TRAFFIC TESTING OF OVERLAYS ON RIGID AIRFIELD PAVEMENTS

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SYNOPSIS

The Office, Chief of Engineers was, in 1944, confronted with the problem of reinforcing a number of airfields for intensive use by airplanes of the B-29 class.

Since sufficient data were not available for formulating criteria for overlay designs, a test program was inaugurated to develop the required data.

At Maxwell Field, Alabama, overlays on a 6-in. concrete pavement on plastic subgrade were tested under traffic. At MacDill Field, Florida, similar traffic tests were made on overlays constructed on 6-in. concrete pavement over a uniform sand subgrade.

Traffic on the test sections consisted of a specially constructed unit producing a load of 60,000 pounds on a B-29 dual wheel assembly.

Although results of this test program have not been completely analyzed, it is believed that the feasibility of constructing overlays on thin concrete pavements, to reinforce such pavements for wheel loads of 60,000 lb., has been proven.

HISTORY

In 1944 the expanded training program of the Army Air Forces for very heavy bomber crews made reinforcement or reconstruction of some existing airfield pavements imperative. The Corps of Engineers was, therefore, confronted with the problem of reinforcing many existing pavements sufficiently to provide for operation of 60,000-lb. wheel loads.

The Corps of Engineers had previously conducted extensive investigations in the design of airfield pavements. (See references (1), (2), (3), (4), (5), (6), (7), (8)). A design method for flexible pavements, based on the California Bearing Ratio test, had been formulated which is applicable to flexible overlays on flexible pavements. Limited information had been derived from a previous test (Lockbourne No. 1—see Ref. (3)) of a concrete overlay on a concrete pavement on plastic sub-grade. No other applicable experimental data were available.

For the purpose of obtaining data to aid in the formulation of criteria for design of overlays on rigid pavements, the Office, Chief of Engineers, in October 1944, initiated tentative plans for accelerated traffic tests in the South Atlantic Division At a conference between representatives of the South Atlantic Division and the Office, Chief of Engineers, further plans were made and the program in final form provided for construction and traffic testing under very heavy bomber loads of various sections of overlays on existing concrete pavements at MacDill Field, Tampa, Florida and Maxwell Field, Montgomery, Alabama. The layouts of the two test sections are shown in Figures 1 and 2.

These tests were conducted under the supervision of the division engineer, South Atlantic Division, Atlanta, Georgia. The Maxwell field test was conducted under direct supervision of the district engineer, Mobile, Alabama, Engineer District. The MacDill Field test was conducted under direct supervision of the district engineer, Savannah, Georgia, Engineer District Construction of both test sections was authorized in February 1945, and construction was completed in the summer of 1945. Traffic was completed at MacDill Field in October 1945, and at Maxwell Field in December 1945. Since very heavy bombers were to be stationed at these fields, each test operation was correlated with an actual design problem.

DEFINITIONS OF TERMS

Terms relative to the tests used throughout this narrative are defined as follows:

Test Section. The complete structure of the overlay and underlying pavement.

Test Site. A portion of an existing 6-in concrete pavement which bounds and underlies the test section.

Test Track A part of the straight portion of the test section on which an accelerated traffic test was conducted

Maneuver Areas. The portions of the test section adjoining the test tracks on which the traffic equipment was turned and

