B-747 gear would have resulted in an excessively high volume of C-5A gear traffic to achieve failure.

Two 25-ft (7.6 m)-wide paving separated by a keyed longitudinal construction joint were used. Corps of Engineers criteria were selected for the key and keyway dimensions (fig. 4). Each test item contained four 25-ft (7.6 m)-sq slabs of uniform thickness; two in the north and two in the south paving lanes. The test items were separated by 25-ft (7.6 m) long and 50-ft (15.2 m)-wide reinforced concrete transition slabs in which the change in the thickness from one test item to another was achieved. Transverse joints were of the weakened plane (dummy) type using a groove equal to one-sixth of the pavement thickness. The test items were instrumented to measure deflection, concrete strain, and thermal gradient in the concrete.

The test track was laid out into two lanes for traffic testing as shown on fig. 4. The C-5A traffic lane was located to produce loading parallel and adjacent to the center-line longitudinal joint. This produces an edge loading along the longitudinal joint, which is the critical orientation of the C-5A gear insofar as stress in the concrete slab is concerned. The lane for the B-747 gear was located in the center of the north paving lane. This orientation produces a maximum stress in the slab when the twin wheels of the twin-tandem assembly are tangent to the transverse joint.

After C-5A traffic had been applied and test items 1 and 4 had reached a shattered-slab failure condition, they were overlaid with asphaltic concrete and the C-5A traffic was continued to assess the adequacy of the existing criteria for nonrigid type overlays. Traffic with the B-747 gear in the north lane represented a strengthening of an unfailed pavement. The 10-in. (25 cm) concrete (item 1) and 8-in. (20 cm) concrete (item 4) was overlaid with 4 and 6 in. (10 and 15 cm) of hot-mix asphaltic concrete, respectively. The hot-mix asphaltic concrete utilized 3/4-in. (1.9 cm) maximum-size crushed limestone, sand filler,and 5 percent of 85-100 penetration grade asphalt. The portland cement concrete surface was cleaned by brooming and badly spalled cracks were tack coated and filled with cold-mix asphaltic concrete prior to the overlay. During the construction of the nonrigid overlay in item 1, a polypropylene membrane was tack coated to a portion of the surface of the cracked portland cement concrete surface (see fig. 4) prior to application of the asphaltic concrete to evaluate its ability to minimize reflection cracking in the overlay due to joints and cracks in the base pavement.

Longitudinal joint study (LJS) test track

A less than desirable performance of the keyed longitudinal construction joint in the MWHGL test track and rather extensive pumping during traffic prompted a second study to determine (a) the feasibility of strengthening keyed construction joints; (b) the performance of keyed construction joints on medium- and high-strength foundations; (c) the performance characteristics of doweled joints; and (d) the ability of filter courses to prevent or deter subgrade pumping under the wide-body jet aircraft loadings. The LJS test track consisted of four nonreinforced concrete items 8-, 10-, and 11-in. (20, 25, and 28 cm) thick each having different longitudinal joint and foundation treatment as shown by the plan and profile (fig 5). The LJS test track was constructed on the site of the MWHGL test track and utilized the same heavy clay (CH) subgrade which was reprocessed and constructed to yield a uniform low strength (k = 50-75 pci (1.4-2.1 kg/cm^3)) foundation. The concrete mix design used for the MWHGL test track was selected for the LJS test track to yield a 28-day design strength of 650 psi (45.7 kg/cm^2).

The LJS test track consisted of two 25-ft (7.6 m)-wide paving lanes separated with a longitudinal construction joint. Each test item consisted of four 25-ft (7.6 m) concrete slabs; two in the north paving lane and two in the south paving lane. Reinforced concrete transition slabs were used to separate the test items and to achieve changes in concrete thicknesses. Each test item was designed, using extrapolated criteria and results of the MWHGL tests, to fail at about the same level of C-5A traffic.

