

VIRGINIA DEPARTMENT OF TRANSPORTATION

STRUCTURE AND BRIDGE DIVISION

INSTRUCTIONAL AND INFORMATIONAL MEMORANDUM

GENERAL SUBJECT: Large Culverts and Open Bottom Structures		NUMBER: IIM-S&B-101.1 IIM-LD-263.1 IIM-MD-2022.7.1
SPECIFIC SUBJECT: Design and Management of Large Culverts and Open Bottom Structures		Date: July 13, 2022
		SUPERSEDES: IIM-S&B-101 IIM-LD-263 IIM-MD-2022.5.1
STRUCTURE AND BRIDGE DIVISION APPROVAL: Kendal R. Walus, P.E. State S&B Engineer Approved: July 13, 2022	LOCATION AND DESIGN DIVISION APPROVAL: Emmett R. Heltzel, P.E. State L&D Engineer Approved: July 13, 2022	MAINTENANCE DIVISION APPROVAL: Robert E. Prezioso, P.E. State Maintenance Engineer Approved: July 13, 2022

Changes are shaded.

EFFECTIVE DATE

This Memorandum is effective immediately.

DESCRIPTION

The purpose of this IIM is to identify responsibility within VDOT for the design and management of large culverts and open bottom structures.

DEFINITIONS

Culvert: Any structure that has an integral floor system that supports the sidewalls and provides a lined channel. A culvert has no distinction between substructure and superstructure and typically has no deck. Multiple box or pipe culverts will be considered a single structure where the clear distance between openings is less than half of the smaller contiguous opening. Otherwise, each opening shall be considered a separate structure.

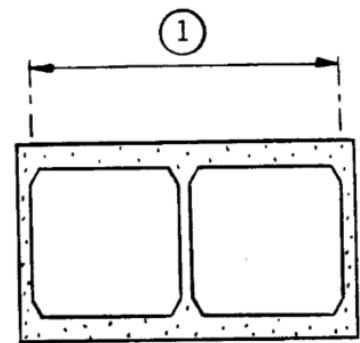
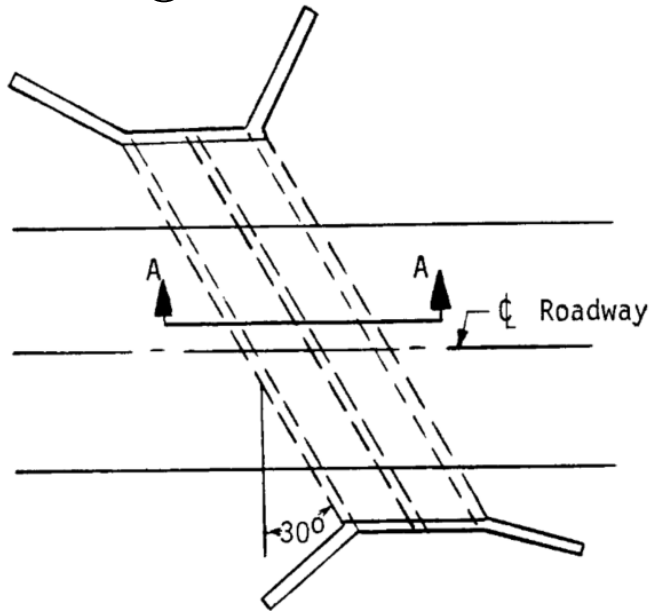
Large Culvert: A culvert that meets either of the following two definitions:

1. NBI Culverts: A culvert that meets the definition of a bridge as defined in Federal item 112 (Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges) in the National Bridge Inspection Standards (NBIS).

Federal item 112 (NBIS length) defines a bridge as follows:

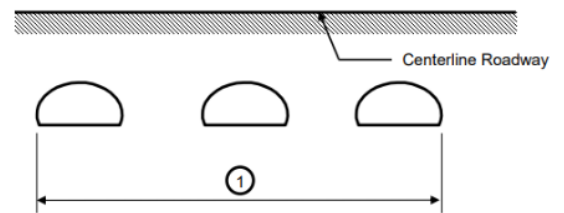
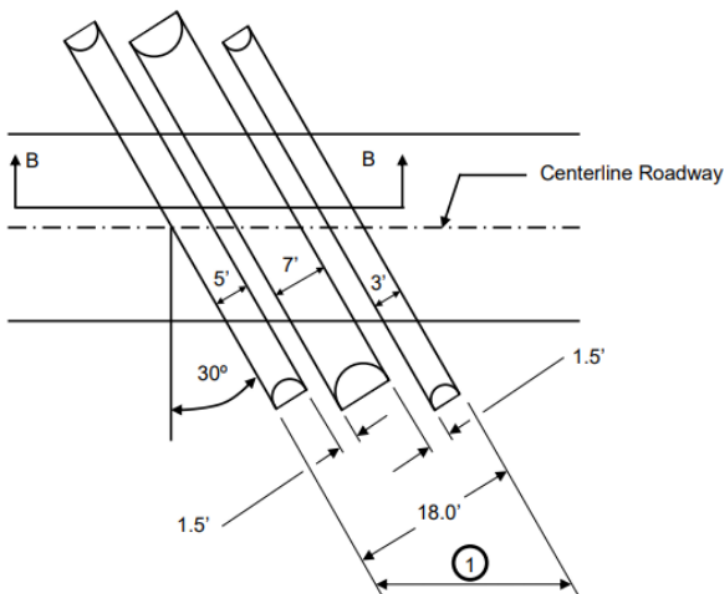
A structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet between undercopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening. In addition, the structure must carry a highway.

