BLOW-UPS AND CRACKING OF PCC PAVEMENTS

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Early in 1966, abnormal map cracking was noted in portions of a 20-mile section of I 65 in Warren and Simpson Counties. In that same year, several blow-ups occurred; and an investigation was initiated. The pavement was constructed in 1964-65; and the design called for a uniform 10-inch slab, mesh reinforced, with joints at 50-foot intervals. Materials in the concrete mixture included Type I portland cement containing 0.45 percent alkali and limestone coarse aggregate of 2 to 2-1/2 inch maximum size. It was originally suspicioned that the map cracking was a result of abnormal shrinkage; however, cores largely confirmed the cracks to be a result of procedures used in placing reinforcing mats. The pavement concrete was placed full depth and the reinforcing mats were depressed to the appropriate depth by a machine. It was generally concluded that cracks were thereby created but were not detected until laitance was removed by traffic and erosion.

Many factors may lead to blow-ups; thermal stresses in low-strength sections were suspected as the primary cause. Stresses of 1800 to 2400 psi may be induced by temperature changes, and these stresses may cause fatigue failures at a very early age if the compressive strength of the concrete is in the order of 3000 psi. In an effort to pin-point the source of trouble, marks were painted on the pavement at 2500-foot intervals and measured periodically; 10-inch gage points were set in the concrete within sections and measured and then sawed out and re-measured at various times through 24 hours; also aggregate samples were obtained for alkali expansion tests. Thus far, it has been determined that the concrete is in high compression and that aggregates from certain ledges in the source quarry are highly expansive in the presence of alkalies. Dolomitic limestones containing occluded clays are suspected. Additional quality tests may be required on such aggregates in the future.

Figure 34. Typical Signs of Distress on I 65 in Warren-Simpson Counties

Figure 35. Pavement Stress Conditions Determined from Beams Sawed from the Pavement