

## SECTION 424 Concrete Paving Inspection

*CMM provisions mobilized by the contract:*

[CMM 424.6](#)..... Concrete Transverse Crack Repair cost responsibility.

[CMM 424.7](#)..... Ancillary Concrete cost responsibility for crack repairs.

### 424.1 Responsibilities of the Paving Inspector

Following are additional duties normally assigned to a paving inspector. These are intended for a non-QMP contract when WisDOT is responsible for the inspection. Refer to the contract provisions and the QMP Manual for a definition of contractor and WisDOT responsibilities in the case of a contract containing the QMP provisions.

1. Inspection/delivery tickets must be collected from the truckers, initialed, totaled, and turned in each day to the engineer.
2. Reports and records as specified by the engineer must be kept. These may include:
  - A count of revolutions on ready-mix trucks
  - Delivery times for the ready-mix.
  - Samples taken - where, when, and how
  - Tests performed and results.
  - Cubic yards of mix placed and location
  - Weather and working conditions
  - Equipment used, and breakdowns and delays
  - Contractor's personnel
3. Required reports will have to be filed with the engineer at the specified frequency and in the specified number.
4. Unsafe conditions should be brought to the attention of the contractor for immediate correction. The inspector should follow-up to be assured they are corrected. These may include:
  - Inadequate or improper signing and flagging
  - Unsafe parking of private vehicles
  - Unsafe concrete truck delivery and waiting traffic pattern

### 424.2 Checking Surface Cross Section

It is essential that careful inspection of the initial pavement slab be performed by checking the crown, straightening both transversely and longitudinally, string lining, and using other visual procedures to detect improperly adjusted equipment or poor paving procedures.

Before paving has progressed too far, a check of the surface cross section of the pavement should be made in order to determine if the finishing equipment has been properly adjusted to the correct slope and crown of the pavement.

Two blocks of uniform height should be placed on the forms or base on either side of the slab and a fine line stretched across them from which measurements are taken to the surface at one-foot intervals. Variations in the measurements from the theoretical will indicate if adjustments are required in the screed. When plotted on an exaggerated scale any deficiencies are immediately determined and corrections can be made accordingly. Periodic checks should be made thereafter as the job progresses.

If correction is necessary, the contractor must be immediately notified, and any required corrective action must be taken before additional pavement can be placed.

### 424.3 Measurement and Payment of Concrete Items

Concrete pavement, including concrete pavement replacement areas, is measured by the square yard in place. Frequently questions will arise concerning the contract items and payment associated with concrete pavement repair and concrete pavement. The following should help explain these differences.

#### 424.3.1 Sawing Asphalt and Sawing Concrete

When specified in connection with pavement removal, this work is measured and paid for by the foot. When this work is not specified, but is done for the convenience of the contractor, it is not measured and paid for. The measurement of Sawing Concrete, when performed in conjunction with the pavement patching and repair items, is further restricted by [standard spec 690.4](#).

Saw cuts for longitudinal and transverse joints are not measured for payment.

#### **424.3.2 Dowels**

Dowel bars installed in new concrete pavement are not measured for payment. Dowel bars that are installed in existing concrete pavements by drilling and epoxying are measured and paid for as Drilled Dowel Bars.

#### **424.3.3 Tie Bars**

Tie bars installed in unhardened concrete pavements are not measured for payment. Tie bars installed to tie existing concrete pavement by drilling and then driving or epoxying the bar into new concrete pavement are measured for payment as Drilled Tie Bars.

#### **424.3.4 Compressive Strength**

Contracts containing the QMP Concrete Pavement special provision contain an incentive/disincentive pay adjustment clause based on 28-day compressive strength. Determine pay adjustments using the Materials Reporting System (MRS). The QMP Concrete Structures specification also has strength incentive computed by the MRS. The MRS can be found at the following link.

