D-9

GORDON

REVISION 17 COMMENTS

Rev 17 comments
Dave
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model reach problematic: what discharge should be used, what energy slope exists in the prototype, and what bathymetry is most representative? This leads to the conclusion that similitude in open rivers cannot be defined in absolute terms.

The lack of an absolute definition of similitude, however, does not preclude the use of loose-bed physical models. Past application of these models (documented by a long list of successful model study reports) proves their utility in solving complex riverine problems. Both large-scale and small-scale models provide information useful in developing problem solutions.

Reduced budgets often limit or exclude the use of large-scale physical models. Therefore, focus must turn to the use of the small-scale models, or micromodels. Because physical loose-bed modeling does not follow strict similitude, the degree of confidence placed on the model depends upon the entire modeling process -- how the model is designed, constructed, and operated to achieve morphologic similarity with the prototype. A systematic approach to model design and operation provides significant benefits toward improving confidence in and acceptance of the micromodel.

Andy, Please Add the following:

Ettema (in his initial evaluation) states: "Micro-models have their place as a **design aid** for river engineering." He also states "As with all hydraulic models, the bottom line for micro-models is that the limits of their applicability fundamentally depend upon the extents to which they meet similitude considerations and on the level of risk the model user is prepared to assume." A substantial risk is also assumed during the design of river training structures without a model. The risk the modeler takes could be considerably less than the risk river engineers normally assume during the design of most river training structures. These structures are usually designed without the aid of models as well as any other quantitative tools. The design process usually consists of a team of river engineers using just their experience and intuition along with a limited amount of data to come up with a completed design. There are no equations or specific guidelines to follow. A phased construction approach is usually utilized to reduce the risks associated with traditional design techniques as well as with the modeling approach to design.

To further reduce the risk river engineers are faced with during normal design practices, models are sometimes used as a type of insurance to the engineer. The use of models would be more prevalent if there was sufficient allotment of time and budget needed to resolve problems. They allow a design to first be tested in the protection of a laboratory setting without the risk of failure in the natural river environment. The model can give a design team additional confidence than just using their experience and intuition. For example, the original contract designer of the Big Creek project (discussed later in the case studies) suggested that a 50-foot dike would solve the problem. However, the model suggested that a 25-foot dike would achieve the desired results and would therefore be the more economical solution.

Confidence in a model comes from the modeler's confidence in understanding the reach of river under study. This level of confidence has a direct correlation to the amount risk involved in the study. If the reach is highly variable or if current construction has destabilized the river then the modeler cannot have the confidence needed to fully understand the mechanisms at work in the channel. The model is a tool which helps the modeler understand these dynamics in the reach. This learning process takes place mainly during the calibration phase when the modeler evaluates the available data and works with the model to achieve bathymetry trends similar to those of the prototype. By trying to get the model to form the appropriate bed conditions, the modeler can learn about the dynamics at work in the river. Without first this understanding, the model is useless. The experience the modeler builds while working with and studying a reach of river is priceless. For example, it would not be recommended that one modeler calibrate the model while another modeler tests design alternatives after calibration. The intimate knowledge of a river reach that a modeler gains during calibration builds confidence in the modeler's recommended design alternative. Therefore, it is the modeler that must have the experience and judgment necessary to effectively operate a model. The model is the tool with which the modeler uses to study a reach and recommend a remedial design. If the engineer does not have the tool available, which is often the case, then his past experience will have to suffice for designing a solution to a river engineering problem. Therefore, the model can be used to build a level of confidence in a particular design which therefore determines the amount of risk involved.

Additional risk can be encountered if the model results are misinterpreted. However, misinterpretation of any data set or study can increase risk. It has often been stated that the results of the model are vulnerable to attack by critics because the study is documented in a published report. Therefore, it is crucial that all aspects of the model study be analyzed and documented in the utmost detail. However, any level of detail will not prevent the possibility of someone misinterpreting the data or the analysis of the data and model study. The close involvement of the modeler in all phases of the final design process as well as during the construction and monitoring of the project can reduce this risk.

Due to the documentation of model studies, it has been stated that if an accident, resulting in a possible loss of life, occurs in a reach where a model has been used to evaluate design alternatives, that a long line of experts may dispute the models value and worth for such an evaluation in a court of law. However, the fact that most structures on the river are designed without the use of an extensive analysis or strict method indicates that all river engineering design is subject to extreme scrutiny whenever a failure occurs. It is possible that because the design of most structures is not documented, this shields the traditional processes of river engineering design from any such scrutiny or responsibility.

However, this seems preposterous. If the traditional design of most river engineering structures is not documented, then the designs initiated from a model study may not require documentation. Therefore, it could be possible that too much documentation of a particular design process may be construed as negative from a legal point of view. Should this considered a method of reducing the risk of legal action against the government?

Risk obviously applies to all modeling…including numerical modeling and large scale modeling…..the results of a river model rarely end up in court however, because very rarely does anyone have data to describe conditions exactly at the time of the accident,,,in addition, ultimate construction of the river often varies significantly from what was recommended in the model.