

CONCRETE CULVERT DESIGN AND DETAILING MANUAL



Ontario

Ministry
of
Transportation

QUALITY AND STANDARDS
TRANSPORTATION ENGINEERING BRANCH
BRIDGE OFFICE
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To all users of the:

**CONCRETE CULVERT DESIGN AND DETAILING
MANUAL**

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CONCRETE CULVERT DESIGN AND DETAILING MANUAL

DIVISION 1 - INTRODUCTION

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1 **INTRODUCTION**

1.1 **GENERAL**

The Concrete Culvert Design and Detailing Manual have been prepared to facilitate the design and detailing of standard rectangular concrete culverts.

1.2 **DIVISIONS**

This Manual is divided up into the following divisions:

Division 1 Introduction

Division 2 Definitions

Division 3 Notation

Division 4 General Information

Division 5 Rigid Frame Open Footing Culverts

Division 6 Rigid Frame Box Culverts

Division 7 Non-Rigid Frame Box Culverts

Division 8 Culvert Details

Division 9 Appendix

1.3 **NUMBERING SYSTEM**

Within each of the above-described divisions, the material is subdivided into sections and subsections. The standard drawings corresponding to the various divisions are numbered independently of the Manual's numbering system.

1.4 **EXISTING HANDBOOK AND DRAWINGS**

This Manual supersedes the 1988 edition of the Concrete Culvert Design and Detailing Manual.

1.5 DISTRIBUTION

Copies of the Manual and revisions may be obtained from:

Ronen Publishing House, Inc.
505 Consumers Road, Suite 910
Toronto, Ontario
M2J 4V8
Tel: 1-800-856-2196
Fax: 1-800-870-7239

1.6 REVISIONS

When additions or revisions are necessary, they will be made available through Ronen Publishing House, Inc., as detailed in Section 1.5. The date shown at top left corner of each page indicates the date of (re)issue.

1.7 STANDARD DRAWINGS

Electronic CAD files containing standard drawings in AutoCAD may be obtained from Ronen Publishing House Inc. The latest revision date will be that available from Ronen House.

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DIVISION 2 - DEFINITIONS

August 2003

2 **DEFINITIONS**

Apron Wall - Also known as a cutoff wall; a vertical non-structural concrete wall built across the full width of the ends of box culverts and extending below the level of the bottom slab.

Bar Mass - The mass of a reinforcing bar per unit length (kg/m).

Bearing Capacity - The maximum load that can be applied to a soil at the respective limit state.

Box Culvert - A culvert in the shape of an enclosed rectangle and consisting of a bottom slab, two wall elements and a top slab.

Culvert Extension - A portion of a culvert built beyond the limits of a previously existing culvert.

Designer - Individual(s) designated by the Structural Engineer to use this manual to design and detail culverts.

Fill Height - The vertical distance from the top of the top slab of a culvert to the riding surface of the roadway above it.

Geotechnical Engineer - A licensed professional engineer designated a specialist in the soils or geotechnical field.

Haunch - The increase in thickness of a culvert's walls or slabs at the corners.

Header Wall - A vertical concrete wall across the full width of the ends of a culvert and extending upwards from the level of the top slab.

Height - For box culverts this is the vertical distance measured from the top of the bottom slab to the bottom of the top slab at mid-span. For open footing culverts this is the vertical distance measured from the level of the top of the footings to the bottom of the top slab at mid-span.

Length - The length of a culvert is the distance between the ends, along the longitudinal axis of the culvert.

Longitudinal Axis - The longitudinal axis of a culvert is located at the geometric centroid of the culvert cross-section and is parallel to the walls of the culvert.

Non-Rigid Frame Culvert - A non-rigid frame culvert is one detailed so that there is no intended transfer of bending moment between wall and slab elements.

Open Footing Culvert - A culvert in the shape of an open rectangle, consisting of two wall elements supported on footings and a top slab. Note that there is no bottom slab.

Retaining Wall - A retaining wall for the purpose of this Manual is an earth retaining structure consisting of a vertical stem element supported by a horizontal footing element and built of reinforced concrete.

Rigid Frame Culvert - A rigid frame culvert is one detailed so that full continuity of bending moment is assured between the wall and slab elements.

Set - A set of longitudinal reinforcing bars refers to the placement of a reinforcing bar in a specific location on a cross-section.

Skew Angle - The skew angle is the angle between the centreline of the highway and a line perpendicular to the longitudinal axis of the culvert.

Skew Number - The skew number is the angle between the centreline of the highway and the longitudinal axis of the culvert, measured clockwise.

Skewed End Culvert - A skewed end culvert is one with ends not at a right angle to the longitudinal axis of the culvert. Usually the ends are built at right angles to the longitudinal axis of the culvert.

Span - The span of a culvert is the minimum horizontal distance measured between the inside faces of the walls.

Standard Culvert - A culvert detailed in accordance with this Manual.

Structural Engineer - A licensed professional engineer of Ontario specializing in structural design.

Strut - A member placed between the footings of an open footing culvert.

Traversable Grate - A safety grating over the open tapered ends of concrete culverts that do not have traffic protection.

CONCRETE CULVERT DESIGN AND DETAILING MANUAL

DIVISION 3 - NOTATION

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3 NOTATION

| | |
|------------------|---|
| A' | the effective contact area of a footing, square metres |
| a | a detailing dimension for culverts with skewed ends, mm |
| B | thickness of the bottom slab of a box culvert, mm |
| b | spacing between adjacent bars as per detailing tables, mm |
| C | a coefficient used in the determination of reinforcing bar quantities. |
| CANBAS | Canadian Bridge Analysis System |
| c' | the effective cohesion between the base of the footing and the soil at the ULS, as per CHBDC. kPa |
| CHBDC | Canadian Highway Bridge Design Code, 2000 Edition |
| CGSB | Canadian General Standards Board |
| F | width of footing for open footing culverts, mm |
| F_1 | a reinforcing bar spacing factor, mm^{-1} |
| H_{ULS} | maximum factored horizontal reaction at the level of the base of the footing at the ULS, kN |
| L_c | culvert length measured along the longitudinal axis, m |
| OCPA | Ontario Concrete Pipe Association |
| OMBAS | Ontario Modular Bridge Analysis System |
| OPSS | Ontario Provincial Standard Specifications |
| S | culvert span measured perpendicular to the longitudinal axis of the culvert, mm |
| SLS | serviceability limit states, as per CHBDC |
| T | thickness of top slab of culvert, mm |

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NOTATION

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| | |
|--------------|--|
| $\tan \phi'$ | effective friction coefficient for concrete cast against soil. |
| ULS | ultimate limit states, as per CHBDC |
| V | unfactored vertical reaction due to the dead load of cast-in-place concrete and soil fill, at the level of the base of the footing, kN |
| V_{SLS} | maximum vertical reaction at the level of the base of the footing at SLS, kN |
| V_{ULS} | maximum factored vertical reaction at the level of the base of the footing at ULS, kN |
| W | thickness of wall of culvert, mm |
| γ | the acute angle between the normal to the longitudinal axis and the end of the same culvert, degrees |
| ϕ' | the effective angle of internal friction, as per CHBDC, degrees |
| θ | skew angle of culvert, degrees |

4 GENERAL INFORMATION

4.1 INTRODUCTION

4.1.1 SCOPE

This Manual contains all data necessary to complete the standard drawings and quantities for concrete box and open footing culverts that fall within the size range of "Standard Concrete Culverts" specified in Sections 4.2.1 and 4.2.2. Data is also provided to permit the detailing of:

- i. Simple retaining walls for use with these culverts.
- ii. Intersecting drains, catch basins and manholes.
- iii. Culverts with skewed ends.

The Manual provides quantities per unit length of culvert but no data is provided for the calculation of extra quantities for footings, apron and header walls or for retaining walls. Concrete quantities are in cubic metres and steel quantities are in kilograms. Provision is made on the drawings for inserting a breakdown of quantities for progress payment purposes. The Designer must compute these quantities.

4.1.2 DESIGN CRITERIA

Design and detailing data contained in this Manual conforms to the requirements of the 2000 edition of the Canadian Highway Bridge Design Code with the exception of the criteria listed in the Appendix. Calculations are based on 30 MPa concrete and grade 400 reinforcing steel.

4.1.3 LIMITATIONS

The following topics are considered to be beyond the scope of this Manual:

- i. Selection of culvert type and size, and all information usually shown on form PH-D-353, or DB-RD-77 or "Design Data Form for Concrete Culverts".
- ii. Culverts with less than 0.6 m fill (require special attention).
- iii. Culverts with skew angle exceeding 25°.

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DIVISION 4 - GENERAL INFORMATION

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- iv. Hydrological considerations and selection of type and extent of end treatment.
- v. Granular backfill requirements.
- vi. Bedding requirements for box culverts.
- vii. Future deepening of municipal drains.
- viii. Precast concrete box culverts (See Appendix D).
- ix. Pipe culverts.

4.2 **STANDARD CONCRETE CULVERTS**

4.2.1 **RIGID FRAME CONCRETE CULVERTS**

Standard rigid frame culverts are rectangular single cell cast-in-place concrete culverts (open footing or box) which conform to the dimensions specified in Table 4-2, have fill heights as specified in Section 4.2.3, and have skew angles not exceeding 25 degrees.

Note that the spans are in increments of 0.5 metres and the heights are in increments of 0.25 and 0.5 metres. Spans and heights which fall between these increments are not standard and should be rounded up to the nearest standard value.

4.2.2 **NON-RIGID FRAME CONCRETE CULVERTS**

Details for smaller box culverts of the non-rigid frame type are included in this package. These culverts comprise the following sizes (in metres):

| <u>Span</u> | | <u>Height</u> |
|-------------|---|---------------|
| 1.25 | x | 1.25 |
| 1.50 | x | 1.25 |
| 1.50 | x | 1.50 |

Concrete culverts with spans less than 1.25 metres or heights less than 1.25 metres are impracticable due to the difficulty in removing interior forms and falsework.

4.2.3 FILL HEIGHTS FOR STANDARD CULVERTS

Rigid frame culverts described in this Manual are designed for fill heights ranging from 0.6 to 6.0 metres. Non-rigid frame culverts are designed for fill heights ranging from 0.6 to 5.0 metres.

Culverts with fill heights between 0.6 and 1.0 metre shall be designed for 0.6 metres of fill. With this exception, all culverts for which the fill height does not correspond to the listed fill heights shall be designed for the next highest listed fill height.

Culverts with less than 0.6 or more than 6.0 metres of fill are not covered by this Manual.

For cast-in-place culverts with less than 0.6 m fill, the use of a distribution slab is not mandatory. However, if no distribution slab is provided, the culvert will have to be structurally designed for the effect of direct wheel load, and the required concrete cover will have to reflect the applicable environmental exposure from Section 8 of the CHBDC.

For precast culverts with less than 0.6 m of fill, a reinforced distribution slab is required to provide an improved live load shear transfer between the units, as well as an enhanced live load distribution.

Detailing tables are provided for each type of culvert, giving all necessary design and detailing information for the listed height of fill.

4.2.4 CULVERT EXTENSIONS

Culvert extensions may be detailed using this Manual provided modifications are made to the standard drawings and to the detailing procedures described in Divisions 5, 6, 7 and 8 and as specified in Section 8.4.4.

4.2.5 SKEWED END CULVERTS

Ends of culverts may be skewed to permit a reduction in total length; for extensions, to accommodate existing skewed end culverts; or to suit geometric constraints or other reasons.

4.2.6 USE OF CULVERT HEADER WALLS

Header walls shall be provided only when one or more of the following criteria apply:

- i. When the culvert has retaining walls, header walls are recommended to allow a further reduction in culvert length. (Note, where recovery distance requirements dictate the culvert length, this further reduction in length may not be desirable).
- ii. When a skewed end culvert has a skew angle greater than 15°.
- iii. When the skew angle of an existing culvert is greater than 15° a header wall may be provided on top of the top slab and below the bottom slab of the extension at the end abutting the existing culvert, as prescribed in Section 8.4.4.

Header wall details are described in Division 8.

4.2.7 USE OF CULVERT APRON WALLS

Apron walls are to be added at the ends of all box culverts and shall be detailed as shown in Division 8.

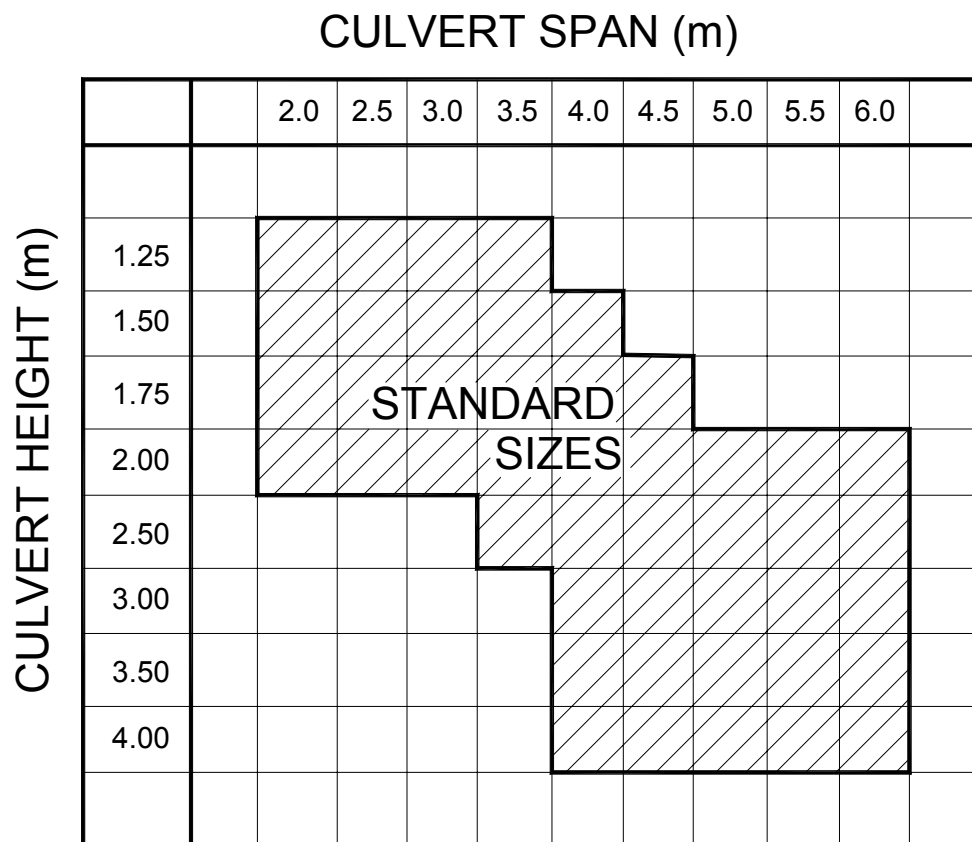
4.2.8 USE OF RETAINING WALLS

Retaining walls may be built at the ends of culverts to reduce the total length of culvert, for hydraulic considerations, or for other reasons. Retaining wall details are described in Division 8.

4.2.9 USE OF TRAVERSABLE SAFETY GRATING

Concrete culverts that have tapered ends that match the slope of the roadway fill, and have no traffic protection around them shall be equipped with the traversable safety grating. Contact the Ministry for the relevant Special Provision and standard drawing on the requirement of such grating. Refer to further details in Section 8.7.

TABLE 4-2
STANDARD RIGID FRAME BOX AND OPEN FOOTING CULVERT SIZES



NOTE: Range of fill heights are 0.6, 1.0, 1.5, 2.0, 2.5, 3.0, 4.0, 5.0 and 6.0 metres.

4.3 **STANDARD DRAWINGS**

The following standard drawings are used for detailing standard culverts:

SS114-1 Rigid Frame Open Footing Culvert.

SS114-2 Rigid Frame Box Culvert.

SS114-3 Non-Rigid Frame Box Culvert.

4.3.1 **PROFESSIONAL ENGINEERS STAMPING**

Standard drawings shall be reviewed together with the corresponding text in the Manual to determine what information, if any, needs to be added to them.

Where information in tables and dimensions are added to standard drawings for their completion, the drawings shall bear the seal, date and signature of a Professional Engineer. This Engineer accepts full responsibility for the accuracy of the added information only.

Where engineering design changes are made on standard drawings that affect the original design, these drawings shall be identified as “Modified” and bear the seals, dates and signatures of two Professional Engineers. These Engineers accept full responsibility for the design that results from these changes.

4.3.2 **INFORMATION TO BE ADDED TO STANDARD DRAWINGS**

When the culvert is without skewed ends, retaining walls, or openings in walls or slabs, all information necessary to complete the drawings is available directly from the detailing tables and from “Design Data Form for Concrete Culverts”.

The following special information must be added to the drawings when a culvert has skewed ends, retaining walls or openings in walls or slabs:

- Plan view of the culvert showing location of applicable features.
- Details of steel arrangement at skewed ends.
- Header wall length and steel arrangement at skewed ends.
- Apron wall length and steel arrangement for box culverts with skewed ends.

- Retaining wall dimensions and reinforcing steel.
- Steel table for retaining walls.
- Details of reinforcement at openings.
- Steel table for such reinforcement.

4.3.3 SCALES FOR ADDED DETAILS

The selection of scales for details to be added to drawings (as specified in Section 4.3.1 above) is important, since the drawings will be reduced for inclusion in the contract documents.

The plan view of the culvert should normally be drawn at 1:50 scale when many additional details are required (e.g. for skewed end culvert with retaining walls).

All details should be drawn to a sufficiently large scale to ensure legibility after reduction to contract size.

4.4 DESIGNATION OF REINFORCING STEEL

The standard notation for designating reinforcing steel bars has been adopted to maintain a degree of uniformity with bridges or other concrete structures that may be included in the same contract as concrete culverts.

The system uses one alphabetical character followed by five numerical characters e.g. P15001.

The alphabetical character indicates the part of the culvert where the bar is located as follows:

- H - transverse bar, outside face, top and bottom slab.
- J - vertical/transverse bar, outside face, walls and slabs, alternating with K bar.
- K - vertical/transverse bar, outside face, walls and slabs, alternating with J bar.
- P - transverse bar, inside face, top slab.
- Q - transverse bar, inside face, bottom slab.

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GENERAL INFORMATION

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- R - longitudinal bar, walls and slabs.
- S - vertical/transverse bar, inside face, bottom haunch (rigid frame box culvert), or,
- S - transverse bar, footing (rigid frame open footing culvert).
- T - vertical bar, inside face, walls
- U - vertical/transverse bar, inside face, top haunch
- V - vertical bar, footing
- W - longitudinal bar, footing
- L - apron wall
- M - apron wall
- Y - header wall
- Z - header wall

The first two numerical characters denote the size of the bar.

e.g. P 15001 is a size 15 bar
Q 20001 is a size 20 bar

The remaining three numerical characters are for use as bar mark numbers so that up to 999 different bars could be used with the same alphabetical character.

The culverts in this book are detailed so that there is generally only one bar type for each alphabetical character with the final three characters 001; however bars in retaining wall systems or around apertures may have several mark numbers.

The character N is used for bars specifically added to reinforce apertures in culvert walls or slabs.

The letters A to G should be used for designating steel for retaining walls.

The letters I, O and X shall not be used for designating reinforcing bars.

4.4.1 REINFORCING STEEL SCHEDULE

Section 12.2.1 of the Structural Manual describes when separate computerized reinforcing steel schedules are required for culverts.

4.5 CONTRACT PREPARATION SYSTEM

Capital construction contract tender documents are produced for the ministry by using the Contract Preparation System (CPS). This is an integrated application facility for the preparation of tender item documents, item quantity sheets, modified and fill-in special provisions, etc., for road design, structural and electrical work.

The designer should be aware of the main tender items and associated specifications shown in Table 4.5 that are to be used, where applicable, in conjunction with concrete culverts.

| OPSS SPEC. No. | CPS ITEM | UNIT |
|-----------------------|---------------------------------|-------------|
| 902 | Earth Excavation for Structure | cubic metre |
| 902 | Rock Excavation for Structure | cubic metre |
| 902 | Unwatering Structure Excavation | lump sum |
| 902 | Clay Seal | lump sum |
| 904 | Concrete in Culverts | cubic metre |
| 905 | Reinforcing Steel Bar | lump sum |
| 314 | Granular B, Type I | tonne |
| 314 | Granular B, Type II | tonne |
| 539 | Roadway Protection | lump sum |
| 539 | Track Protection | lump sum |

TABLE 4.5 – CPS ITEMS FOR CONCRETE CULVERTS

Guidance on estimating quantities and other information on the above tender items may be found in the ministry’s manuals “Contract Design, Estimating and Documentation” (CDED) Volumes I and II.

CONCRETE CULVERT DESIGN AND DETAILING MANUAL

DIVISION 5 - RIGID FRAME OPEN FOOTING CULVERTS

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5 RIGID FRAME OPEN FOOTING CULVERTS

5.1 CULVERT DIMENSIONS AND REINFORCEMENT

Dimensions and detailing information for standard rigid frame open footing culverts is given in Figure 5.1(a). Construction joints indicated are optional and are provided for the contractor's convenience. Note that both the height and width of the haunches are equal to the thickness of the top slab of the culvert. The standard footing depth is shown as 1.2 metres, the minimum for frost protection in Ontario. Culverts to be founded on piles are beyond the scope of this Manual.

Figure 5.1(b) details the layout of the reinforcing steel for standard rigid frame open footing culverts. Table 5-1 identifies the various bar sizes and shapes used for this type of culvert.

The detailing tables at the end of the division should be read in conjunction with Figures 5.1(a) and (b) and Table 5-1.

Details of header walls and retaining walls are provided in Division 8.

The design assumption and parameters, as well as the load cases and combinations, as per CHBDC are summarized in Appendix E (Section 9.5).

FIGURE 5.1(a) RIGID FRAME OPEN FOOTING CULVERT DIMENSIONS

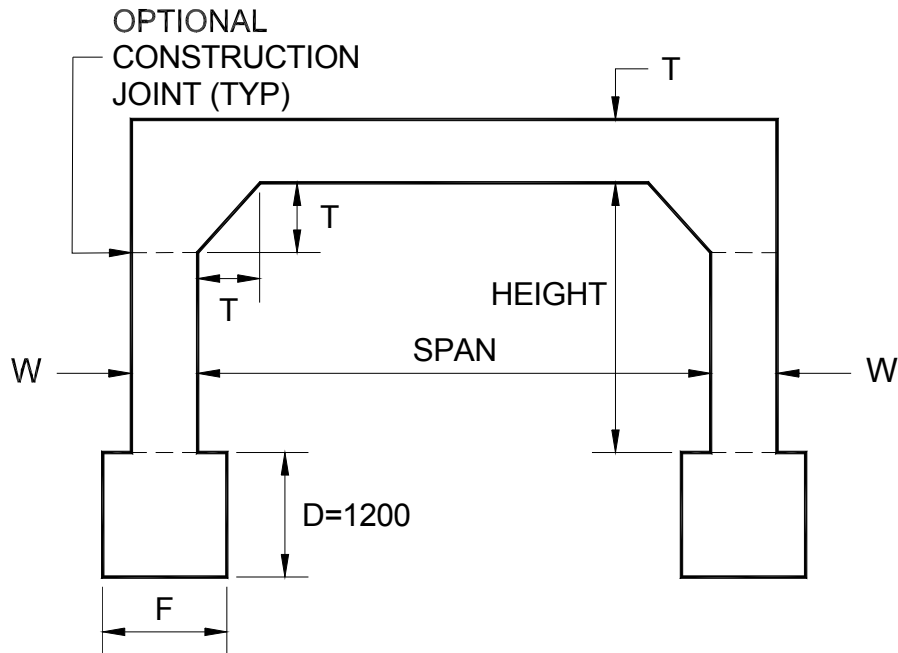
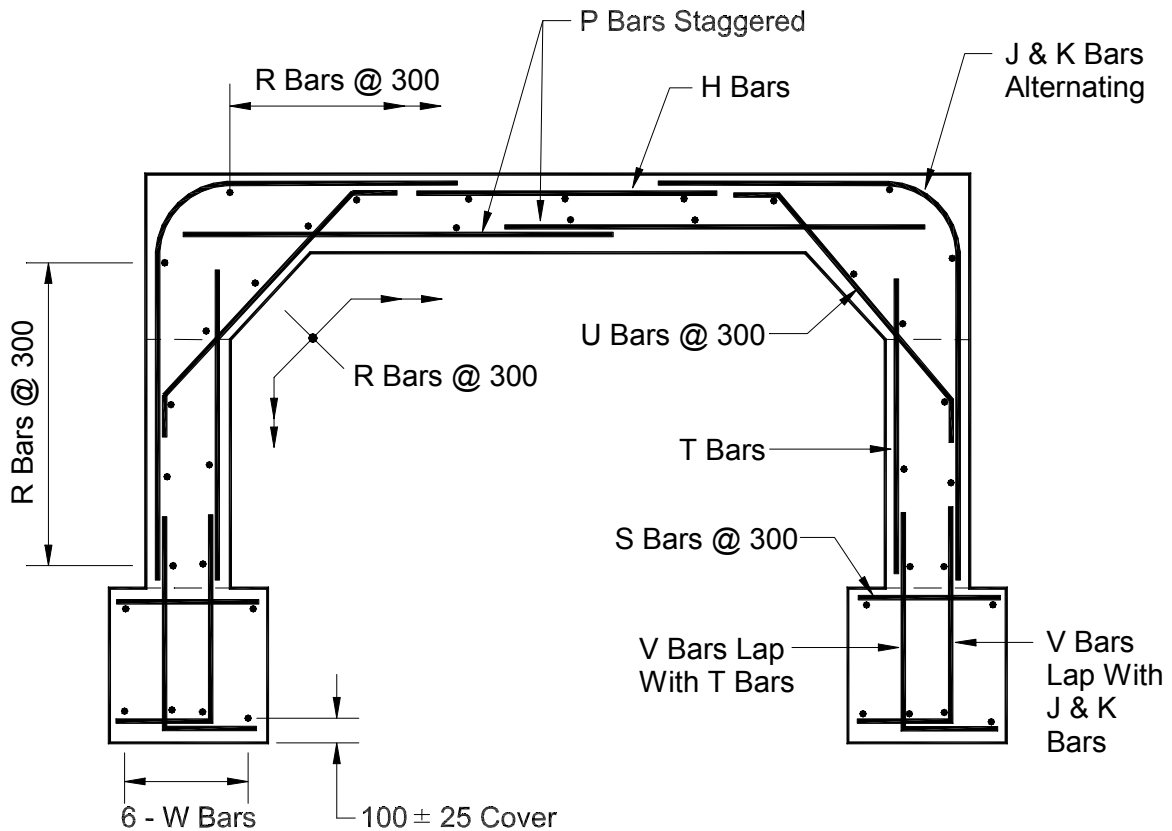


FIGURE 5.1(b) RIGID FRAME OPEN FOOTING CULVERT REINFORCEMENT



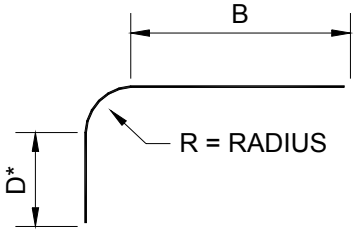
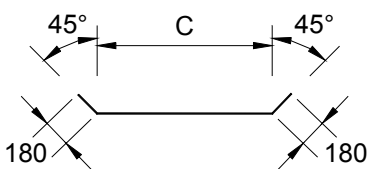
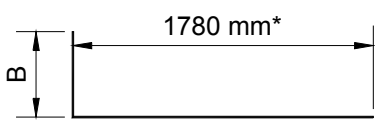
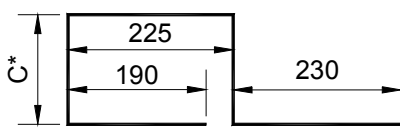
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TABLE 5-1 REINFORCING STEEL IDENTIFICATION

| MARK | DETAILS | REMARKS |
|------------|---|-------------------------------------|
| P BARS | STRAIGHT | BOTTOM OF TOP SLAB STAGGERED |
| H BARS | STRAIGHT | 15M BARS TOP OF TOP SLAB |
| J & K BARS |  | J BARS ALTERNATE WITH K BARS |
| T BARS | STRAIGHT | INSIDE FACE OF WALLS |
| U BARS |  | 15M BARS HAUNCH |
| R BARS | STRAIGHT | 15M BARS LONGITUDINAL |
| V BARS |  | 20M BARS FOOTING DOWELS |
| S BARS | STRAIGHT | 15M BARS TOP OF FOOTING |
| W BARS | STRAIGHT | 20M BARS LONGITUDINAL IN FOOTING |
| Y BARS | STRAIGHT | HEADER WALL |
| Z BARS |  | 15M BARS HEADER WALL |

*NOTE: -All dimensions shown to centreline of bar.
-* represents vertical dimension*

5.2 FOOTING DESIGN

5.2.1 GENERAL INFORMATION

A foundation investigation is generally necessary for culvert design and documentation in the contract for culvert construction purposes. Foundation information such as subsurface conditions, soil strength parameters, settlement limitations, and any dewatering and shoring requirements will be needed. In addition, information will be useful for the contractor to plan his work and as a baseline in the event of any construction disputes. The need and the level of detail required for the foundation investigation shall be determined by the designer and should be based on:

- (a) the complexity and the importance of the culvert, and
- (b) the data currently available for the foundation material.

It is important to realize that the footing width shown on the detailing tables is the minimum width compatible with the wall thickness of the culvert. It does not take into account any geotechnical considerations.

The detailing tables also list four values of footing reactions per metre of culvert: maximum factored vertical reactions at the footing level for the ultimate limit state and serviceability limit state, (V_{ULS} and V_{SLS}); maximum factored horizontal reaction at the footing level for the ultimate limit state (H_{ULS}) and the unfactored vertical reaction due to the dead load of cast-in-place concrete and soil fill at the footing level (V). The maximum vertical reactions are intended for use in calculating the maximum bearing pressures for the relevant limit states. The maximum factored horizontal reaction and unfactored vertical reaction are provided in order that the lateral sliding resistance of the footing can be checked.

If the bearing capacity of the founding soil is not exceeded by using the footing widths shown on the detailing tables and if the lateral sliding stability of the footing has been checked, then the geotechnical considerations are deemed to have been satisfied and the tabulated footing width is adequate.

If the bearing capacities are exceeded or lateral sliding stability is not assured, then the Geotechnical Engineer and the Structural Engineer shall be consulted.

IN ANY CASE, rigid frame open footing culverts should only be used when the foundation conditions are such so as to permit the use of the minimum footing width, or very close to it.

5.2.2 CALCULATION OF BEARING PRESSURE

The maximum applied factored pressure at the ultimate limit state is:

$$\frac{\text{MAXIMUM FACTORED VERTICAL REACTION @ULS, kN}}{\text{FOOTING AREA, square metres}}$$

and must not exceed the factored bearing capacity at the ultimate limit state.

The maximum applied bearing pressure at the serviceability limit state, is:

$$\frac{\text{MAXIMUM VERTICAL REACTION @ SLS, kN}}{\text{FOOTING AREA, square metres}}$$

and must not exceed the bearing capacity at this limit state.

5.2.3 DETERMINATION OF LATERAL SLIDING RESISTANCE

For cast-in-place rigid frame open footing culverts, the designer must check for the possibility of a sliding failure in the soil. The following expression may be used:

$$0.8 A' c' + 0.8 V \tan \phi' \geq H_{ULS}$$

Values of the parameters c' and $\tan \phi'$ for the culvert site can be found in the foundation report or from the Geotechnical Engineer.

For those cases where a check of the lateral sliding stability of the footings is not satisfied, several options are available. Depending on the structure's characteristics and site conditions, one of the following options may be utilized:

- i. The open footing culvert may be replaced with a box culvert or bridge.
- ii. The designer may design and detail reinforced concrete "struts" to be placed at regular intervals along the full length of the culvert and spanning the full distance between its footings.

- iii. Given that it has been determined that the footings will slide, analyze the structure to see how much horizontal movement takes place at the base of the footing. From this, calculate the additional moments induced into the culvert, and provide reinforcement sufficient for the Total moment in each member of the culvert structure.

5.2.4 MODIFICATION OF FOOTING CONCRETE QUANTITIES

The concrete quantities given in the detailing tables are based on the minimum footing dimensions. If the minimum footing width and depth is used, then these quantities are correct. If the footing must be enlarged, then the quantities given in the tables must be adjusted in proportion to the new footing dimensions.

The additional volume of concrete required to construct the four 100 mm lips at the ends of the footings of an open footing culvert must be determined and added to the total volume of footing concrete. This volume must be based on the actual footing dimensions.

5.2.5 MODIFICATION OF FOOTING STEEL QUANTITIES

The steel quantities given in the detailing tables are based on the minimum footing dimensions. If the minimum footing width and depth is used, then these quantities are correct. If the footings are made larger, then the quantities must be increased. In the following expressions, footing dimensions and bar spacing are in millimeters. The resulting quantities are in kilograms per metre of culvert length.

(a) Additional Steel for Widened Footings

The horizontal leg of each V bar must be lengthened by an amount equal to half the increase in footing width. Therefore, the total additional quantity of V type bars for widened footings is:

$$1.570 \times (\text{INCREASE IN FOOTING WIDTH}) \times F_1$$

where,

$$F_1 = \frac{1}{\text{EXTERIOR V BAR SPACING}} + \frac{1}{\text{INTERIOR V BAR SPACING}}$$

The length of the S bar must be increased by an amount equal to the increase in footing width, hence the total additional quantity of S bars is:

$$0.011 \times (\text{INCREASE IN FOOTING WIDTH})$$

(b) Additional Steel for Deepened Footings

When a footing is deepened, the vertical leg of each V bar must be lengthened by an amount equal to the increase in footing depth. In this case the total additional quantity of V type reinforcement for a deepened footing is:

$$3.140 \times (\text{INCREASE IN FOOTING DEPTH}) \times F_1$$

5.3 DETAILING OF OPEN FOOTING CULVERT DRAWINGS

5.3.1 DETAILS FOR STANDARD DRAWINGS

The following is a suggested procedure for completing the drawing for standard rigid frame open footing culverts, SS114-1, with no skewed end, retaining walls or other special features:

- Obtain culvert size, length, and height of fill from "Design Data Form for Concrete Culverts".
- Select appropriate standard drawing for rigid frame open footing culvert.
- Determine from "Design Data Form for Concrete Culverts" whether culvert is an extension or not:

If culvert is an extension, change vertical centreline on left side of section detail 1 to a solid line and label - "END OF EXISTING CULVERT".

Insert length of culvert extension on the horizontal dimension line:

e.g. 16 m EXTN RT
17 m EXTN LT

If culvert is not an extension, label centreline "Centre-Line Highway" and add culvert length each side of Centre-Line Highway.

e.g. 16 m RT
17 m LT

- Select from Division 5 appropriate detailing table for required size of culvert.
- Insert span and height of culvert and dimensions of top slab, haunch and wall on "Typical Culvert Section" detail.
- Determine maximum soil bearing pressure as per Section 5.2.
- Determine footing width required and insert footing dimensions on "Typical Culvert Section" detail. The dimension showing the footing projection may be found from the following expression:

FOOTING WIDTH - WALL THICKNESS

2

- Insert bar size and/or spacing for H, J, K and P bars where required on all details. Note that P bar spacing is at mid-span. Insert spacing for V bars. Insert Y bar size on Detail B.
- Insert bar size and spacing for T bars.
- Insert dimensions on Detail 2 for layout of P bars, noting that smaller dimension is half of the wall thickness and larger dimension is P bar length.
- Add additional P bar at each end of culvert where no header wall is required.
- Add header walls where required as specified in Sections 4.2.6.

WARNING NOTE: a dimension is required on Detail 1 to show the actual distance between any J bar and the adjacent K bar. This is necessary to avoid confusion about the spacing of alternating bars, since the space between adjacent bars is 1/2 of the J spacing.

i.e., if J bar spacing is 300 mm and
K bar spacing is 300 mm

then distance between adjacent bars is 150 mm.

THIS IS AN EXTREMELY IMPORTANT POINT.

- Complete steel bar table for culvert and for header wall.
- Multiply unit quantities by culvert length.
- Calculate modifications to steel and concrete quantities required if actual footing size exceeds minimum footing size and modify unit quantities given.
- Add adjustment to steel quantity for R and W bar laps.

- Add adjustment to footing concrete quantity for 100 mm lip at each end of footings.
- Add header wall quantities where applicable.
- Insert total quantities in "Culvert Quantities" table on standard drawings.
- **The Standard Drawing shall be sealed, dated and signed according to 4.3.1.**

5.3.2 STEEL TABLE FOR CULVERT

Spacing, bar length, and bar bending dimensions are available from the culvert detailing tables located at the end of this division.

Numbers of H, J, K, P, S, T, U and V bars required can be calculated as per Division 8. This procedure considers only one bar per cross-section; therefore for J, K, S, T, U and V bars, numbers given must be multiplied by 2.

Exterior face V bars lap with J bars. For culverts less than or equal to 2 metres high and, if J bar spacing exceeds 400 mm, then exterior face V bars lap with both J and K bars. Interior face V bars lap with T bars.

For R bars the number of sets of bars is available from the detail tables; the number of bars per set and bar length are as given in Division 8.

For W bars the number of sets are always 12 (6 per footing) regardless of the footing width. The bar length and number of bars per set are found as described in Division 8.

5.3.3 STEEL TABLE FOR HEADER WALL

Length and number of Y bars required and number of Z bars required are as given in Division 8.

Modification of these quantities is required for skewed end culverts.

5.3.4 ADJUSTMENT OF CONCRETE QUANTITIES

The additional volume of concrete required for header walls is described in Division 8.

Modification of these quantities is required for skewed end culverts.

5.3.5 QUANTITY TABLE

Complete the quantity table. Concrete and steel quantities should be total quantities for complete length of culvert including header wall, where applicable.

5.4 **DETAILING TABLES**

The following pages contain the detailing tables. These tables list various culvert dimensions; concrete and reinforcing steel quantities, and reinforcing steel detailing information.

All dimensions, spacings and lengths given are in millimetres.

Steel quantities given are in kilograms, per metre length of culvert.

Concrete quantities given are in cubic metres, per metre length of culvert.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 2.00

HEIGHT: 1.25

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------------|----------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| | | DIMENSIONS | W | 210 | 210 | 210 | 210 | 210 | 210 | 210 |
| | T | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 220 | 220 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| QUANTITIES | STEEL | 211.4 | 196.8 | 195.4 | 197.6 | 204.4 | 216.6 | 237.8 | 254.9 | 276.8 |
| | CONC. | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 |
| FOOTING | V ULS | 137.7 | 122.7 | 120.1 | 127.9 | 138.3 | 152.3 | 184.6 | 222.4 | 258 |
| REACTION | V SLS | 86.1 | 82.2 | 85.8 | 94.9 | 105.4 | 117.8 | 144.9 | 175.7 | 204.7 |
| * | H ULS | 46.1 | 46.6 | 50.2 | 54.7 | 59.7 | 65 | 75.8 | 86.9 | 98.1 |
| | V | 46 | 57 | 72 | 86 | 101 | 115 | 145 | 175 | 204 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 300 | 400 | 425 | 425 | 425 | 375 | 300 | 275 | 225 |
| | LENGTH | 2210 | 2210 | 2210 | 2210 | 2210 | 2210 | 2210 | 2220 | 2220 |
| H BARS | C/C | - | - | - | - | - | - | - | - | - |
| | LENGTH | - | - | - | - | - | - | - | - | - |
| J BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 550 | 630 | 630 | 625 | 575 | 525 | 425 | 375 | 325 |
| | LENGTH | 3080 | 2950 | 2890 | 2890 | 2890 | 2890 | 2890 | 2910 | 2910 |
| | B | 1610 | 1480 | 1420 | 1420 | 1420 | 1420 | 1420 | 1420 | 1420 |
| | D | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 |
| | R | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 150 | 150 |
| K BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 550 | 630 | 630 | 625 | 575 | 525 | 425 | 375 | 325 |
| | LENGTH | 2650 | 2520 | 2420 | 2360 | 2310 | 2280 | 2250 | 2260 | 2240 |
| | B | 1180 | 1050 | 950 | 890 | 840 | 810 | 780 | 770 | 750 |
| | D | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 |
| | R | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 150 | 150 |
| U BARS | LENGTH | 910 | 910 | 910 | 910 | 910 | 910 | 910 | 960 | 960 |
| | C | 550 | 550 | 550 | 550 | 550 | 550 | 550 | 600 | 600 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 400 | 425 | 425 | 400 | 375 | 325 | 300 | 275 | 250 |
| | LENGTH | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 |
| R BARS | # SETS | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 |
| V BARS | LENGTH | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 | 2000 | 2000 |
| | B | 215 | 215 | 215 | 215 | 215 | 215 | 215 | 220 | 220 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 2.00
HEIGHT: 1.50

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 230 |
| | T | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 230 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| QUANTITIES | STEEL | 229.1 | 214.5 | 217.6 | 222.9 | 236.6 | 250.2 | 274.4 | 308.4 | 315.1 |
| | CONC. | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.5 |
| FOOTING REACTION * | V ULS | 139.2 | 124.2 | 121.6 | 129.4 | 139.9 | 153.8 | 186.2 | 221.1 | 259.6 |
| | V SLS | 87.4 | 83.4 | 87.1 | 96.2 | 106.7 | 119.1 | 146.2 | 174.7 | 208.6 |
| | H ULS | 53 | 53.8 | 58 | 63.2 | 68.9 | 74.9 | 87.2 | 99.8 | 112.5 |
| | V | 47 | 58 | 73 | 88 | 102 | 117 | 146 | 175 | 208 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 300 | 400 | 450 | 450 | 425 | 400 | 325 | 275 | 250 |
| | LENGTH | 2210 | 2210 | 2210 | 2210 | 2210 | 2210 | 2210 | 2210 | 2230 |
| H BARS | C/C | - | - | - | - | - | - | - | - | - |
| | LENGTH | - | - | - | - | - | - | - | - | - |
| J BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 550 | 625 | 600 | 575 | 500 | 450 | 375 | 300 | 300 |
| | LENGTH | 3370 | 3370 | 3310 | 3210 | 3140 | 3140 | 3140 | 3140 | 3170 |
| | B | 1650 | 1650 | 1590 | 1490 | 1420 | 1420 | 1420 | 1420 | 1420 |
| | D | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| | R | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 160 |
| K BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 550 | 625 | 600 | 575 | 500 | 450 | 375 | 300 | 300 |
| | LENGTH | 3140 | 3140 | 2870 | 2780 | 2710 | 2670 | 2610 | 2580 | 2610 |
| | B | 1420 | 1420 | 1150 | 1060 | 990 | 950 | 890 | 860 | 860 |
| | D | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| | R | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 160 |
| U BARS | LENGTH | 910 | 910 | 910 | 910 | 910 | 910 | 910 | 910 | 1000 |
| | C | 550 | 550 | 550 | 550 | 550 | 550 | 550 | 550 | 640 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 325 | 350 | 325 | 300 | 275 | 250 | 225 | 200 | 200 |
| | LENGTH | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| R BARS | # SETS | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 41 |
| V BARS | LENGTH | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 | 2005 |
| | B | 215 | 215 | 215 | 215 | 215 | 215 | 215 | 215 | 225 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 2.00
HEIGHT: 1.75

| | | FILL HEIGHT | | | | | | | | |
|-------------------------|---------------|-------------------|----------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| | | DIMENSIONS | W | 210 | 210 | 210 | 210 | 210 | 210 | 210 |
| | T | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 220 | 230 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| QUANTITIES | STEEL | 256.4 | 242.9 | 245.1 | 257.9 | 272.1 | 290.9 | 324.4 | 350.8 | 350.6 |
| | CONC. | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.6 | 2.7 |
| FOOTING REACTION | V ULS | 140.7 | 125.8 | 123.2 | 131 | 141.4 | 155.4 | 187.7 | 225.6 | 267.1 |
| | V SLS | 88.7 | 84.7 | 88.3 | 97.5 | 108 | 120.4 | 147.5 | 178.4 | 212.2 |
| | H ULS | 60.2 | 61.4 | 66.1 | 72 | 78.4 | 85 | 98.8 | 112.8 | 127.8 |
| | V | 48 | 60 | 74 | 89 | 103 | 118 | 147 | 178 | 212 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 300 | 400 | 450 | 450 | 450 | 425 | 350 | 300 | 275 |
| | LENGTH | 2210 | 2210 | 2210 | 2210 | 2210 | 2210 | 2210 | 2220 | 2240 |
| H BARS | C/C | - | - | - | - | - | - | - | - | - |
| | LENGTH | - | - | - | - | - | - | - | - | - |
| J BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 |
| | C/C | 500 | 575 | 550 | 500 | 450 | 400 | 325 | 300 | 400 |
| | LENGTH | 3620 | 3620 | 3620 | 3620 | 3610 | 3540 | 3450 | 3430 | 3600 |
| | B | 1650 | 1650 | 1650 | 1650 | 1640 | 1570 | 1480 | 1440 | 1600 |
| | D | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| | R | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 150 | 160 |
| K BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 |
| | C/C | 500 | 575 | 550 | 500 | 450 | 400 | 325 | 300 | 400 |
| | LENGTH | 3390 | 3390 | 3390 | 3390 | 3180 | 3110 | 3020 | 3010 | 2980 |
| | B | 1420 | 1420 | 1420 | 1420 | 1210 | 1140 | 1050 | 1020 | 980 |
| | D | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| | R | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 150 | 160 |
| U BARS | LENGTH | 910 | 910 | 910 | 910 | 910 | 910 | 910 | 960 | 1010 |
| | C | 550 | 550 | 550 | 550 | 550 | 550 | 550 | 600 | 650 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 275 | 275 | 275 | 250 | 225 | 200 | 175 | 150 | 150 |
| | LENGTH | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| R BARS | # SETS | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 45 |
| V BARS | LENGTH | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 | 2000 | 2010 |
| | B | 215 | 215 | 215 | 215 | 215 | 215 | 215 | 220 | 230 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 2.00
HEIGHT: 2.00

| | | FILL HEIGHT | | | | | | | | |
|-------------------------|---------------|-------------------|----------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| | | DIMENSIONS | W | 210 | 210 | 210 | 210 | 210 | 210 | 220 |
| | T | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 220 | 240 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| QUANTITIES | STEEL | 284.9 | 273.9 | 281.9 | 301.1 | 325.6 | 357.9 | 369.2 | 367.9 | 369.9 |
| | CONC. | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.7 | 2.9 |
| FOOTING REACTION | V ULS | 142.3 | 127.3 | 124.7 | 132.5 | 143 | 156.9 | 189.2 | 229.6 | 272.3 |
| | V SLS | 89.9 | 86 | 89.6 | 98.8 | 109.3 | 121.7 | 150.5 | 181.7 | 216.4 |
| | H ULS | 67.9 | 69.3 | 74.6 | 81.1 | 88.1 | 95.5 | 110.5 | 126.9 | 142.5 |
| | V | 49 | 61 | 76 | 90 | 105 | 119 | 149 | 181 | 216 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 325 | 425 | 450 | 450 | 450 | 450 | 375 | 325 | 325 |
| | LENGTH | 2210 | 2210 | 2210 | 2210 | 2210 | 2210 | 2220 | 2230 | 2250 |
| H BARS | C/C | - | - | - | - | - | - | - | - | - |
| | LENGTH | - | - | - | - | - | - | - | - | - |
| J BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 |
| | C/C | 475 | 525 | 475 | 425 | 375 | 325 | 400 | 375 | 375 |
| | LENGTH | 3870 | 3870 | 3870 | 3870 | 3870 | 3870 | 4080 | 4020 | 4050 |
| | B | 1650 | 1650 | 1650 | 1650 | 1650 | 1650 | 1860 | 1780 | 1780 |
| | D | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| | R | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 150 | 170 |
| K BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 |
| | C/C | 475 | 525 | 475 | 425 | 375 | 325 | 400 | 375 | 375 |
| | LENGTH | 3640 | 3640 | 3640 | 3640 | 3640 | 3640 | 3780 | 3410 | 3430 |
| | B | 1420 | 1420 | 1420 | 1420 | 1420 | 1420 | 1560 | 1170 | 1160 |
| | D | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| | R | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 150 | 170 |
| U BARS | LENGTH | 910 | 910 | 910 | 910 | 910 | 910 | 930 | 970 | 1050 |
| | C | 550 | 550 | 550 | 550 | 550 | 550 | 570 | 610 | 690 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 225 | 225 | 225 | 200 | 175 | 150 | 150 | 200 | 200 |
| | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| R BARS | # SETS | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 49 | 49 |
| V BARS | LENGTH | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 | 2000 | 2005 | 2015 |
| | B | 215 | 215 | 215 | 215 | 215 | 215 | 220 | 225 | 235 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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RIGID FRAME OPEN FOOTING CULVERTS

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 2.50

HEIGHT: 1.25

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 220 | 240 |
| | T | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 220 | 250 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| QUANTITIES | STEEL | 255.9 | 229.8 | 229.4 | 233.4 | 241.8 | 258.3 | 280.4 | 279.5 | 288.9 |
| | CONC. | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.5 | 2.6 |
| FOOTING REACTION * | V ULS | 162.7 | 139 | 141.7 | 150.9 | 164.3 | 180.6 | 219.6 | 264.2 | 314.2 |
| | V SLS | 101.1 | 93.3 | 100.8 | 111.7 | 124.8 | 139.5 | 172.7 | 208.8 | 249.2 |
| | H ULS | 46 | 46 | 49 | 53 | 57.5 | 62.2 | 72 | 81.9 | 92 |
| | V | 51 | 65 | 82 | 100 | 117 | 135 | 170 | 207 | 247 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 200 | 275 | 275 | 275 | 250 | 225 | 200 | 175 | 150 |
| | LENGTH | 2710 | 2710 | 2710 | 2710 | 2710 | 2710 | 2710 | 2720 | 2740 |
| H BARS | C/C | - | - | - | 425 | 400 | 350 | 300 | 400 | 375 |
| | LENGTH | - | - | - | 1540 | 1560 | 1580 | 1600 | 1160 | 1320 |
| J BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 375 | 450 | 450 | 425 | 400 | 350 | 300 | 400 | 375 |
| | LENGTH | 3140 | 3140 | 3140 | 2400 | 2390 | 2380 | 2380 | 2610 | 2560 |
| | B | 1670 | 1670 | 1670 | 930 | 920 | 910 | 890 | 1110 | 1030 |
| | D | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 |
| | R | 140 | 140 | 140 | 140 | 140 | 140 | 150 | 160 | 180 |
| K BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 375 | 450 | 450 | 425 | 400 | 350 | 300 | 400 | 375 |
| | LENGTH | 2460 | 2390 | 2330 | 1970 | 1950 | 1940 | 1960 | 1990 | 1960 |
| | B | 990 | 920 | 860 | 500 | 480 | 470 | 470 | 490 | 430 |
| | D | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 |
| | R | 140 | 140 | 140 | 140 | 140 | 140 | 150 | 160 | 180 |
| U BARS | LENGTH | 910 | 910 | 910 | 910 | 910 | 910 | 940 | 980 | 1070 |
| | C | 550 | 550 | 550 | 550 | 550 | 550 | 580 | 620 | 710 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 400 | 450 | 450 | 425 | 400 | 375 | 350 | 325 | 350 |
| | LENGTH | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 |
| R BARS | # SETS | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 42 | 42 |
| V BARS | LENGTH | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 | 2000 | 2010 |
| | B | 215 | 215 | 215 | 215 | 215 | 215 | 215 | 220 | 230 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

CONCRETE CULVERT DESIGN AND DETAILING MANUAL

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RIGID FRAME OPEN FOOTING CULVERTS

