



3.50.1 GENERAL

The intent of rubblizing concrete pavement before a pavement overlay is to produce a structurally sound base that prevents reflective cracking by obliterating the existing pavement distresses and joints. A rubblized and compacted concrete pavement is an assemblage of concrete segments that form a tightly keyed, interlocked, high-density material layer. A rubblized concrete layer is fractured, lacks continuity, and cannot sustain flexural stress. However, it possesses high shear strength and rutting resistance. It is not a typical granular material and is not an engineered material like base course.

[FDM 14-25-15](#) provides guidance on the use of rubblization of concrete pavement. The item Rubblizing, 335.0100, describes the rubblization process and the testing that is done to insure that the intent of rubblization is being accomplished.

3.50.2 PREPARATION OF THE CONCRETE SURFACE

Any existing asphaltic overlay must be removed before rubblizing the underlying concrete. The cleaner the concrete surface is, the better the energy of the rubblizing equipment is transferred into the concrete. Occasional, thin layers of asphalt (often caused by the milling machine working over faulted concrete slabs) are acceptable if the rubblizing equipment can adequately break the concrete through these thin layers.

The rubblizing specification requires the removal of all loose asphaltic patching material, joint fillers, expansion material, or other similar materials from the compacted surface. These items do not need to be removed before rubblizing the concrete. If, after rubblizing and compacting the concrete, any of these items are loose at the surface, they must then be removed so as not to negatively impact the paving of the overlay. It may not be necessary to remove these items if an intervening base layer is placed over the rubblized concrete.

3.50.3 DRAINAGE

If specified, underdrain systems should be installed and functioning before rubblizing begins. In areas of weak subgrade or high water table the drainage system should be functioning as far in advance of the rubblizing as possible to allow for the subgrade to be as stable as possible. The drainage system also serves to remove rainwater from the rubblized concrete layer, base layer, and subgrade during construction.

3.50.4 UTILITIES

Underground utilities must be clearly marked before rubblizing. Special attention should be given to identifying any covers or shutoffs that are not exposed at the surface, such as a manhole cover under an asphalt patch. When necessary, the breaking energy should be reduced in the proximity of sensitive utilities to avoid damage. The rubblizing specification also allows the contractor to remove the pavement over or around utilities and backfill with aggregate.

3.50.5 RUBBLIZING EQUIPMENT

The rubblizing specification requires the use of a self-contained, self-propelled breaker to break the concrete down to specified maximum particle sizes and to create a stable construction platform for the pavement overlay. There are two types of machines that meet this requirement and have been used in Wisconsin. One is the resonant breaker, which produces low amplitude, high frequency blows by vibrating a large steel beam that is connected to a foot (can be varied in width from six to twelve inches) that is moved along the concrete surface at the front of the machine. Resonant breakers require multiple passes to rubblize the full lane width.

The other machine is the multi-head breaker, which has sixteen 1,200 to 1,500 pound drop hammers mounted laterally in pairs with half of the hammers in a forward row and the remainder diagonally offset in a rear row providing continuous breaking of up to thirteen feet wide. Each pair of hammers is attached to a hydraulic lift cylinder that operates as an independent unit, develops between 2,000 and 12,000 foot pounds of energy depending upon the drop height selected, and cycles at a typical rate of 35 impacts per minute. The drop height of each pair of hammers can be instantaneously adjusted to control the amount of breaking energy that is transferred to the concrete. This allows the operator to adjust the breaking for varying conditions along and across the pavement. The multi-head breaker rubblizes a full lane width in a single pass.

Typical production rates for rubblizing have been one lane mile per shift per rubblizing machine. Several machines have been used when project schedules required.

3.50.6 BREAKING THE CONCRETE

The rubblizing specification requires the breaking of the concrete down to specified maximum particle dimensions while giving the engineer the discretion to direct or allow larger maximum particle dimensions. These specified particle dimensions are what can be expected when rubblizing over a fair to good base/subgrade. The particle sizes that can be produced are directly related to the condition of the base/subgrade. A firm and stable base/subgrade will allow for the production of smaller particle sizes than when working over a less firm and stable base/subgrade. Engineering judgment must be used when evaluating the rubblizing process, keeping in mind that the intent of rubblizing is to produce a structurally sound base which prevents reflective cracking by obliterating the existing pavement distresses and joints. The intent is not to meet a gradation requirement.

Attention must also be paid to constructability. Even if it is possible to produce small particle sizes, the resulting rubblized layer must still provide a working platform for paving operations and a stable foundation for the pavement overlay. In cases of isolated, very weak subgrade, subgrade correction may be appropriate. Another way to compensate for a weak subgrade is to modify the rubblizing pattern to produce larger particle sizes that maintain more of the existing concrete pavement's structural support. Experience has shown that segments of twelve to eighteen inches in the lower half of the slab are still effective for eliminating reflective cracking.

Test holes are excavated to satisfy the engineer that the process is meeting the rubblization objectives. This provision is not intended to make the contractor dig a hole. Once the engineer has verified the specification requirements are being met, he can waive the digging of additional test holes. Numerous test holes create non-uniformity in the structure.

