TECHSUMMARY *May 2019*

State Project No. 30000607 / LTRC Project No. 12-1P

Impact of Inundation on Roadway Pavements: Case Study – LA 493

INTRODUCTION

According to the National Oceanic and Atmospheric Administration (NOAA), there have been 233 weather and climatic disasters exceeding $1 billion per event in the US between 1980 and 2018. It is estimated that the total costs of these events exceeds $1.5 trillion. As of April 30, 2018, the Federal Emergency Management Administration (FEMA) has reported that there have been 118 significant flooding events since 1978 in the USA, costing over $57 billion. Eleven (9.3 percent) of these significant flooding events have occurred in Louisiana.

LTRC has conducted a research study on LA 493 that provides evidence of damage to roadways caused by inundation. The evidence supporting this comes from three sources: a rod and level cross-section survey taken approximately one month prior to the first inundation event and subsequent cross-section surveys taken after the first to third inundation events, from pavement assessments with LTRC's profiler in June 2017 and June 2018, and from a structural assessment with the falling weight deflectometer (FWD).

OBJECTIVE

The objectives of this study were to measure the seasonal pavement surface movements, the impact of inundation on the functional properties of the pavement structure, and the impact of inundation on the structural properties of the pavement structure.

SCOPE

This report covers the impact of inundation on the six test sites on LA 493. The effects of inundation were measured by conducting cross-section surveys on the six sites between December 2015 to March 2018. The functional properties of the pavement surface were determined with LTRC's profiler and imaging system. From this, the IRI, rutting, and surface cracking were measured on assessments in June 2017 and June 2018. The structural properties were measured with the FWD in July 2018. The data was used to calculate the in-place structural number and subgrade resilient modulus.

METHODOLOGY

Six experimental test sites were assessed over a period of approximately two years on LA 493 in Natchitoches Parish. During that period, the test sites were inundated three times due to extreme rainfall events.

Cross-section surveys were taken approximately one month prior to the first inundation event and subsequent cross-section surveys were taken after the three inundation events. Pavement assessments were conducted with LTRC's profiling and imaging vehicle to measure

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the pavements profile, IRI, and cracking distresses. Structural assessments were conducted with the falling weight deflectometer.

CONCLUSIONS

Results from the IRI testing implied that (1) there were high degrees of differential profile changes in the roadway surface, (2) the IRI was significantly higher than it should have been for a roadway with its service age, and (3) there was a high degree of IRI variation amongst the test sites. Data from rutting tests also had high degrees of variability. The maximum measured rut depth was 1.685 in.

Longitudinal crack data implied that (1) most of the sites had excessive longitudinal cracking for the time that they were in service, (2) the longitudinal cracking observed is consistent with volumetric changes occurring in the subgrade, and (3) it is logical to infer that the inundation events were responsible for both the magnitude and premature emergence of these longitudinal cracks.

Data from the FWD testing implied that structural damage was present. The amount of damage present ranged from 0.2 to 2.61 in. of equivalent asphaltic concrete thickness.

RECOMMENDATIONS

Extreme weather events are becoming more frequent. There have been at least three major inundation events caused by either unnamed oceanic storms or hurricanes resulting in record flooding in the USA since 2016. Several studies, including this one have shown that inundation causes measurable structural damage to the pavements. It is recommended that DOTD identify flood prone roadways and conduct structural testing on them either annually or biennially so that before- and after-statistical testing of the pavement structure can be conducted. Having this type of program will aid in determining the amount of damage caused by future inundation events.