LONGSPAN

Bridge & Culvert

STREAM CROSSINGS • WETLANDS SPANNING • SMALL BRIDGE REPLACEMENT
OVERPASSES/UNDERPASSES FOR VEHICLES AND GOLF CARTS • PEDESTRIAN WALKWAYS/SKI TUNNELS
RAILROAD GRADE SEPARATIONS • UNDERGROUND STORAGE VAULTS
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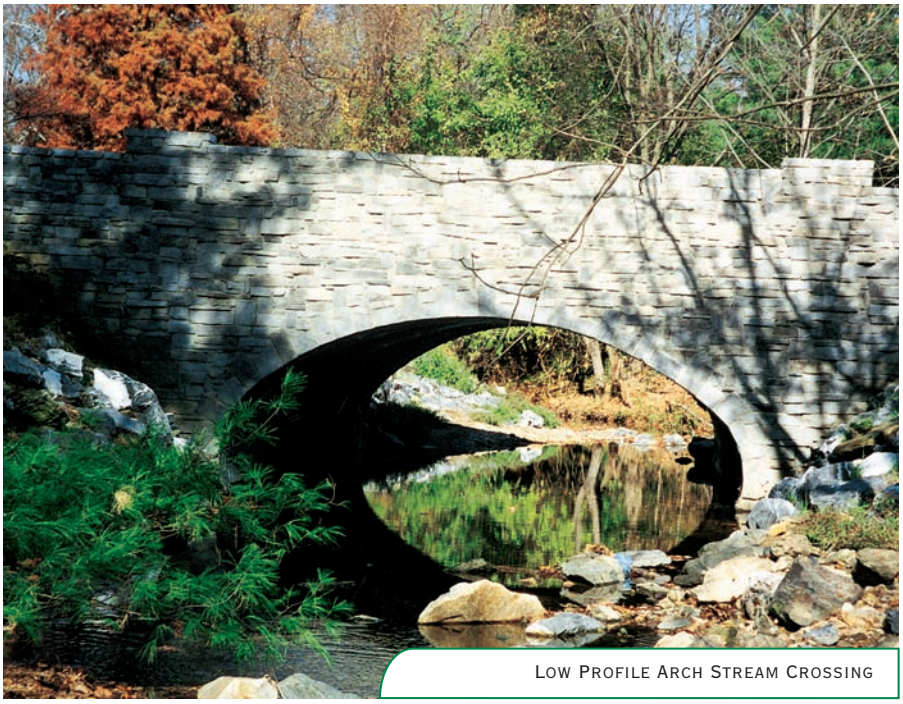
Long Span Bridge & Culvert

LONG SPAN Bridge & Culvert (LSBC) provides America's civil engineers and land developers with the most economical and versatile bridge system in the industry. Our system includes the complete design, supply and assembly of AASHTO long span bridges for use as stream and wetlands crossings, vehicular and pedestrian underpasses, fish and wildlife passages and also tunnels and culverts.

From our headquarters in Camp Hill, PA, LSBC is supported by an engineering staff with substantial experience in the design and evaluation of structural plate bridge systems. From planning through construction of your next bridge project LSBC can provide you with the highest level of engineering support and assistance in the industry. For more information please contact us at **1-888-949-LSBC** or visit our website at **www.longspanbridge.com**



Low Profile Arch Stream Crossing

Long Span Bridge & Culvert Services

LONG SPAN Bridge & Culvert (LSBC) provides developers, contractors and engineers with the industry's most comprehensive design, supply and assembly package featuring long span structural plate bridge systems. Our experienced sales staff together with our design team proudly offers the following services to complement our bridge systems.

Initial Project Consultation and Technical Support

One call to **1-888-949-LSBC** connects you with our staff of experienced engineers. LSBC helps owners, consultants and contractors evaluate long span solutions for specific projects. Fast and accurate construction estimates will help you select the most practical and economical structure for your project.

Full Engineering Design Capability

LSBC can provide engineering designs to support all aspects of our bridge systems including:

- Footing and foundation design
- Poured in place concrete, MSE or segmental block headwalls
- Step beveled ends
- Structural and hydraulic designs
- Scour analysis

Manufacture and Delivery

LSBC will manufacture your bridge to the project specifications and deliver it to the jobsite.

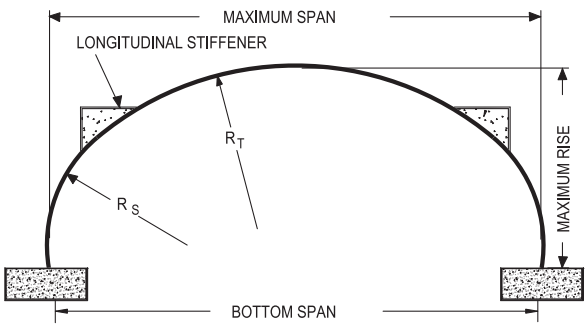
Assembly

Long span bridges are assembled in place with lightweight equipment. Because no heavy equipment is needed to pick and place our sections overall costs and impact to the jobsite environment can be minimized.

Delivery of Long Span bridge

Assembly of light weight sections

Low Profile Arch



These wide-span and low-rise structures allow large open-end areas at relatively low covers. Most commonly used for stream and wetlands crossings low profile arches come in dozens of span and rise combinations.

A table of typical sizes for these arches is listed in Table 1. Contact LSBC for additional sizes.