<http://www.atwoodsystems.com/>

If the contract contains the Incentive IRI Ride bid item 740.0440, the contractor must measure ride quality with a lightweight inertial profiler. Mainline paving and other specified areas are tested to determine the International Roughness Index (IRI) for each wheel path. The QMP Ride provisions has incentive/disincentive pay adjustment based on the measured IRI. Determine pay adjustments using the department's Materials Reporting System (MRS) software available at:

<http://www.atwoodsystems.com/>

In addition to the IRI based pay adjustment, the QMP Ride provisions may also have a disincentive for area(s) of localized roughness in each wheel path.

#### **424.4 Surface Smoothness**

Under [standard spec 415.3.11.8](#) the department may require the contractor to test the smoothness of the hardened pavement surface using a 10-foot straightedge or other engineer-approved device.

High spots of 1/8 inch in 10 feet or less are acceptable. The engineer may direct that high spots exceeding 1/8 inch in 10 feet, but less than 1/2 inch in 10 feet be ground down to 1/8 inch in 10 feet or less. The engineer may direct that concrete having high spots in excess of 1/2 inch in 10 feet be removed and replaced with no additional compensation to the contractor.

If testing reveals more than an occasional minor infraction of the specified straightedge tolerance, it may indicate a malfunction of the paving equipment or improper procedures in the paving process. If this occurs, paving should be immediately discontinued until the source of the trouble can be identified and corrected.

[Standard spec 415.3.11.8](#) requires grinding, when necessary, to correct surface irregularities. The work should be accomplished in a manner that does not adversely affect either the ride or the appearance of the ground pavement. After the high spot or spots have been ground down, additional light grinding may be necessary to leave a neat rectangular area of uniform appearance. Grinding must be done parallel with the roadway centerline.

The grinding should leave grooves comparable to grooves made by tining but should not damage the pavement.

#### **424.5 Deficiencies and Probable Causes**

Table 424-1 outlines pavement deficiencies that sometimes show up in the finished pavement. The inspector should be aware of these deficiencies and their probable cause. If one or more of these conditions occur, the engineer should review region and departmental correspondence and the engineer's own experience before deciding to accept the pavement or to require corrective action by the contractor. If the engineer feels guidance is needed in the decision, or if conditions are severe enough to warrant investigation by persons with specialized training, the lab should be notified.

**TABLE 424-1 Pavement Deficiencies and Causes**

Pavement Condition	Possible Causes
1. Spalling	<ul style="list-style-type: none"> <li>- Water content too high</li> <li>- Air content too low</li> <li>- Excessive finishing</li> </ul>
2. Raveling and sanding	<ul style="list-style-type: none"> <li>- Water content too low.</li> <li>- Incomplete mixing.</li> <li>- Spot repairs to correct surface defects resulting from walking in the finished concrete, or to correct low concrete under the paver.</li> <li>- Inadequate curing.</li> <li>- Air temperature too high or too low.</li> </ul>
3. Random and shrinkage cracking	<ul style="list-style-type: none"> <li>- Paving in too hot weather.</li> <li>- Steel set too low.</li> <li>- Late curing or sawing.</li> <li>- Water content too high.</li> </ul>
4. Thin slabs	<ul style="list-style-type: none"> <li>- Rutted and ridged base.</li> <li>- Wrong base elevation (too high).</li> <li>- Poor base trimming.</li> <li>- Wrong form depth.</li> <li>- Sinking forms or track line under the paver train.</li> </ul>
5. Surface pop-outs	<ul style="list-style-type: none"> <li>- Chert in the aggregate.</li> <li>- Steel set too high.</li> </ul>
6. Slippery pavement	<ul style="list-style-type: none"> <li>- Inadequate texturing.</li> <li>- Rain damage.</li> </ul>
7. Rough centerline joint	<ul style="list-style-type: none"> <li>- Excessive edge slump.</li> </ul>
8. Rough ride	<ul style="list-style-type: none"> <li>- Forms settlement; forms not on grade.</li> <li>- Soft base under slip-form paver.</li> <li>- Stop-and-start paver operation.</li> <li>- Dirty finisher wheels.</li> <li>- Defective longitudinal controls on slip-form paver.</li> <li>- Varying depth of concrete ahead of slip-form paver.</li> <li>- Non-uniform concrete slump.</li> </ul>
9. Nonfunctioning Joint	<ul style="list-style-type: none"> <li>- Poor sawing technique.</li> </ul>
10. Slab tilt, faulting or subsidence	<ul style="list-style-type: none"> <li>- Poor base.</li> </ul>

