Designation: C 1433M – 04$^{\epsilon 1}$

METRIC

Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers [Metric][1]

This standard is issued under the fixed designation C 1433M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

ϵ[1] NOTE—Editorial changes were made throughout in April 2005.

1. Scope

1.1 This specification covers single-cell precast reinforced concrete box sections intended to be used for the construction of culverts and for the conveyance of storm water industrial wastes and sewage.

1.2 This specification is the companion to inch-pound Specification C 1433.

NOTE 1—This specification is primarily a manufacturing and purchasing specification. However, standard designs are included and the criteria used to develop these designs are given in Appendix X1. The successful performance of this product depends upon the proper selection of the box section, bedding, backfill, and care that the installation conforms to the construction specifications. The purchaser of the precast reinforced concrete box sections specified herein is cautioned that he must properly correlate the loading conditions and the field requirements with the box section specified and provide for inspection at the construction site.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 82 Specification for Steel Wire, Plain, for Concrete Reinforcement

A 185 Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

A 496 Specification for Steel Wire, Deformed, for Concrete Reinforcement

A 497 Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement

A 615/A 615M Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

C 31/C 31M Practice for Making and Curing Concrete Test Specimens in the Field

C 33 Specification for Concrete Aggregates

C 39 Test Method for Compressive Strength of Cylindrical Concrete Specimens

C 150 Specification for Portland Cement

C 309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete

C 497M Test Methods for Concrete Pipe, Manhole Sections, or Tile [Metric]

C 595 Specification for Blended Hydraulic Cements

C 618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

C 822 Terminology Relating to Concrete Pipe and Related Products

C 989 Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars

2.2 *AASHTO Standards:*[3]

Standard Specifications for Highway Bridges

3. Terminology

3.1 *Definitions*—For definitions of terms relating to concrete pipe, see Terminology C 822.

4. Types

4.1 Precast reinforced concrete box sections manufactured in accordance with this specification shall be one of two types identified in Tables 1 and 2, and shall be designated by type, span, rise, and design earth cover.

[1] This specification is under the jurisdiction of ASTM Committee C13 on Concrete Pipe and is the direct responsibility of Subcommittee C13.07 on Acceptance Specifications and Precast Concrete Box Sections.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001.

TABLE 1 Design Requirements for Precast Concrete Box Sections Under Earth Dead and HS20 Live Load Conditions

NOTE 1—Design earth covers and reinforcement areas are based on the weight of a column of earth over the width of the box section as defined in Appendix X1.

NOTE 2—Concrete design strength 35 MPa.

NOTE 3—The design earth cover indicated is the height of fill above the top of the box section. Design requirements are based on the material and soil properties, loading data, and typical section as included in Appendix X1. For alternative or special designs, see 7.2.

NOTE 4—Design steel area in millimetres per linear metre of box section at those locations which are indicated on the typical section included in Fig. 1.

NOTE 5—The top section designation, for example, 900 by 600 by 100 mm indicates (interior horizontal span in millimetres) by (interior vertical rise in millimetres) by (wall and slab thickness in millimetres).

NOTE 6—In accordance with the acceptance criteria in 7.2, the manufacturer may interpolate the steel area requirements for fill heights between noted increments or may submit independent designs.

900 by 600 by 100 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
900	600	175	150	100	100	0-0.6	360	810	450	220	410	360	360	300	
900	600	100	100	100	100	0.6-0.9	280	450	450	220					790
900	600	100	100	100	100	0.9-1.5	220	220	220	220					790
900	600	100	100	100	100	3	220	220	220	220					790
900	600	100	100	100	100	4.6	220	300	300	220					790
900	600	100	100	100	100	6.1	240	390	410	220					790
900	600	100	100	100	100	7.6	300	490	490	220					790
900	600	100	100	100	100	9.1	360	580	580	220					790
900	600	100	100	100	100	10.7	430	660	660	220					790

900 by 900 by 100 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
900	900	175	150	100	100	0-0.6	360	850	490	220	430	360	360	300	
900	900	100	100	100	100	0.6-0.9	220	530	530	220					790
900	900	100	100	100	100	0.9-1.5	220	220	240	220					790
900	900	100	100	100	100	3	220	240	240	220					790
900	900	100	100	100	100	4.6	220	320	340	220					790
900	900	100	100	100	100	6.1	220	430	430	220					790
900	900	100	100	100	100	7.6	220	510	530	220					790
900	900	100	100	100	100	9.1	260	620	620	220					790
900	900	100	100	100	100	10.7	300	700	720	220					790

