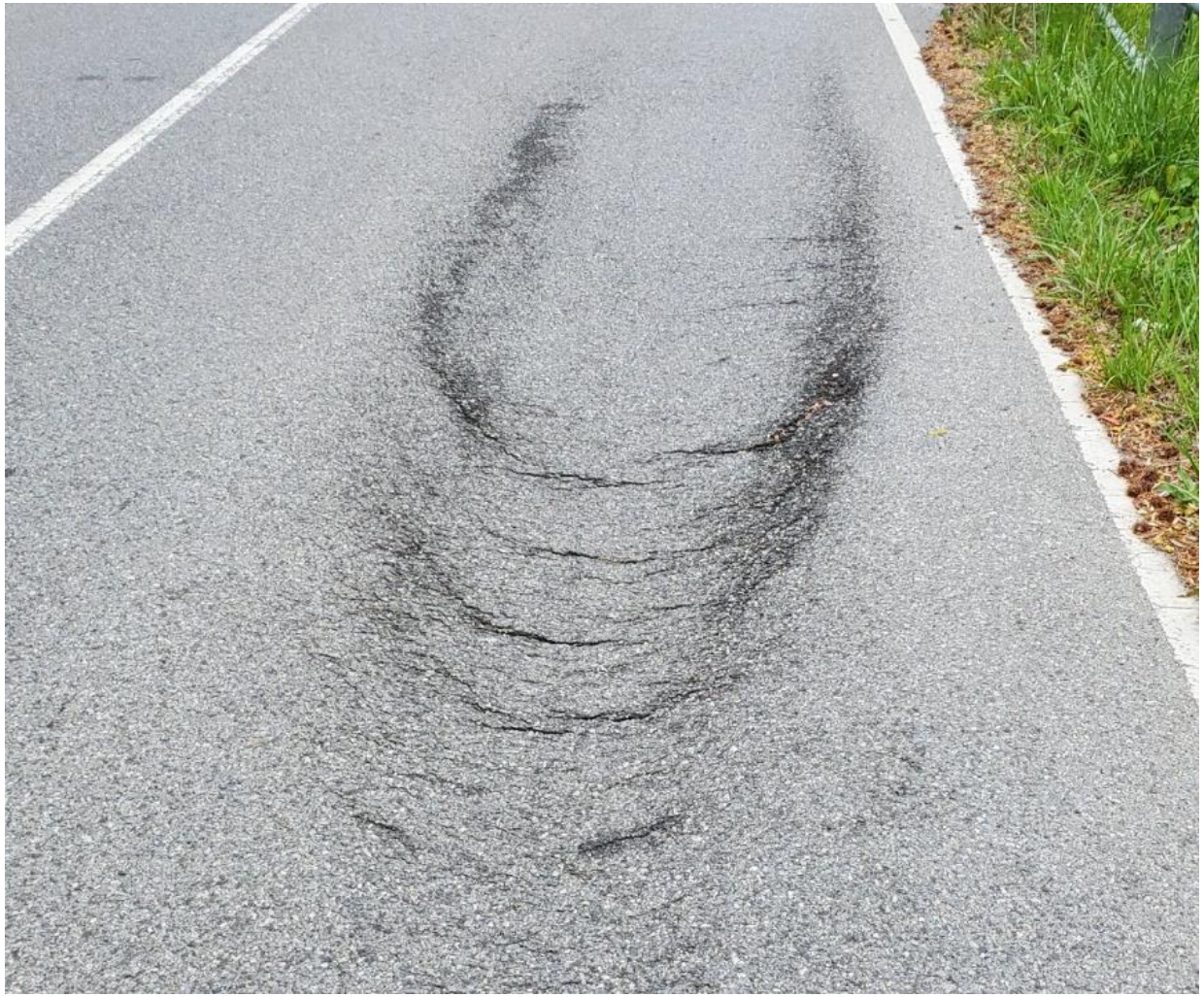
Picture pending…once we find a good example. If you see one, please send to Geoff Hall at ghall1@mdot.Maryland.gov.

Crack Seal	No
Mastic	No
Patch	No

Slippage Cracking: Medium Severity

Typically average crack width is between 3/8" and 1.5" or the area around the crack is moderately spalled and/or surrounded with secondary cracks.