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 2.50

HEIGHT: 1.50

| | | FILL HEIGHT | | | | | | | | |
|---------------------------|---------------|-------------------|----------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| | | DIMENSIONS | W | 210 | 210 | 210 | 210 | 210 | 210 | 210 |
| | T | 210 | 210 | 210 | 210 | 210 | 210 | 220 | 240 | 260 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| QUANTITIES | STEEL | 274.4 | 247.9 | 247.2 | 254.9 | 271.6 | 283.1 | 299.0 | 305.8 | 308.0 |
| | CONC. | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.7 | 2.8 |
| FOOTING REACTION * | V ULS | 164.2 | 140.5 | 143.2 | 152.5 | 165.8 | 182.2 | 221.8 | 268.8 | 319.3 |
| | V SLS | 102.4 | 94.6 | 102.1 | 113 | 126.1 | 140.7 | 174 | 212.6 | 253.4 |
| | H ULS | 53.2 | 53.5 | 57.2 | 62 | 67.3 | 72.8 | 84 | 95.8 | 107.6 |
| | V | 52 | 66 | 83 | 101 | 119 | 136 | 171 | 211 | 251 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 200 | 275 | 275 | 275 | 250 | 225 | 200 | 175 | 175 |
| | LENGTH | 2710 | 2710 | 2710 | 2710 | 2710 | 2710 | 2710 | 2730 | 2750 |
| H BARS | C/C | - | - | - | - | - | 350 | 400 | 400 | 400 |
| | LENGTH | - | - | - | - | - | 1300 | 900 | 1100 | 1120 |
| J BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 |
| | C/C | 375 | 450 | 450 | 425 | 375 | 350 | 400 | 400 | 400 |
| | LENGTH | 3390 | 3390 | 3390 | 3390 | 3390 | 2770 | 2980 | 2910 | 2930 |
| | B | 1670 | 1670 | 1670 | 1670 | 1670 | 1050 | 1240 | 1140 | 1130 |
| | D | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| | R | 140 | 140 | 140 | 140 | 140 | 140 | 150 | 170 | 190 |
| K BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 |
| | C/C | 375 | 450 | 450 | 425 | 375 | 350 | 400 | 400 | 400 |
| | LENGTH | 2830 | 2750 | 2660 | 2610 | 2570 | 2340 | 2370 | 2290 | 2330 |
| | B | 1110 | 1030 | 940 | 890 | 850 | 620 | 630 | 520 | 530 |
| | D | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| | R | 140 | 140 | 140 | 140 | 140 | 140 | 150 | 170 | 190 |
| U BARS | LENGTH | 910 | 910 | 910 | 910 | 910 | 910 | 940 | 1030 | 1110 |
| | C | 550 | 550 | 550 | 550 | 550 | 550 | 580 | 670 | 750 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 325 | 350 | 350 | 325 | 300 | 275 | 250 | 250 | 250 |
| | LENGTH | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| R BARS | # SETS | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 44 | 44 |
| V BARS | LENGTH | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 | 2005 | 2015 |
| | B | 215 | 215 | 215 | 215 | 215 | 215 | 215 | 225 | 235 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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RIGID FRAME OPEN FOOTING CULVERTS

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 2.50
HEIGHT: 1.75

| | | FILL HEIGHT | | | | | | | | |
|---------------------------|---------------|-------------------|----------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| | | DIMENSIONS | W | 210 | 210 | 210 | 210 | 210 | 220 | 220 |
| | T | 210 | 210 | 210 | 210 | 210 | 210 | 230 | 250 | 270 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| QUANTITIES | STEEL | 302.9 | 277.8 | 276.9 | 287.6 | 308.0 | 326.4 | 342.8 | 342.0 | 344.2 |
| | CONC. | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.7 | 2.8 | 3.0 |
| FOOTING REACTION * | V ULS | 165.8 | 142 | 144.8 | 154 | 167.4 | 185.5 | 225.4 | 272.9 | 323.8 |
| | V SLS | 103.6 | 95.9 | 103.3 | 114.3 | 127.3 | 143.5 | 177.5 | 216.5 | 257.7 |
| | H ULS | 60.7 | 61.4 | 65.7 | 71.2 | 77.3 | 84 | 96.6 | 110 | 123.5 |
| | V | 53 | 67 | 85 | 102 | 120 | 138 | 174 | 213 | 254 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 200 | 275 | 275 | 275 | 275 | 250 | 225 | 200 | 200 |
| | LENGTH | 2710 | 2710 | 2710 | 2710 | 2710 | 2720 | 2720 | 2740 | 2760 |
| H BARS | C/C | - | - | - | - | - | - | - | - | - |
| | LENGTH | - | - | - | - | - | - | - | - | - |
| J BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 375 | 425 | 425 | 400 | 350 | 325 | 300 | 400 | 400 |
| | LENGTH | 3690 | 3640 | 3640 | 3640 | 3640 | 3640 | 3670 | 3840 | 3870 |
| | B | 1720 | 1670 | 1670 | 1670 | 1670 | 1670 | 1670 | 1810 | 1810 |
| | D | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| | R | 140 | 140 | 140 | 140 | 140 | 140 | 160 | 180 | 200 |
| K BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 375 | 425 | 425 | 400 | 350 | 325 | 300 | 400 | 400 |
| | LENGTH | 3260 | 3150 | 3030 | 2960 | 2920 | 2860 | 2900 | 2930 | 2970 |
| | B | 1290 | 1180 | 1060 | 990 | 950 | 890 | 900 | 900 | 910 |
| | D | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| | R | 140 | 140 | 140 | 140 | 140 | 140 | 160 | 180 | 200 |
| U BARS | LENGTH | 910 | 910 | 910 | 910 | 910 | 930 | 980 | 1070 | 1150 |
| | C | 550 | 550 | 550 | 550 | 550 | 570 | 620 | 710 | 790 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 250 | 275 | 275 | 250 | 225 | 200 | 200 | 200 | 200 |
| | LENGTH | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| R BARS | # SETS | 46 | 46 | 46 | 46 | 46 | 46 | 48 | 48 | 48 |
| V BARS | LENGTH | 1995 | 1995 | 1995 | 1995 | 1995 | 2000 | 2000 | 2010 | 2020 |
| | B | 215 | 215 | 215 | 215 | 215 | 220 | 220 | 230 | 240 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 2.50
HEIGHT: 2.00

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 210 | 210 | 210 | 210 | 210 | 210 | 230 | 250 | 280 |
| | T | 210 | 210 | 210 | 210 | 210 | 210 | 230 | 260 | 280 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| QUANTITIES | STEEL | 345.3 | 312.4 | 308.5 | 331.4 | 352.3 | 364.0 | 366.4 | 366.3 | 380.6 |
| | CONC. | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.9 | 3.0 | 3.3 |
| FOOTING REACTION * | V ULS | 167.3 | 143.6 | 146.3 | 155.6 | 168.9 | 185.3 | 229.9 | 277.8 | 332.7 |
| | V SLS | 104.9 | 97.2 | 104.6 | 115.6 | 128.6 | 143.3 | 180.6 | 220.5 | 264.3 |
| | H ULS | 68.6 | 69.6 | 74.5 | 80.7 | 87.5 | 94.5 | 109.2 | 124.1 | 139.1 |
| | V | 54 | 68 | 86 | 103 | 121 | 138 | 178 | 217 | 261 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 200 | 275 | 300 | 300 | 275 | 250 | 225 | 225 | 200 |
| | LENGTH | 2710 | 2710 | 2710 | 2710 | 2710 | 2710 | 2730 | 2750 | 2780 |
| H BARS | C/C | - | - | - | - | - | - | - | - | - |
| | LENGTH | - | - | - | - | - | - | - | - | - |
| J BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 |
| | C/C | 350 | 400 | 400 | 350 | 325 | 300 | 400 | 400 | 375 |
| | LENGTH | 4120 | 4050 | 3890 | 3890 | 3890 | 3890 | 4060 | 4110 | 4140 |
| | B | 1900 | 1830 | 1670 | 1670 | 1670 | 1670 | 1810 | 1810 | 1810 |
| | D | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| | R | 140 | 140 | 140 | 140 | 140 | 140 | 160 | 190 | 210 |
| K BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 |
| | C/C | 350 | 400 | 400 | 350 | 325 | 300 | 400 | 400 | 375 |
| | LENGTH | 3890 | 3620 | 3450 | 3360 | 3290 | 3250 | 3260 | 3310 | 3350 |
| | B | 1670 | 1400 | 1230 | 1140 | 1070 | 1030 | 1010 | 1010 | 1020 |
| | D | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| | R | 140 | 140 | 140 | 140 | 140 | 140 | 160 | 190 | 210 |
| U BARS | LENGTH | 910 | 910 | 910 | 910 | 910 | 910 | 1000 | 1110 | 1210 |
| | C | 550 | 550 | 550 | 550 | 550 | 550 | 640 | 750 | 850 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 200 | 225 | 225 | 200 | 175 | 175 | 175 | 175 | 175 |
| | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| R BARS | # SETS | 50 | 50 | 50 | 50 | 50 | 50 | 52 | 50 | 50 |
| V BARS | LENGTH | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 | 2005 | 2015 | 2030 |
| | B | 215 | 215 | 215 | 215 | 215 | 215 | 225 | 235 | 250 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 3.00
HEIGHT: 1.25

| | | FILL HEIGHT | | | | | | | | |
|---------------------------|---------------|-------------------|----------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| | | DIMENSIONS | W | 210 | 210 | 210 | 210 | 210 | 220 | 220 |
| | T | 220 | 210 | 210 | 210 | 210 | 220 | 240 | 260 | 290 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| QUANTITIES | STEEL | 293.1 | 275.5 | 274.0 | 282.9 | 273.9 | 290.2 | 319.7 | 326.0 | 324.5 |
| | CONC. | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.6 | 2.6 | 2.7 | 3.0 |
| FOOTING REACTION * | V ULS | 185.7 | 155.5 | 162.5 | 173.7 | 189.8 | 212.2 | 258.1 | 311 | 371.8 |
| | V SLS | 115.2 | 104.7 | 115.4 | 128.3 | 143.9 | 163.4 | 202.3 | 245.6 | 294.9 |
| | H ULS | 45.2 | 44.7 | 46.9 | 50.2 | 54 | 57.9 | 66.5 | 75.3 | 83.8 |
| | V | 56 | 72 | 93 | 113 | 134 | 156 | 197 | 241 | 291 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 150 | 200 | 200 | 200 | 175 | 175 | 150 | 200 | 175 |
| | LENGTH | 3210 | 3210 | 3210 | 3210 | 3210 | 3220 | 3220 | 3230 | 3260 |
| H BARS | C/C | - | 325 | 325 | 300 | 400 | 350 | 300 | 300 | 325 |
| | LENGTH | - | 1620 | 2000 | 2040 | 1760 | 1780 | 1760 | 1740 | 1760 |
| J BARS | SIZE | 20 | 15 | 15 | 15 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 400 | 325 | 325 | 300 | 400 | 350 | 300 | 300 | 325 |
| | LENGTH | 3550 | 2610 | 2420 | 2400 | 2540 | 2550 | 2570 | 2600 | 2640 |
| | B | 2060 | 1140 | 950 | 930 | 1070 | 1060 | 1050 | 1050 | 1040 |
| | D | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 |
| | R | 150 | 140 | 140 | 140 | 140 | 150 | 170 | 190 | 220 |
| K BARS | SIZE | 20 | 15 | 15 | 15 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 400 | 325 | 325 | 300 | 400 | 350 | 300 | 300 | 325 |
| | LENGTH | 2550 | 2150 | 1990 | 1970 | 1920 | 1930 | 1960 | 2000 | 2080 |
| | B | 1060 | 680 | 520 | 500 | 450 | 440 | 440 | 450 | 480 |
| | D | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 |
| | R | 150 | 140 | 140 | 140 | 140 | 150 | 170 | 190 | 220 |
| U BARS | LENGTH | 940 | 910 | 910 | 910 | 910 | 960 | 1010 | 1080 | 1210 |
| | C | 580 | 550 | 550 | 550 | 550 | 600 | 650 | 720 | 850 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 425 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 |
| | LENGTH | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 |
| R BARS | # SETS | 43 | 43 | 43 | 43 | 43 | 43 | 45 | 45 | 45 |
| V BARS | LENGTH | 1995 | 1995 | 1995 | 1995 | 1995 | 2000 | 2000 | 2005 | 2020 |
| | B | 215 | 215 | 215 | 215 | 215 | 220 | 220 | 225 | 240 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 3.00

HEIGHT: 1.50

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| | | | | | | | | | | |
| DIMENSIONS | W | 210 | 210 | 210 | 210 | 210 | 210 | 220 | 240 | 270 |
| | T | 230 | 210 | 210 | 210 | 210 | 220 | 250 | 270 | 290 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| QUANTITIES | STEEL | 313.9 | 294.3 | 290.3 | 302.3 | 295.1 | 306.4 | 334.0 | 337.7 | 338.3 |
| | CONC. | 2.7 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.8 | 2.9 | 3.1 |
| FOOTING REACTION * | V ULS | 187.3 | 157.1 | 164 | 175.2 | 191.4 | 212.1 | 259.7 | 315.8 | 376.3 |
| | V SLS | 117 | 105.9 | 116.7 | 129.6 | 145.2 | 163.4 | 204.3 | 249.5 | 298.6 |
| | H ULS | 52.5 | 52.6 | 55.6 | 59.8 | 64.4 | 69.3 | 79.6 | 90 | 100.5 |
| | V | 58 | 73 | 94 | 114 | 135 | 155 | 200 | 245 | 293 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 175 | 200 | 200 | 200 | 175 | 175 | 150 | 200 | 200 |
| | LENGTH | 3210 | 3210 | 3210 | 3210 | 3210 | 3210 | 3220 | 3240 | 3270 |
| H BARS | C/C | - | - | 325 | 300 | 400 | 375 | 325 | 325 | 325 |
| | LENGTH | - | - | 1920 | 1980 | 1580 | 1560 | 1700 | 1700 | 1740 |
| J BARS | SIZE | 20 | 15 | 15 | 15 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 400 | 325 | 325 | 300 | 400 | 375 | 325 | 325 | 325 |
| | LENGTH | 3810 | 3640 | 2710 | 2680 | 2880 | 2900 | 2850 | 2880 | 2910 |
| | B | 2060 | 1920 | 990 | 960 | 1160 | 1160 | 1070 | 1070 | 1060 |
| | D | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| | R | 160 | 140 | 140 | 140 | 140 | 150 | 180 | 200 | 220 |
| K BARS | SIZE | 20 | 15 | 15 | 15 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 400 | 325 | 325 | 300 | 400 | 375 | 325 | 325 | 325 |
| | LENGTH | 2880 | 2720 | 2280 | 2250 | 2270 | 2280 | 2250 | 2290 | 2340 |
| | B | 1130 | 1000 | 560 | 530 | 550 | 540 | 470 | 480 | 490 |
| | D | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| | R | 160 | 140 | 140 | 140 | 140 | 150 | 180 | 200 | 220 |
| U BARS | LENGTH | 970 | 910 | 910 | 910 | 910 | 940 | 1040 | 1130 | 1220 |
| | C | 610 | 550 | 550 | 550 | 550 | 580 | 680 | 770 | 860 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 325 | 375 | 375 | 350 | 350 | 325 | 325 | 350 | 375 |
| | LENGTH | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| R BARS | # SETS | 47 | 45 | 45 | 45 | 45 | 45 | 47 | 47 | 47 |
| V BARS | LENGTH | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 | 2000 | 2010 | 2025 |
| | B | 215 | 215 | 215 | 215 | 215 | 215 | 220 | 230 | 245 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 3.00

HEIGHT: 1.75

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| | | | | | | | | | | |
| DIMENSIONS | W | 210 | 210 | 210 | 210 | 210 | 210 | 230 | 260 | 280 |
| | T | 230 | 210 | 210 | 210 | 220 | 230 | 250 | 280 | 300 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| QUANTITIES | STEEL | 342.9 | 326.3 | 321.9 | 329.3 | 332.2 | 348.6 | 355.7 | 350.9 | 359.3 |
| | CONC. | 2.8 | 2.7 | 2.7 | 2.7 | 2.7 | 2.8 | 2.9 | 3.2 | 3.3 |
| FOOTING REACTION * | V ULS | 188.8 | 158.6 | 165.6 | 176.8 | 192.9 | 213.6 | 264.2 | 323 | 381.8 |
| | V SLS | 118.3 | 107.2 | 117.9 | 130.9 | 147 | 165.3 | 207.3 | 255.5 | 303.1 |
| | H ULS | 60.2 | 60.8 | 64.5 | 69.5 | 75 | 80.6 | 92.5 | 104.8 | 117.1 |
| | V | 59 | 74 | 95 | 116 | 136 | 158 | 202 | 251 | 297 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 |
| | C/C | 150 | 175 | 200 | 200 | 200 | 175 | 150 | 150 | 200 |
| | LENGTH | 3210 | 3210 | 3210 | 3210 | 3210 | 3210 | 3230 | 3260 | 3280 |
| H BARS | C/C | - | - | - | 300 | 375 | 350 | 350 | 350 | 350 |
| | LENGTH | - | - | - | 1580 | 1480 | 1480 | 1500 | 1520 | 1540 |
| J BARS | SIZE | 20 | 15 | 15 | 15 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 400 | 325 | 325 | 300 | 375 | 350 | 350 | 350 | 350 |
| | LENGTH | 4060 | 3890 | 3890 | 3130 | 3190 | 3190 | 3210 | 3250 | 3270 |
| | B | 2060 | 1920 | 1920 | 1160 | 1200 | 1190 | 1180 | 1170 | 1160 |
| | D | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| | R | 160 | 140 | 140 | 140 | 150 | 160 | 180 | 210 | 230 |
| K BARS | SIZE | 20 | 15 | 15 | 15 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 400 | 325 | 325 | 300 | 375 | 350 | 350 | 350 | 350 |
| | LENGTH | 3240 | 3050 | 2970 | 2660 | 2570 | 2580 | 2610 | 2670 | 2720 |
| | B | 1240 | 1080 | 1000 | 690 | 580 | 580 | 580 | 590 | 610 |
| | D | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| | R | 160 | 140 | 140 | 140 | 150 | 160 | 180 | 210 | 230 |
| U BARS | LENGTH | 970 | 910 | 910 | 910 | 940 | 970 | 1050 | 1180 | 1270 |
| | C | 610 | 550 | 550 | 550 | 580 | 610 | 690 | 820 | 910 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 275 | 275 | 275 | 275 | 250 | 250 | 250 | 275 | 275 |
| | LENGTH | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| R BARS | # SETS | 51 | 49 | 49 | 49 | 49 | 51 | 51 | 49 | 50 |
| V BARS | LENGTH | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 | 2005 | 2020 | 2030 |
| | B | 215 | 215 | 215 | 215 | 215 | 215 | 225 | 240 | 250 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 3.00
HEIGHT: 2.00

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 210 | 210 | 210 | 210 | 210 | 210 | 250 | 270 | 290 |
| | T | 240 | 210 | 210 | 210 | 220 | 230 | 260 | 280 | 310 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| QUANTITIES | STEEL | 374.7 | 364.9 | 360.3 | 364.2 | 377.5 | 414.6 | 365.3 | 380.6 | 390.0 |
| | CONC. | 2.9 | 2.8 | 2.8 | 2.8 | 2.8 | 2.9 | 3.2 | 3.3 | 3.6 |
| FOOTING REACTION * | V ULS | 191 | 160.2 | 167.1 | 178.3 | 195.1 | 215.9 | 268 | 327.4 | 387.4 |
| | V SLS | 120.2 | 108.5 | 119.2 | 132.2 | 148.3 | 166.6 | 212.9 | 259 | 307.7 |
| | H ULS | 67.7 | 69.2 | 73.7 | 79.4 | 85.4 | 91.7 | 105.8 | 119.8 | 133.6 |
| | V | 61 | 76 | 96 | 117 | 137 | 159 | 208 | 253 | 302 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 |
| | C/C | 150 | 175 | 200 | 200 | 175 | 175 | 175 | 150 | 200 |
| | LENGTH | 3210 | 3210 | 3210 | 3210 | 3210 | 3210 | 3250 | 3270 | 3290 |
| H BARS | C/C | - | - | - | - | - | - | 375 | 350 | 350 |
| | LENGTH | - | - | - | - | - | - | 1260 | 1500 | 1480 |
| J BARS | SIZE | 20 | 15 | 15 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 400 | 300 | 300 | 400 | 375 | 325 | 375 | 350 | 350 |
| | LENGTH | 4370 | 4140 | 4140 | 4280 | 4300 | 4310 | 3610 | 3520 | 3570 |
| | B | 2100 | 1920 | 1920 | 2060 | 2060 | 2060 | 1310 | 1190 | 1190 |
| | D | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| | R | 170 | 140 | 140 | 140 | 150 | 160 | 190 | 210 | 240 |
| K BARS | SIZE | 20 | 15 | 15 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 400 | 300 | 300 | 400 | 375 | 325 | 375 | 350 | 350 |
| | LENGTH | 3750 | 3410 | 3310 | 3270 | 3270 | 3270 | 3020 | 2950 | 3030 |
| | B | 1480 | 1190 | 1090 | 1050 | 1030 | 1020 | 720 | 620 | 650 |
| | D | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| | R | 170 | 140 | 140 | 140 | 150 | 160 | 190 | 210 | 240 |
| U BARS | LENGTH | 1000 | 910 | 910 | 910 | 940 | 970 | 1110 | 1200 | 1310 |
| | C | 640 | 550 | 550 | 550 | 580 | 610 | 750 | 840 | 950 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 225 | 225 | 225 | 200 | 200 | 175 | 225 | 225 | 225 |
| | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| R BARS | # SETS | 55 | 53 | 53 | 53 | 53 | 55 | 53 | 53 | 54 |
| V BARS | LENGTH | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 | 2015 | 2025 | 2035 |
| | B | 215 | 215 | 215 | 215 | 215 | 215 | 235 | 245 | 255 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 3.50

HEIGHT: 1.25

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 210 | 210 | 220 | 220 | 220 | 220 | 220 | 260 | 290 |
| | T | 240 | 220 | 220 | 230 | 230 | 240 | 270 | 300 | 330 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| QUANTITIES | STEEL | 344.6 | 311.2 | 296.1 | 307.7 | 322.6 | 339.2 | 348.9 | 336.1 | 353.4 |
| | CONC. | 2.7 | 2.6 | 2.7 | 2.7 | 2.7 | 2.8 | 2.9 | 3.1 | 3.4 |
| FOOTING REACTION * | V ULS | 207.4 | 172.6 | 181.3 | 199.1 | 218.3 | 242.5 | 294.8 | 359.8 | 431.8 |
| | V SLS | 128.8 | 116.5 | 129.4 | 147.6 | 165.4 | 186.6 | 231.7 | 286.8 | 343.2 |
| | H ULS | 43.7 | 42.8 | 44.1 | 46.5 | 49.5 | 52.9 | 60.3 | 66.9 | 72.7 |
| | V | 62 | 80 | 105 | 128 | 152 | 177 | 225 | 280 | 336 |
| P BARS | SIZE | 20 | 15 | 15 | 15 | 15 | 20 | 20 | 20 | 20 |
| | C/C | 200 | 150 | 175 | 175 | 150 | 200 | 175 | 175 | 175 |
| | LENGTH | 3710 | 3710 | 3720 | 3720 | 3720 | 3720 | 3720 | 3760 | 3790 |
| H BARS | C/C | - | 350 | 375 | 350 | 325 | 300 | 400 | 450 | 425 |
| | LENGTH | - | 1940 | 2140 | 2160 | 2200 | 2200 | 1740 | 1800 | 1780 |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 |
| | C/C | 325 | 350 | 375 | 350 | 325 | 300 | 400 | 450 | 425 |
| | LENGTH | 3830 | 2710 | 2620 | 2610 | 2590 | 2600 | 2840 | 2870 | 2930 |
| | B | 2310 | 1220 | 1130 | 1110 | 1090 | 1080 | 1280 | 1260 | 1270 |
| | D | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 |
| | R | 170 | 150 | 150 | 160 | 160 | 170 | 200 | 230 | 260 |
| K BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 |
| | C/C | 325 | 350 | 375 | 350 | 325 | 300 | 400 | 450 | 425 |
| | LENGTH | 2660 | 2100 | 2000 | 1990 | 1980 | 1980 | 2070 | 2100 | 2190 |
| | B | 1140 | 610 | 510 | 490 | 480 | 460 | 510 | 490 | 530 |
| | D | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 |
| | R | 170 | 150 | 150 | 160 | 160 | 170 | 200 | 230 | 260 |
| U BARS | LENGTH | 1000 | 940 | 960 | 980 | 980 | 1010 | 1100 | 1240 | 1370 |
| | C | 640 | 580 | 600 | 620 | 620 | 650 | 740 | 880 | 1010 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 |
| | C/C | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 |
| | LENGTH | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 |
| R BARS | # SETS | 49 | 47 | 47 | 49 | 49 | 49 | 48 | 48 | 48 |
| V BARS | LENGTH | 1995 | 1995 | 2000 | 2000 | 2000 | 2000 | 2000 | 2020 | 2035 |
| | B | 215 | 215 | 220 | 220 | 220 | 220 | 220 | 240 | 255 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 3.50

HEIGHT: 1.50

| | | FILL HEIGHT | | | | | | | | |
|-------------------------|---------------|-------------------|----------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| | | DIMENSIONS | W | 220 | 220 | 220 | 220 | 220 | 220 | 230 |
| | T | 250 | 220 | 220 | 230 | 240 | 250 | 270 | 300 | 340 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| QUANTITIES | STEEL | 352.0 | 316.9 | 314.2 | 326.2 | 335.8 | 351.4 | 346.6 | 355.8 | 360.7 |
| | CONC. | 2.9 | 2.8 | 2.8 | 2.8 | 2.9 | 2.9 | 3.0 | 3.3 | 3.6 |
| FOOTING REACTION | V ULS | 210.3 | 175.2 | 182.9 | 200.7 | 219.9 | 244.1 | 297.2 | 364.9 | 434.8 |
| | V SLS | 131.4 | 118.6 | 130.8 | 149 | 167.4 | 188.6 | 234.6 | 288.4 | 345.8 |
| | H ULS | 51.4 | 51.2 | 53.3 | 56.7 | 60.6 | 64.9 | 74.3 | 82.9 | 91.6 |
| | V | 65 | 82 | 106 | 129 | 154 | 178 | 227 | 282 | 338 |
| P BARS | SIZE | 20 | 15 | 15 | 15 | 15 | 20 | 20 | 20 | 20 |
| | C/C | 200 | 150 | 150 | 150 | 150 | 200 | 175 | 150 | 175 |
| | LENGTH | 3720 | 3720 | 3720 | 3720 | 3720 | 3720 | 3730 | 3760 | 3790 |
| H BARS | C/C | - | 375 | 375 | 350 | 325 | 300 | 450 | 450 | 450 |
| | LENGTH | - | 1880 | 1980 | 2020 | 2160 | 2160 | 1740 | 1740 | 1740 |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 |
| | C/C | 350 | 375 | 375 | 350 | 325 | 300 | 450 | 450 | 450 |
| | LENGTH | 4090 | 3000 | 2950 | 2930 | 2870 | 2870 | 3100 | 3150 | 3200 |
| | B | 2310 | 1260 | 1210 | 1180 | 1100 | 1090 | 1290 | 1290 | 1280 |
| | D | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| | R | 180 | 150 | 150 | 160 | 170 | 180 | 200 | 230 | 270 |
| K BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 |
| | C/C | 350 | 375 | 375 | 350 | 325 | 300 | 450 | 450 | 450 |
| | LENGTH | 2990 | 2380 | 2330 | 2320 | 2260 | 2270 | 2330 | 2380 | 2470 |
| | B | 1210 | 640 | 590 | 570 | 490 | 490 | 520 | 520 | 550 |
| | D | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| | R | 180 | 150 | 150 | 160 | 170 | 180 | 200 | 230 | 270 |
| U BARS | LENGTH | 1040 | 960 | 960 | 980 | 1010 | 1040 | 1110 | 1240 | 1390 |
| | C | 680 | 600 | 600 | 620 | 650 | 680 | 750 | 880 | 1030 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 |
| | C/C | 375 | 425 | 450 | 450 | 450 | 450 | 450 | 450 | 450 |
| | LENGTH | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| R BARS | # SETS | 50 | 49 | 49 | 51 | 51 | 50 | 50 | 48 | 50 |
| V BARS | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2005 | 2020 | 2035 |
| | B | 220 | 220 | 220 | 220 | 220 | 220 | 225 | 240 | 255 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 3.50
HEIGHT: 1.75

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 210 | 220 | 220 | 220 | 220 | 220 | 240 | 280 | 310 |
| | T | 250 | 220 | 220 | 230 | 240 | 250 | 280 | 310 | 340 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 600 |
| QUANTITIES | STEEL | 394.4 | 345.2 | 341.9 | 354.4 | 365.9 | 382.4 | 387.2 | 388.8 | 397.7 |
| | CONC. | 3.0 | 2.9 | 2.9 | 2.9 | 3.0 | 3.0 | 3.2 | 3.5 | 4.0 |
| FOOTING REACTION * | V ULS | 210.5 | 176.8 | 184.5 | 203.1 | 222.3 | 246.5 | 303.8 | 370 | 442.3 |
| | V SLS | 132 | 120 | 132.1 | 150.3 | 168.8 | 189.9 | 238.4 | 294.6 | 351.9 |
| | H ULS | 59 | 59.7 | 62.7 | 66.9 | 71.7 | 76.8 | 87.6 | 98.5 | 109 |
| | V | 65 | 83 | 107 | 131 | 155 | 179 | 231 | 287 | 346 |
| P BARS | SIZE | 20 | 15 | 15 | 15 | 15 | 20 | 20 | 20 | 20 |
| | C/C | 200 | 150 | 150 | 150 | 150 | 200 | 175 | 175 | 175 |
| | LENGTH | 3710 | 3720 | 3720 | 3720 | 3720 | 3720 | 3740 | 3780 | 3810 |
| H BARS | C/C | - | 375 | 375 | 350 | 325 | 300 | 300 | 300 | 300 |
| | LENGTH | - | 1520 | 1920 | 1940 | 1940 | 1920 | 2120 | 2180 | 2180 |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 325 | 375 | 375 | 350 | 325 | 300 | 300 | 300 | 300 |
| | LENGTH | 4340 | 3430 | 3230 | 3220 | 3230 | 3240 | 3180 | 3210 | 3250 |
| | B | 2310 | 1440 | 1240 | 1220 | 1210 | 1210 | 1100 | 1080 | 1080 |
| | D | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| | R | 180 | 150 | 150 | 160 | 170 | 180 | 210 | 240 | 270 |
| K BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 325 | 375 | 375 | 350 | 325 | 300 | 300 | 300 | 300 |
| | LENGTH | 3330 | 2820 | 2620 | 2610 | 2620 | 2630 | 2610 | 2670 | 2730 |
| | B | 1300 | 830 | 630 | 610 | 600 | 600 | 530 | 540 | 560 |
| | D | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| | R | 180 | 150 | 150 | 160 | 170 | 180 | 210 | 240 | 270 |
| U BARS | LENGTH | 1030 | 960 | 960 | 980 | 1010 | 1040 | 1150 | 1290 | 1420 |
| | C | 670 | 600 | 600 | 620 | 650 | 680 | 790 | 930 | 1060 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 |
| | C/C | 275 | 325 | 325 | 325 | 325 | 325 | 325 | 375 | 425 |
| | LENGTH | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| R BARS | # SETS | 54 | 53 | 53 | 55 | 55 | 54 | 52 | 54 | 54 |
| V BARS | LENGTH | 1995 | 2000 | 2000 | 2000 | 2000 | 2000 | 2010 | 2030 | 2095 |
| | B | 215 | 220 | 220 | 220 | 220 | 220 | 230 | 250 | 315 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 460 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 3.50
HEIGHT: 2.00

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 220 | 220 | 220 | 220 | 220 | 220 | 260 | 290 | 320 |
| | T | 260 | 230 | 230 | 230 | 240 | 250 | 290 | 320 | 340 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 600 |
| QUANTITIES | STEEL | 403.8 | 387.4 | 372.3 | 385.1 | 410.3 | 417.9 | 410.6 | 422.2 | 424.1 |
| | CONC. | 3.2 | 3.0 | 3.0 | 3.0 | 3.1 | 3.1 | 3.5 | 3.8 | 4.2 |
| FOOTING REACTION * | V ULS | 213.5 | 178.5 | 186.1 | 204.7 | 223.9 | 248.1 | 309.9 | 377.8 | 448.2 |
| | V SLS | 134.7 | 121.9 | 134.1 | 151.6 | 170.1 | 191.3 | 244.1 | 299 | 356 |
| | H ULS | 67.3 | 68.4 | 72.2 | 77.2 | 82.8 | 88.7 | 101.4 | 114 | 126.8 |
| | V | 68 | 85 | 108 | 132 | 157 | 180 | 236 | 292 | 350 |
| P BARS | SIZE | 20 | 15 | 15 | 15 | 15 | 20 | 20 | 20 | 20 |
| | C/C | 200 | 150 | 175 | 150 | 150 | 200 | 200 | 175 | 175 |
| | LENGTH | 3720 | 3720 | 3720 | 3720 | 3720 | 3720 | 3760 | 3790 | 3820 |
| H BARS | C/C | - | - | 375 | 350 | 300 | 300 | 300 | 300 | 300 |
| | LENGTH | - | - | 1540 | 1860 | 1860 | 1860 | 1920 | 2120 | 2180 |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 350 | 375 | 375 | 350 | 300 | 300 | 300 | 300 | 300 |
| | LENGTH | 4610 | 4560 | 3670 | 3510 | 3520 | 3520 | 3560 | 3500 | 3510 |
| | B | 2310 | 2310 | 1420 | 1260 | 1250 | 1240 | 1210 | 1110 | 1090 |
| | D | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| | R | 190 | 160 | 160 | 160 | 170 | 180 | 220 | 250 | 270 |
| K BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 350 | 375 | 375 | 350 | 300 | 300 | 300 | 300 | 300 |
| | LENGTH | 3730 | 3440 | 3060 | 2900 | 2900 | 2910 | 2990 | 2960 | 3000 |
| | B | 1430 | 1190 | 810 | 650 | 630 | 630 | 640 | 570 | 580 |
| | D | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| | R | 190 | 160 | 160 | 160 | 170 | 180 | 220 | 250 | 270 |
| U BARS | LENGTH | 1070 | 980 | 980 | 980 | 1010 | 1040 | 1210 | 1340 | 1440 |
| | C | 710 | 620 | 620 | 620 | 650 | 680 | 850 | 980 | 1080 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 250 | 250 | 250 | 250 | 250 | 225 | 275 | 275 | 300 |
| | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| R BARS | # SETS | 56 | 59 | 59 | 59 | 59 | 56 | 56 | 58 | 58 |
| V BARS | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2020 | 2035 | 2100 |
| | B | 220 | 220 | 220 | 220 | 220 | 220 | 240 | 255 | 320 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 460 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 3.50
HEIGHT: 2.50

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 220 | 220 | 220 | 220 | 230 | 250 | 290 | 320 | 350 |
| | T | 280 | 230 | 230 | 240 | 260 | 270 | 300 | 330 | 360 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 600 | 600 |
| QUANTITIES | STEEL | 478.2 | 460.4 | 475.0 | 504.4 | 504.3 | 473.2 | 458.1 | 468.0 | 475.5 |
| | CONC. | 3.5 | 3.3 | 3.3 | 3.3 | 3.4 | 3.6 | 4.0 | 4.5 | 4.8 |
| FOOTING REACTION * | V ULS | 218.3 | 182.4 | 190.1 | 208.7 | 229.8 | 259 | 320 | 390.7 | 463.5 |
| | V SLS | 138.6 | 124.6 | 136.8 | 155 | 175.6 | 200.2 | 253.6 | 309.6 | 368.5 |
| | H ULS | 83.4 | 86.4 | 91.7 | 98 | 105.5 | 113.4 | 129.5 | 146 | 162.2 |
| | V | 71 | 88 | 112 | 135 | 161 | 188 | 245 | 304 | 361 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 200 | 175 |
| | LENGTH | 3720 | 3720 | 3720 | 3720 | 3730 | 3750 | 3790 | 3820 | 3850 |
| H BARS | C/C | - | - | - | - | - | - | 350 | 325 | 325 |
| | LENGTH | - | - | - | - | - | - | 1480 | 1880 | 1900 |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 350 | 350 | 350 | 300 | 300 | 325 | 350 | 325 | 325 |
| | LENGTH | 5440 | 5060 | 5060 | 5080 | 5110 | 5120 | 4310 | 4160 | 4200 |
| | B | 2610 | 2310 | 2310 | 2310 | 2310 | 2310 | 1450 | 1250 | 1240 |
| | D | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| | R | 210 | 160 | 160 | 170 | 190 | 200 | 230 | 260 | 290 |
| K BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 350 | 350 | 350 | 300 | 300 | 325 | 350 | 325 | 325 |
| | LENGTH | 5140 | 4200 | 4060 | 4020 | 4010 | 3990 | 3740 | 3630 | 3700 |
| | B | 2310 | 1450 | 1310 | 1250 | 1210 | 1180 | 880 | 720 | 740 |
| | D | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| | R | 210 | 160 | 160 | 170 | 190 | 200 | 230 | 260 | 290 |
| U BARS | LENGTH | 1130 | 980 | 980 | 1010 | 1080 | 1140 | 1280 | 1410 | 1540 |
| | C | 770 | 620 | 620 | 650 | 720 | 780 | 920 | 1050 | 1180 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 175 | 175 | 150 | 150 | 150 | 175 | 175 | 200 | 200 |
| | LENGTH | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| R BARS | # SETS | 64 | 65 | 65 | 65 | 64 | 64 | 66 | 66 | 64 |
| V BARS | LENGTH | 2000 | 2000 | 2000 | 2000 | 2005 | 2015 | 2035 | 2100 | 2115 |
| | B | 220 | 220 | 220 | 220 | 225 | 235 | 255 | 320 | 335 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 460 | 460 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.00

HEIGHT: 1.50

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 220 | 220 | 220 | 220 | 220 | 220 | 250 | 290 | 330 |
| | T | 260 | 240 | 240 | 250 | 260 | 270 | 300 | 330 | 370 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 600 |
| QUANTITIES | STEEL | 399.6 | 357.0 | 367.0 | 374.2 | 379.8 | 400.2 | 401.1 | 403.3 | 422.2 |
| | CONC. | 3.1 | 3.0 | 3.0 | 3.0 | 3.1 | 3.1 | 3.4 | 3.7 | 4.3 |
| FOOTING REACTION * | V ULS | 220.6 | 192.6 | 201.6 | 224.9 | 247.4 | 274.3 | 341.3 | 413.8 | 497.5 |
| | V SLS | 138.9 | 130.9 | 144.7 | 166.5 | 188.2 | 211.4 | 267.6 | 329.2 | 395.9 |
| | H ULS | 50.1 | 49 | 50.4 | 53.1 | 56.3 | 60.2 | 67.1 | 73.9 | 79 |
| | V | 70 | 90 | 117 | 144 | 172 | 198 | 258 | 321 | 389 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 175 | 200 | 200 | 175 | 175 | 150 | 150 | 150 | 150 |
| | LENGTH | 4220 | 4220 | 4220 | 4220 | 4220 | 4220 | 4250 | 4290 | 4330 |
| H BARS | C/C | - | 325 | 300 | 300 | 400 | 375 | 375 | 400 | 375 |
| | LENGTH | - | 2300 | 2520 | 2560 | 2140 | 2160 | 2180 | 2240 | 2240 |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 325 | 300 | 300 | 400 | 375 | 375 | 400 | 375 |
| | LENGTH | 4360 | 3050 | 2940 | 2920 | 3140 | 3130 | 3170 | 3200 | 3260 |
| | B | 2560 | 1280 | 1170 | 1140 | 1340 | 1320 | 1310 | 1290 | 1290 |
| | D | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| | R | 190 | 170 | 170 | 180 | 190 | 200 | 230 | 260 | 300 |
| K BARS | SIZE | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 325 | 300 | 300 | 400 | 375 | 375 | 400 | 375 |
| | LENGTH | 3070 | 2430 | 2320 | 2310 | 2370 | 2360 | 2400 | 2460 | 2560 |
| | B | 1270 | 660 | 550 | 530 | 570 | 550 | 540 | 550 | 590 |
| | D | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| | R | 190 | 170 | 170 | 180 | 190 | 200 | 230 | 260 | 300 |
| U BARS | LENGTH | 1070 | 1010 | 1010 | 1040 | 1070 | 1100 | 1220 | 1370 | 1540 |
| | C | 710 | 650 | 650 | 680 | 710 | 740 | 860 | 1010 | 1180 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 400 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 |
| | LENGTH | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| R BARS | # SETS | 54 | 54 | 54 | 54 | 54 | 54 | 52 | 54 | 53 |
| V BARS | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2015 | 2035 | 2105 |
| | B | 220 | 220 | 220 | 220 | 220 | 220 | 235 | 255 | 325 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 460 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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RIGID FRAME OPEN FOOTING CULVERTS

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.00

HEIGHT: 1.75

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| | | | | | | | | | | |
| DIMENSIONS | W | 220 | 220 | 220 | 220 | 220 | 220 | 260 | 300 | 340 |
| | T | 260 | 240 | 240 | 250 | 260 | 270 | 310 | 340 | 380 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 600 |
| QUANTITIES | STEEL | 434.8 | 382.6 | 391.6 | 382.4 | 402.1 | 423.5 | 413.2 | 424.0 | 434.6 |
| | CONC. | 3.2 | 3.1 | 3.1 | 3.1 | 3.2 | 3.2 | 3.6 | 3.9 | 4.6 |
| FOOTING REACTION * | V ULS | 222.2 | 194.2 | 203.2 | 226.5 | 249.9 | 275.9 | 346.2 | 421.6 | 503.6 |
| | V SLS | 140.2 | 132.2 | 146.1 | 167.8 | 189.6 | 212.7 | 271.6 | 333.7 | 400.9 |
| | H ULS | 58.1 | 57.7 | 60.1 | 63.7 | 68 | 72.6 | 81.7 | 90.3 | 98.6 |
| | V | 72 | 92 | 119 | 145 | 173 | 200 | 262 | 324 | 394 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 150 | 200 | 200 | 175 | 175 | 150 | 150 | 150 | 150 |
| | LENGTH | 4220 | 4220 | 4220 | 4220 | 4220 | 4220 | 4260 | 4300 | 4340 |
| H BARS | C/C | - | 325 | 300 | 450 | 400 | 375 | 400 | 400 | 400 |
| | LENGTH | - | 2220 | 2340 | 2100 | 2120 | 2120 | 2160 | 2200 | 2220 |
| J BARS | SIZE | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 325 | 300 | 450 | 400 | 375 | 400 | 400 | 400 |
| | LENGTH | 4610 | 3340 | 3280 | 3400 | 3400 | 3400 | 3450 | 3480 | 3540 |
| | B | 2560 | 1320 | 1260 | 1370 | 1350 | 1340 | 1320 | 1310 | 1300 |
| | D | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| | R | 190 | 170 | 170 | 180 | 190 | 200 | 240 | 270 | 310 |
| K BARS | SIZE | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 325 | 300 | 450 | 400 | 375 | 400 | 400 | 400 |
| | LENGTH | 3390 | 2730 | 2670 | 2630 | 2630 | 2630 | 2690 | 2750 | 2850 |
| | B | 1340 | 710 | 650 | 600 | 580 | 570 | 560 | 580 | 610 |
| | D | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| | R | 190 | 170 | 170 | 180 | 190 | 200 | 240 | 270 | 310 |
| U BARS | LENGTH | 1070 | 1010 | 1010 | 1040 | 1070 | 1100 | 1270 | 1410 | 1580 |
| | C | 710 | 650 | 650 | 680 | 710 | 740 | 910 | 1050 | 1220 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 325 | 350 | 375 | 400 | 400 | 400 | 450 | 450 | 450 |
| | LENGTH | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| R BARS | # SETS | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 59 |
| V BARS | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2020 | 2040 | 2110 |
| | B | 220 | 220 | 220 | 220 | 220 | 220 | 240 | 260 | 330 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 460 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.00
HEIGHT: 2.00

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 220 | 220 | 220 | 220 | 220 | 230 | 270 | 310 | 350 |
| | T | 260 | 240 | 240 | 250 | 260 | 280 | 310 | 350 | 380 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 600 | 600 |
| QUANTITIES | STEEL | 464.1 | 436.1 | 423.9 | 417.4 | 438.8 | 432.6 | 430.9 | 432.4 | 442.9 |
| | CONC. | 3.3 | 3.2 | 3.2 | 3.3 | 3.3 | 3.4 | 3.8 | 4.4 | 4.8 |
| FOOTING REACTION * | V ULS | 223.9 | 195.8 | 204.8 | 228.1 | 251.5 | 280.3 | 348.1 | 427.3 | 509.9 |
| | V SLS | 141.6 | 133.6 | 147.4 | 169.2 | 190.9 | 216.3 | 275 | 338.4 | 405.2 |
| | H ULS | 66.4 | 66.6 | 69.8 | 74.3 | 79.4 | 84.9 | 96.1 | 107 | 117.7 |
| | V | 73 | 93 | 120 | 148 | 174 | 203 | 265 | 331 | 397 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 150 | 175 | 200 | 175 | 175 | 175 | 150 | 150 | 150 |
| | LENGTH | 4220 | 4220 | 4220 | 4220 | 4220 | 4230 | 4270 | 4310 | 4350 |
| H BARS | C/C | - | 300 | 300 | 450 | 400 | 400 | 425 | 425 | 425 |
| | LENGTH | - | 1680 | 2260 | 1860 | 1880 | 2080 | 2160 | 2160 | 2220 |
| J BARS | SIZE | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 300 | 300 | 450 | 400 | 400 | 425 | 425 | 425 |
| | LENGTH | 4860 | 3860 | 3570 | 3770 | 3770 | 3690 | 3710 | 3770 | 3800 |
| | B | 2560 | 1590 | 1300 | 1490 | 1470 | 1360 | 1330 | 1330 | 1310 |
| | D | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| | R | 190 | 170 | 170 | 180 | 190 | 210 | 240 | 280 | 310 |
| K BARS | SIZE | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 300 | 300 | 450 | 400 | 400 | 425 | 425 | 425 |
| | LENGTH | 3730 | 3190 | 2960 | 3000 | 3010 | 2920 | 2950 | 3050 | 3120 |
| | B | 1430 | 920 | 690 | 720 | 710 | 590 | 570 | 610 | 630 |
| | D | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| | R | 190 | 170 | 170 | 180 | 190 | 210 | 240 | 280 | 310 |
| U BARS | LENGTH | 1070 | 1010 | 1010 | 1040 | 1070 | 1140 | 1280 | 1450 | 1590 |
| | C | 710 | 650 | 650 | 680 | 710 | 780 | 920 | 1090 | 1230 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 |
| | C/C | 250 | 275 | 275 | 275 | 275 | 300 | 350 | 400 | 450 |
| | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| R BARS | # SETS | 60 | 62 | 62 | 60 | 60 | 60 | 62 | 61 | 63 |
| V BARS | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2005 | 2025 | 2095 | 2115 |
| | B | 220 | 220 | 220 | 220 | 220 | 225 | 245 | 315 | 335 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 460 | 460 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.00
HEIGHT: 2.50

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 220 | 220 | 220 | 220 | 240 | 260 | 300 | 340 | 370 |
| | T | 280 | 250 | 250 | 260 | 270 | 300 | 330 | 360 | 390 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 600 | 600 |
| QUANTITIES | STEEL | 526.7 | 510.8 | 509.1 | 514.1 | 504.2 | 476.6 | 491.1 | 486.8 | 490.6 |
| | CONC. | 3.6 | 3.5 | 3.5 | 3.5 | 3.7 | 3.9 | 4.3 | 5.0 | 5.3 |
| FOOTING REACTION * | V ULS | 227.9 | 199.1 | 208.9 | 231.4 | 259.3 | 290.5 | 362.9 | 440.6 | 521.9 |
| | V SLS | 145.7 | 137 | 150.8 | 172.6 | 197.4 | 225.5 | 285.4 | 349.3 | 415.1 |
| | H ULS | 83.5 | 85.3 | 89.7 | 96 | 103.1 | 110.4 | 125.2 | 140.3 | 155.1 |
| | V | 77 | 96 | 123 | 150 | 180 | 211 | 274 | 342 | 406 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 175 | 200 | 200 | 200 | 175 | 200 | 175 | 175 | 150 |
| | LENGTH | 4220 | 4220 | 4220 | 4220 | 4240 | 4260 | 4300 | 4340 | 4370 |
| H BARS | C/C | - | - | - | 400 | 425 | 450 | 300 | 300 | 450 |
| | LENGTH | - | - | - | 1320 | 1760 | 1780 | 2280 | 2360 | 2160 |
| J BARS | SIZE | 20 | 20 | 20 | 25 | 25 | 25 | 20 | 20 | 25 |
| | C/C | 300 | 300 | 300 | 400 | 425 | 450 | 300 | 300 | 450 |
| | LENGTH | 5390 | 5340 | 5340 | 4550 | 4350 | 4380 | 4190 | 4210 | 4350 |
| | B | 2560 | 2560 | 2560 | 1750 | 1540 | 1520 | 1280 | 1250 | 1350 |
| | D | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| | R | 210 | 180 | 180 | 190 | 200 | 230 | 260 | 290 | 320 |
| K BARS | SIZE | 20 | 20 | 20 | 25 | 25 | 25 | 20 | 20 | 25 |
| | C/C | 300 | 300 | 300 | 400 | 425 | 450 | 300 | 300 | 450 |
| | LENGTH | 4660 | 4210 | 4100 | 3780 | 3580 | 3610 | 3660 | 3720 | 3670 |
| | B | 1830 | 1430 | 1320 | 980 | 770 | 750 | 750 | 760 | 670 |
| | D | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| | R | 210 | 180 | 180 | 190 | 200 | 230 | 260 | 290 | 320 |
| U BARS | LENGTH | 1130 | 1040 | 1040 | 1070 | 1130 | 1240 | 1380 | 1520 | 1650 |
| | C | 770 | 680 | 680 | 710 | 770 | 880 | 1020 | 1160 | 1290 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 175 | 175 | 175 | 175 | 175 | 200 | 225 | 250 | 250 |
| | LENGTH | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| R BARS | # SETS | 68 | 68 | 68 | 68 | 68 | 68 | 70 | 67 | 69 |
| V BARS | LENGTH | 2000 | 2000 | 2000 | 2000 | 2010 | 2020 | 2040 | 2110 | 2125 |
| | B | 220 | 220 | 220 | 220 | 230 | 240 | 260 | 330 | 345 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 460 | 460 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.00
HEIGHT: 3.00