Elbows for curved alignments

TABLE 1

LONG SPAN LOW PROFILE ARCH
TYPICAL SIZES AND LAYOUT DIMENSIONS

LSBC Number	Maximum Span	Bottom Span	Maximum Rise	End Area (ft^2)	Top N	Side N	Top Radius	Side Radius	Return Angle Δ
LA2305	19'- 5"	19'- 2"	6'- 9"	105	23	5	13'- 1"	3'- 7"	15.60°
LA2306	20'- 1"	19'-10"	7'- 6"	120	23	6	13'- 1"	4'- 6"	12.47°
LA2506	21'- 6"	21'- 4"	7'- 9"	133	25	6	14'- 3"	4'- 6"	12.47°
LA2606	22'- 3"	22'- 1"	7'-11"	140	26	6	14'-10"	4'- 6"	12.47°
LA2706	23'- 0"	22'- 9"	8'- 0"	147	27	6	15'- 5"	4'- 6"	12.47°
LA2806	23'- 9"	23'- 6"	8'- 2"	154	28	6	16'- 0"	4'- 6"	12.47°
LA2906	24'- 6"	24'- 3"	8'- 3"	161	29	6	16'- 6"	4'- 6"	12.47°
LA3006	25'- 2"	25'- 0"	8'- 5"	168	30	6	17'- 1"	4'- 6"	12.47°
LA3106	25'-11"	25'- 9"	8'- 7"	176	31	6	17'- 8"	4'- 6"	12.47°
LA3108	27'- 3"	27'- 1"	10'- 0"	217	31	8	17'- 8"	6'- 4"	8.92°
LA3307	28'- 1"	27'-11"	9'- 6"	212	33	7	18'-10"	5'- 5"	10.40°
LA3308	28'- 9"	28'- 7"	10'- 3"	234	33	8	18'-10"	6'- 4"	8.92°
LA3407	28'-10"	28'- 8"	9'- 8"	220	34	7	19'- 5"	5'- 5"	10.40°
LA3607	30'- 3"	30'- 1"	9'-11"	237	36	7	20'- 7"	5'- 5"	10.40°
LA3608	30'-11"	30'- 9"	10'- 8"	261	36	8	20'- 7"	6'- 4"	8.92°
LA3610	31'- 7"	31'- 2"	12'- 1"	309	36	10	20'- 7"	7'- 3"	14.05°
LA3707	31'- 0"	30'-10"	10'- 1"	246	37	7	21'- 1"	5'- 5"	10.40°
LA3710	32'- 4"	31'-11"	12'- 3"	319	37	10	21'- 1"	7'-3"	14.05°
LA3807	31'- 9"	31'- 7"	10'- 2"	255	38	7	21'- 8"	5'- 5"	10.40°
LA3810	33'- 1"	32'- 7"	12'- 5"	330	38	10	21'- 8"	7'- 3"	14.05°
LA3908	33'- 2"	33'- 0"	11'- 1"	289	39	8	22'- 3"	6'- 4"	8.92°
LA3911	34'- 5"	34'- 1"	13'- 3"	367	39	11	22'- 3"	8'- 2"	12.48°
LA4108	34'- 7"	34'- 6"	11'- 4"	308	41	8	23'- 5"	6'- 4"	8.92°
LA4114	37'-11"	37'- 7"	15'- 7"	477	41	14	23'- 5"	10'-11"	9.37°
LA4208	35'- 4"	35'- 2"	11'- 5"	318	42	8	24'- 0"	6'- 4"	8.92°
LA4214	38'- 8"	38'- 4"	15'- 9"	490	42	14	24'- 0"	10'-11"	9.37°

TABLE 1A

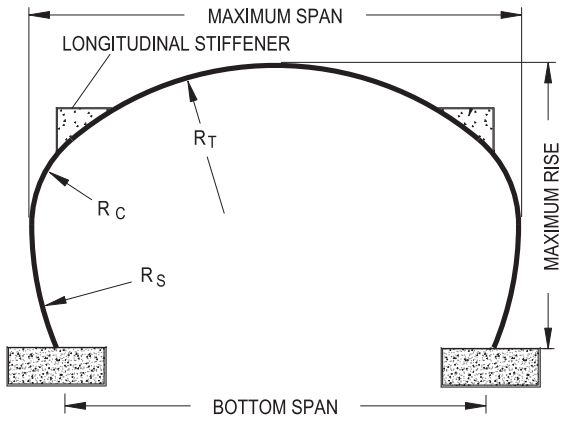
LONG SPAN LOW PROFILE ARCH [1,2,3]
SELECTED LONGER SPAN SIZES AND LAYOUT DIMENSIONS

LSBC Number	Maximum Span	Bottom Span	Maximum Rise	End Area (ft^2)	Top N	Side N	Top Radius	Side Radius	Return Angle Δ
LA4709	40'- 1"	40'- 1"	12'- 9"	398	47	9	26'-10"	7'-10"	3.52°
LA4317	40'- 4"	39'- 7"	18'- 2"	597	43	17	24'- 7"	12'- 3"	14.18°
LA4907	40'- 6"	40'- 6"	11'- 7"	359	49	7	28'- 0"	6'- 4"	2.06°
LA5007	41'- 4"	41'- 4"	11'- 9"	369	50	7	28'- 7"	6'- 5"	1.02°
LA5108	42'- 7"	42'- 7"	12'- 7"	411	51	8	29'- 2"	7'- 3"	1.75°
LA5010	43'- 0"	43'- 0"	13'-10"	464	50	10	28'- 7"	8'-10"	2.47°
LA4718	43'- 2"	42'- 0"	19'- 5"	689	47	18	26'-10"	12'- 2"	18.33°
LA5012	44'- 0"	43'-11"	15'- 4"	530	50	12	28'- 7"	10'- 2"	4.87°
LA5213	45'- 3"	44'-10"	16'- 5"	592	52	13	29'- 9"	9'-10"	11.14°
LA5116	46'- 1"	45'- 7"	18'- 5"	685	51	16	29'- 2"	12'- 1"	11.17°
LA5218	47'- 0"	45'-10"	20'- 1"	772	52	18	29'- 9"	12'- 4"	17.38°
LA5515	49'- 0"	48'-10"	18'- 2"	709	55	15	31'- 5"	12'- 0"	7.66°
LA5517	50'- 7"	50'- 6"	19'- 7"	786	55	17	31'- 5"	14'- 3"	5.19°
LA5421	50'- 8"	49'-10"	22'- 6"	927	54	21	30'-10"	15'- 5"	12.96°
LA5523	51'- 7"	50'- 1"	24'- 2"	1024	55	23	31'- 5"	15'- 8"	17.63°

NOTES FOR TABLE 1A:
1) These structures require AASHTO A-1-a select backfill.
2) Minimum structure thickness is 1 gage (0.280")
3) Circumferential Stiffeners are required. LSBC will provide details.

All dimensions are to the inside crest.
Many additional sizes are available. Contact LONG SPAN Bridge & Culvert for details.

High Profile Arch



When higher heights of cover are encountered or additional hydraulic capacity is needed the high profile arch shape fits the bill. These shapes often require smaller footings and can often reduce the overall length of structure needed when compared to lower rise shapes.

A table of typical sizes for these arches is listed in Table 2. Contact LSBC for additional sizes.

