e. Other controls, if any
f. Normal high and mean high water stages

4. Clearances (horizontal and vertical)

a. Drift at flood stage (not necessarily at peak backwater stage)
b. Navigation at mean high water or normal high water stage

Final Design Data

A. Inventory of Existing Crossing(s)

1. Location in relation to crossing(s)
2. Determination of drainage area (when significantly different)
3. Physical data on structure(s) (size, type, spans, foundation type, low member, available waterway area)
4. Flood history
5. Evaluation of hydraulic adequacy of structure(s) (Note: This data should be obtained not only for the site under consideration, but upstream and downstream crossings as well)

B. Selection of Design Flood

1. Importance to highway system
2. Importance to life and property
3. Conveyance of design, 100-year and maximum probable flood (under or over/under the highway)

C. Hydrologic Analysis

1. Site review (extremely important)
2. Interview with persons providing flood history data
3. Review of available flood records (Department, newspapers)
4. Review of available stream gages in vicinity
5. Definition of drainage area above site
6. Evaluation of potential watershed basin changes (20-year minimum)

a. Urbanization
b. Channelization
c. Water management practices

7. Determination of design discharge and development of discharge-frequency curve
8. Determination of design flood stage and development of stage-storage-frequency curve

D. Hydraulic Analysis

1. Bridges

a. Determination of permissible upstream water surface
b. With bridge length set to minimum criteria or environmental controls, determination of backwater
c. Adjustment of (b) if required to satisfy (a)
d. Check of conveyance for 100-year flood and maximumbable flood; adjustment of bridge length if required
e. Evaluation of scour potential
f. Evaluation of need for channel changes
g. Evaluation of need for bank protection including limits of protection, type, materials, and specifications
h. Evaluation of need for spur dikes and other training devices
i. Evaluation of effects of construction and temporary activities
j. Evaluation of effect on downstream structures and properties

2. Large Culverts (any cross-drain culvert larger than 1800 mm dia pipe, or 1200mm x 1200 mm box culverts)

a. Determination of allowable headwater (AHW) and design storm tailwater elevations
b. Selection of trial culvert size
c. Evaluation of culvert for abrasion, corrosion, debris, scour, suitability for improved entrance, etc.
d. Design of inlet and outlet scour protection, if necessary
e. Check of conveyance of 100-year flood and max. probable flood
f. Evaluation of effect on stream stability.
g. Evaluation of effect on fish and wildlife, if applicable
h. Evaluation of effect of channel change
i. Evaluation of effect on downstream properties and structures