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 230 | 220 | 230 | 250 | 270 | 290 | 330 | 370 | 400 |
| | T | 300 | 260 | 270 | 280 | 290 | 310 | 350 | 380 | 410 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 600 | 600 | 600 |
| QUANTITIES | STEEL | 586.0 | 593.9 | 555.0 | 553.8 | 562.8 | 570.7 | 566.7 | 559.3 | 573.3 |
| | CONC. | 4.0 | 3.7 | 3.9 | 4.0 | 4.2 | 4.5 | 5.2 | 5.6 | 6.0 |
| FOOTING REACTION * | V ULS | 232.9 | 203.1 | 214.6 | 241.8 | 270.6 | 302.5 | 375.6 | 455.9 | 538.6 |
| | V SLS | 150.8 | 140.3 | 156.3 | 181.2 | 206.6 | 234.7 | 296.7 | 361.9 | 428.7 |
| | H ULS | 101 | 104.7 | 111.1 | 119.6 | 128.3 | 137.3 | 155.9 | 174.3 | 192.8 |
| | V | 82 | 100 | 128 | 157 | 188 | 220 | 288 | 353 | 419 |
| P BARS | SIZE | 20 | 20 | 15 | 15 | 15 | 20 | 20 | 20 | 20 |
| | C/C | 175 | 200 | 150 | 150 | 150 | 200 | 200 | 175 | 150 |
| | LENGTH | 4230 | 4220 | 4230 | 4250 | 4270 | 4290 | 4330 | 4370 | 4400 |
| H BARS | C/C | - | - | - | - | - | - | 300 | 300 | 300 |
| | LENGTH | - | - | - | - | - | - | 1600 | 2280 | 2300 |
| J BARS | SIZE | 20 | 25 | 25 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 300 | 425 | 450 | 300 | 300 | 300 | 300 | 300 | 300 |
| | LENGTH | 6220 | 6000 | 6010 | 5890 | 5910 | 5940 | 5070 | 4790 | 4820 |
| | B | 2860 | 2700 | 2700 | 2560 | 2560 | 2560 | 1630 | 1300 | 1290 |
| | D | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| | R | 230 | 190 | 200 | 210 | 220 | 240 | 280 | 310 | 340 |
| K BARS | SIZE | 20 | 25 | 25 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 300 | 425 | 450 | 300 | 300 | 300 | 300 | 300 | 300 |
| | LENGTH | 5920 | 5150 | 4940 | 4780 | 4740 | 4740 | 4430 | 4320 | 4380 |
| | B | 2560 | 1850 | 1630 | 1450 | 1390 | 1360 | 990 | 830 | 850 |
| | D | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| | R | 230 | 190 | 200 | 210 | 220 | 240 | 280 | 310 | 340 |
| U BARS | LENGTH | 1200 | 1070 | 1110 | 1170 | 1220 | 1310 | 1480 | 1620 | 1750 |
| | C | 840 | 710 | 750 | 810 | 860 | 950 | 1120 | 1260 | 1390 |
| T BARS | SIZE | 20 | 20 | 20 | 20 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 200 | 175 | 200 | 200 | 150 | 150 | 150 | 175 | 175 |
| | LENGTH | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| R BARS | # SETS | 72 | 74 | 74 | 74 | 74 | 74 | 73 | 75 | 75 |
| V BARS | LENGTH | 2005 | 2000 | 2005 | 2015 | 2025 | 2035 | 2105 | 2125 | 2140 |
| | B | 225 | 220 | 225 | 235 | 245 | 255 | 325 | 345 | 360 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 460 | 460 | 460 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.00
HEIGHT: 3.50

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 250 | 250 | 260 | 280 | 300 | 320 | 360 | 400 | 430 |
| | T | 320 | 270 | 280 | 290 | 310 | 330 | 370 | 400 | 430 |
| | F | 500 | 500 | 500 | 500 | 500 | 600 | 600 | 600 | 700 |
| QUANTITIES | STEEL | 643.2 | 648.8 | 635.4 | 609.4 | 620.2 | 626.2 | 613.0 | 620.0 | 636.2 |
| | CONC. | 4.5 | 4.2 | 4.4 | 4.6 | 4.8 | 5.3 | 5.8 | 6.3 | 7.0 |
| FOOTING REACTION * | V ULS | 240.4 | 213 | 225.2 | 253.1 | 282.7 | 315.5 | 390.1 | 472 | 556.1 |
| | V SLS | 157.3 | 147.9 | 164.3 | 189.8 | 216.7 | 245.4 | 308.6 | 375.2 | 443.2 |
| | H ULS | 121.8 | 127.4 | 135 | 145 | 155.2 | 165.8 | 187.7 | 209.5 | 231.2 |
| | V | 88 | 106 | 136 | 166 | 197 | 232 | 298 | 365 | 435 |
| P BARS | SIZE | 20 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 200 | 150 | 175 | 175 | 150 | 150 | 150 | 200 | 175 |
| | LENGTH | 4250 | 4250 | 4260 | 4280 | 4300 | 4320 | 4360 | 4400 | 4430 |
| H BARS | C/C | - | - | - | - | - | - | - | - | - |
| | LENGTH | - | - | - | - | - | - | - | - | - |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 25 |
| | C/C | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 450 |
| | LENGTH | 6750 | 6610 | 6390 | 6410 | 6440 | 6470 | 6530 | 6580 | 6770 |
| | B | 2860 | 2800 | 2560 | 2560 | 2560 | 2560 | 2560 | 2560 | 2700 |
| | D | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| | R | 250 | 200 | 210 | 220 | 240 | 260 | 300 | 330 | 360 |
| K BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 25 |
| | C/C | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 450 |
| | LENGTH | 6450 | 6020 | 5740 | 5550 | 5500 | 5490 | 5480 | 5520 | 5580 |
| | B | 2560 | 2210 | 1910 | 1700 | 1620 | 1580 | 1510 | 1500 | 1510 |
| | D | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| | R | 250 | 200 | 210 | 220 | 240 | 260 | 300 | 330 | 360 |
| U BARS | LENGTH | 1280 | 1140 | 1180 | 1240 | 1320 | 1410 | 1580 | 1720 | 1850 |
| | C | 920 | 780 | 820 | 880 | 960 | 1050 | 1220 | 1360 | 1490 |
| T BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 175 | 150 | 150 | 175 | 175 | 175 | 200 | 200 | 200 |
| | LENGTH | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| R BARS | # SETS | 82 | 80 | 80 | 80 | 82 | 82 | 83 | 81 | 81 |
| V BARS | LENGTH | 2015 | 2015 | 2020 | 2030 | 2040 | 2100 | 2120 | 2140 | 2205 |
| | B | 235 | 235 | 240 | 250 | 260 | 320 | 340 | 360 | 425 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 460 | 460 | 460 | 560 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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RIGID FRAME OPEN FOOTING CULVERTS

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.00

HEIGHT: 4.00

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 290 | 290 | 290 | 310 | 330 | 350 | 390 | 420 | 460 |
| | T | 340 | 290 | 290 | 300 | 310 | 330 | 380 | 410 | 450 |
| | F | 500 | 500 | 500 | 600 | 600 | 600 | 600 | 700 | 700 |
| QUANTITIES | STEEL | 687.9 | 674.9 | 678.1 | 686.6 | 694.3 | 696.2 | 700.4 | 731.4 | 746.4 |
| | CONC. | 5.2 | 4.9 | 4.9 | 5.4 | 5.6 | 5.9 | 6.5 | 7.2 | 7.8 |
| FOOTING REACTION * | V ULS | 251.2 | 223.8 | 235.7 | 264.3 | 293.9 | 327.5 | 404.5 | 485 | 574.6 |
| | V SLS | 166.8 | 158.3 | 173.1 | 199.2 | 226 | 255.3 | 320.5 | 385.9 | 458.4 |
| | H ULS | 146.7 | 151.9 | 161.4 | 172.9 | 185.1 | 197.1 | 221.7 | 245.8 | 270.8 |
| | V | 97 | 116 | 143 | 177 | 208 | 241 | 309 | 378 | 449 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 |
| | C/C | 150 | 175 | 200 | 200 | 175 | 175 | 175 | 150 | 200 |
| | LENGTH | 4290 | 4290 | 4290 | 4310 | 4330 | 4350 | 4390 | 4420 | 4460 |
| H BARS | C/C | - | - | - | - | - | - | - | - | - |
| | LENGTH | - | - | - | - | - | - | - | - | - |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 325 | 325 | 300 | 300 | 450 | 450 | 450 | 425 | 425 |
| | LENGTH | 7280 | 7210 | 7130 | 6920 | 7080 | 7110 | 7190 | 7230 | 7300 |
| | B | 2860 | 2860 | 2780 | 2560 | 2700 | 2700 | 2700 | 2700 | 2700 |
| | D | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| | R | 270 | 220 | 220 | 230 | 240 | 260 | 310 | 340 | 380 |
| K BARS | SIZE | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 325 | 325 | 300 | 300 | 450 | 450 | 450 | 425 | 425 |
| | LENGTH | 6980 | 6910 | 6570 | 6300 | 6160 | 6150 | 6200 | 6260 | 6340 |
| | B | 2560 | 2560 | 2220 | 1940 | 1780 | 1740 | 1710 | 1730 | 1740 |
| | D | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| | R | 270 | 220 | 220 | 230 | 240 | 260 | 310 | 340 | 380 |
| U BARS | LENGTH | 1390 | 1250 | 1250 | 1310 | 1370 | 1450 | 1650 | 1780 | 1950 |
| | C | 1030 | 890 | 890 | 950 | 1010 | 1090 | 1290 | 1420 | 1590 |
| T BARS | SIZE | 20 | 20 | 25 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 150 | 150 | 225 | 150 | 150 | 150 | 150 | 150 | 150 |
| | LENGTH | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| R BARS | # SETS | 90 | 88 | 88 | 90 | 90 | 90 | 89 | 89 | 91 |
| V BARS | LENGTH | 2035 | 2035 | 2035 | 2095 | 2105 | 2115 | 2135 | 2200 | 2220 |
| | B | 255 | 255 | 255 | 315 | 325 | 335 | 355 | 420 | 440 |
| S BARS | LENGTH | 360 | 360 | 360 | 460 | 460 | 460 | 460 | 560 | 560 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.50

HEIGHT: 1.75

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 220 | 220 | 220 | 220 | 220 | 240 | 280 | 330 | 380 |
| | T | 280 | 260 | 260 | 270 | 280 | 300 | 340 | 380 | 410 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 600 | 600 |
| QUANTITIES | STEEL | 476.3 | 411.1 | 425.4 | 449.0 | 462.0 | 447.0 | 469.1 | 470.7 | 501.3 |
| | CONC. | 3.4 | 3.3 | 3.3 | 3.4 | 3.4 | 3.6 | 4.0 | 4.7 | 5.1 |
| FOOTING REACTION * | V ULS | 233 | 211.4 | 222.7 | 248.5 | 276.9 | 311.1 | 387.8 | 475.6 | 568.2 |
| | V SLS | 148.3 | 144.5 | 161.1 | 184.7 | 210.6 | 240 | 305.2 | 376.6 | 451.7 |
| | H ULS | 56.6 | 55.6 | 57.2 | 60.2 | 63.7 | 67.4 | 74 | 80.3 | 85.2 |
| | V | 78 | 101 | 130 | 161 | 191 | 224 | 292 | 368 | 442 |
| P BARS | SIZE | 25 | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 |
| | C/C | 225 | 175 | 175 | 150 | 150 | 150 | 225 | 225 | 225 |
| | LENGTH | 4720 | 4720 | 4720 | 4720 | 4720 | 4740 | 4780 | 4830 | 4880 |
| H BARS | C/C | - | 425 | 375 | 350 | 325 | 350 | 350 | 375 | 350 |
| | LENGTH | - | 2220 | 2480 | 2540 | 2540 | 2580 | 2600 | 2660 | 2720 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 400 | 425 | 375 | 350 | 325 | 350 | 350 | 375 | 350 |
| | LENGTH | 5030 | 3600 | 3470 | 3440 | 3450 | 3460 | 3510 | 3560 | 3590 |
| | B | 2950 | 1550 | 1420 | 1380 | 1370 | 1350 | 1340 | 1320 | 1310 |
| | D | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| | R | 210 | 190 | 190 | 200 | 210 | 230 | 270 | 310 | 340 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 400 | 425 | 375 | 350 | 325 | 350 | 350 | 375 | 350 |
| | LENGTH | 3520 | 2830 | 2700 | 2680 | 2680 | 2690 | 2780 | 2880 | 2940 |
| | B | 1440 | 780 | 650 | 620 | 600 | 580 | 610 | 640 | 660 |
| | D | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| | R | 210 | 190 | 190 | 200 | 210 | 230 | 270 | 310 | 340 |
| U BARS | LENGTH | 1130 | 1070 | 1070 | 1100 | 1130 | 1210 | 1380 | 1560 | 1720 |
| | C | 770 | 710 | 710 | 740 | 770 | 850 | 1020 | 1200 | 1360 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 350 | 400 | 450 | 450 | 450 | 450 | 400 | 350 | 300 |
| | LENGTH | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| R BARS | # SETS | 59 | 61 | 61 | 61 | 59 | 58 | 60 | 60 | 62 |
| V BARS | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2010 | 2030 | 2105 | 2130 |
| | B | 220 | 220 | 220 | 220 | 220 | 230 | 250 | 325 | 350 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 460 | 460 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.50

HEIGHT: 2.00

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| | | | | | | | | | | |
| DIMENSIONS | W | 220 | 220 | 220 | 220 | 220 | 250 | 290 | 340 | 390 |
| | T | 280 | 260 | 260 | 270 | 280 | 310 | 350 | 380 | 410 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 600 | 600 |
| QUANTITIES | STEEL | 508.7 | 450.6 | 455.7 | 475.8 | 500.7 | 464.8 | 470.3 | 490.5 | 492.6 |
| | CONC. | 3.5 | 3.4 | 3.4 | 3.5 | 3.5 | 3.8 | 4.3 | 4.9 | 5.3 |
| FOOTING REACTION * | V ULS | 234.6 | 213 | 225.3 | 250.1 | 279.4 | 315.7 | 393.1 | 480.5 | 573.8 |
| | V SLS | 149.7 | 145.8 | 162.4 | 186 | 212 | 243.8 | 309.5 | 380.6 | 456.2 |
| | H ULS | 65 | 64.7 | 67.3 | 71.2 | 75.8 | 80.4 | 89.5 | 98 | 105.7 |
| | V | 80 | 102 | 131 | 162 | 192 | 227 | 297 | 371 | 445 |
| P BARS | SIZE | 25 | 20 | 20 | 20 | 25 | 25 | 20 | 25 | 25 |
| | C/C | 225 | 150 | 150 | 150 | 225 | 225 | 150 | 225 | 225 |
| | LENGTH | 4720 | 4720 | 4720 | 4720 | 4720 | 4750 | 4790 | 4840 | 4890 |
| H BARS | C/C | - | 425 | 400 | 350 | 325 | 375 | 375 | 375 | 375 |
| | LENGTH | - | 2120 | 2260 | 2500 | 2520 | 2540 | 2580 | 2660 | 2720 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 400 | 425 | 400 | 350 | 325 | 375 | 375 | 375 | 375 |
| | LENGTH | 5280 | 3900 | 3830 | 3710 | 3710 | 3750 | 3790 | 3820 | 3850 |
| | B | 2950 | 1600 | 1530 | 1400 | 1380 | 1370 | 1350 | 1330 | 1320 |
| | D | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| | R | 210 | 190 | 190 | 200 | 210 | 240 | 280 | 310 | 340 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 400 | 425 | 400 | 350 | 325 | 375 | 375 | 375 | 375 |
| | LENGTH | 3860 | 3130 | 3060 | 2950 | 2940 | 2990 | 3070 | 3140 | 3190 |
| | B | 1530 | 830 | 760 | 640 | 610 | 610 | 630 | 650 | 660 |
| | D | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| | R | 210 | 190 | 190 | 200 | 210 | 240 | 280 | 310 | 340 |
| U BARS | LENGTH | 1130 | 1070 | 1070 | 1100 | 1130 | 1250 | 1420 | 1580 | 1730 |
| | C | 770 | 710 | 710 | 740 | 770 | 890 | 1060 | 1220 | 1370 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 |
| | C/C | 275 | 300 | 325 | 350 | 350 | 425 | 450 | 450 | 450 |
| | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| R BARS | # SETS | 63 | 63 | 63 | 63 | 63 | 62 | 64 | 66 | 64 |
| V BARS | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2015 | 2035 | 2110 | 2135 |
| | B | 220 | 220 | 220 | 220 | 220 | 235 | 255 | 330 | 355 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 460 | 460 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.50
HEIGHT: 2.50

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 220 | 220 | 220 | 220 | 250 | 270 | 320 | 360 | 400 |
| | T | 290 | 260 | 260 | 270 | 290 | 320 | 360 | 400 | 430 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 600 | 600 | 600 |
| QUANTITIES | STEEL | 580.3 | 572.0 | 549.1 | 577.5 | 535.4 | 518.5 | 496.6 | 509.5 | 534.6 |
| | CONC. | 3.8 | 3.7 | 3.7 | 3.7 | 4.0 | 4.3 | 5.0 | 5.5 | 5.9 |
| FOOTING REACTION * | V ULS | 237.8 | 216.3 | 228.5 | 253.4 | 287.3 | 324.4 | 406.3 | 492.8 | 584.7 |
| | V SLS | 153.1 | 148.5 | 165.1 | 188.7 | 220 | 250.9 | 319.6 | 390.8 | 465.2 |
| | H ULS | 82.7 | 83.6 | 87.9 | 93.4 | 99.9 | 106.6 | 120 | 133.3 | 146.4 |
| | V | 83 | 105 | 135 | 165 | 200 | 235 | 308 | 381 | 454 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 25 |
| | C/C | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 225 | 225 |
| | LENGTH | 4720 | 4720 | 4720 | 4720 | 4750 | 4770 | 4820 | 4860 | 4900 |
| H BARS | C/C | - | - | 375 | 325 | 375 | 400 | 425 | 425 | 400 |
| | LENGTH | - | - | 1720 | 2140 | 2240 | 2240 | 2560 | 2580 | 2640 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 400 | 400 | 375 | 325 | 375 | 400 | 425 | 425 | 400 |
| | LENGTH | 5800 | 5750 | 4600 | 4390 | 4390 | 4420 | 4340 | 4390 | 4420 |
| | B | 2950 | 2950 | 1800 | 1580 | 1540 | 1530 | 1380 | 1370 | 1350 |
| | D | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| | R | 220 | 190 | 190 | 200 | 220 | 250 | 290 | 330 | 360 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 400 | 400 | 375 | 325 | 375 | 400 | 425 | 425 | 400 |
| | LENGTH | 4640 | 4310 | 3830 | 3630 | 3620 | 3670 | 3630 | 3720 | 3780 |
| | B | 1790 | 1510 | 1030 | 820 | 770 | 780 | 670 | 700 | 710 |
| | D | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| | R | 220 | 190 | 190 | 200 | 220 | 250 | 290 | 330 | 360 |
| U BARS | LENGTH | 1150 | 1070 | 1070 | 1100 | 1200 | 1310 | 1490 | 1660 | 1800 |
| | C | 790 | 710 | 710 | 740 | 840 | 950 | 1130 | 1300 | 1440 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 |
| | C/C | 175 | 175 | 200 | 200 | 225 | 250 | 300 | 325 | 350 |
| | LENGTH | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| R BARS | # SETS | 71 | 71 | 71 | 71 | 71 | 72 | 70 | 72 | 72 |
| V BARS | LENGTH | 2000 | 2000 | 2000 | 2000 | 2015 | 2025 | 2100 | 2120 | 2140 |
| | B | 220 | 220 | 220 | 220 | 235 | 245 | 320 | 340 | 360 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 460 | 460 | 460 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.50
HEIGHT: 3.00

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 230 | 220 | 240 | 260 | 280 | 310 | 350 | 390 | 420 |
| | T | 300 | 270 | 270 | 290 | 310 | 340 | 370 | 410 | 450 |
| | F | 500 | 500 | 500 | 500 | 500 | 600 | 600 | 600 | 700 |
| QUANTITIES | STEEL | 640.7 | 645.2 | 620.4 | 605.8 | 566.1 | 555.4 | 556.6 | 565.3 | 590.8 |
| | CONC. | 4.2 | 3.9 | 4.1 | 4.3 | 4.5 | 5.2 | 5.6 | 6.1 | 6.8 |
| FOOTING REACTION * | V ULS | 242 | 220.4 | 234.3 | 264 | 300.7 | 338.9 | 419.4 | 507.3 | 599 |
| | V SLS | 157.6 | 152 | 171.4 | 199 | 229.5 | 262.9 | 330.3 | 402.7 | 477 |
| | H ULS | 101.2 | 103.2 | 109.6 | 117.2 | 125.8 | 134.3 | 151.5 | 168.6 | 185.6 |
| | V | 87 | 108 | 140 | 174 | 207 | 248 | 318 | 392 | 468 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 25 |
| | C/C | 150 | 150 | 175 | 175 | 175 | 175 | 150 | 150 | 225 |
| | LENGTH | 4730 | 4720 | 4740 | 4760 | 4780 | 4810 | 4850 | 4890 | 4920 |
| H BARS | C/C | - | - | - | - | 425 | 450 | 450 | 450 | 425 |
| | LENGTH | - | - | - | - | 1760 | 2180 | 2280 | 2320 | 2560 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 400 | 375 | 400 | 425 | 425 | 450 | 450 | 450 | 425 |
| | LENGTH | 6510 | 6260 | 6260 | 6300 | 5170 | 5000 | 5010 | 5050 | 4990 |
| | B | 3150 | 2950 | 2950 | 2950 | 1790 | 1580 | 1540 | 1520 | 1390 |
| | D | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| | R | 230 | 200 | 200 | 220 | 240 | 270 | 300 | 340 | 380 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 400 | 375 | 400 | 425 | 425 | 450 | 450 | 450 | 425 |
| | LENGTH | 5750 | 5140 | 4880 | 4810 | 4410 | 4270 | 4310 | 4390 | 4380 |
| | B | 2390 | 1830 | 1570 | 1460 | 1030 | 850 | 840 | 860 | 780 |
| | D | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| | R | 230 | 200 | 200 | 220 | 240 | 270 | 300 | 340 | 380 |
| U BARS | LENGTH | 1200 | 1100 | 1130 | 1210 | 1290 | 1420 | 1560 | 1730 | 1890 |
| | C | 840 | 740 | 770 | 850 | 930 | 1060 | 1200 | 1370 | 1530 |
| T BARS | SIZE | 20 | 20 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 200 | 200 | 150 | 150 | 175 | 175 | 200 | 200 | 200 |
| | LENGTH | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| R BARS | # SETS | 74 | 77 | 77 | 77 | 76 | 76 | 76 | 78 | 77 |
| V BARS | LENGTH | 2005 | 2000 | 2010 | 2020 | 2030 | 2095 | 2115 | 2135 | 2200 |
| | B | 225 | 220 | 230 | 240 | 250 | 315 | 335 | 355 | 420 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 460 | 460 | 460 | 560 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.50
HEIGHT: 3.50

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 250 | 260 | 270 | 290 | 310 | 340 | 380 | 420 | 460 |
| | T | 320 | 290 | 300 | 310 | 330 | 360 | 390 | 430 | 460 |
| | F | 500 | 500 | 500 | 500 | 600 | 600 | 600 | 700 | 700 |
| QUANTITIES | STEEL | 687.6 | 641.7 | 638.8 | 638.6 | 625.4 | 636.4 | 639.4 | 633.5 | 664.6 |
| | CONC. | 4.7 | 4.6 | 4.7 | 4.9 | 5.4 | 5.8 | 6.3 | 7.1 | 7.6 |
| FOOTING REACTION * | V ULS | 249.7 | 230.5 | 247.8 | 277.4 | 313.1 | 352.3 | 434.5 | 523.9 | 619 |
| | V SLS | 164.2 | 161.7 | 181.1 | 208.6 | 239.8 | 274 | 342.7 | 416.4 | 493.4 |
| | H ULS | 122.3 | 126 | 134 | 143.5 | 153.2 | 163.4 | 184.1 | 204.8 | 225.7 |
| | V | 93 | 117 | 149 | 182 | 220 | 258 | 330 | 407 | 483 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 150 | 200 | 200 | 200 | 200 | 200 | 175 | 175 | 150 |
| | LENGTH | 4750 | 4760 | 4770 | 4790 | 4810 | 4840 | 4880 | 4920 | 4960 |
| H BARS | C/C | - | - | - | - | - | - | 300 | 450 | 425 |
| | LENGTH | - | - | - | - | - | - | 1660 | 2220 | 2300 |
| J BARS | SIZE | 25 | 20 | 25 | 20 | 20 | 20 | 20 | 25 | 25 |
| | C/C | 450 | 300 | 450 | 300 | 300 | 300 | 300 | 450 | 425 |
| | LENGTH | 7210 | 6660 | 6810 | 6690 | 6720 | 6770 | 5860 | 5650 | 5660 |
| | B | 3320 | 2810 | 2950 | 2810 | 2810 | 2810 | 1860 | 1580 | 1550 |
| | D | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| | R | 250 | 220 | 230 | 240 | 260 | 290 | 320 | 360 | 390 |
| K BARS | SIZE | 25 | 20 | 25 | 20 | 20 | 20 | 20 | 25 | 25 |
| | C/C | 450 | 300 | 450 | 300 | 300 | 300 | 300 | 450 | 425 |
| | LENGTH | 6840 | 5990 | 5670 | 5520 | 5490 | 5510 | 5130 | 5010 | 5050 |
| | B | 2950 | 2140 | 1810 | 1640 | 1580 | 1550 | 1130 | 940 | 940 |
| | D | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| | R | 250 | 220 | 230 | 240 | 260 | 290 | 320 | 360 | 390 |
| U BARS | LENGTH | 1280 | 1210 | 1250 | 1310 | 1390 | 1520 | 1660 | 1830 | 1970 |
| | C | 920 | 850 | 890 | 950 | 1030 | 1160 | 1300 | 1470 | 1610 |
| T BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 15 | 15 | 15 | 15 |
| | C/C | 175 | 175 | 175 | 175 | 200 | 150 | 150 | 150 | 150 |
| | LENGTH | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| R BARS | # SETS | 84 | 83 | 82 | 84 | 84 | 84 | 86 | 84 | 85 |
| V BARS | LENGTH | 2015 | 2020 | 2025 | 2035 | 2095 | 2110 | 2130 | 2200 | 2220 |
| | B | 235 | 240 | 245 | 255 | 315 | 330 | 350 | 420 | 440 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 460 | 460 | 460 | 560 | 560 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.50

HEIGHT: 4.00

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 290 | 290 | 300 | 320 | 340 | 370 | 410 | 450 | 500 |
| | T | 350 | 310 | 310 | 330 | 350 | 370 | 410 | 450 | 480 |
| | F | 500 | 500 | 500 | 600 | 600 | 600 | 700 | 700 | 700 |
| QUANTITIES | STEEL | 730.4 | 724.2 | 708.1 | 712.6 | 710.8 | 719.5 | 705.9 | 738.8 | 762.4 |
| | CONC. | 5.4 | 5.2 | 5.3 | 5.8 | 6.1 | 6.5 | 7.3 | 7.9 | 8.6 |
| FOOTING REACTION * | V ULS | 262.3 | 241.5 | 258.6 | 290 | 326.5 | 365.6 | 449.3 | 541.4 | 641.4 |
| | V SLS | 175 | 171 | 190.1 | 219 | 250.9 | 285 | 355.9 | 430.8 | 511.9 |
| | H ULS | 146.6 | 150.7 | 160.5 | 171 | 182.2 | 194.5 | 218.6 | 242.1 | 267.1 |
| | V | 103 | 125 | 157 | 195 | 230 | 268 | 345 | 421 | 501 |
| P BARS | SIZE | 20 | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 |
| | C/C | 200 | 150 | 150 | 150 | 150 | 150 | 200 | 175 | 175 |
| | LENGTH | 4790 | 4790 | 4800 | 4820 | 4840 | 4870 | 4910 | 4950 | 5000 |
| H BARS | C/C | - | - | - | - | - | - | - | - | - |
| | LENGTH | - | - | - | - | - | - | - | - | - |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 300 | 300 | 300 | 300 | 450 | 450 | 425 | 400 |
| | LENGTH | 7550 | 7490 | 7190 | 7220 | 7250 | 7420 | 7480 | 7550 | 7590 |
| | B | 3110 | 3110 | 2810 | 2810 | 2810 | 2950 | 2950 | 2950 | 2950 |
| | D | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| | R | 280 | 240 | 240 | 260 | 280 | 300 | 340 | 380 | 410 |
| K BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 300 | 300 | 300 | 300 | 450 | 450 | 425 | 400 |
| | LENGTH | 7250 | 7190 | 6430 | 6310 | 6260 | 6200 | 6190 | 6280 | 6290 |
| | B | 2810 | 2810 | 2050 | 1900 | 1820 | 1730 | 1660 | 1680 | 1650 |
| | D | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| | R | 280 | 240 | 240 | 260 | 280 | 300 | 340 | 380 | 410 |
| U BARS | LENGTH | 1420 | 1310 | 1320 | 1410 | 1490 | 1590 | 1760 | 1930 | 2090 |
| | C | 1060 | 950 | 960 | 1050 | 1130 | 1230 | 1400 | 1570 | 1730 |
| T BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 150 | 150 | 150 | 150 | 150 | 150 | 175 | 175 | 175 |
| | LENGTH | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| R BARS | # SETS | 90 | 92 | 92 | 92 | 90 | 92 | 92 | 93 | 93 |
| V BARS | LENGTH | 2035 | 2035 | 2040 | 2100 | 2110 | 2125 | 2195 | 2215 | 2240 |
| | B | 255 | 255 | 260 | 320 | 330 | 345 | 415 | 435 | 460 |
| S BARS | LENGTH | 360 | 360 | 360 | 460 | 460 | 460 | 560 | 560 | 560 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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RIGID FRAME OPEN FOOTING CULVERTS

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.00
HEIGHT: 2.00

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 220 | 220 | 220 | 220 | 240 | 270 | 330 | 380 | 420 |
| | T | 300 | 270 | 270 | 290 | 310 | 330 | 380 | 410 | 450 |
| | F | 500 | 500 | 500 | 500 | 500 | 500 | 600 | 600 | 700 |
| QUANTITIES | STEEL | 569.7 | 501.0 | 515.5 | 530.9 | 543.0 | 536.9 | 519.4 | 541.7 | 566.9 |
| | CONC. | 3.8 | 3.6 | 3.6 | 3.7 | 4.0 | 4.2 | 5.1 | 5.5 | 6.2 |
| FOOTING REACTION * | V ULS | 249.5 | 228.6 | 244 | 271.4 | 308.9 | 350.8 | 437.2 | 536.7 | 636.8 |
| | V SLS | 159.7 | 157.6 | 176.4 | 203.1 | 235.8 | 270.9 | 346.5 | 425.2 | 506.5 |
| | H ULS | 63.5 | 62.8 | 64.5 | 67.8 | 71.3 | 74.7 | 81 | 86.1 | 92.1 |
| | V | 87 | 110 | 143 | 177 | 214 | 252 | 335 | 413 | 497 |
| P BARS | SIZE | 25 | 20 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 200 | 150 | 225 | 225 | 200 | 200 | 225 | 225 | 200 |
| | LENGTH | 5220 | 5220 | 5220 | 5220 | 5240 | 5270 | 5330 | 5380 | 5420 |
| H BARS | C/C | - | 350 | 325 | 300 | 300 | 325 | 350 | 325 | 325 |
| | LENGTH | - | 2600 | 2880 | 2920 | 2960 | 3020 | 3100 | 3140 | 3160 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 350 | 350 | 325 | 300 | 300 | 325 | 350 | 325 | 325 |
| | LENGTH | 5560 | 3910 | 3770 | 3770 | 3780 | 3790 | 3840 | 3880 | 3940 |
| | B | 3200 | 1600 | 1460 | 1420 | 1400 | 1380 | 1350 | 1350 | 1340 |
| | D | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| | R | 230 | 200 | 200 | 220 | 240 | 260 | 310 | 340 | 380 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 350 | 350 | 325 | 300 | 300 | 325 | 350 | 325 | 325 |
| | LENGTH | 3940 | 3140 | 3000 | 3000 | 3020 | 3050 | 3150 | 3220 | 3320 |
| | B | 1580 | 830 | 690 | 650 | 640 | 640 | 660 | 690 | 720 |
| | D | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| | R | 230 | 200 | 200 | 220 | 240 | 260 | 310 | 340 | 380 |
| U BARS | LENGTH | 1180 | 1100 | 1100 | 1150 | 1240 | 1340 | 1560 | 1720 | 1890 |
| | C | 820 | 740 | 740 | 790 | 880 | 980 | 1200 | 1360 | 1530 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 | 20 |
| | C/C | 300 | 325 | 375 | 425 | 450 | 450 | 450 | 450 | 450 |
| | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| R BARS | # SETS | 66 | 66 | 66 | 66 | 66 | 68 | 68 | 67 | 69 |
| V BARS | LENGTH | 2000 | 2000 | 2000 | 2000 | 2010 | 2025 | 2105 | 2130 | 2200 |
| | B | 220 | 220 | 220 | 220 | 230 | 245 | 325 | 350 | 420 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 360 | 460 | 460 | 560 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.00
HEIGHT: 2.50

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 230 | 220 | 240 | 260 | 290 | 320 | 360 | 410 | 450 |
| | T | 310 | 280 | 290 | 310 | 330 | 350 | 390 | 430 | 460 |
| | F | 500 | 500 | 500 | 500 | 500 | 600 | 600 | 700 | 700 |
| QUANTITIES | STEEL | 658.0 | 597.3 | 577.8 | 565.9 | 536.6 | 531.2 | 537.5 | 572.3 | 592.3 |
| | CONC. | 4.1 | 3.9 | 4.1 | 4.3 | 4.6 | 5.1 | 5.6 | 6.4 | 6.9 |
| FOOTING REACTION * | V ULS | 255.3 | 233.8 | 252.3 | 284.4 | 324.7 | 366.9 | 452.3 | 552.4 | 652.9 |
| | V SLS | 164.4 | 161.1 | 183.2 | 213.1 | 248 | 284.1 | 357.1 | 438.2 | 519.7 |
| | H ULS | 81.6 | 81.8 | 85.9 | 90.9 | 96.4 | 101.8 | 112.9 | 123.9 | 134.4 |
| | V | 91 | 114 | 150 | 186 | 224 | 266 | 344 | 428 | 509 |
| P BARS | SIZE | 25 | 25 | 25 | 20 | 20 | 20 | 20 | 25 | 25 |
| | C/C | 200 | 225 | 225 | 150 | 150 | 150 | 150 | 225 | 200 |
| | LENGTH | 5230 | 5220 | 5240 | 5260 | 5290 | 5320 | 5360 | 5410 | 5450 |
| H BARS | C/C | - | 350 | 350 | 350 | 375 | 375 | 375 | 350 | 350 |
| | LENGTH | - | 1740 | 2560 | 2640 | 2960 | 3020 | 3080 | 3120 | 3180 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 350 | 350 | 350 | 350 | 375 | 375 | 375 | 350 | 350 |
| | LENGTH | 6080 | 4850 | 4470 | 4460 | 4340 | 4350 | 4380 | 4440 | 4460 |
| | B | 3200 | 2020 | 1620 | 1580 | 1430 | 1410 | 1380 | 1370 | 1350 |
| | D | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| | R | 240 | 210 | 220 | 240 | 260 | 280 | 320 | 360 | 390 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 350 | 350 | 350 | 350 | 375 | 375 | 375 | 350 | 350 |
| | LENGTH | 4690 | 3990 | 3700 | 3700 | 3600 | 3630 | 3710 | 3800 | 3860 |
| | B | 1810 | 1160 | 850 | 820 | 690 | 690 | 710 | 730 | 750 |
| | D | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| | R | 240 | 210 | 220 | 240 | 260 | 280 | 320 | 360 | 390 |
| U BARS | LENGTH | 1220 | 1130 | 1180 | 1270 | 1370 | 1460 | 1630 | 1820 | 1960 |
| | C | 860 | 770 | 820 | 910 | 1010 | 1100 | 1270 | 1460 | 1600 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 |
| | C/C | 175 | 200 | 225 | 250 | 300 | 350 | 450 | 450 | 450 |
| | LENGTH | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| R BARS | # SETS | 74 | 74 | 74 | 76 | 76 | 74 | 76 | 75 | 77 |
| V BARS | LENGTH | 2005 | 2000 | 2010 | 2020 | 2035 | 2100 | 2120 | 2195 | 2215 |
| | B | 225 | 220 | 230 | 240 | 255 | 320 | 340 | 415 | 435 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 460 | 460 | 560 | 560 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.00

HEIGHT: 3.00

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 230 | 230 | 240 | 260 | 300 | 330 | 370 | 420 | 460 |
| | T | 320 | 280 | 290 | 310 | 340 | 360 | 400 | 450 | 480 |
| | F | 500 | 500 | 500 | 500 | 500 | 600 | 600 | 700 | 700 |
| QUANTITIES | STEEL | 704.2 | 701.6 | 689.1 | 645.4 | 592.1 | 573.7 | 592.0 | 612.1 | 626.6 |
| | CONC. | 4.4 | 4.2 | 4.3 | 4.6 | 5.0 | 5.6 | 6.1 | 7.0 | 7.5 |
| FOOTING REACTION * | V ULS | 257.1 | 237.1 | 255.8 | 288.2 | 332.1 | 374.8 | 462.3 | 563.6 | 665.1 |
| | V SLS | 168.1 | 165 | 186.2 | 216.3 | 254.1 | 290.7 | 364.5 | 447.4 | 529.8 |
| | H ULS | 100 | 102.1 | 108 | 115 | 122.9 | 130.7 | 146.1 | 161.6 | 176.9 |
| | V | 94 | 117 | 152 | 189 | 230 | 273 | 351 | 436 | 518 |
| P BARS | SIZE | 25 | 25 | 20 | 25 | 20 | 20 | 25 | 25 | 25 |
| | C/C | 200 | 225 | 150 | 225 | 150 | 150 | 225 | 225 | 225 |
| | LENGTH | 5230 | 5230 | 5240 | 5260 | 5300 | 5330 | 5370 | 5420 | 5460 |
| H BARS | C/C | - | - | - | 350 | 400 | 425 | 400 | 375 | 375 |
| | LENGTH | - | - | - | 2480 | 2600 | 2680 | 3000 | 3040 | 3080 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 375 | 350 | 350 | 350 | 400 | 425 | 400 | 375 | 375 |
| | LENGTH | 6590 | 6530 | 6550 | 5040 | 5030 | 5040 | 4940 | 5000 | 5030 |
| | B | 3200 | 3200 | 3200 | 1660 | 1610 | 1580 | 1420 | 1400 | 1390 |
| | D | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| | R | 250 | 210 | 220 | 240 | 270 | 290 | 330 | 380 | 410 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 375 | 350 | 350 | 350 | 400 | 425 | 400 | 375 | 375 |
| | LENGTH | 5730 | 5110 | 4900 | 4280 | 4300 | 4330 | 4280 | 4390 | 4440 |
| | B | 2340 | 1780 | 1550 | 900 | 880 | 870 | 760 | 790 | 800 |
| | D | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| | R | 250 | 210 | 220 | 240 | 270 | 290 | 330 | 380 | 410 |
| U BARS | LENGTH | 1250 | 1140 | 1180 | 1270 | 1410 | 1510 | 1680 | 1890 | 2030 |
| | C | 890 | 780 | 820 | 910 | 1050 | 1150 | 1320 | 1530 | 1670 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 |
| | C/C | 150 | 150 | 150 | 175 | 200 | 225 | 250 | 275 | 300 |
| | LENGTH | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| R BARS | # SETS | 78 | 80 | 80 | 80 | 80 | 80 | 81 | 81 | 81 |
| V BARS | LENGTH | 2005 | 2005 | 2010 | 2020 | 2040 | 2105 | 2125 | 2200 | 2220 |
| | B | 225 | 225 | 230 | 240 | 260 | 325 | 345 | 420 | 440 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 460 | 460 | 560 | 560 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.00
HEIGHT: 3.50

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 250 | 260 | 280 | 300 | 330 | 350 | 410 | 450 | 490 |
| | T | 340 | 300 | 310 | 340 | 350 | 380 | 420 | 460 | 500 |
| | F | 500 | 500 | 500 | 500 | 600 | 600 | 700 | 700 | 700 |
| QUANTITIES | STEEL | 758.4 | 713.1 | 676.8 | 666.5 | 654.5 | 666.6 | 651.2 | 660.1 | 672.7 |
| | CONC. | 4.9 | 4.8 | 5.0 | 5.3 | 5.9 | 6.2 | 7.2 | 7.8 | 8.4 |
| FOOTING REACTION * | V ULS | 266.1 | 247.3 | 266.8 | 303.1 | 343.9 | 386.4 | 480.4 | 576.7 | 680.7 |
| | V SLS | 175.5 | 173.7 | 196.8 | 228.5 | 263.9 | 300.3 | 379.4 | 460.6 | 545.3 |
| | H ULS | 121.3 | 125.1 | 132.4 | 141.2 | 151.1 | 160.2 | 179.9 | 199 | 218.3 |
| | V | 101 | 125 | 162 | 200 | 242 | 281 | 368 | 449 | 533 |
| P BARS | SIZE | 25 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 25 |
| | C/C | 225 | 150 | 150 | 175 | 175 | 150 | 150 | 150 | 225 |
| | LENGTH | 5250 | 5260 | 5280 | 5300 | 5330 | 5350 | 5410 | 5450 | 5490 |
| H BARS | C/C | - | - | - | - | 425 | 425 | 425 | 425 | 400 |
| | LENGTH | - | - | - | - | 1960 | 2540 | 2700 | 2740 | 3040 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 400 | 400 | 425 | 425 | 425 | 425 | 425 | 425 | 400 |
| | LENGTH | 7490 | 7060 | 7080 | 7120 | 5890 | 5640 | 5640 | 5680 | 5600 |
| | B | 3570 | 3200 | 3200 | 3200 | 1950 | 1650 | 1590 | 1570 | 1420 |
| | D | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| | R | 270 | 230 | 240 | 270 | 280 | 310 | 350 | 390 | 430 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 400 | 400 | 425 | 425 | 425 | 425 | 425 | 425 | 400 |
| | LENGTH | 7120 | 5900 | 5640 | 5580 | 5090 | 4950 | 4990 | 5070 | 5030 |
| | B | 3200 | 2040 | 1760 | 1660 | 1150 | 960 | 940 | 960 | 850 |
| | D | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| | R | 270 | 230 | 240 | 270 | 280 | 310 | 350 | 390 | 430 |
| U BARS | LENGTH | 1340 | 1240 | 1290 | 1410 | 1480 | 1590 | 1790 | 1960 | 2130 |
| | C | 980 | 880 | 930 | 1050 | 1120 | 1230 | 1430 | 1600 | 1770 |
| T BARS | SIZE | 20 | 20 | 20 | 20 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 175 | 175 | 200 | 200 | 150 | 150 | 175 | 175 | 200 |
| | LENGTH | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| R BARS | # SETS | 88 | 86 | 88 | 88 | 88 | 90 | 87 | 89 | 89 |
| V BARS | LENGTH | 2015 | 2020 | 2030 | 2040 | 2105 | 2115 | 2195 | 2215 | 2235 |
| | B | 235 | 240 | 250 | 260 | 325 | 335 | 415 | 435 | 455 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 460 | 460 | 560 | 560 | 560 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.00

HEIGHT: 4.00

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| | | | | | | | | | | |
| DIMENSIONS | W | 290 | 300 | 310 | 330 | 360 | 380 | 440 | 480 | 520 |
| | T | 360 | 330 | 330 | 350 | 370 | 400 | 440 | 480 | 520 |
| | F | 500 | 500 | 600 | 600 | 600 | 600 | 700 | 700 | 800 |
| QUANTITIES | STEEL | 783.6 | 746.4 | 740.2 | 719.1 | 723.7 | 725.8 | 711.4 | 738.1 | 747.8 |
| | CONC. | 5.7 | 5.6 | 5.9 | 6.2 | 6.6 | 6.9 | 8.0 | 8.6 | 9.5 |
| FOOTING REACTION * | V ULS | 279.5 | 261.3 | 280.6 | 314.9 | 357.8 | 401.1 | 497 | 597.7 | 703.6 |
| | V SLS | 186.4 | 185.4 | 206.8 | 238.3 | 275.3 | 312.4 | 393 | 475.5 | 561.5 |
| | H ULS | 146.3 | 150.2 | 159.4 | 169.4 | 180.7 | 191.4 | 214.9 | 237.7 | 260.6 |
| | V | 110 | 136 | 174 | 212 | 253 | 292 | 380 | 463 | 551 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 150 | 175 | 200 | 175 | 175 | 175 | 175 | 150 | 150 |
| | LENGTH | 5290 | 5300 | 5310 | 5330 | 5360 | 5380 | 5440 | 5480 | 5520 |
| H BARS | C/C | - | - | - | - | - | - | 425 | 400 | 400 |
| | LENGTH | - | - | - | - | - | - | 1800 | 2640 | 2680 |
| J BARS | SIZE | 25 | 20 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 450 | 300 | 450 | 450 | 450 | 450 | 425 | 400 | 400 |
| | LENGTH | 8030 | 7470 | 7610 | 7640 | 7670 | 7720 | 6630 | 6270 | 6320 |
| | B | 3570 | 3060 | 3200 | 3200 | 3200 | 3200 | 2050 | 1630 | 1610 |
| | D | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| | R | 290 | 260 | 260 | 280 | 300 | 330 | 370 | 410 | 450 |
| K BARS | SIZE | 25 | 20 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 450 | 300 | 450 | 450 | 450 | 450 | 425 | 400 | 400 |
| | LENGTH | 7660 | 6810 | 6380 | 6280 | 6210 | 6260 | 5830 | 5680 | 5770 |
| | B | 3200 | 2400 | 1970 | 1840 | 1740 | 1740 | 1250 | 1040 | 1060 |
| | D | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| | R | 290 | 260 | 260 | 280 | 300 | 330 | 370 | 410 | 450 |
| U BARS | LENGTH | 1450 | 1380 | 1390 | 1480 | 1580 | 1690 | 1890 | 2060 | 2230 |
| | C | 1090 | 1020 | 1030 | 1120 | 1220 | 1330 | 1530 | 1700 | 1870 |
| T BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 150 | 150 | 150 | 175 | 175 | 175 | 200 | 200 | 200 |
| | LENGTH | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| R BARS | # SETS | 94 | 96 | 96 | 94 | 96 | 95 | 97 | 97 | 97 |
| V BARS | LENGTH | 2035 | 2040 | 2095 | 2105 | 2120 | 2130 | 2210 | 2230 | 2300 |
| | B | 255 | 260 | 315 | 325 | 340 | 350 | 430 | 450 | 520 |
| S BARS | LENGTH | 360 | 360 | 460 | 460 | 460 | 460 | 560 | 560 | 660 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.50

HEIGHT: 2.00

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 220 | 220 | 260 | 260 | 280 | 310 | 360 | 410 | 480 |
| | T | 320 | 280 | 300 | 320 | 350 | 370 | 410 | 450 | 490 |
| | F | 500 | 500 | 500 | 500 | 500 | 600 | 600 | 700 | 700 |
| QUANTITIES | STEEL | 606.6 | 571.3 | 581.5 | 586.8 | 556.3 | 596.4 | 583.3 | 618.9 | 639.5 |
| | CONC. | 4.1 | 3.8 | 4.1 | 4.3 | 4.6 | 5.1 | 5.6 | 6.4 | 7.0 |
| FOOTING REACTION * | V ULS | 267.2 | 246.4 | 265.8 | 303.4 | 343.6 | 392.3 | 486.4 | 592.3 | 710.6 |
| | V SLS | 171.6 | 169.4 | 196.3 | 227.1 | 263.4 | 303.3 | 382.8 | 469.4 | 564.3 |
| | H ULS | 61.9 | 60.5 | 61.5 | 63 | 65.2 | 67.1 | 70.5 | 73.3 | 93.4 |
| | V | 94 | 119 | 159 | 198 | 239 | 283 | 368 | 458 | 551 |
| P BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 175 | 200 | 200 | 200 | 225 | 200 | 200 | 200 | 200 |
| | LENGTH | 5720 | 5720 | 5760 | 5760 | 5780 | 5810 | 5860 | 5910 | 5980 |
| H BARS | C/C | 300 | 300 | 300 | 300 | 325 | 300 | 325 | 300 | 300 |
| | LENGTH | 2660 | 3040 | 3440 | 3400 | 3420 | 3480 | 3520 | 3580 | 3660 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 300 | 300 | 300 | 325 | 300 | 325 | 300 | 300 |
| | LENGTH | 4160 | 3950 | 3800 | 3830 | 3860 | 3870 | 3920 | 3970 | 4020 |
| | B | 1770 | 1620 | 1440 | 1440 | 1420 | 1400 | 1390 | 1370 | 1360 |
| | D | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| | R | 250 | 210 | 230 | 250 | 280 | 300 | 340 | 380 | 420 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 300 | 300 | 300 | 325 | 300 | 325 | 300 | 300 |
| | LENGTH | 3420 | 3210 | 3060 | 3100 | 3140 | 3170 | 3260 | 3350 | 3440 |
| | B | 1030 | 880 | 700 | 710 | 700 | 700 | 730 | 750 | 780 |
| | D | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| | R | 250 | 210 | 230 | 250 | 280 | 300 | 340 | 380 | 420 |
| U BARS | LENGTH | 1240 | 1130 | 1240 | 1290 | 1410 | 1510 | 1690 | 1870 | 2090 |
| | C | 880 | 770 | 880 | 930 | 1050 | 1150 | 1330 | 1510 | 1730 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 325 | 400 | 300 | 300 | 300 | 300 | 300 | 300 | 250 |
| | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| R BARS | # SETS | 70 | 70 | 70 | 72 | 71 | 71 | 71 | 73 | 73 |
| V BARS | LENGTH | 2000 | 2000 | 2020 | 2020 | 2030 | 2095 | 2120 | 2195 | 2230 |
| | B | 220 | 220 | 240 | 240 | 250 | 315 | 340 | 415 | 450 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 460 | 460 | 560 | 560 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

CONCRETE CULVERT DESIGN AND DETAILING MANUAL

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RIGID FRAME OPEN FOOTING CULVERTS

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.50

HEIGHT: 2.50

| | | FILL HEIGHT | | | | | | | | |
|---------------------------|---------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 230 | 230 | 230 | 260 | 300 | 320 | 370 | 430 | 480 |
| | T | 320 | 290 | 300 | 330 | 360 | 380 | 420 | 460 | 500 |
| | F | 500 | 500 | 500 | 500 | 500 | 600 | 600 | 700 | 700 |
| QUANTITIES | STEEL | 734.9 | 653.2 | 643.4 | 606.2 | 584.4 | 587.2 | 616.6 | 630.7 | 664.0 |
| | CONC. | 4.4 | 4.2 | 4.2 | 4.6 | 5.0 | 5.5 | 6.1 | 7.0 | 7.6 |
| FOOTING REACTION * | V ULS | 271.9 | 252.1 | 269.1 | 307.3 | 352.6 | 400 | 495.2 | 606 | 717.6 |
| | V SLS | 175.5 | 174.2 | 195.7 | 231.2 | 270.7 | 309.7 | 390.1 | 479.7 | 571.3 |
| | H ULS | 80.6 | 80.4 | 83.2 | 87.5 | 91.9 | 96.7 | 105.7 | 114 | 121.5 |
| | V | 97 | 123 | 160 | 202 | 245 | 289 | 375 | 468 | 558 |
| P BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 175 | 200 | 200 | 200 | 225 | 200 | 200 | 200 | 200 |
| | LENGTH | 5730 | 5730 | 5730 | 5760 | 5800 | 5820 | 5870 | 5930 | 5980 |
| H BARS | C/C | - | 300 | 300 | 325 | 325 | 350 | 325 | 325 | 300 |
| | LENGTH | - | 2860 | 2980 | 3320 | 3380 | 3420 | 3500 | 3580 | 3620 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 300 | 300 | 325 | 325 | 350 | 325 | 325 | 300 |
| | LENGTH | 6340 | 4560 | 4500 | 4380 | 4410 | 4420 | 4450 | 4490 | 4550 |
| | B | 3450 | 1710 | 1640 | 1470 | 1450 | 1430 | 1400 | 1380 | 1370 |
| | D | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| | R | 250 | 220 | 230 | 260 | 290 | 310 | 350 | 390 | 430 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 300 | 300 | 325 | 325 | 350 | 325 | 325 | 300 |
| | LENGTH | 4720 | 3820 | 3760 | 3640 | 3700 | 3730 | 3800 | 3890 | 3980 |
| | B | 1830 | 970 | 900 | 730 | 740 | 740 | 750 | 780 | 800 |
| | D | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| | R | 250 | 220 | 230 | 260 | 290 | 310 | 350 | 390 | 430 |
| U BARS | LENGTH | 1250 | 1170 | 1200 | 1320 | 1460 | 1550 | 1730 | 1930 | 2120 |
| | C | 890 | 810 | 840 | 960 | 1100 | 1190 | 1370 | 1570 | 1760 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 | 20 |
| | C/C | 200 | 225 | 250 | 325 | 400 | 450 | 450 | 450 | 400 |
| | LENGTH | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| R BARS | # SETS | 78 | 78 | 78 | 80 | 77 | 77 | 79 | 81 | 78 |
| V BARS | LENGTH | 2005 | 2005 | 2005 | 2020 | 2040 | 2100 | 2125 | 2205 | 2230 |
| | B | 225 | 225 | 225 | 240 | 260 | 320 | 345 | 425 | 450 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 360 | 460 | 460 | 560 | 560 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.50

