# Longitudinal Joint Treatments to Improve Performance

## - for Local Agencies

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# Outline

1) Why Specify Special Treatments for Cold Longitudinal Joints?

2) ODOT 401.17 Cold Longitudinal Joint Treatment Specification Review
   - Pre-2008
   - 2008 – 2015
   - 2015 – Present

3) Cold Longitudinal Joint Treatments – Good, Better & Best (+)
   - Longitudinal Joint Adhesive
   - Void Reducing Asphalt Membrane
   - Longitudinal Joint Preparation
   - Mat and Joint Core Density

4) Cold Longitudinal Joint Design/Construction Tips

# Why Specify Special Treatments for Cold Longitudinal Joints?

- Cold Longitudinal Joint Performance continues to be an industry challenge not only in Ohio but nationally; especially when standard specifications and materials are used
- Cold Longitudinal Construction Joints are often the first areas to show signs of distress
- Poor density at joints with high(er) permeability allows oxygen and water into the pavement structure potentially resulting in premature cracking, stripping, freeze-thaw damage and disintegration
- Poorly constructed joints are expensive to maintain, e.g. crack sealing, mastics and pavement repairs
- Excessive maintenance is costly and increases inconvenience to the motoring public thus increasing user costs
- Poorly constructed joints decrease the expected life of your overlay/pavement

# Cold Longitudinal Joints – Pre-2008

**401.17 Joints.** Seal all cold longitudinal and transverse construction joints on surface courses, and any asphalt concrete course that is open to traffic for more than 30 days, by coating the vertical face of the cold joint with asphalt material, applied at a rate of 0.25 gallon per square yard (1 L/$m^2$).

**401.03 Materials.** Furnish materials conforming to:
Asphalt material (401.14, 401.18)
..... 702.01, 702.04, or 702.13

702.01 – Asphalt Binder
**702.04 – Emulsified Asphalts (typ. SS-1, SS-1H)**
702.13 – Rubberized Asphalt Emulsion

Tip: Avoid using tack coat for CLJ's. If used, apply a double application.

# Cold Longitudinal Joints – 2008-2015

**401.17 Joints.** Seal all cold longitudinal construction joints by coating the entire face of the cold joint with a certified 702.01 PG binder or 702.13 Rubberized Asphalt Emulsion to provide 100 percent coverage of the joint. Overlap the joint edges by at least 1/2 inch (13 mm). Seal all cold transverse construction joints with a certified 702.01 PG binder or 702.13 Rubberized Asphalt Emulsion to provide 100 percent coverage of the joint or with a certified 702.04 asphalt material applied at a rate of 0.25 gallon per square yard (1 L/$m^2$).

**401.03 Materials.** Furnish materials conforming to: acceptable

Asphalt binder

.... (asphalt concrete, 401.14, 401.15)..... 702.01

Asphalt material (401.14, 401.18)

..... 702.01, 702.04, or 702.13

Good

# Cold Longitudinal Joints – 2015-Present

**401.17 Joints.** Seal all cold longitudinal construction joints by coating the entire face of the cold joint with a certified 702.01 PG binder or Supplemental Specification 875.02 Hot Applied Asphaltic Joint Adhesive to provide 100 percent coverage of the joint. Overlap the joint edges by at least 1/2 inch (13 mm). Seal all cold transverse construction joints with a certified 702.01 PG binder, 875.02 Hot Applied Asphaltic Joint Adhesive or 702.13 SBR Asphalt Emulsion to provide 100 percent coverage of the joint or with a certified 702.04 asphalt material applied at a rate of 0.25 gallon per square yard (1 L/m$^2$).

**401.03 Materials.** 401.03 Materials. Furnish materials conforming to:
Asphalt binder
(asphalt concrete, 401.14, 401.15)..... 702.01
Asphalt material (401.14, 401.18).....
..... SS875.02, 702.01, 702.04, or 702.13

# Item 407 – Tack Coat

# Cold Longitudinal Joint Treatments

Better

Supplemental Specification (SS) 875 – Hot Applied Asphaltic Joint Adhesive Material and Construction Requirements (aka **Longitudinal Joint Adhesive**)

875.01 Description. This work consists of furnishing and installing a hot applied asphaltic joint adhesive on cold longitudinal construction joints in asphalt concrete pavements.