Crack Seal	No
Mastic	No
Patch	See Repair Guidelines



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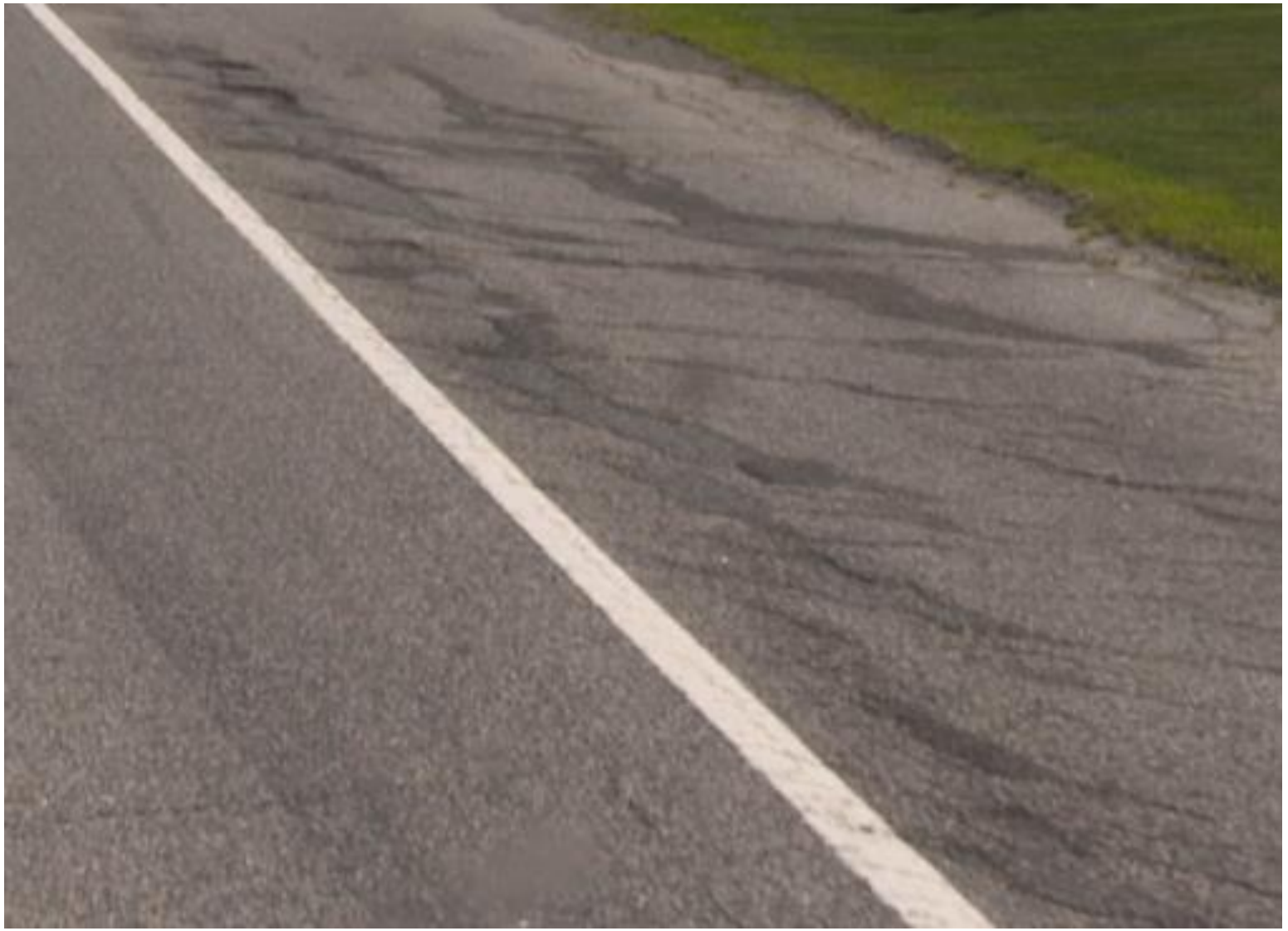
Slippage Cracking: High Severity

Typically average crack width is greater than 1.5" or the area around the crack is broken into easily removed pieces.

Crack Seal	No
Mastic	No
Patch	See Repair Guidelines



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Slippage Cracking: Repair Guidelines

Severity	Low	Medium	High
Crack Seal			
Mastic			
Patching		Partial	Partial
Notes		1	1

1. Contact OMT-PAGD for guidance on patch thickness. Full-depth patching may be needed if the distress is significantly deep (more than half the total HMA thickness).

Swells

- **Description:** An upward bulge in the pavement's surface – a long gradual wave more than 10' long.
- **Typical Cause:** Frost action or swelling soil.
- **Typical Location:** Transverse locations.

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Swells: Low Severity

Typically causes fair ride quality.

Note: no picture available since it is difficult to see low severity swells in a picture.
And, it wouldn't qualify for a repair.

