4-10.1 General

Concrete pavement must be of high quality, with durability and structural soundness to adequately withstand destructive forces resulting from traffic, weather, and variable foundation conditions. A smooth riding surface with sufficient skid-resistant characteristics is also required.

Proper construction methods, operations, and procedures are necessary to produce sound, strong, and durable concrete. It is essential that only materials meeting quality requirements be used.

4-10.1.1 Certification for Materials Testing

In association with the department, UW - Platteville conducts a certification and training program for highway technicians. All individuals involved in materials testing on department projects need to be certified under the Highway Technician Certification Program (HTCP) administered by UW - Platteville. Department staff, contractor staff, and consultant staff working for either the department or contractor must have the appropriate certification for the specific tasks they will be performing. The current HTCP certification list is available at: https://www.uwplatt.edu/highway-technician-certification-program

4-10.1.2 Durability and Structural Soundness

Durability and structural soundness are physical qualities of concrete pavement that are closely related to each other, and construction operations affecting the production of one will often, to a large extent, affect the attainment of the other.

Some of the factors essential to production of sound, durable concrete pavement include the following characteristics:

1. A uniformly stable foundation.
2. Aggregates meeting specified requirements for quality and gradation.
3. Accurate determination of batch proportions with adjustments for moisture content of aggregates.
4. Use of minimum quantity of mixing water required to produce a plastic, workable concrete mix of uniform consistency.
5. Strict control of all admixtures to ensure compatibility, proper introduction and correct quantity.
6. Thorough mixing for the required length of time.
7. Correct placing of steel reinforcement and dowel joint assemblies.
8. Placement within the specified temperature and time limits.
9. Proper consolidation and finishing of the concrete.
10. Strict compliance with required curing methods.
11. Timely sawing of transverse contraction joints.
12. Restriction of loads on pavement until it has gained the required strength.

4-10.1.3 Smooth Ride

A smooth form or track line, a uniformly stable foundation, and equipment in good mechanical condition and adjustment all contribute to good ride. Variation in the mix can cause variations in the pavement surface that lead to poor riding pavements. Steady progress of the paver, with a minimum of stopping and starting, and a uniform load of concrete being carried across the full width of the paver are also essential prerequisites for good ride.

4-10.1.4 Paving Methods

Standard Spec 415 provides that, unless otherwise required by special provision, either slip-form or form methods of paving may be used for pavements having either rural or urban-type cross sections. The method used is the contractor's option.

4-10.1.5 Tining

The timing of the tining operation must be coordinated with the dragging operation and adjusted for conditions to produce a uniform depth of sharp, well-defined grooves. The finished surface should be free from rough or porous areas, irregularities, and depressions resulting from improper handling of the tining machine.
4-10.2 Paving Operations
4-10.2.1 Slip-form Paving Train
The paving train may include a spreader, a paver, floats, a longitudinal drag, a transverse tiner, and a curing compound sprayer. The paver may include a mechanical dowel bar inserter. The concrete from the plant is either dumped or chuted onto the base in front of the spreader by truck, or it is dropped from a truck into a hopper at the side of the spreader and conveyed across the width of the slab.

The spreader lays out the concrete in a uniform lift and strikes off the concrete to approximately final elevation. The slip-form paver will strike off the concrete to final elevation, vibrate the concrete, screed it, then pan-float it to nearly the final finish. Straightening and re-floating may be by a tube float or (usually) by hand floating and straightening. This is done to test for trueness and iron out minor irregularities in the surface.

Final surface finish is accomplished by a longitudinal machine drag equipped with burlap or an artificial turf such as AstroTurf. Dragging is followed by a tiner that drags a steel comb, or series of tines, transversely across the slab to produce a macro-texture.

The textured concrete surface and sides are then coated with an opaque curing compound, by means of a curing compound power sprayer, to seal in moisture and retain heat of chemical action. During cold weather periods, curing paper or polyethylene sheeting is required and the curing compound may be omitted.

The final major step is sawing of transverse and longitudinal joints, by means of power saws, to control shrinkage cracking of the slab.

4-10.2.2 Formed Pavement Paving Train
The operations of placing the concrete are essentially as stated above. There are major differences in the equipment employed, however. There may be a spreader to lay out and strike off the dumped concrete, but there will not be a paver to vibrate and screed the plastic concrete to the final elevation. Instead, specialized finishing machines consolidate and finish the concrete.

