LONGSPAN

BRIDGE & CULVERT

Design & Detail Installation Manual

LongSpan Bridge and Culvert
Construction System

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Lane's Long Span Bridge & Culvert (LSBC) Division provides the nation's civil engineers and land developers with the most economical and versatile bridge and culvert construction systems in the industry, including the complete design, supply, assembly and installation of structural plate bridge and culvert structures.

By combining a design-build service with our plate products, LSBC is uniquely equipped to deliver a final product with all the expertise, efficiency, and assurance characterized by Lane. From consultation to planning, design to manufacture, delivery to assembly and shape monitoring to required cover depth, LSBC can provide you with the highest level of engineering support and assistance in the industry.

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Site Evaluation for Structure

A quality long span installation starts with a competent foundation. The entire area underneath the structure as well as the fill zones on either side of the structure should be evaluated by the design engineer to ensure adequate bearing capacity. The amount of differential settlement between the structure and the fill on either side should be minimal to prevent excessive drag down forces.

Structure Assembly

LSBC can provide a trained and experienced crew that will assemble the structure once the necessary site preparation has been completed. This crew will assemble the plates in accordance with detailed LSBC guidelines and will monitor the structure's shape and alignment throughout the erection process.

They will be responsible for tightening all bolts in the proper sequence and to the specified torque. The crew will make sure that all seams are tightly joined, smooth and symmetric. Any deviations from acceptable tolerances should immediately be reported to LSBC.

Backfill Monitoring

Proper placement and compaction of the backfill around a long span structure is essential. In order to ensure that the backfilling operation is done properly, LSBC can provide a full-time monitor at the site during all backfilling procedures.

The Monitor will:

- Document that the proper soil type is being used for backfilling.
- Record soil measurements including density, moisture content, and lift thickness at specific frequencies.
- Continuously measure the shape of the long span structure during backfilling.
- Document that longitudinal and circumferential stiffeners are installed in accordance with specifications.

Structural Backfill

A select, granular backfill must be used around and over the long span structure to the required minimum cover height. This area is known as the select backfill zone and its exact dimensions are dependent on the quality of soil surrounding the structure, loading condition and the shape of the long span. For typical installations with a good quality, well compacted embankment or insitu soil extending on either side of the structure a minimum width of 6-feet on either side of the long span is acceptable. The structural backfill must conform to one of the following soil classifications from AASHTO specification M-145 as modified in the Table 1 for A-1, A-2-4 OR A-2-5.

AASHTO M-145 — TABLE 1 (Modified)*				
GROUP CLASSIFICATION	A-1 A-2 (Modified)			
Sieve analysis, percent passing:	A-1-a	A-1-b	A-2-4	A-2-5
No. 10 (2.00 mm)	50 max	—	—	—
No. 40 (0.425 mm)	30 max	50 max	—	—
No. 100 (0.150 mm)	—	—	50 max	50 max
No. 200 (0.075 mm)	15 max	25 max	20 max	20 max
Characteristics of fraction passing No. 40 (0.425 mm)				
Liquid Limit	—	—	40 max	41 max
Plasticity Index	6 max		10 max	10 max
Usual Types of Significant Constituent Materials	Stone Fragments Gravel and Sand		Silty or Clayey Gravel and Sand	

*Modified to be more select than M-145.

Select Granular Backfill Requirements Additional Requirements

1. Materials must be dense graded. No open or gap graded material is allowed.
2. Fine beach sands, windblown sands, stream deposits exhibiting fine, rounded particles and typically specified by AASHTO as A-3 materials are not allowed.
3. Onsite mixing or blending to achieve specified gradation is not allowed.
4. Maximum particle size must not exceed 3-inches. For A-2 materials, moisture content must be between -3% to +2% of optimum as defined by AASHTO T-180. All soil classifications are limited in height of cover and structure shape applications as follows:

   a) A-1-a material is suitable for all long span shapes, sizes, and fill heights.

   b) A-1-b material is suitable only for use with high profile arch and pear shaped structures to a 12-feet maximum fill height and for use with elliptical and low profile arch structures to a 20-feet maximum fill height.