Ski Tunnel

Stream Enclosure

TABLE 2

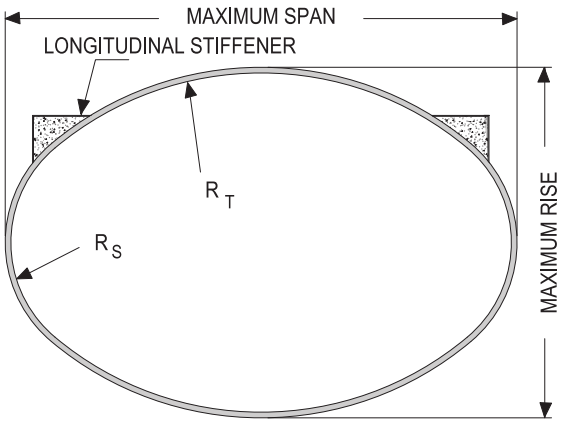
LONG SPAN HIGH PROFILE ARCH
TYPICAL SIZES AND LAYOUT DIMENSIONS

Structure Number	Maximum Span	Bottom Span	Maximum Rise	End Area (ft^2)	Top N	Corner N	Side N	Top Radius R_T	Corner Radius R_C	Side Radius R_S	Return Angle Δ
HA230503	20'- 1"	19'- 6"	9'- 1"	152	23	5	3	13'- 1"	4'- 6"	13'- 1"	11.30º
HA230606	20'- 8"	18'-10"	12'- 1"	214	23	6	6	13'- 1"	5'- 5"	13'- 1"	21.73º
HA250506	21'- 6"	19'-10"	11'- 8"	215	25	5	6	14'- 3"	4'- 6"	14'- 3"	20.0º
HA250708	22'-10"	19'-10"	14'- 6"	284	25	7	8	14'- 3"	6'- 4"	14'- 3"	26.40º
HA260506	22'- 3"	20'- 7"	11'-10"	224	26	5	6	14'-10"	4'- 6"	14'-10"	19.22º
HA260608	22'-11"	20'- 0"	14'- 0"	275	26	6	8	14'-10"	5'- 5"	14'-10"	25.38º
HA270506	23'- 0"	21'- 5"	11'-11"	234	27	5	6	15'- 5"	4'- 6"	15'- 5"	18.52º
HA270708	24'- 4"	21'- 6"	14'-10"	309	27	7	8	15'- 5"	6'- 4"	15'- 5"	24.43º
HA280506	23'- 9"	22'- 2"	12'- 1"	244	28	5	6	16'- 0"	4'- 6"	16'- 0"	17.85º
HA290508	24'- 6"	21'-11"	13'- 9"	288	29	5	8	16'- 6"	4'- 6"	16'- 6"	22.75º
HA290708	25'- 9"	23'- 2"	15'- 1"	334	29	7	8	16'- 0"	6'- 4"	16'- 0"	22.75º
HA300507	25'- 2"	23'- 3"	13'- 1"	283	30	5	7	17'- 1"	4'- 6"	17'- 1"	19.33º
HA300708	26'- 6"	24'- 0"	15'- 3"	347	30	7	8	17'- 1"	6'- 4"	17'- 1"	22.00º
HA310507	25'-11"	24'- 1"	13'- 3"	294	31	5	7	17'- 8"	4'- 6"	17'- 8"	18.70º
HA310708	27'- 3"	24'-10"	15'- 5"	360	31	7	8	17'- 8"	6'- 4"	17'- 8"	21.28º
HA330507	27'- 5"	25'- 8"	13'- 6"	317	33	5	7	18'-10"	4'- 6"	18'-10"	17.57º
HA330808	29'- 5"	27'- 1"	16'- 5"	412	33	8	8	18'-10"	7'- 3"	18'-10"	20.00º
HA340508	28'- 2"	25'-11"	14'- 5"	348	34	5	8	19'- 5"	4'- 6"	19'- 5"	19.24º
HA340810	30'- 1"	26'- 9"	18'- 0"	466	34	8	10	19'- 5"	7'- 3"	19'- 5"	24.12º
HA360608	30'- 3"	28'- 2"	15'- 5"	399	34	6	8	20'- 7"	5'- 5"	20'- 7"	18.33º
HA360810	31'- 7"	28'- 4"	18'- 4"	496	36	8	10	20'- 7"	7'- 3"	20'- 7"	22.77º
HA370608	31'- 0"	29'- 0"	15'- 7"	412	36	6	8	21'- 1"	5'- 5"	21'- 1"	17.83º
HA370710	31'- 8"	28'- 6"	17'- 9"	483	37	7	10	21'- 1"	6'- 4"	21'- 1"	22.15º
*HA370812	32'- 4"	27'-11"	19'-11"	553	37	8	12	21'- 1"	7'- 3"	21'- 1"	26.48º
HA380610	31'- 9"	28'- 8"	17'- 2"	469	37	6	10	21'- 8"	5'- 5"	21'- 8"	21.57º
*HA380812	33'- 1"	28'- 9"	20'- 1"	570	38	8	12	21'- 8"	7'- 3"	21'- 8"	25.62º
HA390610	32'- 6"	29'- 6"	17'- 4"	484	39	6	10	22'- 3"	5'- 5"	22'- 3"	21.02º
*HA390812	33'-10"	29'- 7"	20'- 3"	587	39	8	12	22'- 3"	7'- 3"	22'- 3"	25.12º
HA410610	34'- 0"	31'- 2"	17'- 8"	513	41	6	10	23'- 5"	5'- 5"	23'- 5"	20.0º
*HA410712	34'- 7"	30'- 7"	19'-10"	590	41	7	12	23'- 5"	6'- 4"	23'- 5"	23.90º
HA420610	34'- 8"	31'-11"	17'- 10"	529	42	6	10	24- 0"	5'- 5"	24- 0"	19.52º
*HA410813	35'- 3"	30'- 7"	21'- 3"	645	41	8	13	23'- 5"	7'- 3"	23'- 5"	26.06º
*HA420712	35'- 4"	31'- 5"	20'- 0"	608	42	7	12	24- 0"	6'- 4"	24'- 0"	23.33º
*HA420813	36'- 0"	31'- 5"	21'- 5"	663	42	8	13	24- 0"	7'- 3"	24'- 0"	25.29º
*HA411113	37'- 3"	32'- 6"	23'- 5"	747	41	11	13	23'- 5"	10'- 0"	23'- 5"	25.20º
*HA421113	38'- 0"	33'- 5"	23'- 6"	767	42	11	13	24'- 0"	10'- 0"	24'- 0"	25.23º

* These structures require AASHTO A-1-a select backfill. Minimum gage from Table 6 may need to be increased. Contact LSBC for design details.

All dimensions are to the inside crest.
Many additional sizes are available. Contact LONG SPAN Bridge & Culvert for details.

Horizontal Ellipse



By eliminating the need for concrete footings this shape can often provide the lowest overall installed cost of any long span structure. If a natural stream bottom is desired the invert of the ellipse may be buried and filled with native streambed material. Buried ellipses also make for an excellent vehicle, pedestrian or wildlife underpass.

Typical sizes for these ellipses are listed in Table 3. Contact LSBC for additional sizes.

