Engineering Brief # 29

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In Reply Refer To: AAS-200

Subject: INFORMATION: Engineering Brief No. 29,
Hot Mix Recycling of Asphalt Pavements

From: Chief, Engineering and Specifications Division, AAS-200
To: All Regions

Attn: Chief, Airports Division

Engineering Brief No. 29 provides information and guidance for recycling aged bituminous pavements using hot-mix procedures.

The information contained in this brief is not to be construed as general approval by the Office of Airport Standards. Any use of this method will require prior approval by this office.

Any comments you care to make concerning this brief will be appreciated.

ORIGINAL SIGNED BY:
EDWARD AIKMAN

Attachment

Engineering Brief No. 29

Hot-Mix Recycling of Asphalt Pavements

1. Background.

Construction and maintenance of asphalt pavements until recently have been accomplished by using virgin materials. The scarcity of aggregates combined with the ever increasing cost of asphalt cement and fuel have made the recycling or reuse of materials in existing pavements economically feasible.

Extensive experience over the past several years using bituminous concrete pavement has shown that recycled hot mix:

1. Is comparable in quality to conventional hot mix made with virgin materials.

2. Will reduce the quantity of new aggregate needed.

3. Will reduce the quantity of new asphalt cement needed.

4. Will conserve energy.

5. Can be readily produced in modified batch and drum mix plants.

6. Can result in pavements of the same strength as pavements produced from virgin materials.

7. Can be produced in compliance with all existing air pollution regulations.

8. Is more economical than conventional hot mix in most instances.

9. Eliminates the need for disposal of existing pavement.

10. Can eliminate or greatly reduce reflection cracking in overlays.

Since recycling of asphalt pavements is an effective method of conserving energy and materials, and reducing costs, we feel that the use of recycled asphalt concrete should be considered when a project involves rehabilitation of distressed asphalt pavements.

2. Definition.

Recycled Hot-Mix. A process in which reclaimed asphalt pavement is combined with new asphalt, and/or recycling agents, and new aggregates in a central plant to produce hot-mix paving mixtures. The finished product meets all standard material specifications for the type of mixture being produced.

3. Pavement Design.

a. Hot-mix recycling should be one of the options considered at the design stage of a project. Other alternatives that should be considered include:Cold-mix recycling for use as an aggregate base; surface recycling; .reconstruction with all new materials; and overlay. The alternative selected depends on the type of pavement distress, the probable causes of distress, pavement maintenance history, environmental factors, type of aircraft and amount of time available to accomplish the project.

Material testing of the old pavement to determine basic properties and composition will be necessary to determine that hot-mix recycling is a practical option. The decision to reconstruct, or to overlay should be based on cost and performance on a life cycle basis rather than initial cost. Information on life cycle costing can be found in Report No. DOT-FAA-RD-81-78, Economic Analysis of Airport Recycling Alternatives.

b. If the existing pavement is severely cracked, recycling should be considered in order to eliminate reflective cracking in an overlay.

c. Recycled mixes placed as base and surface courses are being evaluated and it is too early to offer conclusions on life cycle performance. However, the earliest of these pavements is at least 5 years old and are performing as well as conventional pavements.

d. Since most recycled pavement projects are associated with highway construction,recycling of bituminous concrete for pavements serving aircraft weighing more 60,000 pounds or with tire pressures greater than 100 psi should receive a more thorough evaluation.

e. A recycled pavement layer is structurally equivalent to an equal thickness of pavement made from virgin materials provided the mix meets all the design criteria for a new mix.

4. Mix Design.

a. A step-by-step procedure for preparing a job mix design for a recycled mixture is contained in The Asphalt Institute Manual Series No. 20 (MS-lO) entitled, Asphalt Hot-Mix Recycling and in Report No. FAA-RD-78-58,Recycling of Asphalt Concrete Airfield Pavement - A Laboratory Study. Gradation and other material requirements should be the same for a recycled mix as those developed for mixes using all new materials.

b. Regular hot-mix involves blending selected aggregates for a desired gradation and preparing a series of mixtures by mixing this blend with selected asphalt cement. For recycled mixes, selection of the grade of new asphalt cement is governed by the amount and properties of the aged asphalt in the reclaimed material. The extra steps involved in the design of a recycled mix are the evaluation of the reclaimed materials, the selection of the grade of the virgin asphalt cement, and/or the selection of the type and proportions of a recycling agent.

c. Use of a soft asphalt to restore the penetration and viscosity of the reclaimed asphalt cement has been successful. Recycling or softening agents have also been used in conjunction with a soft asphalt. Since there are currently no nationwide standard specifications available for the recycling agents, their use should be limited to those pavements where the asphalt cement was severely hardened.

d. Large amounts of minus 200 sieve material or other gradation deficiencies can be corrected by limiting the quantity of salvaged material used in the recycled mix and by varying the gradation of the new aggregate. Final mix design should always be corrected to reflect the final properties of the material processed by the equipment used on the job.

5. Pavement Removal.

Full depth pavement removal can be accomplished using standard equipment. Bulldozers with ripper teeth can be used for initial pavement breakup. Rollers, compactors and/or travelling hammermills can further break up the pavement. A conventional crushing plant can crush the broken pavement. Milling with a rotary drum cold planing machine can be used where partial depth removal is desired. In this process the pavement is reduced to the desired maximum particle size and used in the hot-mix plant without further processing.

6. Central Mix Plant.

Existing hot-mix plants can be modified at a reasonable cost to handle recycled material. In hot-mix recycling, batch plants are generally limited to 50 percent reclaimed material while drum mix plants can handle up to 70 percent.

Modifications are necessary so that the reclaimed asphalt material can be heated and dried without exposing it directly to the high temperature flame and combustion gases in the dryer. Without these changes, recycled mixtures cannot be produced economically and still comply with regulations governing pollution control.

7. Laydown and Compaction.

Conventional equipment and procedures are used for spreading and compacting hot-mix recycled mixtures.

8. Savings.

Materials savings result from the reduction in new asphalt cement and aggregate. Energy savings result primarily from reduced aggregate haul and drying. Cost savings are influenced by the length of aggregate haul and the distance from the plant to the job site. Factors which have a major influence on bid prices are 1) the familiarity of contractors in the area with recycling procedures; 2) whether contractors equipment has been modified for recycling; and 3) the size of the States recycling program.

In many parts of the country the availability of contractors for central plant-mix recycling is very limited except for large projects. This can result in excessive bids for recycling projects or in no bids being received.

9. Recommendations.

Based on numerous hot-mix recycling projects successfully constructed by most State highway agencies, we recommend that such projects be considered for airport pavement rehabilitation when economically feasible and where other alternatives have been considered.

Toward this end, field tests should first be performed and laboratory tests made on the pavement samples. The results should then be analyzed to determine which alternative method is most suitable. Each alternative should consider expected performance, environmental influences, number of departures, type and weight of aircraft, and initial and projected maintenance costs.

10. Reading Material.

a. Asphalt Hot-Mix Recycling, Manual Series No. 20 (MS-20) The Asphalt Institute, August 1981.

b. Recycling of Asphalt Concrete Airfield Pavement - A Laboratory Study, Report No. FAA-RD-78-58, U.S. Department of Transportation, FAA.

c. Proceedings of the National Seminar on Asphalt Paving Recycling, Transportation Research Record 780, Transportation Research Board, Washington, D. C.

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