

- At least 16 in (400mm) long when measured perpendicular to the direction of travel.
- At least 1/2 in (13 mm) but not more than 5/8 in (16 mm) deep at center.

Excess waste material resulting from the operation may be swept to the grassed shoulder and spread where applicable. If an adjacent grassed shoulder is not available, or if directed by the Engineer, remove and dispose of the waste material in a manner approved by the Engineer.

#### **456.3.06 Quality Acceptance**

General Provisions 101 through 150.

#### **456.3.07 Contractor Warranty and Maintenance**

General Provisions 101 through 150.

### **456.4 Measurement**

Milled indentation rumble strips are measured by the gross linear mile (kilometer). The Plan quantity is the pay quantity unless the Engineer makes authorized changes. No deductions will be made for intersections, ramps, bridges, or skips.

#### **456.4.01 Limits**

General Provisions 101 through 150.

### **456.5 Payment**

Payment will be made at the Contract Unit Price bid per gross linear mile (kilometer). Payment is full compensation for furnishing equipment and labor and for satisfactorily performing the work.

Payment will be made under:

Item No. 456	Indentation rumble strips—ground in place (continuous)	Per gross linear mile (kilometer)
Item No. 456	Indentation rumble strips—ground in place (skip)	Per gross linear mile (kilometer)

#### **456.5.01 Adjustments**

General Provisions 101 through 150.

## **Section 457—Geogrid Reinforcement**

### **457.1 General Description**

Specifications for this work will be included elsewhere in the Contract.

## **Section 461—Sealing Roadway and Bridge Joints and Cracks**

### **461.1 General Description**

This work includes removing the existing sealant material (if applicable), cleaning the joint, and installing silicone sealant in the roadway and bridge joints specified on the Plans. The Plans will designate the:

- Type of joint (transverse or longitudinal)
- Location of joint (mainline, shoulder, ramps, acceleration/deceleration lanes)
- Type of joint (roadway, bridge) to be resealed
- Which type silicone to use (Type A, B, C, or D)

The Engineer will determine the roadway and bridge cracks to be resealed. Unless otherwise specified on the Plans, use Type A silicone for roadway joints and use Type D silicone for bridge joints.

#### **461.1.01 Definitions**

General Provisions 101 through 150.

**461.1.02 Related References****A. Standard Specifications**

Section 430—Portland Cement Concrete

Section 500—Concrete Structures

Section 833—Joint Fillers and Sealers

Section 886—Epoxy Resin Adhesives

**B. Referenced Documents**

QPL 66

**461.1.03 Submittals**

General Provisions 101 through 150.

**461.2 Materials**

Ensure that materials meet the requirements of the following Specifications:

Material	Section
Silicone Sealant and Bond Breakers	833.2.06
Epoxy Resin Adhesives	886

For a list of silicone joint sealant sources, please see QPL 66.

Select and use bond breakers [backer rod (if required) or tape] according to Subsection 833.2.06.A.2, “Bond Breakers”

**461.2.01 Delivery, Storage, and Handling**

General Provisions 101 through 150.

**461.3 Construction Requirements****461.3.01 Personnel**

General Provisions 101 through 150.

**461.3.02 Equipment****A. Air Compressors**

Use air compressors equipped with traps to remove surplus water and oil in the compressed air. Do not use contaminated air. Ensure that the compressor can deliver compressed air at a continuous pressure of at least 90 psi (600 kPa).

The Engineer may check the compressed air for contamination.

**B. Silicone Sealant Pump**

Apply silicone sealant by pumping only. Use a caulking gun with a cartridge for touch-up work or small applications only.

Use a pump with sufficient capacity to deliver the necessary volume of silicone to completely fill the joint in a single pass.

Ensure that the nozzle’s size and shape closely fits into the joint to fill the joint with sealant with enough force to prevent voids in the sealant and to force the sealant to contact the joint faces.

**C. Caulking Gun**

Use a caulking gun with cartridge for the following situations:

- Touch up work.
- Placing vertical runs of Type A silicone in a bridge deck joint when Type B, C, or D silicone is used in the horizontal runs.
- Sealing voids and cracks with Type A silicone where Type B, C, or D silicone (which will be applied on top of the Type A silicone) might leak through.