Buried Ellipse for Pedestrian Traffic

Elliptical Stream Crossing

TABLE 3

LONG SPAN HORIZONTAL ELLIPSE
TYPICAL SIZES AND LAYOUT DIMENSIONS

Structure Number	Span	Rise	Top Radius R_T	Side Radius R_S	End Area (ft^2)	Top & Bottom N	Side N
HE2210	19'-4"	12'-9"	12'-6"	4'-6"	191	22	10
HE2310	20'-1"	13'-0"	13'-1"	4'-6"	202	23	10
HE2408	20'-2"	11'-11"	13'-8"	3'-7"	183	24	8
HE2508	20'-10"	12'-2"	14'-3"	3'-7"	194	25	8
HE2313	21'-0"	15'-2"	13'-1"	5'-11"	248	23	13
HE2609	21'-11"	13'-1"	14'-10"	4'-1"	221	26	9
HE2513	22'-6"	15'-8"	14'-3"	5'-11"	274	25	13
HE2710	23'-0"	14'-1"	15'-5"	4'-6"	249	27	10
HE2613	23'-3"	15'-11"	14'-10"	5'-11"	288	26	13
HE2714	24'-4"	16'-11"	15'-5"	6'-4"	320	27	14
HE2910	24'-6"	14'-8"	16'-6"	4'-6"	274	29	10
HE3010	25'-2"	14'-11"	17'-1"	4'-6"	287	30	10
HE2913	25'-5"	16'-9"	16'-6"	5'-11"	330	29	13
HE2915	26'-1"	18'-2"	16'-6"	6'-10"	369	29	15
HE3111	26'-3"	15'-10"	17'-8"	5'-0"	320	31	11
HE3211	27'-0"	16'-2"	18'-3"	5'-0"	334	32	11
HE3016	27'-2"	19'-1"	17'-1"	7'-3"	405	30	16
HE3116	27'-11"	19'-5"	17'-8"	7'-3"	421	31	16
HE3312	28'-1"	17'-1"	18'-10"	5'-5"	369	33	12
HE3412	28'-10"	17'-5"	19'-5"	5'-5"	384	34	12
HE3316	29'-5"	19'-11"	18'-10"	7'-3"	455	33	16
HE3416	30'-1"	20'-2"	19'-5"	7'-3"	472	34	16
HE3612	30'-3"	17'-11"	20'-7"	5'-5"	415	36	12
HE3517	31'-2"	21'-2"	20'-0"	7'-9"	513	35	17
HE3713	31'-4"	18'-11"	21'-1"	5'-11"	454	37	13
HE3813	32'-1"	19'-2"	21'-8"	5'-11"	471	38	13
HE3618	32'-3"	22'-2"	20'-7"	8'-2"	555	36	18
HE3718	33'-0"	22'-5"	21'-1"	8'-2"	574	37	18
HE3914	33'-2"	20'-1"	22'-3"	6'-4"	512	39	14
HE3819	34'-1"	23'-4"	21'-8"	8'-8"	619	38	19
HE4114	34'-7"	20'-8"	23'-5"	6'-4"	548	41	14
HE4115	34'-11"	21'-4"	23'-5"	6'-10"	574	41	15
[1]HE3920	35'-1"	24'-4"	22'-3"	9'1"	665	39	20
[1]HE3922	35'-9"	25'-9"	22'-3"	10'-0"	718	39	22
HE4216	36'-0"	22'-4"	24-0"	7'-3"	619	42	16
[1]HE4121	36'-11"	25'-7"	23'-5"	9'-7"	735	41	21
[1,2]HE4415	37'-2"	22'-2"	25'-2"	6'-10"	631	44	15
[1]HE4222	38'-0"	26'-7"	24'-0"	10'-0"	785	44	22
[1]HE4224	38'-8"	27'-11"	24'-0"	10'-11"	843	42	24
[1]HE4326	40'-0"	29'-7"	24'-7"	11'-10"	927	43	26

NOTES: [1]These structures require AASHTO A-1-a select backfill.
Minimum gage from Table 6 may need to be increased.
Contact LSBC for design details.
[2] Circumferential Stiffeners are required per AASHTO. LSBC will provide details.

All dimensions are to the inside crest.
Many additional sizes are available. Contact LONG SPAN Bridge & Culvert for details.

Long Span Installation

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 six 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 7 for A-1, A-2-4 OR A-2-5.

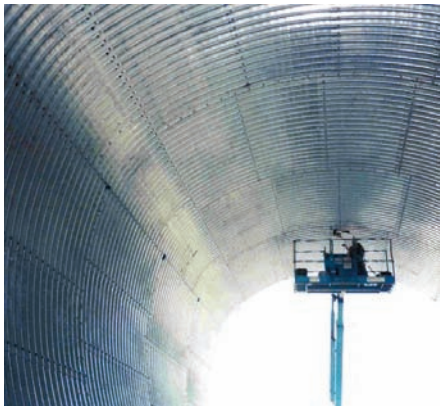


TABLE 4

SELECT GRANULAR BACKFILL REQUIREMENTS

AASHTO M-145 — TABLE 2 (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	

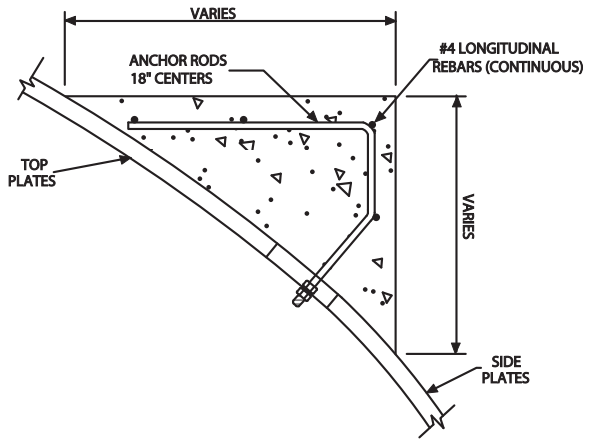
*Modified to be more select than M-145

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. On-site 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.

