Engineering Brief # 12

Date: March 30, 1976

In Reply Refer To: AAS-580

Subject: Engineering Brief No. 12, Fibrous Concrete Aprons at Reno and Las Vegas, Nevada

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

Attn: Chiefs, Airports Divisions

Engineering Brief No. 12, Fibrous Concrete Aircraft Aprons at Reno and Las Vegas, Nevada, reports on the construction and performance of this type of overlay. 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. Report No. FAA-RD-74-31, Steel Fibrous Concrete for Airport Pavement Applications, presents criteria regarding its design and construction.

ORIGINAL SIGNED BY:
LEONARD E. MUDD

Enclosure

ENGINEERING BRIEF NO. 12 - FIBROUS CONCRETE Aircraft

APRONS AT RENO & LAS VEGAS, NEVADA

On February 26 and 27, I participated in inspections of a steel fibrous reinforced concrete apron which was under construction at McCarran International Airport, Las Vegas, and one which had been constructed at Reno International Airport in May of 1975. Both projects are ADAP funded. Participants in the inspection included Byron Osterloh, AWE-620; Fred Horn, ARD-430; Gunnar Tenneson, San Francisco ADO, and representatives of the engineering staffs at both airports.

RENO INTERNATIONAL AIRPORT. A description of the techniques and problems involved in the construction of the Reno apron are described in Engineering Brief No. 5 dated June 8, 1975. The work at Reno had consisted of overlaying the main aircraft parking apron with 23,000 square yards of 4 inch fibrous concrete,The overlay had been placed on an existing concrete apron which was badly spalled and contained structural cracks.

By February the fibrous concrete overlay had been in use for 8 months and was performing well. The only signs of distress were at corners formed by longitudinal construction joints and transverse contraction joints where diagonal cracks had appeared in a number

of slabs. lt is was attributed to some upward warping of the thin fibrous concrete sections at joints. The cracks at joints had resulted from aircraft loads on the warped corners. This is not considered to be a serious problem by airport maintenance personnel since other aspects of the overlay performance are considered to be good. Las Vegas took this performance into account in deciding to go ahead with their fibrous concrete overlay.

McCARRAN INTERNATIONAL AIRPORT (LAS VEGAS). The steel fibrous reinforced concrete overlay at Las Vegas is being constructed to strengthen and rehabilitate the existing transient aircraft parking apron. This apron is 600' wide x 9OO' long and the overlay will be 6 inches thick. The contractor for the overlay is Matich Contractors of Colton, California. Inspection of the project was made in the company of Bob Lowe and Steve Hefner who are airport engineers at Clark County's McCarran International Airport.

Noteworthy features of the Las Vegas job included the following:

1. The size of the project, 60,000 square yards, make it the largest fibrous concrete job yet constructed.

2. The fibrous concrete overlay is being constructed over an existing asphalt pavement which contains many cracks, The existing apron consists of 3 inches of P-401 surface course and 10 inches of p-209 crushed aggregate base course on a caliche subgrade.

3. Because of the special properties of fibrous concrete, the Las Vegas engineers feel that cracks in the existing asphalt pavement will not reflect through the overlay and no special treatment is being given to existing cracks. The only treatment prior to overlay placement is the sweeping of the existing apron. The performance of the overlay bears close watching with a regard to reflective cracking.

4. Because of the high flexural strength of fibrous concrete, 1150 psi in 28 days, airport engineers estimate that the 6-inch overlay on the existing asphalt pavement will be equivalent to a 16 inch plain concrete pavement.

5. The fibrous concrete overlay is being placed with a slip form paver. Paving lanes are 25 feet wide with contraction joints at 50 feet. The fibrous concrete is being placed with a 2 and 1/2 inch slump. However, because of the steel fibers, there is no noticeable edge slump. A stiff broom finish is being provided in a longitudinal direction.

6. The mixing and placing of fibrous concrete at Las Vegas is the most trouble free job yet encountered using this material. This is attributed to experience gained on earlier jobs where numerous problems have been encountered. The arrangements of equipment and procedures at Las Vegas are as follows :

a. A central nix plant is located immediately adjacent to the paving site. A six yard mixer is used but only 3-yard batches are being mixed to insure thorough mixing of the steel fibers in the concrete.

b. Mixed concrete is hauled to the nearby slip-form-paver l in end dump trucks. This eliminates problems which were encountered on earlier jobs where transit mix trucks were used. A particular problem had been the balling up of fibers during nixing.

c. The steel fibers are being deposited onto the feed conveyor belt after cement and aggregate have been introduced. The fibers are fed onto the conveyor belt through a special shaker which was developed and furnished by the U. S. Steel Corporation. The fibers are 1 inch long and are loaded into the shaker directly from shipping boxes. Fiber content in the concrete is 160 pounds per cubic yard.

d. After the fibers are placed on the belt there are no turns in the conveyor system before the ingredients reach the mixer. This straight shot reduces the chance of fiber balling, according to the engineers at Las Vegas.

e. The maximum size aggregate used at Las Vegas is 3/8 inch. This size was selected because it works well with steel fibers. Balling problems were encountered with trial mixes using 3/4 inch aggregate.

f. The fibrous concrete at Las Vegas is being placed during cool weather when temperature variations are minimal. The Las Vegas engineers feel that cool temperatures plus the 6" concrete thickness may eliminate the warping problem encountered at Reno where fibrous concrete was cured during hot weather and the thickness was 4 inches.

CONCLUSIONS. The most interesting facet of the Las Vegas project is that it is the first time steel fibrous concrete has been mixed and placed on a high volume basis and the first time that problems with the mixing and placement procedures have been negligible. In other words, the Las Vegas job is demonstrating that the construction of steel fibrous concrete can be a smooth operation. The rate of production at Las Vegas is about 500 cubic yards of fibrous concrete per day. The cost of the concrete in place is $98 per cubic yard. A copy of the Mix Design for Las Vegas is enclosed.

It should be noted that research on steel fibrous concrete for airport pavement applications was conducted for the FAA by the U. S. Army Engineers Waterways Experiment Station and criteria for its use is contained in Report No. FAA-RD-74-31 dated November 1974.

The fibrous concrete overlay for Las Vegas was designed to accommodate Boeing 747 aircraft based on criteria contained in this report.

Several trial applications have been constructed based on this research including relatively small projects at Tampa International Airport,Florida, and John F. Kennedy Airport, New York. The largest projects to date are at Reno and Las Vegas with the Las Vegas job indicating that fibrous concrete techniques are now ready for full scale production. The performance of fibrous concrete at various locations and under varying conditions should be monitored closely. Comments its performance will be appreciated.

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Enclosure