MANUAL FOR CONDITION SURVEY OF CONTINUOUSLY REINFORCED CONCRETE PAVEMENTS

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SUMMARY REPORT 177-19(S)
SUMMARY OF
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Introduction

A large portion of the Interstate highways of Texas is paved with continuously reinforced concrete pavement (CRCP). Some of these highways were constructed during the early phases of the Interstate program and others at a later date, and, thus, the pavement ages vary considerably and some portions require rehabilitation of some form.

In order to monitor the historical development of distress and the various prominent distress types found in these pavements, a condition survey of these pavements was initiated. Virtually all CRCP were surveyed under this program in 1974 and again in 1978. Between 1974 and 1978, the condition survey procedure was modified slightly so that the survey would be more objective and could be carried out at a reasonable speed.

Analysis of the results will provide objective data which may improve overall CRCP management in Texas.

Report 177-19 describes the development of the present survey procedure and details the procedure for use by the Texas State Department of Highways and Public Transportation.

Purpose of Condition Survey

Condition surveys provide the pavement planner, engineer, or maintenance personnel with information regarding the various forms of distress which may be present in a pavement. Various condition survey procedures exist, each with its own advantages and disadvantages. Agencies use condition surveys depending on their requirements, their resources, and the amount of pavement to be surveyed. Before a condition survey program is undertaken, the following questions should be asked.

For What Are the Survey Data Going to Be Used?

Many different forms of distress occur in a pavement structure. Therefore, before deciding on a condition survey procedure, the objectives and uses of the data must be specified. If this were not the case, large amounts of data could clutter the survey and make data analysis impractical. The survey data generally should be used for the following activities: corroborating design predictions, scheduling maintenance and rehabilitation procedures, and providing information for the design of overlays.

Can the Data Be Obtained Efficiently?

It would be impractical to attempt observation and measurement of all the different distress manifestations which may occur in a pavement. Only the most widely prevalent distress manifestations which can be measured objectively in one way or another should be recorded. Considering the length of pavement to be surveyed, one could survey a small sample in great detail or a larger sample in less detail or some combination of the two extremes. The survey data should be readily usable and should be suited to computer storage and manipulation. To make the survey, one should be able to make accurate observations with minimum training, and, similarly, these data should be reproducible by properly instructed surveyors.

How Will the Data Be Stored and Used?

Condition surveys produce masses of data. These data should be stored in a format which permits easy computer manipulation, as shown by previous studies. Details omitted from present summaries should also be stored so that later changes or additions to initial summaries can be made.

Is the Procedure Flexible in Order to Allow for Special Conditions?

Not all areas will have the same distribution of the various distress manifestations. A distress manifestation which may be widely prevalent in one area may be nonexistent in another. The survey procedure should readily adapt to such situations, and users of the procedure should be aware of the possibility of making necessary changes in the procedure.

Development of the Survey Procedure

Few survey procedures could satisfy most requirements upon initial application. With time, improvements can be made so that the procedure fits the circumstances and useful data result. The CRCP survey procedure used in this project has been developed over a number of years. Initially, the various distress manifestations which occur in CRCP were ascertained. Subsequently, most of these distress manifestations were subjectively recorded with regard to severity and extent. Finally, the present survey procedure records these distress manifestations in as objective a manner as possible. In order to substantiate the present procedure, the development of typical CRCP distress manifestations should be examined briefly.

Distress Manifestations

Soon after the construction, transverse cracks appear in a pavement. The cracks are generally caused by drying shrinkage, and temperature stresses cause fatigue cracking in the pavement. These fatigue cracks start at the outer edge of the pavement, where the tensile stress is at a maximum, and slowly progress across the slab. When two transverse cracks are fairly close together (roughly 2 feet, or 0.61 m, apart) the portion of the slab between the cracks acts as a beam in the transverse direction and longitudinal cracks occur. When two or more transverse cracks are linked by a longitudinal crack, a punchout is formed. Concurrently with the above, the slab is flexed under load and the upper edges of the cracks may break off or spall. This spalling may also result from material ingress into a crack and subsequent elongation of the slab due to increased temperatures. Further distress may be caused by pumping. Water may enter the pavement structure through any one of the above cracks. When a load subsequently passes over the pavement,

this water may be pumped out along the edge of the concrete. The velocity of the water being pumped out from under the slab may be sufficient to carry fines with it, in which case voids under the slab may result. These voids result in increased deflections and stresses within the slab.

