

3.2.5 CONCRETE RIGID FRAME

Historical Overview

The earliest known extant rigid frame bridge in Maryland was built in 1934. It is assumed that the earliest rigid frame small structures would date to the same era. The usage of the rigid frame structure, however, grew more rapidly after World War II. A post-war report of the State Roads Commission discussed the importance of the “contribution of the rigid frame structure” to the field of concrete structure design (Maryland State Roads Commission 1947: 53). Since that time, its importance has been nationally recognized (Condit 1961: 213). Rigid frame construction is still used for small structures today, particularly in areas where environmental concerns preclude the use of a paved invert.

Description

A rigid frame structure is cast in place and may or may not be poured monolithically, resulting in walls that support the deck slabs as continuous bents. This type of construction produces a structure of “great stability” (Miller 1996: 20). Rigid frame small structures are generally non-arched in Maryland (Figure 3.12). They can be drainage structures built well below the roadway surface with earth fill between the structure and roadway, or they can be at-grade structures with the roadway directly on top of the deck slab. Some at-grade structures have solid parapets with incised rectangular designs.

Rigid frame structures feature positive and negative moment¹ throughout the structure due to the interaction of the “legs” (walls) and beams (slab). In slab beam frame construction, the primary reinforcement is tension steel.

A review of the partially completed SHA Office of Bridge Development’s Small Structures Inventory indicates that there are few rigid frame small structures on the state’s roadways. Some extant examples of the rigid frame small structure are:

03069XO MD 146 over Tributary of Little Gunpowder Falls, Baltimore County N.D.
6-foot concrete rigid frame with 4.5 feet of fill between top of structure and roadway. Solid concrete parapet with incised rectangular design on west side only of structure, 29-foot wide roadway, concrete abutments, no wingwalls.

03173XO MD 146 over Merryman Branch, Baltimore County N.D.
11.5-foot concrete rigid frame with 12 feet of fill between top of structure and roadway. Concrete wingwalls, 9-foot wide roadway.

08020XO MD 224 over Branch of Mallows Bay, Charles County N.D.
9.75-foot concrete rigid frame with 8 feet of fill between top of structure and roadway. Concrete wingwalls, 20-foot wide roadway.

Tips for Dating Rigid Frame Small Structures

Most rigid frame small structures in Maryland generally date after World War II but a small number of extant structures appear to pre-date the war. Rigid frame structures would date no earlier than 1930. Research reveals that some pre-World War II, at-grade, rigid frame small structures have solid parapet rails.

¹ Bending forces in bridge members are caused by “moment.” A moment is commonly developed by a transverse loading which causes a member to bend (USDOT 1991: 3-12).

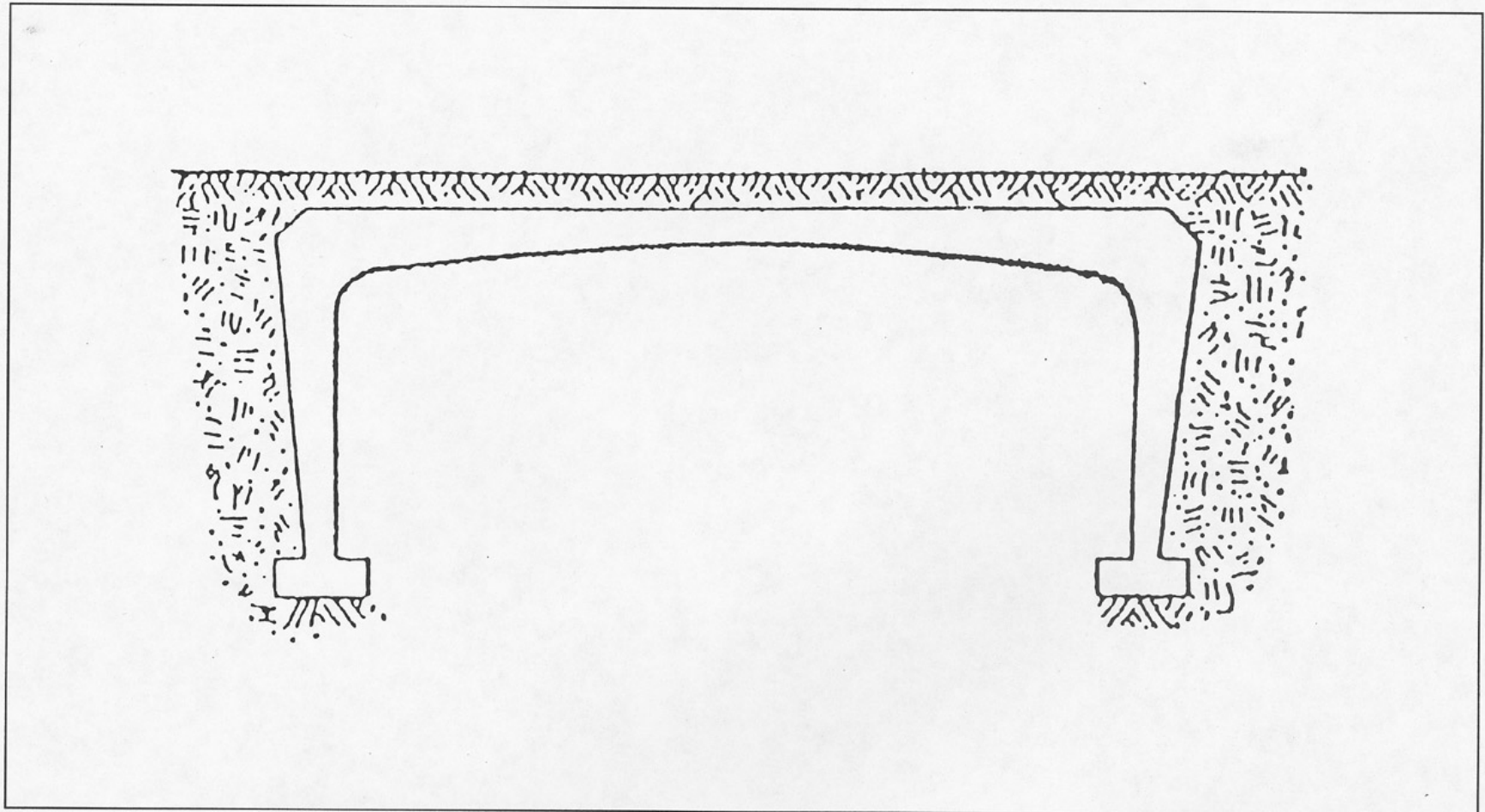


Figure 3.12 Rigid frame structure (Source: Spero 1995: 171).