TN TDOT Department of Transportation

Design and Application of Stormwater Conveyance from Bridge Decks

Problem Description

TDOT has long used large catch basins at the end of bridge rails to gather runoff from bridge decks. These are located on the bridge approach pavement and may be contributing to fill settlement under bridge approaches resulting in bumps at the end of bridges. TDOT has moved away from these catch basins and instituted a new standard with an open channel riprap lined flume at the end of the bridge. For this standard, research is required to determine the most accurate way to calculate capacity to intercept flow along the bridge rail and to calculate the capacity of flow conveyed down the roadway embankment without erosion damage. This research is necessary to facilitate conveyance of stormwater away from bridge decks. Inadequate conveyance facilities may contribute to standing water puddles on roadways, an immediate safety hazard that can lead to hydroplaning, erosion on roadway embankment slopes and bridge substructures and safety guardrail components which presents a long-term safety hazard and maintenance expense.

PROJECT NUMBER:
RES2023-05

PRINCIPAL INVESTIGATOR:
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TDOT LEAD STAFF:
Wesley Peck
Structures

PROJECT SCHEDULE:
September 2022 to May 2025

Research Objectives

This research will combine physical modeling in the hydraulic laboratory with computational fluid dynamics (CFD) simulations to:

i) Quantify the performance of the new standard in conveying stormwater away from a bridge deck, assessing it in terms of its capture efficiency and the resulting water depths and spreads in the vicinity of the inlet, for a range of bridge conditions and rainfall intensities, up to and beyond design storm conditions.

ii) Optimize the location and configuration of the inlet and flume, for different bridge conditions (longitudinal slope, cross-slope, and contributing width), under the design storm.

Based on the results obtained for Objectives (i) and (ii):

iii) A general calculation method will be developed for this standard, together with recommend-dations for placement and configuration of both the inlet and the end of the flume, including maintenance considerations.

Potential Implementation and Expected Benefits

Results from this applied research will have immediate benefits. The equations and recommendations will allow TDOT to strengthen the design procedures and technical drawings/specifications for this new standard. There will be time and cost savings as well as increased efficiency during the engineering design process. All objectives related to bridge drainage will be enhanced by a design procedure that maximizes water removal efficiency.

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