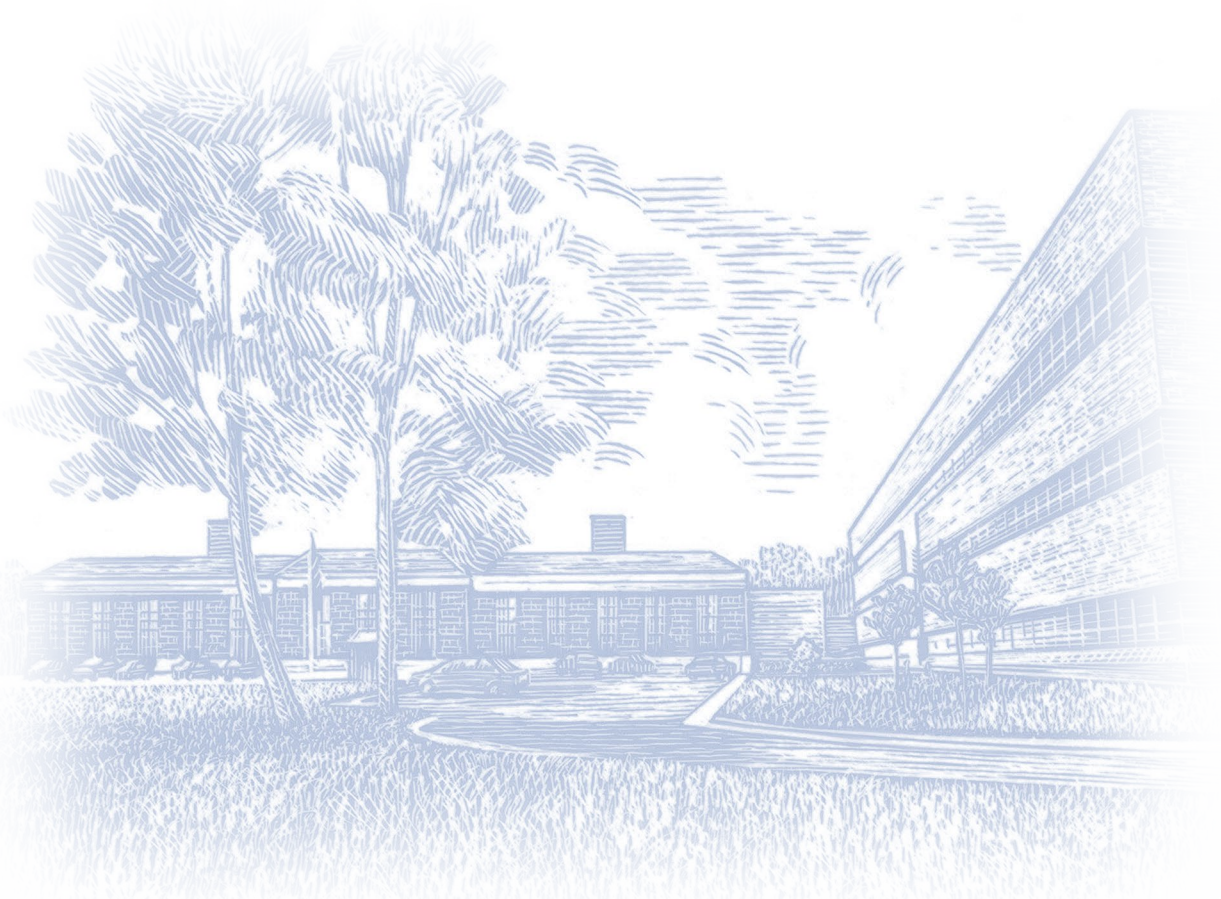


# Hydraulics Laboratory Assessment Summary

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#### Overview Of Hydraulics Laboratory

The Hydraulics Laboratory provides a means of testing the hydraulic performance of highway drainage structures and stream crossings. To ensure safe travel in any instance when water meets our nations highways, the laboratory works to solve hydraulic and stream stability problems and supports operational engineers with design guidance and tools.

The Hydraulics Laboratory consists of a physical modeling component and a numerical modeling component that work in tandem; results are extrapolated from one and verified and calibrated by the other:

- The physical modeling facility features a tilting flume capable of simulating 15 degrees longitudinal and cross slopes. The flume has a sediment recess for local scour modeling and a sediment trap connected to a sediment reticulation pump for limited live-bed scour studies. It has pumps with variable-frequency drives capable of simulating in-flow hydrographs. The facility also includes a culvert test facility for evaluating entrance loss coefficients of various types of culvert inlets.
- The numerical modeling capability includes two-dimensional (2-D) and three-dimensional (3-D) modeling and features a 3-D sediment transport model capable of reproducing scour results that can be extended to field conditions. The 3-D model is a very effective research tool for extrapolating laboratory results to limits difficult to achieve with a physical model study.

