

## SETTLEMENT OF HIGHWAY BRIDGE APPROACHES <sup>4,5,6</sup>

by  
T. C. Hopkins  
Research Engineer  
Division of Research  
Kentucky Department of Highways

Differential settlement between the highway pavement and bridge deck not only presents a hazardous condition to rapidly moving traffic but creates a rough and uncomfortable ride. It requires costly maintenance which impedes the normal flow of traffic.

A summary of data collected in 1964 showed that about 50 percent of 782 bridge approaches surveyed had required maintenance. By 1968, about 80 percent of these approaches had required maintenance.

Settlement predictions based on consolidation tests performed on undisturbed samples secured from the foundation soils prior to construction of the approach embankments were made at five bridge sites. Settlement due to volume change of the embankments following construction of the pavement was determined as the difference between foundation settlement obtained from mercury-filled settlement gages and settlement plates and total settlement determined from pavement profiles.

Generally, most of the approach settlement was due to settlement of the embankment. However consolidation of the embankment foundation could have contributed to the approach settlement if sufficient time had not been allowed for complete consolidation of the foundation before paving. Although poor compaction near abutments can contribute to approach settlement, pavement profiles show that embankments settle even when compacted according to specifications.

Settlement investigations at proposed bridge sites can provide a much needed basis for design to control or minimize the effect of approach settlement. For cases where the calculated ultimate settlement is large or the rate of settlement is slow, the embankment could be constructed early and allowed to consolidate, if time permits, or a temporary pavement could be constructed and periodically maintained until the embankment and foundation are stabilized, at which time a permanent pavement could be constructed.

Alternately, some means of bridging, such as extending the structure and (or) providing heavily reinforced concrete approach slabs could be employed. In cases where the calculated ultimate settlement is small, or the rate of settlement is very fast, such elaborate countermeasures would not be warranted.

Indeterminate factors such as creep or internal erosion preclude the exact calculation of total settlement. Nevertheless, in many cases, consolidation is the major cause of settlement and its control would constitute a significant partial solution of the bridge approach settlement problem.