1200 by 600 by 125 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
1200	600	190	150	125	125	0-0.6	390	850	430	260	430	390	390	300	
1200	600	125	125	125	125	0.6-0.9	450	490	430	260					970
1200	600	125	125	125	125	0.9-1.5	260	260	260	260					970
1200	600	125	125	125	125	3	260	260	280	260					970
1200	600	125	125	125	125	4.6	300	360	390	260					970
1200	600	125	125	125	125	6.1	410	490	490	260					970
1200	600	125	125	125	125	7.6	490	600	600	260					970
1200	600	125	125	125	125	9.1	600	700	700	260					970
1200	600	125	125	125	125	10.7	700	810	830	260					970

1200 by 900 by 125 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
1200	900	190	150	125	125	0-0.6	390	960	490	260	470	390	390	300	
1200	900	125	125	125	125	0.6-0.9	340	600	530	260					970
1200	900	125	125	125	125	0.9-1.5	260	260	280	260					970
1200	900	125	125	125	125	3	260	300	320	260					970
1200	900	125	125	125	125	4.6	260	430	430	260					970
1200	900	125	125	125	125	6.1	300	550	550	260					970
1200	900	125	125	125	125	7.6	360	680	680	260					970
1200	900	125	125	125	125	9.1	450	810	810	260					970
1200	900	125	125	125	125	10.7	530	940	940	260					970

TABLE 1 *Continued*

1200 by 1200 by 125 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
1200	1200	190	150	125	125	0-0.6	390	1000	530	260	490	390	390	300	
1200	1200	125	125	125	125	0.6-0.9	280	660	600	260					970
1200	1200	125	125	125	125	0.9-1.5	260	300	320	260					970
1200	1200	125	125	125	125	3	260	320	340	260					970
1200	1200	125	125	125	125	4.6	260	450	470	260					970
1200	1200	125	125	125	125	6.1	260	580	600	260					970
1200	1200	125	125	125	125	7.6	300	700	720	260					970
1200	1200	125	125	125	125	9.1	360	830	850	260					970
1200	1200	125	125	125	125	10.7	430	960	980	260					970

1500 by 900 by 150 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
1500	900	200	175	150	150	0-0.6	410	940	470	300	450	410	410	360	
1500	900	150	150	150	150	0.6-0.9	450	620	470	300					1150
1500	900	150	150	150	150	0.9-1.5	300	300	300	300					920
1500	900	150	150	150	150	3	300	360	360	300					920
1500	900	150	150	150	150	4.6	360	510	510	300					890
1500	900	150	150	150	150	6.1	450	660	660	300					890
1500	900	150	150	150	150	7.6	550	810	810	300					890
1500	900	150	150	150	150	9.1	660	960	960	300					890
1500	900	150	150	150	150	10.7	790	1100	1130	300					890

1500 by 1200 by 150 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
1500	1200	200	175	150	150	0-0.6	410	1020	510	300	470	410	410	360	
1500	1200	150	150	150	150	0.6-0.9	390	700	530	300					1150
1500	1200	150	150	150	150	0.9-1.5	300	340	340	300					1150
1500	1200	150	150	150	150	3	300	410	410	300					920
1500	1200	150	150	150	150	4.6	300	550	580	300					890
1500	1200	150	150	150	150	6.1	390	700	720	300					890
1500	1200	150	150	150	150	7.6	450	870	890	300					890
1500	1200	150	150	150	150	9.1	550	2120	2120	300					890
1500	1200	150	150	150	150	10.7	640	1190	1210	300					890

1500 by 1500 by 150 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
1500	1500	200	175	150	150	0-0.6	410	1060	550	300	510	410	410	360	
1500	1500	150	150	150	150	0.6-0.9	340	750	600	300					1150
1500	1500	150	150	150	150	0.9-1.5	300	360	390	300					1150
1500	1500	150	150	150	150	3	300	430	450	300					1150
1500	1500	150	150	150	150	4.6	300	580	600	300					920
1500	1500	150	150	150	150	6.1	320	750	770	300					890
1500	1500	150	150	150	150	7.6	410	890	940	300					890
1500	1500	150	150	150	150	9.1	470	1060	1080	300					890
1500	1500	150	150	150	150	10.7	560	1230	1250	300					890

1800 by 900 by 175 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
1800	900	200	175	175	175	0-0.6	490	960	430	360	410	410	410	360	
1800	900	175	175	175	175	0.6-0.9	510	640	430	360					1100
1800	900	175	175	175	175	0.9-1.5	360	360	360	360					1020
1800	900	175	175	175	175	3	360	430	430	360					1000
1800	900	175	175	175	175	4.6	490	580	600	360					970
1800	900	175	175	175	175	6.1	640	750	770	360					970
1800	900	175	175	175	175	7.6	770	940	940	360					970
1800	900	175	175	175	175	9.1	920	1100	1100	360					970
1800	900	175	175	175	175	10.7	1060	1270	1270	360					970

1800 by 1200 by 175 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
1800	1200	200	175	175	175	0-0.6	410	1040	490	360	450	410	410	360	

