

REPORT OF DEPARTMENT OF MAINTENANCE

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PROGRESS REPORT OF PROJECT COMMITTEE ON DISTORTION OF CONCRETE PAVEMENTS

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SYNOPSIS

Indications derived from the study of distorted concrete pavement slabs now being carried on by the Committee are that

"Distortions are caused by the uplifting of slab ends through subgrade upheaval resulting from unequal soil moisture distribution and not by internal slab forces

Slabs placed on dry compact clay soils (generally A 6 or A 7) have distorted, while on reasonably moist clay or on sandy loams, except where frost is a major factor, the slabs have not distorted

Distortion may be prevented by subgrade treatment to insure maintenance of uniform moisture content, by treatment to change subgrade characteristics so moisture expansion is prevented, by selected subgrade soil or construction features to eliminate moisture entrance into subgrade

Distorted pavements were levelled by mud jack at reasonable cost in Texas and Missouri "

The Project Committee was organized in January, 1935, and held two meetings during the year.

C Methods for correcting distortions that have already occurred

THE PROBLEM

Reports from several states reveal that the riding qualities of some pavements are appreciably impaired by distortion resulting in high slab ends at cracks and joints due to forces either external, internal or a combination of the two, that come into action after the pavement has been constructed.

The objectives of the Committee are to determine:

- A The causes for distortions,
- B Means for preventing these distortions on future construction,

INDICATIONS

Indications derived from the studies of the Committee to date are as follows:

A Causes for the Distortions

- 1 High joints caused by warping are related to the type and character of the natural sub-soil and to the condition as to moisture and compactness of the subgrade at the time of concreting.

- (a) High joints have not been reported on sands and sandy loam soils (except where frost action is a major fac-

- tor) nor on clay soils which are reasonably moist at the time of concreting
- (b) Pavements placed on clay soils (generally A6 and A7 groups) that are in a dry (generally below 15%) and compact condition at the time of concreting have developed high joints
- 2 Heaving of the subgrade resulting from unequal moisture distribution causes uplift of the slab ends. The heaving may be caused by soil expansion or by frost action or by combination of both of these
 3. Curling of the slab or distortion caused by internal forces is not, in itself, sufficient to cause excessively high joints
- B Means for Preventing Distortions on Future Construction. There is evidence to indicate that high joints may be prevented by:
1. Treatment of the subgrade so that a uniform moisture content will be maintained
 - 2 Treatment of the subgrade to change its characteristics so it will not expand from absorbed moisture
 - 3 Design or construction features which will prevent the entrance of moisture to the subgrade
 - 4 Careful maintenance of joints by keeping them sealed and preventing the entrance of moisture to the subgrade
 5. Carrying the moisture which enters the joints to the side ditches in such a manner that the water will not come in contact with the subsoil.
- 6 Selection of the best available soil for the subgrade during the grading operations. The best available soil may be located by soil surveys
- C Methods of Correcting Distorted Pavements. Pavements having high joints have been leveled by:
- 1 The use of a mud jack. This has restored good riding qualities at reasonable cost in Texas and Missouri. The main objection to the method is that the lifting operations cause cracking unless carefully performed
 - 2 Equalizing the moisture content of the subgrade by artificial means. As used experimentally in Kansas this method was satisfactory but further development is required to make it practical and economical

RESEARCH IN PROGRESS

Certain features of the problem requiring detailed studies are being actively investigated by various members of the Committee. These are as follows.

- 1 Detailed analyses of conditions under which pavements have and have not developed high joints
- 2 Laboratory tests of soils to determine pertinent features that cause or prevent the expansion of soils from the absorption of moisture and/or frost action
- 3 Detailed studies of experimental roads and test sections including:
 - (a) Subgrade treatments with water, granular admixtures, bituminous materials, blanket courses of selected materials, etc
 - (b) Variable compositions of the concrete

- (c) Variable design features for the pavement slab such as reinforcing, jointing, transverse joint types, etc
- (d) Special drainage features at joints

GLOSSARY OF TERMS

The following terms have been adopted for clarity in the reports of the committee

- 1 *Curling*—The distortion of the pavement slab from its proper plane caused by differential contraction resulting from a difference in moisture content or temperature be-

tween the top and bottom fibers of the slab. The word "curling" seems to be generally used and commonly understood in concrete literature as applying to distortion of slabs caused by internal forces

- 2 *Warping*—The distortion or displacement of the pavement slab from its proper plane caused by the action of some external force or forces
- 3 *High Joint*—The condition resulting from warping or curling of the slabs on each side of a joint or crack