

## Section 2531. Pavement Surface Repair (Milling)

### 2531.01 DESCRIPTION.

- A. Mill the surface of HMA or PCC pavement to improve:
  - The surface profile and cross section for use as a traffic surface, and
  - The surface texture.
- B. For the purpose of this work, milling is a general term meaning removal of a pavement surface by milling with cold planing equipment.
- C. The type of coarse aggregate existing in the concrete will be identified.
- D. Unless designated in the contract documents, do not extend milling across bridges.

### 2531.02 MATERIALS.

None

### 2531.03 CONSTRUCTION.

#### A. Equipment.

1. Meet the following requirements for milling equipment:
  - a. Capable of removing the pavement surface to the necessary depth. Use cold planing equipment.
  - b. Capable of milling the surface of one traffic lane in no more than two passes.
  - c. Milling drum with a minimum of 60 cutting teeth per foot (195 cutting teeth per meter) of width with a transverse spacing of approximately 1/4 inch (5 mm).
  - d. Cutting teeth with a cutting head face which is pointed to an angle of not more than 75 degrees.
  - e. Milling drum that produces a uniformly cut surface free of ridges or valleys.
2. Use milling equipment that is automatically controlled on one side, and has cross slope control or is automatically controlled on both sides.
3. Replace broken teeth immediately.
4. Use a rotary broom as described in [Article 2001.14](#) to clean the milled surface.
5. Use water as necessary to avoid a traffic hazard and a dust nuisance.

#### B. Pavement Surface Repair.

1. Mill the entire surface of the pavement in a longitudinal direction. Mill substantially the entire surface area of the pavement until:
  - The pavement surface on both sides of the transverse joints and all cracks are in the same plane and have the same surface texture, and
  - The pavement meets the smoothness requirement.
2. In each lane, ensure at least 95% of the area in each 100 foot (30 m) section has a newly textured surface. Except at or near joints and cracks, limit milling to no more than 1/2 inch (15 mm) in depth. At joints and cracks, limit milling to no more than 3/4 inch (20 mm) in depth.
3. Meet the following requirements for milling:
  - a. Progress in the direction against normal traffic in the lane being milled unless specified otherwise by the Engineer.
  - b. Ensure all construction traffic entering or leaving the work area moves in the direction of traffic of the open lane.
  - c. Begin and end at lines normal to the pavement center line within any one milled area and at the project limits. This will not be required at the end of each shift.
  - d. Control the depth of adjacent cuts to produce a smooth, uniform cross section, free from irregularities between adjacent passes of the milling equipment.

- e. Ensure there are no transverse troughs due to lowering the drum below the cutting plane (caused by continued down pressure when forward motion of the machine has stopped).
- f. Limit milling in each traffic lane to no more than two passes, but additional passes in the cutting path may be necessary to secure a smooth profile.
- g. Ensure each single pass does not extend to both sides of the center line or a lane line between traffic lanes. However, ensure the first pass at the center line or lane line overlaps the joint line approximately 2 inches (50 mm) to minimize spalling.
- h. Ensure the joint match, if any, between two passes in a traffic lane is within 1 foot (0.3 m) of the center of the lane, to avoid joints directly in the wheel path, and is straight or parallel to the center line or lane line.
- i. Ensure each pass is designed to maintain the existing crown and a taper from center line to pavement edge.
- j. Ensure the transverse slope of the milled pavement is uniform to a degree that there is no depression or misalignment greater than 1/4 inch in 12 feet (6 mm in 3.6 m) when tested by stringline or straightedge placed perpendicular to the center line. Ensure the joint match between two adjacent passes matches within 1/8 inch (3 mm).
- k. In order to match the outside edge of the pavement, mill adjacent paved areas (for example, shoulders, curb and gutter, turn lanes, tapers, paved crossovers, and so forth) to minimize vertical projections.
- l. Ensure the finished surface has a uniform, coarse texture. Obtain the Engineer's approval.
- m. Control the forward speed of the milling machine to prevent the formation of visible corrugations on the pavement surface.