TABLE 1 *Continued*

1800	1200	175	175	175	175	0.6-0.9	450	700	490	360					1100
1800	1200	175	175	175	175	0.9-1.5	360	360	360	360					1020
1800	1200	175	175	175	175	3	360	470	490	360					1000
1800	1200	175	175	175	175	4.6	430	640	660	360					970
1800	1200	175	175	175	175	6.1	530	830	850	360					970
1800	1200	175	175	175	175	7.6	640	1020	1040	360					970
1800	1200	175	175	175	175	9.1	770	1210	1230	360					970
1800	1200	175	175	175	175	10.7	890	1400	1420	360					970

1800 by 1500 by 175 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
1800	1500	200	175	175	175	0-0.6	410	1110	530	360	470	410	410	360	
1800	1500	175	175	175	175	0.6-0.9	410	770	550	360					1330
1800	1500	175	175	175	175	0.9-1.5	360	410	410	360					1100
1800	1500	175	175	175	175	3	360	490	510	360					1000
1800	1500	175	175	175	175	4.6	360	680	700	360					970
1800	1500	175	175	175	175	6.1	470	870	910	360					970
1800	1500	175	175	175	175	7.6	550	1080	1110	360					970
1800	1500	175	175	175	175	9.1	660	1270	1300	360					970
1800	1500	175	175	175	175	10.7	770	1460	1510	360					970

1800 by 1800 by 175 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
1800	1800	200	175	175	175	0-0.6	410	2120	580	360	490	410	410	360	
1800	1800	175	175	175	175	0.6-0.9	360	810	600	360					1330
1800	1800	175	175	175	175	0.9-1.5	360	430	430	360					1330
1800	1800	175	175	175	175	3	360	510	550	360					1100
1800	1800	175	175	175	175	4.6	360	700	750	360					1000
1800	1800	175	175	175	175	6.1	410	910	940	360					970
1800	1800	175	175	175	175	7.6	490	1110	1150	360					970
1800	1800	175	175	175	175	9.1	580	1300	1340	360					970
1800	1800	175	175	175	175	10.7	680	1510	1550	360					970

2100 by 1200 by 200 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
2100	1200	200	200	200	200	0-0.6	550	1040	450	410	410	410	410	410	
2100	1200	200	200	200	200	0.6-0.9	510	700	470	410					1200
2100	1200	200	200	200	200	0.9-1.5	410	410	410	410					1100
2100	1200	200	200	200	200	3	410	530	530	410					1100
2100	1200	200	200	200	200	4.6	550	720	740	410					1050
2100	1200	200	200	200	200	6.1	700	940	960	410					1050
2100	1200	200	200	200	200	7.6	850	1150	1170	410					1050
2100	1200	200	200	200	200	9.1	1000	1360	1380	410					1050
2100	1200	200	200	200	200	10.7	1170	1590	1590	410					1050

2100 by 1500 by 200 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
2100	1500	200	200	200	200	0-0.6	490	1110	510	410	450	410	410	410	
2100	1500	200	200	200	200	0.6-0.9	470	770	530	410					1500
2100	1500	200	200	200	200	0.9-1.5	410	430	430	410					1100
2100	1500	200	200	200	200	3	410	580	600	410					1100
2100	1500	200	200	200	200	4.6	490	790	810	410					1050
2100	1500	200	200	200	200	6.1	620	1020	1040	410					1050
2100	1500	200	200	200	200	7.6	740	1230	1250	410					1050
2100	1500	200	200	200	200	9.1	870	1460	1490	410					1050
2100	1500	200	200	200	200	10.7	1000	1700	1720	410					1050

2100 by 1800 by 200 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
2100	1800	200	200	200	200	0-0.6	450	1150	550	410	470	410	410	410	
2100	1800	200	200	200	200	0.6-0.9	430	830	580	410					1500
2100	1800	200	200	200	200	0.9-1.5	410	470	470	410					1200
2100	1800	200	200	200	200	3	410	600	640	410					1100
2100	1800	200	200	200	200	4.6	430	830	850	410					1050
2100	1800	200	200	200	200	6.1	550	1060	1080	410					1050

TABLE 1 *Continued*

2100	1800	200	200	200	200	7.6	660	1300	1320	410					1050
2100	1800	200	200	200	200	9.1	770	1530	1550	410					1050
2100	1800	200	200	200	200	10.7	890	1760	1800	410					1050

2100 by 2100 by 200 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
2100	2100	200	200	200	200	0-0.6	470	1190	580	410	470	410	410	410	
2100	2100	200	200	200	200	0.6-0.9	470	870	620	410					1500
2100	2100	200	200	200	200	0.9-1.5	470	490	490	410					1500
2100	2100	200	200	200	200	3	470	620	660	410					1200
2100	2100	200	200	200	200	4.6	470	850	890	410					1100
2100	2100	200	200	200	200	6.1	510	1080	1130	410					1050
2100	2100	200	200	200	200	7.6	600	1320	1360	410					1050
2100	2100	200	200	200	200	9.1	700	1550	1590	410					1050
2100	2100	200	200	200	200	10.7	810	1780	1850	410					1050

