FDR Using Cement

Recycling roads saves money and natural resources.

By Barry Wilder

Deteriorating roads are a constant problem for cities and counties. That's why engineers and public works officials are turning to a process called full-depth reclamation (FDR) with cement. This process rebuilds worn out asphalt pavements by recycling the existing roadway. The old asphalt and base materials are pulverized, mixed with cement and water, and compacted to produce a strong, durable base for either an asphalt or concrete surface. There's no need to haul in aggregate or haul out old material for disposal. Truck traffic is greatly reduced, and there is little or no waste. FDR recycles the materials from deteriorated asphalt pavement and, with the addition of cement, creates a new stabilized base. A surface consisting of a thin bituminous chip seal, hot-mix asphalt, or concrete completes the rebuilt road. The recycled base will be stronger, more uniform, and more moisture resistant than the original base, resulting in a long, low-maintenance life. And most important, recycling costs are normally 25 to 50 percent less than removal and replacement of the old pavement.

FDR with cement conserves virgin construction materials and makes smart economic and strategic sense. If old asphalt and base materials are not recycled, they must be disposed of or stockpiled, increasing transportation costs and utilizing valuable landfill space.

Full-depth reclamation using cement can cut costs up to 50 percent and will increase the longevity of roads.

FDR with cement makes the reconstruction of old roads a largely self-sustaining process. The original "investment" in virgin road materials becomes a onetime cost, which is reclaimed through cement stabilization and the addition of a new, thin surface course.

Simple and Fast

The complete recycling process can be finished in one day, and traffic can be maintained throughout construction. The procedure includes the following steps:

Site Investigation. The site should be investigated to determine the cause of failure. Core samples or test holes should be used to determine layer thicknesses and to obtain samples of the material to be recycled. Material sampling should include the asphalt surface, base course aggregate, and subgrade soil.

FDR with cement recycles existing asphalt pavements and aggregate bases to create a thicker pavement structure and a longer lasting base.

Thickness Design. Pavement thickness can be determined by using Portland Cement Association's (www.cement.org) *Thickness Design for Soil-Cement Pavements*. Other methods, such as the American Association of State Highway and Transportation Officials' (www.transportation.org) *Guide for Design of Pavement Structures* can also be used.

Laboratory Evaluation. Material samples from the site should be pulverized in the laboratory to create an aggregate-soil mix that will be similar to that expected from the reclamation process. The mix design procedure is the same as that performed for soil-cement. This includes the determination of maximum dry density and optimum moisture content. Pulverization construction begins with pulverizing the existing asphalt pavement using equipment that resembles a large roto-tiller. The depth of pulverization is usually 6 to 10 in., which on secondary roads will typically include all of the surface and base, plus some part of the subgrade.

The pulverized material is shaped to the desired cross-section and grade. This could involve additional earthwork to widen the roadway. Final base elevation requirements may necessitate a small amount of material removal or addition. FDR with cement recycles existing asphalt pavements and aggregate bases to create a thicker pavement structure and a longer lasting base.

The FDR Process

A measured amount of cement is spread either in dry or slurry form on the surface of the shaped roadway. Water is then added to bring the aggregate-soil-cement mixture to optimum moisture content (water content at maximum dry density as determined by ASTM D558). The aggregate-soil-cement-water mixture is combined and blended with the pulverizing/mixing machinery. More than one pass of the mixer may be required to achieve a uniform blend of materials. The mixture is compacted to the required density of at least 96 percent of standard Proctor density (ASTM D558). The compaction is usually performed with vibratory rollers. A pneumatic-tired roller may follow to finish the surface. Final compaction should take place no more than two hours after initial mixing of the cement. The field density and moisture are monitored for quality control purposes. The goal of curing is to keep the base continuously moist so the cement can hydrate. The completed base should be coated with bituminous primer to seal in the moisture. The new pavement surface consisting of a chip seal, hotmix asphalt, or concrete is constructed to complete the FDR process.

The success of an FDR project depends upon careful attention to the following control factors:

- Adequate pulverization.
- Proper cement content.
- Proper moisture content.
- Adequate density.
- Adequate curing. GE

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