Engineering Brief # 5

Date: June 18, 1975

In Reply Refer To: AAS-580

Subject: Engineering Brief No. 5, Steel Fibrous Reinforced Concrete

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

Attn: Chiefs, Airports Division

Engineering Brief No. 5, Steel Fibrous Reinforced Concrete, describes the use of this type of overlay for a terminal parking apron at Reno International Airport, Nevada. The purpose of Engineering Briefs is to keep FAA field offices informed of nm; 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. Report No. FAA-RD-74-31, Steel Fibrous Concrete for Airport Pavement Applications, presents detailed information regarding its design and construction.

ORIGINAL SIGNED BY:
E. DONALD BAUER

Enclosure

ENGINEERING BRIEF NO. 5

STEEL FIBROUS REINFORCED CONCRETE

During the period of May 14-15, 1975, I inspected the steel fibrous reinforced concrete overlay at Reno International Airport Reno, Nevada. Assistance for concrete overlay at Reno International Airport Reno, Nevada. Assistance for the project is being provided under ADAP. The fibrous concrete overlay is being placed on a terminal parking apron over an existing 11 inch thick portland cement concrete pavement. The existing pavement has experienced severe surface concrete pavement. The existing pavement has experienced severe surface scaling. The area to be paved is approximately 1400 feet long and 225 feet wide (35,000 square yards). The fibrous concrete overlay will cover approximately 23,000 square yards of the area. The remaining 11,700 square yards consist of removal and replacement of the existing slabs with conventional concrete pavement. The removal and replacement of Slabs was to allow for transitioning the new construction into the existing grades.

Personnel contacted during the visit were Mr. Robert Mandeville, Airport Manager, and Mr. Lloyd Walker, Superintendent of

Maintenance, Reno International Airport and Mr. John McLaury, engineer, city of Reno. Mr. Byron Osterloh, Engineering Staff, Western Region, accompanied me during the visit. Mr. Michael Mavrakis, Assistant ADO Chief and Mr. Gunnar Tenneson, Project Engineer, both of the San Francisco Airport District Office also participated in the inspection.

Mr. Kenneth Van Fleet, Superintendent, Oberg Construction Corporation, contractor for the Reno job was most cooperative in showing us the operation and answering questions.

Existing Pavement. As mentioned above, the existing portland cement concrete pavement has experienced severe surface scaling. The pavement resembles exposed aggregate concrete as nearly all of the surface mortar is gone. The reason for this is not completely known and is probably due to a combination of factors. The weather conditions at Reno are particularly severe in the winter in that a freeze-thaw cycle occurs nearly every day. The aggregates in the area are somewhat reactive. The apron is in the terminal unloading area and de-icing chemicals are liberally used for the safety of the de-planing passengers. Many of the city streets, curbs, and sidewalks are exhibiting surface scaling just as severe as the airport apron. The phenomenon is thus not the result of airport-type operations Some structural cracking was apparent in the existing pavement but was not considered too serious. An overlay was needed to provide some strengthening for future use by DC-10 and L-1011 aircraft and to correct the surface scaling condition. Overlaying the apron presented a problem in that only 4 to 5 inches of head room were available due to the need to provide drainage away from the terminal building. The only two available alternates were to remove and replace the slabs or to overlay with fibrous concrete. Fibrous concrete will provide the necessary strength with only a 4 inch thickness.

Fibrous Concrete - The fibrous concrete was delivered to the site in ready mix trucks from a batch plant located some 1/2 to 3/4 mile from the paving site. The fibers were furnished by U.S. Steel and were rectangular in cross section and 1 inch long. They were produced by shearing large flat sheets. The fibers were shipped to the site in one cubic foot boxes each weighing 40 pounds. They were emptied by hand into a front end loader. The front end loader emptied the fibers into a hopper which had a vibrating screen with opening about 3 inches wide. The vibrating screen broke up any fiber clumps to a rather small size. One man was positioned above the vibrating screen with a rake device to assure the free flow of fibers and to break up large clumps. A conveyor belt carried the fibers from the bottom of the vibrating screen hopper to the top of a large diameter pipe (about 24" diameter) which had a shaft down the center with blades attached. The shaft rotated at about 2000 rpm to further disperse the fibers just prior to falling onto the aggregate belt. The process was then conventional in that the aggregates and "fibers went into the weigh hopper. The cement and water were weighed and then discharged into the ready mix truck. After the truck was loaded fly ash was added from a separate silo and the material transit mixed enroute to the site. A photograph of the plant is

shown in Figure 1.

Placement of Fibrous Concrete. - The existing pavement was cleaned and coated with mortar prior to placing the fibrous concrete overlay. The mortar was intended to provide a bond between the existing pavement and the fibrous overlay. The mortar was still wet when the overlay was placed. The ready mix trucks discharged the fibrous concrete onto the pavement immediately ahead of a Blaw Knox spreader which operated on steel side forms attached to the existing pavement. Vibration was furnished by a hand-operated electric vibrator. The overlay was finished with floats and then textured with a hand operated steel tined comb worked from a moving bridge. Curing compound was applied from a moving bridge as soon as possible after the texturing was performed. Figure 2 shows an edge of the finished overlay with a pencil for size comparison. Joints in the fibrous concrete matched the joints in the base pavement. Contraction joints were sawed and the construction joints were of course formed. No load transfer devices were used across the joints.

General Comments. The fibrous concrete overlay at Reno appears to be,excellent. Very little clumping of fibers was experienced. This was probably due to the use of the rotating blades in conjunction with " the vibrating screen. Flexural strengths in the vicinity of 900 psi at 7 days were being obtained on this job. The cost of producing the fibrous concrete is about double the cost of conventional concrete. In this instance the use of fibrous concrete eliminated the need to remove and replace the existing pavement. The Reno job is the first application of fibrous concrete on an airport project where a sufficient quantity of fibrous concrete was involved to allow the contractor to get "strung out" and get production rolling. The batch plant was producing on the order of 300 cubic yards per day. The excellent results obtained on this job as compared to research oriented applications is probably due to the relatively large quantity of material involved. The U.S. Army used fibrous concrete on a project at Fort Hood, Texas where a rather large volume of material was involved. To date, the Reno International Airport and Fort Hood jobs are the largest applications of fibrous concrete. Another fibrous concrete overlay is planned for later this year at McCarran International Airport
Las Vegas, Nevada.

We would appreciate any comments you may have on fibrous concrete applications.

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Figure 1. - Overall view of batch plant. Flyash silo is on extreme left. Vibrating screen for initial dispersion of fibers is in the center of the picture. Large diameter tube with rotating blades is positioned between the two hoppers on the right side of the picture.

Figure 2. - Closeup of edge of 4-inch fibrous overlay. Side form is still in place. Pencil used to illustrate size.