

# JOINT TRANSPORTATION RESEARCH PROGRAM

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SPR-3405

2011

## Analysis of INDOT Current Hydraulic Policies

### Introduction

Hydraulic design often tends to be on a conservative side for safety reasons. Hydraulic structures are typically oversized with the goal being reduced future maintenance costs, and to reduce the risk of property owner complaints. This approach leads to a conservative design with higher construction costs. Therefore, there is a need to quantify the cost-benefit aspect of this conservative approach. Accordingly, this project has the following three objectives: (i) To compare design policies of INDOT with other border states (Ohio, Illinois, Michigan, and Kentucky); (ii) Perform cost-benefit analysis of large versus smaller hydraulic structures in terms of capital and maintenance costs; and (iii) Investigate ways to improve the hydraulic design by looking at the effect of input data and sources.

### Findings

- In general, the hydrologic design policies implemented by Indiana (INDOT) and Michigan are most updated compared to Ohio, Illinois, and Kentucky design policies. For example, INDOT uses TR20 and HEC1 software programs for computing design discharge; whereas Illinois hydrologic policy recommends the use of USGS regression equations.
- The magnitude of INDOT design discharge (Q100) is conservative in comparison to Illinois and Kentucky design discharge (Q50 or less). The magnitude of design discharge for Michigan and Ohio is similar to that for Indiana.
- INDOT's culvert design discharge magnitude (Q100) is conservative in comparison to other states' culvert design discharge magnitudes. For example, Illinois uses Q50 as design discharge compared to Q100 by Indiana.
- INDOT's maximum back water limit criterion (1.5") for new alignment culverts is not found in neighboring states' design manual. The maximum back water limit criterion becomes limit criterion for culvert design (culvert size) in many cases.

- An increase in backwater limit to 1' will result in 44% reduction in culvert size (represented as culvert area) with an average backwater of 0.79'. Increase in backwater limit will also increase the outlet velocity by 72% that may result into extra cost in outlet protection structures.
- Depending on the type and the size of the culvert, a change in hydraulic policy may result in saving from 12 to 58% of the original cost associated with the current conservative design.

### Implementation Recommendations

The hydraulics division at INDOT will use the findings from the final project report in determining the modifications to the current hydraulics design policies.

### References

Merwade, V., Kumar, S. *Analysis of INDOT Current Hydraulic Policies*. Publication FHWA/IN/JTRP-2011/14. Joint Transportation Research Program, Indiana Department of Transportation and Purdue University, West Lafayette, Indiana, 2011. doi: 10.5703/1288284314628

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