For test item 1, 24 in. (61 cm) of the heavy clay (CH) subgrade was replaced with a pit-run clayey gravelly sand to achieve a medium-strength foundation (k = 200-300 pci (5.5-8.3 kg/cm^3)). A concrete thickness of 8 in. (20 cm) was selected. A conventional keyed joint was used for 25 ft (7.6 m) of the longitudinal joint and a doweled joint was used for the remaining 25 ft (7.6 m) of the longitudinal joint. Item 2 was an 11-in. (28 cm) plain concrete placed directly on the heavy clay subgrade. A conventional keyed joint was used and the test item was dedicated to a study of the feasibility of strengthening this type joint. Three methods of strengthening the joint were studied as shown by sections A-A, B-B, and C-C of fig. 5. Test item 3 was a 10-in. (25 cm) reinforced concrete and 4 in. (10 cm) of concrete sand filter on the heavy clay subgrade to determine whether the sand-filter course would prevent pumping of the subgrade under the heavy loadings which was experienced in the MWHGL tests. A doweled longitudinal joint was used to study the performance of this type joint on a low-strength foundation. For test item 4, a 6-in. (15 cm) thickness of cement-stabilized clay gravel base was used on the heavy clay subgrade to achieve a high-strength foundation (k > 400 pci (11.1 kg/cm^3). A 10-in. (25 cm) nonreinforced concrete thickness was used. The longitudinal joint in the east slab was a conventional keyed type while in the west slab a doweled joint was used.

The concrete was dry batched at a local plant, transit mixed,and delivered to the construction site, a distance of about 2-1/2 miles (4 km) in ready-mix trucks. The 3- to 4-in. (7.6 to 10.2 cm) slump concrete was deposited in the side forms and spread by hand using shovels rather than with a paver. Internal vibration was used to consolidate the concrete and finishing was with bull floats and burlap drags. The concrete was moist cured followed by plastic membrane curing. Transverse joints were sawed and all joints were sealed with a hot-poured sealer. All test items were instrumented to measure concrete strains and elastic deflections in the foundation.

In conjunction with the longitudinal joint study, studies of the performance of fibrous concrete were conducted for the U. S. Army Construction Engineering Research Laboratory (CERL). Steel fiber reinforcement of concrete had undergone laboratory study for some time at CERL, and before that at the U. S. Army Engineer Ohio River Division Laboratories and findings indicated the material exhibited superior strength and performance characteristics from a crack inhibitor standpoint. Several small pavement sections had been constructed and were under observation; however, this was the first attempt to study the performance of the material under controlled simulated traffic conditions.

Test item 5, a 6-in.-thick fibrous concrete on a 4-in. sand filter, was added at the east end of the LJS test track. Because of space limitations, item 5 was limited to 25 ft long and 50 ft wide and was placed without either transverse or longitudinal joints. Both the east and west transverse edges were thickened to 9 in. to compensate for free edge stresses. After the C-5A traffic had been applied and item 3 had reached a shattered slab condition in the south paving lane, both the north and south lanes of item 3 were overlaid with a 4-in. thickness of fibrous concrete and traffic was continued to study its performance as a strengthening and resurfacing material. Neither longitudinal or transverse joints were provided in the fibrous concrete overlay of item 3.

Both the fibrous concrete slab on grade and overlay were constructed using a 3/8-in. maximum-size chert gravel, natural sand, nine bags per cubic yard of type I cement, 5 to 6 percent air entrainment, and 2 percent by volume of steel fibers. A 1-in. long by 0.016-in.-diam steel fiber was used for the slab on grade and the slump varied from 4 to 6 in. For the overlay, a steel fiber 1 in. long with a 0.010- by 0.022-in. cross-sectional area was used along with a 3- to 4-in. slump. For both slabs, the concrete was dry batched at a local plant, transit mixed, and delivered to the construction site, a distance of about 2-1/2 miles, in ready-mix trucks. The steel fibers were blended with the aggregates by manually feeding the fibers onto the aggregate conveyor belt. The concrete was spread by hand using shovels, consolidated by surface vibration, and finished with hand floats. Both slabs were moist cured for seven days followed with polyethylene membrane curing for 21 days.

The LJS test track was laid out into two lanes for traffic testing in the same manner as for the MWHGL test track as shown on fig. 5. Traffic with the C-5A gear on overlaid item 3 represented performance of the fibrous concrete as a strengthening of a failed concrete pavement. In contrast, traffic with the B-747 gear on an overlaid item 3 represented performance of the fibrous concrete as a strengthening of an unfailed concrete pavement.

Structural layer (SL) test track

The third test track was a comparative performance of structural layers in pavement systems and their effectiveness in stiffening the system thereby reducing the concrete stress and the effects of detrimental deformations under load. High quality structural layers, such as soil stabilization and processed base courses, have been utilized in concrete pavement construction but because of the lack of performance data there is no method for the rational assessment of their structural advantages. Some agencies allow structural credit through the use of equivalency factors or substitution ratios. The results from the SL test track will lend credence to such factors or ratios and serve as a basis for the development of a design system which will account for the structural benefits of the layers based upon a measurement of the material strength or quality.

