

### 3.0 TYPES OF SMALL STRUCTURES ON MARYLAND'S ROADWAYS

#### Introduction

Several types of small structures are present on Maryland's roadways. These structures date from around the first quarter of the nineteenth century to the present. Some structure types were generally used only for small structures (shorter crossings, cross drains, culverts), while other types are also utilized for bridges (longer crossings of 20 feet and over).

For inspection purposes the State Highway Administration (SHA) Office of Bridge Development is now developing an inventory of small structures on Maryland's state highways. The inventory, which is approximately 90 percent complete, includes the following small structure types:

#### Masonry

- arches

#### Concrete

- slab
- box culvert
- girder/beam
- arch
- rigid frame

#### Metal

- beam
- arch

#### Timber

- beam

#### Pipes

- pipes and pipe arches

County and city-owned small structures are not included on the SHA's bridge inspection inventory but instead are inventoried and maintained by the county and municipal governments. Communications with county and city road departments concerning small structures have not revealed any small structure types beyond those listed above.

This chapter presents a brief background history/chronology of the use of the different types of structural designs for small structures. A more complete history of bridge development, by structural type, is included in Spero's *Historic Highway Bridges in Maryland 1631-1960*. The majority of the bridge development chronology presented in that report also relates to small structures since many bridge structural types were also used for small structures (e.g. stone arches and concrete girders). Some structural types were predominantly used for small structures (e.g. slab and box culvert).

This chapter also describes and illustrates each structural type. Reports of the State Roads Commission throughout the first half of the twentieth century discuss the types of small structures built and the materials used. Materials used in the early twentieth century included stone, timber, steel and concrete. The State Roads Commission

Report of 1939-40 indicates that structures continued to be built of concrete, steel and timber, and I-beam, timber beam and “several types of reinforced concrete” construction were used (Maryland State Roads Commission 1940: 54). One of the early post-World War II reports claimed that “improvements in metallurgy, structural steel, steel reinforcement and other similar components and in cement for concrete as a structural material and in timber has given the designer broader fields of application” (Maryland State Roads Commission 1947: 53).

### **Standard Plans**

The State Roads Commission’s standard plans (Standard Plans, hereafter) issued between 1912 and 1933 are also excellent illustrations of the types of small structures built in the first half of the twentieth century. During this period, the State built many “work horse” structures that rarely deviated from the designs presented in the Standard Plans.

The 1912 plans, published on a single sheet, applied to box culverts, box bridges and slab and girder structures, all of concrete. These plans feature a roadway width of 22 feet. The 1919 designs feature a roadway width of 24 feet and had a separate sheet for the concrete slab and girder designs. Comparison of the plans shows that by 1919, the diameter of the reinforcing bars was reduced as well as the space between the bars, therefore increasing the number of reinforcing bars but decreasing their size and weight (Spero 1995: 180).

In the 1920-23 Report of the State Roads Commission, the author noted that “new Standard Plans have been prepared for slab and girder spans” (Maryland State Roads Commission 1924b: 58). Dated 1924, these plans featured a 24-foot roadway. Concrete slab bridges were specified for small structures up to 18 feet in span. By that date, girder structures were no longer specified in the Standard Plans for use on small structures. With the exception of a standard open handrail design introduced in 1928, the 1924 plans continued in use until 1930 when the standard roadway width was increased to 27 feet.

In 1931, a series of Standard Plans were developed for concrete box culverts. No standard roadway width is included in the plans. The 1933 plans increased the roadway width to 30 feet. Changes were again made to the reinforcing bars of the slab structure which were moved closer together to increase the load-carrying capacity. The 1933 Standard Plans also included designs for timber and steel beam structures, both for use on secondary roads only.

Table 3.1 outlines the types and sizes of Standard Plans for small structures that were prepared by the State Roads Commission. Illustrations from these plans are interspersed within the text of this chapter. Excerpts from the plans in a reduced format are included in the appendix to this report. The original plans are on file in the SHA’s Office of Bridge Development in Baltimore.

**Table 3.1**

**Standard Plans for Small Structures issued by the Maryland State Roads Commission**

| Year | Description                                     | Span Length/Structure Size   | Road Width | Details   | Other  |
|------|---|--|------------|---|--|
| 1912 | Standard Steel-Concrete Culvert                 | 6' or 8'   | 24'        | Solid Parapet Rail  |  |
|      | Concrete Box Culverts                           | 18"x18", 24"x18", 24"x24",<br>36"x24", 36"x36", 4'x2', 4'x3'<br>4'x4', 5'x3', 5'x4', 5'x5' |            |   |  |
|      | Standard Box Bridges                            | 10' to 16'   | 24'        |   |  |
|      | Standard Slab Bridges                           | 6', 8', 10', 12', 14', 15', 16'  | 24'        |   |  |
|      | Standard Girder Bridges                         | 18'  | 24'        |   |  |
|      | Detail of Coping--Culverts & Bridges            |  |            |   |  |
|      |   |  |            |   |  |
| 1919 | Details for Standard Slab Bridges               | 6', 8', 10', 12', 14', 16'   | 24'        | Solid Parapet Rail  |  |
|      | Standard Girder Bridges-Plan/Details            | 18'  | 24'        | Paneled Parapet Rail  |  |
| 1924 | Standard Bridge Abutment-Slab Bridge            | 6', 8', 10', 12', 14', 16', 18'  |            |   |  |
|      | Standard Slab Bridge                            | 6', 8', 10', 12', 14', 16', 18'  | 24'        | Paneled Parapet Rail<br>Single panel up to 14",<br>then three panel | Individual plans-each size   |
| 1928 | Standard Open Handrail                          |  |            |   |  |
| 1930 | Standard Slab Bridge-Superstructure Details     | 6', 8', 10', 12', 14', 16', 18'  | 27'        | Open Rail   | Individual plans-each size   |
|      | Standard Slab Bridge-Isometric View             |  |            | Open Rail   |  |
|      | Standard Bridge Abutments-Slab Bridge           | 6', 8', 10', 12', 14', 16', 18'  |            | Horizontal scoring  |  |
| 1931 | Standard Box Culvert                            | 2x2, 3x2, 3x3, 4x2, 4x3, 4x4,<br>5x4, 5x5, 6x6   |            | No fill has incised parapet   | Individual plans-each size<br>Individual plans for: no fill,<br>5-foot max. fill & 10' max. fill |
| 1933 | Standard Slab Bridge-Superstructure Details     | 6', 8', 10', 12', 14', 16', 18'  | 30'        | Open Rail   | Individual plans-each size   |
|      | Standard Balustrade Details                     |  |            | Open Rail   |  |
|      | Standard Abutments for Concrete Slab Spans      | 6', 8', 10', 12', 14', 16', 18'  |            | Horizontal Scoring  |  |
|      | Standard Timber bridges for secondary roads     | 10, 12, 14, 16, 18   |            |   | H-10 load, Note: to be used<br>only on infrequently used roads                                   |
|      | Standard Timber Bridges for Secondary Roads     | 10, 12, 14, 16, 18   |            |   | H-15 load  |
|      | Standard Steel Beam Bridges for Secondary Roads | 10-14', 15-19'   |            |   | H-15 load  |