Engineering Brief # 19

Date: October 25, 1978

In Reply Refer To: AAP-580

Subject: Engineering Brief No. 19, Use of Light Load Nondestructive Testing (NDT) Equipment on Heavy Load Pavements

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

Attn: Chiefs, Airports Divisions

Engineering Brief No. 19, Use of Light Load NDT Equipment on Heavy Load Pavements, describes a project conducted at Dulles International Airport where both light and heavy load NDT devices were utilized in the evaluation of airport pavements. The project at Dulles permitted a side-by-side comparison of two different NDT devices on heavy load pavements.

The purpose of Engineering Briefs is to keep FAA field offices informed of projects which are being tried on airports, but are not necessarily known to other regions and ADOs. Any comments you care to offer on the use of light load NDT devices will be appreciated.

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LEONARD E. MUDD

Enclosure

ENGINEERING BRIEF NO. 19

USE OF LIGHT LOAD NDT EQUIPMENT ON HEAVY LOAD PAVEMENTS

During the spring of 1978 Austin Research Engineers, Inc. of Austin, Texas were contracted by Metropolitan Washington Airports to evaluate the existing airport pavements at Dulles International Airport. The pavements are portland cement concrete 15 inches thick with 9 inches of granular base resting on an E-7 subgrade. Dulles was opened in 1962 thus the pavements have been trafficked for 16 years. Some maintenance has been performed on the pavements, joint sealing, crack filling, some slab replacement, however no heavy maintenance has been required.

Austin Research Engineers used nondestructive testing and core sampling to perform the pavement evaluation. The nondestructive testing was performed with two different devices, the Corps of Engineers 16 kip vibrator and the Dynaflect. Both machines apply a sinusoidal load to the pavement and sense pavement response by deflection measurement. Photos of both machines are shown in Figures 1 and 2.

AAP-580 was interested in the Dulles project since it offered an opportunity for direct comparison of the Corps' machine and the Dynaflect on a heavy load pavement. The Corps' machine is capable of developing a maximum peak-to-peak load of 30,000 pounds whereas the Dynaflect produces a maximum load of 1,000 pounds. A major concern in using small load NDT devices on thick pavements is that very small deflections are produced and the validity of extrapolating the results to relatively large deflections produced by heavy aircraft loads has been questioned. Comparison of the results obtained on the Dulles pavements seems to indicate the Dynaflect and Corps' machine agreed quite well. Some variations were noted in results, however the impact on the final results was minimal.

Borings were made at 60 locations on the Dulles airport and provided specimens for laboratory testing which established material characteristics. Concrete strengths and elastic modulii for all pavement components were determined by laboratory tests. These characteristics were used to analyze the pavements using elastic layer theory. A fatigue analysis was performed which predicted the amount of pavement life used and remaining. Figure 3 shows a core sample.

The Dulles project is an excellent example of the use of NDT as an aid in the evaluation of airport pavements. While the NDT results were not used "directly in the evaluation, they were used to great advantage in establishing areas of similar pavement response and thus allowed a rational method of determining the extent of pavement which is representative of cored specimens. This method of using NDT is covered in AC 150/5370-11, Use of Nondestructive Testing Devices in the Evaluation of Airport Pavement, Chapter 1.

One interesting observation is the agreement between the Dynaflect and the Corps' machine in detecting areas of equal relative deflections. This agreement was noted even though the Corps' machine produced deflections on the order of 11 to 13 times the Dynaflect defections. The Dynaflect deflections were also considerably smaller than the minimum deflection of 0.0005 inches recommended in AC 150/537011. The Dynaflect deflections averaged about 0.00013 inches and the Corps' machine averaged about 0.0016 inch. Apparently no nonlinear response occurred since good agreement was achieved.

Austin Research Engineers has not completed the final report on the evaluation of the pavements at Dulles. While assessment of the condition of the pavements at Dulles is beyond the authority of AAP-580, the author feels the pavements are in good structural condition based on a brief visual inspection made in July 1978. Some longitudinal cracking was observed in a number of the outer paving lanes but it did not seem to be detrimental and was probably caused by shrinkage. Other defects were also noted such as corner breaks but all were considered minor. Apparently a very effective joint maintenance policy has been followed at Dulles as nearly all joints are in good shape. Joint sealants appear to be clean, live and adhering to the pavement.

AAP-580 plans to study the results of the Dulles program further to determine if some relaxation in the minimum deflections given in AC 150/5370-11 is in order. If a lower deflection appears warranted, the use of light load NDT equipment would be expanded.

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