The SL test track consisted of five test items as shown on fig. 6 which were constructed on the heavy clay (CH) subgrade (k = 50-75 pci (1.4-2.1 kg/cm^3) that served as the subgrade for the MWHGL and LJS test tracks. Two 25-ft (7.5 m)-wide paving lanes separated by a longitudinal construction joint were used and each test item was 50-ft (15.2 m) square. Traffic was applied with a twin-tandem gear having the same dimensional characteristics as one of the twin-tandem assemblies of the B-747 main gear. Two traffic lanes positioned as shown on fig. 8 were used. A 200-kip (90,800 kg) traffic lane was located in the south lane parallel to and adjacent to the longitudinal construction joint while a 240-kip (108,960 kg) twin-tandem gear was used to traffic the lane laid out in the middle of the north paving lane.

Test items 1 and 2 were surfaced with 7 and 4 in. (18 and 10 cm) of fibrous concrete, respectively, consisting of 3/8-in. (0.95 cm) maximum-size chert gravel, natural sand, 250 lb/yd^3 (148 kg/m^3) and 846 lb/yd^3 (502 kg/m^3) of type 1P (17 percent fly ash) cement. Three different types of steel fibers were used. A 1-in. (2.5 cm) long by 0.016 (0.04 cm)-diam steel fiber was used for all of test item 1 while a 3/4-in. (1.9 cm)long with a 0.010- by 0.014-in. (0.025 by 0.036 cm) cross section was used in the north slab of item 2. For the south slab of item 2, a 3/4-in. (1.9 cm) long by 0.016-in. (0.04 cm)-diam steel fiber, which had a 3/8-in. (0.95 cm) long flattened sections and 1/8-in. (0.32 cm) long round sections along its length, was used. The plastic concrete had a design slump of 2 to 4 in. (5 to 10 cm) and an air content of 4 to 6 percent. No transverse joints were used, thus the slab sizes were 25 by 50 ft (7.6 x 15.2 m) in each paving lane. In test item 1, a keyed and tied longitudinal construction joint was used while in item 2 a thickened-edge longitudinal construction was used.

The base course for test item 1 was a 20-in. (57 cm) thick MESL. This is a process which has been pursued to provide economical and rapid construction and which has shown extremely good performance as a structural layer. The membrane used for the bottom and sides of the encasement was a 6-mil (0.15mm)-thick polyethylene.

The surface membrane was a polypropylene-asphalt system. The material used within the MESL was a native lean clay (CL) having an LL of 43 and PI of 21. The material was processed and compacted at a moisture content of about 14 percent (approximately CE 55 optimum). After completion, plate bearing tests indicated a k value of 270 pci (7.6 kg/cm^3) which without the encasement would degrade to about 75 to 100 pci (2.1 to 2.8 kg/cm^3) as it became soaked.

The base course for test item 2 was 17 in. (43 cm) of cement-stabilized clay gravel with a cement content of 6 percent compacted at a moisture content of 8 percent. Plate bearing tests conducted six days after construction indicated a k value of 545 pci (15 kg/cm^3).

A 15-in. (38 cm)-thick nonreinforced concrete pavement was used for items 3, 4, and 5. The concrete mix design was the same as that used for the MWHGL and LJS test tracks. A keyed and tied longitudinal construction joint was used in all three test items. Sawed transverse contraction joints were used to form 25-ft (7.6 m)-sq slabs in items 3 and 4 and test item 5 was divided into 12.5-ft (3.8 m)-sq slabs by means of sawed transverse and longitudinal contraction joints. The concrete was dry batched at a local plant and transit mixed to the job site and deposited between wooden forms. The concrete was spread by hand, consolidated by internal vibration, and finished by hand floats and burlap drag. Moist curing for seven days followed by polyethylene membrane curing for 21 days was used.

A 6-in. (15 cm)-thick bituminous concrete base course using 3/4-in. (1.9 cm) maximum-size uncrushed gravel and sand with 4.6 percent 85-100 penetration grade asphalt cement was used for item 3. A plate bearing test conducted several days following construction indicated a k value of 99 pci (2.8 kg/cm^3), which was not surprising since the ambient temperature was high and plasticity of bituminous concrete is temperature susceptible.

For item 4, a 6-in. (15 cm)-thick cement-stabilized lean-clay base course was used consisting of the same material that was used in the MESL of item 1. The lean clay soil was processed to a moisture content of about 18 percent. A cement content of 12 percent was distributed by hand and mixed into the lean clay soil with a rotary tiller. A plate bearing test conducted about seven days after construction indicated a k value of 167 pci (4.7 kg/cm^3).