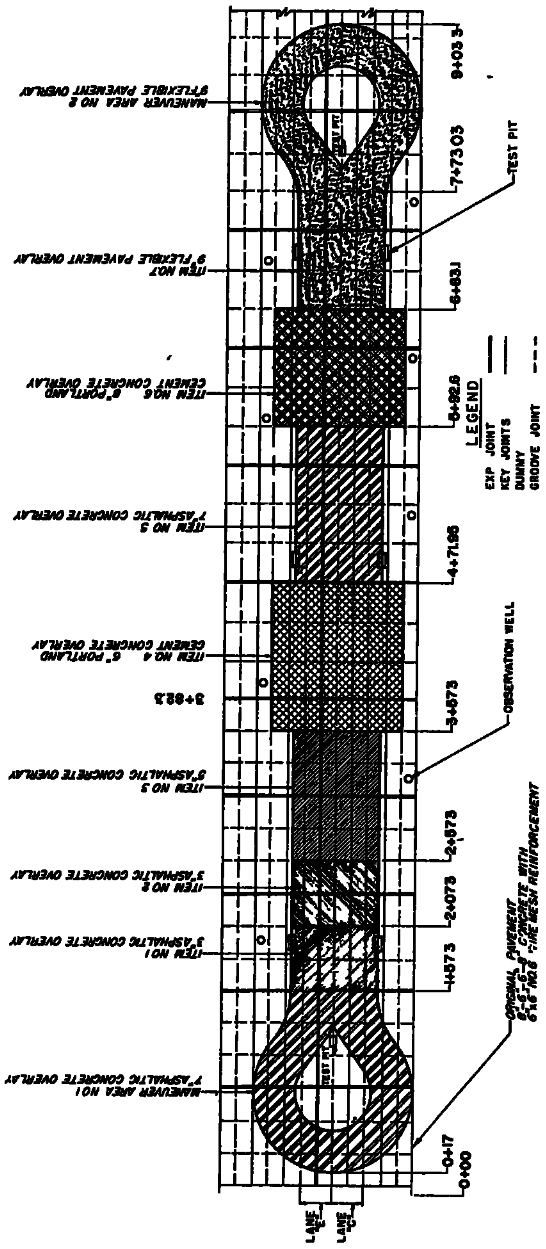

Figure 1. Layout of Test Track at McDill Field

maneuvered to obtain desired positions for traffic on the test tracks.

Traffic. The movement of a 60,000-lb. load on one set of dual wheels over the test section.

load over every point in a given portion of a traffic lane.

Pass. One trip of the traffic equipment over an area regardless of its transverse position.

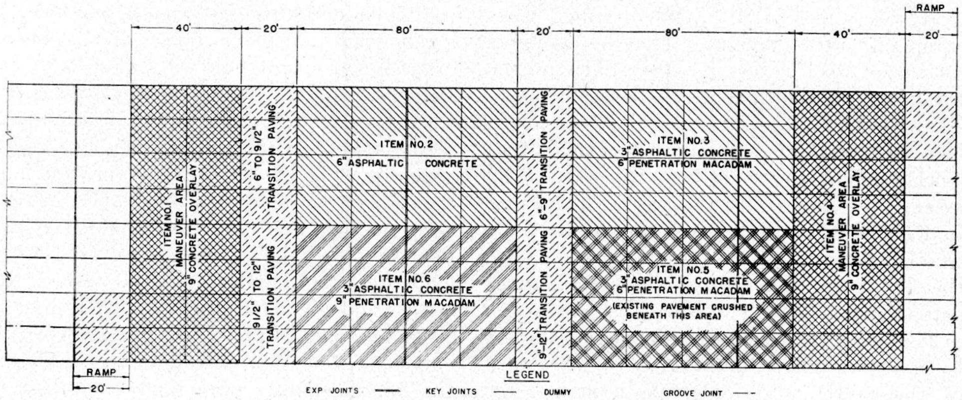

Figure 2. Layout of Test Track Maxwell Field

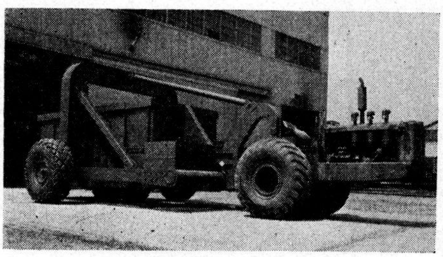

Figure 3. Traffic Device

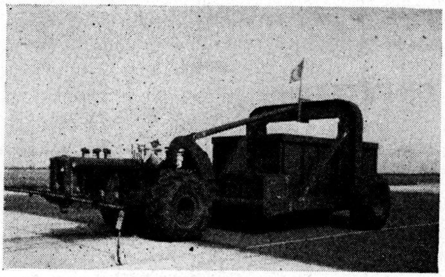

Figure 4. Traffic Device with Guide Bar Mounted

Traffic Device. The vehicle producing the 60,000-lb. load on the pavement. The traffic device is illustrated in Figures 3 and 4.

Traffic Lane. The area of a test track over which traffic was conducted.

Coverage. One application of the traffic

Traffic Cycle. Twenty-four passes of the traffic equipment over a traffic lane in such an order as to produce coverages varying from one at the edges of the lane to six at the center.

Item. A portion of a test track which embodies a separate type of structure.

Overlay. A pavement of any type constructed over a previously existing pavement in the test section.

Failure. The stage of destruction which necessitates exploration to obtain valid data, or which necessitates repairs before continuing traffic.