HEIGHT: 3.00

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 230 | 230 | 260 | 290 | 320 | 350 | 400 | 440 | 500 |
| | T | 340 | 290 | 320 | 340 | 370 | 390 | 440 | 480 | 520 |
| | F | 500 | 500 | 500 | 500 | 600 | 600 | 600 | 700 | 700 |
| QUANTITIES | STEEL | 776.1 | 789.0 | 699.9 | 653.8 | 640.9 | 616.8 | 613.1 | 663.7 | 686.9 |
| | CONC. | 4.7 | 4.4 | 4.8 | 5.1 | 5.8 | 6.1 | 6.8 | 7.6 | 8.3 |
| FOOTING REACTION * | V ULS | 276.5 | 255.5 | 279.7 | 318.9 | 363.2 | 412.3 | 506.8 | 616.4 | 733.4 |
| | V SLS | 180.1 | 177 | 204.5 | 239.9 | 278.6 | 319.8 | 402.6 | 489.3 | 584.4 |
| | H ULS | 99.6 | 101.3 | 106.3 | 112.7 | 119.3 | 126.1 | 139.8 | 153.4 | 166.1 |
| | V | 101 | 126 | 168 | 209 | 256 | 298 | 386 | 476 | 570 |
| P BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 200 | 200 | 200 | 225 | 225 | 225 | 225 | 200 | 200 |
| | LENGTH | 5730 | 5730 | 5760 | 5790 | 5820 | 5850 | 5900 | 5940 | 6000 |
| H BARS | C/C | - | - | 325 | 350 | 350 | 375 | 375 | 350 | 325 |
| | LENGTH | - | - | 2840 | 3000 | 3060 | 3400 | 3480 | 3500 | 3580 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 325 | 300 | 325 | 350 | 350 | 375 | 375 | 350 | 325 |
| | LENGTH | 6870 | 6800 | 5110 | 5070 | 5090 | 4960 | 5000 | 5050 | 5100 |
| | B | 3450 | 3450 | 1720 | 1650 | 1620 | 1460 | 1420 | 1410 | 1390 |
| | D | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| | R | 270 | 220 | 250 | 270 | 300 | 320 | 370 | 410 | 450 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 325 | 300 | 325 | 350 | 350 | 375 | 375 | 350 | 325 |
| | LENGTH | 5640 | 5110 | 4370 | 4340 | 4390 | 4280 | 4370 | 4460 | 4550 |
| | B | 2220 | 1760 | 980 | 920 | 920 | 780 | 790 | 820 | 840 |
| | D | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| | R | 270 | 220 | 250 | 270 | 300 | 320 | 370 | 410 | 450 |
| U BARS | LENGTH | 1310 | 1170 | 1290 | 1390 | 1520 | 1620 | 1830 | 2000 | 2200 |
| | C | 950 | 810 | 930 | 1030 | 1160 | 1260 | 1470 | 1640 | 1840 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 150 | 150 | 175 | 200 | 250 | 275 | 325 | 350 | 400 |
| | LENGTH | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| R BARS | # SETS | 84 | 84 | 84 | 84 | 83 | 85 | 85 | 85 | 86 |
| V BARS | LENGTH | 2005 | 2005 | 2020 | 2035 | 2100 | 2115 | 2140 | 2210 | 2240 |
| | B | 225 | 225 | 240 | 255 | 320 | 335 | 360 | 430 | 460 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 460 | 460 | 460 | 560 | 560 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.50

HEIGHT: 3.50

| | | FILL HEIGHT | | | | | | | | |
|--------------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 250 | 260 | 280 | 310 | 340 | 370 | 430 | 470 | 530 |
| | T | 360 | 310 | 330 | 360 | 380 | 400 | 450 | 500 | 540 |
| | F | 500 | 500 | 500 | 600 | 600 | 600 | 700 | 700 | 800 |
| QUANTITIES | STEEL | 785.5 | 788.6 | 735.1 | 709.9 | 677.2 | 676.9 | 700.3 | 707.2 | 732.5 |
| | CONC. | 5.2 | 5.0 | 5.3 | 5.9 | 6.3 | 6.7 | 7.8 | 8.4 | 9.5 |
| FOOTING REACTION * | V ULS | 284 | 265.9 | 288.2 | 329.4 | 373.4 | 423.2 | 525.3 | 634.1 | 753 |
| | V SLS | 187.7 | 185.7 | 211.6 | 248.6 | 287 | 328.8 | 414.9 | 503.9 | 600.5 |
| | H ULS | 120.2 | 124.6 | 130.8 | 138.9 | 147.8 | 156.7 | 174.5 | 192.2 | 209.6 |
| | V | 108 | 134 | 175 | 220 | 263 | 307 | 401 | 489 | 588 |
| P BARS | SIZE | 25 | 25 | 20 | 20 | 20 | 20 | 25 | 25 | 25 |
| | C/C | 200 | 225 | 150 | 150 | 150 | 150 | 225 | 200 | 200 |
| | LENGTH | 5750 | 5760 | 5780 | 5810 | 5840 | 5870 | 5930 | 5970 | 6030 |
| H BARS | C/C | - | - | - | 375 | 400 | 400 | 375 | 375 | 350 |
| | LENGTH | - | - | - | 2820 | 2960 | 3060 | 3420 | 3440 | 3540 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 375 | 350 | 375 | 375 | 400 | 400 | 375 | 375 | 350 |
| | LENGTH | 7580 | 7330 | 7360 | 5700 | 5670 | 5660 | 5570 | 5630 | 5660 |
| | B | 3620 | 3450 | 3450 | 1740 | 1680 | 1640 | 1470 | 1450 | 1420 |
| | D | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| | R | 290 | 240 | 260 | 290 | 310 | 330 | 380 | 430 | 470 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 375 | 350 | 375 | 375 | 400 | 400 | 375 | 375 | 350 |
| | LENGTH | 6880 | 5840 | 5660 | 4990 | 4980 | 5000 | 4950 | 5060 | 5130 |
| | B | 2920 | 1960 | 1750 | 1030 | 990 | 980 | 850 | 880 | 890 |
| | D | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| | R | 290 | 240 | 260 | 290 | 310 | 330 | 380 | 430 | 470 |
| U BARS | LENGTH | 1390 | 1270 | 1350 | 1480 | 1580 | 1680 | 1900 | 2100 | 2300 |
| | C | 1030 | 910 | 990 | 1120 | 1220 | 1320 | 1540 | 1740 | 1940 |
| T BARS | SIZE | 20 | 20 | 20 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 200 | 175 | 200 | 150 | 175 | 175 | 200 | 225 | 250 |
| | LENGTH | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| R BARS | # SETS | 91 | 92 | 92 | 91 | 93 | 91 | 93 | 92 | 94 |
| V BARS | LENGTH | 2015 | 2020 | 2030 | 2095 | 2110 | 2125 | 2205 | 2225 | 2305 |
| | B | 235 | 240 | 250 | 315 | 330 | 345 | 425 | 445 | 525 |
| S BARS | LENGTH | 360 | 360 | 360 | 460 | 460 | 460 | 560 | 560 | 660 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.50
HEIGHT: 4.00

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 290 | 300 | 320 | 350 | 370 | 400 | 460 | 510 | 560 |
| | T | 380 | 340 | 350 | 370 | 390 | 420 | 470 | 510 | 550 |
| | F | 500 | 500 | 600 | 600 | 600 | 600 | 700 | 800 | 800 |
| QUANTITIES | STEEL | 798.7 | 771.9 | 767.1 | 746.5 | 745.8 | 728.2 | 760.0 | 799.4 | 792.2 |
| | CONC. | 6.0 | 5.8 | 6.3 | 6.7 | 7.0 | 7.5 | 8.6 | 9.6 | 10.3 |
| FOOTING REACTION * | V ULS | 297.8 | 277.9 | 300.4 | 343.6 | 386.4 | 438.3 | 542.4 | 655.7 | 773.5 |
| | V SLS | 198.9 | 197.3 | 223.3 | 260.4 | 297.8 | 341.3 | 428.9 | 520.6 | 616.2 |
| | H ULS | 145.3 | 149.2 | 157.4 | 167.9 | 178 | 188.6 | 210.3 | 231.9 | 253.4 |
| | V | 117 | 145 | 188 | 231 | 273 | 319 | 413 | 508 | 602 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 25 |
| | C/C | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 225 | 200 |
| | LENGTH | 5790 | 5800 | 5820 | 5850 | 5870 | 5900 | 5960 | 6010 | 6060 |
| H BARS | C/C | - | - | - | - | 400 | 425 | 400 | 375 | 375 |
| | LENGTH | - | - | - | - | 1900 | 2940 | 3060 | 3140 | 3500 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 425 | 425 | 425 | 425 | 400 | 425 | 400 | 375 | 375 |
| | LENGTH | 8310 | 7870 | 7890 | 7920 | 6730 | 6260 | 6290 | 6320 | 6210 |
| | B | 3820 | 3450 | 3450 | 3450 | 2230 | 1710 | 1660 | 1630 | 1460 |
| | D | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| | R | 310 | 270 | 280 | 300 | 320 | 350 | 400 | 440 | 480 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 425 | 425 | 425 | 425 | 400 | 425 | 400 | 375 | 375 |
| | LENGTH | 7940 | 6710 | 6420 | 6270 | 5810 | 5610 | 5690 | 5760 | 5690 |
| | B | 3450 | 2290 | 1980 | 1800 | 1310 | 1060 | 1060 | 1070 | 940 |
| | D | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| | R | 310 | 270 | 280 | 300 | 320 | 350 | 400 | 440 | 480 |
| U BARS | LENGTH | 1510 | 1410 | 1460 | 1560 | 1650 | 1780 | 2000 | 2190 | 2370 |
| | C | 1150 | 1050 | 1100 | 1200 | 1290 | 1420 | 1640 | 1830 | 2010 |
| T BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 15 | 15 | 15 | 15 |
| | C/C | 175 | 175 | 175 | 200 | 200 | 150 | 150 | 150 | 175 |
| | LENGTH | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| R BARS | # SETS | 97 | 100 | 97 | 97 | 99 | 99 | 101 | 100 | 100 |
| V BARS | LENGTH | 2035 | 2040 | 2100 | 2115 | 2125 | 2140 | 2220 | 2295 | 2320 |
| | B | 255 | 260 | 320 | 335 | 345 | 360 | 440 | 515 | 540 |
| S BARS | LENGTH | 360 | 360 | 460 | 460 | 460 | 460 | 560 | 660 | 660 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 6.00

HEIGHT: 2.00

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 310 | 310 | 310 | 320 | 310 | 340 | 400 | 470 | 550 |
| | T | 360 | 320 | 340 | 360 | 380 | 400 | 450 | 490 | 540 |
| | F | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 700 | 800 |
| QUANTITIES | STEEL | 600.0 | 589.7 | 590.3 | 592.2 | 606.2 | 610.1 | 618.2 | 638.9 | 663.3 |
| | CONC. | 5.2 | 4.9 | 5.0 | 5.2 | 5.3 | 5.6 | 6.3 | 7.2 | 8.2 |
| FOOTING REACTION * | V ULS | 299.1 | 272.3 | 298.8 | 340.3 | 377.8 | 429.1 | 536.5 | 655.3 | 786.7 |
| | V SLS | 195.6 | 190.5 | 218.9 | 255.6 | 289.3 | 332.4 | 422.4 | 519.8 | 626.2 |
| | H ULS | 61 | 57.1 | 55.8 | 56 | 58.3 | 58.3 | 74 | 102.5 | 135.2 |
| | V | 112 | 140 | 181 | 224 | 264 | 310 | 404 | 505 | 612 |
| P BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 225 | 225 | 225 | 225 | 200 | 200 | 200 | 200 | 200 |
| | LENGTH | 6310 | 6310 | 6310 | 6320 | 6310 | 6340 | 6400 | 6470 | 6550 |
| H BARS | C/C | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| | LENGTH | 3420 | 3780 | 3800 | 3840 | 3860 | 3900 | 3960 | 4060 | 4160 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| | LENGTH | 4150 | 3940 | 3940 | 3950 | 3940 | 3960 | 4020 | 4060 | 4120 |
| | B | 1690 | 1550 | 1520 | 1490 | 1450 | 1440 | 1420 | 1400 | 1380 |
| | D | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| | R | 290 | 250 | 270 | 290 | 310 | 330 | 380 | 420 | 470 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| | LENGTH | 3440 | 3230 | 3230 | 3240 | 3250 | 3290 | 3400 | 3490 | 3590 |
| | B | 980 | 840 | 810 | 780 | 760 | 770 | 800 | 830 | 850 |
| | D | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| | R | 290 | 250 | 270 | 290 | 310 | 330 | 380 | 420 | 470 |
| U BARS | LENGTH | 1480 | 1370 | 1420 | 1490 | 1540 | 1630 | 1860 | 2070 | 2330 |
| | C | 1120 | 1010 | 1060 | 1130 | 1180 | 1270 | 1500 | 1710 | 1970 |
| T BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 400 | 350 |
| | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| R BARS | # SETS | 74 | 74 | 74 | 74 | 74 | 74 | 73 | 75 | 77 |
| V BARS | LENGTH | 2095 | 2095 | 2095 | 2100 | 2095 | 2110 | 2140 | 2225 | 2315 |
| | B | 315 | 315 | 315 | 320 | 315 | 330 | 360 | 445 | 535 |
| S BARS | LENGTH | 460 | 460 | 460 | 460 | 460 | 460 | 460 | 560 | 660 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 6.00
HEIGHT: 2.50

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 310 | 310 | 310 | 280 | 310 | 340 | 410 | 460 | 530 |
| | T | 360 | 320 | 330 | 350 | 380 | 410 | 460 | 500 | 540 |
| | F | 600 | 600 | 600 | 500 | 600 | 600 | 700 | 700 | 800 |
| QUANTITIES | STEEL | 665.9 | 637.8 | 634.4 | 642.6 | 624.3 | 672.9 | 646.1 | 699.4 | 722.9 |
| | CONC. | 5.5 | 5.2 | 5.3 | 5.0 | 5.7 | 6.0 | 7.1 | 7.7 | 8.7 |
| FOOTING REACTION * | V ULS | 305 | 276.7 | 302.2 | 337 | 382.4 | 435.3 | 546 | 661 | 789 |
| | V SLS | 199.4 | 194.3 | 221.7 | 252.9 | 293.1 | 337.6 | 430.2 | 524.6 | 628.3 |
| | H ULS | 81.3 | 78.9 | 79.9 | 83.6 | 87 | 90.4 | 95.9 | 101.6 | 104.9 |
| | V | 116 | 144 | 185 | 220 | 269 | 315 | 415 | 510 | 615 |
| P BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 200 | 225 | 225 | 200 | 200 | 175 | 200 | 175 | 175 |
| | LENGTH | 6310 | 6310 | 6310 | 6280 | 6310 | 6340 | 6410 | 6460 | 6530 |
| H BARS | C/C | 300 | 300 | 300 | 300 | 325 | 300 | 325 | 300 | 300 |
| | LENGTH | 3160 | 3540 | 3780 | 3780 | 3840 | 3880 | 3960 | 4020 | 4100 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 300 | 300 | 300 | 325 | 300 | 325 | 300 | 300 |
| | LENGTH | 4780 | 4560 | 4450 | 4430 | 4450 | 4470 | 4530 | 4580 | 4630 |
| | B | 1820 | 1670 | 1540 | 1490 | 1460 | 1440 | 1420 | 1400 | 1390 |
| | D | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| | R | 290 | 250 | 260 | 280 | 310 | 340 | 390 | 430 | 470 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 300 | 300 | 300 | 325 | 300 | 325 | 300 | 300 |
| | LENGTH | 4050 | 3850 | 3740 | 3720 | 3760 | 3810 | 3920 | 4020 | 4100 |
| | B | 1090 | 960 | 830 | 780 | 770 | 780 | 810 | 840 | 860 |
| | D | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| | R | 290 | 250 | 260 | 280 | 310 | 340 | 390 | 430 | 470 |
| U BARS | LENGTH | 1480 | 1370 | 1390 | 1410 | 1540 | 1660 | 1900 | 2090 | 2300 |
| | C | 1120 | 1010 | 1030 | 1050 | 1180 | 1300 | 1540 | 1730 | 1940 |
| T BARS | SIZE | 15 | 15 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 325 | 375 | 450 | 425 | 450 | 450 | 450 | 400 | 350 |
| | LENGTH | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| R BARS | # SETS | 80 | 82 | 82 | 80 | 80 | 82 | 83 | 81 | 83 |
| V BARS | LENGTH | 2095 | 2095 | 2095 | 2030 | 2095 | 2110 | 2195 | 2220 | 2305 |
| | B | 315 | 315 | 315 | 250 | 315 | 330 | 415 | 440 | 525 |
| S BARS | LENGTH | 460 | 460 | 460 | 360 | 460 | 460 | 560 | 560 | 660 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 6.00
HEIGHT: 3.00

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 240 | 240 | 260 | 300 | 330 | 360 | 420 | 480 | 530 |
| | T | 360 | 310 | 330 | 360 | 390 | 420 | 470 | 510 | 560 |
| | F | 500 | 500 | 500 | 500 | 600 | 600 | 700 | 700 | 800 |
| QUANTITIES | STEEL | 815.3 | 772.2 | 746.6 | 688.1 | 680.9 | 654.4 | 684.7 | 717.3 | 768.6 |
| | CONC. | 5.1 | 4.7 | 5.0 | 5.5 | 6.2 | 6.6 | 7.6 | 8.4 | 9.4 |
| FOOTING REACTION * | V ULS | 297.9 | 270.5 | 298.4 | 346 | 392.2 | 445.9 | 555.8 | 674.7 | 799.7 |
| | V SLS | 194 | 188.8 | 218.6 | 260.4 | 301.2 | 346.4 | 438.4 | 535.8 | 637.2 |
| | H ULS | 98.6 | 99.8 | 103.9 | 109.4 | 115.1 | 121 | 132.4 | 142.9 | 153.9 |
| | V | 110 | 137 | 179 | 226 | 276 | 323 | 422 | 521 | 623 |
| P BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 175 | 175 | 175 | 200 | 200 | 200 | 200 | 175 | 175 |
| | LENGTH | 6240 | 6240 | 6260 | 6300 | 6330 | 6360 | 6420 | 6480 | 6530 |
| H BARS | C/C | - | 300 | 300 | 325 | 325 | 350 | 325 | 325 | 300 |
| | LENGTH | - | 2080 | 3320 | 3460 | 3780 | 3840 | 3920 | 4000 | 4020 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 325 | 300 | 300 | 325 | 325 | 350 | 325 | 325 | 300 |
| | LENGTH | 7160 | 5720 | 5130 | 5120 | 5000 | 5020 | 5070 | 5110 | 5180 |
| | B | 3700 | 2340 | 1720 | 1660 | 1500 | 1470 | 1440 | 1420 | 1410 |
| | D | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| | R | 290 | 240 | 260 | 290 | 320 | 350 | 400 | 440 | 490 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 325 | 300 | 300 | 325 | 325 | 350 | 325 | 325 | 300 |
| | LENGTH | 5660 | 4730 | 4420 | 4410 | 4320 | 4370 | 4470 | 4550 | 4670 |
| | B | 2200 | 1350 | 1010 | 950 | 820 | 820 | 840 | 860 | 900 |
| | D | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| | R | 290 | 240 | 260 | 290 | 320 | 350 | 400 | 440 | 490 |
| U BARS | LENGTH | 1380 | 1240 | 1320 | 1460 | 1590 | 1720 | 1950 | 2140 | 2360 |
| | C | 1020 | 880 | 960 | 1100 | 1230 | 1360 | 1590 | 1780 | 2000 |
| T BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 |
| | C/C | 150 | 175 | 200 | 250 | 300 | 350 | 450 | 400 | 350 |
| | LENGTH | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| R BARS | # SETS | 86 | 84 | 86 | 86 | 88 | 88 | 87 | 87 | 89 |
| V BARS | LENGTH | 2010 | 2010 | 2020 | 2040 | 2105 | 2120 | 2200 | 2230 | 2305 |
| | B | 230 | 230 | 240 | 260 | 325 | 340 | 420 | 450 | 525 |
| S BARS | LENGTH | 360 | 360 | 360 | 360 | 460 | 460 | 560 | 560 | 660 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 6.00
HEIGHT: 3.50

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 260 | 270 | 290 | 340 | 370 | 400 | 470 | 510 | 570 |
| | T | 380 | 340 | 350 | 380 | 410 | 430 | 480 | 530 | 580 |
| | F | 500 | 500 | 500 | 600 | 600 | 600 | 700 | 800 | 800 |
| QUANTITIES | STEEL | 869.3 | 805.3 | 766.3 | 743.0 | 728.6 | 715.5 | 725.6 | 776.5 | 778.4 |
| | CONC. | 5.6 | 5.4 | 5.7 | 6.5 | 7.0 | 7.3 | 8.5 | 9.5 | 10.4 |
| FOOTING REACTION * | V ULS | 306.4 | 282.1 | 310.1 | 360.8 | 408.1 | 461.6 | 576.2 | 697.5 | 823.2 |
| | V SLS | 201.8 | 198.6 | 228.2 | 272.6 | 314.4 | 359.3 | 455.2 | 551.1 | 656.5 |
| | H ULS | 120.7 | 123 | 128.9 | 136.7 | 144.4 | 152.2 | 167.8 | 183.7 | 198.9 |
| | V | 117 | 146 | 189 | 240 | 288 | 335 | 437 | 537 | 641 |
| P BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 200 | 200 | 200 | 225 | 225 | 225 | 200 | 200 | 200 |
| | LENGTH | 6260 | 6270 | 6290 | 6340 | 6370 | 6400 | 6470 | 6510 | 6570 |
| H BARS | C/C | - | - | 350 | 350 | 350 | 350 | 350 | 325 | 325 |
| | LENGTH | - | - | 3120 | 3400 | 3460 | 3820 | 3940 | 3940 | 4020 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 325 | 350 | 350 | 350 | 350 | 350 | 350 | 325 | 325 |
| | LENGTH | 7690 | 7620 | 5770 | 5700 | 5710 | 5580 | 5610 | 5680 | 5730 |
| | B | 3700 | 3700 | 1830 | 1710 | 1680 | 1510 | 1470 | 1460 | 1430 |
| | D | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| | R | 310 | 270 | 280 | 310 | 340 | 360 | 410 | 460 | 510 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 325 | 350 | 350 | 350 | 350 | 350 | 350 | 325 | 325 |
| | LENGTH | 6570 | 5920 | 5040 | 5020 | 5050 | 4940 | 5020 | 5140 | 5240 |
| | B | 2580 | 2000 | 1100 | 1030 | 1020 | 870 | 880 | 920 | 940 |
| | D | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| | R | 310 | 270 | 280 | 310 | 340 | 360 | 410 | 460 | 510 |
| U BARS | LENGTH | 1460 | 1370 | 1420 | 1580 | 1700 | 1800 | 2040 | 2240 | 2470 |
| | C | 1100 | 1010 | 1060 | 1220 | 1340 | 1440 | 1680 | 1880 | 2110 |
| T BARS | SIZE | 20 | 20 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 175 | 200 | 150 | 175 | 200 | 225 | 275 | 300 | 325 |
| | LENGTH | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| R BARS | # SETS | 94 | 94 | 94 | 96 | 94 | 94 | 95 | 97 | 97 |
| V BARS | LENGTH | 2020 | 2025 | 2035 | 2110 | 2125 | 2140 | 2225 | 2295 | 2325 |
| | B | 240 | 245 | 255 | 330 | 345 | 360 | 445 | 515 | 545 |
| S BARS | LENGTH | 360 | 360 | 360 | 460 | 460 | 460 | 560 | 660 | 660 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 6.00
HEIGHT: 4.00

| | | FILL HEIGHT | | | | | | | | |
|--------------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 300 | 300 | 320 | 360 | 390 | 420 | 480 | 540 | 600 |
| | T | 400 | 360 | 370 | 390 | 420 | 440 | 500 | 550 | 590 |
| | F | 500 | 500 | 600 | 600 | 600 | 700 | 700 | 800 | 800 |
| QUANTITIES | STEEL | 845.0 | 828.1 | 827.8 | 787.5 | 791.9 | 798.0 | 784.3 | 814.5 | 853.0 |
| | CONC. | 6.4 | 6.1 | 6.6 | 7.1 | 7.6 | 8.2 | 9.3 | 10.4 | 11.3 |
| FOOTING REACTION * | V ULS | 316.7 | 290.6 | 322.6 | 371.3 | 419.3 | 473.6 | 588.5 | 712.6 | 844.4 |
| | V SLS | 213.3 | 208.2 | 238.7 | 281.3 | 323.7 | 369.3 | 465.4 | 567.1 | 672.8 |
| | H ULS | 144.1 | 148 | 155.8 | 165.5 | 175 | 185 | 205 | 224.9 | 244.5 |
| | V | 126 | 155 | 201 | 249 | 297 | 347 | 448 | 552 | 656 |
| P BARS | SIZE | 25 | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 225 | 150 | 150 | 150 | 225 | 225 | 225 | 200 | 200 |
| | LENGTH | 6300 | 6300 | 6320 | 6360 | 6390 | 6420 | 6480 | 6540 | 6600 |
| H BARS | C/C | - | - | - | 375 | 375 | 375 | 375 | 350 | 325 |
| | LENGTH | - | - | - | 2260 | 3300 | 3460 | 3500 | 3920 | 4000 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 400 | 375 | 375 | 375 | 375 | 375 | 375 | 350 | 325 |
| | LENGTH | 8380 | 8160 | 8170 | 6790 | 6320 | 6280 | 6360 | 6230 | 6280 |
| | B | 3860 | 3700 | 3700 | 2290 | 1770 | 1700 | 1680 | 1480 | 1460 |
| | D | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| | R | 330 | 290 | 300 | 320 | 350 | 370 | 430 | 480 | 520 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 400 | 375 | 375 | 375 | 375 | 375 | 375 | 350 | 325 |
| | LENGTH | 7710 | 6700 | 6430 | 5840 | 5650 | 5650 | 5770 | 5710 | 5800 |
| | B | 3190 | 2240 | 1960 | 1340 | 1100 | 1070 | 1090 | 960 | 980 |
| | D | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| | R | 330 | 290 | 300 | 320 | 350 | 370 | 430 | 480 | 520 |
| U BARS | LENGTH | 1580 | 1460 | 1520 | 1630 | 1760 | 1860 | 2120 | 2340 | 2540 |
| | C | 1220 | 1100 | 1160 | 1270 | 1400 | 1500 | 1760 | 1980 | 2180 |
| T BARS | SIZE | 20 | 20 | 20 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 175 | 175 | 175 | 150 | 150 | 150 | 175 | 200 | 200 |
| | LENGTH | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| R BARS | # SETS | 102 | 100 | 100 | 102 | 102 | 102 | 101 | 103 | 105 |
| V BARS | LENGTH | 2040 | 2040 | 2100 | 2120 | 2135 | 2200 | 2230 | 2310 | 2340 |
| | B | 260 | 260 | 320 | 340 | 355 | 420 | 450 | 530 | 560 |
| S BARS | LENGTH | 360 | 360 | 460 | 460 | 460 | 560 | 560 | 660 | 660 |
| W BARS | # SETS | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

* - The designer must check the resistance to SLIDING, according to Section 5.2.3 of this Manual.

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DIVISION 6 - RIGID FRAME BOX CULVERTS

August 2003

6 RIGID FRAME BOX CULVERTS

6.1 CULVERT DIMENSIONS AND REINFORCEMENT

Dimensions and detailing information for standard rigid frame box culverts are given in Figure 6.1(a). Construction joints indicated are optional and are provided for the contractor's convenience. Note that both the horizontal and vertical dimensions of all haunches are equal to the thickness of the top slab of the culvert.

Reinforcing details for standard rigid frame box culverts are shown in Figure 6.1(b). Table 6-1 identifies the bar sizes and shapes used for these culverts.

The detailing tables should be read in conjunction with Figures 6.1(a) and (b) and Table 6-1.

Details of apron walls, header walls and retaining walls are provided in Division 8.

The design assumption and parameters, as well as the load cases and combinations, as per CHBDC are summarized in Appendix E (Section 9.5).

6.2 FOUNDATION INVESTIGATION

For foundation investigation requirements of rigid frame box culverts, refer to Section 5.2.1.

FIGURE 6.1(a) RIGID FRAME BOX CULVERT DIMENSIONS

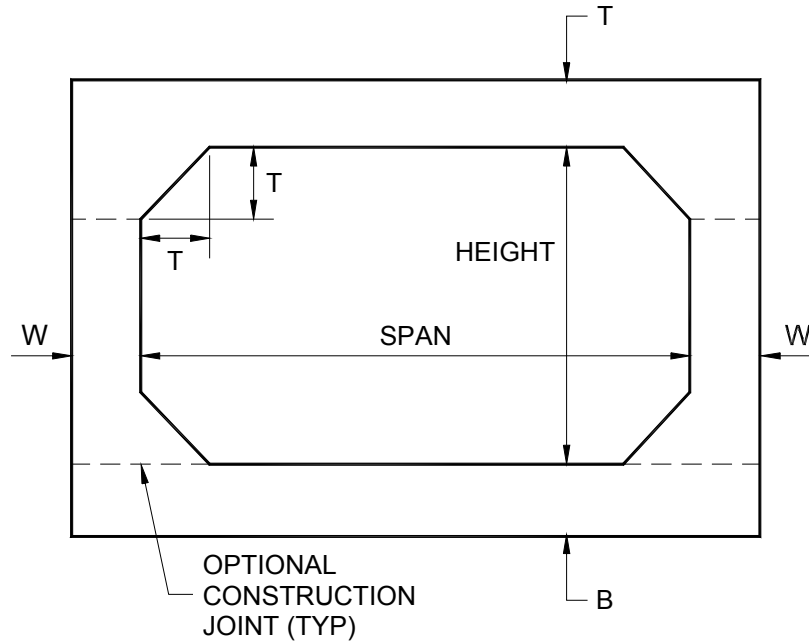
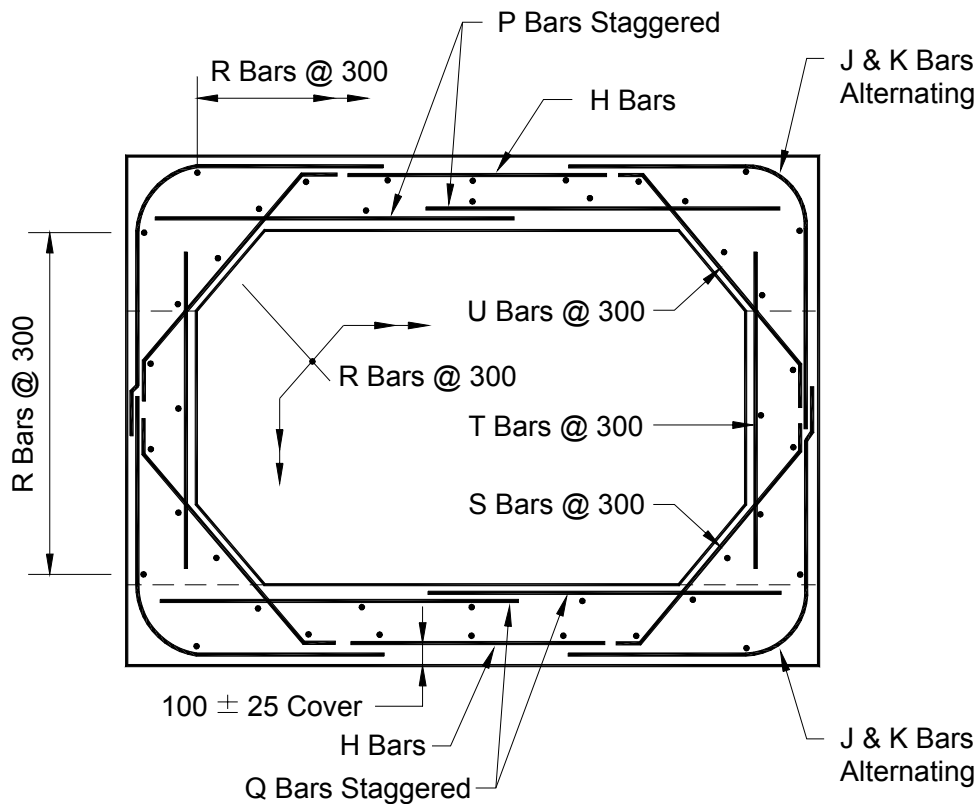


FIGURE 6.1(b) RIGID FRAME BOX CULVERT REINFORCEMENT



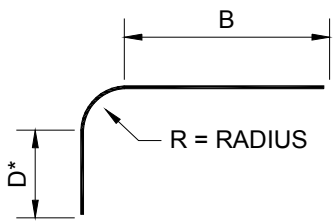
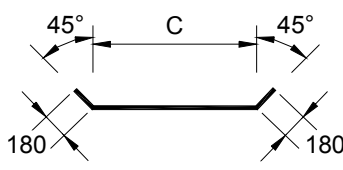
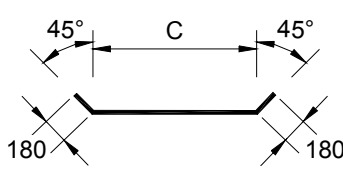
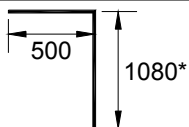
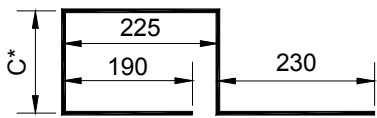
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TABLE 6-1 REINFORCING STEEL IDENTIFICATION

| MARK | DETAILS | REMARKS |
|------------|---|--|
| P BARS | STRAIGHT | BOTTOM OF TOP SLAB STAGGERED |
| Q BARS | STRAIGHT | TOP OF BOTTOM SLAB STAGGERED |
| H BARS | STRAIGHT | 15M BARS TOP OF TOP SLAB & BOTTOM OF BOTTOM SLAB |
| J & K BARS |  | J BARS ALTERNATE WITH K BARS |
| S BARS |  | 15M BARS HAUNCH (AT BOTTOM) |
| T BARS | STRAIGHT | 15M BARS INSIDE FACE OF WALLS |
| U BARS |  | 15M BARS HAUNCH (AT TOP) |
| R BARS | STRAIGHT | 15M BARS LONGITUDINAL |
| L BARS |  | 15M BARS DOWELS TO APRON WALL |
| M BARS | STRAIGHT | 15M BARS, APRON WALL |
| Y BARS | STRAIGHT | 15M BARS, HEADER WALL |
| Z BARS |  | 15M BARS HEADER WALL |

*NOTE: -All dimensions shown to centreline of bar.
-represents vertical dimension*

6.3 DETAILING OF BOX CULVERT DRAWINGS

6.3.1 DETAILS FOR STANDARD DRAWINGS

The following is the procedure used for completing the structural standard drawing for standard rigid frame box culverts, SS114-2, with no skewed ends, retaining walls or other special features:

- Obtain culvert size, length, and height of fill from "Design Data Form for Concrete Culverts".
- Select appropriate standard drawing for rigid frame box culvert.
- Determine from "Design Data Form for Concrete Culverts" whether culvert is extension or not:

If culvert is an extension, change vertical centreline on left side of section 1 to a solid line and label - "END OF EXISTING CULVERT" Insert length of culvert extension on the horizontal dimension line:

e.g. 9 m EXTN RT
11 m EXTN LT

If culvert is not an extension, label centreline "Centre-line Highway" and add culvert length each side of Centre-line Highway

e.g. 16 m RT
13 m LT

- Select from Division 6 appropriate detailing table for required size of culvert.
- Insert span and height of culvert and dimensions of top slab, haunch, bottom slab and wall on "Typical Culvert Section" detail.
- Insert bar size and/or spacing for H, J, K, P, and Q bars where required on all details. Note that P and Q bar spacing is specified at mid-span. Insert Y bar size on Detail B.
- Insert dimensions on Section 2 for layout of P and Q bars, noting that the smaller dimension is half the wall thickness and that the larger dimension is the P bar or Q bar length.

WARNING NOTE: a dimension is required on Section 1 to show the actual distance between any J bar and the adjacent K bar. This is necessary to avoid confusion about the spacing of alternating bars, since the space between adjacent bars is 1/2 of the J spacing.

i.e., if J bar spacing is 300 mm and
K bar spacing is 300 mm

then distance between adjacent bars is 150 mm.

THIS IS AN EXTREMELY IMPORTANT POINT.

- Complete steel bar table for culvert, apron wall and header wall, where applicable.
- Multiply unit quantities by culvert length.
- Add additional P Bar at each end of culvert if no header wall is required.
- Add header walls where required as specified in Sections 4.2.6.
- Add adjustment to steel quantity for R bar laps.
- Add apron wall quantities.
- Add header wall quantities, where applicable.
- Insert total quantities in "Culvert Quantities" table on standard drawing.
- **The Standard Drawing shall be sealed, dated and signed according to 4.3.1.**

6.3.2 STEEL TABLE FOR CULVERT

Spacing, bar length, and bar bending dimensions are available from the individual culvert detailing tables at the end of this division.

The number of H, J, K, P, Q, S, T and U bars required can be calculated using the expression given in Division 8. This procedure considers only one bar per cross-section, therefore, the number of S, T and U bars must be doubled, and the number of J and K bars must be quadrupled.

For R bars the number of sets of bars is available on the detailing tables; the number of bars per set and bar length in Division 8.

For H bars the spacing and length of bar are given in the detailing tables, when these bars are required.

6.3.3 STEEL TABLE FOR APRON WALL AND HEADER WALL

The length and number of L, M, Y and Z bars required for apron and header walls are as given in Division 8.

Modification of these quantities is required for culverts with skewed ends.

6.3.4 ADJUSTMENT OF CONCRETE QUANTITIES

The additional volume of concrete required for apron and header walls is discussed in Division 8.

Modification of these quantities is required for culverts with skewed ends.

6.3.5 QUANTITY TABLE

Complete the quantity table. Concrete and steel quantities should be the total quantity for the complete length of culvert including apron wall and header wall, where applicable.

6.4 **DETAILING TABLES**

The following pages contain the detailing tables. These tables list various culvert dimensions, concrete and reinforcing steel quantities, and reinforcing steel detailing information.

All dimensions, spacings and lengths given are in millimetres.

Steel quantities given are in kilograms, per metre length of culvert.

Concrete quantities given are in cubic metres, per metre length of culvert.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 2.50

HEIGHT: 1.25

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 210 | 210 | 210 | 210 | 220 | 220 | 230 | 240 | 260 |
| | T | 220 | 220 | 220 | 220 | 220 | 220 | 230 | 240 | 270 |
| | B | 220 | 220 | 240 | 240 | 240 | 240 | 260 | 280 | 320 |
| QUANTITIES | STEEL | 256.8 | 233.4 | 227.6 | 233.1 | 240.5 | 256.5 | 279.5 | 310.6 | 325.5 |
| | CONC. | 1.9 | 1.9 | 2 | 2 | 2 | 2 | 2.1 | 2.3 | 2.6 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 225 | 275 | 300 | 275 | 275 | 250 | 200 | 175 | 175 |
| | LENGTH | 2710 | 2710 | 2710 | 2710 | 2720 | 2720 | 2730 | 2740 | 2760 |
| H BARS | C/C | 325 | 400 | 425 | 400 | 375 | 325 | 300 | 375 | 350 |
| | LENGTH | 1490 | 1590 | 1650 | 1670 | 1690 | 1690 | 1710 | 1270 | 1250 |
| J BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 325 | 400 | 425 | 400 | 375 | 325 | 300 | 375 | 350 |
| | LENGTH | 2230 | 2180 | 2150 | 2140 | 2140 | 2140 | 2140 | 2520 | 2570 |
| | B | 950 | 900 | 870 | 860 | 860 | 860 | 850 | 1070 | 1070 |
| | D | 1050 | 1050 | 1050 | 1050 | 1050 | 1050 | 1050 | 1190 | 1190 |
| | R | 145 | 145 | 145 | 145 | 145 | 145 | 155 | 165 | 195 |
| K BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 325 | 400 | 425 | 400 | 375 | 325 | 300 | 375 | 350 |
| | LENGTH | 1810 | 1760 | 1730 | 1720 | 1720 | 1720 | 1740 | 1910 | 1990 |
| | B | 530 | 480 | 450 | 440 | 440 | 440 | 450 | 460 | 490 |
| | D | 1050 | 1050 | 1050 | 1050 | 1050 | 1050 | 1050 | 1190 | 1190 |
| | R | 145 | 145 | 145 | 145 | 145 | 145 | 155 | 165 | 195 |
| S BARS | LENGTH | 900 | 900 | 930 | 930 | 940 | 940 | 1000 | 1050 | 1180 |
| | C | 540 | 540 | 570 | 570 | 580 | 580 | 640 | 690 | 820 |
| T BARS | LENGTH | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 |
| U BARS | LENGTH | 940 | 940 | 940 | 940 | 960 | 960 | 1000 | 1040 | 1150 |
| | C | 580 | 580 | 580 | 580 | 600 | 600 | 640 | 680 | 790 |
| Q BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 225 | 250 | 250 | 250 | 225 | 200 | 175 | 150 | 150 |
| | LENGTH | 2710 | 2710 | 2710 | 2710 | 2720 | 2720 | 2730 | 2740 | 2760 |
| R BARS | # SETS | 60 | 60 | 60 | 60 | 60 | 60 | 64 | 64 | 64 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 2.50

HEIGHT: 1.50

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 210 | 210 | 210 | 210 | 220 | 220 | 230 | 240 | 280 |
| | T | 220 | 220 | 220 | 220 | 220 | 220 | 230 | 240 | 290 |
| | B | 220 | 220 | 240 | 240 | 240 | 240 | 260 | 280 | 330 |
| QUANTITIES | STEEL | 265.2 | 237.7 | 236.1 | 241.6 | 249.2 | 259.1 | 286.4 | 314.3 | 308.8 |
| | CONC. | 2 | 2 | 2.1 | 2.1 | 2.1 | 2.1 | 2.2 | 2.4 | 2.9 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 200 | 250 | 275 | 250 | 250 | 225 | 200 | 175 | 175 |
| | LENGTH | 2710 | 2710 | 2710 | 2710 | 2720 | 2720 | 2730 | 2740 | 2780 |
| H BARS | C/C | 350 | 450 | 450 | 425 | 400 | 375 | 325 | 400 | 300 |
| | LENGTH | 1450 | 1590 | 1650 | 1670 | 1690 | 1690 | 1710 | 1290 | 1690 |
| J BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 15 |
| | C/C | 350 | 450 | 450 | 425 | 400 | 375 | 325 | 400 | 300 |
| | LENGTH | 2370 | 2300 | 2270 | 2260 | 2260 | 2260 | 2260 | 2630 | 2360 |
| | B | 970 | 900 | 870 | 860 | 860 | 860 | 850 | 1060 | 850 |
| | D | 1170 | 1170 | 1170 | 1170 | 1170 | 1170 | 1170 | 1310 | 1170 |
| | R | 145 | 145 | 145 | 145 | 145 | 145 | 155 | 165 | 215 |
| K BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 15 |
| | C/C | 350 | 450 | 450 | 425 | 400 | 375 | 325 | 400 | 300 |
| | LENGTH | 1940 | 1880 | 1860 | 1850 | 1850 | 1840 | 1860 | 2030 | 2020 |
| | B | 540 | 480 | 460 | 450 | 450 | 440 | 450 | 460 | 510 |
| | D | 1170 | 1170 | 1170 | 1170 | 1170 | 1170 | 1170 | 1310 | 1170 |
| | R | 145 | 145 | 145 | 145 | 145 | 145 | 155 | 165 | 215 |
| S BARS | LENGTH | 900 | 900 | 930 | 930 | 940 | 940 | 1000 | 1050 | 1250 |
| | C | 540 | 540 | 570 | 570 | 580 | 580 | 640 | 690 | 890 |
| T BARS | LENGTH | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| U BARS | LENGTH | 940 | 940 | 940 | 940 | 960 | 960 | 1000 | 1040 | 1240 |
| | C | 580 | 580 | 580 | 580 | 600 | 600 | 640 | 680 | 880 |
| Q BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 200 | 225 | 225 | 225 | 200 | 175 | 150 | 150 | 150 |
| | LENGTH | 2710 | 2710 | 2710 | 2710 | 2720 | 2720 | 2730 | 2740 | 2780 |
| R BARS | # SETS | 62 | 62 | 62 | 62 | 62 | 62 | 66 | 66 | 66 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 2.50

HEIGHT: 1.75

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 220 | 220 | 220 | 220 | 230 | 230 | 240 | 260 | 280 |
| | T | 220 | 220 | 220 | 220 | 230 | 230 | 240 | 260 | 290 |
| | B | 220 | 220 | 240 | 240 | 240 | 240 | 270 | 320 | 340 |
| QUANTITIES | STEEL | 272 | 247.4 | 244 | 249.6 | 260.9 | 274.9 | 295.4 | 310.2 | 314.9 |
| | CONC. | 2.2 | 2.2 | 2.2 | 2.2 | 2.3 | 2.3 | 2.5 | 2.8 | 3.1 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 200 | 250 | 250 | 250 | 250 | 225 | 200 | 175 | 175 |
| | LENGTH | 2720 | 2720 | 2720 | 2720 | 2730 | 2730 | 2740 | 2760 | 2780 |
| H BARS | C/C | 400 | 475 | 500 | 475 | 450 | 400 | 350 | 325 | 325 |
| | LENGTH | 1310 | 1530 | 1610 | 1650 | 1650 | 1670 | 1690 | 1690 | 1670 |
| J BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 400 | 475 | 500 | 475 | 450 | 400 | 350 | 325 | 325 |
| | LENGTH | 2580 | 2470 | 2430 | 2410 | 2420 | 2410 | 2420 | 2450 | 2500 |
| | B | 1050 | 940 | 900 | 880 | 880 | 870 | 860 | 860 | 860 |
| | D | 1300 | 1300 | 1300 | 1300 | 1300 | 1300 | 1300 | 1300 | 1300 |
| | R | 145 | 145 | 145 | 145 | 155 | 155 | 165 | 185 | 215 |
| K BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 400 | 475 | 500 | 475 | 450 | 400 | 350 | 325 | 325 |
| | LENGTH | 2160 | 2050 | 2030 | 2010 | 2020 | 2010 | 2040 | 2100 | 2170 |
| | B | 630 | 520 | 500 | 480 | 480 | 470 | 480 | 510 | 530 |
| | D | 1300 | 1300 | 1300 | 1300 | 1300 | 1300 | 1300 | 1300 | 1300 |
| | R | 145 | 145 | 145 | 145 | 155 | 155 | 165 | 185 | 215 |
| S BARS | LENGTH | 910 | 910 | 940 | 940 | 970 | 970 | 1040 | 1170 | 1270 |
| | C | 550 | 550 | 580 | 580 | 610 | 610 | 680 | 810 | 910 |
| T BARS | LENGTH | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| U BARS | LENGTH | 960 | 960 | 960 | 960 | 1000 | 1000 | 1040 | 1130 | 1240 |
| | C | 600 | 600 | 600 | 600 | 640 | 640 | 680 | 770 | 880 |
| Q BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 175 | 225 | 225 | 200 | 200 | 175 | 150 | 150 | 150 |
| | LENGTH | 2720 | 2720 | 2720 | 2720 | 2730 | 2730 | 2740 | 2760 | 2780 |
| R BARS | # SETS | 66 | 66 | 66 | 66 | 70 | 70 | 70 | 70 | 70 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 2.50

HEIGHT: 2.00

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|-------|------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 220 | 220 | 220 | 220 | 230 | 230 | 240 | 260 | 270 |
| | T | 220 | 220 | 220 | 220 | 230 | 230 | 240 | 260 | 290 |
| | B | 220 | 220 | 240 | 240 | 240 | 250 | 270 | 330 | 350 |
| QUANTITIES | STEEL | 279.8 | 257.8 | 253.1 | 260.4 | 271.4 | 281 | 305.3 | 313.6 | 336.4 |
| | CONC. | 2.3 | 2.3 | 2.3 | 2.3 | 2.4 | 2.4 | 2.6 | 3 | 3.2 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 200 | 225 | 250 | 225 | 225 | 200 | 175 | 175 | 150 |
| | LENGTH | 2720 | 2720 | 2720 | 2720 | 2730 | 2730 | 2740 | 2760 | 2770 |
| H BARS | C/C | - | 525 | 525 | 500 | 475 | 450 | 375 | 350 | 325 |
| | LENGTH | - | 1370 | 1530 | 1570 | 1590 | 1610 | 1630 | 1630 | 1630 |
| J BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 425 | 525 | 525 | 500 | 475 | 450 | 375 | 350 | 325 |
| | LENGTH | 3320 | 2670 | 2590 | 2570 | 2570 | 2560 | 2570 | 2600 | 2630 |
| | B | 1670 | 1020 | 940 | 920 | 910 | 900 | 890 | 890 | 870 |
| | D | 1420 | 1420 | 1420 | 1420 | 1420 | 1420 | 1420 | 1420 | 1420 |
| K BARS | R | 145 | 145 | 145 | 145 | 155 | 155 | 165 | 185 | 215 |
| | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 425 | 525 | 525 | 500 | 475 | 450 | 375 | 350 | 325 |
| | LENGTH | 2340 | 2250 | 2190 | 2170 | 2170 | 2170 | 2180 | 2260 | 2330 |
| | B | 690 | 600 | 540 | 520 | 510 | 510 | 500 | 550 | 570 |
| S BARS | D | 1420 | 1420 | 1420 | 1420 | 1420 | 1420 | 1420 | 1420 | 1420 |
| | R | 145 | 145 | 145 | 145 | 155 | 155 | 165 | 185 | 215 |
| S BARS | LENGTH | 910 | 910 | 940 | 940 | 970 | 980 | 1040 | 1180 | 1270 |
| | C | 550 | 550 | 580 | 580 | 610 | 620 | 680 | 820 | 910 |
| T BARS | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| U BARS | LENGTH | 960 | 960 | 960 | 960 | 1000 | 1000 | 1040 | 1130 | 1220 |
| | C | 600 | 600 | 600 | 600 | 640 | 640 | 680 | 770 | 860 |
| Q BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 |
| | C/C | 175 | 200 | 225 | 200 | 200 | 175 | 150 | 150 | 200 |
| | LENGTH | 2720 | 2720 | 2720 | 2720 | 2730 | 2730 | 2740 | 2760 | 2770 |
| R BARS | # SETS | 70 | 70 | 70 | 70 | 74 | 74 | 74 | 72 | 74 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 3.00
HEIGHT: 1.50

