plate records from all of the instruments are treated with a thin solution of the Kopal varnish in acetone, thus fixing the record for handling without danger of deletion Each record is then either examined under the microscope or enlarged by projection, and the deformations in particular spots in the pavement are thus determined and reduced to unit deformation

In many cases it has been possible to install the instruments only in the top surface of the slab In other cases by molding slots in the pavement at the time of its construction it has been possible to install what has been termed a scissors attachment, by means of which deformations at the bottom of the pavements are likewise determined

Absolute conclusions cannot be drawn from an analysis of the deformation readings thus far obtained The following, however, may be stated as very strong indications

1. The highest tensile stresses exist along the edges of a slab of uniform thickness
2. High tension also exists at the corners on the top of the slab but the value of this tension is not as high as that along the edge.
3. At an unsupported transverse joint, comparatively high tension can exist either on the top or bottom of the slab when the wheel load passes over the joint.
4 It is noticeable that the stress in the interior portion of a plain slab at some distance away from a transverse joint is considerably less than the stress along the outer edge.

These readings point directly to the necessity for increasing the thickness of a slab along the edge as compared with its interior thickness in order that it may be affected in like amount by wheel loads. Ordinarily a unit extension in concrete of 0001 to 0002 of an inch per inch of length might result in the formation of a crack. It will be noted that these values have been exceeded in a number of slabs upon which deformation measurements have been taken It is quite apparent that a number of variables such as modulus of elasticity, condition of subgrade, loading, etc , have affected the magnitude of the deformation readings in the various test sections

SKEW ARCH INVESTIGATIONS

A T Goldbeck

U S Bureau of Public Roads, Washington, D C

The design of skew arches has not in the past been based on well-established theory. Several failures of skew arches have occurred, and in several instances such arches are showing signs of distress at the obtuse angle end of the abutment. The infeience to be drawn from the physical behavior of such arches is that higher stress exists at the obtuse angle end than at the acute angle end of the abutment. For the purpose of discovering the law of distribution of these stresses, a series of tests is being performed at the U S. Bureau of Public Roads These tests, although not complete, are sufficiently complete to indicate a certain, well-defined trend.

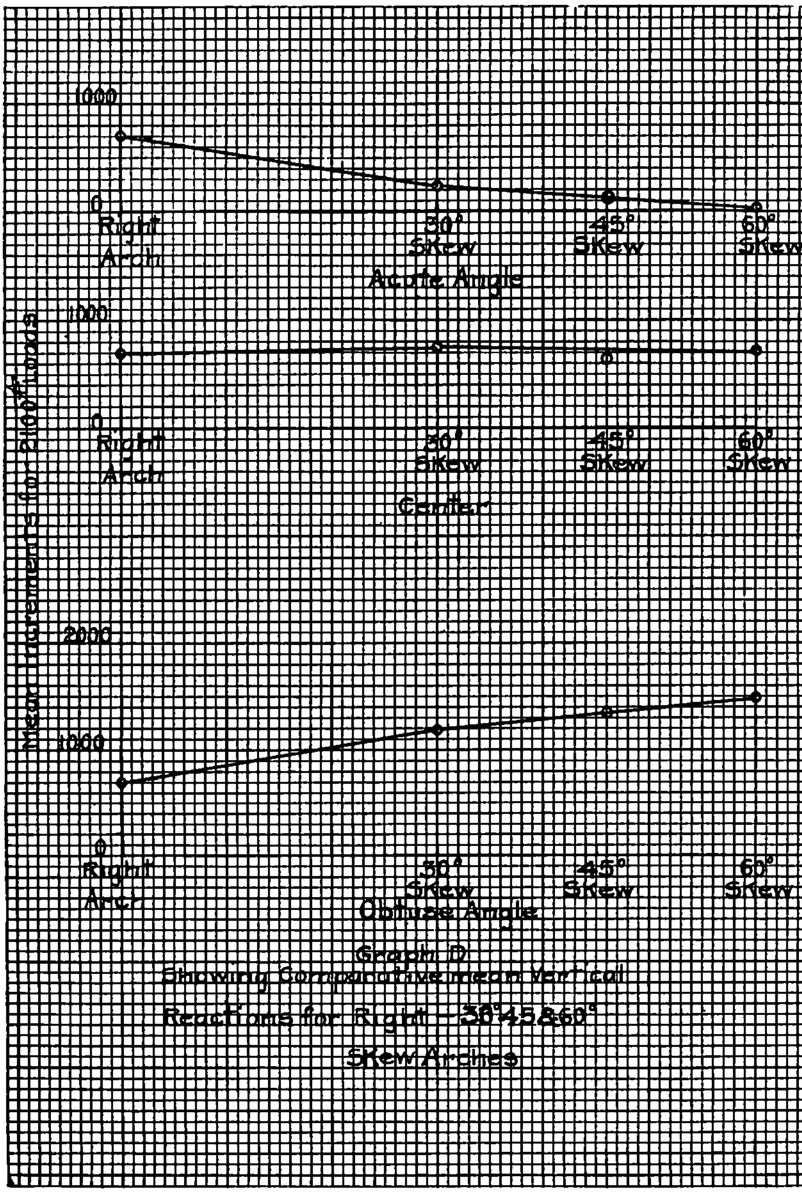

FIGURE 1
Comparative Mean Vertical Reactions for Skew Arches

DESCRIPTION OF SPANS

The arches are made of 1 3 mortar 7 feet in span measured on the center line of the roadway. The ring is 4½ feet wide at right angles to the roadway and the rise is one-fifth of the span. The angles of skew of the arches thus far tested include 60°, 45°, 30°, and 15° In all cases the arch ring has been tested without attached abutments.

APPLICATION OF LOAD

The load was applied at 42 points symmetrically distributed over the arch, thus closely simulating a uniform load. Calibrated springs were used in applying the load.

REACTION MEASUREMENTS

The final scheme of reaction measurements adopted was as follows The arch ring was supported at three points on each side of the arch The reactions were measured on one side of the arch only, by means of a combination of a single lever and a soil pressure cell placed at each point of reaction measurement Horizontal reactions were measured at these points in a similar manner, and in the case of the 60° arch the lateral end thrust of the abutment was also measured The distribution of horizontal and vertical abutment reactions obtained from these tests is shown in Figure 1 A complete analysis of the test results has not been made but it will be seen by inspection of the curves that in arches of the dimensions tested, the indications are quite strong that the centroid of the vertical reactions for the 60° skew is located one-third of the length of the abutment measured from the obtuse angle, and that its location shifts between that point and the center as the angle of skew decreases The centroid of the horizontal reactions lies in the obtuse angle third of the abutment length rather close to the third point and shifts from that position toward the center with a decrease in the angle of skew The foregoing is a rather rough statement of the indications of the tests