2400 by 1200 by 200 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
2400	1200	200	200	200	200	0-0.6	660	1130	490	410	430	410	410	410	
2400	1200	200	200	200	200	0.6-0.9	640	830	530	410					1270
2400	1200	200	200	200	200	0.9-1.5	430	470	470	410					1150
2400	1200	200	200	200	200	3	580	660	680	410					1150
2400	1200	200	200	200	200	4.6	790	910	940	410					1050
2400	1200	200	200	200	200	6.1	1000	1210	1210	410					1050
2400	1200	200	200	200	200	7.6	1230	1440	1460	410					1050

2400 by 1500 by 200 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
2400	1500	200	200	200	200	0-0.6	600	1210	530	410	450	410	410	410	
2400	1500	200	200	200	200	0.6-0.9	580	890	600	410					1270
2400	1500	200	200	200	200	0.9-1.5	410	510	510	410					1270
2400	1500	200	200	200	200	3	510	700	740	410					1150
2400	1500	200	200	200	200	4.6	700	980	1020	410					1050
2400	1500	200	200	200	200	6.1	890	1270	1300	410					1050
2400	1500	200	200	200	200	7.6	1080	1550	1590	410					1050

2400 by 1800 by 200 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
2400	1800	200	200	200	200	0-0.6	550	1250	600	410	470	410	410	410	
2400	1800	200	200	200	200	0.6-0.9	530	960	640	410					1400
2400	1800	200	200	200	200	0.9-1.5	410	550	550	410					1270
2400	1800	200	200	200	200	3	470	740	790	410					1150
2400	1800	200	200	200	200	4.6	640	1040	1080	410					1050
2400	1800	200	200	200	200	6.1	810	1340	1380	410					1050
2400	1800	200	200	200	200	7.6	980	1630	1680	410					1050

2400 by 2100 by 200 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
2400	2100	200	200	200	200	0-0.6	510	1320	640	410	490	410	410	410	
2400	2100	200	200	200	200	0.6-0.9	490	1000	700	410					1660
2400	2100	200	200	200	200	0.9-1.5	410	580	600	410					1400
2400	2100	200	200	200	200	3	430	790	830	410					1150
2400	2100	200	200	200	200	4.6	600	1080	1130	410					1050
2400	2100	200	200	200	200	6.1	740	1380	1440	410					1050
2400	2100	200	200	200	200	7.6	890	1700	1740	410					1050

2400 by 2400 by 200 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
2400	2400	200	200	200	200	0-0.6	470	1360	680	410	510	410	410	410	
2400	2400	200	200	200	200	0.6-0.9	470	1040	740	410					1660
2400	2400	200	200	200	200	0.9-1.5	410	620	640	410					1660
2400	2400	200	200	200	200	3	410	810	870	410					1270
2400	2400	200	200	200	200	4.6	550	1100	1170	410					1150

TABLE 1 *Continued*

2400	2400	200	200	200	200	6.1	700	1400	1490	410					1150
2400	2400	200	200	200	200	7.6	850	1720	1780	410					1050

2700 by 1500 by 225 mm

Span	Rise	Top	Bottom	Side	Haunch	Depth	Circumferential Reinforcement Areas, mm²/m								
mm	mm	mm	mm	mm	mm	m	A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
2700	1500	225	225	225	225	0-0.6	620	1130	530	470	470	470	470	470	
2700	1500	225	225	225	225	0.6-0.9	620	870	580	470					1380
2700	1500	225	225	225	225	0.9-1.5	470	530	550	470					1250
2700	1500	225	225	225	225	3	620	770	810	470					1250
2700	1500	225	225	225	225	4.6	850	1080	1100	470					1120
2700	1500	225	225	225	225	6.1	1080	1380	1420	470					1120
2700	1500	225	225	225	225	7.6	1320	1700	1720	470					1120

2700 by 1800 by 225 mm

Span	Rise	Top	Bottom	Side	Haunch	Depth	Circumferential Reinforcement Areas, mm²/m								
mm	mm	mm	mm	mm	mm	m	A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
2700	1800	225	225	225	225	0-0.6	580	1190	580	470	470	470	470	470	
2700	1800	225	225	225	225	0.6-0.9	550	940	640	470					1500
2700	1800	225	225	225	225	0.9-1.5	470	580	600	470					1380
2700	1800	225	225	225	225	3	580	830	670	470					1250
2700	1800	225	225	225	225	4.6	770	1450	1190	470					1120
2700	1800	225	225	225	225	6.1	980	1460	1510	470					1120
2700	1800	225	225	225	225	7.6	1190	1780	1820	470					1120

