Illinois Department of Transportation
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Cold-Recycled Bituminous Concrete
Using Bituminous Materials

COUNTY SUPERINTENDENTS OF HIGHWAYS
MUNICIPAL ENGINEERS

#90-34

Utilizing existing bituminous pavement surfaces by cold in-place recycling offers lower costs and the conservation of energy, aggregates and binders with little or no change in grade.

The National Cooperative Highway Research Program has published a Synthesis of Highway Practice 160 entitled "Cold-Recycled Bituminous Concrete using Bituminous Materials". This report prepared by Jon A. Epps at the University of Nevada-Reno is a comprehensive and current collection of information on the subject. Some of the subjects covered in detail are: construction methods, mix design & properties, structural design, performance, economics, specifications and quality control plus appendices covering the mix design methods of five states and the construction specifications of five states.

A summary of the report and the information needed to order the report can be found on the attached page.

Very truly yours,

Bill Sunley

William T. Sunley, P.E.
Engineer of Local Roads
and Streets

Attachment

cc-
District Engineers

COLD-RECYCLED BITUMINOUS CONCRETE USING BITUMINOUS MATERIALS

SUMMARY

Recycling of existing asphalt pavements offers reduced costs, preservation of geometrics, conservation of aggregates and binders, and energy conservation. Although recycling existed as early as 1915, most asphalt recycling has taken place since 1975. Asphalt concrete recycling falls into three general types: surface, cold, and hot. This synthesis is limited to cold in-place recycling with bituminous binders.

Cold in-place recycling benefits include structural improvements without changes in roadway geometry, treatment of all types of pavement distress, elimination of reflection cracking, improvement of ride quality, minimal hauling costs, high production rates, low engineering costs, conservation of aggregates and energy, minimal environmental problems, and cost-effectiveness. Problem areas include greater construction variation than central-plant recycling, curing needed for strength gain, strength gain and construction susceptible to climatic conditions, greater traffic disruption, and need for a wearing surface. Cold in-place recycling has been used primarily on highways with medium and low traffic volumes. It has been used in at least 24 states, including several that have constructed numerous projects.

Construction of cold in-place recycling consists of pavement sizing, addition of new aggregate, addition of new asphalt or recycling agent, mixing, laydown, aeration, compaction, curing, and application of wearing surface. Some of these operations may be combined and others may not be used on some projects. The exact equipment and methods used depend on the agency's specifications, the contractor's experience, and whether the recycling is full- or partial-depth.

Most agencies analyze the recycled pavement for asphalt content and aggregate gradation. New aggregate is added to the mix to provide additional thickness, to correct gradation, or to allow for acceptance of new binder. New binder is usually a slow- or medium-setting asphalt emulsion, although some agencies use a high-float emulsion.

Several state agencies and other organizations have developed mix design procedures for cold in-place recycling of asphalt pavements. A standard national method is not available, but certain basic steps are normally included in the mix design process. These include obtaining samples from the field; processing of samples; evaluation of samples for asphalt content, asphalt physical properties, aggregate gradation, and recycled pavement gradation; selection of amount and type of new aggregate; estimation of asphalt demand; selection of type and amount of recycling agent; testing of trial mixture; establishment of job mix formula; and adjustment in the field.

Few thickness design guides have been published specifically for cold in-place recycling. Most agencies assume that the structural capacity of the recycled material is

equal to that of conventional materials; they replace conventional material with an equal thickness of recycled material without a formal structural design.

Comprehensive national data on performance of cold in-place recycling are not available. Although reports on performance are in the literature, they do not use a common method of defining performance nor do they provide an equal amount of project detail. The general performance data reported by states that have constructed a number of projects indicate that performance has been mostly good or very good, particularly with respect to cracking.

Economic evaluation of pavement rehabilitation strategies should consider initial and recurring costs to the agency (initial capital cost, future capital costs for reconstruction or rehabilitation, maintenance costs, salvage value, engineering) and to users (travel time, vehicle operation, accidents, discomfort, delay during maintenance or rehabilitation). Detailed performance histories and thus life-cycle costs are not available for cold in-place recycling. However, preliminary information indicates that there will be significant life-cycle cost savings compared with conventional overlay techniques. The main savings is in material costs and particularly in the cost of asphalt binder.

Specifications for cold-mix recycling have evolved from soil stabilization and from other cold-mix specifications. Because there is a lack of performance data, users should remain flexible and allow for as many alternatives as possible in order to produce the desired product at the least cost. Currently, the experience and knowledge of the user agency as well as local contractors, equipment manufacturers, and materials suppliers must be relied on to set the standards for cold-recycling operations.

Cold in-place recycling is a viable engineering and economic rehabilitation alternative for asphalt-surfaced pavements with moderate to low traffic volumes. It can be used to strengthen a roadway with minimal change in the vertical cross section. Physical properties of cold in-place recycled materials are typically between those of an asphalt concrete mixture and a cold, asphalt-stabilized base material. Because properties vary from project to project, laboratory tests should be used to establish strength coefficients. Surfacing materials should be placed on all cold in-place recycled projects.

Research is needed to better define structural coefficients, life-cycle costs, field density control techniques, laboratory mixture design techniques, equipment that offers better control of gradation, effects of different diluents in recycling agents, and use of cold-recycled bituminous materials as a base on high-volume highways.

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