1974 Survey Procedure

The above distress development is fairly prevalent and led to the observation of the following distress manifestations during the 1974 statewide condition survey: transverse cracks, localized cracks, spalling, pumping, punchouts, and patches.

Once the types of distress manifestations to be recorded had been determined, the question of how to record the severity and extent of each was addressed.

It became apparent that a condition survey utilizing the 1974 procedure could be done rapidly, and, thus, it was decided to apply the procedure to all the rural CRCP in Texas. The procedure was applied to 0.2-mile sections, consecutively. It was felt that this was roughly the maximum length of road to which similar subgrade properties would apply. Similarly, this was estimated to be the minimum length of a road to which a specific construction procedure could be applied. Smaller sections would probably have resulted in unnecessary detail. Only the distress in the outer lane was recorded, as this is the more heavily trafficked lane.

In addition to the above survey procedure, a photo survey was developed for use on urban freeways. This photo-survey procedure is described in CTR Report 177-10.

1978 Survey Procedure

Application of the 1974 procedure demonstrated the need for more objectivity while still retaining the speed of the survey. The present procedure was developed by modifying the 1974 procedure in order to obtain more objectivity. The recording and observation of the various distress manifestations were changed as described in Report 177-19. The survey form is shown in Fig 1.

The method for obtaining data for every 0.2-mile section proved successful in 1974 and again in 1978. This survey procedure was applied to all the rural CRCP in Texas during 1978.

CRCP CONDITION SURVEY

DISTRICT 17 | CONTROL 675 | SECT. 5 | HIGHWAY IH-45 | AGE (F10.0) 11.0 | DIR S | COUNTY MADISON | JOB 6 | CFHR NO. 1704 | MO DAY YEAR 9-19-79

LOCATION FROM NJCT US-75 N OF MADISONV. TO LEON COUNTY LINE

MILE POST	MILE POINT	COMMENTS BRIDGES OVERLAYS LANDMARKS	SPALLING MINOR NO. OF CRACKS	SPALLING SEVERE NO. OF CRACKS	PUMPING MINOR %	PUMPING SEVERE %	PUNCH OUTS MINOR <20FT	PUNCH OUTS MINOR >20FT	PUNCH OUTS SEVERE <20FT	PUNCH OUTS SEVERE >20FT	REPAIR PATCHES ASPHALT CONCRETE NO. OF OCCURRENCES	REPAIR PATCHES P.C. CONCRETE NO. OF OCCURRENCES	RIDING QUALITY
152.2	18.600		32	33	6		7	3		1			3.1
152.0	18.310		53	13	4		3	1				8	3.2
151.8	18.110	BRIDGE	54	34	15	1	4	4				9	3.1
151.6	17.910		31	5	16		1	1	2			3	2.9
151.4	17.710		33	5	9								2.7
151.2	17.510		30	2	8		1					1	3.0
151.0	17.310	RAMP	20	24	6		2	1			1		3.4
150.8	17.120		26	41	10								3.4
150.6	16.920		22	18	7								3.4
150.4	16.720	OVERLAY											4.0
150.2	16.520		15	10	13	1	2	1				1	3.6
150.0	16.320		34	13	4							3	3.3

Fig 1. Condition survey form.

The Present Condition Survey Procedure

Application of the present survey procedure during 1978 demonstrated that the survey met most of the requirements described in Report 177-19. The various questions are satisfied by the survey procedure reported therein.

Implementation

The application procedure is detailed in the condition survey manual which appears in Appendix 1 of Report 177-19. As with all general procedures which have to be applied over a wide range of conditions, exceptions will occur which will be difficult to fit to the procedure; for instance, large-scale longitudinal or random cracking. A number of these exceptions are covered in the procedural manual.

KEY WORDS: continuously reinforced concrete pavement, pavement evaluation, condition survey, jointed concrete pavements, jointed reinforced concrete pavements, distress.

The full text of Research Report No. 177-19 can be obtained from Mr. Phillip L. Wilson, State Planning Engineer, Transportation; Transportation Planning Division; File D-10R; State Department of Highways and Public Transportation; P.O. Box 5051; Austin, Texas 78763.