2700 by 2100 by 225 mm

Span	Rise	Top	Bottom	Side	Haunch	Depth	Circumferential Reinforcement Areas, mm²/m								
mm	mm	mm	mm	mm	mm	m	A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
2700	2100	225	225	225	225	0-0.6	530	1230	620	470	470	470	470	470	
2700	2100	225	225	225	225	0.6-0.9	530	980	680	470					1500
2700	2100	225	225	225	225	0.9-1.5	470	600	640	470					1380
2700	2100	225	225	225	225	3	530	670	910	470					1250
2700	2100	225	225	225	225	4.6	720	1190	1250	470					1120
2700	2100	225	225	225	225	6.1	890	1530	1570	470					1120
2700	2100	225	225	225	225	7.6	1080	1870	1910	470					1120

2700 by 2400 by 225 mm

Span	Rise	Top	Bottom	Side	Haunch	Depth	Circumferential Reinforcement Areas, mm²/m								
mm	mm	mm	mm	mm	mm	m	A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
2700	2400	225	225	225	225	0-0.6	490	1270	680	470	470	470	470	470	
2700	2400	225	225	225	225	0.6-0.9	490	1020	720	470					1830
2700	2400	225	225	225	225	0.9-1.5	470	640	680	470					1500
2700	2400	225	225	225	225	3	490	890	960	470					1380
2700	2400	225	225	225	225	4.6	660	1230	1300	470					1120
2700	2400	225	225	225	225	6.1	830	1570	1630	470					1120
2700	2400	225	225	225	225	7.6	1020	1910	1970	470					1120

2700 by 2700 by 225 mm

Span	Rise	Top	Bottom	Side	Haunch	Depth	Circumferential Reinforcement Areas, mm²/m								
mm	mm	mm	mm	mm	mm	m	A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
2700	2700	225	225	225	225	0-0.6	470	1320	720	470	470	470	470	470	
2700	2700	225	225	225	225	0.6-0.9	470	1060	790	470					1830
2700	2700	225	225	225	225	0.9-1.5	470	660	720	470					1830
2700	2700	225	225	225	225	3	470	910	1000	470					1500
2700	2700	225	225	225	225	4.6	640	1250	1340	470					1250
2700	2700	225	225	225	225	6.1	790	1590	1680	470					1250
2700	2700	225	225	225	225	7.6	960	1950	2040	470					1120

3000 by 1500 by 250 mm

Span	Rise	Top	Bottom	Side	Haunch	Depth	Circumferential Reinforcement Areas, mm²/m								
mm	mm	mm	mm	mm	mm	m	A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
3000	1500	250	250	250	250	0-0.6	620	1080	510	510	510	510	510	510	
3000	1500	250	250	250	250	0.6-0.9	640	870	580	510					1480
3000	1500	250	250	250	250	0.9-1.5	510	550	580	510					1330
3000	1500	250	250	250	250	3	740	830	870	510					1330
3000	1500	250	250	250	250	4.6	100	1170	1190	510					1200
3000	1500	250	250	250	250	6.1	1270	1490	1530	510					1200
3000	1500	250	250	250	250	7.6	1550	1820	1850	510					1200
3000	1500	250	250	250	250	9.1	1820	2160	2180	510					1200

TABLE 1 *Continued*

3000 by 1800 by 250 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
3000	1800	250	250	250	250	0-0.6	580	1130	580	510	510	510	510	510	
3000	1800	250	250	250	250	0.6-0.9	580	910	620	510					1480
3000	1800	250	250	250	250	0.9-1.5	510	600	640	510					1330
3000	1800	250	250	250	250	3	680	910	940	510					1330
3000	1800	250	250	250	250	4.6	910	890	1270	510					1200
3000	1800	250	250	250	250	6.1	1170	1590	1630	510					1200
3000	1800	250	250	250	250	7.6	1400	1930	1970	510					1200

3000 by 2100 by 250 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
3000	2100	250	250	250	250	0-0.6	530	1170	620	510	510	510	510	510	
3000	2100	250	250	250	250	0.6-0.9	550	960	680	510					1630
3000	2100	250	250	250	250	0.9-1.5	510	640	680	510					1480
3000	2100	250	250	250	250	3	640	940	1000	510					1330
3000	2100	250	250	250	250	4.6	850	1300	1360	510					1200
3000	2100	250	250	250	250	6.1	1080	1660	1720	510					1200
3000	2100	250	250	250	250	7.6	1300	2040	2080	510					1200

