HOW BRIDGES AFFECT THE ROADWAY ALIGNMENT AND PROFILE

- Bridges over roadways have required minimum vertical underclearances, measured from the roadway underneath to the bottom of the girder, which varies depending on the type of roadway it crosses. (Because of the cross slope on bridge decks, this point usually occurs at an outside girder, not at the PGL.)

- Bridges over a State owned road (it will have a route number such as US 1 or MD 193) require a minimum vertical underclearance of 16'-9".

- Bridges over a County owned road (it has a name, but not a number designation) require a minimum vertical underclearance of 15'-0".

- Bridges over Amtrak have a required minimum vertical underclearance, measured from the top of the rail to the bottom of the girder of 24'-6".

- Bridges over streams must have the bottom of the girders above the design year storm elevation. They must also provide a minimum hydraulic opening under them that will allow the flow from the design year storm to pass under them.

- It is best to locate the roadway so that the bridge crosses over a straight section of a stream, instead of at a meander.

- It is best to try to have the bridge cross a stream or roadway as close to 90° as possible. Small skew angles (<45°) between bridges and their crossing cause a multitude of design problems.

DESIGN PARAMETERS

Superstructure:

- For this project, the girders should be preliminarily designed to insure that the span configurations chosen would work. Prestressed concrete beams (AAHSTO girders) are sized by span length and can be found in prestressed concrete textbooks. For steel girders, the BEST Center has a program called Merlin Dash that can help do the design and analysis for you. Check with the University to see what other design programs are available for you to use.

- The deck and girders should be designed for HS-25 loading (25% higher than HS-20).
• Steel girders bridges are generally designed as continuous steel girders, so that roadway joints at the piers are eliminated. Concrete girder bridges are designed as simple spans, but a closure pour at the piers makes them continuous for live load.

• The bridge typical section should match the roadway typical section, with the exception that the bridge cannot be in a superelevation transition area. The cross slope should be constant across the bridge.

Substructure:

• The substructure units should be skewed so they are parallel to the roadway or stream that the bridge is crossing.

• Bridges over Amtrak have required minimum horizontal clearances, measured from the center of the track to the nearest substructure unit of 18’-0”.

• Keep piers out of streams, if possible.

• Generally, when an abutment is located in fill, it will be on a pile foundation. Abutments or piers that are located in existing ground could be on spread footing or pile foundations, depending on what the geotechnical investigation reveals. For purposes of this class, it would be acceptable to research nearby bridges to see what type of foundation they are on and to use something similar.

Waterway Crossings:

• When laying out a bridge over a stream, try to minimize wetland impacts. However, choosing a very long bridge to completely span wetlands is usually impractical. It is better to weigh the cost of the excess length of bridge with the cost of mitigating the destroyed wetlands.

STANDARD DETAILS

SHA has an extensive manual of Standard Details for bridges. The following details will be useful for this project and will be provided:

• Parapets
• Bridge Decks
• Abutments
• Box Culverts
• Retaining Walls

1/5/04
PLANS

General Plan & Elevation Sheet:

Plan View:

- Show Base Line of Construction (Line with Stationing) for the roadway over the bridge. Orient with stations increasing from left to right unless the associated highway plans are different. The structure plans should match the highway plans with respect to labeling (Base Line of Construction and P.G.L.) and orientation of this line.

- Show a North Arrow.

- Show center line of each substructure unit with the station and angle at the intersection with the Base Line of Construction.

- Show existing and proposed out to out, lane, shoulder, sidewalk and parapet widths tied to the Base Line of Construction.

- Show span length dimensions.

- Show width of lane, shoulder, sidewalk and grading under the bridge.

- Show waterway name and direction of flow arrow for structures over streams.

- Show horizontal railroad clearances.

- Show any pertinent topographic features.

Elevation View:

- Show the elevation view of the structure as a projection of the General Plan.

- Show any fencing or railing on top of the parapet.

- Show minimum vertical underclearance for highway over highway or railroad bridges. For bridges over dual highways show this dimension for both roadways.

- Show existing and proposed ground lines.

- Show all applicable water surface elevations (design storm, normal water surface).

- Show grading details (2:1 slope, etc.) under the bridge.
Substructure Details:

Abutment:

- Show Typical Section through abutment with dimensions locating the centerline of bearing, etc.
- Show proposed ground line elevations.

Pier:

- Show Typical Section through the pier with all pertinent dimensions.
- Show proposed ground line elevations.

Superstructure Typical Section:

- Typical Section should be drawn looking stations ahead.
- Show Base Line of Construction and P.G.L.
- Show the proposed out to out, lane, shoulder, clear roadway, sidewalk and parapet widths tied to the Base Line of Construction.
- Show girder spacing and deck overhang widths
- Show the P/GE, crown point and all cross slopes. Cross slope arrows should be drawn with the arrow pointing in the direction that water would flow.
- Show any fencing or railing on top of the parapet.

ESTIMATES

- Since the bridge plans will in a preliminary stage, it is acceptable to do a major quantity estimate. Unit costs will be provided for you to use.
Table A.14  Section Properties of AASHTO Bridge Girders

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<th>$c_1$ (in.)</th>
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