Test item 5 was used to study the structural performance of concrete pavement constructed on insulating materials used to prevent detrimental penetration of frost action. The item was divided into four subitems (5A, 5B, 5C, and 5D) to study four different types of insulating materials. In item 5A, a 6-in. (15 cm) layer of the cement-stabilized lean-clay material used in item 4 was constructed over a 3-in. (7.6 cm) thickness of 35-psi (2.5 kg/cm^2) compressive strength polystyrene board material. In item 5B, a 9-in. (23 cm)-thick lightweight concrete was composed of polystyrene beads in a sand-cement mortar which was mixed in the laboratory, deposited between forms, spread by shovels, hand finished, and moist cured. In items 5C and 5D, 3-in. (7.6 cm)-thick 120-psi (8.4 kg/cm^2) and 35-psi (2.5 kg/cm^2)

compressive strength polystyrene boards were used directly under the concrete, respectively.

DISCUSSION OF PERFORMANCE DATA

In these as well as previous test tracks, performance was measured in terms of the amount of traffic to produce structural failure in the test items. The traffic was measured by the number of maximum stress repetitions (coverages) that occur at a point in the pavement slab due to the passes of the landing gear under test. By definition, a coverage occurs when each point of the pavement within the test lane has been subjected to one maximum stress, assuming that the stress is equal under the full tire-print width. One pass of the 12-wheel C-5A gear produces separate and distinct maximum stresses under both the front and rear 6-wheel arrays; however, considering only a 6-wheel array, only one maximum stress occurs for each pass. When the total gear (two twin-tandem arrays) of the B-747 is considered, it is found that there is a minimum of overlapping for the normally considered traffic area width. Thus, the use of a single twin-tandem gear as representative of the B-747 main gear is reasonably valid from a coverage standpoint. From the above description, it will be noted that a coverage represents several operations of an aircraft; the number depending upon the aircraft and the width of area trafficked.

Visual inspections of the pavement surface were made continuously as the traffic progressed and any viable distress was recorded. Periodically, traffic was halted and electronic instrumentation tests under static-load conditions and cross-section measurements were made. Traffic was continued on each test item until it was adjudged to be structurally failed.

No effort has been made to assessthe functional failure condition of the various test items because this is as yet to be defined for airfield pavements. Several of the factors contributing to functional failure were evaluated including the structural condition, permanent deformations, spalling, joint and crack faulting, and subgrading pumping. Loss of rideability and increase in maintenance requirement with time or traffic would not be quantitatively assessed because of the limited extent of the test items. However, from past experience based upon performance studies, it has been found that airfield pavements are normally considered functionally failed when the structural failure is between the first crack and shattered-slab conditions.

Pertinent test data are summarized in tables 1 and 2 for all three test tracks. Table 1 shows the pertinent physical properties while table 2 summarizes the pavement response and performance data. Much more detailed data are available in the referenced reports which have been or soon will be published. This type data are extremely valuable to the development and validation of response and performance models needed for pavement design and evaluation.

In general, the performance of the two-layer test items (pavement/subgrade), with respect to structural failure, agreed reasonably well with predictions based upon the Westergaard algorithm and previous performance data. Comparisons of measured slab stresses and pavement deflections with computed values using the analogy of an elastic plate on a dense liquid were of the same order of consistency as has been experienced with previous test tracks. This lends credence to the use of previously developed design (safety) factors for design. However, performance of the three layer test items (pavement, stabilized layer, and subgrade) show that the use of a modulus value measured by a plate test on the surface of the subgrade for characterization of the foundation strength as input to the Westergaard algorithm is inadequate. The algorithm, in these cases, predict better performance than was actually measured. The data also suggest that the boundary conditions of the Westergaard algorithm are being exceeded by the extremely large loads and loaded areas and suggests the need for improvements.