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|------|-------|-------|------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 230 | 230 | 230 | 230 | 240 | 240 | 260 | 280 | 320 |
| | T | 230 | 230 | 230 | 240 | 250 | 250 | 260 | 280 | 340 |
| | B | 230 | 230 | 250 | 250 | 260 | 260 | 310 | 370 | 390 |
| QUANTITIES | STEEL | 331.9 | 299.7 | 299.5 | 306.8 | 317 | 339.2 | 361.2 | 390 | 398.7 |
| | CONC. | 2.4 | 2.4 | 2.5 | 2.5 | 2.6 | 2.6 | 2.9 | 3.3 | 3.8 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 175 | 200 | 225 | 200 | 200 | 175 | 175 | 150 | 150 |
| | LENGTH | 3230 | 3230 | 3230 | 3230 | 3240 | 3240 | 3260 | 3280 | 3320 |
| H BARS | C/C | 400 | 325 | 325 | 325 | 300 | 400 | 350 | 325 | 325 |
| | LENGTH | 1430 | 1990 | 2050 | 2090 | 2090 | 1670 | 1670 | 1690 | 1650 |
| J BARS | SIZE | 20 | 15 | 15 | 15 | 15 | 20 | 20 | 20 | 20 |
| | C/C | 400 | 325 | 325 | 325 | 300 | 400 | 350 | 325 | 325 |
| | LENGTH | 2790 | 2370 | 2340 | 2330 | 2340 | 2690 | 2720 | 2740 | 2840 |
| | B | 1240 | 960 | 930 | 900 | 900 | 1110 | 1120 | 1110 | 1110 |
| | D | 1310 | 1170 | 1170 | 1170 | 1170 | 1310 | 1310 | 1310 | 1310 |
| | R | 155 | 155 | 155 | 165 | 175 | 175 | 185 | 205 | 265 |
| K BARS | SIZE | 20 | 15 | 15 | 15 | 15 | 20 | 20 | 20 | 20 |
| | C/C | 400 | 325 | 325 | 325 | 300 | 400 | 350 | 325 | 325 |
| | LENGTH | 2160 | 1960 | 1920 | 1930 | 1950 | 2080 | 2120 | 2180 | 2330 |
| | B | 610 | 550 | 510 | 500 | 510 | 500 | 520 | 550 | 600 |
| | D | 1310 | 1170 | 1170 | 1170 | 1170 | 1310 | 1310 | 1310 | 1310 |
| | R | 155 | 155 | 155 | 165 | 175 | 175 | 185 | 205 | 265 |
| S BARS | LENGTH | 960 | 960 | 980 | 1000 | 1040 | 1040 | 1150 | 1300 | 1460 |
| | C | 600 | 600 | 620 | 640 | 680 | 680 | 790 | 940 | 1100 |
| T BARS | LENGTH | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| U BARS | LENGTH | 1000 | 1000 | 1000 | 1030 | 1070 | 1070 | 1130 | 1210 | 1440 |
| | C | 640 | 640 | 640 | 670 | 710 | 710 | 770 | 850 | 1080 |
| Q BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 175 | 200 | 200 | 175 | 175 | 150 | 150 | 200 | 200 |
| | LENGTH | 3230 | 3230 | 3230 | 3230 | 3240 | 3240 | 3260 | 3280 | 3320 |
| R BARS | # SETS | 70 | 70 | 72 | 72 | 72 | 72 | 72 | 74 | 72 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 3.00

HEIGHT: 1.75

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|-------|-------|-------|------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 220 | 220 | 220 | 230 | 230 | 240 | 240 | 260 | 290 |
| | T | 220 | 220 | 230 | 230 | 240 | 250 | 250 | 280 | 330 |
| | B | 220 | 220 | 240 | 240 | 250 | 260 | 310 | 360 | 410 |
| QUANTITIES | STEEL | 352.2 | 316.2 | 308.3 | 319.7 | 329.2 | 339.8 | 388.6 | 396 | 409.1 |
| | CONC. | 2.4 | 2.4 | 2.5 | 2.5 | 2.6 | 2.7 | 2.9 | 3.3 | 3.9 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 150 | 175 | 200 | 200 | 175 | 175 | 150 | 200 | 200 |
| | LENGTH | 3220 | 3220 | 3220 | 3230 | 3230 | 3240 | 3240 | 3260 | 3290 |
| H BARS | C/C | 400 | 325 | 350 | 325 | 325 | 300 | 350 | 350 | 350 |
| | LENGTH | 1390 | 1970 | 2070 | 2090 | 2110 | 2110 | 1670 | 1670 | 1650 |
| J BARS | SIZE | 20 | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 |
| | C/C | 400 | 325 | 350 | 325 | 325 | 300 | 350 | 350 | 350 |
| | LENGTH | 2930 | 2500 | 2450 | 2450 | 2450 | 2460 | 2820 | 2860 | 2930 |
| | B | 1260 | 970 | 910 | 910 | 890 | 890 | 1110 | 1100 | 1090 |
| | D | 1440 | 1300 | 1300 | 1300 | 1300 | 1300 | 1440 | 1440 | 1440 |
| | R | 145 | 145 | 155 | 155 | 165 | 175 | 175 | 205 | 255 |
| K BARS | SIZE | 20 | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 |
| | C/C | 400 | 325 | 350 | 325 | 325 | 300 | 350 | 350 | 350 |
| | LENGTH | 2290 | 2080 | 2050 | 2050 | 2060 | 2080 | 2220 | 2300 | 2430 |
| | B | 620 | 550 | 510 | 510 | 500 | 510 | 510 | 540 | 590 |
| | D | 1440 | 1300 | 1300 | 1300 | 1300 | 1300 | 1440 | 1440 | 1440 |
| | R | 145 | 145 | 155 | 155 | 165 | 175 | 175 | 205 | 255 |
| S BARS | LENGTH | 910 | 910 | 960 | 970 | 1000 | 1040 | 1110 | 1250 | 1440 |
| | C | 550 | 550 | 600 | 610 | 640 | 680 | 750 | 890 | 1080 |
| T BARS | LENGTH | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| U BARS | LENGTH | 960 | 960 | 980 | 1000 | 1030 | 1070 | 1070 | 1180 | 1370 |
| | C | 600 | 600 | 620 | 640 | 670 | 710 | 710 | 820 | 1010 |
| Q BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 |
| | C/C | 150 | 175 | 175 | 175 | 150 | 150 | 175 | 175 | 175 |
| | LENGTH | 3220 | 3220 | 3220 | 3230 | 3230 | 3240 | 3240 | 3260 | 3290 |
| R BARS | # SETS | 72 | 72 | 74 | 76 | 76 | 76 | 76 | 74 | 76 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 3.00
HEIGHT: 2.00

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 220 | 220 | 220 | 230 | 230 | 240 | 240 | 270 | 300 |
| | T | 220 | 230 | 230 | 230 | 240 | 250 | 250 | 280 | 330 |
| | B | 220 | 230 | 240 | 240 | 250 | 260 | 320 | 360 | 430 |
| QUANTITIES | STEEL | 355.5 | 323.8 | 323.5 | 334.1 | 343.1 | 350.7 | 395.4 | 405.5 | 415.6 |
| | CONC. | 2.5 | 2.6 | 2.6 | 2.7 | 2.7 | 2.9 | 3.1 | 3.5 | 4.2 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 |
| | C/C | 150 | 175 | 175 | 175 | 175 | 150 | 200 | 200 | 200 |
| | LENGTH | 3220 | 3220 | 3220 | 3230 | 3230 | 3240 | 3240 | 3270 | 3300 |
| H BARS | C/C | 300 | 375 | 375 | 350 | 325 | 325 | 375 | 375 | 375 |
| | LENGTH | 1690 | 1910 | 2010 | 2050 | 2070 | 2070 | 1650 | 1670 | 1630 |
| J BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 |
| | C/C | 300 | 375 | 375 | 350 | 325 | 325 | 375 | 375 | 375 |
| | LENGTH | 2760 | 2650 | 2600 | 2590 | 2590 | 2600 | 2950 | 2990 | 3070 |
| | B | 1110 | 990 | 940 | 930 | 910 | 910 | 1120 | 1110 | 1110 |
| | D | 1420 | 1420 | 1420 | 1420 | 1420 | 1420 | 1560 | 1560 | 1560 |
| | R | 145 | 155 | 155 | 155 | 165 | 175 | 175 | 205 | 255 |
| K BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 |
| | C/C | 300 | 375 | 375 | 350 | 325 | 325 | 375 | 375 | 375 |
| | LENGTH | 2320 | 2230 | 2200 | 2190 | 2200 | 2220 | 2360 | 2450 | 2590 |
| | B | 670 | 570 | 540 | 530 | 520 | 530 | 530 | 570 | 630 |
| | D | 1420 | 1420 | 1420 | 1420 | 1420 | 1420 | 1560 | 1560 | 1560 |
| S BARS | LENGTH | 910 | 940 | 960 | 970 | 1000 | 1040 | 1130 | 1270 | 1480 |
| | C | 550 | 580 | 600 | 610 | 640 | 680 | 770 | 910 | 1120 |
| T BARS | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| U BARS | LENGTH | 960 | 980 | 980 | 1000 | 1030 | 1070 | 1070 | 1200 | 1380 |
| | C | 600 | 620 | 620 | 640 | 670 | 710 | 710 | 840 | 1020 |
| Q BARS | SIZE | 20 | 15 | 15 | 15 | 15 | 20 | 20 | 20 | 20 |
| | C/C | 200 | 150 | 150 | 150 | 150 | 200 | 175 | 175 | 175 |
| | LENGTH | 3220 | 3220 | 3220 | 3230 | 3230 | 3240 | 3240 | 3270 | 3300 |
| R BARS | # SETS | 76 | 78 | 78 | 80 | 80 | 78 | 78 | 80 | 80 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 3.50
HEIGHT: 1.25

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 230 | 230 | 230 | 240 | 250 | 260 | 300 | 330 | 370 |
| | T | 250 | 250 | 240 | 240 | 250 | 260 | 300 | 340 | 380 |
| | B | 250 | 250 | 270 | 270 | 270 | 290 | 320 | 400 | 460 |
| QUANTITIES | STEEL | 397.8 | 362.1 | 375 | 379.5 | 396.3 | 399.1 | 437.5 | 463.4 | 495.3 |
| | CONC. | 2.7 | 2.7 | 2.7 | 2.7 | 2.8 | 3 | 3.5 | 4.1 | 4.8 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 150 | 200 | 200 | 175 | 175 | 175 | 175 | 150 | 150 |
| | LENGTH | 3730 | 3730 | 3730 | 3740 | 3750 | 3760 | 3800 | 3830 | 3870 |
| H BARS | C/C | 300 | 350 | 325 | 325 | 300 | 300 | 450 | 425 | 400 |
| | LENGTH | 1850 | 1930 | 1990 | 2010 | 2030 | 2050 | 1630 | 1610 | 1590 |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 |
| | C/C | 300 | 350 | 325 | 325 | 300 | 300 | 450 | 425 | 400 |
| | LENGTH | 2720 | 2680 | 2650 | 2650 | 2650 | 2660 | 3060 | 3130 | 3200 |
| | B | 1260 | 1220 | 1200 | 1200 | 1190 | 1180 | 1390 | 1390 | 1400 |
| | D | 1190 | 1190 | 1190 | 1190 | 1190 | 1190 | 1320 | 1320 | 1320 |
| | R | 175 | 175 | 165 | 165 | 175 | 185 | 225 | 265 | 305 |
| K BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 |
| | C/C | 300 | 350 | 325 | 325 | 300 | 300 | 450 | 425 | 400 |
| | LENGTH | 2120 | 2080 | 2040 | 2030 | 2040 | 2070 | 2290 | 2420 | 2540 |
| | B | 660 | 620 | 590 | 580 | 580 | 590 | 620 | 680 | 740 |
| | D | 1190 | 1190 | 1190 | 1190 | 1190 | 1190 | 1320 | 1320 | 1320 |
| | R | 175 | 175 | 165 | 165 | 175 | 185 | 225 | 265 | 305 |
| S BARS | LENGTH | 1010 | 1010 | 1030 | 1040 | 1070 | 1130 | 1280 | 1490 | 1690 |
| | C | 650 | 650 | 670 | 680 | 710 | 770 | 920 | 1130 | 1330 |
| T BARS | LENGTH | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 |
| U BARS | LENGTH | 1050 | 1050 | 1030 | 1040 | 1080 | 1130 | 1290 | 1450 | 1620 |
| | C | 690 | 690 | 670 | 680 | 720 | 770 | 930 | 1090 | 1260 |
| Q BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 175 | 175 | 175 | 175 | 150 | 150 | 150 | 150 | 150 |
| | LENGTH | 3730 | 3730 | 3730 | 3740 | 3750 | 3760 | 3800 | 3830 | 3870 |
| R BARS | # SETS | 76 | 76 | 78 | 78 | 76 | 76 | 80 | 78 | 82 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 3.50
HEIGHT: 1.50

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 230 | 230 | 230 | 240 | 250 | 260 | 300 | 330 | 370 |
| | T | 250 | 240 | 240 | 240 | 250 | 260 | 300 | 340 | 380 |
| | B | 250 | 250 | 270 | 270 | 270 | 290 | 330 | 400 | 480 |
| QUANTITIES | STEEL | 416.3 | 380.4 | 385.3 | 385.8 | 395.3 | 422.2 | 434.6 | 469.7 | 500.8 |
| | CONC. | 2.8 | 2.7 | 2.8 | 2.9 | 3 | 3.1 | 3.7 | 4.3 | 5 |
| P BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | C/C | 150 | 175 | 175 | 175 | 175 | 150 | 150 | 150 | 150 |
| | LENGTH | 3730 | 3730 | 3730 | 3740 | 3750 | 3760 | 3800 | 3830 | 3870 |
| H BARS | C/C | 300 | 350 | 350 | 350 | 325 | 300 | 300 | 450 | 425 |
| | LENGTH | 1870 | 1970 | 2010 | 2050 | 2070 | 2070 | 2090 | 1650 | 1630 |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 25 |
| | C/C | 300 | 350 | 350 | 350 | 325 | 300 | 300 | 450 | 425 |
| | LENGTH | 2830 | 2780 | 2760 | 2750 | 2750 | 2770 | 2820 | 3240 | 3310 |
| | B | 1250 | 1210 | 1190 | 1180 | 1170 | 1170 | 1160 | 1370 | 1380 |
| | D | 1310 | 1310 | 1310 | 1310 | 1310 | 1310 | 1310 | 1450 | 1450 |
| | R | 175 | 165 | 165 | 165 | 175 | 185 | 225 | 265 | 305 |
| K BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 25 |
| | C/C | 300 | 350 | 350 | 350 | 325 | 300 | 300 | 450 | 425 |
| | LENGTH | 2230 | 2170 | 2140 | 2140 | 2140 | 2170 | 2270 | 2520 | 2650 |
| | B | 650 | 600 | 570 | 570 | 560 | 570 | 610 | 650 | 720 |
| | D | 1310 | 1310 | 1310 | 1310 | 1310 | 1310 | 1310 | 1450 | 1450 |
| | R | 175 | 165 | 165 | 165 | 175 | 185 | 225 | 265 | 305 |
| S BARS | LENGTH | 1010 | 1000 | 1030 | 1040 | 1070 | 1130 | 1300 | 1490 | 1720 |
| | C | 650 | 640 | 670 | 680 | 710 | 770 | 940 | 1130 | 1360 |
| T BARS | LENGTH | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| U BARS | LENGTH | 1050 | 1030 | 1030 | 1040 | 1080 | 1130 | 1290 | 1450 | 1620 |
| | C | 690 | 670 | 670 | 680 | 720 | 770 | 930 | 1090 | 1260 |
| Q BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 | 20 |
| | C/C | 150 | 175 | 150 | 150 | 150 | 200 | 200 | 200 | 200 |
| | LENGTH | 3730 | 3730 | 3730 | 3740 | 3750 | 3760 | 3800 | 3830 | 3870 |
| R BARS | # SETS | 78 | 80 | 80 | 80 | 78 | 78 | 80 | 80 | 84 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 3.50
HEIGHT: 1.75

| | | FILL HEIGHT | | | | | | | | |
|------------|--------|-------------|-------|-------|-------|-------|------|-------|-------|------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 230 | 230 | 230 | 240 | 250 | 260 | 300 | 330 | 370 |
| | T | 250 | 240 | 240 | 240 | 250 | 260 | 300 | 340 | 380 |
| | B | 250 | 250 | 270 | 270 | 270 | 290 | 320 | 400 | 480 |
| QUANTITIES | STEEL | 423.8 | 396.6 | 390.6 | 411.8 | 409.8 | 431 | 442.9 | 472.5 | 490 |
| | CONC. | 2.9 | 2.9 | 2.9 | 3 | 3.1 | 3.3 | 3.8 | 4.5 | 5.2 |
| P BARS | SIZE | 20 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 200 | 150 | 175 | 150 | 150 | 150 | 150 | 200 | 200 |
| | LENGTH | 3730 | 3730 | 3730 | 3740 | 3750 | 3760 | 3800 | 3830 | 3870 |
| H BARS | C/C | 325 | 375 | 375 | 350 | 350 | 325 | 325 | 300 | 300 |
| | LENGTH | 1870 | 1970 | 2030 | 2070 | 2090 | 2090 | 2110 | 2090 | 2070 |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 325 | 375 | 375 | 350 | 350 | 325 | 325 | 300 | 300 |
| | LENGTH | 2960 | 2910 | 2880 | 2870 | 2870 | 2890 | 2940 | 3010 | 3080 |
| | B | 1250 | 1210 | 1180 | 1170 | 1160 | 1160 | 1150 | 1150 | 1160 |
| | D | 1440 | 1440 | 1440 | 1440 | 1440 | 1440 | 1440 | 1440 | 1440 |
| K BARS | R | 175 | 165 | 165 | 165 | 175 | 185 | 225 | 265 | 305 |
| | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 325 | 375 | 375 | 350 | 350 | 325 | 325 | 300 | 300 |
| | LENGTH | 2360 | 2290 | 2270 | 2260 | 2260 | 2290 | 2390 | 2500 | 2630 |
| | B | 650 | 590 | 570 | 560 | 550 | 560 | 600 | 640 | 710 |
| S BARS | D | 1440 | 1440 | 1440 | 1440 | 1440 | 1440 | 1440 | 1440 | 1440 |
| | R | 175 | 165 | 165 | 165 | 175 | 185 | 225 | 265 | 305 |
| T BARS | LENGTH | 1010 | 1000 | 1030 | 1040 | 1070 | 1130 | 1280 | 1490 | 1720 |
| | C | 650 | 640 | 670 | 680 | 710 | 770 | 920 | 1130 | 1360 |
| U BARS | LENGTH | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| | C | 1050 | 1030 | 1030 | 1040 | 1080 | 1130 | 1290 | 1450 | 1620 |
| Q BARS | SIZE | 690 | 670 | 670 | 680 | 720 | 770 | 930 | 1090 | 1260 |
| | C/C | 15 | 15 | 15 | 20 | 20 | 20 | 20 | 20 | 20 |
| | LENGTH | 150 | 150 | 150 | 200 | 200 | 175 | 175 | 175 | 175 |
| R BARS | # SETS | 3730 | 3730 | 3730 | 3740 | 3750 | 3760 | 3800 | 3830 | 3870 |
| | | 82 | 84 | 84 | 84 | 82 | 82 | 84 | 84 | 88 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 3.50
HEIGHT: 2.00

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|-------|-------|-------|------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 250 | 250 | 250 | 260 | 270 | 270 | 290 | 330 | 360 |
| | T | 260 | 250 | 250 | 260 | 270 | 270 | 300 | 340 | 390 |
| | B | 260 | 250 | 250 | 280 | 300 | 310 | 390 | 460 | 490 |
| QUANTITIES | STEEL | 417.1 | 383.6 | 377.4 | 379.2 | 406.6 | 433.8 | 464.5 | 478 | 505.5 |
| | CONC. | 3.2 | 3.1 | 3.1 | 3.3 | 3.5 | 3.6 | 4.2 | 4.9 | 5.5 |
| P BARS | SIZE | 20 | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 |
| | C/C | 200 | 150 | 175 | 175 | 150 | 150 | 200 | 200 | 175 |
| | LENGTH | 3750 | 3750 | 3750 | 3760 | 3770 | 3770 | 3790 | 3830 | 3860 |
| H BARS | C/C | 375 | 300 | 300 | 300 | 400 | 350 | 325 | 325 | 325 |
| | LENGTH | 1810 | 2370 | 2430 | 2490 | 2090 | 2090 | 2070 | 2090 | 2070 |
| J BARS | SIZE | 20 | 15 | 15 | 15 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 375 | 300 | 300 | 300 | 400 | 350 | 325 | 325 | 325 |
| | LENGTH | 3140 | 2710 | 2680 | 2670 | 3030 | 3030 | 3070 | 3130 | 3190 |
| | B | 1290 | 1020 | 990 | 960 | 1160 | 1160 | 1160 | 1150 | 1140 |
| | D | 1560 | 1420 | 1420 | 1420 | 1560 | 1560 | 1560 | 1560 | 1560 |
| | R | 185 | 175 | 175 | 185 | 195 | 195 | 225 | 265 | 315 |
| K BARS | SIZE | 20 | 15 | 15 | 15 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 375 | 300 | 300 | 300 | 400 | 350 | 325 | 325 | 325 |
| | LENGTH | 2550 | 2320 | 2290 | 2290 | 2450 | 2450 | 2520 | 2640 | 2760 |
| | B | 700 | 630 | 600 | 580 | 580 | 580 | 610 | 660 | 710 |
| | D | 1560 | 1420 | 1420 | 1420 | 1560 | 1560 | 1560 | 1560 | 1560 |
| | R | 185 | 175 | 175 | 185 | 195 | 195 | 225 | 265 | 315 |
| S BARS | LENGTH | 1070 | 1040 | 1040 | 1110 | 1170 | 1180 | 1370 | 1580 | 1730 |
| | C | 710 | 680 | 680 | 750 | 810 | 820 | 1010 | 1220 | 1370 |
| T BARS | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| U BARS | LENGTH | 1110 | 1080 | 1080 | 1130 | 1170 | 1170 | 1280 | 1450 | 1630 |
| | C | 750 | 720 | 720 | 770 | 810 | 810 | 920 | 1090 | 1270 |
| Q BARS | SIZE | 15 | 15 | 15 | 15 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 150 | 150 | 150 | 150 | 200 | 175 | 175 | 175 | 150 |
| | LENGTH | 3750 | 3750 | 3750 | 3760 | 3770 | 3770 | 3790 | 3830 | 3860 |
| R BARS | # SETS | 84 | 84 | 84 | 84 | 84 | 84 | 88 | 90 | 92 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 3.50
HEIGHT: 2.50

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 250 | 250 | 250 | 260 | 270 | 270 | 290 | 340 | 390 |
| | T | 260 | 250 | 250 | 260 | 270 | 270 | 300 | 340 | 400 |
| | B | 260 | 250 | 250 | 290 | 310 | 320 | 390 | 460 | 500 |
| QUANTITIES | STEEL | 434.9 | 406.3 | 405.6 | 408.6 | 427.8 | 449.1 | 486.9 | 513.6 | 522.3 |
| | CONC. | 3.5 | 3.4 | 3.4 | 3.6 | 3.8 | 3.9 | 4.4 | 5.3 | 6.1 |
| P BARS | SIZE | 20 | 15 | 15 | 15 | 15 | 20 | 20 | 20 | 20 |
| | C/C | 175 | 150 | 150 | 150 | 150 | 200 | 175 | 175 | 175 |
| | LENGTH | 3750 | 3750 | 3750 | 3760 | 3770 | 3770 | 3790 | 3840 | 3890 |
| H BARS | C/C | 300 | 325 | 325 | 325 | 300 | 400 | 375 | 350 | 350 |
| | LENGTH | 1330 | 2310 | 2410 | 2430 | 2470 | 2050 | 2030 | 2030 | 2070 |
| J BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 | 20 |
| | C/C | 300 | 325 | 325 | 325 | 300 | 400 | 375 | 350 | 350 |
| | LENGTH | 3490 | 2990 | 2940 | 2950 | 2950 | 3300 | 3340 | 3420 | 3480 |
| | B | 1530 | 1050 | 1000 | 990 | 970 | 1180 | 1180 | 1190 | 1160 |
| | D | 1670 | 1670 | 1670 | 1670 | 1670 | 1810 | 1810 | 1810 | 1810 |
| | R | 185 | 175 | 175 | 185 | 195 | 195 | 225 | 265 | 325 |
| K BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 20 | 20 | 20 | 20 |
| | C/C | 300 | 325 | 325 | 325 | 300 | 400 | 375 | 350 | 350 |
| | LENGTH | 2860 | 2590 | 2550 | 2600 | 2620 | 2750 | 2820 | 2950 | 3090 |
| | B | 900 | 650 | 610 | 640 | 640 | 630 | 660 | 720 | 770 |
| | D | 1670 | 1670 | 1670 | 1670 | 1670 | 1810 | 1810 | 1810 | 1810 |
| | R | 185 | 175 | 175 | 185 | 195 | 195 | 225 | 265 | 325 |
| S BARS | LENGTH | 1070 | 1040 | 1040 | 1130 | 1180 | 1200 | 1370 | 1590 | 1800 |
| | C | 710 | 680 | 680 | 770 | 820 | 840 | 1010 | 1230 | 1440 |
| T BARS | LENGTH | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| U BARS | LENGTH | 1110 | 1080 | 1080 | 1130 | 1170 | 1170 | 1280 | 1460 | 1700 |
| | C | 750 | 720 | 720 | 770 | 810 | 810 | 920 | 1100 | 1340 |
| Q BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 200 | 200 | 200 | 200 | 175 | 175 | 150 | 150 | 150 |
| | LENGTH | 3750 | 3750 | 3750 | 3760 | 3770 | 3770 | 3790 | 3840 | 3890 |
| R BARS | # SETS | 92 | 92 | 92 | 92 | 92 | 92 | 96 | 98 | 96 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.00
HEIGHT: 1.50

| | | FILL HEIGHT | | | | | | | | |
|------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 240 | 240 | 240 | 240 | 270 | 280 | 300 | 360 | 390 |
| | T | 260 | 250 | 250 | 260 | 280 | 300 | 320 | 410 | 410 |
| | B | 260 | 260 | 270 | 280 | 310 | 330 | 360 | 440 | 550 |
| QUANTITIES | STEEL | 494.3 | 446.3 | 450.7 | 496.5 | 481.8 | 507.3 | 555.5 | 570.2 | 614.8 |
| | CONC. | 3.2 | 3.1 | 3.2 | 3.3 | 3.6 | 3.9 | 4.2 | 5.4 | 6.1 |
| P BARS | SIZE | 20 | 15 | 15 | 15 | 15 | 15 | 20 | 15 | 20 |
| | C/C | 200 | 150 | 150 | 150 | 150 | 150 | 175 | 150 | 200 |
| | LENGTH | 4240 | 4240 | 4240 | 4240 | 4270 | 4280 | 4300 | 4360 | 4390 |
| H BARS | C/C | 425 | 300 | 300 | 425 | 450 | 425 | 375 | 375 | 350 |
| | LENGTH | 1750 | 2350 | 2410 | 1930 | 1990 | 2030 | 2050 | 1970 | 2010 |
| J BARS | SIZE | 25 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 425 | 300 | 300 | 425 | 450 | 425 | 375 | 375 | 350 |
| | LENGTH | 3300 | 2850 | 2820 | 3210 | 3220 | 3220 | 3240 | 3400 | 3410 |
| | B | 1560 | 1270 | 1240 | 1470 | 1450 | 1420 | 1410 | 1420 | 1430 |
| | D | 1450 | 1310 | 1310 | 1450 | 1450 | 1450 | 1450 | 1450 | 1450 |
| | R | 185 | 175 | 175 | 185 | 205 | 225 | 245 | 335 | 335 |
| K BARS | SIZE | 25 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 425 | 300 | 300 | 425 | 450 | 425 | 375 | 375 | 350 |
| | LENGTH | 2490 | 2250 | 2220 | 2400 | 2430 | 2450 | 2500 | 2740 | 2790 |
| | B | 750 | 670 | 640 | 660 | 660 | 650 | 670 | 760 | 810 |
| | D | 1450 | 1310 | 1310 | 1450 | 1450 | 1450 | 1450 | 1450 | 1450 |
| | R | 185 | 175 | 175 | 185 | 205 | 225 | 245 | 335 | 335 |
| S BARS | LENGTH | 1050 | 1040 | 1050 | 1080 | 1200 | 1270 | 1370 | 1690 | 1890 |
| | C | 690 | 680 | 690 | 720 | 840 | 910 | 1010 | 1330 | 1530 |
| T BARS | LENGTH | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| U BARS | LENGTH | 1100 | 1070 | 1070 | 1100 | 1200 | 1270 | 1350 | 1690 | 1730 |
| | C | 740 | 710 | 710 | 740 | 840 | 910 | 990 | 1330 | 1370 |
| Q BARS | SIZE | 15 | 15 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 150 | 150 | 200 | 175 | 200 | 175 | 175 | 175 | 150 |
| | LENGTH | 4240 | 4240 | 4240 | 4240 | 4270 | 4280 | 4300 | 4360 | 4390 |
| R BARS | # SETS | 86 | 86 | 86 | 86 | 86 | 88 | 88 | 90 | 92 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.00
HEIGHT: 1.75

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 250 | 240 | 240 | 250 | 260 | 280 | 310 | 350 | 400 |
| | T | 270 | 250 | 250 | 260 | 280 | 300 | 330 | 370 | 440 |
| | B | 270 | 270 | 270 | 280 | 310 | 330 | 400 | 450 | 560 |
| QUANTITIES | STEEL | 487.5 | 474.2 | 472.9 | 481.9 | 482.1 | 516.6 | 555.7 | 581.6 | 604.4 |
| | CONC. | 3.5 | 3.3 | 3.3 | 3.4 | 3.7 | 4 | 4.7 | 5.4 | 6.6 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 175 | 200 | 200 | 200 | 200 | 200 | 175 | 175 | 175 |
| | LENGTH | 4250 | 4240 | 4240 | 4250 | 4260 | 4280 | 4310 | 4350 | 4400 |
| H BARS | C/C | 300 | 300 | 300 | 300 | 300 | 450 | 425 | 400 | 400 |
| | LENGTH | 2250 | 2350 | 2430 | 2470 | 2490 | 2070 | 2050 | 2050 | 2010 |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 300 | 300 | 300 | 300 | 450 | 425 | 400 | 400 |
| | LENGTH | 3060 | 2980 | 2940 | 2940 | 2950 | 3320 | 3380 | 3440 | 3550 |
| | B | 1310 | 1270 | 1230 | 1210 | 1190 | 1400 | 1410 | 1410 | 1410 |
| | D | 1440 | 1440 | 1440 | 1440 | 1440 | 1570 | 1570 | 1570 | 1570 |
| | R | 195 | 175 | 175 | 185 | 205 | 225 | 255 | 295 | 365 |
| K BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 300 | 300 | 300 | 300 | 450 | 425 | 400 | 400 |
| | LENGTH | 2470 | 2370 | 2340 | 2350 | 2380 | 2550 | 2640 | 2740 | 2940 |
| | B | 720 | 660 | 630 | 620 | 620 | 630 | 670 | 710 | 800 |
| | D | 1440 | 1440 | 1440 | 1440 | 1440 | 1570 | 1570 | 1570 | 1570 |
| | R | 195 | 175 | 175 | 185 | 205 | 225 | 255 | 295 | 365 |
| S BARS | LENGTH | 1100 | 1050 | 1050 | 1100 | 1180 | 1270 | 1450 | 1630 | 1960 |
| | C | 740 | 690 | 690 | 740 | 820 | 910 | 1090 | 1270 | 1600 |
| T BARS | LENGTH | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| U BARS | LENGTH | 1140 | 1070 | 1070 | 1110 | 1180 | 1270 | 1390 | 1560 | 1830 |
| | C | 780 | 710 | 710 | 750 | 820 | 910 | 1030 | 1200 | 1470 |
| Q BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 200 | 200 | 200 | 175 | 175 | 175 | 150 | 150 | 150 |
| | LENGTH | 4250 | 4240 | 4240 | 4250 | 4260 | 4280 | 4310 | 4350 | 4400 |
| R BARS | # SETS | 90 | 90 | 90 | 90 | 88 | 92 | 92 | 92 | 94 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.00
HEIGHT: 2.00

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 250 | 250 | 250 | 250 | 250 | 280 | 310 | 340 | 400 |
| | T | 260 | 260 | 260 | 260 | 270 | 300 | 330 | 380 | 450 |
| | B | 260 | 260 | 270 | 300 | 320 | 360 | 430 | 480 | 570 |
| QUANTITIES | STEEL | 506.3 | 460.8 | 480.1 | 495.5 | 513.5 | 519.4 | 560.9 | 599.3 | 626.1 |
| | CONC. | 3.5 | 3.5 | 3.5 | 3.7 | 3.8 | 4.3 | 5 | 5.7 | 6.9 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 175 | 200 | 200 | 200 | 175 | 200 | 175 | 150 | 175 |
| | LENGTH | 4250 | 4250 | 4250 | 4250 | 4250 | 4280 | 4310 | 4340 | 4400 |
| H BARS | C/C | 300 | 350 | 325 | 300 | 300 | 300 | 450 | 425 | 425 |
| | LENGTH | 2270 | 2370 | 2450 | 2470 | 2490 | 2490 | 2050 | 2050 | 2030 |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 |
| | C/C | 300 | 350 | 325 | 300 | 300 | 300 | 450 | 425 | 425 |
| | LENGTH | 3160 | 3110 | 3070 | 3060 | 3060 | 3100 | 3510 | 3570 | 3680 |
| | B | 1310 | 1260 | 1220 | 1210 | 1190 | 1190 | 1410 | 1390 | 1390 |
| | D | 1560 | 1560 | 1560 | 1560 | 1560 | 1560 | 1700 | 1700 | 1700 |
| | R | 185 | 185 | 185 | 185 | 195 | 225 | 255 | 305 | 375 |
| K BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 |
| | C/C | 300 | 350 | 325 | 300 | 300 | 300 | 450 | 425 | 425 |
| | LENGTH | 2570 | 2510 | 2480 | 2470 | 2480 | 2540 | 2770 | 2900 | 3100 |
| | B | 720 | 660 | 630 | 620 | 610 | 630 | 670 | 720 | 810 |
| | D | 1560 | 1560 | 1560 | 1560 | 1560 | 1560 | 1700 | 1700 | 1700 |
| | R | 185 | 185 | 185 | 185 | 195 | 225 | 255 | 305 | 375 |
| S BARS | LENGTH | 1070 | 1070 | 1080 | 1130 | 1170 | 1310 | 1490 | 1680 | 1990 |
| | C | 710 | 710 | 720 | 770 | 810 | 950 | 1130 | 1320 | 1630 |
| T BARS | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| U BARS | LENGTH | 1110 | 1110 | 1110 | 1110 | 1140 | 1270 | 1390 | 1580 | 1860 |
| | C | 750 | 750 | 750 | 750 | 780 | 910 | 1030 | 1220 | 1500 |
| Q BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 25 |
| | C/C | 175 | 200 | 175 | 175 | 150 | 150 | 150 | 150 | 200 |
| | LENGTH | 4250 | 4250 | 4250 | 4250 | 4250 | 4280 | 4310 | 4340 | 4400 |
| R BARS | # SETS | 92 | 92 | 92 | 92 | 92 | 96 | 96 | 98 | 98 |

CONCRETE CULVERT DESIGN AND DETAILING MANUAL

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RIGID FRAME BOX CULVERTS

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.00
HEIGHT: 2.50

| | | FILL HEIGHT | | | | | | | | |
|------------|--------|-------------|-------|-------|-------|------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 250 | 250 | 250 | 260 | 280 | 310 | 310 | 370 | 430 |
| | T | 270 | 250 | 250 | 260 | 280 | 310 | 320 | 410 | 480 |
| | B | 270 | 260 | 270 | 300 | 330 | 340 | 440 | 500 | 580 |
| QUANTITIES | STEEL | 522.3 | 493.3 | 504.7 | 516.8 | 521 | 533.7 | 585.3 | 579.5 | 638.5 |
| | CONC. | 3.8 | 3.7 | 3.7 | 4 | 4.3 | 4.7 | 5.3 | 6.5 | 7.8 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 150 | 175 | 175 | 175 | 175 | 175 | 150 | 150 | 175 |
| | LENGTH | 4250 | 4250 | 4250 | 4260 | 4280 | 4310 | 4310 | 4370 | 4430 |
| H BARS | C/C | 350 | 375 | 350 | 350 | 350 | 350 | 300 | 325 | 325 |
| | LENGTH | 2090 | 2350 | 2430 | 2450 | 2470 | 2490 | 2470 | 2470 | 2450 |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 350 | 375 | 350 | 350 | 350 | 350 | 300 | 325 | 325 |
| | LENGTH | 3510 | 3360 | 3320 | 3330 | 3350 | 3390 | 3400 | 3520 | 3630 |
| | B | 1390 | 1280 | 1240 | 1230 | 1220 | 1210 | 1210 | 1180 | 1180 |
| | D | 1810 | 1810 | 1810 | 1810 | 1810 | 1810 | 1810 | 1810 | 1810 |
| | R | 195 | 175 | 175 | 185 | 205 | 235 | 245 | 335 | 405 |
| K BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 350 | 375 | 350 | 350 | 350 | 350 | 300 | 325 | 325 |
| | LENGTH | 2920 | 2760 | 2730 | 2750 | 2790 | 2860 | 2880 | 3120 | 3300 |
| | B | 800 | 680 | 650 | 650 | 660 | 680 | 690 | 780 | 850 |
| | D | 1810 | 1810 | 1810 | 1810 | 1810 | 1810 | 1810 | 1810 | 1810 |
| | R | 195 | 175 | 175 | 185 | 205 | 235 | 245 | 335 | 405 |
| S BARS | LENGTH | 1100 | 1050 | 1070 | 1140 | 1240 | 1340 | 1490 | 1790 | 2090 |
| | C | 740 | 690 | 710 | 780 | 880 | 980 | 1130 | 1430 | 1730 |
| T BARS | LENGTH | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| U BARS | LENGTH | 1140 | 1080 | 1080 | 1130 | 1210 | 1340 | 1370 | 1700 | 1990 |
| | C | 780 | 720 | 720 | 770 | 850 | 980 | 1010 | 1340 | 1630 |
| Q BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 20 | 25 |
| | C/C | 175 | 175 | 175 | 150 | 150 | 150 | 225 | 150 | 150 |
| | LENGTH | 4250 | 4250 | 4250 | 4260 | 4280 | 4310 | 4310 | 4370 | 4430 |
| R BARS | # SETS | 100 | 100 | 100 | 100 | 100 | 104 | 104 | 104 | 108 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.00
HEIGHT: 3.00

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 250 | 250 | 250 | 270 | 280 | 290 | 320 | 380 | 430 |
| | T | 280 | 280 | 280 | 280 | 280 | 290 | 340 | 410 | 460 |
| | B | 280 | 280 | 280 | 300 | 360 | 370 | 450 | 500 | 590 |
| QUANTITIES | STEEL | 587.4 | 519.4 | 526.8 | 546 | 562.8 | 585.8 | 621.8 | 602.5 | 657.7 |
| | CONC. | 4.2 | 4.2 | 4.2 | 4.4 | 4.8 | 4.9 | 5.8 | 6.9 | 8.1 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 150 | 175 | 175 | 175 | 175 | 175 | 150 | 150 | 150 |
| | LENGTH | 4250 | 4250 | 4250 | 4270 | 4280 | 4290 | 4320 | 4380 | 4430 |
| H BARS | C/C | - | 300 | 300 | 400 | 375 | 350 | 325 | 350 | 325 |
| | LENGTH | - | 2050 | 2470 | 2330 | 2410 | 2410 | 2390 | 2430 | 2370 |
| J BARS | SIZE | 20 | 15 | 15 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 375 | 300 | 300 | 400 | 375 | 350 | 325 | 350 | 325 |
| | LENGTH | 4940 | 3640 | 3430 | 3660 | 3630 | 3650 | 3720 | 3800 | 3900 |
| | B | 2560 | 1400 | 1190 | 1280 | 1250 | 1250 | 1240 | 1210 | 1240 |
| | D | 2060 | 1920 | 1920 | 2060 | 2060 | 2060 | 2060 | 2060 | 2060 |
| K BARS | R | 205 | 205 | 205 | 205 | 205 | 215 | 265 | 335 | 385 |
| | SIZE | 20 | 15 | 15 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 375 | 300 | 300 | 400 | 375 | 350 | 325 | 350 | 325 |
| | LENGTH | 3460 | 3080 | 2980 | 3110 | 3130 | 3140 | 3260 | 3430 | 3580 |
| | B | 1080 | 840 | 740 | 730 | 750 | 740 | 780 | 840 | 920 |
| S BARS | D | 2060 | 1920 | 1920 | 2060 | 2060 | 2060 | 2060 | 2060 | 2060 |
| | R | 205 | 205 | 205 | 205 | 205 | 215 | 265 | 335 | 385 |
| S BARS | LENGTH | 1130 | 1130 | 1130 | 1180 | 1280 | 1320 | 1550 | 1800 | 2070 |
| | C | 770 | 770 | 770 | 820 | 920 | 960 | 1190 | 1440 | 1710 |
| T BARS* | LENGTH | 3000* | 3000* | 3000* | 3000* | 3000* | 3000* | 3000 | 3000 | 3000 |
| U BARS | LENGTH | 1170 | 1170 | 1170 | 1200 | 1210 | 1250 | 1440 | 1720 | 1930 |
| | C | 810 | 810 | 810 | 840 | 850 | 890 | 1080 | 1360 | 1570 |
| Q BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 |
| | C/C | 150 | 175 | 150 | 150 | 150 | 225 | 225 | 225 | 175 |
| | LENGTH | 4250 | 4250 | 4250 | 4270 | 4280 | 4290 | 4320 | 4380 | 4430 |
| R BARS | # SETS | 106 | 106 | 106 | 106 | 108 | 108 | 108 | 110 | 112 |

*T BARS to be Size 20M. Modify drawing SS114-2 accordingly.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.00
HEIGHT: 3.50

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 260 | 260 | 270 | 280 | 290 | 300 | 330 | 380 | 450 |
| | T | 280 | 260 | 270 | 280 | 310 | 330 | 350 | 410 | 460 |
| | B | 280 | 280 | 300 | 340 | 370 | 400 | 470 | 510 | 610 |
| QUANTITIES | STEEL | 582.9 | 537.3 | 536.2 | 537.9 | 547.6 | 588.7 | 608.4 | 629.7 | 666.2 |
| | CONC. | 4.5 | 4.4 | 4.6 | 4.9 | 5.3 | 5.7 | 6.4 | 7.4 | 8.8 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 150 | 150 | 175 | 175 | 175 | 150 | 150 | 150 | 150 |
| | LENGTH | 4260 | 4260 | 4270 | 4280 | 4290 | 4300 | 4330 | 4380 | 4450 |
| H BARS | C/C | - | 300 | 300 | 300 | 300 | 400 | 375 | 375 | 350 |
| | LENGTH | - | 1070 | 1810 | 1910 | 2070 | 2050 | 2070 | 2050 | 2010 |
| J BARS | SIZE | 20 | 15 | 15 | 15 | 15 | 20 | 20 | 20 | 20 |
| | C/C | 400 | 300 | 300 | 300 | 300 | 400 | 375 | 375 | 350 |
| | LENGTH | 5190 | 4380 | 4030 | 3990 | 3940 | 4110 | 4140 | 4240 | 4350 |
| | B | 2560 | 1920 | 1550 | 1500 | 1400 | 1400 | 1400 | 1400 | 1440 |
| | D | 2310 | 2170 | 2170 | 2170 | 2170 | 2310 | 2310 | 2310 | 2310 |
| K BARS | R | 205 | 185 | 195 | 205 | 235 | 255 | 275 | 335 | 385 |
| | SIZE | 20 | 15 | 15 | 15 | 15 | 20 | 20 | 20 | 20 |
| | C/C | 400 | 300 | 300 | 300 | 300 | 400 | 375 | 375 | 350 |
| | LENGTH | 3830 | 3550 | 3410 | 3410 | 3430 | 3610 | 3680 | 3800 | 3940 |
| | B | 1200 | 1090 | 930 | 920 | 890 | 900 | 940 | 960 | 1030 |
| S BARS | D | 2310 | 2170 | 2170 | 2170 | 2170 | 2310 | 2310 | 2310 | 2310 |
| | R | 205 | 185 | 195 | 205 | 235 | 255 | 275 | 335 | 385 |
| T BARS | LENGTH | 1140 | 1110 | 1170 | 1250 | 1350 | 1440 | 1610 | 1820 | 2130 |
| | C | 780 | 750 | 810 | 890 | 990 | 1080 | 1250 | 1460 | 1770 |
| U BARS | LENGTH | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| | C | 1180 | 1130 | 1170 | 1210 | 1310 | 1380 | 1480 | 1720 | 1960 |
| Q BARS | SIZE | 820 | 770 | 810 | 850 | 950 | 1020 | 1120 | 1360 | 1600 |
| | C/C | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 |
| | LENGTH | 150 | 175 | 150 | 150 | 150 | 225 | 225 | 200 | 200 |
| R BARS | # SETS | 4260 | 4260 | 4270 | 4280 | 4290 | 4300 | 4330 | 4380 | 4450 |
| | | 112 | 112 | 112 | 112 | 116 | 116 | 116 | 116 | 120 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.00
HEIGHT: 4.00

| | | FILL HEIGHT | | | | | | | | |
|------------|--------|-------------|-------|-------|------|-------|-------|-------|------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 280 | 280 | 280 | 300 | 320 | 320 | 360 | 420 | 480 |
| | T | 290 | 280 | 280 | 300 | 340 | 350 | 380 | 430 | 490 |
| | B | 310 | 310 | 330 | 350 | 390 | 410 | 480 | 570 | 660 |
| QUANTITIES | STEEL | 587.6 | 556.4 | 568.9 | 567 | 573.4 | 599.9 | 612.5 | 653 | 673.8 |
| | CONC. | 5.1 | 5.1 | 5.2 | 5.6 | 6.2 | 6.3 | 7.2 | 8.6 | 10 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 150 | 175 | 175 | 175 | 175 | 150 | 150 | 150 | 150 |
| | LENGTH | 4280 | 4280 | 4280 | 4300 | 4320 | 4320 | 4360 | 4420 | 4480 |
| H BARS | C/C | - | - | - | - | 325 | 300 | 300 | 400 | 400 |
| | LENGTH | - | - | - | - | 750 | 850 | 1190 | 1350 | 1210 |
| J BARS | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 300 | 325 | 300 | 325 | 325 | 300 | 300 | 400 | 400 |
| | LENGTH | 5180 | 5160 | 5160 | 5190 | 4900 | 4850 | 4740 | 4890 | 5050 |
| | B | 2420 | 2420 | 2420 | 2420 | 2060 | 2000 | 1840 | 1770 | 1840 |
| | D | 2420 | 2420 | 2420 | 2420 | 2420 | 2420 | 2420 | 2560 | 2560 |
| K BARS | R | 215 | 205 | 205 | 225 | 265 | 275 | 305 | 355 | 415 |
| | SIZE | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 20 |
| | C/C | 300 | 325 | 300 | 325 | 325 | 300 | 300 | 400 | 400 |
| | LENGTH | 4240 | 3950 | 3830 | 4010 | 4070 | 4060 | 4060 | 4290 | 4460 |
| | B | 1480 | 1210 | 1090 | 1240 | 1230 | 1210 | 1160 | 1170 | 1250 |
| S BARS | D | 2420 | 2420 | 2420 | 2420 | 2420 | 2420 | 2420 | 2560 | 2560 |
| | R | 215 | 205 | 205 | 225 | 265 | 275 | 305 | 355 | 415 |
| | LENGTH | 1220 | 1210 | 1240 | 1320 | 1460 | 1510 | 1710 | 1990 | 2290 |
| | C | 860 | 850 | 880 | 960 | 1100 | 1150 | 1350 | 1630 | 1930 |
| | T BARS | LENGTH | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| U BARS | LENGTH | 1240 | 1210 | 1210 | 1290 | 1440 | 1460 | 1610 | 1830 | 2090 |
| | C | 880 | 850 | 850 | 930 | 1080 | 1100 | 1250 | 1470 | 1730 |
| Q BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 |
| | C/C | 150 | 150 | 150 | 150 | 150 | 225 | 225 | 225 | 225 |
| | LENGTH | 4280 | 4280 | 4280 | 4300 | 4320 | 4320 | 4360 | 4420 | 4480 |
| R BARS | # SETS | 120 | 120 | 120 | 124 | 124 | 120 | 124 | 126 | 130 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.50
HEIGHT: 1.75

| | | FILL HEIGHT | | | | | | | | |
|------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 290 | 290 | 290 | 290 | 290 | 320 | 330 | 420 | 470 |
| | T | 310 | 310 | 310 | 310 | 320 | 340 | 350 | 440 | 490 |
| | B | 300 | 320 | 320 | 350 | 380 | 400 | 470 | 550 | 660 |
| QUANTITIES | STEEL | 517.7 | 488.3 | 502.6 | 546.4 | 583.7 | 590.7 | 656.3 | 655.5 | 698.6 |
| | CONC. | 4.3 | 4.4 | 4.4 | 4.6 | 4.8 | 5.2 | 5.6 | 7.1 | 8.4 |
| P BARS | SIZE | 20 | 15 | 15 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 175 | 150 | 150 | 200 | 175 | 175 | 150 | 175 | 175 |
| | LENGTH | 4790 | 4790 | 4790 | 4790 | 4790 | 4820 | 4830 | 4920 | 4970 |
| H BARS | C/C | 300 | 325 | 300 | 450 | 400 | 400 | 350 | 375 | 350 |
| | LENGTH | 2610 | 2730 | 2810 | 2410 | 2430 | 2450 | 2450 | 2430 | 2410 |
| J BARS | SIZE | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 325 | 300 | 450 | 400 | 400 | 350 | 375 | 350 |
| | LENGTH | 3190 | 3130 | 3090 | 3420 | 3410 | 3450 | 3460 | 3610 | 3700 |
| | B | 1380 | 1320 | 1280 | 1480 | 1460 | 1460 | 1460 | 1470 | 1480 |
| | D | 1440 | 1440 | 1440 | 1570 | 1570 | 1570 | 1570 | 1570 | 1570 |
| | R | 235 | 235 | 235 | 235 | 245 | 265 | 275 | 365 | 415 |
| K BARS | SIZE | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 325 | 300 | 450 | 400 | 400 | 350 | 375 | 350 |
| | LENGTH | 2640 | 2580 | 2540 | 2660 | 2660 | 2720 | 2740 | 2990 | 3170 |
| | B | 830 | 770 | 730 | 720 | 710 | 730 | 740 | 850 | 950 |
| | D | 1440 | 1440 | 1440 | 1570 | 1570 | 1570 | 1570 | 1570 | 1570 |
| | R | 235 | 235 | 235 | 235 | 245 | 265 | 275 | 365 | 415 |
| S BARS | LENGTH | 1250 | 1280 | 1280 | 1320 | 1380 | 1480 | 1610 | 1970 | 2270 |
| | C | 890 | 920 | 920 | 960 | 1020 | 1120 | 1250 | 1610 | 1910 |
| T BARS | LENGTH | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| U BARS | LENGTH | 1310 | 1310 | 1310 | 1310 | 1340 | 1440 | 1480 | 1860 | 2070 |
| | C | 950 | 950 | 950 | 950 | 980 | 1080 | 1120 | 1500 | 1710 |
| Q BARS | SIZE | 15 | 15 | 15 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 150 | 150 | 150 | 175 | 175 | 175 | 150 | 150 | 150 |
| | LENGTH | 4790 | 4790 | 4790 | 4790 | 4790 | 4820 | 4830 | 4920 | 4970 |
| R BARS | # SETS | 94 | 96 | 96 | 96 | 96 | 96 | 98 | 100 | 102 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.50
HEIGHT: 2.00

