



## 4-15.1 Hauling Concrete

For dual lane construction, ready-mixed (central-mixed, transit-mixed, shrink-mixed) concrete should be delivered to the site of the work at a rate that will allow placement of not less than 78 cubic yards per hour.

Concrete may be hauled in transit-mix, agitating, or non-agitating type trucks. [Standard spec 501.3.5.2](#) sets forth the allowable delivery times for the different types of vehicles. [Standard spec 501.3.5.3](#) sets forth the requirements, including minimum and maximum revolutions, of truck mixers. The delivery time and/or revolutions should be checked on an intermittent or spot basis unless inspection tickets, as specified in [standard spec 501.3.5.4](#), are required.

Concrete may be deposited directly on the grade, into a hopper type spreader, or into a conveyor hopper outside the track line. When the concrete is deposited directly on the grade there is a greater possibility of segregation. Use of a hopper type spreader or a conveyor hopper provides more even concrete dumping. Use of a conveyor hopper avoids truck damage to the base.

[Standard spec 415.3.7.2](#) specifies that insofar as practical, concrete shall be delivered by vehicles operating outside the lanes being placed. If the delivery vehicle is permitted by the engineer to operate in the lane in which concrete is being placed, means shall be provided to satisfactorily correct any induced irregularities and to restore the foundation before to placing concrete. When formed pavement is placed a subgrade planer shall be operated just ahead of the deposited concrete. When slip form methods are used, approved methods or equipment shall be used to restore the subgrade satisfactorily.

When slip form methods are used, the condition of the base is especially critical because the slip form paver rides directly on the base. The consequence of damage to the base by hauling vehicles may be either deficient pavement depths or excessive roughness or both. If delivery vehicles are permitted by the engineer to operate in the lane which concrete is being placed, reasonable limits need to be placed on the operation of the hauling vehicles. Trucks delivering concrete should not be permitted to cross the track line at indiscriminate locations. Any crossing of the track line should be confined to a distinct area, and as the paver approaches that location another area should be designated 300 feet ahead. Previously crossed track lines should have irregularities corrected using a stringline for reference.

## 4-15.2 Placing Concrete

Unless otherwise specified in the contract, pavement of rural cross section should be placed to its full width in a single construction operation, except that pavement constructed directly on crushed aggregate base course, open graded may be placed to a single lane width in a single operation.

The standard specifications require concrete to be deposited on a moist base. When concrete is deposited on a dry base, the base absorbs some of the water that is required in the mix for proper workability, and the concrete becomes difficult to finish. When sprinkling of the base immediately ahead of the paver is not sufficient to correct this condition, the contractor should thoroughly wet the base well in advance of the paving operation. If the surface of the base dries before the concrete is placed, additional sprinkling ahead of the paver will be required.

No single factor affects the durability of concrete as much as the relationship between the quantity of water contained in the mix and its cement content. [Standard spec 501.3.5.3](#) specifies that the mixing water shall be added at the batching plant, but if additional mixing water is required to obtain the specified slump, water may be added at the site with the permission of the engineer. The total of all free water may not be in excess of that permitted in the specifications. [Standard spec 501.3.5.3](#) further provides that if additional water is added at the site of the work, a minimum of 20 revolutions of the truck mixer at mixing speed will be required before discharge of any concrete. This precludes adding water to concrete delivered by non-mixer type trucks. If it is necessary to add water at the site, the plant operations staff and inspector should be notified so the amount of mix water can be adjusted at the plant. Consistency of the concrete is very important and should not vary between loads. This may happen if water is added at the paving site and concrete is delivered by a mix of vehicles which includes dump trucks and transit mix trucks.

In the case of a contract that includes the QMP provisions, the above statements regarding adding mixing water also apply except that Quality Assurance personnel should be involved, and permission of the engineer is not required.

[Standard spec 415.3.7.1](#) requires concrete to be placed across the full width of the pavement in a manner that requires as little re-handling as possible. This will control segregation and promote consolidation and settlement in the concrete. When a hopper-type spreader is used, the hopper should be partially filled at all times for its full

width as it moves ahead to spread the concrete. The discharge chute must be kept in motion in order to distribute the concrete over as wide an area as possible. Windrowing or piling of the concrete is not permitted.

Concrete should be delivered to the paver at such a rate as to allow uniform progress, with stopping and starting of the paver held to a minimum. This is especially critical for operation of a slip form paver.

