Project Summary

Texas Department of Transportation

0-6094: Mitigation Methods for Temporary Concrete Traffic Barrier Effects on Flood Water Flows

Background

Temporary traffic barriers are installed in work zones to shield motorists from hazards, and separate and protect work crews from traffic. In 1986, the Federal Highway Administration (FHWA) specified that all temporary concrete traffic barriers must pass a specified crash test before being installed in work zones. The requirement to use successfully crash tested concrete traffic barriers poses a concern with respect to hydraulic performance because the additional height and less open space of these barriers may adversely impact the surrounding floodplain elevation. In the event of extreme flooding, these barriers obstruct water flows and magnify the flooding by increasing the head water elevation. The issue of hydraulic performance of concrete traffic barriers came to light when a number of major arterial highways were shut down due to recent statewide flooding.

The primary objective of this project was to determine the hydraulic performance of standard and modified temporary concrete traffic barriers (TCTBs). Tasks included, an evaluation of susceptibility to clogging, a stability analysis in terms of sliding and overturning, and development of a method to model standard and modified TCTBs in HEC-RAS (the Hydrologic Engineering Center-River Analysis System).

What the Researchers Did

A combined experimental and analytical approach was used to achieve the objectives of the project. Two standard types and a modified TCTB were evaluated. The fraction of open space of the two standard (F-shaped and single slope) TCTBs were much smaller than the modified TCTB. If the modified TCTBs were better in-terms of hydraulic performance and had an adequate factor of safety for sliding and overturning, then the modified TCTB might be recommended as a choice in the future to achieve its objectives without considerably hindering water flow during any flood event.

A parametric study was conducted with HEC-RAS software for different geometric situations using parameters obtained from laboratory measurements. The total length of the TCTB barricade and the geometry and other properties of the flood plain such as the elevation of the location where TCTBs might be placed compared to that of other locations of the flood plain, were varied for each type of TCTB. The corresponding geometry and hydraulic efficiency parameters were used as the input for the model to characterize the magnification of highway flooding due to installation of TCTBs. This parametric study was also performed to provide information about situations when the use of TCTBs might be detrimental.

Research Performed by:

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What They Found

- Every TCTB must be washed and cleaned before placement so that there will not be any loose dirt at the bottom surface of the TCTB.
- The bed on which the TCTBs will be placed must be cleaned so that there will not be any loose dirt on the surface.
- The cross slope (outward to the flow) of the bed on which the TCTBs will be placed must be measured accurately.
- The surface materials of the bed must be identified to understand the coefficient of friction. If the bed surface materials cannot be identified clearly, a conservative assumption is recommended.
- From the landscape of the location, and the geometry and drainage pattern of the roadway, a possible flood scenario(s) should be identified.
- Once a possible flood scenario(s) is identified, the type of TCTBs that can be used in that particular location should be identified. If more than one type of barrier can be used for the particular location, other factors such as availability, speed restriction, and special needs (i.e., crossing Ocelots) could be considered.
- The Low Speed Traffic Barrier (LPCB) is the only barrier that could be used in all possible flood scenarios considered in this study. However, the LPCB is only applicable for low speed areas.
- Researchers recommend that in any special situation requiring the use of a TCTB that does not fit within the guidelines of this study, the TCTB should be anchored to avoid any failure against sliding or overturning.

What This Means

Temporary traffic barriers are installed in work zones with the purpose of shielding motorists from hazards, and separating and protecting work crews from traffic. Researchers believe that the results of this study may also assist TxDOT choose the best TCTBs for flood prone work zones.

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