Heavy Bomber. A military airplane weighing 74,000 lb. gross, supported on two wheels.

Very Heavy Bomber. A military airplane weighing 120,000 lb. gross, supported on two sets of dual wheels.

Operation. Airplane traffic by the greatest possible number of planes on an airfield for a period of 20 years or longer.

EQUIPMENT

Although similar tests have been made under traffic by conventional grading equipment loaded to the desired weight, a more exact simulation of plane wheel loads was desired for this program. A traffic device designed and procured by the Pittsburgh Engineer District was therefore provided for each test section. This device consisted of a rectangular load box mounted on one set of B-29 dual wheels, and connected to a towing unit by a single pin. The load unit was supported laterally by outrigger wheels and a yoke over and around the load box. The load was measured on hydraulic jacks equipped with pressure guages. Weights used were steel plates and steel shot, and the total load on the dual wheels was 60,000 lb. The power unit was a "Super C" Tournapull. The load unit was so constructed that other wheels might be substituted for the B-29 assembly. The traffic device is illustrated in Figures 3 and 4. It is believed that the MacDill and Maxwell Field programs are the first traffic tests to be completed under actual airplane loads on airplane wheels.

The operator kept the traffic device aligned by use of a guide bar attached to the front of the power unit. Flexible pointers suspended from the guide bar traced lines painted on the pavement. The guide bar on the power unit at MacDill Field is shown in Figure 4 This was a movable bar with a pointer on each end which was shifted from one side to the other by a rope worked by the operator Numbers on the movable guide bar, being brought into line with a fixed reference point, indicated the position of the bar. At the end of each pass the operator shifted the guide bar to the next position in numerical order, by lining up the correct number with the reference point. A traffic cycle was thus completed by placing the guide bar in positions numbered 1 through 24, and keeping the pointers on the ends of the bar on the guide lines painted on the pavement. The guide bar on the Maxwell Field test device was fixed in one position, with its center at the center of the power unit. Each lateral position of the test device was indicated by a pointer suspended from the guide bar. Each pointer was numbered so that the number was visible to the operator, and the operator aligned the device by placing the proper pointer over the guide line painted on the pavement.

The traffic lanes were 25 ft. wide One traffic cycle consisted of 24 passes, so distributed that coverages per cycle varied from one at edge of lane to 6 over the center 75 in.

At Maxwell Field the traffic device was at first turned on the maneuver areas, each 40 ft. in length, which were constructed for the purpose. After completion of a few coverages, it was discovered that the B-29 tires were wearing very rapidly and that much of the excessive wear was being caused by turning on a short radius. The traffic for the remainder of the test was therefore carried across the maneuver areas and onto the original pavement by way of newly constructed ramps. The traffic device was then turned on a wide radius on the original pavement, and tire depreciation was thus greatly reduced. The life of tires, however, was much less than had been expected, and the B-29 alloy wheels were also overstressed. Nineteen tires and eight wheels were used on the load unit throughout the entire test.

At MacDill Field, rapid depreciation of the B-29 tires again presented unexpected difficulty. Twenty-four tires and two wheels on the B-29 assembly were replaced during the course of the test.

TEST PROCEDURES

Prior to construction of the overlays, extensive field tests were made. Soundings were first made to determine uniformity of pavements and subgrades. Slabs of pavement were removed for flexure tests, and plate bearing tests and in-place California bearing ratio tests were made on the subgrades exposed by removal of the slabs. In these pits subgrade densities, gradations, and Atterburg limits were determined to depths of 4 ft or more. Auger borings were made along edges of pavements adjacent to the test strips for the purpose of determining accurately the soil profile. Well points were set in the subgrade when overlays were placed for use as observation wells, and continuous records of ground water elevations were kept. Rods were anchored deep in the subgrade at selected locations for the purpose of holding extensometer dials for measuring pavement deformations under static loads. In the course of construction, and after completion of the overlay pavements, moduli of rupture of the concrete overlays, and Hubbard-Field stabilities and Marshall stabilities of the asphaltic concrete were determined. After completion of the traffic tests, the overlays were removed and the crack pattern in the original pavement plotted. Exploration trenches were then cut into the subgrade at points of pavement distress, and condition of subgrade at such points was determined.

MAXWELL FIELD

Maxwell Field has been a training station of the Army Air Forces for a number of years. The original landing field was located in the northeast corner of the present site. All of the original pavements, with exception of a small concrete apron, were removed when the field was reconstructed in 1943.