875.02 Materials. Use hot applied asphaltic joint adhesive meeting the following requirements:

| Test | Description | Requirement |
|---|---|---|
| ASTM D 3236 | Brookfield Viscosity @ 400°F (205°C) | 4,000 - 10,000 CP |
| ASTM D 5329 | Cone Penetration @ 77°F (25°C) | 60-100 dmm |
| ASTM D 5329 | Flow @ 140°F (60°C) | 5 mm Max. |
| ASTM D 5329 | Resilience @ 77°F (25°C) | 30% Min. |
| ASTM D 113 | Ductility @ 77°F (25°C) | 30 cm Min. |
| ASTM D 113 | Ductility @ 39.2°F (4°C) | 30 cm Min. |
| ASTM D 5329 | Tensile Adhesion @ 77°F (25°C) | 500% Min. |
| AASHTO T 53 | Softening Point | 170°F Min. |
| ASTM D 5329 | Asphalt Compatibility | Pass |

875.04 Placement. Ensure the face of the longitudinal joint is clean, dry, and free from debris before the joint adhesive is applied. Apply the joint adhesive material to the entire face of the surface course of asphalt concrete pavement where an adjacent asphalt concrete pavement surface will be constructed. Apply at a recommended thickness of 0.125” (3.2 mm). The use of an application shoe attached to the end of application wand is required. Apply the joint adhesive in front of the paving operation. If the adhesive is tracked by construction vehicles, repair the damaged area and restrict traffic from driving on the adhesive.

875.07 Basis of Payment. The Department will pay for accepted quantities at the contract price as follows:

| **Item** | **Unit** | **Description** |
|---|---|---|
| 875 | Pounds (Kilogram) | Longitudinal Joint Adhesive |

Designer Notes:

Recommended rates of material to be used on longitudinal joints on plans for quantity calculations.

Material quantities:
For 2 inch thick pavements, apply at a rate of 1 pound per 2 feet.
For 1.75 inch thick pavements, apply at a rate of 1 pound per 3 feet.
For 1.5 inch thick pavements, apply at a rate of 1 pound per 4 feet.
For 1.25 inch thick pavements, apply at a rate of 1 pound per 5 feet.
For 1 inch thick pavements, apply at a rate of 1 pound per 6 feet.
For 0.75 inch thick pavements, apply at a rate of 1 pound per 7 feet.

This specification is to be used for surface courses only.

Do not include this as a pay item with asphalt concrete using SS 806 or 447 acceptance. For projects with multiple locations/roadways using different acceptance methods, this item may be specified as a pay item on the locations/roadways NOT using SS 806 or 447 acceptance

# Item 875 - Longitudinal Joint Adhesive Cost

From 2020 ODOT Summary of Contracts:

Avg. Unit Price Awarded $1.25 per pound

For 1.25” overlay ➔ $0.25 per foot

For 1.5” overlay ➔ $0.31 per foot

# SS 875 – Longitudinal Joint Adhesive

# SS 875 – Longitudinal Joint Adhesive

Best

# Cold Longitudinal Joint Treatments

Supplemental Specification (SS) 872 – Void Reducing Asphalt Membrane

**872.01 Description.** This work consists of furnishing and installing Void Reducing Asphalt Membrane (VRAM) material during construction of cold longitudinal construction joints in asphalt concrete surface courses.

**872.02 Materials.** Provide a base asphalt modified with styrene-butadiene diblock or triblock copolymer without oil extension, or styrene-butadiene rubber elastomers. Do not use air blown asphalt, acid modification, or other modifiers. Provide VRAM material certified in accordance with Supplement 1032 and meeting the requirements of Table 872.02-1.