- Sealing small cracks in the concrete.

### 461.3.03 Preparation

Before installing a bond breaker or sealant, ensure that the joint is clean and dry. Complete all cleaning, air blasting, or air drying.

### 461.3.04 Fabrication

General Provisions 101 through 150.

### 461.3.05 Construction

#### A. Resealing Existing Joints

##### 1. Remove Existing Sealant

Completely remove the existing sealant in the joints. Take care during removal and cleaning to prevent damaging or enlarging the existing width of the joint. Repair any damaged areas at no cost to the Department.

##### 2. Depth of Existing Joint

Determine if the joint depth will accommodate the required sealant thickness and bond breaker and provide the required recess below the riding surface.

Consider that the backer rod is thicker after it is squeezed into the joint.

If necessary, saw the existing joint deeper and wider to provide the joint depth and width specified on the Plans.

##### 3. Clean the Joint

Thoroughly clean the joint of all foreign material including oil, asphalt, curing compound, sealant adhesive, paint, rust, and existing sealant, if still present. Demonstrate to the Engineer that the proposed method of cleaning old sealant or foreign material from joints will not widen the joints by more than 0.040 in (1 mm). The method shall not alter the joint profile (including rounding of the top corner) or alter the texture of the concrete riding surface. Do not use chemical agents to clean the joint. Ensure that the cleaning process produces a new, clean concrete face on the vertical faces of the joint.

#### B. Sealing New Joints

##### 1. Sawing

Saw the transverse and longitudinal joints according to the Specifications and Plan details.

- Make the initial cut and wait for the concrete to harden enough to prevent spalling or raveling:
- Make the second cut to the width and depth shown on the Plans.

**NOTE: Do not use a gang saw to make a completed cut in a single operation.**

- If spalling of the sawed edge harms the joint seal, patch the spall with an approved epoxy patching compound and allow it to fully cure before installing the joint sealant.
- Make each patch to the intended neat lines of the finished cut joint.

##### 2. Cleaning Freshly Cut Sawed Joints

Immediately after sawing the joint do the following:

- Completely remove the resulting slurry from the joint and clean the immediate area by flushing it with a jet of water under pressure. Use other tools as necessary.
- When the surfaces are thoroughly clean and dry and immediately before placing the joint sealer, use compressed air with a pressure of at least 90 psi (620 kPa) to blow out the joint and remove dust traces.
- If freshly cut sawed joints are contaminated before they are sealed, clean them according to Section 461.
- Ensure that cleaning methods do not alter the joint profile, the rounding of the top corners, or the concrete riding surface texture. Do not clean the joint with chemical agents.

#### C. Sealing Joints

##### 1. Install Bond Breakers

Select and use bond breakers [backer rod (if required) or tape] according to Section 833.2.06.A.2.

- a. Before installing a bond breaker, clean and dry the joint or crack. Before placing the bond breaker and sealant, complete the cleaning, air blasting, or air drying.
- b. Ensure that the backer rod diameter is at least 25 percent larger than the joint width.
- c. Install the backer rod in the joint at the depth specified on the joint detail in the Plans, as directed by the Engineer, and according to Subsection 461.3.05.B.

**NOTE: The width of some bridge joints may require back-up material other than the typically shaped round backer rod.**

- d. Use material available in square or rectangular shapes, or cut the strips from sheet stock to fit properly into the joint. Use approved bond breaking tapes in place of backer rod in some applications. See Plan details for various joint types.

## 2. Install Silicone Sealant

Install the silicone sealant immediately after cleaning the joint or crack and installing the bond breaker. Keep the joint or crack clean and dry.

If the joint or crack becomes contaminated, damp, or wet, remove the bond breaker if it has been installed. Clean and dry the joint or crack and install a new bond breaker before placing the sealant.