Soil conditions over the entire landing field area are extremely variable, ranging from coarse sands and gravels to highly plastic silty clays. The predominant soils are classified as A-2, A-5, A-6, and A-7 by the Public Roads system, or as CL, CH, ML, and MH by the Casagrande system. The water table is more than 20 ft. below subgrade.

The design for a heavy bomber field, made in 1943, provided for a base course, or "stabilized subgrade," 6 in. in depth, consisting of local sand gravel mixed with the subgrade soil, and 9-6-6-9-in. concrete pavement on aprons, runways, and taxiways Runway shoulders 75 ft. wide were surfaced with 12 in. of clay gravel and 1½ in. of asphaltic concrete. These pavements were completed in September 1943. Lanes are 25 ft. wide with center longitudinal joints of the dummy groove type. Free edges only are thickened 3 in. in 12.5 ft. Longidutinal expansion joints occur only at the centers of runways. Interior joints between lanes are the keyed type. Longitudinal dummy groove joints in interior lanes contain no steel, but those adjacent to free edges are tied with ⅝ in round deformed bars spaced 30 in. center to center. Transverse expansion joints are spaced at 120-ft. intervals and are doweled with ¾ in. by 16-in. smooth round bars spaced 16 in. center to center. Transverse contraction joints are the dummy groove type, are spaced at 20 ft. intervals, and are not doweled.

Traffic on the described pavement, from October 1943 to September 1944, averaged 423 cycles per day, principally by airplanes weighing 40,000 to 50,000 lb. gross Extensive cracking had occurred at the end of this period In September 1944, B-29 planes began operations at the field, and under this traffic breaking up of the pavement progressed rapidly, indicating the necessity for replacing or reinforcing runways and taxiways.

The selected test site was on an east-west taxiway in the northwest corner of the field. Since a parallel taxiway connects extensions of the N-S and NW-SE runways. operation of the test did not impede traffic.

The subgrade under the test site was found, by preconstruction tests, to consist principally of soils of the A-2 and A-6 groups as classified by the Public Roads method, or SF and CL groups as classified by the Casagrande method. The plastic index ranged from 11 to 19. Moisture contents over most of this area ranged from 1 to 5 per cent higher than the optimum. Maximum densities, by the Modified A.A.S.H.O. Method, averaged 118 pounds per cubic foot. Field densities averaged 92 per cent of the maximum in the top 12 in. and 90 per cent at depths of 12 to 24 in. The modulus of subgrade reaction averaged 384 lb. per sq. in. per inch with a maximum of 486 and a minimum of 164 lb. per sq. in. per inch. In-place California bearing ratios averaged 16 per cent for the stabilized top 6 in. of subgrade, and 11 per cent for the underlying natural subgrade. The modulus of rupture of the existing concrete was determined by sawed beams to average 744 lb. per sq. in.

The test track comprised six overlay items. The layout is shown in Figure 2. The items were designated and constructed as follows:

Item No. 1: Maneuver area, 9-in. concrete overlay separated from original pavement by a ½-in. layer of sand asphalt. The item was 100 ft. wide by 40 ft. long. Concrete aggregates were gravel and sand of local commercial production. The cement factor was 1.5 bbl. per cu. yd. The average modulus of rupture at 28 days, as determined by laboratory cured specimens, was 799 lb. per sq. in. Butt joints, doweled with ¾-in. by 16-in. smooth round bars 18 in on centers, were constructed over longitudinal keyed joints. Dummy groove joints were placed coincident with all underlying dummy groove joints.

Item No. 2: Asphaltic concrete, 6 in. in depth. The item was 80 ft. long by 50 ft. wide.

Item No. 3: Three inches of asphaltic concrete over 6 in. of slag and asphalt penetration macadam The dimensions were 80 ft. in length by 50 feet in width. This item extended over one transverse expansion joint.

Item No. 4: Maneuver area was identical with Item No. 1.

Item No. 5: Three inches of asphaltic concrete over 6 in. of slag and asphalt penetration macadam. The original pavement was broken into pieces not exceeding 12 in. in any dimension. Otherwise this item was identical with Item No. 3 The original pavement under this item was broken up because considerable subsidence had occurred in some failed areas on the field It was believed that breaking the rigid pavement might secure further compaction of the subgrade before the overlay was placed.

Item No. 6: Three inches of asphaltic concrete over 9 in. of slag and asphalt penetraction macadam. The item was 80 ft. long by 50 ft wide.