*Responsibility for the costs of crack repairs, mobilization for traffic control, and traffic control devices prescribed in 424.6, table 424-3 are mobilized into the contract by [standard spec 415.5.3](#).*

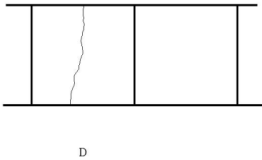
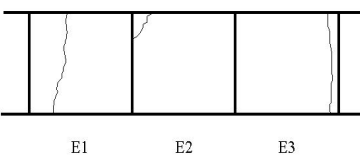
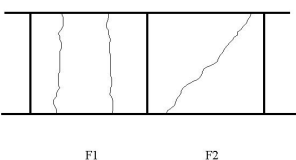
#### **424.6 Concrete Transverse Crack Repair**

[Standard spec 415.3.17](#) states that the engineer is responsible for conducting two inspections of the concrete pavement and selected ancillary concrete items listed in [standard spec 416.5.2](#). The first should be performed after the pavement reaches opening strength but before opening to construction or public service. The second is done before opening to public service, or before partial acceptance, whichever comes first.

If cracking occurs, the engineer, with input from the contractor, is responsible for determining if a repair is needed and for assigning the responsibility for the cost of repairs, costs for mobilization for traffic control, and costs for traffic control devices. All repairs should be made according to the appropriate standard detail drawing or plan detail.

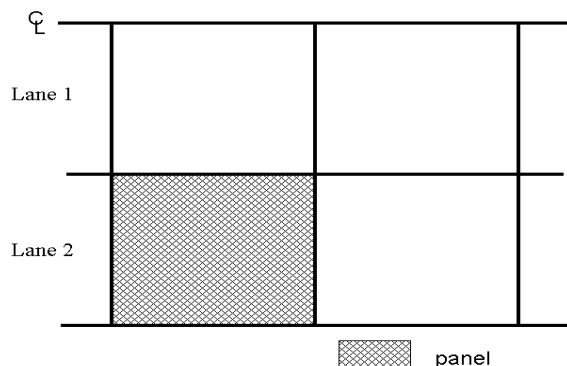
Table 424-2 outlines repair options and when it is appropriate to use the type of repair described. These options may not address all cracking situations. Please contact the BTS, Foundation and Pavements Unit regarding situations not covered in the table, or for any questions.

**TABLE 424-2 Transverse Crack Repair Options**

REPAIR OPTION:	CONDITION:	EXAMPLE:
A. Do Nothing	A1. Pavement will serve original function or purpose. A2. Crack will not be a local or aesthetic issue. A3. Crack will not be a future maintenance issue. A4. Pavement has minor vertical or horizontal displacement.	No Example
B. Seal Only (Work includes seal with approved joint filling material)	B1. Crack has minor spalling or other distresses.	No Example
C. Rout and Seal Cracks Only Un-doweled or Doweled (Work includes standard routing equipment with routing the full length of crack, sealed with approved joint filling material)	C1. Crack has minor spalling or any other distresses. C2. Joints are sealed because of local preference. C3. Cracked panel is in an intersection and has irregular geometry.	No Example
D. Retrofit Dowel Bar	D1. Crack is in center one-third of panel. D2. Crack is transverse and less than a 6:1 skew. D3. Crack is a clean, single crack with minor spalling or parallel cracks. D4. Do not use if panel is in more than two pieces.	
E. Partial Panel Replacement	E1. Mid-panel crack occurs. E2. Corner crack occurs. E3. Majority of crack occurs within 3 ft. of a joint.	
F. Full Panel Replacement	F1. Panel is in 3 or more pieces. F2. Crack is diagonal and encompasses a majority of the panel. F3. Local preference or aesthetic reasons.	