Initial finishing may be done by a double-screed machine. Float finishing is usually done with a finishing machine having a front screed, plus a trailing float pan that is independently suspended. The rest of the operation (straight-edging, dragging, tining, curing, and sawing) is as previously described for slip-formed pavement.

4-10.2.3 Continuously Reinforced Pavement
The paving train for continuously reinforced pavement is essentially the same as for non-reinforced pavement except that since the reinforcement is laid out on bar chairs ahead of the paver, the concrete has to be delivered from outside the form line or string line.

4-10.3 Concrete Reinforcement
Generally, storage requirements for steel reinforcement and requirements relative to rust will be the same as provided in CMM 5-15 for steel reinforcement used in structures. Light rust is acceptable but heavy rust or scale is not. Welds should be checked for breakage and re-welded as needed. The epoxy coating should be checked for damage during shipping and handling per subsections Standard Spec 505.2.4 and Standard Spec 505.2.6. All reinforcement steel received on the job must be held in approved storage and distributed along the work only as needed for immediate placement. Mesh reinforcement is no longer used by WisDOT.

4-10.3.1 Installation
Most efforts to control cracking in rigid pavements have involved experimentation with transverse joints. Continuously reinforced pavement eliminates transverse joints, except for construction joints and expansion joints. Cracking of the slab is allowed to develop in a random pattern. Sufficient longitudinal continuous reinforcement steel is placed to hold the cracks so tightly closed the pavement will retain its structural integrity.

Construction procedures and practices relating to continuously reinforced concrete pavement are generally the same as for non-reinforced concrete pavement, except for joints and reinforcement.

Reinforcement bars are laid out longitudinally, side by side, on the base in advance of the paving train. They are tied end to end, with the specified lap, and to transverse bars at the specified interval. The steel grid is placed on bar chairs that support it at the correct elevation. Placement of the concrete, spreading, and consolidation follows in one pass of the paving train.

The reinforcement should be checked to ensure that the correct bar laps have been made at the splices and that the bars are at the correct spacing and depth. Also, check that the correct bar sizes have been installed and that the epoxy coating has not been damaged during installation.

Checks should also be made to ensure that the bar chairs are secured to the base and the reinforcing bars are securely tied to the chairs with approved types of fasteners, as discussed in Standard Spec 415.4.
4-10.3.2 Pavement Gaps

Sometimes it is necessary to leave an unplanned temporary gap in the pavement to accommodate traffic at locations designated in the contract and for haul roads or other reasons approved by the engineer. Such gaps are not desirable and should be discouraged. When the leave-out is paved, the two adjacent free pavement ends may be subject to considerable daily movement because of changes in temperature, which may produce slippage of the reinforcement in the fresh concrete before sufficient bond strength is developed. A wide construction joint or wide transverse cracks may result.

The necessity for gaps or leave-outs can be eliminated if pavement is placed in these areas beforehand. Then there is only a short section of hardened concrete pulling on the two green slabs at each end. This method should be followed if possible.

When the gap cannot be paved beforehand, and if there is no plan detail, the following construction methods must be employed. At least 50% additional longitudinal reinforcement steel should be installed in the gap and across each construction joint at the ends of the gap. The additional members should extend at least 3 feet into the pavement ends adjacent to the gap and into the gap a minimum distance of 7 feet. Splices for the additional longitudinal steel in the gap should be lapped and staggered as provided on the plans.

The temperature of the concrete in the free ends of the pavement should be stabilized by applying a double layer of burlap to the surface of the pavement for 200 feet from each free end. The burlap must be kept wet and remain in place for at least 24 hours just prior to paving the gap and until the curing time has expired for the newly placed adjacent pavement.

Contractor requests to leave unplanned gaps are subject to the approval of the engineer.

4-10.4 Measurement of Clearances before Opening Roadway for Traffic

When pavement construction occurs beneath an existing bridge, the construction staff will measure horizontal and minimum vertical clearance upon completion of the pavement. Send the measurements to the Structures Development Section, Bureau of Structures (BOS), and the regional bridge maintenance engineer. The Structures Development Staff will enter the clearances in Highway Structures Information System (HSI).