Original plans also provided for traffic testing a portion of the original pavement without overlay. After failures resulted in portions of this pavement, traffic was concentrated along longitudinal joints, and later overlays of 3 in. and 4 in. of asphaltic concrete were constructed over the failed areas. These areas are designated, for the purpose of reference, as follows:

Item No. 7: Original concrete pavement without overlay Traffic followed the same pattern as that on the overlays. Two transverse expansion joints were covered by this item.

Item No. 8: Original concrete pavement without overlay along keyed longitudinal construction joint. Traffic moved in one track. Two transverse expansion joints were covered.

Item No. 9: Original concrete pavement without overlay along outside longitudinal dummy groove hinged joints. Traffic moved in one track. Two transverse expansion joints were covered.

Item No. 10: Overlay of 3 in. of asphaltic concrete over a portion of the original pavement which had failed under previous concentrated traffic. This item was used as a turning area, and the traffic was therefore more concentrated than that of the prescribed pattern. The item covered one transverse expansion joint.

Item No. 11: Overlay of 4 in of asphaltic concrete over a portion of the original pavement which had failed under previous concentrated traffic. This item was used as a turning area, and the traffic was therefore more concentrated than that of the prescribed pattern. The item covered one transverse expansion joint.

Prior to beginning of traffic, the traffic device was moved over the pavement and deformations under static load were measured at corners, edges, and interior portions of underlying slabs. Measurements of deflections under static load at the same points were made at intervals throughout the test.

Permanent deformations of the pavements were recorded at intervals throughout the test. A partial record of these deformations is presented in Table 1.

It was originally planned to complete the traffic on the overlays before beginning that on the original pavement, but after it was found necessary to turn on the old pavement, the method of operation was revised, and items without overlay were tracked coincidentally with the overlay items After completion of traffic on the original pavement and construction of overlay items 10 and 11 over failed areas, tracking of these items and the original overlays was continued in one operation.

Three thousand coverages on the center 75 in., or a total of 12,000 passes over the entire width, were completed on Items 1 through 6. Conditions of the various items of overlay and the underlying pavement after completion of the traffic are described briefly as follows.

Item No. 1: Nine-inch concrete overlay. No damage was perceptible at conclusion of the test.

Item No. 2: Six-inch asphaltic concrete overlay. No damage was apparent on the surface Cracks developed over underlying joints in portions not subject to traffic Removal of the overlay revealed corner cracks at intersection of construction joint with transverse expansion and contraction joints.

Item No. 3 Three inches of asphaltic concrete over 6 in of penetration macadam. The surface was not damaged. Removal of the overlay showed no damage to the underlying concrete pavement.

Item No. 4: Nine-inch concrete overlay Two corner cracks developed at one end of the item at the intersection of a longitudinal keyed joint and a transverse dummy groove joint in the underlying pavement. These cracks developed at 1530 coverages, and were probably caused by impact of the traffic moving from the adjacent flexible pavement. The item was otherwise undamaged.

Item No. 5: Three inches of asphaltic concrete over 6 in of penetration macadam with original pavement broken. The greatest permanent deformations on the test track occurred on this item, as shown in Table 1. The overlay was, however, apparently undamaged

Item No. 6: Three inches of asphaltic concrete over 9 in. of penetration macadam. The overlay was not damaged Removal of with center of duals along outside longitudinal dummy groove hinged joints. Cracking began only after 650 coverages Only four cracks had developed with 890 coverages Tracking was stopped with 980 coverages, and at that time the pavement was in good condition.

Item No. 10: Three-inch overlay of asphaltic concrete over previously damaged pavement. Seventy-three hundred passes were made in turning on this area. It is estimated that this traffic effected approximately 1800 coverages The condition of the overlay was not impaired and removal of the overlay revealed no perceptible change in condition of the underlying pavement.