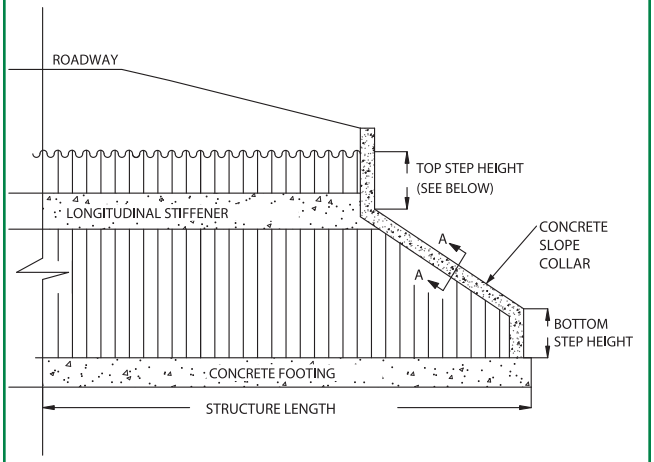
Long Span Conceptual Details

Typical Longitudinal Stiffener

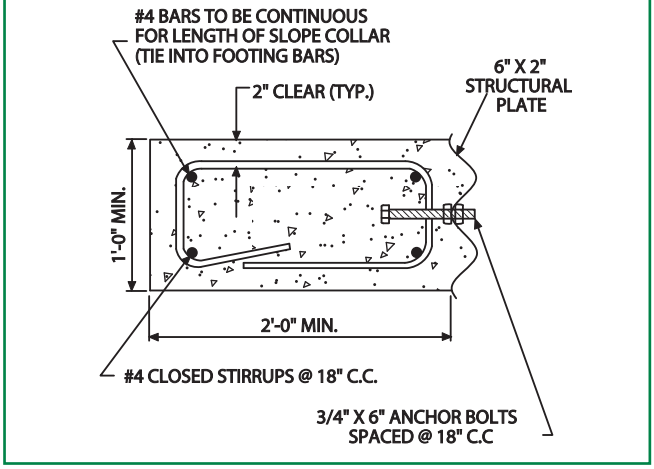


Longitudinal Stiffeners

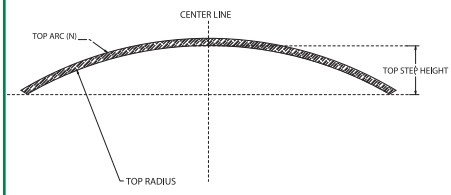
Step Beveled End Profile View



Section A-A Concrete Slope Collar



Typical Top Step Heights



Notes:

1) For Horizontal Ellipse top & 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"

TABLE 5
MINIMUM THICKNESS AND MINIMUM COVER
FOR H 20, HS 20 and HS 25 LIVE LOADS

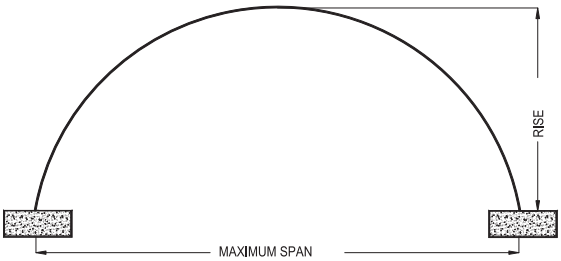
THICKNESS		Top Radius R_T, (Ft.)				
Inches	GAGE	15'	15'-17'	17'-20'	20'-23'	23'-25'
0.109"	(12)	2.5'				
0.138"	(10)	2.5'	3.0'			
0.168"	(8)	2.5'	3.0'	3.0'		
0.188"	(7)	2.5'	3.0'	3.0'		
0.218"	(5)	2.0'	2.5'	2.5'	3.0'	
0.249"	(3)	2.0'	2.0'	2.5'	3.0'	4.0'
0.280"	(1)	2.0'	2.0'	2.5'	3.0'	4.0'

Notes for Table 5

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.

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

Structural Plate Arch



With spans that range from 5'-0" to 26'-0" bottomless structural plate arches offer the most economical way to span a stream or wetlands area. Foundation options for this shape include concrete footings, structural plate footings and full-steel inverts. Details for these foundation types are located on Page 18.

A table of typical sizes for these arches is listed in Table 6.

TABLE 6

Long Span Structural Plate Arch
Typical Sizes and Layout Dimensions

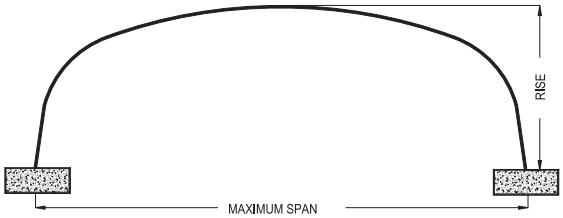
Span (Ft-In)	Rise (Ft-In)	End Area (ft^2)	Arc (N)
5-0	1'- 9.5"	6.5	8
	2'- 2.5"	8.5	9
	2'- 7.5"	10.5	10
6-0	1'- 10"	7.5	9
	2'- 4"	10.0	10
	2'- 9"	12.5	11
	3'- 1.5"	15.0	12
7-0	2'- 4.5"	12.0	11
	2'- 10"	15.0	12
	3'- 3"	17.5	13
	3'- 8"	20.0	14
8-0	2'- 5"	13.5	12
	2'-11"	17.0	13
	3'- 4"	20.0	14
	3'- 9"	23.5	15
	4'- 2"	26.5	16
9-0	2'-11.5"	19.0	14
	3'- 5"	23.0	15
	3'- 10.5"	26.5	16
	4'- 3.5"	30.0	17
	4'- 8"	33.5	18
10-0	2'-11.5"	21.0	15
	3'- 5.5"	25.5	16
	3'- 11.5"	29.5	17
	4'- 4.5"	33.5	18
	4'- 9.5"	37.0	19
	5'- 2.5"	41.0	20
11-0	3'- 6"	27.5	17
	4'- 0"	32.5	18
	4'- 5.5"	37.0	19
	4'- 11"	41.0	20
	5'- 3.5"	45.5	21
	5'- 8.5"	49.5	22
12-0	4'- 0.5"	59.0	19
	4'- 6.5"	54.5	20
	5'- 0"	49.5	21
	5'- 5"	45.0	22
	5'- 10"	40.0	23
	6'- 2.5"	35.0	24
13-0	4'- 1"	38.0	20
	4'- 7"	43.5	21
	5'- 0.5"	49.0	22
	5'- 6"	54.0	23
	5'- 11"	59.0	24
	6'- 4"	64.5	25
	6'- 9"	69.5	26
14-0	4'- 7.5"	46.5	22
	5'- 1.5"	52.5	23
	5'- 7"	58.0	24
	6'- 0"	64.0	25
	6'- 5.5"	69.5	26
	6'- 10"	75.0	27
	7'- 3"	80.5	28
15-0	4'- 7.5"	50.0	23
	5'- 2"	56.0	24
	5'- 8"	62.5	25
	6'- 1.5"	68.5	26
	6'- 6.5"	74.5	27
	6'- 11.5"	80.5	28
	7'- 4.5"	86.5	29
	7'- 9"	92.5	30

