Engineering Brief # 14

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In Reply Refer To: AAP-580

Subject: Engineering Brief No. 14, Reconstruction of Airfield Pavements from Recycled Materials

From: Chief, Airports Engineering Division, AAP-500
To: All Regions

Attn: Chief, Airports Division

Engineering Brief No. 14, Reconstruction of Airfield Pavements from Recycled Materials, describes how recycled materials are being used to reconstruct pavements in New England and Jacksonville, Florida. In New England, old asphalt pavements are being recycled to form a reconstituted base for new bituminous concrete surfacing. At Jacksonville, a failed concrete pavement is being recycled to provide a filter course and econocrete base for a new runway keel section.

The purpose of Engineering Briefs is to keep FAA field offices informed of new developments in airport construction which are being tried on a case-by-case basis in one or more regions, but which are not necessarily known to other regions and ADOs. Any comments you care to offer on the use of recycled materials for airport construction will he appreciated.

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LEONARD E. MUDD

Enclosure

Engineering Brief No. 14

RECONSTRUCTION OF AIRFIELD PAVEMENTS
FROM RECYCLED MATERIALS

During the past few years there has been an increasing use of recycled materials in the reconstruction of airfield pavements. The application of recycled materials has taken several forms as is indicated for ADAP projects which have been completed or are underway at the locations mentioned below. In each case recycled materials have been used effectively without increasing costs over conventional methods of construction and in fact superior pavements at lower costs have been achieved in most cases.

RUNWAY RECONSTRUCTION USING RECONSTITUTED BASE AT NEW ENGLAND AIRPORTS.
The reconstituted base procedure involves the recycling of old asphalt pavements which are in poor condition to form a base for

new bituminous concrete surfacing. This process has been popular with engineers in New England in the reconstruction of runways at locations such as Martha's Vineyard, Manchester, New Hampshire, and Rockland, Maine. It has also been used throughout New England in street reconstruction over the past decade. Airport work has been limited to runways serving aircraft weighing 60,000 pounds and less.

The most extensive airport application of the reconstituted base has been at Martha's Vineyard. Runway 6-24 and its parallel taxiway were completed in 1975. Because of the success of this project, Runway 15-33 was rebuilt in the fall of 1976 using the same construction techniques.

The scope of the 6-24 and 15-33 projects consisted of reconstructing the center 100 feet of the runways and repairing the outer 25' sections.

The steps involved in the reconstruction of the runways were as follows:

1. A large grader with rippers tore the existing bituminous concrete into chunks 2 to 3 feet in size and 3 to 5 inches thick.

2. The chunks were pushed into workable windrows by the grader along with the existing stone base course material.

3. A traveling hammer mill towed by a front end loader made several passes over the windrowed material.

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX inspected these pavements in November of 1975, Runway 13-31 was in very bad condition indicating that almost all cracks in the original pavement had reflected thru the overlay. On the other hand the taxiway, apron, and runway where the reconstituted base procedure had been used were in excellent condition and free of cracks.

Because of the obvious advantages of rebuilding badly cracked pavements by reconstitution, authorities at Beverly Municipal Airport near Boston are planning to rebuild Runway 9-27 using this procedure this coming spring. The interesting thing about the Beverly situation is that the consulting engineer for the project estimates that it will be cheaper to rebuild the 4800' x l5O' runway by reconstituting the lOO' wide center strip than it would be by the more conventional methods of sealing all cracks in the old pavement and rebuilding the crown with an overlay, or by removing and replacing the old pavement lOO' wide.

The Beverly experience indicates that for badly cracked bituminous pavement the reconstituted base procedure is cost competitive for airports serving aircraft weighing less than 60,000 pounds, even in the urban environment where paving materials are readily available.

RUNWAY RECONSTRUCTION USING RECYCLED PORTLAND CEMENT CONCRETE AT

JACKSONVILLE, FLORIDA.
On February 22, 1977, I inspected a project involving the reconstruction of runway 13-31 at Jacksonville International Airport, Florida. Runway 13-31 is a very active cross wind runway and is 7700' long by l5O' wide. The existing structure consisted of 11 inch and 13 inch unreinforced portland cement concrete which was supported on a 6 inch limerock stabilized subbase. The 13 inch slabs were located at the ends of the runway and were 5OO' long. The remainder of the runway was 11 inch concrete. The concrete slabs were 25' square and were keyed to adjacent slabs. The reconstruction was necessary because of the extensive failures in the center 5O' of the runway. The outer 5O' on either side of the runway was in good condition.

