

- X. For crossings subject to small boat traffic, a minimum horizontal clearance of 5 m and a vertical clearance of 3 m shall be provided. For boat access under bridges that cross shipping channels, the minimum clearances shall be in accordance with the requirements of the Port Authority. Where no boat traffic is anticipated, horizontal clearances shall be consistent with hydraulic requirements and structure economy. Horizontal clearances are defined as the unobstructed clear distance between piers, fender systems, and culvert walls, which is projected by the bridge or box culvert normal to the flow.
- XI. Bridge foundations and abutments shall be analysed for scour depth for the design storm frequency and the overtopping storm frequency flows. Scour analysis will discuss recommended foundation depths and scour protection measures.
- XII. To facilitate maintenance and provide for abutment stability, a minimum berm width of 3 m shall be provided between the top edge of the main channel and the toe of bridge abutments.
- XIII. Special consideration shall be given to roadway locations across desert wadis, washes, and similar natural geographical features. Where roadways are located across a succession of outwash areas, discharge is typically infrequent, wide and shallow, transporting large volumes of solids, both mineral and organic. Rather than bridging the natural channels, the generally accepted technique is to concentrate the flow by a series of guide dikes leading like a funnel to a relatively short crossing.
- XIV. Final bridge opening requirements and calculation should be summarised in a Bridge Recommendation Report. These reports will define the recommended option for both the hydraulic and road geometric requirements for the most cost-effective design.

A5.2.2.1. Scour

Scour estimates shall be developed using a multidisciplinary approach involving the Hydraulics, the Geotechnical, and the Structures engineers.

Bridges and bridge culverts shall be designed to withstand the design flood without damage and shall withstand the overtopping storm frequency flow without failure. Scour estimates for these events shall consist of the total scour (refer to Figure 2-3 for an example resulting from the followings).

1. Natural or manmade channel aggradations and degradation:

- Aggradations and degradation are long-term streambed elevation changes due to natural or manmade causes that can affect the reach of the river on which the bridge is located. Aggradations deposits material eroded from the channel or watershed upstream of the bridge; whereas, degradation lowers or scours the streambed due to a deficit in sediment supply from upstream.

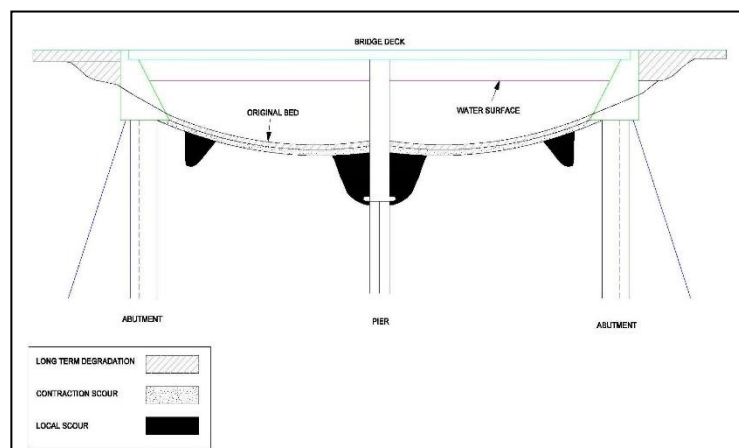


Figure 2-3: Schematic of typical bridge scour