12.10 Temporary Construction Causeway Design

12.10.1 Background

The need to provide a construction access facility that will not have a significant impact on normal flow conditions has been identified by the Environmental Division.

12.10.2 Causeway Design

12.10.2.1 Design Objectives

- Provide a design that is reasonably convenient, economical, and logistically feasible for the contractor to build and remove.
- Provide a design that will not be subject to failure due to normal stream flow conditions. This should consider in-stream obstructions such as piers or islands that could direct high velocity jets at points along the causeway.
- Provide a design that will not cause a significant increase in the Ordinary High Water stage, will not significantly increase the velocity of flow through the causeway opening(s) for that flood, will not significantly alter flow distribution, and will not concentrate flow on the piers and foundations that would subject them to forces for which they were not designed. The causeway's influence on flood flow elevations should be checked in the event that it does not wash out during a significant flood.

12.10.2.2 Plans

The temporary construction causeway should be designed as a rock prism. The design details and required notes should be shown on the typical section sheets (series 2 plan sheets) in the project plans or on a separate detail sheet for "Bridge Only" projects. A note, "Temporary Construction Causeway Required, See Sheet _____ of _____ for details" should be shown on the road plan sheet where the causeway appears. The design details and required notes for the "Temporary Construction Causeway" will be shown on the front sheet of Bridge plans for "Bridge Only" projects. A typical causeway design detail is shown in Figure 12-3.

The pay item(s) for causeways will be included with the road plans. For "Bridge Only" projects, the causeway pay item(s) will be included in the bridge plans.

The contractor should bid the rock causeway as shown on the plans. The contractor may elect to revise the design or substitute another design after being awarded the contract. If so, he should submit a revised design including necessary sketches and notes for review by the district construction, hydraulic and environmental personnel. The Department should obtain a revised environmental permit if necessary, for the contractor's revised design.

The material used in construction of the causeway should be Standard Class I Dry Riprap.

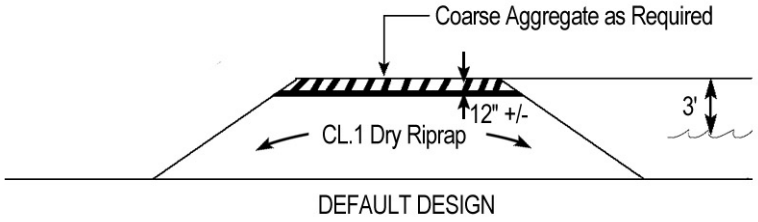

Figure 12-3. Temporary Construction Causeway Design

Show “Ordinary High Water” as the level that the top of the causeway is 3’ over.

12.10.2.3 General Notes

1. The basis of payment for the temporary causeway will be lump sum, which price should include all labor, equipment, materials and incidentals needed for construction, maintenance, removal and disposal of the causeway.

2. The Project Engineer may make minor adjustment in the location of the causeway provided that the adjustment does not change the design of the causeway.

12.10.3 Design Procedure

Step 1 Set the alignment of the causeway to facilitate construction activity. Set the finished grade 3'± above the Ordinary High Water elevation. Set the side slope angle at the natural angle of repose (approx. 1½:1).

Step 2: Determine the required waterway opening(s) and the resulting hydraulic performance using appropriate hydraulic design techniques. It is recommended that pipes be used whose diameter (or rise as appropriate) is 2-feet less than the causeway is high. In other words, if the causeway is 6-feet high, then use 48-inch pipe(s).

12.11 Daily Stream Flow Information

12.11.1 Background

In instances where a VDOT project crosses and/or is in the floodplain of a major waterway, it will be necessary to provide the contractor (or others as appropriate) with a means of determining which times of year would be most suitable for in-stream work (i.e. periods of normally extended low flows) as well as those times when larger or flood flows can be expected. When such information is available, the best source is usually stream gaging information from gage stations which provide daily flow data.

12.11.2 Development of a Composite Stream Flow Hydrograph

To provide the needed information, it will be necessary to plot approximately 10 consecutive Water Years of daily stream flow hydrographs, superimposed one upon the other, for a given stream gage. The department has developed computer software for this purpose. A "Water Year" starts October 1st of the previous year and goes through September 30th of the year under consideration. It is therefore desirable, when generating these plots, to have them start with October of the first Water Year under consideration and end in September of the last (usually 10th) Water Year. It is also desirable to use the most recent 10 consecutive years for which uninterrupted daily flow data is available for the stream gage being employed. Ideally, a stream gage would be used which is located relatively near (either up or downstream) of the project. It may not always be possible or feasible to utilize a stream gage located on the same stream and/or in very close proximity to the project. In such instances it will be acceptable to utilize a gage on another nearby stream, which in the judgment of the hydraulic engineer, can provide more appropriate stream flow information. The most important objective is to provide an indication of those times of year when sustained periods of low flow or high flows can be expected.

After selecting a stream gage, it is highly recommended that the gaging records be reviewed prior to utilizing the plotting software to insure that the gage is of the recording type (i.e. that daily stream flow records are available) and to determine the most recent 10 consecutive years for which uninterrupted data is available. The usual references for this information are the U.S. Geological Survey's annual publications entitled WATER RESOURCES DATA VIRGINIA, VOLUME 1, SURFACE-WATER-DISCHARGE AND SURFACE-WATER-QUALITY RECORDS (for each Water Year under consideration) and their Internet web site which is entitled "NWISWeb Data for Virginia", the "URL" for which is http://waterdata.usgs.gov\va\nwis\.

The software necessary to generate these plots – COMPOSITE HYDROGRAPH – is located on the Central Office Location & Design Division's 0501COLND file server. Access to the software will normally be granted to any VDOT personnel involved in drainage design and is an integral part of the department's "Hydraulic

Engr. Package" of software. Consultants needing these hydrographs must currently request them from the designated drainage design coordinator. Permission for access to the software must be requested of the Central Office Location & Design Division's AES Manager but shall not be granted without the approval of the State Hydraulic Engineer.

The software's database contains daily stream flow records for all recording stream gages in the state of Virginia. This data will, for gages currently in operation, be available up through the most recent Water Year for which data has been published. The software can, at the user's option, generate the hydrograph either as a ".BMP" file saved to disk or as a letter size hard-copy printout. The ".BMP" file should be made available to the Road Designer so he can import it into MicroStation and convert into a plan sheet for inclusion in the plan assembly. Probably the quickest and most convenient way to do this will be to attach the file to the cover e-memo used to transmit the usual "LD-293B" memorandum (in the case of a bridged waterway) to the Road Designer. If no bridged waterway is involved, as would be the case when the floodplain involvement is by virtue of a major culvert or roadway encroachment, the file should be generated and transmitted at the conclusion of the hydrologic & hydraulic analysis. An example daily stream flow composite hydrograph plot is included in the Appendix 12-E1, "Example Daily Stream Flow Information".

12.12 References

The Federal Highway Administration Hydraulic Engineering Circular No. 17, "The Design of Encroachments on Flood Plains Using Risk Analysis" – October 1980.

Survey Instructions Manual – Virginia Department of Highways & Transportation.

Hydraulics of Bridge Waterways, Federal Highway Administration – 1970.

HEC-2 Water Surface Profiles – U. S. Army Corps of Engineers.

Highways in the River Environment – Hydraulic and Environmental Design Considerations – Federal Highway Administration – 1975.