3000 by 2400 by 250 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
3000	2400	250	250	250	250	0-0.6	510	1210	660	510	510	510	510	510	
3000	2400	250	250	250	250	0.6-0.9	530	1000	720	510					1630
3000	2400	250	250	250	250	0.9-1.5	510	680	720	510					1480
3000	2400	250	250	250	250	3	600	980	1040	510					1330
3000	2400	250	250	250	250	4.6	790	1340	1420	510					1200
3000	2400	250	250	250	250	6.1	1000	1720	1780	510					1200
3000	2400	250	250	250	250	7.6	1210	2100	2160	510					1200

3000 by 2700 by 250 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
3000	2700	250	250	250	250	0-0.6	510	1250	720	510	510	510	510	510	
3000	2700	250	250	250	250	0.6-0.9	510	1040	770	510					2010
3000	2700	250	250	250	250	0.9-1.5	510	700	770	510					1630
3000	2700	250	250	250	250	3	580	1020	1100	510					1480
3000	2700	250	250	250	250	4.6	740	1380	1460	510					1200
3000	2700	250	250	250	250	6.1	940	1760	1850	510					1200
3000	2700	250	250	250	250	7.6	1130	2140	2230	510					1200

3000 by 3000 by 250 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
3000	3000	250	250	250	250	0-0.6	510	1270	770	510	510	510	510	510	
3000	3000	250	250	250	250	0.6-0.9	510	1080	830	510					2010
3000	3000	250	250	250	250	0.9-1.5	510	740	830	510					1780
3000	3000	250	250	250	250	3	530	1040	1150	510					1630
3000	3000	250	250	250	250	4.6	720	1420	1530	510					1330
3000	3000	250	250	250	250	6.1	900	1760	1910	510					1330
3000	3000	250	250	250	250	7.6	1080	2180	2290	510					1200

3300 by 1200 by 275 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
3300	1200	275	275	275	275	0-0.6	680	980	550	550	550	550	550	550	
3300	1200	275	275	275	275	0.6-0.9	720	790	550	550					1580
3300	1200	275	275	275	275	0.9-1.5	620	550	550	550					1580
3300	1200	275	275	275	275	3	940	810	850	550					1400
3300	1200	275	275	275	275	4.6	1270	1150	1170	550					1400
3300	1200	275	275	275	275	6.1	1630	1460	1490	550					1400
3300	1200	275	275	275	275	7.6	1990	1780	1820	550					1400

TABLE 1 *Continued*

3300 by 1800 by 275 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
3300	1800	275	275	275	275	0-0.6	600	1080	580	550	550	550	550	550	
3300	1800	275	275	275	275	0.6-0.9	620	910	620	550					1580
3300	1800	275	275	275	275	0.9-1.5	550	640	660	550					1400
3300	1800	275	275	275	275	3	790	960	1000	550					1400
3300	1800	275	275	275	275	4.6	1080	1340	1380	550					1270
3300	1800	275	275	275	275	6.1	1360	1700	1740	550					1270
3300	1800	275	275	275	275	7.6	1660	2080	2120	550					1270

3300 by 2400 by 275 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
3300	2400	275	275	275	275	0-0.6	550	1170	660	550	550	550	550	550	
3300	2400	275	275	275	275	0.6-0.9	550	1000	720	550					1760
3300	2400	275	275	275	275	0.9-1.5	550	720	770	550					1580
3300	2400	275	275	275	275	3	700	1060	1130	550					1400
3300	2400	275	275	275	275	4.6	940	1460	1530	550					1270
3300	2400	275	275	275	275	6.1	1170	1670	1930	550					1270
3300	2400	275	275	275	275	7.6	1420	2270	2350	550					1270

3300 by 3000 by 275 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
3300	3000	275	275	275	275	0-0.6	550	1230	770	550	550	550	550	550	
3300	3000	275	275	275	275	0.6-0.9	550	1060	830	550					2190
3300	3000	275	275	275	275	0.9-1.5	550	790	870	550					1760
3300	3000	275	275	275	275	3	640	1150	1250	550					1580
3300	3000	275	275	275	275	4.6	850	1550	1660	550					1270
3300	3000	275	275	275	275	6.1	1040	1970	2080	550					1270
3300	3000	275	275	275	275	7.6	1250	2400	2500	550					1270

3300 by 3300 by 275 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
3300	3300	275	275	275	275	0-0.6	550	1250	810	550	550	550	550	550	
3300	3300	275	275	275	275	0.6-0.9	550	1080	870	550					2190
3300	3300	275	275	275	275	0.9-1.5	550	830	910	550					1910
3300	3300	275	275	275	275	3	620	1170	1300	550					1760
3300	3300	275	275	275	275	4.6	810	1590	1720	550					1400
3300	3300	275	275	275	275	6.1	100	1990	2120	550					1400
3300	3300	275	275	275	275	7.6	1210	2120	2540	550					1400