3.50.7 COMPACTION

When compacting rubblized concrete over weak or wet subgrade or in the proximity of sensitive utilities, it may be necessary to reduce the vibratory roller's amplitude to prevent damage to the subgrade or the utilities. In extreme cases the roller should be operated in the static mode.

When the multi-head breaker is used the contractor usually chooses to use a "grid roller" for the first two vibratory steel roller passes. The Z-pattern bars that are attached to the roller drum serve to further pulverize the broken concrete particles at the surface.

When an intervening base layer is placed over the rubblized concrete before the pavement overlay, compaction of the base layer will be as required by the specification for that base layer.

Observation of the compaction process is an effective way to determine the stability of the rubblized layer. If there still are concerns after compaction, proof rolling with a loaded tandem-axle truck is a quick and effective procedure for determining the stability of the rubblized layer.

3.50.8 FILLER AGGREGATE

Filler aggregate is used to fill holes and localized depressions in the rubblized concrete. It is not to be used as a means of adjusting the grade.

3.50.9 PARTIAL-WIDTH CONSTRUCTION

When partial-width rubblizing and paving is required, if possible, the contractor should leave a six to twelve-inch wide strip of rubblized concrete unpaved when overlaying the first lane. This strip provides additional space to operate on the second lane without encroaching upon the first lane's overlay.

3.50.10 RAIN

Light to medium rain does not effect the rubblizing operation. For safety considerations, heavy rains and/or lightning will temporarily stop the rubblizing operation. Rubblized concrete drains well, especially if edgedrains are functioning, and paving operations can usually begin shortly after the rain has stopped. Caution is required when rubblizing over a moisture-sensitive subgrade. In these cases, rubblizing and paving should be coordinated to minimize exposure of the subgrade to rain.

3.50.11 CONSTRUCTION TRAFFIC

Construction traffic on rubblized concrete should be monitored. The contractor should minimize the amount and weight of construction traffic on the rubblized surface. This is especially important in areas with weak subgrade.

3.50.12 ASPHALTIC OVERLAY

3.50.12.1 General

When designing the thickness of the asphalt overlay, the rubblized concrete layer is assigned a support value. The support value is the product of the layer coefficient assigned to the rubblized concrete and its thickness.

Similar calculations are made for the subbase, if any present, and for the asphaltic surface. The required total pavement structure thickness is the sum of all calculated thickness; thus, the rubblized concrete becomes an integral part of the pavement structure in addition to providing a working platform for paving operations and a stable foundation for the asphaltic surface. The layer coefficient for rubblized concrete in the WisPAVE program defaults to 0.22 with an allowable range of 0.20 to 0.24. As a comparison, base course (crushed stone) is assigned a value of 0.14.

3.50.12.2 Paving

The paving of an asphaltic overlay on a rubblized and compacted concrete surface is very similar to paving on a prepared base aggregate. Care must be taken to maintain the compacted condition of the rubblized surface up to the time of paving. If local traffic or construction traffic has impacted the rubblized surface, a vibratory steel roller is used to reestablish a stabilized surface before paving.

Because concrete rubblizing and asphaltic overlay projects often involve opening the roadway to traffic before the total designed thickness is paved, consideration must be given to the thickness of the first lift. It must be thick enough to adequately cover the rubblized concrete surface and carry traffic temporarily until the additional lifts are paved. The number of large trucks determines the minimum thickness needed to carry traffic. When making cross-slope corrections with the first lift, attention must be paid to maintaining an adequate thickness not only at the centerline but also at the edge of the pavement. Additional thickness may also be required in areas of low base/subgrade support.

If the thickness of the asphaltic overlay is decreased when approaching a bridge or overpass, rubblizing should stop at the point where the thickness of the overlay begins to decrease. It is important to maintain the designed thickness over all rubblized areas.

When a yielding subgrade is the suspected cause of depressions in the rubblized layer, consideration should be given to an asphaltic leveling course in place of the use of filler aggregate. This would add greater strength to the section over the yielding subgrade than filler aggregate, and may be a more effective means of achieving smoothness.

3.50.12.3 Traffic Control

Concrete rubblizing and asphaltic overlay projects are constructed using a wide variety of traffic control scenarios. As a general rule, public and construction traffic over the rubblized concrete should be minimized as much as possible. Low volume, low speed local traffic can be accommodated if the shoulders are adequate to carry this traffic. Low speed traffic can also cross rubblized concrete to gain access to driveways and cross roads. If possible, high volume intersections should be rubblized and compacted shortly before the first lift is paved. In cases where the rubblized concrete is exposed to public traffic, close attention must be paid to the condition of the rubblized surface.

3.50.12.4 Curb and Gutter and Partial-Depth Concrete Milling

Partial-depth concrete milling is sometimes used to create a butt joint along the gutter flange to match the thickness of the asphaltic overlay, or to reduce the thickness that is placed over the gutter. Partial-depth concrete milling is also used for cross-slope correction. Adjustments must be made when rubblizing this area as the reduced thickness of the concrete will cause this area to rubblize differently than the full-depth concrete. Typically, less energy should be used to rubblize this area in order to maintain a "structurally sound base." Sometimes one or more lifts are paved over the gutter to the curb face to reestablish the flow lines. If new curb and gutter is placed it should be allowed to cure before rubblizing adjacent to it.