### 4-15.3 Dowel Bar Assemblies

Conventional concrete pavement design requires dowel bar (load transfer) assemblies at specified spacing along the length of the slab. They are used to transfer or carry wheel loading across the transverse joint sawing at each of those points.

Dowel assemblies should conform to the basic design of the latest revision of the Standard Detail Drawings and be approved before. Field inspection should ensure that one end of the dowel bar is sawed and free from burrs or protruding edges and that there are no ridges or indentations beyond or within the normal circumference of the bar. Any deviation in the roundness of the bar that will restrain the free movement of the concrete is considered cause for rejection or correction. Dowel bars shall be epoxy coated. Damaged coating shall be repaired in accordance with [standard spec 505.2.6.1](#).

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 on the assembly, but heavy rust or scale is not. Each dowel should be lightly greased.

The importance of the proper installation of load transfer dowels and the subsequent placing and manipulation of the concrete around them cannot be overemphasized. A joint can become a potential point of weakness if the correct installation procedures are not observed. Any restriction to the free movement of the concrete may result in a crack near the joint. The supporting assembly or basket must be staked down securely to prevent its displacement and it must be rigid enough to hold the dowel in its true position when the concrete is manipulated around it. The bars should be parallel to the pavement centerline as to both alignment and grade before the installation is approved. The exact location of each end of each assembly should be marked with a flag or stake set outside the paving limits so the transverse joint can be sawed at the exact center of the assembly.

At each dowel assembly there is a greater concentration of steel that tends to prevent the free flow of concrete at the point. Unless particular efforts are made to properly place and consolidate the concrete around the assemblies, void pockets may be created with a resultant loss of strength. The specifications state that the concrete needs to be consolidated along the full length and on both sides of the joint by vibration in a manner that precludes displacement of the dowels.

#### 4-15.3.1 Dowel Bar Implanter

Some paving machines have the capability of implanting a row of dowel bars without the need for an assembly to position the bars and secure them against movement. The paving inspector should check that each dowel is lubricated and the full array of bars is being placed at each location.

The dowels should be placed within the tolerance given in [standard spec 415.3.8](#). Any marring of the pavement should be removed by subsequent finishing operations.

The exact location of each row of dowels should be marked on both sides of the pavement to facilitate sawing of the transverse joint.

### 4-15.4 Adjusting Drainage and Utility Fixtures

The adjustment of manhole, catch basin, or inlet covers or frames should be carefully performed and inspected as described in [CMM 6-20](#).

### 4-15.5 Checking Depth

[Standard spec 415.3.18](#) specifies that contractor probing is the primary method for determination of thickness of pavement. Details of the probing equipment and procedure are outlined in [CMM 8-70](#). The engineer will periodically observe the contractor's testing procedure to ensure that the test is being performed properly. Also, the engineer will use probing to verify that the pavement thickness is acceptable. Verification tests will be performed at a minimum frequency of once for each half-day of paving. The engineer may elect to increase the verification testing frequency as necessary to ensure that the pavement has an acceptable thickness.

The engineer will select a longitudinal location at random and designate the transverse positions for a series of two probes in each lane of pavement at that location. The contractor must secure metal plates to the grade and perform the probing as directed by the engineer. The engineer will be present and observe both placement of the plates and probing of the freshly placed concrete.

In the case of contracts containing QMP provisions, the contractor is responsible for performing thickness measurements of the newly constructed pavement. The method and transverse locations of probing will be

described in the contractors Quality Control plan. The method of Quality Assurance is described in the QMP manual.

#### **4-15.6 Hand Methods**

The use of hand methods instead of placement by machine is limited by the requirements of [standard spec 415.3.11.2](#). It is generally agreed that pavement gaps 200 feet or less in length are too short for efficient and cost-effective use of a paver and therefore can be placed by hand, although bridge finishing equipment has been allowed on such short gaps, with acceptable results. Each situation must be evaluated by the engineer before hand placement is allowed.

Consolidation of hand-placed concrete is important and is discussed in detail in [standard spec 415.3.11.3](#). Over-vibration is to be avoided.

The concrete should be placed close to its final location to minimize segregation and air loss from excessive manipulation, and to avoid time delays in finishing and curing. Walking in the concrete should be kept to a minimum.

Other general requirements discussed previously for placing by machine, such as pre-wetting the base, are applicable.