TABLE 1
MAXWELL FIELD TEST
Maximum Permanent Deformations

Item No	Description of Overlay	Maximum Deformation inches				Location of Point of Maximum Deformation, with Respect to Underlying Joints
		258 Coverages	516 Coverages	1158 Coverages	3000 Coverages	
1	9-in Concrete overlay Maneuver Area		No Record			
2	6-in Asphaltic Concrete overlay	0 20	0 26	0 35	0 37	Uniform
3	3-in Asphaltic Concrete on 6-in Pen Macadam	0 24	0 30	0 35	0 51	Intersection of Longitudinal Keyed Joint and Transverse Dummy Groove Joint
4	Same as No 1		No Record			
5	Same as No 3 with underlying concrete broken	0 77	0 93	1 00	1 18	Intersection of Longitudinal Keyed Joint and Transverse Dummy Groove Joint
6	3-in Asphaltic Concrete on 9-in Pen Macadam	0 22	0 30	0 40	0 57	Intersection of Longitudinal Keyed Joint and Transverse Expansion Joint

the overlay revealed no cracking in the original pavement

Item No. 7. Most of the corners of this item of original pavement were cracked after 28 coverages Cracking over the entire area was general at 254 coverages Traffic was continued, with progressive disintegration, through 516 coverages The item was then considered a failure and traffic was stopped.

Item No 8: This item of original pavement was subjected to concentrated traffic in one track with center of duals along a keyed longitudinal construction joint Cracking began with six passes, and complete failure had occurred at 500 passes, when traffic was stopped.

Item No. 9: This item of original pavement was subjected to traffic in one track

Item No. 11: Four-inch overlay of asphaltic concrete over previously damaged pavement. Traffic coverages and condition were the same as described above for the adjacent Item No. 10

MACDILL FIELD

MacDill Field is located on a peninsula between Tampa Bay and Hillsborough Bay, approximately six miles southwest of Tampa, Florida Most of the existing pavements are 8-6-6-8-in. concrete and were constructed in 1940, 1941, and 1942 by the Constructing Quartermaster and Corps of Engineers The first constructed pavement was opened to traffic in April 1941. Medium and heavy bombers have used the field since that time, and use by B-29s was begun early in 1945 Breaking up of the pavement under B-29 loads indicated the immediate necessity for reconstructing or reinforcing the existing concrete pavements.

Soils at this field consist entirely of medium to fine beach sand to a depth of 6 ft. or more, underlain in some areas by a stratum of clayey shell marl. The sand is extremely uniform Ninety-eight to 100 per cent passes the number 40 sieve, and 1 to 2 per cent passes the number 200 sieve. The ground water elevation is only a few inches below the surface and varies with the tides. The modulus of subgrade reaction was found to range from 369 to 622, and average 462 lb. per sq. in. per inch. The in-place California bearing ratio on subgrade averaged 10 per cent. Maximum densities by the Modified A.A.S.H.O. Method averaged 106 lb per cu. ft. Field densities averaged 99 per cent of the maximum in the top 6 in. of subgrade, 98 per cent at depths of 6 to 12 in., and 97 per cent at depths of 12 to 18 in.

The test site was on the N-S runway, near the south end. The depth to ground water under this area varied from 0 5 to 3.5 ft. below top of pavement. The original 8-6-6-8-in. concrete pavement was placed in 25-ft. lanes, with keyed longitudinal construction joints and hinged joints of the dummy groove type at centers of lanes. Transverse joints are spaced 25 to 30 ft. center to center. Every third transverse joint is an expansion joint, and the next two are dummy groove type contraction joints. There is a longitudinal expansion joint in the center of the 150-ft runway pavement. All edges of lanes are thickened from 6 to 8 in. in a transition distance of 3 ft. The pavement is reinforced with 6- by 6-in. No. 6 wire mesh placed in the upper third of the slab. At the south end of the track, from station 0 + 00 to station 3 + 82.3, under Maneuver Area No 1, Items Nos. 1, 2, 3 and part of Item No. 4, transverse expansion and contraction joints are doweled with ¾- by 16-in. smooth round bars spaced 18 in. on center, and edges of the longitudinal expansion joint are free. The average modulus of rupture of concrete in this portion of the original pavement, as determined by sawed beams, is 667 lb per sq in North of station 3 + 82.3, under Items 5 through 7, the remainder of Item 4, and Maneuver Area No. 2, the longitudinal expansion joint is doweled with ¾-in smooth round bars, spaced 24 in on centers, and transverse dummy joints are tied with ½-in. deformed bars spaced 24 in on centers. Transverse expansion joints are doweled with ¾- by 16-in. round, smooth bars, spaced 24 in. on centers. The average modulus of rupture of this portion of the underlying pavement, as determined by sawed beams, is 838 lb. per sq. in

Deformations at corners, edges, and interior portions of the underlying slab under a static load of 60,000 lb were measured before traffic was begun, and at intervals throughout the test Permanent deformations were also measured at intervals throughout the test A partial record of permanent deformations is shown in Table 2

The test track was constructed 100 ft. wide. Traffic centered along the longitudinal expansion joint in one lane, designated as lane "E", and along a longitudinal construction joint in the other lane, designated as lane "C" The layout is shown in Figure 1.