### C. Smoothness.

1. The Engineer will partly profile the pavement on the initial trace using the procedure described in [Article 2316.02, B](#). The average profile index for each area may be shown in the contract documents. The bidder is also advised that all profilograph information is available for inspection at the Office of Contracts by a request to the Contracts Engineer.
2. After the contract is awarded, the profilograph information will be available from the Engineer. This information represents a summary of conditions found to exist at the time the survey was made. The availability of this information will not constitute a guarantee that a profile other than that indicated will not be encountered at the time of milling.
3. Provide a control profilograph trace as described in [Article 2316.02, B](#) prior to performing any grinding work. This control trace will be used to identify the required smoothness for the project. Each segment of the finished ground surface is to:
  - Have a final profile index of 35% of the control profilograph trace or 10 inches per mile (160 mm/km), whichever is greater, and
  - Not include any bumps exceeding 0.5 inches in 25 feet (13 mm in 8 m).
4. When the Engineer approves, the following areas will be excluded from profilograph testing:
  - Depressed pavement areas due to subsidence or other localized causes, and
  - Areas where the maximum cut at mid panel or a fault restricts further milling.
5. End profilograph testing 15 feet (5 m) prior to excluded areas and resume 15 feet (5 m) following excluded areas.
6. Test and evaluate the milled surface according to [Section 2316](#), with the following modifications:
  - a. Run the test and evaluate the profilograph using the same procedure as for the control trace.
  - b. Each segment for which continuous milling is designated will be evaluated individually, and it shall meet the smoothness and bump requirements specified above, regardless of its length.
  - c. In excluded areas, smoothness requirements will be modified or may be waived by the Engineer.
  - d. Certify smoothness of the finished surface according to [Article 2316.02, C](#).
  - e. The Engineer may test for smoothness and bumps near the center line and at other spot locations where compliance is questioned. Additional milling may be required.
  - f. Do not use the original and final profilograph trace to determine milling depth.

**D. Limitations.**

1. Perform lane closures necessary to accomplish this work as shown in the contract documents, or as directed the Engineer. Open the entire roadbed to traffic at the end of the working period. Uncompleted sections may be opened to traffic without completion of milling across an entire lane.
2. Overnight lane closures will not be permitted. Work will not be permitted on Sundays or holidays described in [Article 1108.03](#). Apply [Articles 1107.08](#) and [1107.09](#).
3. Continuously remove all slurry or residue resulting from the milling operations. Do not deposit on the slab or paved shoulder. Pavement and paved shoulders shall be left in a clean condition. Residue from milling operations should not be permitted to flow across lanes occupied by public traffic or to flow into gutters or other drainage facilities. This residue may be placed on the shoulder or foreslope, or removed according to [Article 1104.08](#).
4. When the following work is included in the contract, sequence the operations in the following order:
  - a. Undersealing,
  - b. Longitudinal subdrains,
  - c. Patching,
  - d. Milling,
  - e. Installation of load transfer, and
  - f. Crack and joint sealing.

**E. Pavement Markings.**

Place pavement markings according to [Section 2527](#); however, pavement marking of edge lines on Interstate pavement may be delayed up to 24 hours after the lane is opened to traffic. Pavement marking will not be allowed on Sundays or holidays, unless the Engineer approves otherwise.

**2531.04 METHOD OF MEASUREMENT.**

- A. The Engineer will calculate the area in square yards (square meters) of pavement milled, for each type of coarse aggregate from the length of each area and the nominal pavement width.
- B. Adjacent paved areas milled to minimize vertical projections will not be measured for payment.

**2531.05 BASIS OF PAYMENT.**

- A. Payment for Pavement Surface Repair (Milling Limestone) or Pavement Surface Repair (Milling Gravel) will be the contract unit price per square yard (square meter).
- B. Payment is full compensation for furnishing all equipment, materials, and labor to mill the pavement and test for smoothness according to the contract documents, including removal of slurry and residue from the project.