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 280 | 280 | 280 | 280 | 300 | 310 | 320 | 400 | 470 |
| | T | 310 | 300 | 300 | 300 | 320 | 340 | 350 | 440 | 490 |
| | B | 310 | 320 | 320 | 350 | 380 | 400 | 470 | 550 | 660 |
| QUANTITIES | STEEL | 538.8 | 504.5 | 533.5 | 569.2 | 584.5 | 602.6 | 683.6 | 671.9 | 713.1 |
| | CONC. | 4.4 | 4.4 | 4.4 | 4.6 | 5 | 5.3 | 5.7 | 7.2 | 8.6 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 175 | 200 | 200 | 175 | 175 | 175 | 150 | 175 | 175 |
| | LENGTH | 4780 | 4780 | 4780 | 4780 | 4800 | 4810 | 4820 | 4900 | 4970 |
| H BARS | C/C | 300 | 325 | 300 | 450 | 450 | 425 | 350 | 375 | 375 |
| | LENGTH | 2650 | 2750 | 2830 | 2430 | 2450 | 2470 | 2450 | 2450 | 2430 |
| J BARS | SIZE | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 325 | 300 | 450 | 450 | 425 | 350 | 375 | 375 |
| | LENGTH | 3280 | 3220 | 3180 | 3520 | 3540 | 3560 | 3580 | 3710 | 3820 |
| | B | 1350 | 1310 | 1270 | 1470 | 1460 | 1440 | 1450 | 1440 | 1470 |
| | D | 1560 | 1560 | 1560 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| | R | 235 | 225 | 225 | 225 | 245 | 265 | 275 | 365 | 415 |
| K BARS | SIZE | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 325 | 300 | 450 | 450 | 425 | 350 | 375 | 375 |
| | LENGTH | 2740 | 2660 | 2620 | 2750 | 2790 | 2830 | 2860 | 3090 | 3240 |
| | B | 810 | 750 | 710 | 700 | 710 | 710 | 730 | 820 | 890 |
| | D | 1560 | 1560 | 1560 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| | R | 235 | 225 | 225 | 225 | 245 | 265 | 275 | 365 | 415 |
| S BARS | LENGTH | 1250 | 1250 | 1250 | 1300 | 1390 | 1460 | 1590 | 1950 | 2270 |
| | C | 890 | 890 | 890 | 940 | 1030 | 1100 | 1230 | 1590 | 1910 |
| T BARS | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| U BARS | LENGTH | 1290 | 1270 | 1270 | 1270 | 1350 | 1420 | 1460 | 1830 | 2070 |
| | C | 930 | 910 | 910 | 910 | 990 | 1060 | 1100 | 1470 | 1710 |
| Q BARS | SIZE | 20 | 15 | 20 | 20 | 20 | 20 | 25 | 20 | 25 |
| | C/C | 200 | 150 | 175 | 175 | 150 | 150 | 225 | 150 | 200 |
| | LENGTH | 4780 | 4780 | 4780 | 4780 | 4800 | 4810 | 4820 | 4900 | 4970 |
| R BARS | # SETS | 98 | 98 | 98 | 100 | 100 | 100 | 102 | 104 | 106 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.50
HEIGHT: 2.50

| | | FILL HEIGHT | | | | | | | | |
|------------|--------|-------------|------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 280 | 280 | 280 | 280 | 300 | 310 | 330 | 400 | 490 |
| | T | 310 | 290 | 290 | 300 | 320 | 340 | 350 | 440 | 520 |
| | B | 320 | 300 | 300 | 330 | 380 | 400 | 470 | 600 | 660 |
| QUANTITIES | STEEL | 577.2 | 543 | 567.2 | 588.6 | 604.1 | 616.5 | 699.3 | 693.6 | 731.4 |
| | CONC. | 4.8 | 4.6 | 4.6 | 4.8 | 5.3 | 5.6 | 6.1 | 7.9 | 9.5 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 20 | 20 |
| | C/C | 150 | 175 | 175 | 175 | 150 | 150 | 225 | 150 | 150 |
| | LENGTH | 4780 | 4780 | 4780 | 4780 | 4800 | 4810 | 4830 | 4900 | 4990 |
| H BARS | C/C | 325 | 350 | 325 | 300 | 300 | 300 | 400 | 425 | 425 |
| | LENGTH | 2610 | 2750 | 2850 | 2870 | 2890 | 2890 | 2470 | 2450 | 2450 |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 |
| | C/C | 325 | 350 | 325 | 300 | 300 | 300 | 400 | 425 | 425 |
| | LENGTH | 3550 | 3470 | 3420 | 3410 | 3430 | 3460 | 3830 | 3960 | 4100 |
| | B | 1370 | 1320 | 1270 | 1250 | 1240 | 1230 | 1450 | 1440 | 1450 |
| | D | 1810 | 1810 | 1810 | 1810 | 1810 | 1810 | 1950 | 1950 | 1950 |
| K BARS | R | 235 | 215 | 215 | 225 | 245 | 265 | 275 | 365 | 445 |
| | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 |
| | C/C | 325 | 350 | 325 | 300 | 300 | 300 | 400 | 425 | 425 |
| | LENGTH | 3010 | 2900 | 2860 | 2860 | 2900 | 2940 | 3120 | 3370 | 3600 |
| | B | 830 | 750 | 710 | 700 | 710 | 710 | 740 | 850 | 950 |
| S BARS | D | 1810 | 1810 | 1810 | 1810 | 1810 | 1810 | 1950 | 1950 | 1950 |
| | R | 235 | 215 | 215 | 225 | 245 | 265 | 275 | 365 | 445 |
| | LENGTH | 1270 | 1210 | 1210 | 1270 | 1390 | 1460 | 1610 | 2020 | 2340 |
| | C | 910 | 850 | 850 | 910 | 1030 | 1100 | 1250 | 1660 | 1980 |
| | T BARS | LENGTH | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| U BARS | LENGTH | 1290 | 1240 | 1240 | 1270 | 1350 | 1420 | 1480 | 1830 | 2190 |
| | C | 930 | 880 | 880 | 910 | 990 | 1060 | 1120 | 1470 | 1830 |
| Q BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 |
| | C/C | 175 | 175 | 150 | 150 | 150 | 225 | 200 | 225 | 200 |
| | LENGTH | 4780 | 4780 | 4780 | 4780 | 4800 | 4810 | 4830 | 4900 | 4990 |
| R BARS | # SETS | 108 | 106 | 106 | 108 | 108 | 108 | 108 | 112 | 114 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.50

HEIGHT: 3.00

| | | FILL HEIGHT | | | | | | | | |
|------------|--------|-------------|-------|-------|-------|-------|-------|-------|------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 280 | 280 | 280 | 290 | 300 | 320 | 330 | 410 | 490 |
| | T | 310 | 310 | 310 | 310 | 320 | 340 | 360 | 440 | 520 |
| | B | 310 | 310 | 320 | 350 | 390 | 400 | 470 | 590 | 660 |
| QUANTITIES | STEEL | 622.1 | 577.3 | 590.2 | 596.4 | 623.1 | 627.7 | 716.3 | 693 | 750.3 |
| | CONC. | 5 | 5 | 5.1 | 5.3 | 5.6 | 6 | 6.5 | 8.3 | 9.9 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 20 | 20 |
| | C/C | 150 | 150 | 150 | 150 | 150 | 150 | 225 | 150 | 150 |
| | LENGTH | 4780 | 4780 | 4780 | 4790 | 4800 | 4820 | 4830 | 4910 | 4990 |
| H BARS | C/C | 350 | 400 | 400 | 350 | 325 | 325 | 450 | 300 | 300 |
| | LENGTH | 2030 | 2630 | 2730 | 2810 | 2830 | 2850 | 2410 | 2870 | 2730 |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 20 | 20 |
| | C/C | 350 | 400 | 400 | 350 | 325 | 325 | 450 | 300 | 300 |
| | LENGTH | 4090 | 3790 | 3740 | 3710 | 3710 | 3740 | 4120 | 3870 | 4070 |
| | B | 1660 | 1360 | 1310 | 1280 | 1270 | 1260 | 1470 | 1240 | 1310 |
| | D | 2060 | 2060 | 2060 | 2060 | 2060 | 2060 | 2200 | 2060 | 2060 |
| K BARS | R | 235 | 235 | 235 | 235 | 245 | 265 | 285 | 365 | 445 |
| | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 20 | 20 |
| | C/C | 350 | 400 | 400 | 350 | 325 | 325 | 450 | 300 | 300 |
| | LENGTH | 3420 | 3240 | 3210 | 3200 | 3210 | 3250 | 3440 | 3530 | 3750 |
| | B | 990 | 810 | 780 | 770 | 770 | 770 | 790 | 900 | 990 |
| S BARS | D | 2060 | 2060 | 2060 | 2060 | 2060 | 2060 | 2200 | 2060 | 2060 |
| | R | 235 | 235 | 235 | 235 | 245 | 265 | 285 | 365 | 445 |
| S BARS | LENGTH | 1250 | 1250 | 1270 | 1320 | 1410 | 1480 | 1620 | 2020 | 2340 |
| | C | 890 | 890 | 910 | 960 | 1050 | 1120 | 1260 | 1660 | 1980 |
| T BARS* | LENGTH | 3000* | 3000* | 3000* | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| U BARS | LENGTH | 1290 | 1290 | 1290 | 1310 | 1350 | 1440 | 1510 | 1850 | 2190 |
| | C | 930 | 930 | 930 | 950 | 990 | 1080 | 1150 | 1490 | 1830 |
| Q BARS | SIZE | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 150 | 175 | 150 | 150 | 225 | 225 | 175 | 200 | 150 |
| | LENGTH | 4780 | 4780 | 4780 | 4790 | 4800 | 4820 | 4830 | 4910 | 4990 |
| R BARS | # SETS | 110 | 110 | 112 | 112 | 112 | 112 | 114 | 118 | 120 |

*T BARS to be Size 20M. Modify drawing SS114-2 accordingly.

CONCRETE CULVERT DESIGN AND DETAILING MANUAL

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.50
HEIGHT: 3.50

| | | FILL HEIGHT | | | | | | | | |
|------------|--------|-------------|-------|-------|-------|-------|-------|-------|------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 280 | 280 | 290 | 290 | 300 | 310 | 320 | 420 | 480 |
| | T | 310 | 310 | 310 | 310 | 320 | 340 | 360 | 450 | 520 |
| | B | 310 | 320 | 320 | 360 | 400 | 400 | 480 | 580 | 670 |
| QUANTITIES | STEEL | 643.3 | 585.2 | 603.4 | 624.5 | 652.4 | 681.1 | 734.5 | 730 | 795.2 |
| | CONC. | 5.3 | 5.3 | 5.4 | 5.6 | 6 | 6.2 | 6.8 | 8.8 | 10.4 |
| P BARS | SIZE | 25 | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 |
| | C/C | 225 | 150 | 150 | 150 | 150 | 225 | 200 | 225 | 225 |
| | LENGTH | 4780 | 4780 | 4790 | 4790 | 4800 | 4810 | 4820 | 4920 | 4980 |
| H BARS | C/C | - | 300 | 400 | 375 | 350 | 325 | 300 | 325 | 300 |
| | LENGTH | - | 1990 | 2450 | 2630 | 2670 | 2710 | 2710 | 2610 | 2450 |
| J BARS | SIZE | 20 | 15 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 375 | 300 | 400 | 375 | 350 | 325 | 300 | 325 | 300 |
| | LENGTH | 5490 | 4220 | 4140 | 4050 | 4040 | 4050 | 4070 | 4270 | 4450 |
| | B | 2810 | 1680 | 1460 | 1370 | 1350 | 1320 | 1310 | 1370 | 1440 |
| | D | 2310 | 2170 | 2310 | 2310 | 2310 | 2310 | 2310 | 2310 | 2310 |
| K BARS | R | 235 | 235 | 235 | 235 | 245 | 265 | 285 | 375 | 445 |
| | SIZE | 20 | 15 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 375 | 300 | 400 | 375 | 350 | 325 | 300 | 325 | 300 |
| | LENGTH | 3920 | 3540 | 3570 | 3550 | 3570 | 3590 | 3660 | 3880 | 4070 |
| | B | 1240 | 1000 | 890 | 870 | 880 | 860 | 900 | 980 | 1060 |
| S BARS | D | 2310 | 2170 | 2310 | 2310 | 2310 | 2310 | 2310 | 2310 | 2310 |
| | R | 235 | 235 | 235 | 235 | 245 | 265 | 285 | 375 | 445 |
| S BARS | LENGTH | 1250 | 1270 | 1280 | 1340 | 1420 | 1460 | 1620 | 2030 | 2340 |
| | C | 890 | 910 | 920 | 980 | 1060 | 1100 | 1260 | 1670 | 1980 |
| T BARS | LENGTH | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| U BARS | LENGTH | 1290 | 1290 | 1310 | 1310 | 1350 | 1420 | 1490 | 1890 | 2170 |
| | C | 930 | 930 | 950 | 950 | 990 | 1060 | 1130 | 1530 | 1810 |
| Q BARS | SIZE | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 150 | 150 | 150 | 225 | 200 | 200 | 175 | 175 | 150 |
| | LENGTH | 4780 | 4780 | 4790 | 4790 | 4800 | 4810 | 4820 | 4920 | 4980 |
| R BARS | # SETS | 118 | 120 | 120 | 120 | 120 | 120 | 122 | 124 | 128 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 4.50
HEIGHT: 4.00

| | | FILL HEIGHT | | | | | | | | |
|------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 290 | 290 | 300 | 310 | 340 | 340 | 370 | 460 | 490 |
| | T | 300 | 300 | 300 | 310 | 340 | 350 | 400 | 480 | 520 |
| | B | 340 | 330 | 330 | 370 | 410 | 460 | 500 | 630 | 700 |
| QUANTITIES | STEEL | 687.6 | 616.6 | 647.9 | 664.8 | 655.3 | 698.5 | 718.9 | 752.4 | 809.3 |
| | CONC. | 5.8 | 5.7 | 5.8 | 6.2 | 6.8 | 7.2 | 8 | 10.2 | 11.1 |
| P BARS | SIZE | 25 | 20 | 20 | 20 | 20 | 20 | 25 | 20 | 25 |
| | C/C | 225 | 150 | 150 | 150 | 150 | 150 | 225 | 150 | 225 |
| | LENGTH | 4790 | 4790 | 4800 | 4810 | 4840 | 4840 | 4870 | 4960 | 4990 |
| H BARS | C/C | - | - | 400 | 375 | 400 | 350 | 350 | 350 | 325 |
| | LENGTH | - | - | 1810 | 1890 | 2030 | 2110 | 2130 | 2010 | 1990 |
| J BARS | SIZE | 20 | 15 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 375 | 300 | 400 | 375 | 400 | 350 | 350 | 350 | 325 |
| | LENGTH | 5720 | 5440 | 4710 | 4690 | 4670 | 4630 | 4680 | 4880 | 4940 |
| | B | 2810 | 2670 | 1800 | 1760 | 1690 | 1640 | 1610 | 1680 | 1680 |
| | D | 2560 | 2420 | 2560 | 2560 | 2560 | 2560 | 2560 | 2560 | 2560 |
| | R | 225 | 225 | 225 | 235 | 265 | 275 | 325 | 405 | 445 |
| K BARS | SIZE | 20 | 15 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 375 | 300 | 400 | 375 | 400 | 350 | 350 | 350 | 325 |
| | LENGTH | 4260 | 3950 | 3980 | 4000 | 4030 | 4040 | 4130 | 4360 | 4450 |
| | B | 1350 | 1180 | 1070 | 1070 | 1050 | 1050 | 1060 | 1160 | 1190 |
| | D | 2560 | 2420 | 2560 | 2560 | 2560 | 2560 | 2560 | 2560 | 2560 |
| | R | 225 | 225 | 225 | 235 | 265 | 275 | 325 | 405 | 445 |
| S BARS | LENGTH | 1300 | 1280 | 1300 | 1380 | 1520 | 1610 | 1780 | 2200 | 2400 |
| | C | 940 | 920 | 940 | 1020 | 1160 | 1250 | 1420 | 1840 | 2040 |
| T BARS | LENGTH | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| U BARS | LENGTH | 1280 | 1280 | 1290 | 1340 | 1460 | 1490 | 1680 | 2030 | 2190 |
| | C | 920 | 920 | 930 | 980 | 1100 | 1130 | 1320 | 1670 | 1830 |
| Q BARS | SIZE | 25 | 20 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 225 | 150 | 225 | 225 | 225 | 200 | 200 | 175 | 150 |
| | LENGTH | 4790 | 4790 | 4800 | 4810 | 4840 | 4840 | 4870 | 4960 | 4990 |
| R BARS | # SETS | 128 | 128 | 128 | 128 | 128 | 128 | 130 | 134 | 134 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.00
HEIGHT: 2.00

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|------|-------|-------|-------|-------|------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 290 | 290 | 290 | 300 | 310 | 310 | 360 | 440 | 510 |
| | T | 310 | 300 | 310 | 320 | 340 | 350 | 390 | 480 | 540 |
| | B | 310 | 300 | 320 | 340 | 380 | 440 | 520 | 630 | 700 |
| QUANTITIES | STEEL | 652.2 | 616 | 619.2 | 678.6 | 683.6 | 715.8 | 761 | 785.7 | 847.7 |
| | CONC. | 4.8 | 4.7 | 4.9 | 5.1 | 5.5 | 5.9 | 6.9 | 8.7 | 10.1 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 150 | 175 | 175 | 150 | 150 | 150 | 150 | 150 | 150 |
| | LENGTH | 5290 | 5290 | 5290 | 5300 | 5310 | 5310 | 5360 | 5440 | 5510 |
| H BARS | C/C | 400 | 425 | 425 | 375 | 375 | 350 | 325 | 325 | 325 |
| | LENGTH | 2630 | 2730 | 2790 | 2850 | 2850 | 2850 | 2870 | 2830 | 2810 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 400 | 425 | 425 | 375 | 375 | 350 | 325 | 325 | 325 |
| | LENGTH | 3690 | 3630 | 3610 | 3590 | 3620 | 3620 | 3680 | 3840 | 3950 |
| | B | 1620 | 1580 | 1540 | 1510 | 1500 | 1490 | 1490 | 1500 | 1520 |
| | D | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| | R | 235 | 225 | 235 | 245 | 265 | 275 | 315 | 405 | 465 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 400 | 425 | 425 | 375 | 375 | 350 | 325 | 325 | 325 |
| | LENGTH | 2930 | 2860 | 2850 | 2850 | 2890 | 2900 | 3010 | 3280 | 3460 |
| | B | 860 | 810 | 780 | 770 | 770 | 770 | 820 | 940 | 1030 |
| | D | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| | R | 235 | 225 | 235 | 245 | 265 | 275 | 315 | 405 | 465 |
| S BARS | LENGTH | 1270 | 1240 | 1280 | 1340 | 1440 | 1540 | 1780 | 2170 | 2450 |
| | C | 910 | 880 | 920 | 980 | 1080 | 1180 | 1420 | 1810 | 2090 |
| T BARS | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| U BARS | LENGTH | 1310 | 1280 | 1310 | 1350 | 1420 | 1450 | 1630 | 2000 | 2270 |
| | C | 950 | 920 | 950 | 990 | 1060 | 1090 | 1270 | 1640 | 1910 |
| Q BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 20 | 25 |
| | C/C | 175 | 175 | 175 | 150 | 150 | 225 | 225 | 150 | 175 |
| | LENGTH | 5290 | 5290 | 5290 | 5300 | 5310 | 5310 | 5360 | 5440 | 5510 |
| R BARS | # SETS | 108 | 106 | 108 | 108 | 108 | 108 | 112 | 114 | 116 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.00
HEIGHT: 2.50

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 280 | 280 | 290 | 290 | 310 | 320 | 390 | 450 | 520 |
| | T | 310 | 300 | 320 | 320 | 340 | 350 | 420 | 470 | 560 |
| | B | 310 | 310 | 330 | 350 | 430 | 450 | 560 | 650 | 700 |
| QUANTITIES | STEEL | 689 | 633.5 | 638.4 | 687.4 | 712.5 | 751.9 | 771.1 | 794.8 | 880.8 |
| | CONC. | 5 | 5 | 5.3 | 5.4 | 6.1 | 6.4 | 8 | 9.3 | 10.8 |
| P BARS | SIZE | 25 | 20 | 20 | 20 | 20 | 25 | 20 | 20 | 20 |
| | C/C | 225 | 150 | 150 | 150 | 150 | 225 | 150 | 150 | 150 |
| | LENGTH | 5280 | 5280 | 5290 | 5290 | 5310 | 5320 | 5390 | 5450 | 5520 |
| H BARS | C/C | 425 | 300 | 300 | 425 | 400 | 375 | 375 | 375 | 350 |
| | LENGTH | 2610 | 3170 | 3250 | 2870 | 2850 | 2870 | 2850 | 2890 | 2850 |
| J BARS | SIZE | 25 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 425 | 300 | 300 | 425 | 400 | 375 | 375 | 375 | 350 |
| | LENGTH | 3940 | 3510 | 3490 | 3820 | 3870 | 3870 | 3990 | 4060 | 4200 |
| | B | 1620 | 1350 | 1300 | 1490 | 1500 | 1490 | 1500 | 1490 | 1490 |
| | D | 1950 | 1810 | 1810 | 1950 | 1950 | 1950 | 1950 | 1950 | 1950 |
| | R | 235 | 225 | 245 | 245 | 265 | 275 | 345 | 395 | 485 |
| K BARS | SIZE | 25 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 425 | 300 | 300 | 425 | 400 | 375 | 375 | 375 | 350 |
| | LENGTH | 3180 | 2960 | 2950 | 3070 | 3140 | 3150 | 3340 | 3500 | 3730 |
| | B | 860 | 800 | 760 | 740 | 770 | 770 | 850 | 930 | 1020 |
| | D | 1950 | 1810 | 1810 | 1950 | 1950 | 1950 | 1950 | 1950 | 1950 |
| | R | 235 | 225 | 245 | 245 | 265 | 275 | 345 | 395 | 485 |
| S BARS | LENGTH | 1250 | 1240 | 1310 | 1340 | 1510 | 1560 | 1920 | 2200 | 2500 |
| | C | 890 | 880 | 950 | 980 | 1150 | 1200 | 1560 | 1840 | 2140 |
| T BARS | LENGTH | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| U BARS | LENGTH | 1290 | 1270 | 1340 | 1340 | 1420 | 1460 | 1760 | 1990 | 2340 |
| | C | 930 | 910 | 980 | 980 | 1060 | 1100 | 1400 | 1630 | 1980 |
| Q BARS | SIZE | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 150 | 150 | 150 | 225 | 225 | 200 | 200 | 200 | 150 |
| | LENGTH | 5280 | 5280 | 5290 | 5290 | 5310 | 5320 | 5390 | 5450 | 5520 |
| R BARS | # SETS | 114 | 114 | 116 | 116 | 116 | 114 | 118 | 122 | 122 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.00
HEIGHT: 3.00

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|------|-------|-------|-------|------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 290 | 290 | 290 | 300 | 310 | 320 | 380 | 450 | 540 |
| | T | 320 | 320 | 320 | 320 | 340 | 350 | 410 | 480 | 580 |
| | B | 320 | 320 | 320 | 370 | 430 | 460 | 560 | 660 | 740 |
| QUANTITIES | STEEL | 705 | 653 | 656.5 | 698 | 729.8 | 797.2 | 808.3 | 833 | 884.7 |
| | CONC. | 5.5 | 5.5 | 5.5 | 5.9 | 6.4 | 6.7 | 8.2 | 9.9 | 11.9 |
| P BARS | SIZE | 25 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 225 | 150 | 150 | 225 | 225 | 200 | 225 | 225 | 225 |
| | LENGTH | 5290 | 5290 | 5290 | 5300 | 5310 | 5320 | 5380 | 5450 | 5540 |
| H BARS | C/C | 300 | 350 | 325 | 300 | 450 | 400 | 400 | 400 | 400 |
| | LENGTH | 2670 | 3110 | 3190 | 3250 | 2830 | 2850 | 2830 | 2870 | 2850 |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 350 | 325 | 300 | 450 | 400 | 400 | 400 | 400 |
| | LENGTH | 4030 | 3810 | 3770 | 3750 | 4130 | 4130 | 4240 | 4330 | 4480 |
| | B | 1590 | 1370 | 1330 | 1310 | 1510 | 1500 | 1510 | 1490 | 1490 |
| | D | 2060 | 2060 | 2060 | 2060 | 2200 | 2200 | 2200 | 2200 | 2200 |
| | R | 245 | 245 | 245 | 245 | 265 | 275 | 335 | 405 | 505 |
| K BARS | SIZE | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 350 | 325 | 300 | 450 | 400 | 400 | 400 | 400 |
| | LENGTH | 3400 | 3270 | 3230 | 3230 | 3400 | 3420 | 3600 | 3810 | 4070 |
| | B | 960 | 830 | 790 | 790 | 780 | 790 | 870 | 970 | 1080 |
| | D | 2060 | 2060 | 2060 | 2060 | 2200 | 2200 | 2200 | 2200 | 2200 |
| S BARS | LENGTH | 1300 | 1300 | 1300 | 1380 | 1510 | 1580 | 1890 | 2230 | 2610 |
| | C | 940 | 940 | 940 | 1020 | 1150 | 1220 | 1530 | 1870 | 2250 |
| T BARS* | LENGTH | 3000* | 3000* | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| U BARS | LENGTH | 1340 | 1340 | 1340 | 1350 | 1420 | 1460 | 1720 | 2020 | 2430 |
| | C | 980 | 980 | 980 | 990 | 1060 | 1100 | 1360 | 1660 | 2070 |
| Q BARS | SIZE | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 150 | 150 | 225 | 200 | 200 | 175 | 175 | 175 | 150 |
| | LENGTH | 5290 | 5290 | 5290 | 5300 | 5310 | 5320 | 5380 | 5450 | 5540 |
| R BARS | # SETS | 120 | 120 | 120 | 120 | 120 | 122 | 124 | 126 | 128 |

*T BARS to be Size 20M. Modify drawing SS114-2 accordingly.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.00
HEIGHT: 3.50

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 290 | 290 | 290 | 290 | 310 | 330 | 390 | 460 | 540 |
| | T | 310 | 310 | 320 | 320 | 340 | 360 | 420 | 490 | 580 |
| | B | 320 | 320 | 350 | 410 | 450 | 480 | 560 | 660 | 770 |
| QUANTITIES | STEEL | 724.4 | 676.7 | 683.8 | 735 | 740.4 | 804.6 | 820.2 | 887.1 | 928.8 |
| | CONC. | 5.7 | 5.7 | 6 | 6.3 | 6.8 | 7.3 | 8.7 | 10.5 | 12.7 |
| P BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 200 | 225 | 225 | 225 | 225 | 200 | 200 | 200 | 225 |
| | LENGTH | 5290 | 5290 | 5290 | 5290 | 5310 | 5330 | 5390 | 5460 | 5540 |
| H BARS | C/C | 325 | 350 | 350 | 300 | 300 | 450 | 450 | 425 | 425 |
| | LENGTH | 1990 | 2710 | 3030 | 3110 | 3170 | 2770 | 2790 | 2770 | 2810 |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 |
| | C/C | 325 | 350 | 350 | 300 | 300 | 450 | 450 | 425 | 425 |
| | LENGTH | 4620 | 4260 | 4100 | 4060 | 4070 | 4440 | 4520 | 4640 | 4750 |
| | B | 1940 | 1580 | 1410 | 1370 | 1340 | 1540 | 1530 | 1540 | 1510 |
| | D | 2310 | 2310 | 2310 | 2310 | 2310 | 2450 | 2450 | 2450 | 2450 |
| | R | 235 | 235 | 245 | 245 | 265 | 285 | 345 | 415 | 505 |
| K BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 |
| | C/C | 325 | 350 | 350 | 300 | 300 | 450 | 450 | 425 | 425 |
| | LENGTH | 3810 | 3630 | 3570 | 3580 | 3630 | 3800 | 3930 | 4140 | 4380 |
| | B | 1130 | 950 | 880 | 890 | 900 | 900 | 940 | 1040 | 1140 |
| | D | 2310 | 2310 | 2310 | 2310 | 2310 | 2450 | 2450 | 2450 | 2450 |
| | R | 235 | 235 | 245 | 245 | 265 | 285 | 345 | 415 | 505 |
| S BARS | LENGTH | 1280 | 1280 | 1340 | 1420 | 1540 | 1630 | 1920 | 2260 | 2650 |
| | C | 920 | 920 | 980 | 1060 | 1180 | 1270 | 1560 | 1900 | 2290 |
| T BARS | LENGTH | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| U BARS | LENGTH | 1310 | 1310 | 1340 | 1340 | 1420 | 1510 | 1760 | 2060 | 2430 |
| | C | 950 | 950 | 980 | 980 | 1060 | 1150 | 1400 | 1700 | 2070 |
| Q BARS | SIZE | 25 | 20 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 225 | 150 | 225 | 200 | 200 | 175 | 175 | 150 | 125 |
| | LENGTH | 5290 | 5290 | 5290 | 5290 | 5310 | 5330 | 5390 | 5460 | 5540 |
| R BARS | # SETS | 128 | 128 | 128 | 128 | 128 | 130 | 130 | 134 | 134 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.00
HEIGHT: 4.00

| | | FILL HEIGHT | | | | | | | | |
|------------|--------|-------------|-------|------|-------|-------|-------|-------|-------|------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 290 | 290 | 290 | 310 | 330 | 350 | 400 | 480 | 550 |
| | T | 320 | 310 | 310 | 340 | 360 | 380 | 430 | 510 | 580 |
| | B | 350 | 340 | 380 | 440 | 480 | 510 | 580 | 720 | 800 |
| QUANTITIES | STEEL | 778.9 | 726.6 | 756 | 759.1 | 763.3 | 808.8 | 833.1 | 867.1 | 931 |
| | CONC. | 6.3 | 6.1 | 6.4 | 7.1 | 7.7 | 8.2 | 9.4 | 11.7 | 13.5 |
| P BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 200 | 225 | 225 | 225 | 225 | 225 | 200 | 225 | 200 |
| | LENGTH | 5290 | 5290 | 5290 | 5310 | 5330 | 5350 | 5400 | 5480 | 5550 |
| H BARS | C/C | - | 350 | 325 | 325 | 325 | 300 | 300 | 300 | 300 |
| | LENGTH | - | 1930 | 2190 | 2510 | 2590 | 2650 | 2670 | 2570 | 2430 |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 325 | 350 | 325 | 325 | 325 | 300 | 300 | 300 | 300 |
| | LENGTH | 6000 | 4900 | 4770 | 4650 | 4640 | 4640 | 4710 | 4880 | 5060 |
| | B | 3060 | 1970 | 1840 | 1670 | 1630 | 1600 | 1590 | 1640 | 1710 |
| | D | 2560 | 2560 | 2560 | 2560 | 2560 | 2560 | 2560 | 2560 | 2560 |
| K BARS | R | 245 | 235 | 235 | 265 | 285 | 305 | 355 | 435 | 505 |
| | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 325 | 350 | 325 | 325 | 325 | 300 | 300 | 300 | 300 |
| | LENGTH | 4330 | 4090 | 4040 | 4040 | 4070 | 4100 | 4210 | 4420 | 4610 |
| | B | 1390 | 1160 | 1110 | 1060 | 1060 | 1060 | 1090 | 1180 | 1260 |
| S BARS | D | 2560 | 2560 | 2560 | 2560 | 2560 | 2560 | 2560 | 2560 | 2560 |
| | R | 245 | 235 | 235 | 265 | 285 | 305 | 355 | 435 | 505 |
| T BARS | LENGTH | 1340 | 1310 | 1370 | 1520 | 1630 | 1730 | 1970 | 2400 | 2710 |
| | C | 980 | 950 | 1010 | 1160 | 1270 | 1370 | 1610 | 2040 | 2350 |
| U BARS | LENGTH | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| | C | 980 | 950 | 950 | 1060 | 1150 | 1230 | 1440 | 1780 | 2080 |
| Q BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 225 | 225 | 200 | 200 | 200 | 175 | 175 | 150 | 125 |
| | LENGTH | 5290 | 5290 | 5290 | 5310 | 5330 | 5350 | 5400 | 5480 | 5550 |
| R BARS | # SETS | 136 | 136 | 136 | 136 | 136 | 138 | 138 | 140 | 142 |

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RIGID FRAME BOX CULVERTS

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.50
HEIGHT: 2.00

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 320 | 290 | 300 | 320 | 350 | 390 | 440 | 540 | 620 |
| | T | 350 | 320 | 330 | 350 | 380 | 420 | 470 | 570 | 640 |
| | B | 320 | 330 | 360 | 390 | 450 | 460 | 550 | 640 | 730 |
| QUANTITIES | STEEL | 713.2 | 704.5 | 740.1 | 741.9 | 756.4 | 791.2 | 856.4 | 869.1 | 949.6 |
| | CONC. | 5.6 | 5.3 | 5.6 | 6.1 | 6.8 | 7.4 | 8.7 | 10.8 | 12.5 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 175 | 175 |
| | LENGTH | 5820 | 5790 | 5800 | 5820 | 5850 | 5890 | 5940 | 6040 | 6120 |
| H BARS | C/C | 375 | 375 | 350 | 350 | 350 | 325 | 300 | 300 | 300 |
| | LENGTH | 2990 | 3110 | 3190 | 3210 | 3270 | 3250 | 3250 | 3210 | 2990 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 375 | 375 | 350 | 350 | 350 | 325 | 300 | 300 | 300 |
| | LENGTH | 3810 | 3700 | 3680 | 3700 | 3720 | 3790 | 3870 | 4050 | 4280 |
| | B | 1680 | 1620 | 1580 | 1570 | 1540 | 1550 | 1550 | 1570 | 1690 |
| | D | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| | R | 275 | 245 | 255 | 275 | 305 | 345 | 395 | 495 | 565 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 375 | 375 | 350 | 350 | 350 | 325 | 300 | 300 | 300 |
| | LENGTH | 3090 | 2960 | 2950 | 2980 | 3040 | 3140 | 3280 | 3580 | 3790 |
| | B | 960 | 880 | 850 | 850 | 860 | 900 | 960 | 1100 | 1200 |
| | D | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| | R | 275 | 245 | 255 | 275 | 305 | 345 | 395 | 495 | 565 |
| S BARS | LENGTH | 1380 | 1310 | 1380 | 1480 | 1650 | 1780 | 2040 | 2450 | 2790 |
| | C | 1020 | 950 | 1020 | 1120 | 1290 | 1420 | 1680 | 2090 | 2430 |
| T BARS | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| U BARS | LENGTH | 1460 | 1340 | 1380 | 1460 | 1590 | 1760 | 1970 | 2400 | 2710 |
| | C | 1100 | 980 | 1020 | 1100 | 1230 | 1400 | 1610 | 2040 | 2350 |
| Q BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 25 | 20 | 25 |
| | C/C | 175 | 175 | 150 | 150 | 150 | 150 | 225 | 150 | 175 |
| | LENGTH | 5820 | 5790 | 5800 | 5820 | 5850 | 5890 | 5940 | 6040 | 6120 |
| R BARS | # SETS | 114 | 116 | 116 | 114 | 118 | 116 | 120 | 120 | 126 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.50
HEIGHT: 2.50

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|------|-------|-------|-------|-------|-------|-------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 320 | 290 | 300 | 320 | 350 | 390 | 440 | 530 | 610 |
| | T | 350 | 320 | 330 | 350 | 380 | 420 | 470 | 570 | 640 |
| | B | 320 | 330 | 360 | 400 | 450 | 460 | 550 | 650 | 730 |
| QUANTITIES | STEEL | 709.4 | 716.9 | 756 | 774.4 | 789.8 | 790.1 | 859.7 | 950.1 | 986.5 |
| | CONC. | 6 | 5.6 | 5.9 | 6.5 | 7.2 | 7.8 | 9.1 | 11.3 | 13.1 |
| P BARS | SIZE | 20 | 20 | 25 | 25 | 25 | 20 | 25 | 20 | 20 |
| | C/C | 150 | 150 | 225 | 225 | 225 | 150 | 225 | 150 | 150 |
| | LENGTH | 5820 | 5790 | 5800 | 5820 | 5850 | 5890 | 5940 | 6030 | 6110 |
| H BARS | C/C | 425 | 425 | 400 | 375 | 375 | 375 | 350 | 325 | 325 |
| | LENGTH | 2990 | 3130 | 3210 | 3270 | 3270 | 3290 | 3290 | 3270 | 3170 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 425 | 425 | 400 | 375 | 375 | 375 | 350 | 325 | 325 |
| | LENGTH | 4060 | 3940 | 3920 | 3920 | 3970 | 4020 | 4100 | 4260 | 4430 |
| | B | 1680 | 1610 | 1570 | 1540 | 1540 | 1530 | 1530 | 1530 | 1590 |
| | D | 1950 | 1950 | 1950 | 1950 | 1950 | 1950 | 1950 | 1950 | 1950 |
| | R | 275 | 245 | 255 | 275 | 305 | 345 | 395 | 495 | 565 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 425 | 425 | 400 | 375 | 375 | 375 | 350 | 325 | 325 |
| | LENGTH | 3340 | 3190 | 3180 | 3210 | 3280 | 3370 | 3500 | 3780 | 3980 |
| | B | 960 | 860 | 830 | 830 | 850 | 880 | 930 | 1050 | 1140 |
| | D | 1950 | 1950 | 1950 | 1950 | 1950 | 1950 | 1950 | 1950 | 1950 |
| | R | 275 | 245 | 255 | 275 | 305 | 345 | 395 | 495 | 565 |
| S BARS | LENGTH | 1380 | 1310 | 1380 | 1490 | 1650 | 1780 | 2040 | 2450 | 2780 |
| | C | 1020 | 950 | 1020 | 1130 | 1290 | 1420 | 1680 | 2090 | 2420 |
| T BARS | LENGTH | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| U BARS | LENGTH | 1460 | 1340 | 1380 | 1460 | 1590 | 1760 | 1970 | 2380 | 2690 |
| | C | 1100 | 980 | 1020 | 1100 | 1230 | 1400 | 1610 | 2020 | 2330 |
| Q BARS | SIZE | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 175 | 150 | 225 | 225 | 225 | 225 | 200 | 150 | 150 |
| | LENGTH | 5820 | 5790 | 5800 | 5820 | 5850 | 5890 | 5940 | 6030 | 6110 |
| R BARS | # SETS | 120 | 124 | 124 | 120 | 124 | 124 | 128 | 128 | 134 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.50
HEIGHT: 3.00

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|------|-------|-------|------|-------|-------|------|------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 320 | 300 | 300 | 330 | 360 | 390 | 430 | 530 | 610 |
| | T | 350 | 320 | 330 | 360 | 390 | 420 | 470 | 570 | 640 |
| | B | 320 | 330 | 360 | 420 | 490 | 500 | 570 | 690 | 770 |
| QUANTITIES | STEEL | 771.4 | 715 | 780.7 | 785.5 | 800 | 827.3 | 896.6 | 945 | 1033 |
| | CONC. | 6.3 | 6 | 6.2 | 7 | 7.9 | 8.5 | 9.6 | 12.1 | 14 |
| P BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 225 | 225 | 225 | 225 | 225 | 225 | 200 | 225 | 225 |
| | LENGTH | 5820 | 5800 | 5800 | 5830 | 5860 | 5890 | 5930 | 6030 | 6110 |
| H BARS | C/C | 450 | 300 | 425 | 425 | 425 | 400 | 375 | 375 | 350 |
| | LENGTH | 2930 | 3510 | 3210 | 3250 | 3250 | 3290 | 3270 | 3290 | 3230 |
| J BARS | SIZE | 25 | 20 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 450 | 300 | 425 | 425 | 425 | 400 | 375 | 375 | 350 |
| | LENGTH | 4340 | 3870 | 4170 | 4200 | 4240 | 4270 | 4350 | 4500 | 4650 |
| | B | 1710 | 1430 | 1570 | 1550 | 1550 | 1530 | 1530 | 1520 | 1560 |
| | D | 2200 | 2060 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 |
| | R | 275 | 245 | 255 | 285 | 315 | 345 | 395 | 495 | 565 |
| K BARS | SIZE | 25 | 20 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 450 | 300 | 425 | 425 | 425 | 400 | 375 | 375 | 350 |
| | LENGTH | 3630 | 3320 | 3430 | 3490 | 3560 | 3630 | 3750 | 4060 | 4260 |
| | B | 1000 | 880 | 830 | 840 | 870 | 890 | 930 | 1080 | 1170 |
| | D | 2200 | 2060 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 |
| | R | 275 | 245 | 255 | 285 | 315 | 345 | 395 | 495 | 565 |
| S BARS | LENGTH | 1380 | 1320 | 1380 | 1550 | 1730 | 1830 | 2060 | 2510 | 2840 |
| | C | 1020 | 960 | 1020 | 1190 | 1370 | 1470 | 1700 | 2150 | 2480 |
| T BARS* | LENGTH | 3000* | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| U BARS | LENGTH | 1460 | 1350 | 1380 | 1510 | 1630 | 1760 | 1960 | 2380 | 2690 |
| | C | 1100 | 990 | 1020 | 1150 | 1270 | 1400 | 1600 | 2020 | 2330 |
| Q BARS | SIZE | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 150 | 150 | 200 | 200 | 200 | 200 | 175 | 150 | 125 |
| | LENGTH | 5820 | 5800 | 5800 | 5830 | 5860 | 5890 | 5930 | 6030 | 6110 |
| R BARS | # SETS | 126 | 128 | 128 | 126 | 130 | 130 | 132 | 136 | 138 |

*T BARS to be Size 20M. Modify drawing SS114-2 accordingly.

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.50
HEIGHT: 3.50

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|-------|-------|-------|--------|--------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 320 | 290 | 300 | 330 | 360 | 380 | 430 | 530 | 610 |
| | T | 350 | 320 | 330 | 360 | 390 | 420 | 470 | 570 | 640 |
| | B | 340 | 350 | 390 | 450 | 490 | 500 | 580 | 690 | 770 |
| QUANTITIES | STEEL | 788.4 | 786.3 | 787.2 | 810.8 | 836.9 | 870.8 | 935.8 | 1000.7 | 1106.6 |
| | CONC. | 6.7 | 6.3 | 6.7 | 7.6 | 8.3 | 8.8 | 10.1 | 12.6 | 14.6 |
| P BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 200 | 200 | 200 | 225 | 225 | 200 | 200 | 200 | 200 |
| | LENGTH | 5820 | 5790 | 5800 | 5830 | 5860 | 5880 | 5930 | 6030 | 6110 |
| H BARS | C/C | 300 | 300 | 300 | 450 | 450 | 425 | 400 | 400 | 375 |
| | LENGTH | 2410 | 3310 | 3510 | 3170 | 3210 | 3230 | 3230 | 3290 | 3130 |
| J BARS | SIZE | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 300 | 300 | 450 | 450 | 425 | 400 | 400 | 375 |
| | LENGTH | 4710 | 4210 | 4130 | 4490 | 4510 | 4540 | 4620 | 4750 | 4950 |
| | B | 1970 | 1520 | 1420 | 1590 | 1570 | 1550 | 1550 | 1520 | 1610 |
| | D | 2310 | 2310 | 2310 | 2450 | 2450 | 2450 | 2450 | 2450 | 2450 |
| | R | 275 | 245 | 255 | 285 | 315 | 345 | 395 | 495 | 565 |
| K BARS | SIZE | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 300 | 300 | 450 | 450 | 425 | 400 | 400 | 375 |
| | LENGTH | 3900 | 3630 | 3620 | 3820 | 3870 | 3910 | 4050 | 4330 | 4530 |
| | B | 1160 | 940 | 910 | 920 | 930 | 920 | 980 | 1100 | 1190 |
| | D | 2310 | 2310 | 2310 | 2450 | 2450 | 2450 | 2450 | 2450 | 2450 |
| | R | 275 | 245 | 255 | 285 | 315 | 345 | 395 | 495 | 565 |
| S BARS | LENGTH | 1410 | 1340 | 1420 | 1590 | 1730 | 1820 | 2070 | 2510 | 2840 |
| | C | 1050 | 980 | 1060 | 1230 | 1370 | 1460 | 1710 | 2150 | 2480 |
| T BARS | LENGTH | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| U BARS | LENGTH | 1460 | 1340 | 1380 | 1510 | 1630 | 1750 | 1960 | 2380 | 2690 |
| | C | 1100 | 980 | 1020 | 1150 | 1270 | 1390 | 1600 | 2020 | 2330 |
| Q BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 225 | 200 | 200 | 200 | 175 | 175 | 150 | 125 | 100 |
| | LENGTH | 5820 | 5790 | 5800 | 5830 | 5860 | 5880 | 5930 | 6030 | 6110 |
| R BARS | # SETS | 134 | 136 | 136 | 136 | 138 | 136 | 140 | 142 | 146 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 5.50
HEIGHT: 4.00

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|-------|-------|-------|--------|--------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 300 | 300 | 320 | 340 | 370 | 370 | 450 | 520 | 610 |
| | T | 340 | 330 | 350 | 370 | 400 | 410 | 490 | 560 | 650 |
| | B | 350 | 360 | 420 | 470 | 530 | 550 | 650 | 690 | 790 |
| QUANTITIES | STEEL | 879.9 | 808.5 | 802.5 | 849.9 | 848.2 | 892.1 | 922.4 | 1015.6 | 1093.1 |
| | CONC. | 6.8 | 6.8 | 7.5 | 8.2 | 9.1 | 9.3 | 11.4 | 13 | 15.4 |
| P BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 175 | 200 | 200 | 200 | 225 | 200 | 200 | 200 | 200 |
| | LENGTH | 5800 | 5800 | 5820 | 5840 | 5870 | 5870 | 5950 | 6020 | 6110 |
| H BARS | C/C | - | 325 | 325 | 300 | 300 | 450 | 450 | 425 | 425 |
| | LENGTH | - | 2550 | 3010 | 3110 | 3150 | 3130 | 3130 | 3110 | 2890 |
| J BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 325 | 325 | 300 | 300 | 450 | 450 | 425 | 425 |
| | LENGTH | 6290 | 4860 | 4660 | 4640 | 4670 | 4830 | 4950 | 5070 | 5320 |
| | B | 3310 | 1900 | 1670 | 1620 | 1600 | 1600 | 1600 | 1610 | 1720 |
| | D | 2560 | 2560 | 2560 | 2560 | 2560 | 2700 | 2700 | 2700 | 2700 |
| | R | 265 | 255 | 275 | 295 | 325 | 335 | 415 | 485 | 575 |
| K BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 325 | 325 | 300 | 300 | 450 | 450 | 425 | 425 |
| | LENGTH | 4500 | 4090 | 4040 | 4070 | 4140 | 4290 | 4460 | 4610 | 4860 |
| | B | 1520 | 1130 | 1050 | 1050 | 1070 | 1060 | 1110 | 1150 | 1260 |
| | D | 2560 | 2560 | 2560 | 2560 | 2560 | 2700 | 2700 | 2700 | 2700 |
| | R | 265 | 255 | 275 | 295 | 325 | 335 | 415 | 485 | 575 |
| S BARS | LENGTH | 1380 | 1380 | 1520 | 1650 | 1820 | 1860 | 2230 | 2480 | 2880 |
| | C | 1020 | 1020 | 1160 | 1290 | 1460 | 1500 | 1870 | 2120 | 2520 |
| T BARS | LENGTH | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| U BARS | LENGTH | 1410 | 1380 | 1460 | 1550 | 1680 | 1700 | 2040 | 2340 | 2720 |
| | C | 1050 | 1020 | 1100 | 1190 | 1320 | 1340 | 1680 | 1980 | 2360 |
| Q BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 200 | 200 | 200 | 175 | 175 | 175 | 175 | 125 | 100 |
| | LENGTH | 5800 | 5800 | 5820 | 5840 | 5870 | 5870 | 5950 | 6020 | 6110 |
| R BARS | # SETS | 144 | 144 | 140 | 142 | 144 | 144 | 150 | 150 | 150 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 6.00
HEIGHT: 2.00

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|-------|-------|-------|-------|--------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 330 | 310 | 330 | 360 | 410 | 420 | 510 | 630 | 780 |
| | T | 370 | 340 | 360 | 390 | 440 | 450 | 510 | 580 | 660 |
| | B | 350 | 350 | 370 | 450 | 480 | 490 | 610 | 700 | 810 |
| QUANTITIES | STEEL | 773.1 | 777.1 | 805.8 | 819.3 | 832.9 | 881.8 | 903.5 | 939.4 | 1041.1 |
| | CONC. | 6.4 | 6 | 6.4 | 7.4 | 8.3 | 8.5 | 10.4 | 12.5 | 15.1 |
| P BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | C/C | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 175 |
| | LENGTH | 6330 | 6310 | 6330 | 6360 | 6410 | 6420 | 6510 | 6630 | 6780 |
| H BARS | C/C | 350 | 350 | 325 | 325 | 325 | 300 | 300 | 300 | 300 |
| | LENGTH | 3370 | 3470 | 3570 | 3630 | 3610 | 3630 | 3610 | 3530 | 3450 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 350 | 350 | 325 | 325 | 325 | 300 | 300 | 300 | 300 |
| | LENGTH | 3890 | 3810 | 3790 | 3800 | 3890 | 3900 | 4030 | 4230 | 4470 |
| | B | 1730 | 1690 | 1640 | 1610 | 1620 | 1610 | 1650 | 1740 | 1850 |
| | D | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| | R | 295 | 265 | 285 | 315 | 365 | 375 | 435 | 505 | 585 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 350 | 350 | 325 | 325 | 325 | 300 | 300 | 300 | 300 |
| | LENGTH | 3190 | 3080 | 3080 | 3120 | 3260 | 3280 | 3470 | 3690 | 3950 |
| | B | 1030 | 960 | 930 | 930 | 990 | 990 | 1090 | 1200 | 1330 |
| | D | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| | R | 295 | 265 | 285 | 315 | 365 | 375 | 435 | 505 | 585 |
| S BARS | LENGTH | 1460 | 1390 | 1480 | 1680 | 1860 | 1900 | 2290 | 2680 | 3160 |
| | C | 1100 | 1030 | 1120 | 1320 | 1500 | 1540 | 1930 | 2320 | 2800 |
| T BARS | LENGTH | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| U BARS | LENGTH | 1540 | 1420 | 1510 | 1630 | 1850 | 1890 | 2190 | 2550 | 2990 |
| | C | 1180 | 1060 | 1150 | 1270 | 1490 | 1530 | 1830 | 2190 | 2630 |
| Q BARS | SIZE | 20 | 20 | 20 | 20 | 20 | 25 | 20 | 20 | 25 |
| | C/C | 175 | 150 | 150 | 150 | 150 | 225 | 150 | 150 | 150 |
| | LENGTH | 6330 | 6310 | 6330 | 6360 | 6410 | 6420 | 6510 | 6630 | 6780 |
| R BARS | # SETS | 120 | 120 | 120 | 124 | 122 | 124 | 128 | 130 | 134 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 6.00
HEIGHT: 2.50