Significant findings from each of the test tracks which will affect design and construction criteria are discussed below:

a. <u>MWHGL test track.</u>

(1) Pumping of the subgrade material through the joints and cracks and at the edges of the slabs was much more severe than anticipated. This was especially true for the C-5A traffic tests while not as severe for the B-747 twin-tandem gear loading. From previous test tracks and performance data, it had been generally concluded that with the thicknesses required to limit concrete stresses for conventional gear configurations, deflections were small and pumping was not a critical factor to airfield pavement performance. The C-5A gear design, which was influenced by the need for increased flotation, results in reduced concrete stresses and thus thinner pavements. In turn, the larger total load and loaded area results in increased stresses deep in the foundation and thus increased deflections. This was demonstrated by the fact that the twin-tandem gear of the B-747 aircraft did not result in as severe pumping in the same pavement system as did the C-5A gear even though the wheel loadings and thus concrete stresses were higher for the twin-tandem gear. For this reason, it is probable that pumping would have been more severe for the B-747 loading had the total gear been used for the traffic. Thus, while the practice of increasing the number of wheels and wheel spacing achieves lower concrete stresses and thinner pavements, it draws attention to either the increased need for stronger and higher quality foundations or the use of a limiting deflection criteria for pavement thickness determination.

(2) The longitudinal keyed construction joint on the low-strength subgrade failed rather early under the C-5A traffic which was not anticipated. Previous test track and performance studies had led to the conclusion that the keyed joint was the weakest of those normally used in airfield pavement construction but was considered satisfactory for all but the highest volume traffic areas. Examinations at the conclusion of traffic indicated that the joint failure was characterized by an equal amount of keyway and key failures with the failure extending the full length of the test track (all test items). The

failure of the keyed joint did not appear to be associated with the flexural stress due to the load since failures occurred in all four thicknesses at about the same coverage level. The same can be said regarding the subgrade pumping which may have affected the joint performance. However, there seems to be no correlation between the severity of pumping and joint failure occurrence. Since there was about an equal amount of keyway and key failure in all pavement thicknesses, it was concluded that the dimensions are close to optimum. The failure of the keyed construction joint is believed to be due to stresses in the joint created by excessive load transfer from the loaded to the unloaded slab resulting from the large deflections of the pavement system under the C-5A gear loading. As with the pumping problem previously discussed, this indicates a need for improved foundation treatment as well as improved joint designs. The performance of the transverse weakened plane (aggregate interlock) type joints was satisfactory and there was little evidence of faulting even though pumping did occur at these joints.

(3) Performance of the nonrigid overlay applied to test items 1 and 4 indicated that existing methodology is satisfactory for determining the thickness required to strengthen a concrete pavement (either new or distressed) to carry additional traffic. Reflection cracking in the nonrigid overlay due to joints and cracks in the base pavement was expected to occur from past experience; however, some reflection cracking was evident in the overlay within a day or two following construction and before any traffic had been applied. These cracks were apparently due to movements in the base pavement that occurred during compaction of the overlay and to subsequent temperature changes in the concrete. A polypropylene membrane applied to a portion of item 1 prior to the application of the nonrigid overlay failed to prevent reflection cracks but did seem to deter its occurrence. There was no evidence that the reflection cracking influenced the performance of the nonrigid overlay items. In fact, there was amazing little raveling or spalling along the many cracks in the overlay.

b. LJS test track.

(1) All keyed joint strengthening methods employed in test item 2 performed satisfactorily. No failures were evident in the jointing system until the slab had experienced structural failure. While all three methods employed appear to be tedious and costly to construct, they must be evaluated against the alternatives which would be to (a) restrict traffic loading; (b) continue traffic until the joints fail and then maintain them during the remainder of the pavement life; or (c) overlay the entire item to reduce the edge (joint) stresses to tolerable limits. Final decisions regarding which alternative to use would of course depend on a cost-effectiveness study which would be heavily influenced by local factors. The study did prove the feasibility of strengthening the joints to extend the life of existing pavements to be subjected to wide-bodied jet aircraft traffic.

(2) The service life of the keyed joint on medium-strength subgrades was judged to be about the same as the slab itself based upon the performance of test item 1. Failures of the keyed joint were experienced but not until structural cracking of the slab had occurred. In test item 4 which was constructed on a high-strength subgrade (stabilized base), the performance of the keyed joint was satisfactory. The performance of the doweled type construction joint was entirely satisfactory in all test items regardless of the subgrade strength. This demonstrates the superior performance of the doweled over the keyed type joint; a condition that had been indicated from service tests.

(3) A lack of pumping evidenced in test items 3 and 4 as compared to the MWHGL tests indicated the value of a thin sand filter course or soil stabilization in preserving the integrity of the subgrade. Although there was some pumping of the subgrade at the ends of the test items, there was little or no evidence of detrimental pumping in the item interior. Minor pumping was observed in test item 1; however, after only a small amount of traffic, clear water was pumped and it is believed that this had negligible effect on the performance of the item on the granular type foundation. Pumping, which became rather severe with continuing traffic, occurred at each end of test item 4 and undoubtedly contributed to the rather early distress noted at the junctures of the test item and transition slabs. Thus, as in the earlier MWHGL tests, it was evident that the heavy, widely distributed loads were resulting in greater deflections in the pavement system and increasing the need for positive protection against pumping of fine-grained soils through the joints.