Span (Ft-In)	Rise (Ft-In)	End Area (ft^2)	Arc (N)
16-0	5'- 2.5"	60.0	25
	5'- 8.5"	66.5	26
	6'- 2"	73.0	27
	6'- 7.5"	79.5	28
	7'- 0.5"	86.0	29
	7'- 5.5"	92.0	30
	7'- 10.5"	98.5	31
	8'- 3"	104.5	32
17-0	5'- 2.5"	63.0	26
	5'- 9"	70.5	27
	6'- 2.5"	77.5	28
	6'- 8.5"	84.5	29
	7'- 1.5"	91.5	30
	7'- 7"	98.0	31
	8'- 0"	105.0	32
	8'- 4.5"	111.5	33
	8'- 9.5"	118.5	34
18-0	5'- 9"	74.0	28
	6'- 3.5"	82.0	29
	6'- 9"	89.5	30
	7'- 2.5"	97.0	31
	7'- 8"	104.0	32
	8'- 1"	111.5	33
	8'- 6"	118.5	34
	8'- 11"	125.5	35
	9'- 3.5"	132.5	36
19-0	5'- 9.5"	78.5	29
	6'- 3.5"	86.5	30
	6'- 9.5"	94.5	31
	7'- 3.5"	102.5	32
	7'- 9"	110.0	33
	8'- 2"	117.5	34
	8'- 7.5"	125.0	35
	9'- 0"	133.0	36
	9'- 5"	140.0	37
	9'- 9.5"	148.0	38
20-0	6'- 4"	91.0	31
	6'- 10"	99.5	32
	7'- 4"	107.5	33
	7'- 9.5"	116.0	34
	8'- 3"	124.0	35
	8'- 8.5"	132.0	36
	9'- 1.5"	140.0	37
	9'- 6.5"	148.0	38
	9'- 11"	156.0	39
	10'- 4"	164.0	40
21-0	6'- 4"	95.0	32
	6'- 10.5"	104.0	33
	7'- 4.5"	113.0	34
	7'- 10.5"	121.5	35
	8'- 4"	130.0	36
	8'- 9.5"	139.0	37
	9'- 2.5"	147.0	38
	9'- 7.5"	155.5	39
	10'- 0.5"	164.0	40
	10'- 5.5"	172.0	41
	10'- 10"	180.5	42

Span (Ft-In)	Rise (Ft-In)	End Area (ft^2)	Arc (N)
22-0	6'- 11"	108.5	34
	7'- 5"	118.0	35
	7'- 11"	127.5	36
	8'- 5"	136.5	37
	8'- 10.5"	145.5	38
	9'- 3.5"	154.5	39
	9'- 9"	163.0	40
	10'- 2"	172.0	41
	10'- 7"	180.5	42
	10'- 11.5"	189.0	43
	11'- 4.5"	198.0	44
23-0	6'- 11"	113.0	35
	7'- 5.5"	123.0	36
	7'- 11.5"	133.0	37
	8'- 5.5"	142.5	38
	8'- 11"	152.0	39
	9'- 4.5"	161.5	40
	9'- 10"	170.5	41
	10'- 3"	180.0	42
	10'- 8"	189.0	43
	11'- 1"	198.0	44
	11'- 6"	207.0	45
24-0	7'- 5.5"	128.0	37
	8'- 0"	138.5	38
	8'- 6"	149.0	39
	9'- 0"	158.5	40
	9'- 5.5"	168.5	41
	9'- 11"	178.0	42
	10'- 4"	188.0	43
	10'- 9"	197.5	44
	11'- 2"	207.0	45
	11'- 7"	216.5	46
	12'- 0"	226.0	47
25-0	7'- 6"	133.0	38
	8'- 0"	144.0	39
	8'- 6.5"	155.0	40
	9'- 0.5"	165.0	41
	9'- 6"	175.0	42
	10'- 0"	186.0	43
	10'- 5"	196.0	44
	10'- 10"	206.0	45
	11'- 3.5"	216.0	46
	11'- 8.5"	226.0	47
	12'- 1.5"	236.0	48
	12'- 6"	245.0	49
26-0	8'- 0.5"	149.0	40
	8'- 7"	161.0	41
	9'- 1"	172.0	42
	9'- 7"	183.0	43
	10'- 0.5"	193.0	44
	10'- 6"	204.0	45
	10'- 11"	214.0	46
	11'- 4.5"	225.0	47
	11'- 9.5"	235.0	48
	12'- 2.5"	245.0	49
	12'- 7.5"	256.0	50
	13'- 0"	266.0	51

Notes: 1) All Dimensions are to inside crests.
2) Minimum Cover for HS-20 and HS-25 Live Loads is a follows
Spans from 5-8 feet = 12" Spans from 17-23 feet = 36"
Spans from 9-16 feet = 24" Spans from 24-26 feet = 48"

Structural Plate Box Culverts



With spans that exceed 50-feet, structural plate box culverts are the solution when the available stream to road distance is minimal. This shape offers significant hydraulics and generally requires less than 2-feet of soil cover. Foundation options for the structural plate box culvert include concrete footings, structural plate footings and full-steel inverts. Details for these foundation types are located on Page 18.

A table of typical sizes for box culverts is listed in Table 7.

TABLE 7

Low Profile Bottomless Box Culverts
Typical Sizes and Layout Dimensions

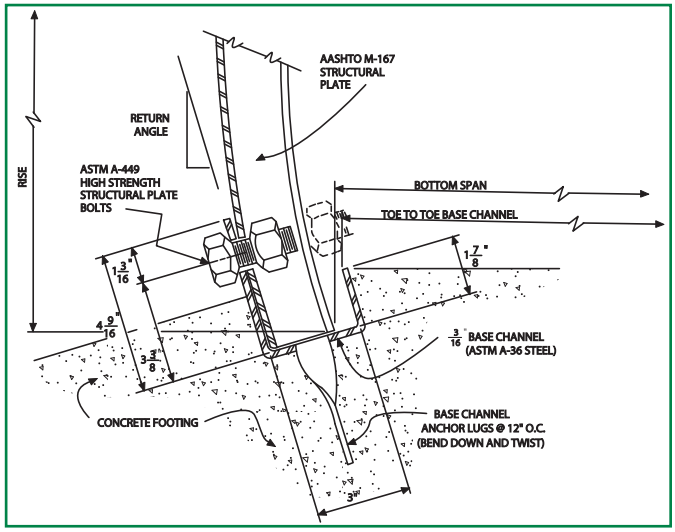
SPAN (Ft-In)	RISE (Ft-In)	END AREA Ft.²
10'-5"	3'-10"	33.57
11'-8"	4'-8"	46.59
12'-7"	4'-10"	53.15
13'-0"	7'-3"	79.09
12'-8"	4'-2"	44.98
13'-6"	6'-1"	70.59
13'-10"	4'-4"	51.22
15'-6"	6'-5"	87.80
14'-11"	4'-5"	57.67
16'-0"	5'-3"	75.00
15'-11"	7'-8"	108.57
16'-11"	7'-11"	119.01
17'-1"	5'-6"	83.07
17'-7"	6'-10"	106.42
17'-5"	4'-9"	71.23
17'-10"	8'-2"	129.87
18'-6"	4'-11"	78.87
19'-6"	8'-8"	153.11
19'-4"	5'-3"	87.91
20'-3"	6'-3"	111.15
20'-6"	8'-11"	165.27
20'-9"	5'-5"	95.87
21'-3"	6'-6"	121.05
21'-4"	7'-10"	149.46
21'-10"	5'-8"	105.13
22'-10"	5'-11"	114.81
23'-0"	7'-2"	145.26
23'-1"	8'-7"	175.93
23'-11"	6'-2"	125.03
23'-11"	7'-6"	156.88
24'-0"	8'-10"	188.95
24'-0"	10'-2"	220.80