Examples (① denotes Item 112 – NBIS bridge length):



SECTION A-A

BOX CULVERT



SECTION B - B

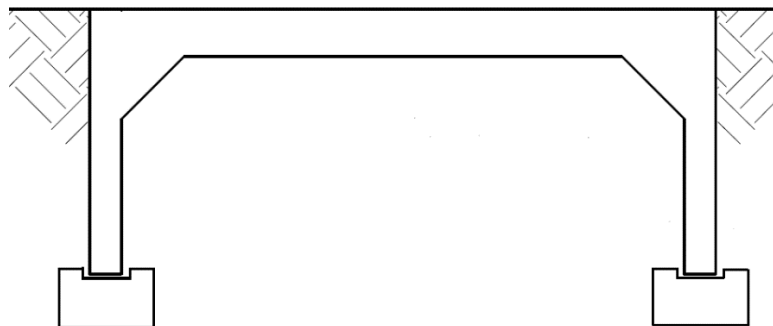
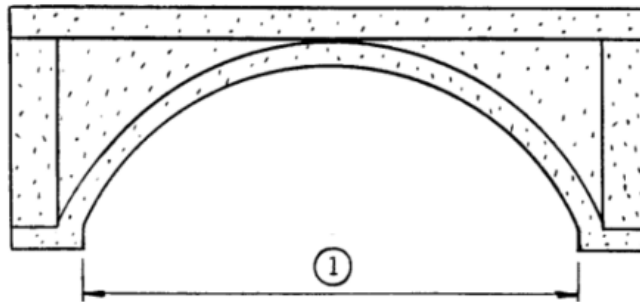
PIPE CULVERT

2. Non-NBI Culverts: A culvert to be included in the VDOT Structure Inventory that does not meet the NBI definition above. Non-NBI culverts must meet the following criteria:

- The total hydraulic opening (aggregate area of all openings combined) is equal to or greater than 36 square feet. For box culverts, the triangular haunches shall not be excluded from the opening measurement.
- The total length is less than 20 feet between the extreme ends of openings for multiple boxes or pipes (distance “1” in the previous sketches)
- A culvert in this category may be comprised of a single barrel or multiple barrels, provided the clear distance between any two openings is less than half the width of the smaller contiguous opening.

Open Bottom Structures: A drainage structure that does not have a bottom structural element and needs to be founded on footings. All open bottom structures regardless of NBIS length requirements are categorized as bridges in the Department’s structure inventory.

Examples are arches and rigid frames (three sided structures).



RESPONSIBILITY FOR DESIGN AND MANAGEMENT OF LARGE CULVERTS AND OPEN BOTTOM STRUCTURES

Location and Design Division (Drainage Designer or Project Manager)

In consultation with the District Bridge office, the drainage designer determines if a culvert is classified as “large” based on the above definitions. The drainage designer determines the size, geometrics, number of barrels and other non-structural parameters of the culvert or open bottom structure according to the Drainage Manual. As soon as a large culvert or open bottom structure is identified as being part of a project, drainage designer or the project manager must notify the District Bridge office.

Large culverts require a “D” number and open bottom structures require a “B” number in accordance with the VDOT Road Design Manual, Chapter 2E, Section 2E.6.

For large culverts, the road plans (title sheet and drainage description sheet) must refer to the Federal Structure Number, which will be provided by the District Bridge office.

Structure and Bridge Division

Large culverts and open bottom structures shall be assigned a Federal Structure Number and will become part of the structure inventory. For design-bid-build projects, Structure and Bridge is responsible for the structural design, geotechnical evaluation, selection of materials, developing plans for non-standard designs, load rating analysis and review of shop drawings. For design-build projects, the design-builder is responsible for the items listed above, except for selection of materials, which must be approved by VDOT. Refer to additional information in Part 2 Chapter 20 of the Manual of the Structure and Bridge Division.

For record keeping purposes, the District Bridge office shall ensure that the pertinent road plan sheets depicting large culverts (generally the title sheet, plan sheet, drainage description sheet and, if applicable, any non-standard design sheets) are filed in the Plan File Room in ProjectWise under the Federal Structure Number. Final shop drawings will be also be filed as part of the plans.

Structure and Bridge Division is responsible for inspection and maintenance of the large culverts and open bottom structures.

Maintenance Division

Maintenance Division and Residency offices are responsible for maintaining culverts and pipes that do not meet the above definition of a large culvert.

USE OF PIPE OR BOX CULVERT STANDARDS

For large culverts, the engineer who selects the pipe or box culvert standards shall consult with a structural engineer to ensure the selected standard sections, including wingwalls and headwalls, work for the geotechnical site conditions. The box culvert standards were designed for cast-in-place concrete. Approval from the Department is required to use precast box culverts. The precast fabricator shall submit shop drawings, design calculations and a load rating in accordance with IIM-S&B-86.