The various overlay items were defined and constructed as follows:

Maneuver Area No. 1: Seven-inch asphaltic concrete overlay containing Florida limestone aggregate.

Item No. 1: Three-inch asphaltic concrete overlay containing slag aggregate. Length, 50 ft.

Item No. 2: Three-inch asphaltic concrete overlay containing Florida limestone aggregate. Length, 50 ft.

Item No. 3: Five-inch asphaltic concrete overlay containing Florida limestone aggregate. Length, 100 ft

Item No. 4: Six-inch portland cement concrete overlay. Joints were constructed coincident with joints in underlying pavement. Concrete aggregates were Florida limestone and sand. The cement factor was 1.5 bbl per cu. yd The average modulus of rupture of overlay concrete, determined by laboratory cured specimens, was 677 lb. per sq. in The longitudinal expansion joint was not doweled. The one transverse expansion joint was doweled with ¾ in. by 16 in. smooth bars 12 in on centers Longitudinal construction joints were doweled with ¾-in by 16-in. smooth bars 18 in on center Longitudinal hinged joints were the dummy groove type, tied with ⅝-in. by 30-in deformed bars Transverse contraction joints were dummy groove type without ties. One-half inch of sand asphalt was placed between the original pavement and overlay. The length of the item was 114.6 ft.

Item No. 5: Seven-inch asphaltic concrete overlay containing Florida limestone aggregate. Length of this item was 120.6 ft.

Item No. 6: Eight-inch portland cement concrete overlay. Details of this item were identical with those of Item No. 4, except that dowels were 1-in smooth bars. Length of the item was 90.5 ft.

Item No. 7: Overlay consisting of 3 in. of asphaltic concrete containing Florida limestone aggregate over a 6-in. limerock base Length of the item was 90 ft

Three thousand coverages on the center 75 in., or a total of 12,000 passes, were completed on Items 1 through 7.

Items Nos. 1 and 2, 3-in. asphaltic concrete overlays, were in excellent condition at conclusion of the test and showed no indication of impending failure. Removal of the overlay, however, revealed that the original concrete was shattered along most of the longitudinal expansion joint, and that extensive cracking had occurred under most parts of these two items

Item No. 3, 5-in. asphaltic concrete overlay, was in excellent condition at conclusion of the test, and only very slight cracking had occurred in the underlying original pavement.

TABLE 2
MACDILL FIELD TEST
Maximum Permanent Deformations

Item No	Description of Overlay	Maximum Deformation inches				Location of Point of Maximum Deformation, with Respect to Underlying Joints
		1300 Coverages	1600 Coverages	2000 Coverages	3000 Coverages	
1	3-in Asphaltic Concrete	0 7	0 7	1 0	1 5	Intersection Long Exp Jt & Transv Exp Jt.
2	3-in Asphaltic Concrete	1 1	1 2	1 6	2.2	Intersection Long Exp Jt & Transv. Exp Jt
3	5-in Asphaltic Concrete	0 4	0 5	0 8	0 8	Intersection Long Exp Jt & Transv Dummy Groove Jt
4	6-in Portland Cement Concrete	0 6	0 7	1 0	1 5	Intersection Long Exp Jt & Transv Exp Jt
5	7-in Asphaltic Concrete	0 8	1.1	1 3	1 7	Intersection Long Constr Jt & Transv Dummy Groove Jt
6	8-in Portland Cement Concrete	0 0	0 1	0.1	0 2	Intersection Long Exp Jt & Transv Exp Jt
7	3-in Asphaltic Concrete over 6" Limerock	1 0	1 0	1 0	1.1	Intersection Long Exp Jt & Transv Constr Jt

Maneuver Area No. 2. This overlay was identical with Item No. 7.

While tracking of the overlay items was in progress, the desirability of continuing the test on the original pavement without overlay became apparent. This was done after completion of traffic on the overlays. The area of pavement so tested is designated, for the purpose of reference, as Item No. 8.

The asphaltic concrete surface adjacent to rigid items was built up as subsidence occurred, but impact along the edge of the concrete could not be entirely prevented This impact probably accounted in part for early development of corner cracks at the edges of the concrete items.