3600 by 1200 by 300 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
3600	1200	300	300	300	300	0-0.6	680	940	620	620	620	620	620	620	
3600	1200	300	300	300	300	0.6-0.9	770	790	620	620					1860
3600	1200	300	300	300	300	0.9-1.5	700	620	620	620					1680
3600	1200	300	300	300	300	3	1060	870	890	620					1500
3600	1200	300	300	300	300	4.6	1460	1210	1230	620					1500
3600	1200	300	300	300	300	6.1	1870	1550	1590	620					1500
3600	1200	300	300	300	300	7.6	2270	1910	1930	620					1500
3600	1200	300	300	300	300	9.1	2690	2250	2270	620					1500

3600 by 1800 by 300 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
3600	1800	300	300	300	300	0-0.6	620	1040	620	620	620	620	620	620	
3600	1800	300	300	300	300	0.6-0.9	660	890	620	620					1680
3600	1800	300	300	300	300	0.9-1.5	620	680	700	620					1500
3600	1800	300	300	300	300	3	910	1020	1060	620					1500
3600	1800	300	300	300	300	4.6	1250	1420	1460	620					1350
3600	1800	300	300	300	300	6.1	1570	1820	1870	620					1350
3600	1800	300	300	300	300	7.6	1910	2230	2270	620					1350
3600	1800	300	300	300	300	9.1	2250	2630	2670	620					1350

TABLE 1 *Continued*

3600 by 2400 by 300 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
3600	2400	300	300	300	300	0-0.6	620	1100	660	620	620	620	620	620	
3600	2400	300	300	300	300	0.6-0.9	620	980	720	620					1680
3600	2400	300	300	300	300	0.9-1.5	620	770	810	620					1500
3600	2400	300	300	300	300	3	810	1150	1210	620					1500
3600	2400	300	300	300	300	4.6	1080	1570	1660	620					1350
3600	2400	300	300	300	300	6.1	1360	2010	2080	620					1350
3600	2400	300	300	300	300	7.6	1630	2440	2520	620					1350
3600	2400	300	300	300	300	9	1930	2880	2970	620					1350

3600 by 3000 by 300 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
3600	3000	300	300	300	300	0-0.6	620	1170	770	620	620	620	620	620	
3600	3000	300	300	300	300	0.6-0.9	620	1040	830	620					2040
3600	3000	300	300	300	300	0.9-1.5	620	850	910	620					1680
3600	3000	300	300	300	300	3	740	1230	1340	620					1500
3600	3000	300	300	300	300	4.6	980	1680	1780	620					1350
3600	3000	300	300	300	300	6.1	1210	2140	2250	620					1350
3600	3000	300	300	300	300	7.6	1460	2590	2690	620					1350

3600 by 3600 by 300 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
3600	3600	300	300	300	300	0-0.6	620	1230	870	620	620	620	620	620	
3600	3600	300	300	300	300	0.6-0.9	620	1100	940	620					2370
3600	3600	300	300	300	300	0.9-1.5	620	910	1020	620					2040
3600	3600	300	300	300	300	3	680	1300	1440	620					1860
3600	3600	300	300	300	300	4.6	890	1760	1910	620					1500
3600	3600	300	300	300	300	6.1	1130	2210	2370	620					1500
3600	3600	300	300	300	300	7.6	1340	2670	2820	620					1500