Figure 1

Typical Longitudinal Stiffener

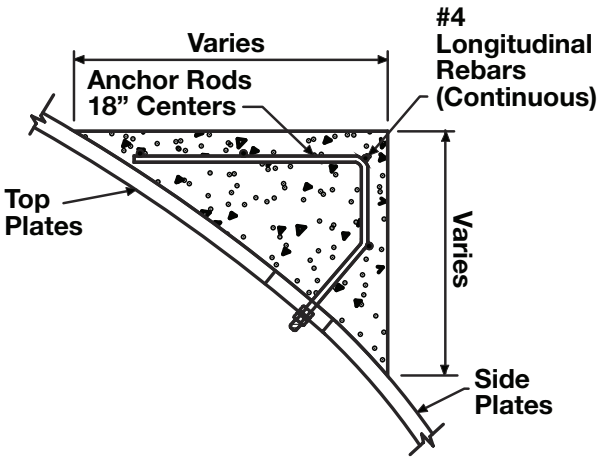

Figure 2

Step Beveled End Profile View

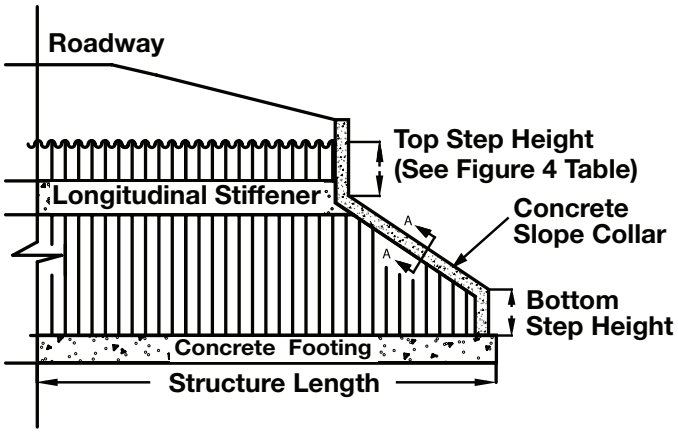

Figure 3

Concrete Slope Collar

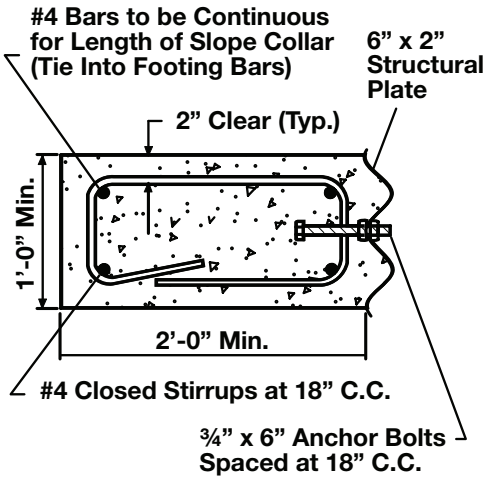

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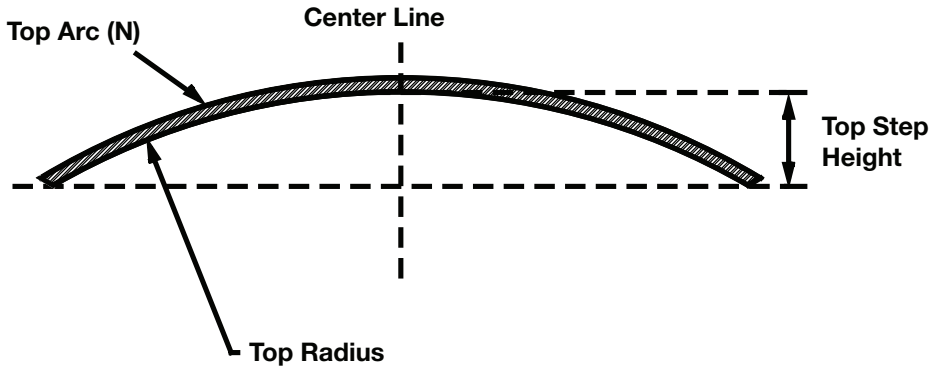
Figure 4

Typical Top Step Heights



Notes:

1. For Horizontal Ellipse top and bottom step dimension must be equal.
2. Contact LSBC for step heights on larger structures.