Runway 13-31 along with the entire airport complex was constructed in the late l96O's. The Boeing 727-200 is the most frequent user of the airport. It is a dual-gear aircraft with an average maximum gross weight of 191,000 pounds. It is considered to have been a major contributor to the distress which appeared in Runway 13-31. Other factors were pavement thickness, and subsidence of the pavement resulting from the pumping of subbase fines through joints and cracks. Failure of the pavement in the critical 50 foot runway center section was evident from extensive longitudinal and transverse cracking, corner cracking, spalling along longitudinal joints and differential pavement settlement.

The Port Authority and its consultant considered two basic approaches to correct the Runway 13-31 problem. One was to replace the failed 50' wide center pavement with a 5O' wide keel section of rigid or asphalt pavement. The other approach was to strengthen the entire runway with a flexible or rigid overlay.

For both of these options various alternatives were considered as is indicated below:

1. For the keel sections the following strength-equivalent pavements were evaluated.

a. 16" PCC on 8" limerock base.

b. 14" PCC on 8" soil cement.

c. 14" PCC on 6" econocrete,

d. lO" Fibrous concrete on 8" limerock.

e. 25" Bituminous concrete pavement with a 6" wearing surface, 13" linerock base, and 6" sand subbase.

f. 16-1/2 inch full depth asphalt.

2. For the overlays a 17-1/2 inch asphalt concrete and a 14-l/2 inch PCC were considered for placement on the existing 11 inch PCC and 6 inch stabilized subbase.

For all keel sections considered, the construction procedure consisted of the break out of the 5O' wide existing concrete

section and removal of its existing base course. Preparation for the overlays included the replacement and mud-jacking of existing panels which had failed or subsided,

The only proposed procedure where recycled material was to be used was the portland cement concrete with the econocrete subbase. Based on the engineers estimate it turned out to be the one of lowest cost at $22.82/sq. yd. Thus the designer recommended the structural keel section consisting of 14 inches of plain portland cement concrete supported on a 6 inch lean concrete base and a 6 inch open graded filter course. The designer also concluded that the econocrete would be stronger and more durable than conventional subbase and would provide a more economical pavement through the use of recycled materials from the existing runway.

The existing runway pavement is being recycled to produce a 6 inch crushed concrete filter course and 6 inch econocrete base by breaking out the existing concrete, processing it through a crusher to produce a maximum size aggregate of about 1-1/2 inches, and running it through a central nix plant to produce a lean max with about 240 pounds of cement per cubic yard of econocrete. The econocrete slump will be about 3 inches with an average compressive strength of about 1000 psi at 28 days. Transverse contraction joints will be formed every 50 feet in the econocrete base,

The 6 inch open graded filter course is also being prepared from recycled material and will serve as a drainage blanket under the econocrete. It is being placed on a filter fabric to prevent infiltration of subgrade fines into the open graded mix.

When I visited the Jacksonville project all concrete from the center 50' section had been broken up and removed to the site of the portable crushing plant operation which was adjacent to Runway 13-31. The majority of this material had already been crushed and was being stockpiled for use in the filter course and econocrete. The crushing of the broken up concrete turned out to be an easy operation, even dowel bars and chairs were easily removed by hand picking from the broken up concrete as it moved from primary to the secondary crusher.

The preparation of the subgrade and the installation of subdrains, filter fabric and filter course were about 50 percent complete at the time of ny inspection. The old subgrade was being proof rolled prior to fine grading and a great deal of undercutting was being done to remove unsuitable materials from below subgrade elevation. These unsuitable materials were being revealed by the proof rolling operation and are now considered to be an additional factor which contributed to runway failure. The undercuts in the subgrade were being backfilled with the subbase course material which had been salvaged from the old runway. No unusual difficulties were being encountered in the placement of subdrains, filter fabric, and filter course once the subgrade preparation had been completed.

Mr. Jay G. Dresser Jr., Project Engineer for the Jacksonville Port Authority, is very pleased with progress in the runway reconstruction and is surprised that almost no unforseen problems

have been encountered in recycling the old concrete runway materials. It is now anticipated that this recycling approach will solve the Runway 13-31 problem at Jacksonville and substantially reduce costs because in place materials were recycled for use in the reconstruction.

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