Follow these guidelines when placing the sealant:

- a. Ensure that the air temperature during placement is at least 40 °F (4 °C).
- b. Use a pump to apply the silicone sealant. The pump must be able to completely fill the joint to the specified width and height of sealant in one pass.  
Use a nozzle with the proper size and shape to closely fit inside the joint. The sealant must be introduced inside the joint with enough pressure to prevent voids in the sealant and to force the sealant into contact with the joint faces.
- c. Use a caulking gun with cartridge for touch-up work, small applications (such as vertical runs with Type A silicone in a bridge deck joint when Type B, C, or D silicone is used), and to seal voids and cracks with Type A silicone where Type B, C, or D silicone might leak through. You may also use a caulking gun to seal small cracks in the concrete.
- d. After placing Type A silicone sealant, tool it to provide the specified recess, thickness, and shape as shown on the Plans. Apply sufficient force to the sealant in this tooling operation to force the sealant against the joint faces and to ensure proper wetting and bonding of the sealant to the joint faces.  
Type B, C, and D silicones are self-leveling and do not normally require tooling.
- e. Because of the consistency of Type B, C, and D silicones, ensure that the bond breaker completely closes off gaps and voids where the silicone might leak through.

To ensure that the gaps are closed use any of the following methods:

- Stuff small pieces of backer-rod into the gaps and voids
- Place a piece of bond breaking tape over the void
- Use Type A silicone to seal the void.

If using Type B, C, or D silicone and a backer-rod, ensure the backer rod is Type M. Do not use Type L backer-rod with Type B, C, and D silicone.

- f. Place the sealant to conform to the specified recess and thickness shown in the Plans.

## 3. Clean Pavement

After sealing a joint or crack, immediately remove the surplus sealant or other residue on the pavement or structure surfaces.

## 4. Open to Traffic

Do not permit traffic on the sealed joints or cracks until:

- The sealant is tack free.
- The sealant has cured enough to resist displacement from slab movement or other causes.
- Debris from traffic does not imbed into the sealant.

## 5. Special Requirements

The following requirements apply to this work:

- a. Seal the joints and cracks for any one day's work on resealing projects within 30 calendar days after surface grinding for that day is completed, unless otherwise specified on the Plans. Seal joints on new pavement after the curing period.  
When the Plans call for resealing before specified grinding, increase the recess depth and joint depth by 1/4 to 3/8 in (6 to 10 mm) to compensate for the depth of the pavement removed during the grinding operation.
- b. The Engineer will determine all cracks to be resealed.
- c. Route cracks to the depth specified on the Plans by wet or dry sawing with diamond or abrasive blades. Remove sawing residue or other contaminants.
- d. If the manufacturer recommends a primer, use it according to the recommendations. When required, install primer before the backup material.
- e. Seal the bridge joints, including the approach slab, specified on the Plans.

Only reseal non-armored joints (one-sealant receptacle and concrete surfaces on joint faces), unless otherwise indicated on the Plans.

### 461.3.06 Quality Acceptance

If a sealed joint fails due to any of the following reasons, it will be rejected.

- Adhesion or cohesion failure of joint material
- Unsatisfactory or improper quality of work
- Damage by operations or public traffic
- Damage to the sealant from displacing because of slab movements or insufficient curing before opening to traffic

Repair the joint to the Engineer's satisfaction at no additional cost to the Department.

### 461.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

## 461.4 Measurement

When listed as a pay item in the Proposal, joints and cracks sealed and resealed will be measured in linear feet (meters).

No separate measurement and payment will be made unless a pay item for the work is included in the Proposal. If no pay item is included in the Proposal, include the cost of the joint sealing and resealing in the overall bid price submitted.

No separate measurement or payment will be made for any sawcutting required to seal or reseal the joint.

### 461.4.01 Limits

General Provisions 101 through 150.

## 461.5 Payment

When listed as a pay item in the Proposal, joints and cracks sealed or resealed will be paid for at the Contract Unit Price bid per linear foot (meter). Payment is full compensation for furnishing materials, equipment, tools, labor, and incidentals to complete the work.

Payment will be made under:

Item No. 461	Resealing roadway joints and cracks, type___	Per linear foot (meter)
Item No. 461	Resealing bridge joints, type___	Per linear foot (meter)
Item No. 461	Sealing roadway joints and cracks, type___	Per linear foot (meter)
Item No. 461	Sealing bridge joints, type___	Per linear foot (meter)

### 461.5.01 Adjustments

General Provisions 101 through 150.