Top or Bottom Arc (N)	Step or Mid-Ordinate
20N	2'-10"
21N	2'-11"
22N	3'-1"
23N	3'-3"
24N	3'-4"
25N	3'-6"
26N	3'-7"
27N	3'-9"
28N	3'-11"
29N	4'-0"
30N	4'-2"
31N	4'-3"
32N	4'-5"
33N	4'-7"
34N	4'-8"
35N	4'-10"
36N	4'-11"
37N	5'-1"
38N	5'-3"
39N	5'-4"
40N	5'-6"
41N	5'-8"
42N	5'-9"
43N	5'-11"
44N	6'-0"

Figure 5

Notes:

1. Heights of cover for loading are measured to the top of the concrete pavement or the bottom of the flexible pavement.
2. Minimum cover for E 80 loading can be determined individually. Contact LSBC for design assistance.
3. Minimum cover for off-road or construction loads must be determined individually. Contact LSBC for assistance.
4. The table assumes granular backfill over the top of the structure to the full minimum cover height compacted to not less than 90% AASHTO T-180 density.

MINIMUM THICKNESS AND MINIMUM COVER FOR H 20, HS 20 and HS 25 LIVE LOADS

Thickness		Top Radius RT (Ft.)				
Inches	Gage	15'	15'-17'	17'-20'	20'-23'	23'-25'
0.109"	(12)	2.5'				
0.138"	(10)	2.5'	3.0'			
0.168"	(8)	2.5'	3.0'	3.0'		
0.188"	(7)	2.5'	3.0'	3.0'		
0.218"	(5)	2.0'	2.5'	2.5'	3.0'	
0.249"	(3)	2.0'	2.0'	2.5'	3.0'	4.0'
0.280"	(1)	2.0'	2.0'	2.5'	3.0'	4.0'

NOTE: Many of these details are conceptual. Please contact LSBC for assistance on your application.

Figure 6

Base Channel Profile

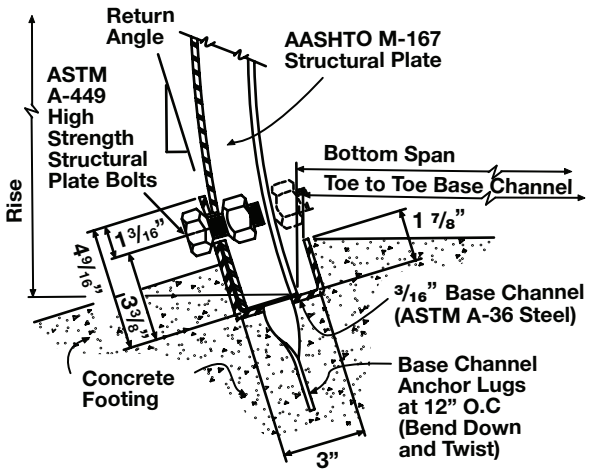


Figure 7

Base Channel Detail

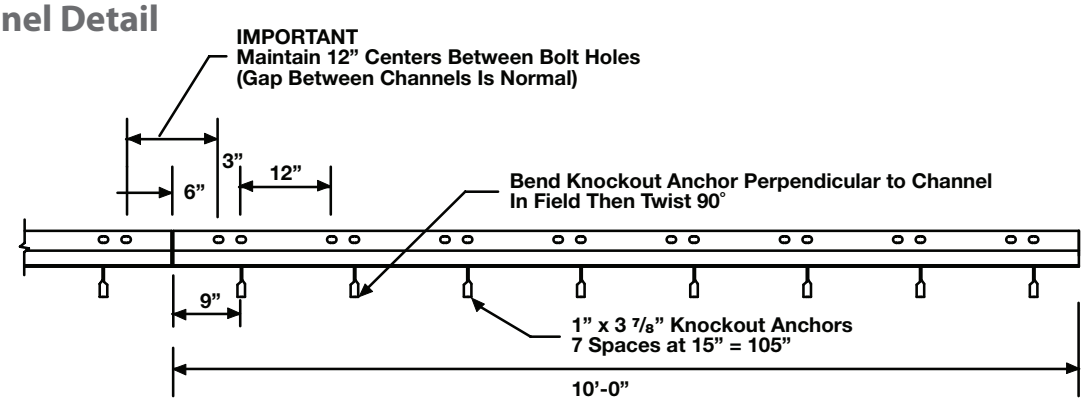


Figure 8

Long Span Tunnel

NOTE: Long pan tunnels for use as: vehicular, ski, golf cart, pedestrian and wildlife underpasses.