(4) Performance of the fibrous concrete slab on grade and overlay was good. The good performance is attributed to the increased first crack (flexural) strength but, primarily, to the tenaciousness of the material after cracking has occurred. This had been suspected based upon previous laboratory static-load tests and impact and explosive loading tests; however, these were the first controlled field repetitive loading type tests performed. The 6-in. (15 cm) fibrous concrete slab at a flexural strength of about 950 psi (67 kg/cm^2) outperformed the 10-in. (25 cm) concrete test item at a flexural strength of about 745 psi (52 kg/cm^2) under both the C-5A and B-747 gear loadings; however, the 10-in. (25 cm) concrete on 6 in. (15 cm) of cement-stabilized material outperformed the 6-in. (15 cm) fibrous concrete item. Initial distress in the fibrous concrete test item was at the thickened edges even though they were increased 50 percent in thickness over the interior thickness, an increase much greater than used for plain concrete. Cracking of the fibrous concrete occurred very slowly and the cracks were held tightly closed and did not work excessively under traffic. There was much less raveling and spalling along the cracks than occurred in the concrete items even though deflections under load were higher. This attests to the tenacity of the fiber concrete. Performance of the 4-in. (10 cm) fibrous concrete overlay of item 3 (10-in. (25 cm) PCC on 4-in. (10 cm) sand filter) was much the same as the 6-in. (15 cm) fibrous concrete slab on grade. Hairline cracks first occurred coincident with the longitudinal construction joint in the base pavement evidencing that this is the

point where deflections and stresses are highest. Under additional traffic, hairline cracking continued; however, there was amazing little raveling or spalling at the crack during the traffic history. Although a direct comparison of performance under traffic between concrete and fibrous concrete cannot be made until the failure condition of fibrous concrete has been established, preliminary results indicate that a substantial reduction in thickness for equal performance can be achieved through the use of fibrous concrete versus concrete.

c. SL test track. Traffic testing on the SL test track was completed in 1973 and a complete analysis of the results remains to be completed; however, indications of performance can be drawn from the visual observation and the analysis of data completed to date.

(1) The fibrous concrete on items 1 and 2 gave extremely good performance. Although initial cracking occurred early in the traffic life, it was much later than for a comparable thickness of concrete, the cracks propagated at a much slower rate and did not ravel and spall. The longitudinal joint in item 1 was a tied-keyed type which performed very well throughout the test with only a minor amount of faulting at the ends of the item. In item 2, the 4-in. (10 cm) fibrous concrete, a thickened-edge butt type longitudinal joint with the edges thickened to 5 in. (13 cm) was used on the strong stabilized subgrade. Some faulting began to show at this joint fairly early in the traffic life and continued to develop to a miximum of about 0.6 in. (1.5 cm). After-traffic tests showed that the faulting occurred due to a lensing condition within the 17-in. (43 cm) cement-stabilized layer. Traffic in the north lane was continued far beyond what was considered functional failure simply to gain some knowledge of the collapse failure of fibrous concrete. Although the item was considered failed at 150 coverages, traffic was continued at 950 coverages at which time maximum permanent deformations of 3.2 in. (8 cm) had occurred. In fact, an upheaval occurred outside of the edge of the pavement indicating shear failures in the foundation much like an underdesigned flexible pavement thickness. Even so, the cracked fibrous concrete was not badly raveled or spalled and foreign objects on the surface would be minimal.

(2) The MESL used as a base for the 7-in. (18 cm) fibrous concrete in item 1 performed very well as a base. The membrane encapsulation maintained a relatively constant moisture content and thus r retained the high k value that this material exhibits at or near optimum moisture and density conditions. Had the membrane not maintained the moisture content, experience indicates that, due to increase in moisture content, the k value would have approached a value of about 100 pci (2.8 kg/cm^3) rather than the value of 250 pci (7 kg/cm^3) measured after traffic and the performance would have been drastically reduced. The cement-treated clay gravel used in item 3 as a base for the 4-in. (10 cm) fibrous concrete provided a high k value and good performance; however, after-traffic testing revealed that the construction had not provided uniform distribution of the cement through the material. The top of each layer was firmly cemented; however, the lower portion had little or no cement resulting in highly lensed