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|------|-------|-------|--------|--------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 330 | 310 | 330 | 360 | 400 | 410 | 480 | 580 | 700 |
| | T | 380 | 340 | 360 | 390 | 440 | 450 | 510 | 620 | 680 |
| | B | 350 | 350 | 390 | 450 | 510 | 530 | 610 | 750 | 850 |
| QUANTITIES | STEEL | 812.4 | 802.8 | 813.6 | 851.5 | 857 | 914.3 | 969.4 | 1061.7 | 1090.5 |
| | CONC. | 6.8 | 6.3 | 6.9 | 7.7 | 8.8 | 9.1 | 10.7 | 13.5 | 15.7 |
| P BARS | SIZE | 25 | 25 | 25 | 25 | 20 | 25 | 25 | 25 | 20 |
| | C/C | 225 | 225 | 225 | 225 | 150 | 225 | 225 | 225 | 150 |
| | LENGTH | 6330 | 6310 | 6330 | 6360 | 6400 | 6410 | 6480 | 6580 | 6700 |
| H BARS | C/C | 375 | 375 | 375 | 350 | 350 | 325 | 300 | 300 | 300 |
| | LENGTH | 3370 | 3510 | 3610 | 3650 | 3670 | 3690 | 3690 | 3530 | 3370 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 375 | 375 | 375 | 350 | 350 | 325 | 300 | 300 | 300 |
| | LENGTH | 4150 | 4040 | 4020 | 4040 | 4100 | 4110 | 4210 | 4460 | 4690 |
| | B | 1720 | 1670 | 1620 | 1600 | 1580 | 1570 | 1580 | 1650 | 1790 |
| | D | 1950 | 1950 | 1950 | 1950 | 1950 | 1950 | 1950 | 1950 | 1950 |
| K BARS | R | 305 | 265 | 285 | 315 | 365 | 375 | 435 | 545 | 605 |
| | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 375 | 375 | 375 | 350 | 350 | 325 | 300 | 300 | 300 |
| | LENGTH | 3460 | 3310 | 3310 | 3360 | 3470 | 3500 | 3650 | 3990 | 4200 |
| | B | 1030 | 940 | 910 | 920 | 950 | 960 | 1020 | 1180 | 1300 |
| S BARS | D | 1950 | 1950 | 1950 | 1950 | 1950 | 1950 | 1950 | 1950 | 1950 |
| | R | 305 | 265 | 285 | 315 | 365 | 375 | 435 | 545 | 605 |
| S BARS | LENGTH | 1480 | 1390 | 1510 | 1680 | 1890 | 1950 | 2240 | 2740 | 3130 |
| | C | 1120 | 1030 | 1150 | 1320 | 1530 | 1590 | 1880 | 2380 | 2770 |
| T BARS | LENGTH | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| U BARS | LENGTH | 1560 | 1420 | 1510 | 1630 | 1830 | 1870 | 2140 | 2600 | 2940 |
| | C | 1200 | 1060 | 1150 | 1270 | 1470 | 1510 | 1780 | 2240 | 2580 |
| Q BARS | SIZE | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 150 | 150 | 225 | 225 | 225 | 200 | 200 | 150 | 150 |
| | LENGTH | 6330 | 6310 | 6330 | 6360 | 6400 | 6410 | 6480 | 6580 | 6700 |
| R BARS | # SETS | 126 | 128 | 126 | 130 | 132 | 132 | 132 | 136 | 140 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 6.00
HEIGHT: 3.00

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|------|-------|-------|-------|--------|------|--------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 320 | 320 | 330 | 350 | 400 | 410 | 470 | 560 | 700 |
| | T | 360 | 350 | 360 | 380 | 440 | 450 | 510 | 600 | 700 |
| | B | 350 | 350 | 420 | 450 | 520 | 550 | 650 | 750 | 880 |
| QUANTITIES | STEEL | 846.6 | 805.7 | 841 | 887.9 | 892.9 | 951.1 | 1005.4 | 1065 | 1140.5 |
| | CONC. | 6.9 | 6.8 | 7.4 | 7.9 | 9.3 | 9.7 | 11.4 | 13.7 | 16.9 |
| P BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 200 | 225 | 225 | 200 | 225 | 200 | 200 | 200 | 225 |
| | LENGTH | 6320 | 6320 | 6330 | 6350 | 6400 | 6410 | 6470 | 6560 | 6700 |
| H BARS | C/C | 400 | 425 | 400 | 375 | 375 | 350 | 325 | 325 | 325 |
| | LENGTH | 3350 | 3530 | 3610 | 3670 | 3670 | 3690 | 3690 | 3670 | 3390 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 400 | 425 | 400 | 375 | 375 | 350 | 325 | 325 | 325 |
| | LENGTH | 4390 | 4290 | 4270 | 4270 | 4350 | 4360 | 4450 | 4600 | 4940 |
| | B | 1740 | 1660 | 1620 | 1590 | 1580 | 1570 | 1570 | 1580 | 1760 |
| | D | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 |
| | R | 285 | 275 | 285 | 305 | 365 | 375 | 435 | 525 | 625 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 400 | 425 | 400 | 375 | 375 | 350 | 325 | 325 | 325 |
| | LENGTH | 3680 | 3570 | 3560 | 3590 | 3720 | 3740 | 3900 | 4170 | 4480 |
| | B | 1030 | 940 | 910 | 910 | 950 | 950 | 1020 | 1150 | 1300 |
| | D | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 |
| | R | 285 | 275 | 285 | 305 | 365 | 375 | 435 | 525 | 625 |
| S BARS | LENGTH | 1440 | 1420 | 1550 | 1650 | 1900 | 1970 | 2290 | 2680 | 3200 |
| | C | 1080 | 1060 | 1190 | 1290 | 1540 | 1610 | 1930 | 2320 | 2840 |
| T BARS | LENGTH | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| U BARS | LENGTH | 1490 | 1460 | 1510 | 1590 | 1830 | 1870 | 2130 | 2510 | 2990 |
| | C | 1130 | 1100 | 1150 | 1230 | 1470 | 1510 | 1770 | 2150 | 2630 |
| Q BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 225 | 225 | 200 | 200 | 200 | 175 | 175 | 150 | 125 |
| | LENGTH | 6320 | 6320 | 6330 | 6350 | 6400 | 6410 | 6470 | 6560 | 6700 |
| R BARS | # SETS | 132 | 132 | 132 | 136 | 138 | 136 | 138 | 140 | 146 |

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RIGID FRAME BOX CULVERTS

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 6.00
HEIGHT: 3.50

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|-------|-------|--------|--------|--------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 320 | 310 | 330 | 360 | 390 | 410 | 450 | 530 | 650 |
| | T | 360 | 340 | 360 | 390 | 430 | 450 | 490 | 580 | 700 |
| | B | 360 | 360 | 410 | 470 | 520 | 570 | 680 | 780 | 900 |
| QUANTITIES | STEEL | 879.9 | 851.2 | 872.8 | 924.9 | 934.9 | 965.5 | 1053.7 | 1170.8 | 1202.9 |
| | CONC. | 7.3 | 7 | 7.7 | 8.6 | 9.5 | 10.2 | 11.7 | 14 | 17.2 |
| P BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 175 | 200 | 200 | 200 | 200 | 200 | 175 | 175 | 200 |
| | LENGTH | 6320 | 6310 | 6330 | 6360 | 6390 | 6410 | 6450 | 6530 | 6650 |
| H BARS | C/C | 450 | 450 | 425 | 400 | 400 | 375 | 350 | 350 | 350 |
| | LENGTH | 3150 | 3450 | 3570 | 3630 | 3650 | 3650 | 3650 | 3670 | 3410 |
| J BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 450 | 450 | 425 | 400 | 400 | 375 | 350 | 350 | 350 |
| | LENGTH | 4740 | 4570 | 4540 | 4550 | 4600 | 4630 | 4690 | 4810 | 5130 |
| | B | 1840 | 1700 | 1640 | 1610 | 1590 | 1590 | 1590 | 1570 | 1700 |
| | D | 2450 | 2450 | 2450 | 2450 | 2450 | 2450 | 2450 | 2450 | 2450 |
| | R | 285 | 265 | 285 | 315 | 355 | 375 | 415 | 505 | 625 |
| K BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 450 | 450 | 425 | 400 | 400 | 375 | 350 | 350 | 350 |
| | LENGTH | 4000 | 3840 | 3840 | 3890 | 3970 | 4020 | 4150 | 4400 | 4720 |
| | B | 1100 | 970 | 940 | 950 | 960 | 980 | 1050 | 1160 | 1290 |
| | D | 2450 | 2450 | 2450 | 2450 | 2450 | 2450 | 2450 | 2450 | 2450 |
| S BARS | LENGTH | 1450 | 1410 | 1540 | 1710 | 1880 | 2000 | 2270 | 2650 | 3160 |
| | C | 1090 | 1050 | 1180 | 1350 | 1520 | 1640 | 1910 | 2290 | 2800 |
| T BARS | LENGTH | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| U BARS | LENGTH | 1490 | 1420 | 1510 | 1630 | 1790 | 1870 | 2040 | 2410 | 2920 |
| | C | 1130 | 1060 | 1150 | 1270 | 1430 | 1510 | 1680 | 2050 | 2560 |
| Q BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 200 | 200 | 200 | 175 | 175 | 175 | 150 | 100 | 100 |
| | LENGTH | 6320 | 6310 | 6330 | 6360 | 6390 | 6410 | 6450 | 6530 | 6650 |
| R BARS | # SETS | 140 | 140 | 140 | 144 | 144 | 144 | 146 | 148 | 152 |

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DETAILING TABLE DIMENSIONS & QUANTITIES

SPAN: 6.00
HEIGHT: 4.00

| | | FILL HEIGHT | | | | | | | | |
|-------------------|---------------|-------------|-------|-------|-------|------|--------|--------|------|--------|
| | | 0.6 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 | 6.0 |
| DIMENSIONS | W | 340 | 320 | 340 | 360 | 400 | 410 | 480 | 590 | 670 |
| | T | 370 | 350 | 370 | 390 | 440 | 460 | 530 | 630 | 720 |
| | B | 370 | 390 | 440 | 490 | 560 | 590 | 690 | 820 | 930 |
| QUANTITIES | STEEL | 894.7 | 863.1 | 885.5 | 941.6 | 937 | 1025.5 | 1050.5 | 1136 | 1240.6 |
| | CONC. | 7.9 | 7.7 | 8.4 | 9.1 | 10.4 | 10.9 | 12.9 | 15.9 | 18.5 |
| P BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 175 | 200 | 200 | 200 | 200 | 175 | 175 | 200 | 175 |
| | LENGTH | 6340 | 6320 | 6340 | 6360 | 6400 | 6410 | 6480 | 6590 | 6670 |
| H BARS | C/C | 300 | 300 | 300 | 425 | 450 | 400 | 400 | 375 | 375 |
| | LENGTH | 2430 | 3190 | 3550 | 3550 | 3570 | 3570 | 3570 | 3410 | 3190 |
| J BARS | SIZE | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 300 | 300 | 425 | 450 | 400 | 400 | 375 | 375 |
| | LENGTH | 5230 | 4820 | 4670 | 4840 | 4900 | 4920 | 5030 | 5280 | 5520 |
| | B | 2210 | 1830 | 1650 | 1650 | 1630 | 1620 | 1620 | 1710 | 1810 |
| | D | 2560 | 2560 | 2560 | 2700 | 2700 | 2700 | 2700 | 2700 | 2700 |
| | R | 295 | 275 | 295 | 315 | 365 | 385 | 455 | 555 | 645 |
| K BARS | SIZE | 20 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 300 | 300 | 300 | 425 | 450 | 400 | 400 | 375 | 375 |
| | LENGTH | 4310 | 4090 | 4070 | 4240 | 4350 | 4360 | 4550 | 4840 | 5080 |
| | B | 1290 | 1100 | 1050 | 1050 | 1080 | 1060 | 1140 | 1270 | 1370 |
| | D | 2560 | 2560 | 2560 | 2700 | 2700 | 2700 | 2700 | 2700 | 2700 |
| | R | 295 | 275 | 295 | 315 | 365 | 385 | 455 | 555 | 645 |
| S BARS | LENGTH | 1510 | 1480 | 1610 | 1730 | 1960 | 2040 | 2380 | 2860 | 3260 |
| | C | 1150 | 1120 | 1250 | 1370 | 1600 | 1680 | 2020 | 2500 | 2900 |
| T BARS | LENGTH | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| U BARS | LENGTH | 1550 | 1460 | 1550 | 1630 | 1830 | 1900 | 2200 | 2640 | 3010 |
| | C | 1190 | 1100 | 1190 | 1270 | 1470 | 1540 | 1840 | 2280 | 2650 |
| Q BARS | SIZE | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | C/C | 200 | 200 | 175 | 175 | 175 | 150 | 150 | 125 | 100 |
| | LENGTH | 6340 | 6320 | 6340 | 6360 | 6400 | 6410 | 6480 | 6590 | 6670 |
| R BARS | # SETS | 146 | 146 | 148 | 150 | 152 | 152 | 154 | 158 | 160 |

CONCRETE CULVERT DESIGN AND DETAILING MANUAL

DIVISION 7 - NON-RIGID FRAME BOX CULVERTS

August 2003

7 NON-RIGID FRAME BOX CULVERTS

7.1 GENERAL

These culverts differ from standard rigid frame box culverts as there are no haunches at the corners, slabs and walls have only one layer of steel in each direction and all steel is straight (except for apron dowels). Note that these culverts are designed to accommodate fill heights of up to 5 .0 metres.

7.2 CULVERT DIMENSIONS AND REINFORCEMENT

Dimensions and detailing information for standard non-rigid frame box culverts are given in Figure 7.2(a). Construction joints indicated are optional and are provided for the contractor's convenience.

Reinforcing details for standard non-rigid frame box culverts are shown in Figure 7.2(b). Table 7-2 identifies the various bar types used in these culverts.

Detailing information listed in the detailing table at the end of this division should be read in conjunction with Figure 7.2(a) and (b) and Table 7-2.

Details of apron walls are provided in Division 8.

FIGURE 7.2(a) NON-RIGID FRAME BOX CULVERT DIMENSIONS

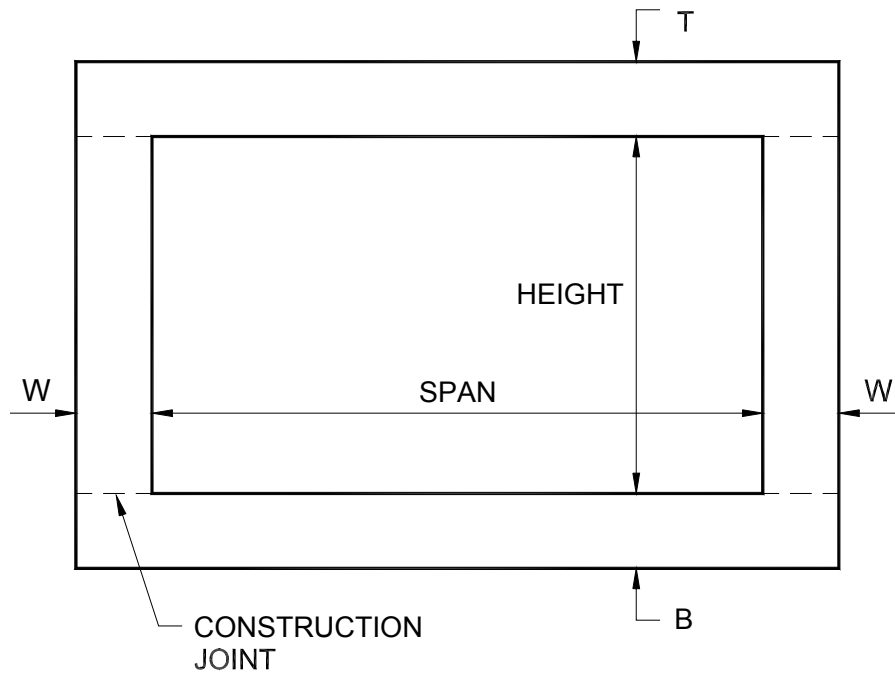
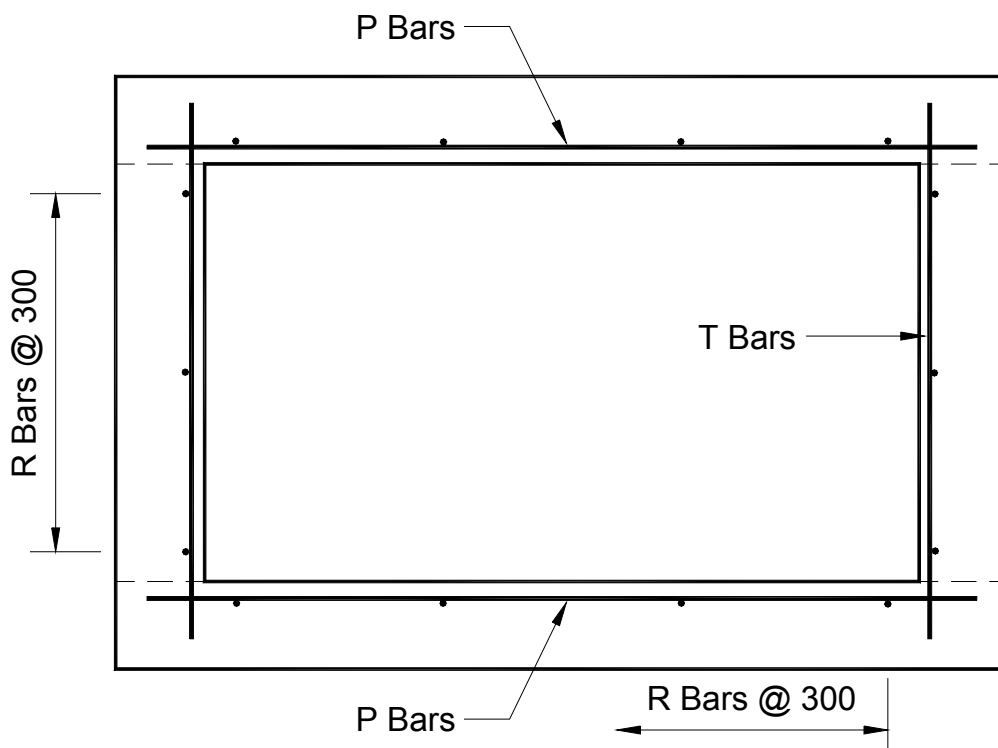


FIGURE 7.2(b) NON-RIGID FRAME BOX CULVERT REINFORCEMENT



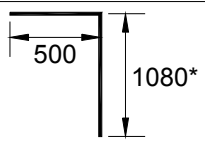
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NON-RIGID FRAME BOX CULVERTS

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TABLE 7-2 REINFORCING STEEL IDENTIFICATION

| MARK | DETAILS | REMARKS |
|--------|---|------------------------------------|
| P BARS | STRAIGHT | BOTTOM AND TOP SLAB INSIDE FACE |
| T BARS | STRAIGHT | INSIDE FACE OF WALLS |
| R BARS | STRAIGHT | 15M BARS LONGITUDINAL |
| L BARS |  | 15M BARS DOWELS TO APRON WALL |
| M BARS | STRAIGHT | 15M BARS, APRON WALL |

*NOTE: -All dimensions shown to centreline of bar.
- * represents vertical dimension*

7.3 DETAILING OF BOX CULVERT DRAWINGS

7.3.1 DETAILS FOR STANDARD DRAWINGS

The following is a suggested procedure for completing the structural standard drawings for standard non-rigid frame box culvert, SS114-3, without skewed ends, retaining walls or other special features.

- Obtain culvert size, length, and height of fill from Culvert Data Sheet.
- Select appropriate structural standard drawing.
- Determine from Culvert Data Sheet whether culvert is extension or not:

If culvert is an extension, change vertical centreline on left side of section Detail 1 to a solid line and label - "END OF EXISTING CULVERT". Insert length of culvert extension on the horizontal dimension line:

e.g. 9 m RT
11 m LT

If culvert is not an extension, label centreline "Centre-Line Highway" and add culvert length each side of Centre-Line Highway

e.g. 16 m RT
17 m LT

- Select from Division 7 appropriate detailing table for required size of culvert.
- Insert span and height of culvert and dimensions of top slab, bottom slab and walls on "Typical Culvert Section" detail.
- Insert bar size and /or spacing for P and T bars where required on
- all details.
- Multiply unit quantities by culvert length.
- Add apron wall quantities

- Complete steel bar table.
- Add adjustment to steel quantity for R bar laps.
- Insert total quantities in "Culvert Quantities" table on drawing.
- **The Standard Drawing shall be sealed, dated and signed according to 4.3.1.**

7.3.2 STEEL TABLE FOR CULVERT

Spacing and bar lengths are available from the culvert detailing table located at the end of this division.

Number of P and T bars required is available from Division 8. This procedure considers only one bar per cross-section; therefore the numbers given must be multiplied by 2 for P and T bars.

For R bars the number of sets of bars is available on the detailing tables; the number of bars per set and bar lengths in Division 8.

7.3.3 STEEL TABLE FOR APRON WALL

Length and number of L and M bars are available as given in Division 8.

7.3.4 ADJUSTMENT OF CONCRETE QUANTITIES

The additional volume of concrete required for apron walls is described in Division 8.

7.3.5 QUANTITY TABLE

Complete the quantity table. Concrete and steel quantities should be the total quantity for the complete length of culvert including apron walls.

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NON-RIGID FRAME BOX CULVERTS

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7.4 DETAILING TABLE

This table lists non-rigid frame culvert dimensions, concrete and steel quantities, and reinforcing steel detailing information.

| | | SPAN x HEIGHT | | |
|------------|--------|---------------|-----------|-----------|
| | | 1.25x1.25 | 1.50x1.25 | 1.50x1.50 |
| DIMENSIONS | T | 190 | 220 | 220 |
| | B | 230 | 250 | 250 |
| | W | 190 | 220 | 220 |
| QUANTITIES | CONC. | 1.2 | 1.5 | 1.6 |
| | STEEL | 79.9 | 91.0 | 100.5 |
| P BARS | SIZE | 20 | 20 | 20 |
| | C/C | 300 | 250 | 250 |
| | LENGTH | 1490 | 1800 | 1800 |
| T BARS | SIZE | 15 | 15 | 15 |
| | C/C | 250 | 300 | 250 |
| | LENGTH | 1500 | 1550 | 1800 |
| R BARS | #SETS | 24 | 26 | 28 |

Fill Height ≤ 5.0 m

CONCRETE CULVERT DESIGN AND DETAILING MANUAL

DIVISION 8 - CULVERT DETAILS

August 2003

8 CULVERT DETAILS

8.1 REINFORCING STEEL DETAILS

8.1.1 VERTICAL AND TRANSVERSE BARS

The number of vertical and transverse bars, as designated in Section 4.4, required for a given length of culvert may be determined from the following expression:

$$\frac{1000 \times C \times L_c}{b}$$

where,

- C equals 1 for H (open footing culverts)
- C equals 4 for J and K (both, box culverts) and V (open footing culverts)
- C equals 2 for the remainder

Round up decimal numbers up to the nearest whole number.

8.1.2 LONGITUDINAL BARS

The number and length of longitudinal bars, as designated in Section 4.4, required for a given length of culvert may be obtained from the following table:

TABLE 8-1 LONGITUDINAL REINFORCING BAR DETAILS

| Lc (m) | NO. OF BARS PER SET | LENGTH OF EACH R BAR | LENGTH OF EACH W BAR |
|------------------|---------------------|----------------------|----------------------|
| up to 6 | 1 | Lc - 150 mm | Lc - 150 mm |
| over 6 up to 12 | 2 | Lc/2 + 150 mm | Lc/2 + 200 mm |
| over 12 up to 18 | 3 | Lc/3 + 250 mm | Lc/3 + 320 mm |
| over 18 up to 24 | 4 | Lc/4 + 300 mm | Lc/4 + 375 mm |
| over 24 up to 30 | 5 | Lc/5 + 330 mm | Lc/5 + 410 mm |
| over 30 up to 36 | 6 | Lc/6 + 350 mm | Lc/6 + 435 mm |

The length of each bar includes an allowance for lap lengths.

For longer culverts, determine the number of bars required per set for one-half the actual length and then multiply this number by two. The length of each bar may be taken as the entry corresponding to one-half the actual culvert length.

8.1.3 REINFORCING STEEL QUANTITY ADJUSTMENT FOR R AND W BARS

The quantities given in the detailing tables are based on a one-metre long section of standard culvert. These quantities require adjustment to account for the lapping of the R and W bars.

The additional steel quantity (in kilograms) to account for the lapping of the R bars is:

$$(\text{No. OF SETS OF R BARS}) \times (\text{No. OF BARS PER SET} - 1) \times 0.707$$

The additional steel quantity (in kilograms) to account for the lapping of W bar is:

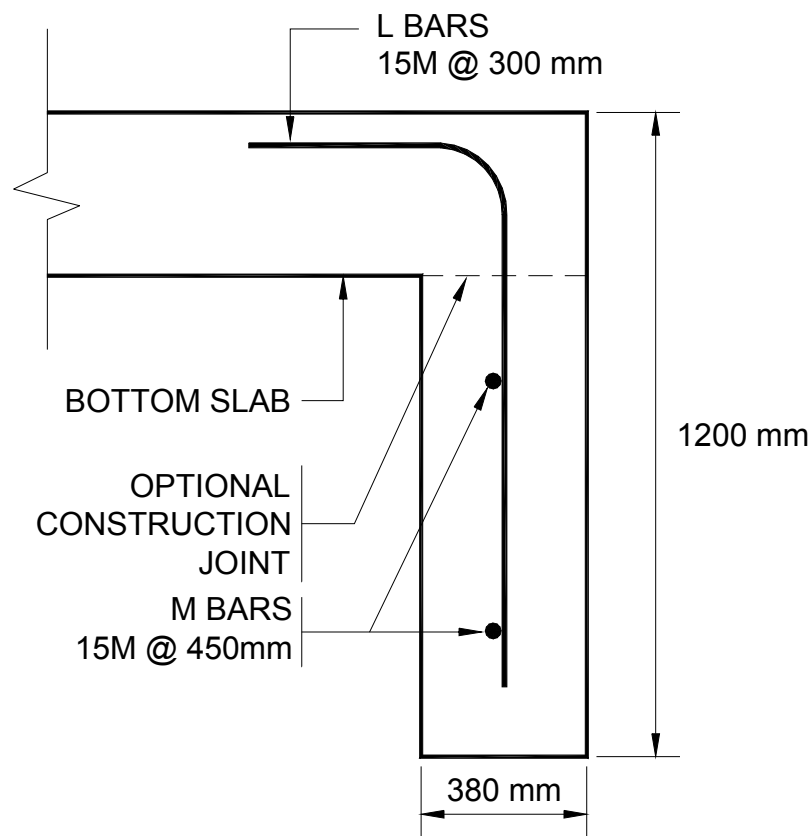
$$(\text{No. OF SETS OF W BARS}) \times (\text{No. OF BARS PER SET} - 1) \times 1.295$$

8.2 APRON WALLS

8.2.1 DETAILS OF APRON WALLS

All box culverts must have a 1.2 metre deep apron wall at each end. A cross-sectional view of a typical apron wall is shown in Figure 8.2.1.

FIGURE 8.2.1 SECTION AT APRON WALL



8.2.2 CONCRETE QUANTITY FOR APRON WALL

The additional volume of concrete (cubic metres) required for each apron wall may be determined from the following expression:

$$380 \times (S + 2 \times W) \times (1200 - B) \times 10^{-9}$$

Modification of this quantity is required for culverts with skewed ends.

8.2.3 REINFORCING STEEL QUANTITY FOR APRON WALL

The quantities shown on the standard drawings must be adjusted to include reinforcement for the apron walls.

The length of L bars for apron walls is the same for all culverts. The required number of L bars varies and may be determined from the following expression:

$$\frac{S + 2 \times W}{300} + 1$$

This expression provides the number of L bars for one apron wall.

The length of each M bar (in mm) may be determined from the following expression:

$$(S + 2 \times W) - 100$$

Modification of this quantity is required for culverts with skewed ends.

8.3 HEADER WALLS

8.3.1 DETAILS OF HEADER WALLS

Header wall details are shown in Figures 8.3.1(a) and (b).

8.3.2 CONCRETE QUANTITY FOR HEADER WALL

The additional volume of concrete required for one header wall (in cubic metres) may be determined from the following expression:

$$0.114 \times (S + 2 \times W) / 1000$$

Modification of this quantity is required for culverts with skewed ends.

8.3.3 REINFORCING STEEL QUANTITY FOR HEADER WALL

The quantities shown on the structural standard drawings must be adjusted to include reinforcement for the header walls, where applicable.

The area of Y bars needed in the header walls may be determined from Table 8-3(a), for culvert ends skewed up to 25 degrees. The area of steel indicated is the total area required for both the top and bottom reinforcing bars of the header wall. The same area of steel should be placed in both locations.

TABLE 8-3(a) AREA OF STEEL FOR Y BARS FOR VARIOUS SKEWED END ANGLES

| SPAN (m) | REINFORCING AREA (mm ²) | | | | | |
|-------------|-------------------------------------|------|------|------|------|------|
| | 0° | 5° | 10° | 15° | 20° | 25° |
| up to 2 | 1001 | 1004 | 1011 | 1025 | 1047 | 1076 |
| 2 - 3 | 1417 | 1421 | 1441 | 1472 | 1513 | 1578 |
| 3 - 4 | 2005 | 2019 | 2047 | 2105 | 2195 | 2312 |
| 4 - 5 | 2838 | 2858 | 2918 | 3022 | 3172 | 3400 |
| 5 - 6 | 4018 | 4046 | 4145 | 4322 | 4601 | 4983 |

Using the total area of reinforcing given in Table 8-3(a), the size and number of Y bars can be obtained from Table 8-3(b).

TABLE 8-3(b) REINFORCING BAR DETAILS

| BAR SIZE | MASS (kg/m) | AREA (mm ²) |
|----------|----------------|----------------------------|
| 15M | 1.570 | 200 |
| 20M | 2.355 | 300 |
| 25M | 3.925 | 500 |
| 30M | 5.495 | 700 |
| 35M | 7.850 | 1000 |

The additional quantity of steel required (in kilograms) for the Y bars in one header wall is:

$$(Y \text{ BAR LENGTH}) \times (Y \text{ BAR MASS}) \times (\text{No. OF Y BARS REQ'D})$$

The length of Z bars remains constant for all culverts. However, the required number of Z bars may be determined from the formula:

$$(S + 2 \times W) / 300 + 1$$

This expression provides the number of bars for one header wall only.

The additional quantity of steel required (in kilograms) for the Z bars in one header wall is:

$$1.57 \times ((2T + 930) / 1000) \times (\text{No. of Z BARS REQ'd})$$

Modification of the Z bar quantity is required for culverts with skewed ends.

FIGURE 8.3.1(a) ELEVATION AT END OF CULVERT

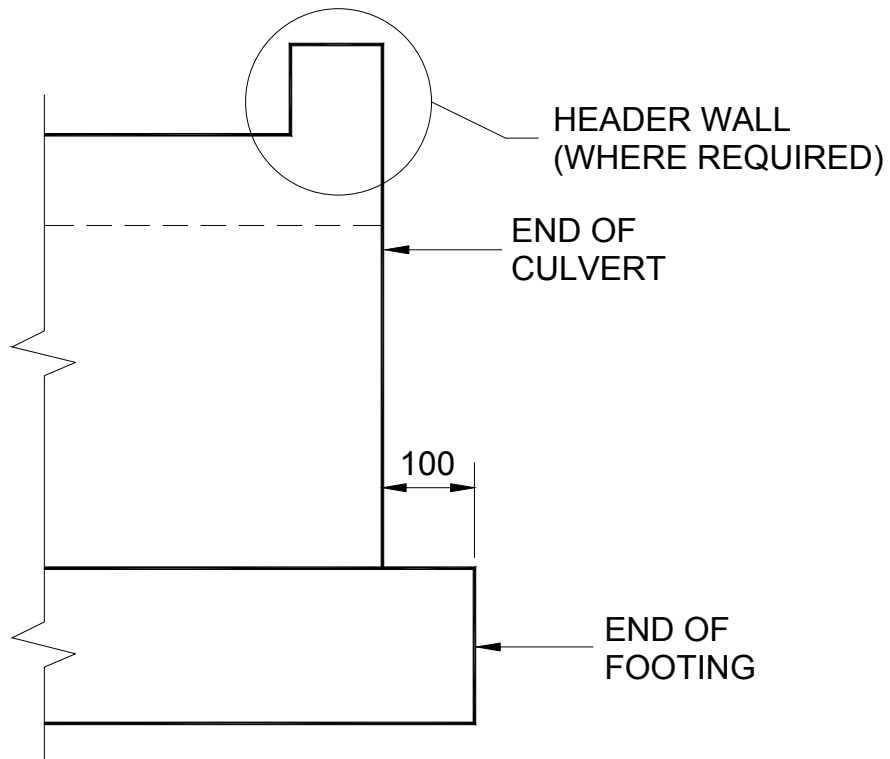
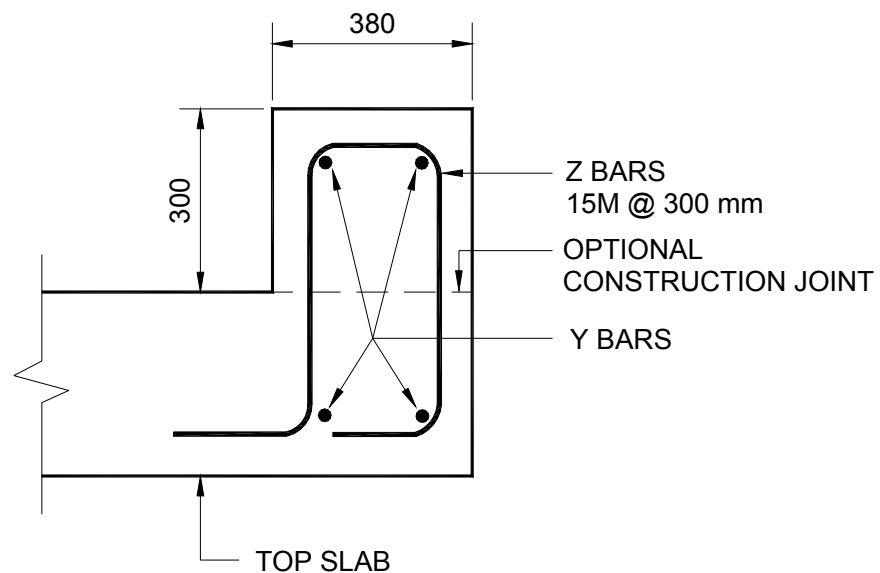


FIGURE 8.3.1(b) SECTION AT HEADER WALL



8.4 SKEWED END CULVERTS

8.4.1 DETAILS OF SKEWED END CULVERTS

A plan view of the culvert shall be added to the standard drawing, showing the skew angle and skewed end or ends.

In most cases the ends of a culvert are skewed at the same angle γ as the skew angle of the culvert θ .

A detail showing steel layout at skewed ends shall be added to the standard drawing with the modified bar spacing and necessary dimensions shown in the appropriate places.

A plan view of header wall and apron (where applicable) shall be added.

8.4.2 CONCRETE QUANTITY ADJUSTMENT FOR SKEWED END CULVERTS

Concrete quantities for the apron walls and header walls must be adjusted to account for the skewed ends. The increase is proportional to secant γ .

8.4.3 REINFORCING STEEL QUANTITY ADJUSTMENT FOR SKEWED END CULVERTS

In computing the quantity of reinforcing bars required for skewed end culverts the quantities described in Section 8.1 must be modified as follows.

The total number of additional vertical or transverse bars required for each bar type of a culvert skewed at both ends is as follows:

$$\frac{C(S + 2 \times W)}{b} \tan \gamma$$

where C is defined in Section 8.1.1.

Note that if the culvert has only one skewed end, then half the value derived from the above formula should be used.

Figure 8.4.3(a) details how P and Q bars are to be fanned. H bars are to be similarly treated.

Figure 8.4.3(b) details how J and K bars are to be fanned. S (box culverts), T, and U bars are to be similarly treated.

The additional steel quantity for each bar type is the product of the number of additional bars, the length of each bar type and the bar mass per metre.

The lengths of the L and Z bars remain unchanged but the number required must be increased by a factor equal to secant γ .

The number of rows of M and Y bars required remains unchanged. However the lengths need to be increased. The length of the M bars shall be increased by a factor equaling secant γ . The treatment of the Y bars is described in Section 8.3.

FIGURE 8.4.3(a) FANNING OF P AND Q BARS

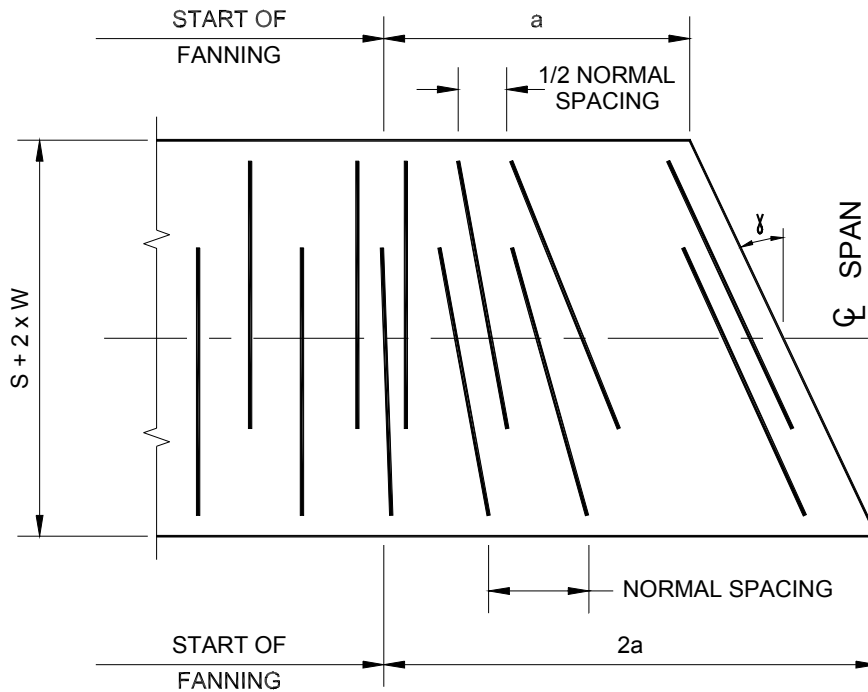
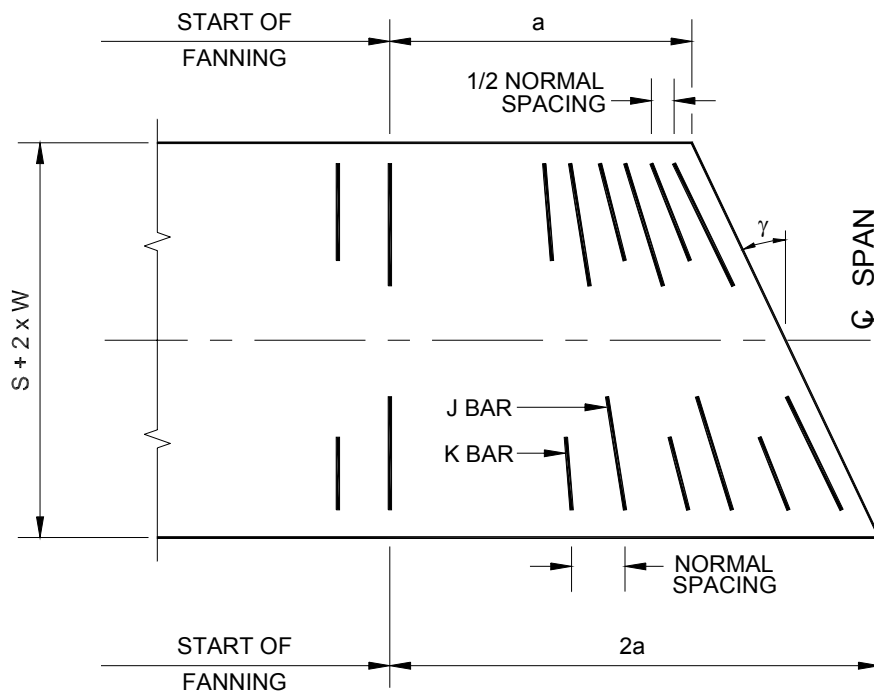


FIGURE 8.4.3(b) FANNING OF J AND K BARS



where $a = (S + 2 \times W) \tan \theta$

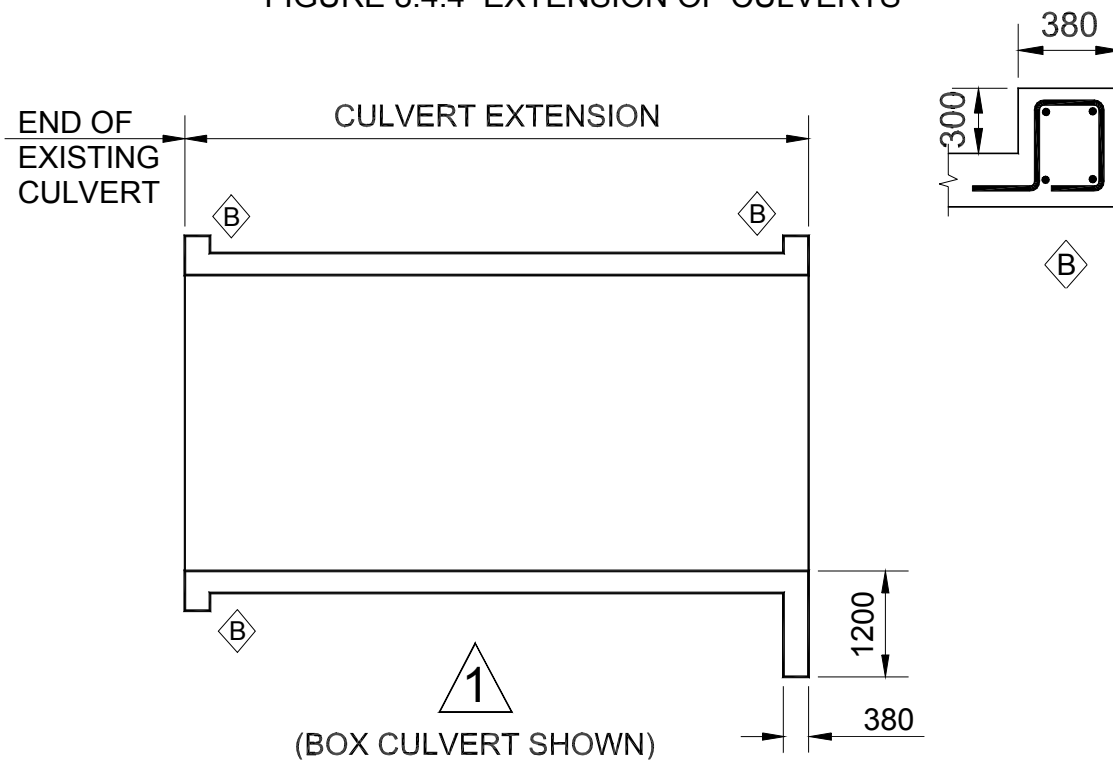
8.4.4 EXTENSION OF CULVERTS

When an existing culvert is being extended, at least one of the following requirements shall be met.

- i. Header walls shall be constructed as specified in Section 4.2.6; and/or
- ii. Dowels shall be embedded into the existing culvert and cross the joint between the existing and extension culverts; and/or
- iii. A reinforced concrete slab shall be placed over the full length of the joint between the existing and extension culverts.

Figure 8.4.4 illustrates the details that would be shown on Detail 1 if header walls were to be constructed. The other requirements, if specified, must be similarly detailed.

FIGURE 8.4.4 EXTENSION OF CULVERTS



8.5 INTERSECTING DRAINS, CATCH BASINS OR MANHOLES

Where drains or other features intersect a culvert, modifications must be made to the structural standard drawings to provide an opening in the wall or top slab of the culvert, and details of the additional steel required to reinforce the perimeter of such openings must be added. A plan view detailing the location and dimensions of the opening shall be shown.

The maximum diameter for circular openings is 760 mm. The maximum side dimension of square or rectangular openings is 600 mm.

Details in Sections 8.5.1 and 8.5.2 apply where a hole interferes with P bars in the top slab. Similar details apply where a hole interferes with H, J, K, S, T or U bars in slabs or walls.

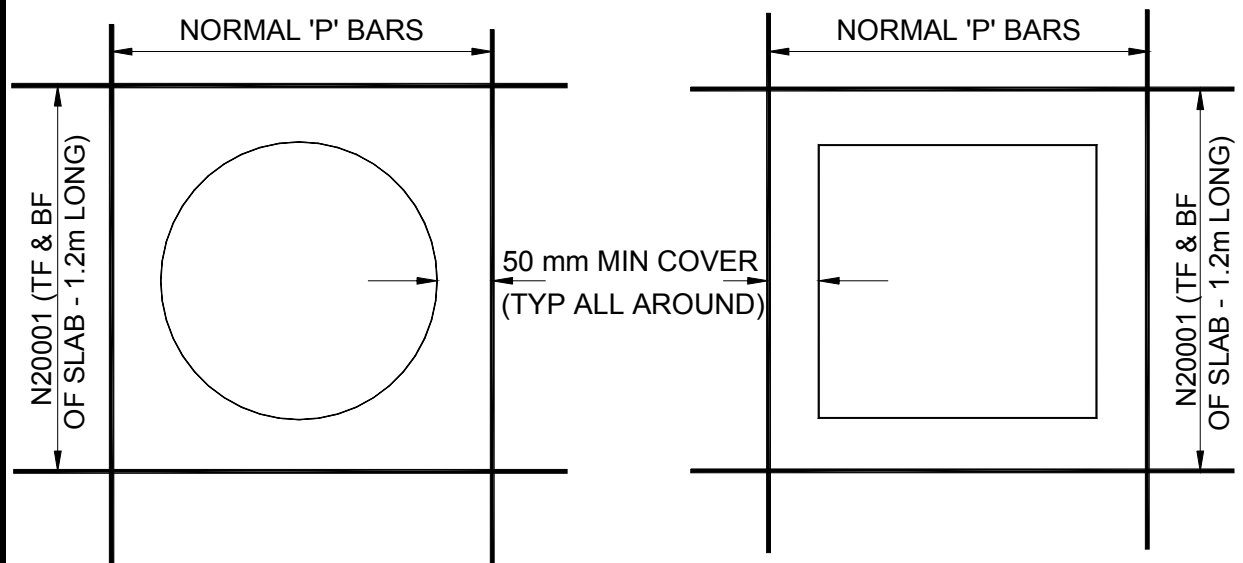
R bars may be cut for any hole where required.

Culverts requiring holes located within 300 mm of any haunch or with a dimension exceeding the above limits shall be referred to the Structural Engineer for special design consideration and advice.

8.5.1 HOLE DIAMETER OR SIDE DIMENSION NOT EXCEEDING 300 mm

- Adjust bar space at hole to provide 50 mm of concrete cover to P bars.
- Provide 1 - 20M bar 1.2 metres long, each side, as shown in Figure 8.5.1.

FIGURE 8.5.1 REINFORCING DETAILS FOR SMALL OPENINGS



8.5.2 HOLES 301 mm TO 760 mm DIAMETER OR RECTANGULAR HOLES WITH 301 mm TO 600 mm SIDE DIMENSION

- Adjustments must be made to steel arrangements as detailed in Figures 8.5.2(a) and (b).
- Move one P bar from hole location to each edge of hole providing 50 mm cover to each.
- Cut other P bars at hole and place the cut piece at other side of hole in line with original bar.
- Place one longitudinal bar in bottom face at each side of hole (perpendicular to P, same diameter as P).
- Place 4 - 20M diagonal bars (top and bottom).

FIGURE 8.5.2(a) REINFORCING DETAILS FOR LARGE ROUND OPENINGS

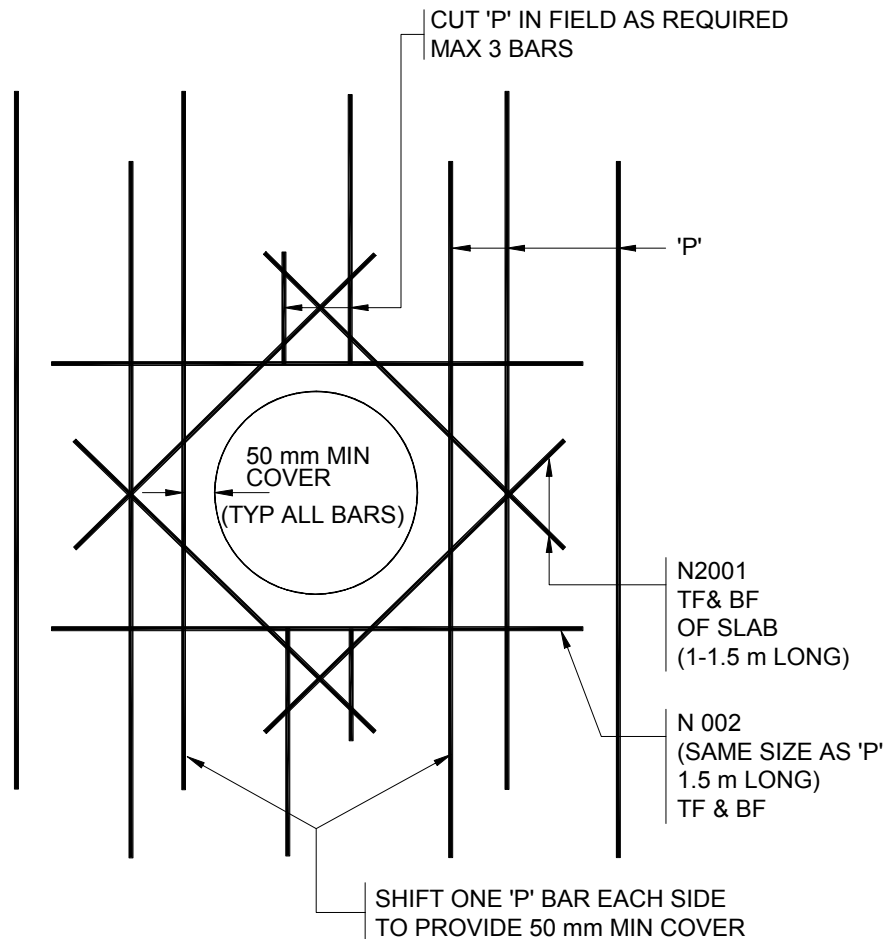
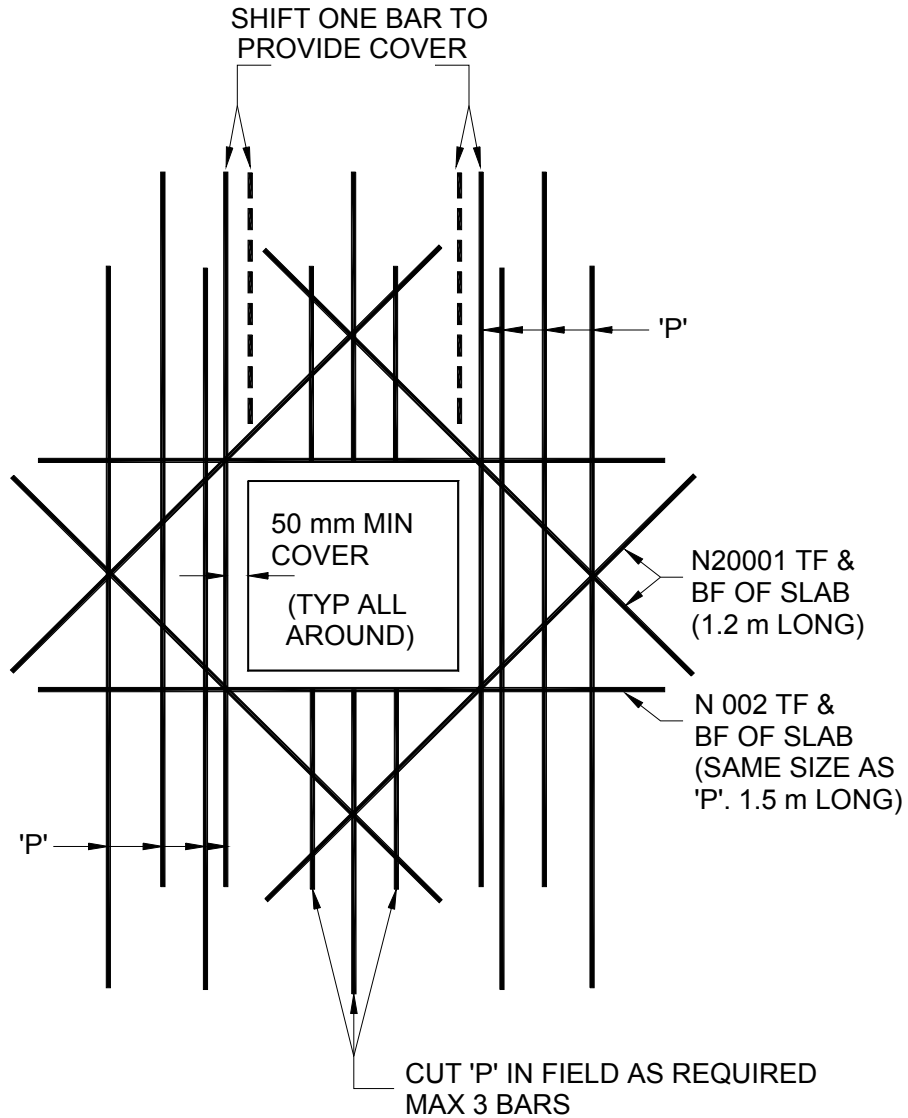


FIGURE 8.5.2(b) REINFORCING DETAILS FOR LARGE RECTANGULAR OPENINGS



8.6 RETAINING WALLS FOR CULVERTS

8.6.1 GENERAL

Table 8-6 provides the dimensions and reinforcement details for retaining walls up to 3 metres high. Retaining walls more than 3 metres high shall be designed by an Engineer.