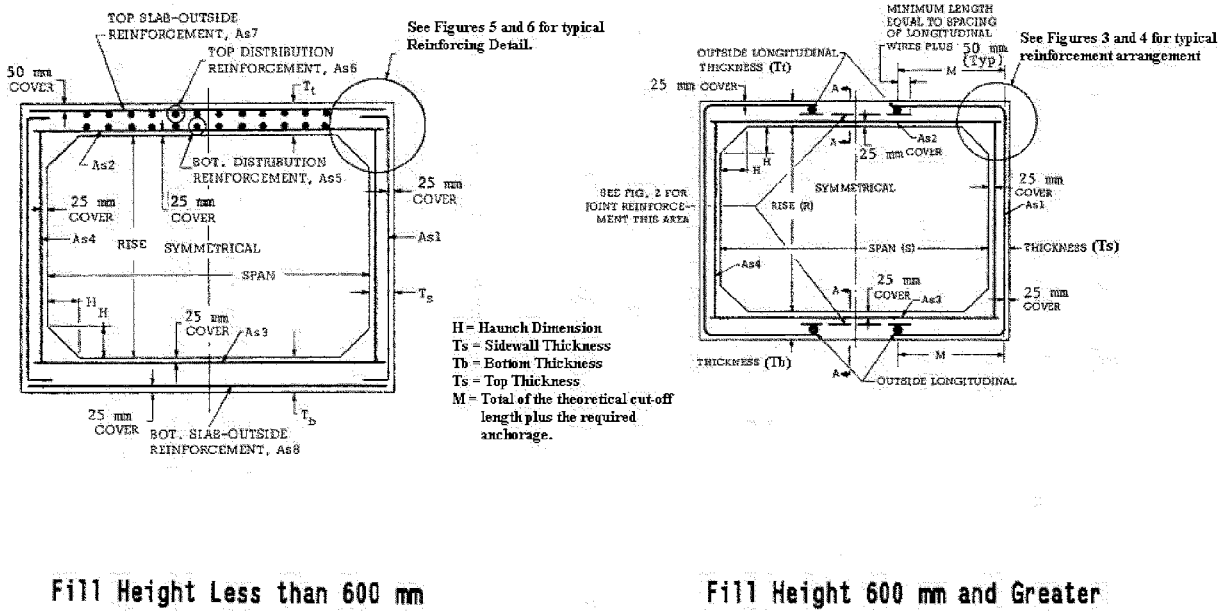

FIG. 1 Typical Box Sections

TABLE 2 Design Requirements for Precast Concrete Box Sections Under Earth Dead and Interstate Live Load Conditions

NOTE 1—Design earth covers and reinforcement areas are based on the weight of a column of earth over the width of the box section as defined in Appendix X1.

NOTE 2—Concrete design strength 35 MPa.

NOTE 3—The design earth cover indicated is the height of fill above the top of the box section. Design requirements are based on the material and soil properties, loading data, and typical section as included in Appendix X1. For alternative or special designs, see 7.2.

NOTE 4—Design steel area in square millimetres per linear metre of box section at those locations which are indicated on the typical section included in Fig. 1.

NOTE 5—The top section designation, for example, 900 by 600 by 100 mm, indicates (interior horizontal span in millimetres) by (interior vertical rise in millimetres) by (wall and slab thickness in millimetres).

NOTE 6—In accordance with the acceptance criteria in 7.2, the manufacturer may interpolate the steel area requirements for fill heights between noted increments or may submit independent designs.

900 by 600 by 100 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
900	600	175	150	100	100	0-0.6	360	810	450	220	410	360	360	300	
900	600	100	100	100	100	0.6-0.9	280	450	450	220					790
900	600	100	100	100	100	0.9-1.5	220	220	220	220					790
900	600	100	100	100	100	3	220	220	220	220					790
900	600	100	100	100	100	4.6	220	300	300	220					790
900	600	100	100	100	100	6.1	240	390	410	220					790
900	600	100	100	100	100	7.6	300	490	490	220					790
900	600	100	100	100	100	9.1	360	580	580	220					790
900	600	100	100	100	100	10.7	430	660	660	220					790

900 by 900 by 100 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
900	900	175	150	100	100	0-0.6	360	850	490	220	430	360	360	300	
900	900	100	100	100	100	0.6-0.9	220	530	530	220					790
900	900	100	100	100	100	0.9-1.5	220	220	240	220					790
900	900	100	100	100	100	3	220	240	260	220					790
900	900	100	100	100	100	4.6	220	320	340	220					790
900	900	100	100	100	100	6.1	220	430	430	220					790
900	900	100	100	100	100	7.6	220	510	530	220					790
900	900	100	100	100	100	9.1	260	620	620	220					790
900	900	100	100	100	100	10.7	300	700	720	220					790

1200 by 600 by 125 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
1200	600	190	150	125	125	0-0.6	390	850	430	260	430	390	390	300	
1200	600	125	125	125	125	0.6-0.9	450	490	430	260					970
1200	600	125	125	125	125	0.9-1.5	260	260	260	260					970
1200	600	125	125	125	125	3	260	260	280	260					970
1200	600	125	125	125	125	4.6	320	390	390	260					970
1200	600	125	125	125	125	6.1	410	490	490	260					970
1200	600	125	125	125	125	7.6	490	600	600	260					970
1200	600	125	125	125	125	9.1	600	700	700	260					970
1200	600	125	125	125	125	10.7	700	810	830	260					970

1200 by 900 by 125 mm

Span mm	Rise mm	Top mm	Bottom mm	Side mm	Haunch mm	Depth m	Circumferential Reinforcement Areas, mm²/m								
							A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	A_{s8}	"M," mm
1200	900	190	150	125	125	0-0.6	390	960	490	260	470	390	390	300	
1200	900	125	125	125	125	0.6-0.9	340	600	530	260					970
1200	900	125	125	125	125	0.9-1.5	260	260	280	260					970
1200	900	125	125	125	125	3	260	300	320	260					970
1200	900	125	125	125	125	4.6	260	430	450	260					970
1200	900	125	125	125	125	6.1	300	550	550	260					970
1200	900	125	125	125	125	7.6	390	680	680	260					970
1200	900	125	125	125	125	9.1	450	810	810	260					970
1200	900	125	125	125	125	10.7	530	940	940	260					970