MINNESOTA DEPARTMENT OF TRANSPORTATION
STATE AID FOR LOCAL TRANSPORTATION DIVISION
Technical Memorandum No. 04-SA-04
September 20, 2004

TO: County Engineers
City Engineers
District State Aid Engineers

FROM: Julie Skallman
State Aid Engineer

SUBJECT: Hydraulic Risk Assessment Form

The Risk Assessment Form was created in 1981 as a response to FHPM 6.7.3.2 (Currently FAPG 23 CFR 650A) "Location and Hydraulic Design of Encroachments on Flood Plains". The intent of the Regulation was to encourage the abolishment of arbitrary design frequencies, such as the 50 year frequency, for all classes of roads. Instead, it was decided that the design selected for an encroachment should be supported by analyses of design alternatives with consideration given to capital costs and risks to other economic, engineering, social and environmental concerns. The process to determine the least total expected cost (LTEC) requires considerable expenditure of resources. MnDOT developed a risk assessment procedure as an attempt to screen the projects and determine the level of analysis required.

Question #4 on the Risk Assessment Form addresses capital cost of the structure. It currently states that if the cost of the structure exceeds $500,000 an LTEC Design processes is specified or justification as to why it is not required is necessary. This dollar amount was based on $45/sq ft for the bridge structure back in 1981. The current cost for building a bridge structure has significantly increased. Average bridge costs ranged from $75 to $95/ sq ft in the Annual Federal Report for fiscal year 2003. Therefore the structural cost limit is raised to $1 million effective immediately. A copy of the revised form is attached for your use. The form may be downloaded from the SALT website at http://www.dot.state.mn.us/stateaid/res_sa_tech_memos.html. Look for Tech Memo 04-SA-04 on the list on that page.

If you have any questions concerning this memorandum, please contact Paul Stine, State Aid Operations Engineer, at (651) 296-9973. Any questions regarding the attached form should be directed to Petra DeWall, Hydraulic Design Engineer, at (651) 747-2164.

Enclosure: Risk Assessment for Encroachment Design

cc: DSAA

RISK ASSESSMENT
FOR
ENCROACHMENT DESIGN

Date_____

District_____

County_____

Vicinity of_____

_____

Sec. ____ T____ R_____

DATA REQUIREMENTS

1. Location of Crossing: Roadway_____ C.S._____ M.P._____

2. Name of Stream:_____ Bridge No. Old:_____ New:_____

3. Current ADT_____ Projected ADT_____

4. Practicable detour available Yes_____ No_____

   If no is checked, please explain:_____

   _____

   If there is no practicable detour available, then the use of the road must be analyzed. Considerations such as emergency vehicle access, emergency supply and evacuation route, and the need for school bus, milk and mail routes should be studied. Factors to consider for this analysis include design frequency, depth, duration, and frequency of inundation if appropriate, and available funding.

5. Hydraulic Data: (Fill in as appropriate)

   Approximate Flowline Elevation

   Q_2 = _____ TW_2 Elevation _____

   Q_5 = _____ TW_5 Elevation _____

   Q_{10} = _____ TW_{10} Elevation _____

   Q_{25} = _____ TW_{25} Elevation _____

   Q_{50} = _____ TW_{50} Elevation _____

   Q_{100} = _____ TW_{100} Elevation _____

   Circle Design Frequency
   Reasons for selecting Design Frequency: _____

   _____

6. Magnitude and Frequency of the smaller of "Overtopping" or "500 yr." flood:

_____ cfs _____ year frequency

7. Low member elevation _____

8. Minimum roadway overflow elevation if appropriate _____

9. Elevation of high risk property, i.e. residences _____

Other buildings _____

10. Horizontal location of overflow:

At structure _____ (See 12) Not at structure _____

11. Type of proposed structure:

Bridge _____ (See 12) Culvert(s)_____

12. If the proposed structure is a bridge with the sag point located on the bridge and there is ice and debris potential, strong consideration should be given to using Q_{50} as design discharge with 3′ of clearance between the 50 year tailwater stage and low member.