A panel is defined as the limits between two adjacent transverse joints and two adjacent longitudinal joints or pavement edge.

**FIGURE 424-1 Definition of Panel**



The department will allocate responsibility for costs as specified in table 424-3. If the cause is unknown the department and contractor will share the cost of repair and calculate the applicable contractor-shared reimbursement as described in the contract specifications.

Investigation of the cause will help determine the responsibility for costs of the crack repair. Suggested causes for cracking are listed below but are not intended to be a complete list.

- A pavement/subgrade not built in compliance with plans & specifications.
- Differential subgrade layers and cross section.
- Improper sawing methods (e.g. location, timing, mix type).
- Improper joint layout.
- Interface between different mixes.
- Utility work and trenching.

**TABLE 424-3 Transverse Cracking Policy for New PCC Pavements**

Cracking Occurs	Responsibility	Location of Crack	Repair Options	Cost of Repair	Cost of Mobilization for Traffic Control	Cost of Traffic Control Devices
1 Crack occurs BEFORE opening to service as defined by <a href="#">standard spec 415.3.17</a>	Contractor	A Crack occurs within 3 feet of a transverse pavement joint.	Use partial or full panel replacement	100% contractor	100% contractor	100% contractor
	Contractor/ department (cause unknown)	B Crack occurs beyond 3 feet of a transverse pavement joint and pavement is constructed in compliance with specs.	table 424-2	<a href="#">standard spec 415.5.3</a>	100% contractor	100% department at contract unit prices
	Contractor	C Crack occurs beyond 3 feet of a transverse pavement joint and pavement is NOT constructed in compliance with specs.	table 424-2	100% contractor	100% contractor	100% contractor
	Department (cause by others, utility, or public)	D Crack occurs beyond 3 feet of a transverse pavement joint and pavement is constructed in compliance with specs.	table 424-2	<a href="#">standard spec 415.5.3</a>	100% department	100% department at contract unit prices [1]
2 Crack occurs AFTER opening to service as defined by <a href="#">standard spec 415.3.17</a>	Contractor/ department (cause unknown)	A Crack occurs at any location from a transverse pavement joint and pavement is constructed in compliance with specs.	table 424-2	<a href="#">standard spec 415.5.3</a>	100% contractor	100% department at contract unit prices [2]
	Contractor	B Crack occurs at any location from a transverse pavement joint and pavement is NOT constructed in compliance with specs.	table 424-2	100% contractor	100% contractor	100% contractor
	Department (cause by others, utility, public)	C Crack occurs at any location from a transverse pavement joint and pavement is constructed in compliance with specs.	table 424-2	<a href="#">standard spec 415.5.3</a>	100% department	100% department at contract unit prices [1]

<sup>[1]</sup> When utility is responsible for cracking, WisDOT will pay for concrete repair and pursue reimbursement from the utility.

- <sup>[2]</sup> This cost is 100% contractor if crack occurs before opening to service and contractor chooses to make repair after opening and project engineer determines it is feasible to have done before opening to traffic.

#### 424.7 Ancillary Concrete

*Responsibility for the costs of crack repairs, mobilization for traffic control, and traffic control devices prescribed in 424.7, table 424-4 are mobilized into the contract by [standard spec 416.5.2](#).*

Ancillary Concrete is defined as curb and gutter (separate or integrally placed), curb, gutter, medians, raised medians, sidewalks, driveways, loading zones, safety islands, and steps. The engineer should allocate responsibility for costs, repairs, and traffic control according to table 424-4.

Cracks resulting from the following will be considered contractor-caused:

- Mismatched joints from pavement to curb to driveway/sidewalk etc.
- Inconsistent or no attention paid to expansion.
- Damage by public/business traffic due to non-protection of work.
- Damage by contractor operations (prime or subcontractor).
- Joint layout.

Cracks resulting from the following will be considered department-caused:

- Poor design.
- Damage by public/business traffic.

When a utility is found to have caused the crack, WisDOT will pay for concrete repair and pursue reimbursement from the utility.