**TABLE 872.02-1 VRAM MATERIAL REQUIREMENTS**

| Test | Test Requirement | Test Method |
|---|---|---|
| Dynamic shear @ 82°C (unaged), G*/sin δ, kPa | 1.00 min. | AASHTO T 315 |
| Creep stiffness @ -18°C (unaged), Est Stiffness (S), MPa<br>m-value | 300 max.<br>0.300 min. | AASHTO T 313 |
| Ash, % | 1.0 to 4.0 | AASHTO T 111 |
| Elastic Recovery, (unaged) 10 cm elongation, hold 5 minutes before cutting, 25°C, Report to nearest 0.1% | 65 min. | AASHTO T301 |
| Separation of Polymer, Difference in °C of the softening point (ring and ball apparatus) | 3 max. | ASTM D7173, AASHTO T53 |

**872.04 Construction.** Construct all cold longitudinal joints in the surface course using VRAM material. Do not seal the face of cold longitudinal joints in the surface course as required by 401.17 when using VRAM for the cold longitudinal joint.

**B.** Application of VRAM. Apply VRAM below cold longitudinal construction joints in surface courses. Apply VRAM only when the pavement surface temperature and the ambient temperature are a minimum of 40 °F (4.5 °C) and rising. Apply VRAM at the application rate and width listed in Table 872.04-1.

Coordinate the application of VRAM and placement of the asphalt mixture to ensure the center of the VRAM application is within ± 2.0 inches (50 mm) of the center of the cold longitudinal joint being constructed.

**TABLE 872.04-1 VRAM APPLICATION REQUIREMENTS**

| Surface Course Thickness, in. (mm) | VRAM Width, "W", in. (mm) | Application Rate [1], lb/ft (kg/m) |
|---|---|---|
| Dense Graded Asphalt Mixtures [2] | | |
| 1 (25) | 15 (380) | 0.95 (0.131) |
| 1 1/4 (32) | 15 (380) | 1.09 (0.151) |
| 1 1/2 (38) | 15 (380) | 1.22 (0.169) |
| 1 3/4 (45) | 15 (380) | 1.36 (1.188) |
| 2 (50) | 15 (380) | 1.49 (0.206) |
| 2 1/4 (55) | 15 (380) | 1.62 (0.224) |
| 2 1/2 (65) | 15 (380) | 1.76 (0.243) |
| SMA Mixtures [2] | | |
| 1 1/2 (38) | 12 (305) | 0.83 (0.115) |
| 1 3/4 (45) | 12 (305) | 0.92 (0.127) |
| 2 (50) | 12 (305) | 1.00 (0.138) |
| 424 Type B & SS-860 Thinlay Mixtures | | |
| 0.75 (19) | 15 (380) | 0.60 (0.082) |
| 1 (25) | 15 (380) | 0.67 (0.092) |
| 1 1/4 (32) | 15 (380) | 0.73 (0.101) |

[1] The application rate has a surface demand for liquid included within it. The nominal thickness of the VRAM may taper from the center of the application to a lesser thickness on the edge of the application. Maintain the width and application rate.
[2] In the event of a joint between an SMA and dense graded asphalt mixture, the use SMA application rate.

**872.07 Basis of Payment.** Department will pay for accepted quantities at the contract price as follows:

| Item | Unit | Description |
|---|---|---|
| 872 | Foot (Meter) | Void Reducing Asphalt Membrane |

**Designer Notes:**

This specification is to be used for surface courses only. Do not use this specification in combination with SS 806 or Item 447 Asphalt Concrete Mat and Joint Core Density Acceptance. When using this specification with 446 acceptance, joint cores per Item 446 Asphalt Concrete Core Density Acceptance cannot be used to calculate pay factors. The asphalt concrete surface course pay item must be modified to remove joint cores similar to the example APP note below. No note is required if using this specification with 448 acceptance.