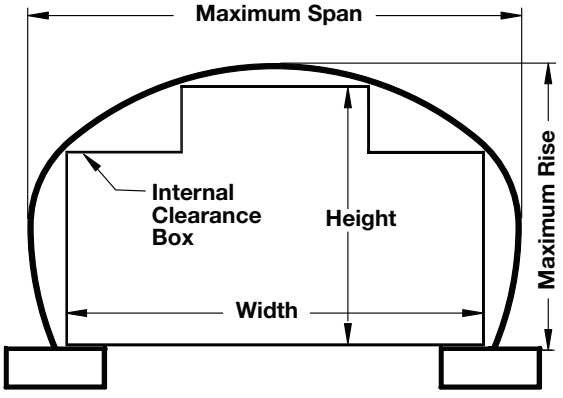


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Figure 9

Typical Concrete Footing

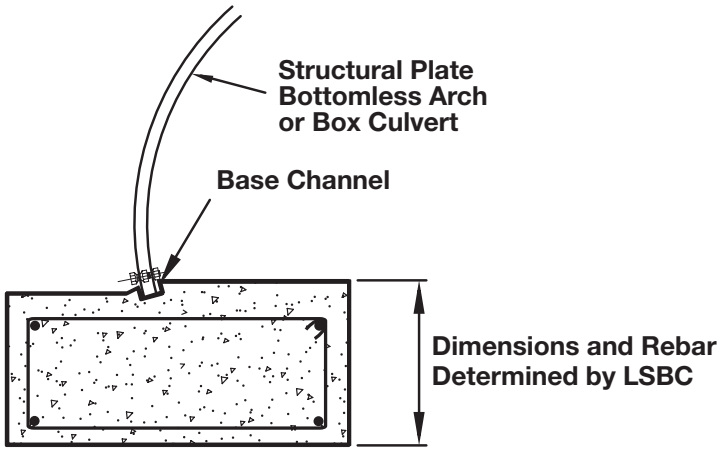
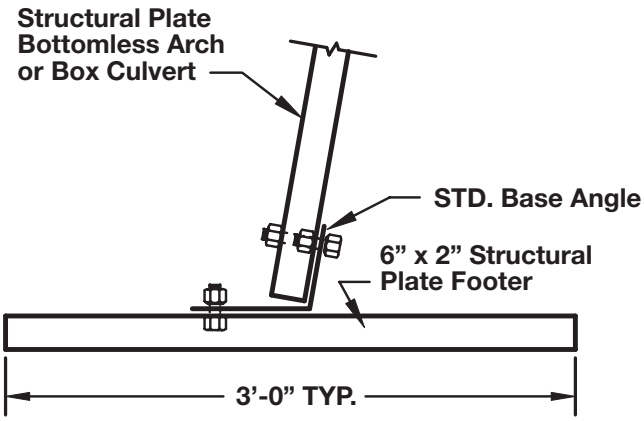


Figure 10

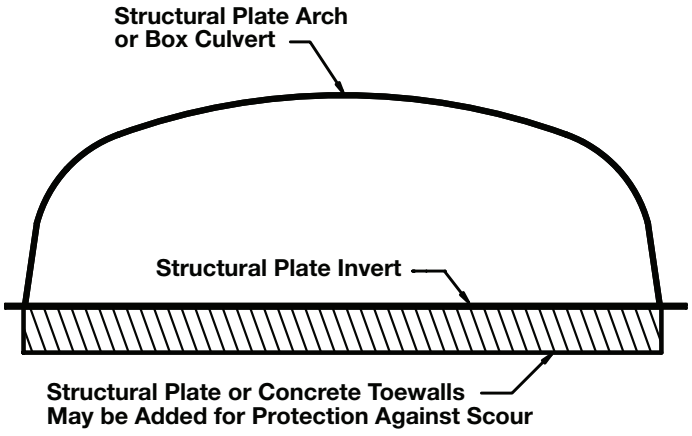
Structural Plate Footing for Box Culverts and Arches (Section View N.T.S.)



(Width to be Determined by LSBC.)

Figure 11

Structural Plate Invert



4.0 Multiple End Treatment Options Available

Long span structures offer more end treatment and architectural facing options than any other bridge system in the industry. These options allow developers and engineers to choose the most economic and aesthetically pleasing finish to their bridge, culvert or underpass. Options include:

Reinforced Concrete Headwalls and Wingwalls

Stone, brick or patterned concrete facing may be added to enhance the existing site.

Modular Block Headwalls and Wingwalls

A wide variety of block styles and colors can be used to create an attractive cost effective facing to your structure

Step-Beveled Ends with Concrete Slope Collars

This economic approach allows the long span structure to conform to a desired slope and uses a poured in-place collar to provide protection and a finished look.

Mechanically Stabilized Earth (MSE) Walls

These gravity walls are designed using precast concrete panels and reinforcing strips. A wide variety of styles and finishes are available.

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