Engineering Brief # 24

Date: February 9, 1981

In Reply Refer To: AAS-200

Subject; INFORMATION: Engineering Brief No. 24,
Prestressed Concrete Overlay at Chicago
O'Hare International Airport

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

Attn: Chief, Airports Division

Engineering Brief No. 24, Prestressed Concrete Overlay at Chicago O'Hare International Airport, presents a brief description on the construction of a prestressed concrete overlay pavement at O'Hare International Airport.

The purpose of engineering briefs is to keep FAA field offices informed of construction methods which are being tried, but which are not necessarily known to the Regions and ADO's. The information contained in this brief is not to be construed as general approval by the Office of Airport Standards. Any use of this type of construction will require prior approval by this office.

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

ORIGINAL SIGNED BY:
EDWARD AIKMAN

Enclosure:

ENGINEERING BRIEF NO. 24

Prestressed Concrete Overlay at
Chicago O'Hare International Airport

On August 27, 1980, a visit was made to Chicago O'Hare International Airport to inspect the new prestressed concrete overlay pavement. The overlay is located on the 27L end of Runway 8R-27L. The prestressed concrete portion of the overlay is 800 feet long and 150 feet wide. A bituminous overlay 800 feet long is used to transition down to the base pavement surface.

The base pavement is a continuously reinforced concrete pavement 12-inches thick supported on an 18-inch thick crushed limestone base. Load transfer in the base pavement is provided by keyways and #5 tie bars on 20-inch centers except for the centerline joint which is keyed but not tied. A 500-foot portion of the base

pavement had been overlain previously with a 6-inch thick bituminous overlay. A l/4-inch thick asphaltic emulsion slurry seal coat was applied to a 400-foot segment of the base pavement prior to this project.
Approximately 5% of the
Prior to placing the prestressed concrete overlay approximately 5% of the base pavement was removed and reconstructed. A nominal 1-1/2 inch thick bituminous leveling course was placed over the base pavement. Two layers of polyethylene sheeting were placed over the leveling course to reduce the friction between the prestressed concrete overlay and the bituminous leveling course.

The 800-foot prestressed concrete overlay pavement was placed in two 400-foot sections. Six paving lanes 25 feet wide provided a width of 150 feet. The eastern half of the overlay is 9-inches thick prestressed concrete and the western half is 8-inches thick prestressed concrete. The difference in thickness between the two sections is accommodated by using a transverse sleeper slab with a one-inch step. The 9-inch thick pavement is located where taxiways cross the runway and thus will receive considerable cross traffic. The overlay design is based on the 747 aircraft. High quality concrete, 5000 psi compressive strength, was specified. The slabs were prestressed using post tensioning techniques. Longitudinal prestress is designed to provide an average value of about 400 psi over a 20-year design life. Transverse prestress is designed to provide about 225 psi over a 20-year life. Prestress is provided by tendons of high strength deformed bars conforming to ASTM A-722 and A-29. The tendons are housed in conduit which was cast in the concrete. After the concrete had cured sufficiently hydraulic jacks were used to apply tension to the tendon. A cement grout was pumped into the conduit to completely fill the voids between the tendon and conduit. After the grout had cured, the tension on the tendon was released and the bond between the tendon and the grout provided the necessary compression to prestress the slab. Both the 8 and 9 inch thick pavements were placed in 400 foot lengths with no transverse joints. Movements at each end of the slabs are estimated to be on the order of 1-1/2 to 2 inches. These relatively large movements are accommodated by specially designed joints composed of structural steel members. Waterproofing is accomplished by using a flexible fabric material clamped to the structural steel members.

Analyses of the prestressed pavement section using various methods and load placements indicate stresses should be well below those required to induce slab cracking. It is hoped that the prestressed overlay will remain crack-free during its design life. The performance of prestressed pavements in Europe has demonstrated that thin prestressed pavements can support heavy aircraft operations with little or no maintenance, if adequate jointing is provided.

The new overlay surface was grooved by sawing l/4-by-l/4 inch grooves on 1-1/4 inch centers after the pavement had cured. All work was accomplished within the 60-day limit established in the contract despite the heavy rainfall encountered during construction. Had the old pavement been removed and reconstructed the unusual amount of rain would have undoubtedly caused delays.

The success of this project was largely due to excellent cooperation of all parties involved in the construction. The contractor was very competent and the engineer provided personnel on-site who were in a position of authority so that when problems or questions arose they could be worked out in an expeditious manner.

Attached are several selected photographs of the construction in progress. These photos were supplied by the Great Lakes Region. The overlay is performing satisfactorily to date. Since runway 8R-27L is the third busiest runway at O'Hare it will receive a large amount of traffic in a relatively short time. Most of the traffic will be departing aircraft. Performance data should be accumulated rapidly.

Total cost for this project was $1,609,678.35. The prestressed concrete portion of the project cost approximately $950,000. The prestressed concrete totaled 13,417 square yards. Unit cost for the prestressed concrete was thus slightly more than $70 per square yard. Approval of prestressed concrete pavements for ADAP projects is still on a case-by-case basis. We should gain valuable information from the O'Hare installation to assist us in any future applications of prestressed concrete pavements.

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