If the cause of a crack is unknown, the contractor and department will share the responsibility.

**TABLE 424-4 Cracking Policy for Ancillary Concrete**

Responsibility	Location of Crack	Required Repair	Cost of Repair	Cost of Mobilization for Traffic Control	Cost of Traffic Control Devices
Contractor/ Department (Cause Unknown.)	A Crack occurs at any location and is constructed in compliance with plans and specifications and cannot be attributed to the contractor operations.	A1 Remove and replace.	<a href="#">standard spec 416.5.2</a>	100% contractor	100% department
		A2 Leave in place.	No cost	No cost	No cost
		A3 Saw only (for C&G only).	100% contractor	100% contractor	100% department
Contractor	B Crack occurs at any location and is NOT constructed in compliance with plans and specifications.	B1 Remove and replace.	100% contractor	100% contractor	100% contractor
		B2 Leave in place.	No cost	No cost	No cost
		B3 Saw only (for C&G only)	100% contractor	100% contractor	100% contractor
Department (Cause by others, utility, public.)	C Crack occurs at any location and is constructed in compliance with plans and specification and cannot be attributed to the contractor operations.	C1 Remove and replace.	<a href="#">standard spec 416.5.2</a>	100% department	100% department
		C2 Leave in place.	No cost	No cost	No cost
		C3 Saw only (for C&G only).	100% contractor	100% contractor	100% department

#### 424.8 Rain-Damaged Pavement

Areas damaged by rain may be re-dragged or re-dragged and re-tined if the concrete is still plastic. It is even better, if rain is suspected or forecast, to have plastic ready for covering the pavement and to halt paving operations if rain is prolonged. If all else fails, the damaged area must be ground by machine to avoid accidents caused by slick pavement. Grinding should be parallel to the centerline, and the finished areas should be rectangular, neat and not distracting to motorists.

#### **424.9 Concrete Pavement Repair and Replacement**

Concrete Pavement Repair and Replacement, and Special High Early Strength Concrete Pavement Repair and Replacement are defined in [standard spec 416](#) and detailed in [SDD 13C9](#).

Repair lengths of 15 feet or less are constructed, measured, and paid for under [standard spec 416](#). Repair sections between 15 and 100 feet in length should be paid as Concrete Pavement Replacement. Repair sections 100 feet or longer should be paid as Concrete Pavement, as provided in [standard spec 415](#).

All concrete pavement repair and replacement items are measured by the square yard in place. Saw cuts, tie bars, and dowel bars installed in existing concrete pavements are paid separately. For concrete pavement items, tie bars and dowel bar assemblies at contraction joints are included in the contract price. The plan will show a breakdown in the miscellaneous quantities of areas designated as repair or replacement. The length of 15 feet was chosen as the distinction between repair and replacement, based on the maximum joint spacing. A "repair" section will not contain contraction joints, dowel assemblies, or tie bars.

The item of Special High Early Strength Concrete Pavement Repair is used when same day opening to traffic is necessary. Frequently the sawing is done one or more days before the removal and replacement operation.

The major differences between the repair and replacement items are outlined below:

1. Measurement and payment.
  - Pavement repair items include removing pavements and repairing shoulders, while saw cuts, tie bars, and dowel bars installed in existing concrete pavements are paid separately.
  - For pavement replacement, concrete pavement is measured by the square yard, and removing pavement and shoulder repair are paid separately.
2. Concrete mixes.
  - Grade C mixes are specified for concrete pavement repair and a special 8-hour concrete mix is specified for special high early strength concrete pavement repair.
  - Concrete pavement may be constructed with Grade A concrete.
3. Opening to traffic.
  - Repair areas must be opened to traffic based on cylinder tests of 3,000 psi.
  - Special high early strength concrete pavement repair areas must be opened to traffic by sunset on the same day the old pavement is removed.
  - Concrete pavement may be opened to traffic based on either test cylinders or minimum time periods related to atmospheric temperatures.

#### **424.10 Opening to Service**

Refer to [standard spec 502.3.10](#) for strength requirements for opening to service.