SPAN (Ft-In)	RISE (Ft-In)	END AREA Ft.²
24'-3"	5'-6"	109.86
25'-7"	6'-5"	136.76
26'-1"	7'-9"	170.76
28'-2"	6'-4"	149.56
28'-3"	7'-8"	187.01
28'-4"	9'-0"	224.78
30'-0"	6'-4"	157.53
30'-3"	7'-8"	197.45
30'-6"	9'-0"	237.80
32'-2"	6'-11"	182.06
32'-4"	8'-3"	224.88
32'-6"	9'-7"	268.14
34'-4"	7'-6"	209.07
34'-5"	8'-10"	254.80
34'-6"	10'-2"	300.74
35'-9"	7'-9"	221.55
35'-10"	9'-1"	269.22
36'-1"	10'-5"	317.10
38'-2"	8'-4"	250.82
38'-5"	9'-8"	301.71
38'-6"	11'-0"	353.04
40'-3"	9'-0"	284.71
40'-4"	10'-4"	338.40
40'-5"	11'-8"	392.20
42'-9"	9'-3"	330.55
42'-10"	10'-7"	387.58
46'-3"	10'-0"	383.16
46'-4"	11'-5"	444.82
49'-3"	10'-5"	412.97
49'-4"	11'-9"	478.60
51'-1"	12'-7"	532.19
51'-8"	13'-1"	560.81