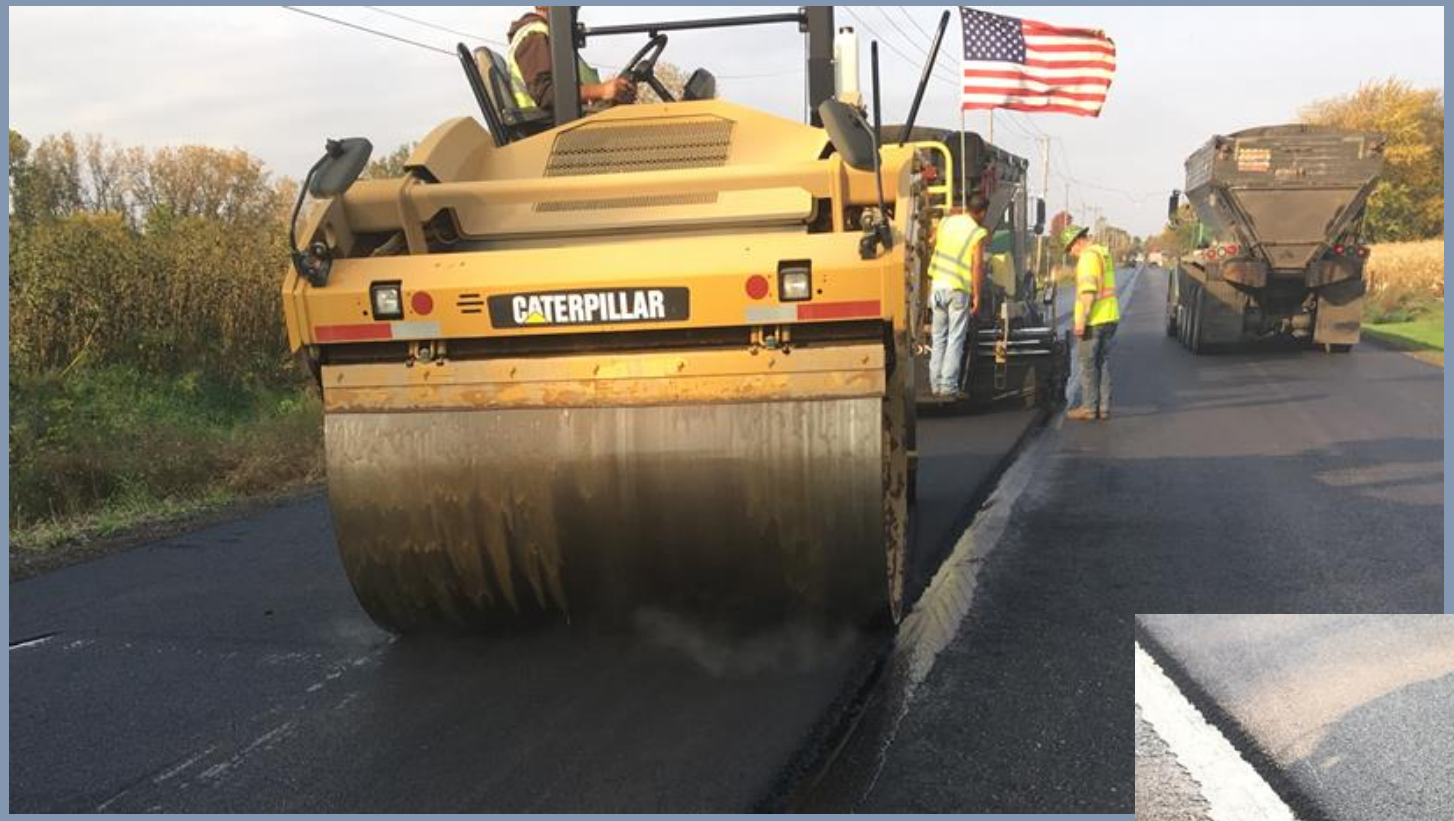
## Item 872 – Void Reducing Asphalt Membrane Cost

From 2020 ODOT Summary of Contracts:

| | |
|---|---|
| Avg. Unit Price Awarded | $2.89 per foot |

# VRAM


**Void Reducing Asphalt Membrane**




# VRAM

## Void Reducing Asphalt Membrane

# SS-872 VRAM

Best+

# Cold Longitudinal Joint Treatments

Supplemental Specification (SS) 874 – Longitudinal Joint Preparation

**874.01 Description.** This work consists of preparing an asphalt concrete surface course cold, centerline, longitudinal paving joint prior to placing the adjacent asphalt lane using one of the methods described in 874.04. The Contractor may choose method 1 or method 2. Use only one method per paving route.

