

FINAL REPORT

Highway Research Committee Project No. 8

INVESTIGATION OF THE RELATIVE MOVEMENTS OF A WIDENED BRIDGE

In the last few years the Arkansas Highway Department has widened several two-ring concrete arch bridges with steel girders supported on I-Beams which run clear through and cantilever out from the piers.

The purpose of the investigation was to determine how much the widened portions of a bridge would move vertically relative to the old portions with changes in temperature, and what effect these movements would have on the structure.

A bridge on U.S. Highway 67 over the Ouachita River in Hot Spring County was selected for checking. It is 1,167 feet long with three main arch spans of approximately 125 feet each, and was built in 1931 with a 20 foot roadway which was widened to 28 feet in 1957.

For this investigation bolts were grouted in holes drilled in the curb over the steel girders and in the roadway over the arch ribs as shown on the attached sheet. Elevations were taken on the bolt heads at varying intervals from September 1963 to September 1965 at temperatures ranging from 32° to 104°F. A special level was set aside for use on this project and levels were run from a bench mark on the curb of the abutment which was 35 feet from the end of the West arch span.

The accompanying graphs show that there was relatively little difference in the movements of the original and the widened portions of the bridge. The maximum range of movement of an arch rib point was .082 feet, made up of .047 maximum fall and .035 maximum rise. The maximum range of a girder point occurred on the adjacent girder and amounted to .072 feet, of which .047 was maximum fall and .025 was maximum rise. These occurred at the center of the middle span. The maximum relative movement of a girder point with respect to the adjacent arch point was generally from .003 to .025 feet, with an absolute maximum at one position of .054 feet.

Careful examination of the structure reveals no deleterious effect, scaling, or cracking due to the differential movements. The use of steel girders provides a faster and more economical solution of the widening problem than would be afforded by the use of additional arch ribs.