Conceptual Details and Photos

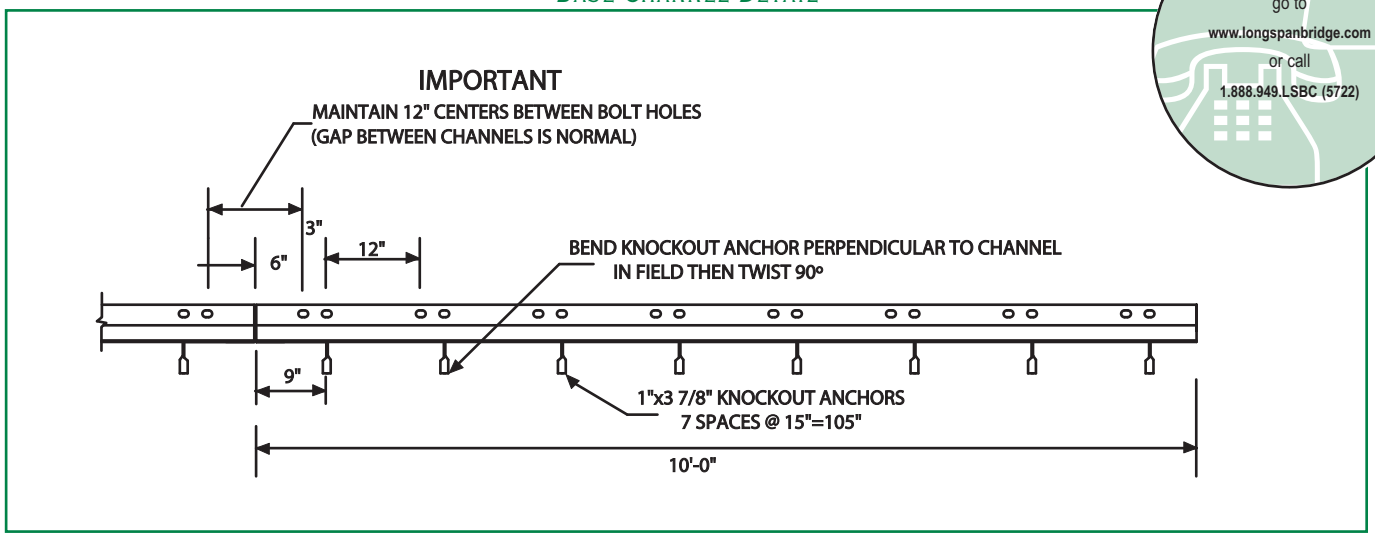
Multiple Structure Installation

Base Channel Profile



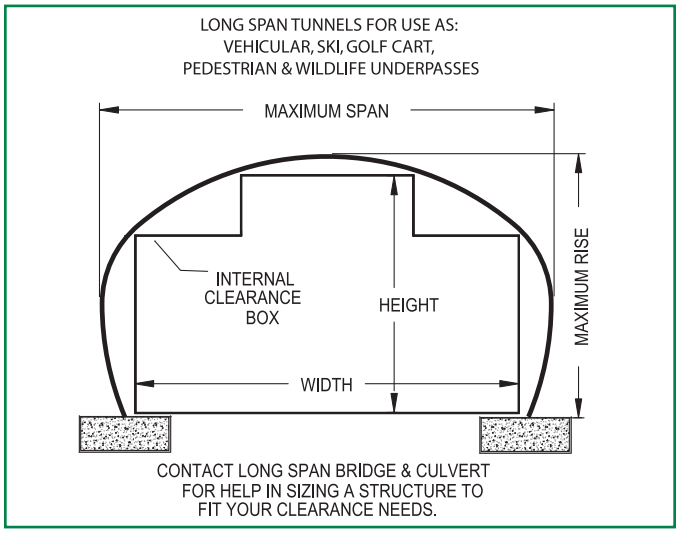
Base Channel

Base Channel Detail



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

Long Span Tunnels



Ski Underpass

Rail Road Underpass

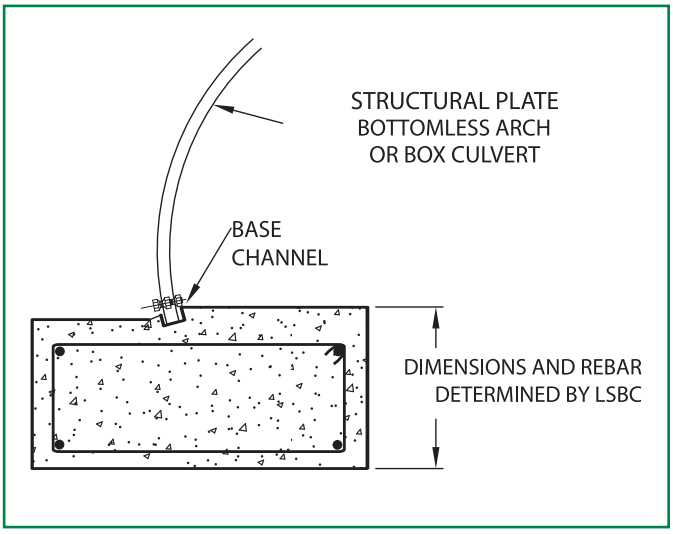
Skewed End with Concrete Headwalls

Long Span Assembly

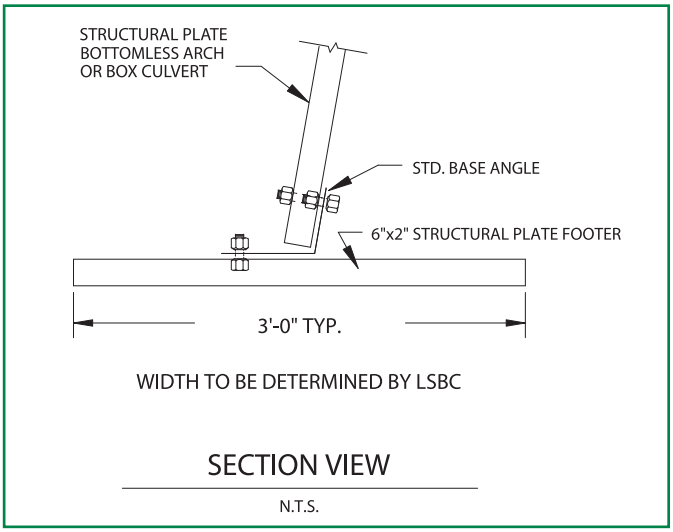
NOTE: Many of these details are conceptual. Please contact LSBC for assistance on your application.

Footing Options for Structural Plate Arches and Box Culverts

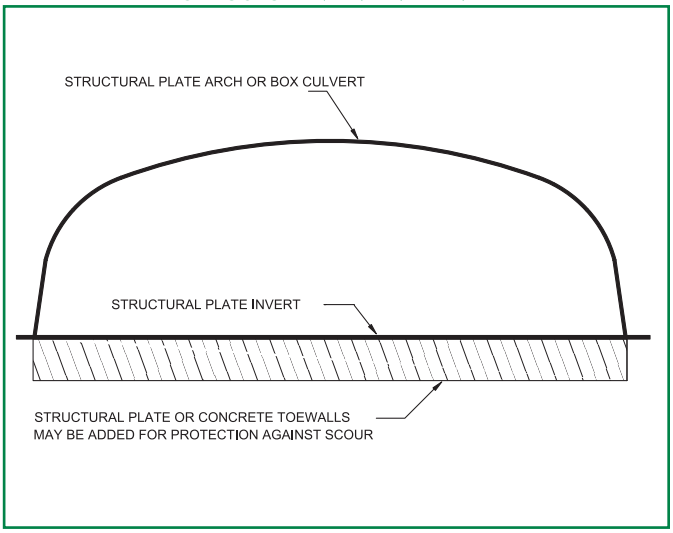
Typical Concrete Footing



Structural Plate Footing for Box Culverts & Arches



Structural Plate Invert



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.

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.

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.

LONG SPAN Bridge & Culvert's design team can provide designs for any of these options. For additional information or design assistance contact LSBC at 1-888-949-LSBC.

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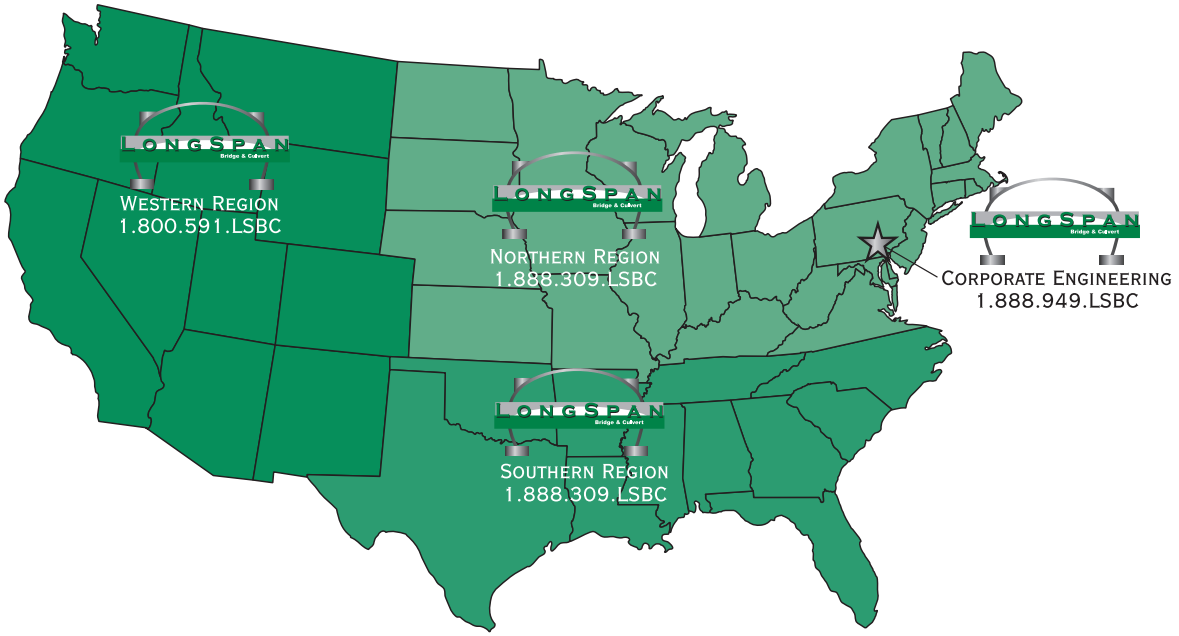

Photo Disclaimer

The pictures included herein are intended solely to provide viewers with a visual example of the types of structures that LSBC can design, manufacture and build for our clients, all pursuant to AASHTO and ASTM requirements. These pictures represent a variety of projects including LSBC's, Lane Enterprise's, and others merely to represent the wide variety of structures that LSBC's experienced team can provide for you.

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