**874.04 Construction.** Ensure the asphalt concrete surface course cold longitudinal joint is properly constructed so that the completed joint is offset from the centerline according to BP-3.1.

**A. Method 1.** Remove a minimum of 3 inches (75 mm) width from the first pass of the entire length of the asphalt concrete surface course. Trim the face of the cold longitudinal joint to a vertical face without damaging, chipping, or spalling the remaining asphalt mat, either at the joint or the pavement surface below the joint. Provide a straight longitudinal joint using a string line or other controls as a point of reference. Prior to removal, mark the removal area at a minimum of 5- foot (1.5 m) intervals and obtain the Engineer's approval.

Place longitudinal joint adhesive according to Supplemental Specification 875 Longitudinal Joint Adhesive.

**B. Method 2.** Place VRAM material according to Supplemental Specification 872 Void Reducing Asphalt Membrane.

**874.07 Basis of Payment.** When using Method 1, include the cost of furnishing, placing, and removing 3 inches (75 mm) of asphalt; and furnishing and placing SS 875 Longitudinal Joint Adhesive in the contract unit price for Longitudinal Joint Preparation. When using Method 2, include the cost of furnishing and placing SS 872 Void Reducing Asphalt Membrane in the contract unit price for Longitudinal Joint Preparation. The Department will pay for accepted quantities at the contract price as follows:

| Item | Unit | Description |
|---|---|---|
| 874 | Foot or Mile (Meter or Kilometer) | Longitudinal Joint Preparation |

**Designer Notes:**

This specification is to be used with asphalt concrete surface courses on projects where centerline rumble stripes are specified.

Do not calculate or include any pay quantity for asphalt that may be removed with Method 1. Ensure typical sections are coordinated with BP-3.1, TC-64.10 and this specification.

Ensure Supplemental Specifications 872 and 875 are referenced on the plan title sheet. Do not include any pay item quantities for 872 and 875 associated with this specification.

# Item 874 – Longitudinal Joint Preparation Cost

From 2020 ODOT Summary of Contracts:

| | |
|---|---|
| Avg. Unit Price Awarded | $1.15 per foot / $1692.66 per mile |

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# Cold Longitudinal Joint Treatments

Item 447 – Asphalt Concrete Mat and Joint Core Density Acceptance

- The 447 acceptance method is intended for limited access, multi-lane facilities with controlled grades and cross slopes, and is for surface courses only. It is not for use on 2-lane facilities or any facility with numerous driveways or intersections, or anywhere the maintenance of traffic plan does not allow continuous paving.

- The 447 acceptance method requires a minimum of 10,000 feet (3000 m) of cold longitudinal paving joint(s) after removing areas excluded by the specification.

# Cold Longitudinal Joint Treatments

Item 447 – Asphalt Concrete Mat and Joint Core Density Acceptance

- With 447 acceptance, SS 875 Longitudinal Joint Adhesive is required on all cold longitudinal joints and is incidental to the surface course pay item.

- 447 joint density does not apply to ramps, intersections, gore areas or transitions.

Recommendation:

- Specify **Item-875 Joint Adhesive** or **Item-872 Void Reducing Asphalt Membrane** for ramps, intersections, gore areas and transitions.

# Cold Longitudinal Construction Joints Design/Construction Tips

1) Consider full width paving to eliminate cold joints when possible and practical
2) Consider requiring hot joints when possible and practical, i.e. echelon paving
3) Pave straight joints
4) When closing the joint, ensure screed overlaps the adjacent lift with 1-1 ½ inches of material
5) Keep initial (breakdown) roller pass 6 inches off the cold joint. Roll and close the joint on the second pass
6) **Specify SS-875 Joint Adhesive, SS-872 Void Reducing Asphalt Membrane or maybe even a cut-back joint – all to substantially improve cold longitudinal joint performance**

# Questions?

## Thank you.

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