Crack Seal	No
Mastic	No
Patch	No

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Swells: Medium Severity

Typically causes mediocre ride quality.

Picture pending…once we find a good example. If you see one, please send to Geoff Hall at ghall1@mdot.Maryland.gov.

Crack Seal	No
Mastic	No
Patch	See Repair Guidelines

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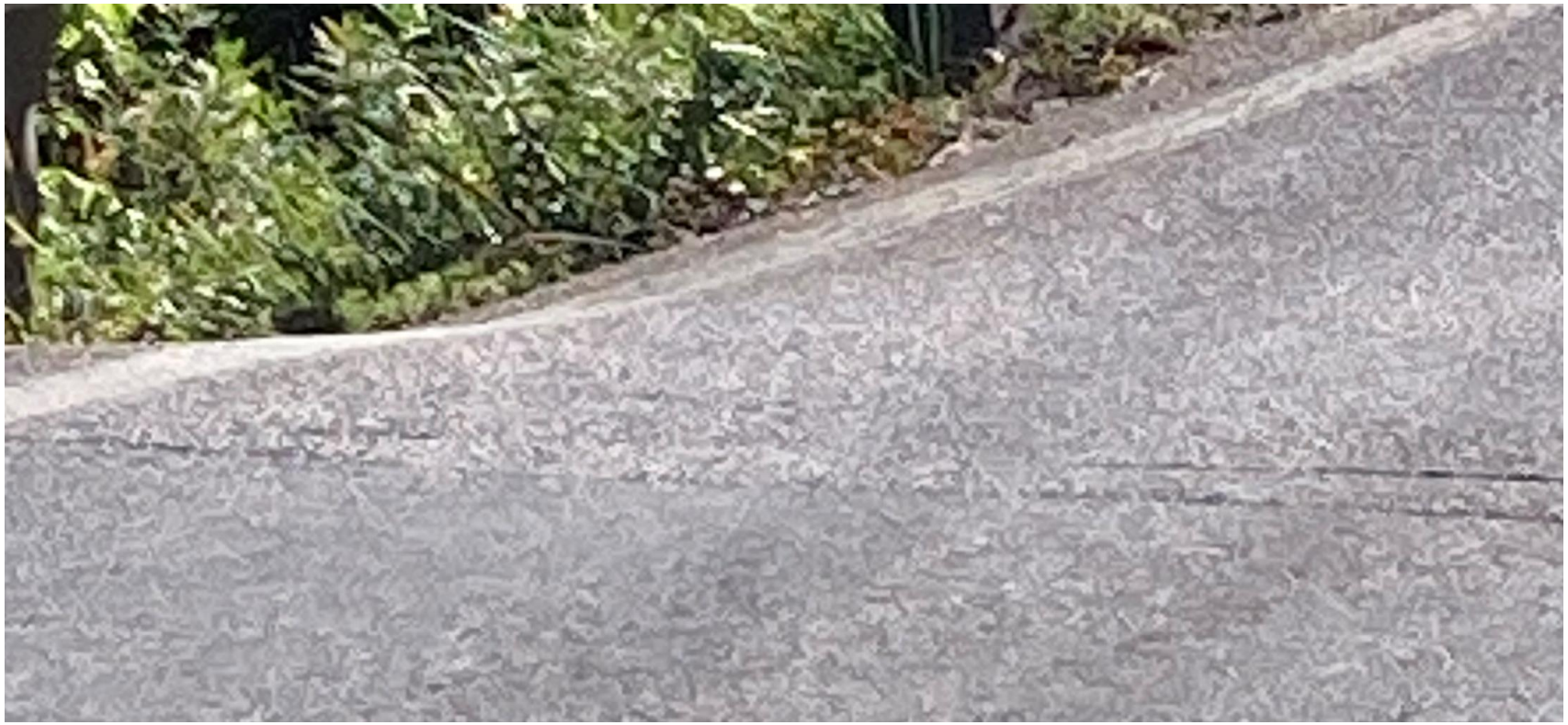
Swells: High Severity

Typically causes poor ride quality.



Crack Seal	No
Mastic	No
Patch	See Repair Guidelines

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Swells: Repair Guidelines

Severity	Low	Medium	High
Crack Seal			
Mastic			
Patching – if not milling		Partial	
Patching – if milling			
Patching - asphalt thickness greater than 6"			Partial
Patching - asphalt thickness less than 6"			Full
Notes		1,2	1

1. Contact OMT-PAGD for guidance on patch thickness.
2. Full-depth patching may be needed if the distress is significantly deep (more than half the total HMA thickness).

PAGD Contacts

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