Cracks developed over underlying joints in portions of the asphaltic concrete overlays not subject to traffic.

Item No. 4, 6-in. concrete overlay, began to crack at corners adjacent to transition pavement after 150 coverages. No further cracking was noted until 330 coverages were completed, when several new corner cracks appeared One longitudinal crack parallel to the expansion joint developed at about 400 coverages At 1700 coverages, some points on the overlay were higher than at beginning of the test, indicating movement in the underlying pavement, and possibly in the subgrade. Progressive breaking of this pavement continued until 3000 coverages were completed. At 3000 coverages the item was badly cracked up, but still in a usable condition The area along the longitudinal expansion joint cracked first and developed the most extensive cracking The portion overlying the longitudinal construction joint cracked more slowly, but had developed numerous corner cracks and several longitudinal cracks at the end of the test. Removal of the overlay revealed only three corner cracks in the underlying pavement adjacent to the longitudinal construction joint, and, adjacent to the longitudinal expansion joint, only about half the number developed in the overlay. The greatest concentration of cracks, both in overlay and original pavement, occurred at the intersection of longitudinal and transverse expansion joints. Two adjacent corner cracks in original pavement at this point when the overlay was constructed probably caused initial cracking of the overlay. A transverse crack normal to the longitudinal expansion joint, and extending across half a lane of the original pavement, also apparently influenced cracking of the overlay.

Item No. 5 and Maneuver Area No. 1, 7-in. asphaltic concrete overlays, were in excellent condition at conclusion of the test. Cracking of original pavement under Item 5 was more extensive than that under Item 3, but concentrated cracking had occurred in only two small areas.

Item No. 6, 8-in. concrete overlay, began cracking at corners adjacent to transition pavements at about 400 coverages. These initial cracks probably were due to impact on the unsupported edge, but additional cracks later developed at three interior corners. The condition of this item had not been seriously impaired at the completion of 3000 coverages. The number and aggregate length of cracks in the underlying original pavement were less than the number and length of those developed in the overlay.

Item No 7 and Maneuver area No. 2, 3 in. of asphaltic concrete over 6 in. of limerock, were in excellent condition at conclusion of the test and gave no indication of impending failure. Removal of the overlay revealed no damage to the underlying original pavement.

Item No. 8: One hundred and two coverages of the unprotected pavement resulted in such extensive cracking that tracking was discontinued, since destruction of this pavement was not desired. Definite failure was impending at this stage, but the pavement was still in a usable condition.

CONCLUSIONS

Field investigations and laboratory tests are incomplete at this time. It is only possible, therefore, to arrive at incomplete and tentative conclusions on the basis of data presently available. Complete reports will be prepared by the engineer districts concerned and released by the Office, Chief of Engineers at a later date. It is desired to point out the possible influence of conditions of traffic at the time the tests were made, with particular reference to the behavior of the asphaltic concrete overlays As in the case of all accelerated tests, the effect of time and weather on the pavements tested cannot be evaluated. It is believed that the following conclusions are warranted on the basis of information presented in this narrative.

a. Each of the overlays on the original test section at Maxwell Field, Item 1 through Item 6, indicates that such pavements will give satisfactory performance under traffic of the very heavy bombers.

b. Longitudinal keyed construction joints in the original Maxwell Field pavement were not of adequate design

c. The performance of relatively thin overlays (3 in. to 4 in.) of asphaltic concrete indicate that overlays of this type over concrete pavements may prove the most economical method for surfacing existing concrete pavements for heavier wheel loads and repairing defective concrete pavements Also, this type of reinforcement may be used to advantage on portions of parking aprons subjected to frequent taxiway use.

d. An overlay of asphaltic concrete alone over portland cement concrete pavement permits development of cracks over underlying joints in areas not subject to concentrated traffic. Use of an intermediate course, such as the penetration macadam at Maxwell Field, or the Florida Limerock at MacDill Field apparently minimizes such cracking. Further study should be given the required thickness of such a layer.

e. Apparently nothing was gained by breaking the original concrete pavement of Item No. 6, Maxwell Field, before placing the overlay.

f. The longitudinal expansion joint in original pavement in the MacDill Field test was not equal in performance to the keyed construction joint It is to be noted that edges were thickened at key joints to 8 in.

g. Although laboratory tests indicated much higher flexural strengths for the concrete in original pavement at MacDill Field north of station 3 + 82.3 than in that south of this station, this difference was not reflected in performance of the two areas under traffic.

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