CHAPTER 10 APPENDIX C

Passage of Floating Debris

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The problem of passing floating debris should always be a consideration in the design of bridges over waterways. Facilitating passage of debris may involve additional costs and compromises with other design objectives. These other factors need to be considered, along with the degree of the debris problem, in the overall bridge design. General guidance on design features is presented below. Additional guidance is available in the FHWA Hydraulic Engineering Circular No. 9 dated October, 2005.

1. FREEBOARD. Current OOS policy in setting the design elevation of bridges and approach roads is set forth in the main body of Chapter 10. Unless there is some exceptional debris problem which must be addressed at a particular site, the standard OSS policy governs in regard to freeboard at bridges

2. PIER TYPE It is desirable to use bridge piers that are solid with rounded noses and which are aligned with the flow. If pile bents or multiple columns are used, consider including a solid web wall between the columns to an elevation above the design storm to reduce the potential for the entrapment of debris between the columns. An example of such a pier design is Bridge No. 3015, MD 7 over White Marsh Run.

3. PIER LOCATION. Piers should be placed outside of the main path of the floating debris. For a straight reach of a stream, avoid locating the piers near the thalweg where the flow is deepest and fastest. For a curved channel, avoid the area near the bank toe on the outside bend.

4. PIER SPACING. It is desirable to provide for adequate spacing of piers to accommodate debris, consistent with other design elements. A concept referred to as the "design log length" is helpful in determining support spacing. The objective is to keep the spans long enough to keep logs from becoming lodged between supports. Support spacing should be slightly greater than the design log length. The FHWA HEC-9 guideline on estimating the design log length for a given site is provided below. For the purpose of limiting debris collection only, use the smallest of the three values in support spacing.
   - Width of the upstream channel
   - Maximum length of sturdy logs, suggested as 80 feet for Maryland.
   - One fourth of the upstream channel plus 30 feet.

   The Office of Structures has established separate stream stability criteria for pier spacing that will typically provide for longer spans than the HEC-9 criteria. SHA prefers to span stream channels with widths of 80 feet or less in order to comply with Maryland flood plain regulations, and provide for a minimum 10 foot setback between the channel bank and the abutment or pier. The following typical examples, comparing the SHA criteria and the FHWA HEC-9 criteria, indicate that current SHA design criteria provides for adequate span lengths to limit collection of debris at most sites.

Comparison of SHA Support Spacing Criteria (Stream Stability) VS FHWA HEC-9 Support Spacing Criteria (Passage of Debris).

CHANNEL WIDTH (FT)	SHA SUPPORT SPACING CRITERIA	FHWA HEC-9 SUPPORT SPACING CRITERIA (FT)
40	60 foot single span	40-50
80	100 foot single span	50-60
> 80	Fit the bridge to the stream channel to the extent practicable in locating supports • Avoid the area of the thalweg, • Avoid the area of the banks, especially the outside bank on curved channels, • Maintain a 10 foot berm beyond the channel bank.	60-70

5. SUPERSTRUCTURE. Design the superstructure to withstand extreme floods and overtopping conditions. Streamline the superstructure to minimize lateral forces on the bridge and to avoid features which will collect debris. There are trade-offs which need to be considered. The standard open rail (5” structural tubing rail) provides minimal obstruction to flood flows, but is more likely to intercept debris. On the other hand, the solid parapet and low rail presents a more streamlined shape for passing debris, but is likely to increase backwater due to the increased height of the solid parapet. The design of the connection of the pier cap with the superstructure should be streamlined to the extent practicable to minimize features that may collect debris.