#### Key Strengths and Observations

- Research is relevant, high quality, and well executed, meeting State and national needs.
  - Woodrow Wilson Bridge foundation study saved an estimated \$50 million.
  - Complex pier scour study done with the University of Florida resulted in better predictions of local pier scour.
  - Studies of riprap countermeasures for piers and abutments have been implemented in HEC-23, *Bridge Scour and Stream Instability Countermeasures*, and adopted by many State DOTs for increased safety nationwide.
  - Research results show up frequently in peer-reviewed journals.

- Research products from the laboratory are recognized and used nationally and internationally.
  - HEC-18, *Evaluating Scour at Bridges*, serves as a national and international standard.
  - Various FHWA HEC and Hydraulic Design Series (HDS) manuals (particularly HDS-5, *Hydraulic Design of Highway Culverts*) have been translated for international use.
- The laboratory expertise, experience, and facilities are well suited to address all three structure research and development focus areas.
- Highly qualified support services staff have successfully operated and improved the laboratory over a period of more than 17 years. Support staff has been instrumental in developing, installing, and operating innovative procedures and equipment that make the laboratory state of the art.

## Key Recommendations

- Centralize Software — Computer software maintenance, upgrading, and technical assistance are essential to the future of hydraulics activities nationally. At a minimum, coordination of issues and efforts related to software is needed. A single source for such maintenance, upgrading and technical assistance is desirable, and FHWA's Hydraulics Laboratory is a natural location for this activity.
- Post data from previous lab and field studies on web site — Data from previous laboratory and field studies (reviewed and modified, if necessary) should be made available on the Internet for use by all in model verification.
- Increase emphasis on documentation of small studies and an archiving process of research results — The laboratory should increase emphasis on both the documentation of small studies and an archiving process to ensure the long-term availability of research results.
- Negotiate long term Lab support contracts — Consideration should be given to a longer term for the contract for laboratory support, given that the learning curve may be up to a year for some activities in the laboratory. In addition, contract staff members may not be as productive or cost-effective in the final months of a contract or be as interested in longer-term studies if their future with the laboratory is in doubt. One approach may be options for contract extension beyond the base performance period.
- Formalize the project selection process under the new (HRDI) team structure — The project selection process under the new team model will benefit from structure and widespread understanding of the new process by all TFHRC staff members. The panel notes that although its backward review of project selection processes suggests that historically the right research has been addressed, its ability to comment on the appropriateness of the new approach is limited.



## Status of Current and Planned Activities

- The FHWA national hydraulics team has been moving towards using the Brigham Young University (BYU) SMS (Surface Modeling System) as the umbrella for all highway drainage software. We have established a mutually beneficial relationship with BYU where they provide a user friendly graphical interface for FHWA engineering programs, provide maintenance support and extend license agreements to FHWA and State Highway agencies for a nominal fee. Mr. Lwin, however does not favor using FHWA funds to provide license agreements to States; setting up a pooled fund account where each State could put in \$1K or \$2K per year and perpetually maintain and enhance the highway drainage software system. We intend to test that idea at the next AASHTO task committee meeting.
- On 2/3/05 met with website planning group including Terry Halkyard, Michelle Cribbs, Betsy Joyce (webmaster), Jorge Pagan to format a Hydraulics web page with links to the research web



page; discussed protocols for posting experimental lab data. On 3/17/05 met with ICF Consultants, represented by Mark Youman, to discuss merits of an agency web site arrangement for sharing technical information internally and with external customers. Deborah Gwaltney, NHI e-learn program manager, is the COTR for a contract with ICF.

- Feb. '05 Terry Halkyard set up a database of all R&D publications Hydraulics R&D publications are automatically posted under the Hydraulics list of publications as they come on line.
- The RD&T business philosophy is to re-compete contracts at least once every five years to bring in new ideas to our programs. Although there is a potential to disrupt our program, it has not been any more a problem than having key personnel leave a contractor for better opportunities.
- On 11/01/04 sent FY-04 topics for all three-focus areas to Shelia Duwadi. On 11/16/04 Jorge Pagan hosted a strategy meeting on Unknown Foundations research. Attended by Sam Mansukhani, Jerry DiMaggio, Cynthia Nurmi, Ian Friedland, Khmis Harmany, Michelle Cribbs, Jose Krolak and Sterling Jones. Cynthia, Sam & Khamis will prepare RFP for a Synthesis study and we are planning a summit on Unknown foundations in Nov 2005. On 3/11/05 a new hydraulics roadmap, which includes headquarters activities as well as research, was presented to the national hydraulics team for discussion. That roadmap will be maintained on the Hydraulics web site and discussed periodically during team meetings. We have set up an executive subgroup in the hydraulics team to vote prioritize projects for funding in a given year.