DATA REQUIREMENTS	LTEC DESIGN
1. BACKWATER DAMAGE - Major flood damage in this context refers to shopping centers, hospitals, chemical plants, power plants, housing developments, etc.	
1a. Is the overtopping flood greater than the 100 yr. flood? Yes __(Go to 1 b.) No __(Go to 1 e.)	
1b. Is the overtopping flood greater than the "greatest" flood (500 yr. frequency)? Yes __(Go to 1 d.) No __(Go to 1 c.)	
1c. Is there major flood damage potential for the overtopping flood? No ____(Go to 1 e.)	YES ____ (Go to 1 e.)
1d. Is there major flood damage potential for the "greatest" flood (500 year frequency)? No ____(Go to 1 e.)	YES ____ (Go to 1 e.)
1e. Will there be flood damage potential to residence(s) or other buildings during a 100 yr. flood? Yes __(Go to 1 f.) No __(Go to 2)	
1f. Could this flood damage occur even if the roadway crossing wasnNt there? Yes __(Go to 1 g.) No __(Go to 1 h.)	
1g. Could this flood damage be significantly increased by the backwater caused by the proposed crossing? Yes __(Go to 1 h.) No __(Go to 2)	
1h. Could the stream crossing be designed in such a manner so as to minimize this potential flood damage? Yes __(Go to 1 i.) No __(Go to 2)	

DATA REQUIREMENTS	LTEC DESIGN
1i. Does the value of the building(s) and/or its contents have sufficient value to justify further evaluation of risk and potential flood damage? No ___(Go to 2)	YES ___ (Go to 2)
2. TRAFFIC RELATED LOSSES	
2a. Is the overtopping flood greater than the "greatest" flood (500 yr. frequency)? Yes ___(Go to 3) No ___(Go to 2 b.)	
2b. Does the ADT exceed 50 vehicles per day? Yes ___(Go to 2 c.) No ___(Go to 3)	
2c. Would the (duration of road closure in days) multiplied by the (length of detour minus the length of normal route in miles) exceed 20? Yes ___(Go to 2 d.) No ___(Go to 3)	
2d. Does the annual risk cost for traffic related costs exceed 10% of the annual capital costs? No ___(Go to 3) (See figures A and B for assistance)	YES ___ (Go to 3)
3. ROADWAY AND/OR STRUCTURE REPAIR COSTS	
3a. Is the overtopping flood less than a 100 year frequency flood? Yes ___(Go to 3 b.) No ___(Go to 3 i.)	
3b. Compare the tailwater (TW) elevation with the roadway sag point elevation for the overtopping flood. Check the appropriate category.	
When TW is above the sag point (Go to 4)	
When TW is between 0 and .5N below sag point (Go to 3 c.)	
When TW is between .5N and 1.0N below sag point (Go to 3 d.)	
When TW is 1.0N and 2.0N below sag point (Go to 3 e.)	
When TW is more than 2.0N below sag point (Go to 3 g.)	
3c. Does the embankment have a good erosion resistant vegetative cover? Yes ___(Go to 3 i.) No ___(Go to 3 d.)	
3d. Is the shoulder constructed from erosion resistant material such as paved, coarse gravel, or clay type soil? Yes ___(Go to 3 i.) No ___(Go to 3 e.)	
3e. Will the duration of overtopping for the 25 year flood exceed 1 hour? Yes ___(Go to 3 f.) No ___(Go to 3 i.)	
3f. Is the embankment constructed from erosion resistant material such as a clay type soil? Yes ___(Go to 3 i.) No ___(Go to 3 g.)	
3g. Is the overtopping flood less than a 25 year frequency flood? Yes ___(Go to 3 h.) No ___(Go to 3 i.)	
3h. Will the cost of protecting the roadway and/or embankment from severe damage	YES____

DATA REQUIREMENTS	LTEC DESIGN
caused by overtopping exceed the cost of providing additional culvert or bridge capacity? No ___(Go to 3 i.)	(Go to 3 i.)
3i. Is there damage potential to the structure caused by scour, ice, debris or other means during the lesser of the overtopping flood or the 100 year flood? Yes ___(Go to 3 j.) No ___(Go to 4)	
3j. Will the cost of protecting the structure from damage exceed the cost of providing additional culvert or bridge water capacity? No ___(Go to 4)	YES___ (Go to 4)
4. Will the capital cost of the structure exceed $1,000,000? No ___(Go to 5)	YES___ (Go to 5)
5. In your opinion, are there any other factors you feel should require further study through a risk analysis? No ___(Go to 6)	YES___ (Indicate)
6. If there are no TNs in the LTEC Design column on the right, proceed with the design, selecting the lowest acceptable grade line and the smallest waterway opening consistent with the constraints imposed on the project. The risk assessment has demonstrated that potential flood damage costs, traffic related costs, roadway and/or structure repair costs are minor and therefore disregarded for this project. One or more TNs in the LTEC Design column indicates further analysis in the category checked may be required utilizing the LTEC design process or justification why it is not required.	

JUSTIFICATION _____

_____

_____

_____

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota

Signature: _____

Printed Name: _____

License Number: _____

Date: _____