Engineering Brief # 3

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ENGINEERING BRIEF N0. 3

LCPF RUNWAY EXTENSION AT
PORTLAND INTERNATIONAL AIRPORT, OREGON

On August 21 and 22, 1974, I inspected a runway extension project at Portland International Airport which is being constructed with a stabilized base consisting of lime, cement, pozzolan, and filler (LCPF) and a bituminous surface. The inspection was part of an Airport Engineering Seminar which dealt primarily with the design and construction of LCPF pavements and the use of nondestructive testing machines in pavement evaluation and design. The seminar was organized by the ATA member airlines and was attended by some 40 representatives from the ATA, the Airlines, AOCI, the Aircraft Manufacturing Industry, and FAA.

There is widespread interest in he LCPF paving because of the apparent cost savings which are realized when it can be used in place of more conventional rigid and flexible pavements. At Portland, for example, the cost of constructing the 2200 foot extension to runway 10R and 4200' extension to its parallel taxiway is 1.5 million dollars based on competitive bids whereas the estimate for an alternate pavement section which called for a bituminous stabilized base was 2.5 million dollars. The Port of Portland, the sponsor, figures they cut paving costs by 1 million dollars, for a 40% saving.

Although the LCPF pavement has had limited applications, the Port of Portland had extensive experience with it at marine terminals before they decided to use LCPF in the extension of runway 10R. To date, the Port of Portland has constructed approximately 70 acres of heavy-duty LCPF pavements at their dock facilities. The dock facilities are used to store containerized cargo from ships. The container packets are moved around the LCPF paved dock storage areas by transtainers which impose single wheel loads of up to 100,000 pounds on the LCPF pavement. The marine terminal pavements were designed for repeated transtainer loads of 85,000 pounds per wheel and consist of a 22-inch pavement made up of 6" of type C-LCPF mix, 6" of type B-LCPF mix, an 8" of type A-LCPF mix and a 2-inch asphalt surface.

LCPF pavements were used originally by the Port of New York Authority at Kennedy and Newark Airports. At these locations they were referred to as lime-cement-flyash (LCF) pavements although the contents of the pavement are essentially the same as those being used on the Portland project. The difference is that a manufactured pozzolan (flyash) was used on the New York airports while pozzolan from natural deposits is being used at Portland.

The use of LCF pavements in the New York area was initiated by

Nai C. Yang, who was formerly an engineer with the Port of New York Authority. He is also a consultant on the Portland project. At Newark Airport, extensive paving has been accomplished using LCF Pavement: a new runway 4L-22R opened in February 1970; a new keel section for runway 4R-22L opened in August 1973; and almost all aprons, taxiways, roadways, and automobile parking areas associated with the new terminal complex opened in August of 1973. In addition, an LCF taxiway parallel to runway 11-29 is now under construction and a new keel section for this runway is planned for 1975.

I inspected the Newark pavements in early August 1974. They appeared to be in excellent condition and the PONYA engineers at Newark are pleased with its performance. Approximately 1.5 million square yards of LCF pavement have been placed at Newark. A substantial portion was ADAP funded.

On the same day, I inspected the inner and outer LCF taxiways which circumvent the terminal complex at Kennedy which were also ADAP funded. They were constructed in phases beginning in 1969. There have been failures in some segments of these taxiways and surface repairs have been made. However, the consensus among the parties involved with the Kennedy taxiways seems to be that the problem resulted from tight completion schedules which did not permit careful control over construction rather than from any inherent defect in LCF pavements. The major problem at Kennedy seems to be poor bonding between the LCF base and 4-inch asphalt surface. This is attributed to factors such as placing asphalt after rains, extensive use of LCF bases as haul roads, and failure to cure and properly clean the LCF surface before placing asphalt.

Special care has and is being taken at Newark and Portland to prevent a repeat of the Kennedy mistakes. Marvin Byington, Aviation Construction Manager for the Port of Portland, feels that inspection, testing, and quality control are probably more important to the construction of LCPF pavements than to the more familiar conventional pavement. He indicates that the Port of Portland spends as much on inspection as they do on design to insure that the proper mixes come out of the plant and that required compaction is achieved for the 3 LCPF mixes and bituminous surface mix used on the job. The Portland runway section consists of a sand subgrade, 8" of type C-LCPF mix, two 8" thick type B-LCPF mixes, and 8" of type A-LCPF mix, and a 4" asphaltic concrete surface course. The Type C mix consists of 3% lime, 1% cement, 6% pozzolan, 10% filler, 0% stone and 80% sand with a compressive strength of 800 psi. Type B mix is similar to type C but contains 10% stone and 70% sand with a compressive strength of 1500 psi. Type A mix contains 3.3% line, 1.1% cement, 6.6% pozzolan, 8% filler, 25% stone, and 56% sand with a compressive strength of 2000 psi. The primary purpose of the Type C mix is to provide a working platform on which the higher strength layers are constructed. The critical design aircraft for Portland is the DC 10-30.

According to Marvin Byington, LCPF pavements are cheaper because they are easier to construct than more conventional rigid and

flexible pavements. This was verified by Walt Gamble, Division Manager for the paving contractor, Gibbons and Reed. It takes fewer people and less equipment to build LCPF because timing is less critical. You have about 3 days to work with LCPF before it is firmly set, whereas, asphalt is fixed by the time it cools and concrete working time is less than 4 hours. In addition, the energy consumed for manufacturing, mixing, and placing the ingredients for LCPF is considerably less than for asphalt mixes.

LCF (LCPF) pavements show great promise, especially from the standpoint of economics. We plan to monitor its performance closely. Any comments on your experience with LCF pavements will be appreciated.

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