The retaining walls listed in Table 8-6 are designed for situations where the factored bearing capacity of the foundation material at the ultimate limit state is not less than 300 kPa; the bearing capacity at serviceability limit state is not less than 180 kPa; and, the factored coefficient of friction between the underside of the footings and foundation material, used for checking lateral sliding stability at the ultimate limit state, is not less than 0.4. Should the soil parameters at the site of the proposed construction differ significantly from the above-described values, then the design of the retaining wall should be referred to the Structural Engineer.

When retaining walls are required for a culvert, the structural standard drawings may be used provided that the following information is added in the space provided:

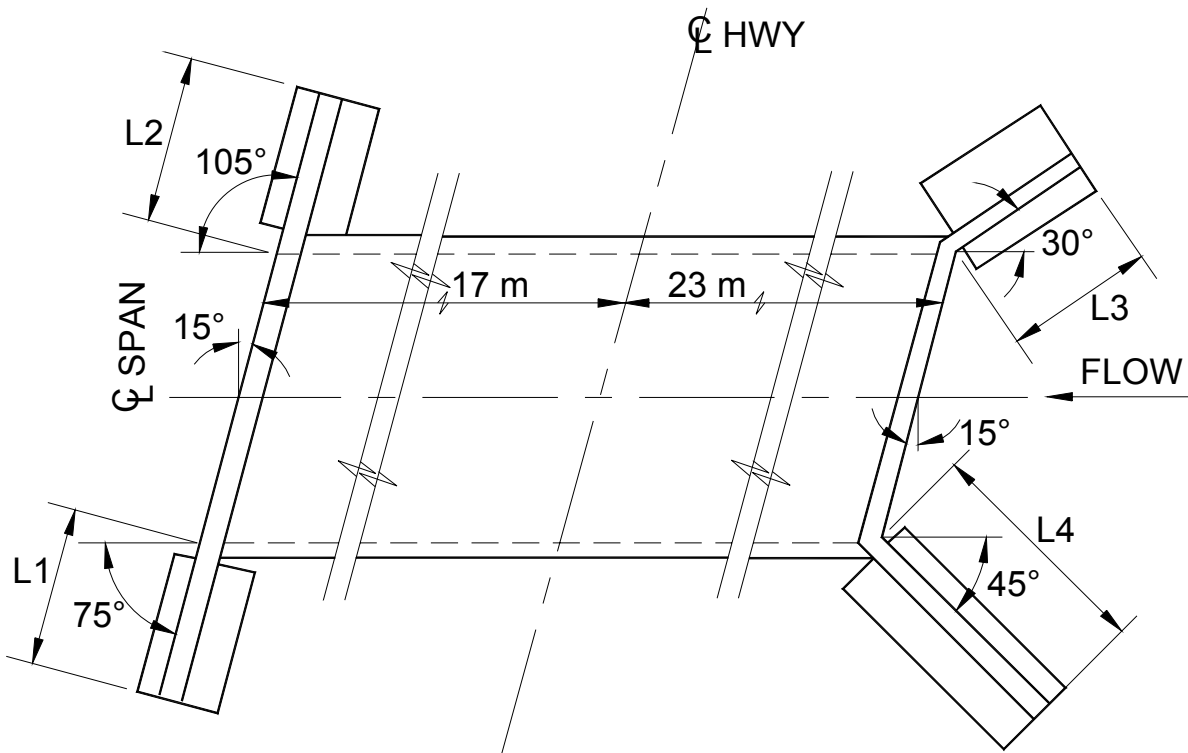
- A plan view of the culvert showing the layout and lengths of the retaining walls.
- Modification of culvert walls to suit adjacent retaining walls.
- Retaining Wall Details - A plan, elevation and cross-sectional view of each retaining wall showing dimensions and bar details for walls.
- A steel bar list table for retaining wall reinforcement. (Note: this may be combined with bar list for other special features).

8.6.2 PLAN VIEW OF CULVERT WITH RETAINING WALL

This detail should be drawn to a scale small enough to leave space available for the other details mentioned above plus details of skewed end treatments and special openings (holes) where applicable. The entire length of culvert need not be shown; the barrel of the culvert may be shown broken to conserve space.

The plan should include all dimensions shown in Figure 8.6.2, plus layout dimensions for other special features.

FIGURE 8.6.2 PLAN VIEW OF TYPICAL CULVERT



8.6.3 MODIFICATION OF CULVERT TO SUIT RETAINING WALLS

The modifications described in this section are required to permit some independent relative movement between the culvert and retaining wall.

Modifications to the header wall shall be made as shown in Figures 8.6.3(a), (b), and (c). For box culverts the apron wall shall be modified so that it has the same configuration in plan view as the header wall. No modification is required for box culverts with retaining walls perpendicular to the longitudinal axis.

Figures 8.6.3(a), (b), and (c) indicate square-ended culverts. Details for most skew-ended culverts are similar. In certain unusual circumstances (such as when the skew angle of the culvert is greater than the angle between retaining wall face and centre-line of culvert span) the location of the construction joint must be adjusted to ensure that the wall can move independently of the culvert.

The front face of the retaining wall shall meet the inside face of the culvert wall at the end of the culvert. The construction joint between the retaining wall and culvert shall be perpendicular to the front face of the retaining wall and shall touch the outside corner of the culvert wall (for box culverts) or the outside corner of the culvert footing (for open footing culverts).

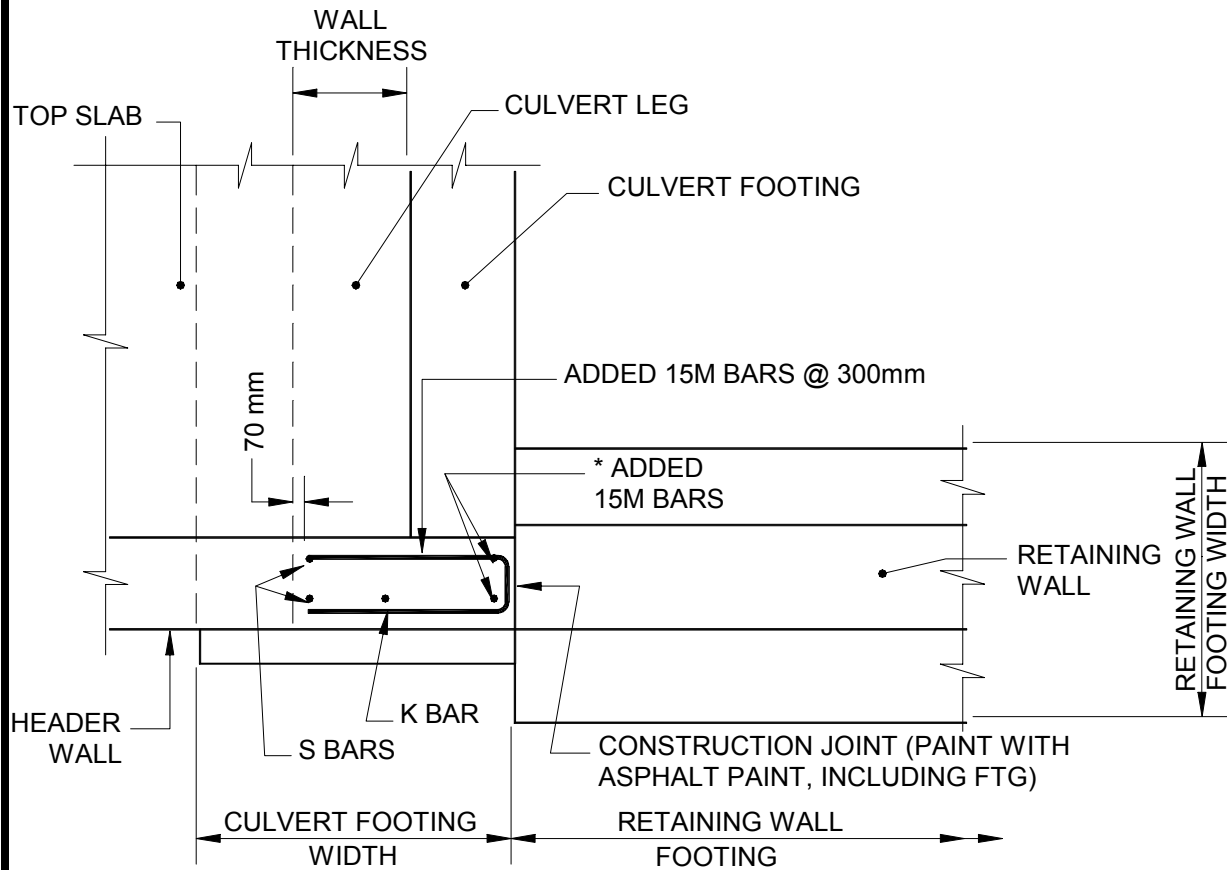
In order to achieve the minimum depth of footing for frost protection, the top of the retaining wall footing shall be set:

- i. 300 mm below the elevation of the top of the bottom slab for box culverts, or
- ii. 600 mm below the elevation of the top of the footing of open footing culverts.

The slope of the retaining wall top (where applicable) starts at the construction joint adjacent to the header wall.

A note should be added to the drawings stating: "Asphalt paint shall be supplied in accordance with CAN/CGSB-37.2-M88, coverage 2 square metres per litre".

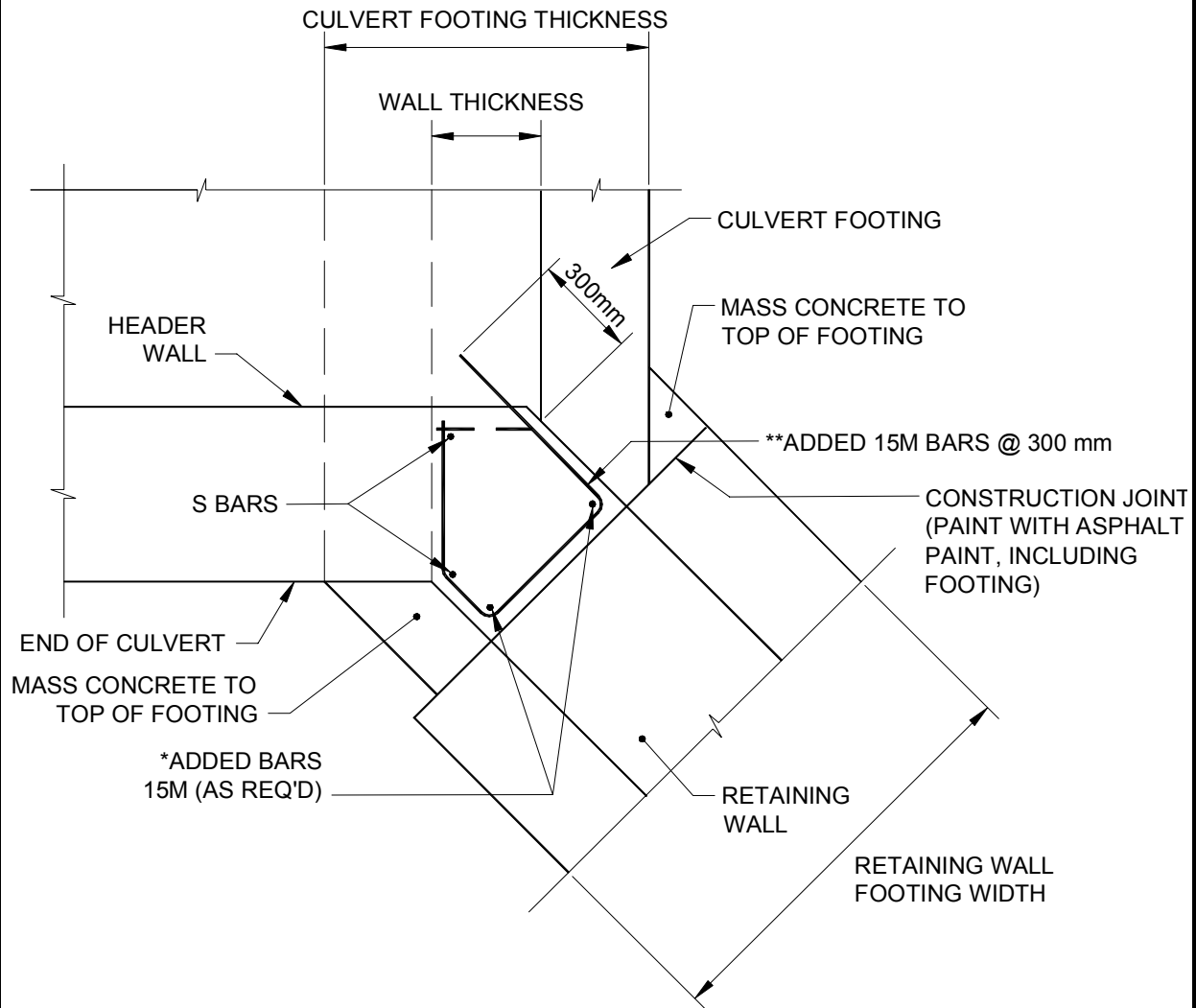
FIGURE 8.6.3(a) RETAINING WALLS PERPENDICULAR TO LONGITUDINAL AXIS (open footing culverts)



* Length of bar is the dimension from top of footing to top of header wall minus 75 mm.

NOTE: Add bars to bar list of culvert. See Section 8.6.3 for note on asphalt paint.

FIGURE 8.6.3(b) RETAINING WALLS NOT PERPENDICULAR TO LONGITUDINAL AXIS (open footing culvert)

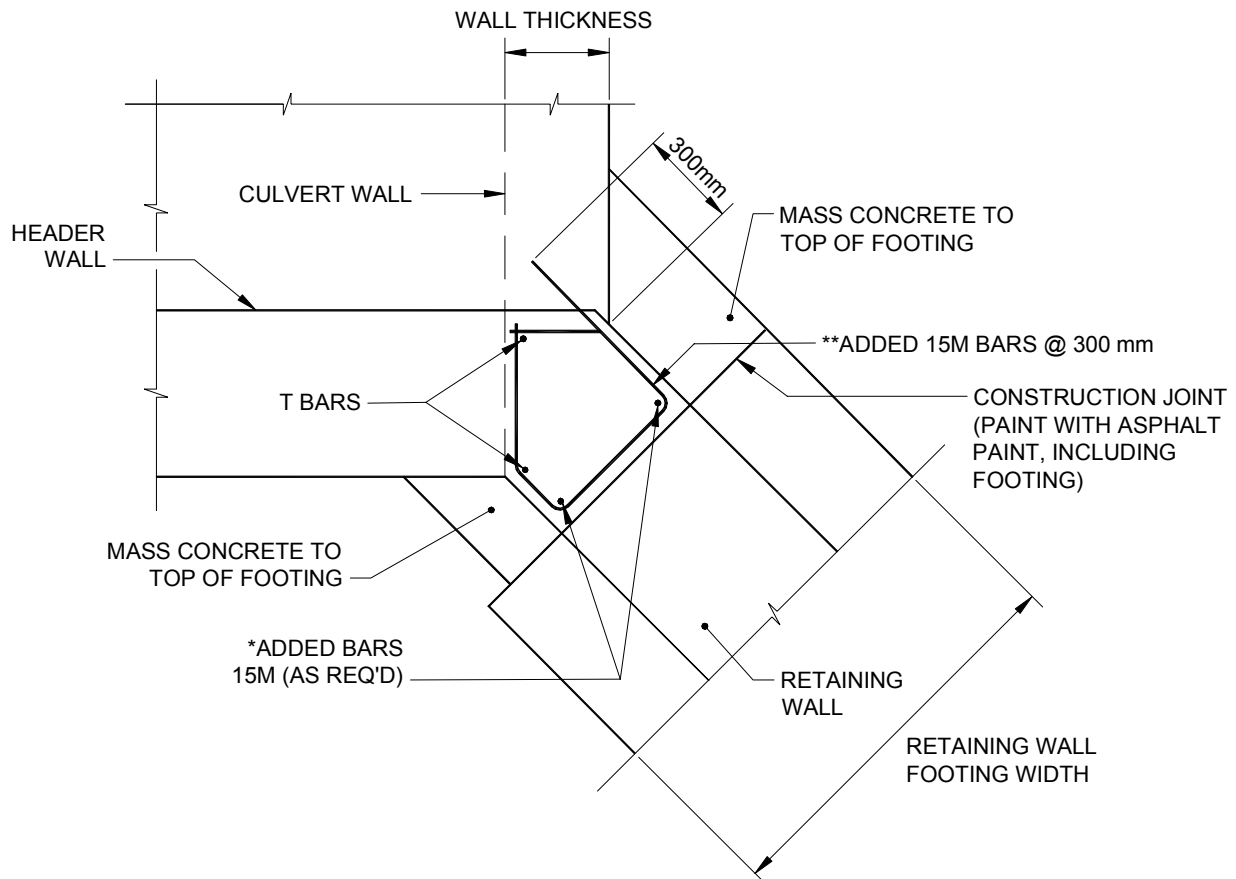


* Length of bar is the dimension from top of footing to top of header wall minus 75 mm.

** Bend top bar in field to suit as shown.

NOTE: See Section 8.6.3 for note on asphalt paint.

FIGURE 8.6.3(c) RETAINING WALLS NOT PERPENDICULAR TO LONGITUDINAL AXIS (box culvert)



* Length of bar is the dimension from bottom of culvert bottom slab to top of header wall minus 75 mm.

** Bend top bar in field to suit as shown.

NOTE: See Section 8.6.3 for note on asphalt paint.

8.6.4 RETAINING WALL DETAILS

The following formulae provide the actual wall height of a full height retaining wall (the distance from the top of the retaining wall footing to the top of the header wall) immediately adjacent to a culvert with standard header walls:

i. Open Footing Culverts

$$\text{Actual Wall Height} = \text{Culvert Height} + \text{Top Slab Thickness} + 900 \text{ mm}$$

ii. Box Culverts

$$\text{Actual Wall Height} = \text{Culvert Height} + \text{Top Slab Thickness} + 600 \text{ mm}$$

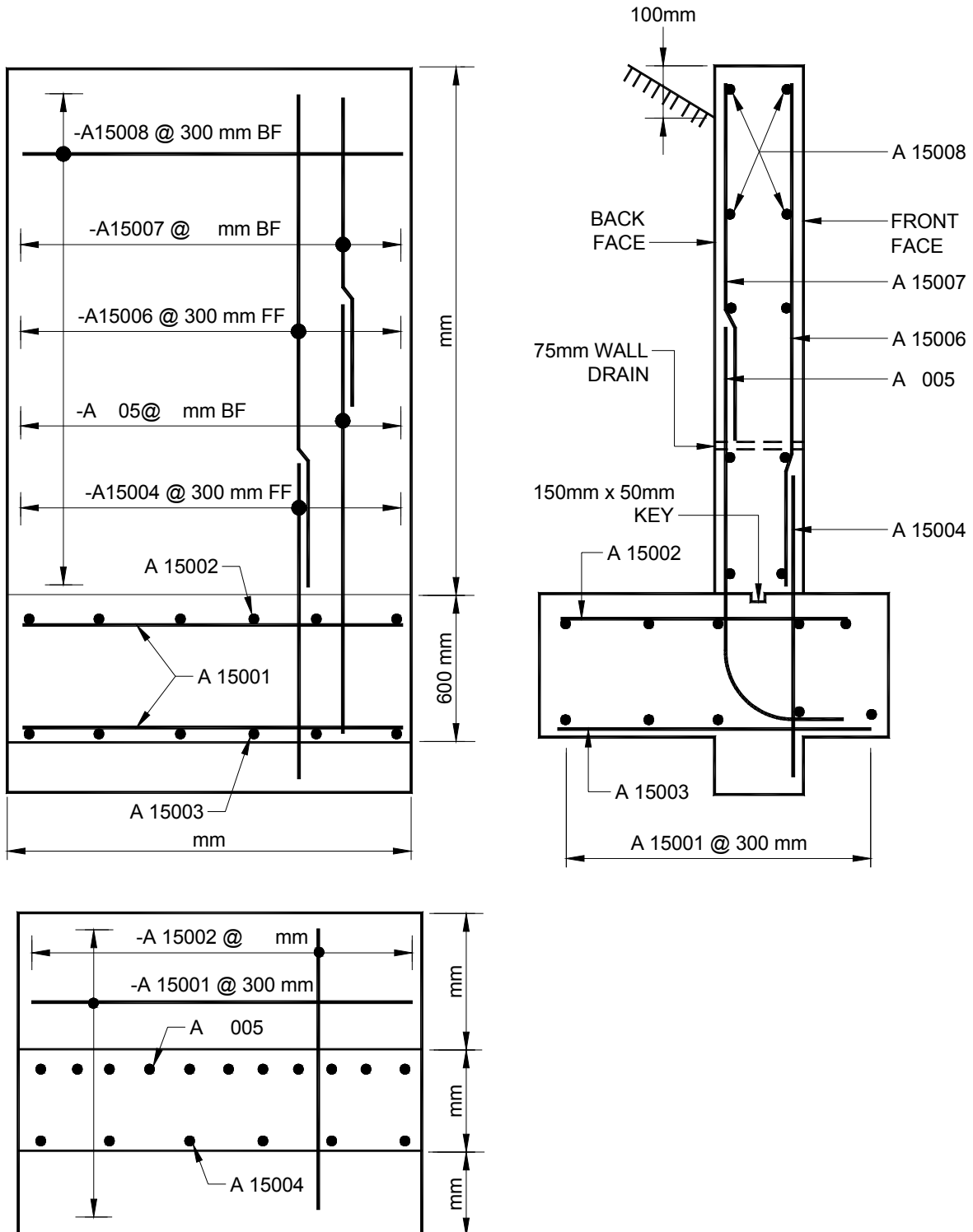
These formulations are correct for locations where the minimum depth of frost cover is required.

Design tables for retaining walls of various heights are given in Table 8-6.

(a) Retaining Walls with Constant Height

The dimensions and bar details shown in Figure 8.6.4(a) should be included for each applicable retaining wall. Where there is more than one retaining wall of this type, each wall shall be designated by a letter of the alphabet, e.g. Wall "A", Wall "B" etc. and the alphabetic symbol in the bar designation shall be that of the wall, e.g. for "Wall B" use B 001 etc. Section 8.6.4(b) explains how to adjust bars A15006 and A 007 for varying height retaining walls.

FIGURE 8.6.4(a) TYPICAL RETAINING WALL DETAILS



Where two or more walls have identical dimensions (i.e. same height and same length) they may be given the same alphabetic symbol but each must be designated by that symbol on the plan view and the title of the detail must show the number of walls required.

e.g. DETAILS OF WALL 'A'
 [(2 REQUIRED)]

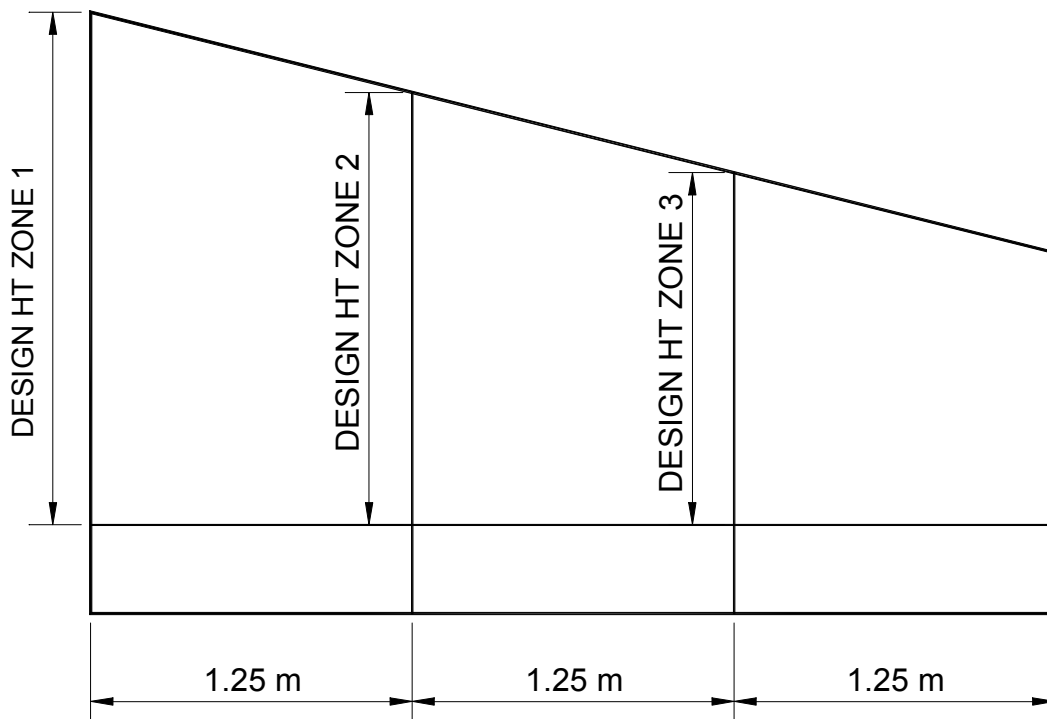
(b) Retaining Walls With Varying Height

For the purposes of design and detailing, retaining walls of this type are divided into THEORETICAL zones each approximately 1.25 metres long, as shown in Figure 8.6.4(b).

Note that this theoretical division will not appear on the final drawings since there is NO joint of any kind between the zones.

Each 1.25 metre long zone is then designed using the data given on Table 8-6 for the highest portion of the wall in that zone.

FIGURE 8.6.4(b) DETAILING OF RETAINING WALL PANELS



Because the actual retaining wall height at the culvert usually depends on the thickness of the culvert top slab, the retaining wall height adjacent to the culvert will seldom correspond to the increments listed in Table 8-6.

For cases where the actual retaining wall height corresponds to an increment listed in Table 8-6, the design wall height shall be the same. When the actual wall height is not listed in Table 8-6, the design wall height shall be the actual wall height rounded up to the next higher entry on Table 8-6.

e.g. Actual Wall Height = 2.81 metres, use 3 metre design height from Table 8-6

Actual Wall Height = 2.4 metres, use 2.4 metre design height from Table 8-6

(c) Detailing of Steel Reinforcement

Front Face

- Dowels from footing (A15004) are always 15M @ 300
- For a design height of up to and including 1200 mm, A15004 bar extends to the top of the retaining wall; A15006 bars are omitted.
- A15006 bars are always 15M @ 300 but vary in length. Longest A15006 bar length for design height over 1200 mm is highest actual wall height minus 50 mm. Shortest A15006 bar length for design height over 1200 mm is lowest actual wall height minus 50 mm. Intermediately placed A15006 bars vary linearly in length between these values.
- Length of sloping A15008 bars is dimension of sloping top of wall minus 100 mm (front and back faces). If this length is within 100 mm of horizontal bar length, make sloping bars same as horizontal bars.

Back Face

- Size, spacing and lengths of vertical bars are given in Table 8-6 for the selected design height.
- For design height up to and including 2400 mm, A 005 bar extends to top of retaining wall; A15007 bar is omitted.

- Number of vertical bars for each type in first panel is

$$\frac{1175}{\text{BAR SPACING (mm)}} + 1$$

(round up decimal numbers to nearest whole number).

- Place first bar in 2nd panel so that distance from last bar in 1st panel is not greater than spacing of bars in 2nd panel.
- Number of vertical bars for each type in 2nd panel is

$$\frac{1250}{\text{BAR SPACING (mm)}}$$

Treat subsequent panels in similar manner.

- Add or subtract one bar in last panel if required to complete reinforcing steel.

NOTE: *If the design height of any panel is obtained by rounding up the actual wall height to the next increment, then the top vertical bars in each face must be shortened by the same amount as the height is rounded up. (e.g. If actual wall height is 2.81 metres, design height is 3 metres, length of vertical bars must be shortened by 190 mm.).*

(d) Adjustment of Steel

The size or spacing of individual bars may be adjusted for convenience, where necessary, provided that at least as much steel is provided at each location as is called for in Table 8-6.

For instance, the bar arrangements in any panel may be continued into a lower panel, partially or completely, in order to provide a more satisfactory overall arrangement.

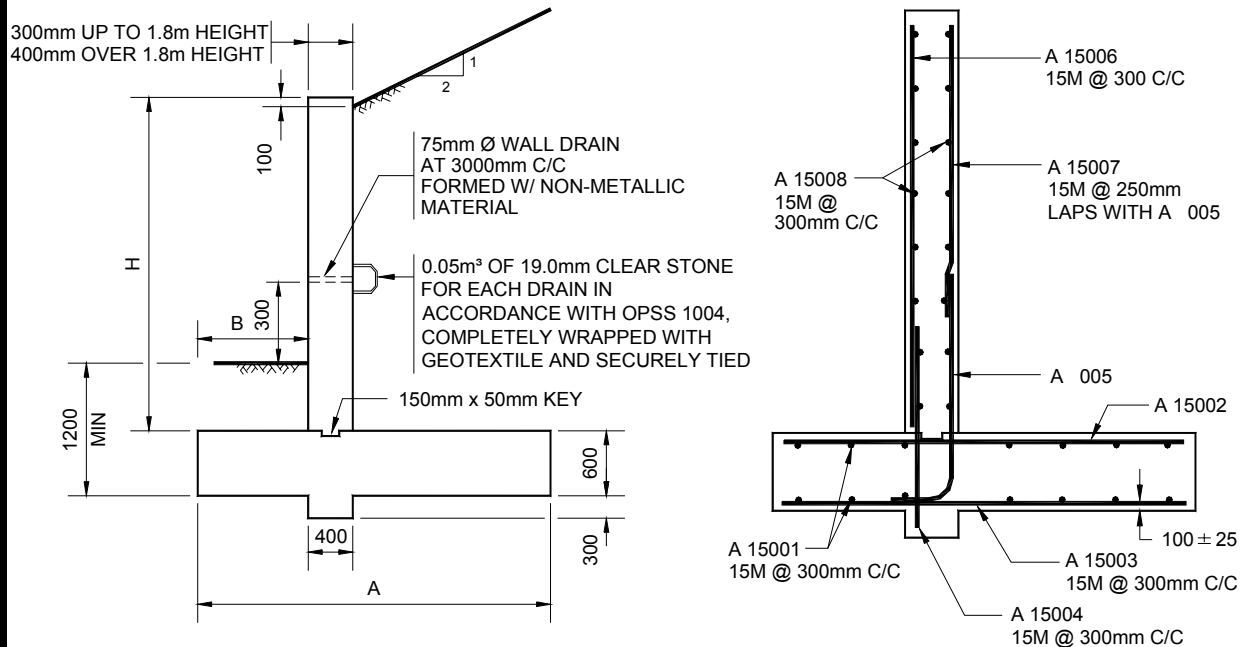
8.7 SPECIAL TREATMENT OF CULVERT ENDS

For aesthetic, economic or other reasons the designer may choose to detail the end faces of the culvert with slopes matching the side slopes of the adjacent roadway fill.

This treatment would improve the appearance of the culvert, reduce the quantity of concrete required, and where formerly wingwalls might have been necessary, none would be needed now.

The concrete culverts that have the ends tapered to match the roadway fill slope, and have no traffic protection around them may be equipped with the traversable safety grating. Figure 8.7 shows the schematic plan and elevation of such grating. The criteria for this is given in 4.2.9.

TABLE 8-6 RETAINING WALL DETAILS



| H (m) | DIMENSIONS | | REINFORCING BAR DETAILS | | | | | | | | | | |
|----------|------------|-----|-------------------------|------|--------|--------|-------|-----|------|-----|--------|--------|------|
| | | | A15002 | | A15003 | A15004 | A 005 | | | | A15006 | A15007 | |
| | A | B | C/C | LGTH | LGTH | LGTH | SIZE | C/C | B | C | D | LGTH | LGTH |
| 1.2 | 1200 | 400 | 250 | 1100 | 1100 | 2000 | 15 | 250 | 1340 | 470 | 300 | - | - |
| 1.8 | 1600 | 400 | 250 | 1500 | 1500 | 1290 | 15 | 250 | 1940 | 470 | 300 | 1750 | - |
| 2.4 | 2100 | 700 | 250 | 2000 | 2000 | 1290 | 20 | 250 | 2540 | 470 | 300 | 2350 | - |
| 3.0 | 2600 | 800 | 200 | 2500 | 2500 | 1290 | 15 | 125 | 1690 | 470 | 300 | 2950 | 1990 |

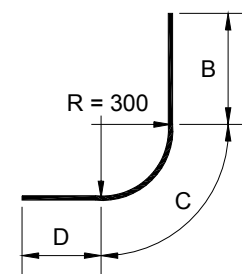
NOTES: Footing dimensions are based on an allowable soil capacity of 180 kPa @ SLS and 300 kPa @ ULS.

Reinforcing steel shall be grade 400 unless otherwise noted.

Clear cover to reinforcing steel is 70 ± 20mm unless otherwise noted.

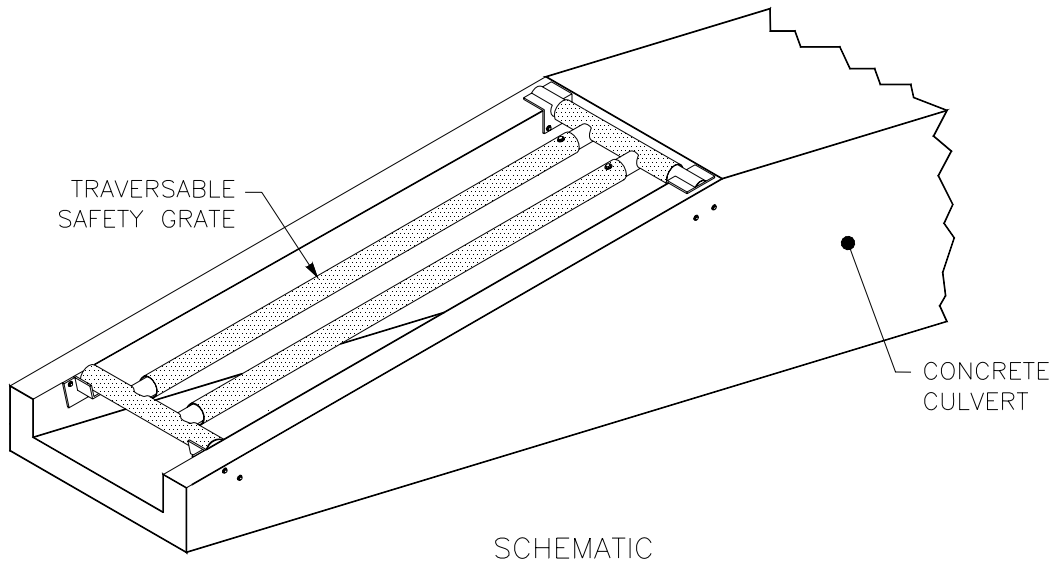
Dimensions in millimeters, unless otherwise noted.

Designed according to 2000 CHBDC

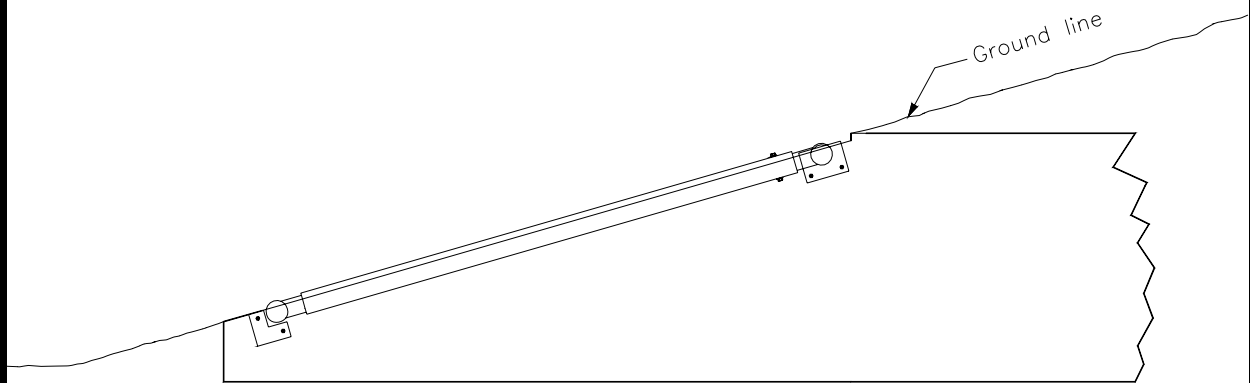


DETAIL OF BAR TYPE A 005

FIGURE 8.7 TRAVERSABLE SAFETY GRATING FOR CONCRETE CULVERT
(ASSEMBLY DETAIL)



SCHEMATIC



SIDE ELEVATION

CONCRETE CULVERT DESIGN AND DETAILING MANUAL

DIVISION 9 - APPENDIX

August 2003

9

APPENDIX

9.1 APPENDIX A: HALF-SIZE PRINTS OF STANDARD DRAWINGS

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No



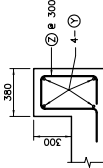
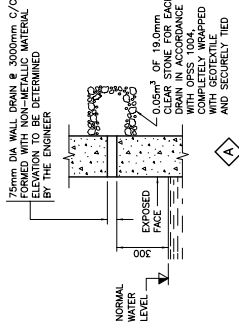
RIGID FRAME OPEN FOOTING CULVERT SHEET

GENERAL NOTES

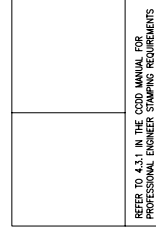
- CLASS OF CONCRETE TO BE 30MPa
- CHARACTERISTICS OF REINFORCEMENT:
 - TOP SLAB 40 ± 10 FOR SLABS ≤ 300 THICK
 - BOTTOM OF TOP SLAB 50 ± 10 FOR SLABS > 300 THICK
- BOTTOM OF FOOTINGS 100 ± 25
- REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED.
- LEGEND:
 - ALT DENOTES ALTERNATE
 - IF DENOTES INSIDE FACE
 - OF DENOTES OUTSIDE FACE
 - EF DENOTES EACH FACE

CONSTRUCTION NOTES

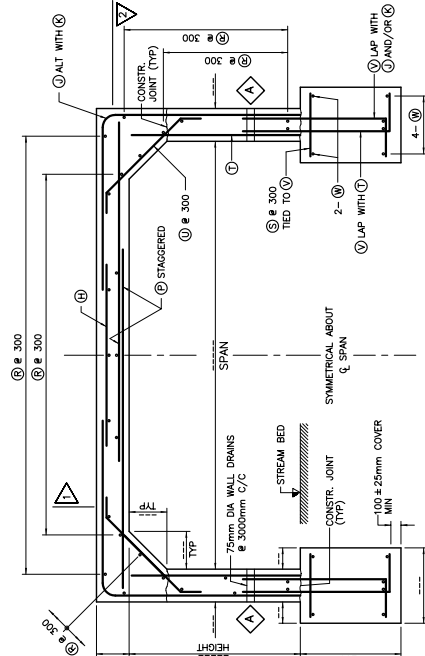
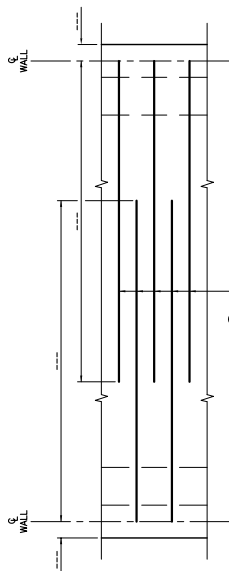
- BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND BOTH SIDES OF CULVERT KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 500mm.
- SIDES OF FOOTING TO BE CAST AGAINST UNDISTURBED SOIL.
- NO CONCRETE SHALL BE PLACED FOR ANY FOOTINGS UNTIL THE DEPTH OF THE EXCAVATION AND THE CHARACTER OF THE FOUNDATION HAVE BEEN APPROVED BY THE ENGINEER.
- SUPPORT FOR CONCRETE SHALL BE ON FORMED SURFACES. ON NON-FORMED SURFACES, CONCRETE BLOCKS (MIN. 20MPa) SHALL BE USED.



HEADER WALL (WHERE REQUIRED)



REFER TO 4.1 IN THE CODD MANUAL FOR PROFESSIONAL ENGINEER STAMPING REQUIREMENTS



TYPICAL CULVERT SECTION (HEADER WALL DETAILS SHOWN IN (A))

| MARK | BAR SIZE | C/C | DETAILS | REMARKS |
|------|----------|-----|----------|--|
| (L) | 15M | --- | STRAIGHT | TOP OF TOP SLAB |
| (U) | --- | M | | J BARS ALTERNATE WITH K BARS |
| (K) | --- | M | | K BARS ALTERNATE WITH J BARS |
| (P) | --- | M | STRAIGHT | BOTTOM OF TOP SLAB STAGGERED |
| (B) | 15M | 300 | STRAIGHT | LONGITUDINAL MIN. LAP SPICE = 500 |
| (S) | 15M | 300 | STRAIGHT | TOP OF FOOTING |
| (T) | --- | M | STRAIGHT | INSIDE FACE OF WALLS HAUNCH |
| (U) | 15M | 300 | | HAUNCH |
| (V) | 20M | --- | | FOOTING DOWNELS |
| (M) | 20M | --- | STRAIGHT | LONGITUDINAL IN FOOTING MIN. LAP SPICE = 600 |
| (Y) | --- | M | STRAIGHT | HEADER WALL |
| (Z) | 15M | 300 | | HEADER WALL |

NOTES: - All dimensions shown to centre line of bar
 - * represents vertical dimension
 - ** c/c spacing given at midspan

APPLICABLE STANDARD DRAWINGS
 CSD-303.010 POSITION OF SITE MARKERS AND DATE FIGURES
 CSD-303.010 BACKFILL AND COVER FOR CONCRETE CULVERTS

STANDARD DRAWING JANUARY 2004
SS114-1
 RIGID FRAME OPEN FOOTING CULVERT

| ITEM | VOLUME OF CONCRETE cubic metres | FOOTINGS | RETAINING WALL | TOTAL |
|------|---------------------------------|----------|----------------|-------|
| | | | | |

DRAWING NOT TO BE SCALED
 100 mm ON ORIGINAL DRAWING

| DATE | BY | CHK | CODE | CHECKED TO | LOAD | DATE |
|------|----|-----|------|------------|------|------|
| | | | | | | |

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

| | | |
|-------------------------|----------------|--------------|
| ○ | CONT No | WP No |
| RIGID FRAME BOX CULVERT | | |
| | | SHEET |

GENERAL NOTES

- CLASS OF CONCRETE TO BE 30MPa
- CLEAR COVER TO REINFORCING STEEL
BOTTOM OF TOP SLAB 40 ± 10 FOR SLABS ≤ 300 THICK
50 ± 10 FOR SLABS > 300 THICK
- REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED.
- LEGEND
ALT DENOTES ALTERNATE OF DENOTES OUTSIDE FACE
IF DENOTES INSIDE FACE

CONSTRUCTION NOTES

- BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND BOTH SIDES OF CULVERT KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME.
- AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 500mm.
- NO CONCRETE SHALL BE PLACED UNTIL THE DEPTH OF THE EXCAVATION AND THE REINFORCING STEEL HAS BEEN CHECKED AND APPROVED BY THE ENGINEER.
- SUPPORTS FOR REINFORCING STEEL SHALL BE AS PER OPSD-3922.000 AND OPSD-3922.010 ON FORMED SURFACES. ON NON-FORMED SURFACES, CONCRETE BLOCKS (MIN. 20MPa) SHALL BE USED.

| MARK | BAR SIZE | C/C | DETAILS | REMARKS |
|-------|----------|-----|----------|---|
| (H) | 15M | --- | STRAIGHT | TOP OF TOP SLAB A BOTTOM OF BOTTOM SLAB |
| (I) | --- | --- | --- | J BARS ALTERNATE WITH K BARS |
| (K) | --- | --- | --- | K BARS ALTERNATE WITH J BARS |
| (P)** | --- | --- | STRAIGHT | BOTTOM OF TOP SLAB STAGGERED |
| (Q)** | --- | --- | STRAIGHT | TOP OF BOTTOM SLAB STAGGERED |
| (R) | 15M | 300 | STRAIGHT | APRON WALL LONGITUDINAL MIN. LAP SPLICE = 500 |
| (S) | 15M | 300 | --- | HAUNCH |
| (T) | 15M | 300 | STRAIGHT | INSIDE FACE OF WALLS |
| (U) | 15M | 300 | --- | HAUNCH |
| (L) | 15M | 300 | --- | DOWELS TO APRON WALLS |
| (M) | 15M | --- | STRAIGHT | APRON WALL |
| (V) | --- | --- | STRAIGHT | HEADER WALL |
| (Z) | 15M | 300 | --- | HEADER WALL |

NOTES:
- All dimensions shown to centre line of bar
- All dimensions are in metres unless otherwise stated
- ** C/c spacing given at midpoint

APPLICABLE STANDARD DRAWINGS

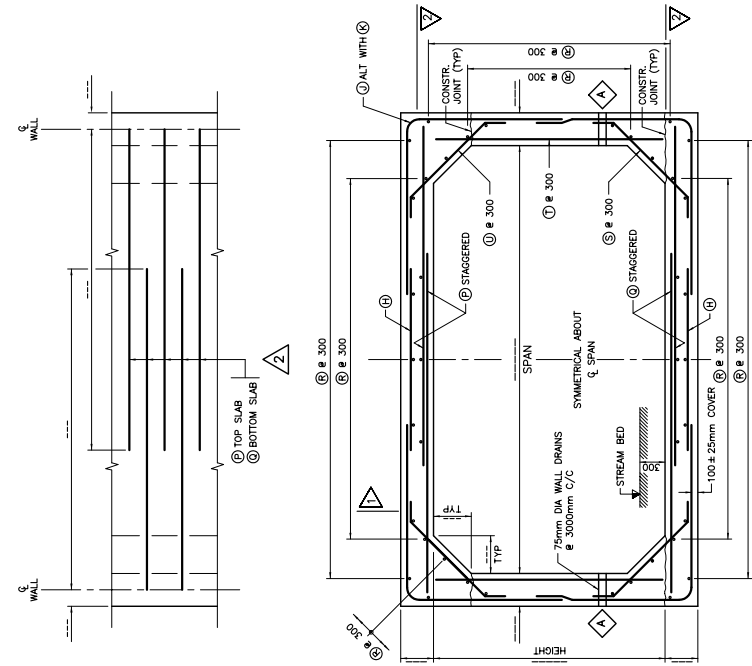
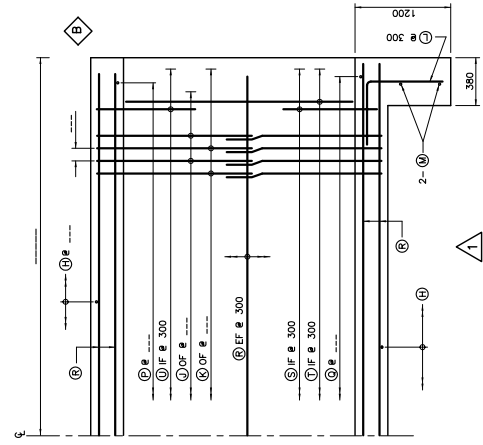
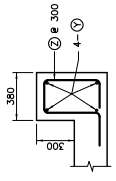
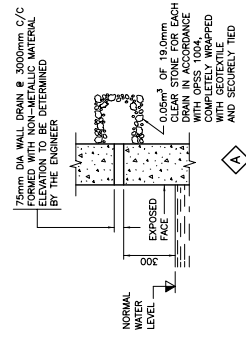
OPSD-4601.000 LOCATION OF SITE NUMBER AND DATE FIGURES
OPSD-803.010 BACKFILL AND COVER FOR CONCRETE CULVERTS
STANDARD DRAWING
JANUARY 2004

SS114-2

RIGID FRAME BOX CULVERT

| QUANTITIES | | TOTAL | |
|--------------------|---------------|----------------|-----|
| ITEM | WALLS & SLABS | RETAINING WALL | |
| VOLUME OF CONCRETE | --- | --- | --- |
| cu. m | --- | --- | --- |

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING



TYPICAL SECTION
(APRON DETAILS SHOWN IN (A)
(HEADER WALL DETAILS SHOWN IN (B))

| | | | | | | |
|----------|-----|------------|----------|------|----|-------------|
| DESIGNER | CHK | CODE CHECK | 100 LOAD | DATE | BY | DESCRIPTION |
| DRAWN | GR | SITE | | | | |

9.2 APPENDIX B: REDUCED PRINT OF DESIGN DATA FORM FOR
CONCRETE CULVERTS

9.3 **APPENDIX C: DEVIATIONS FROM CHBDC**

The following items represent the design criteria used in the preparation of this manual that deviates from the 2000 edition of the Canadian Highway Bridge Design Code.

- 1) The minimum inside height of Concrete Box Culverts shall be 1.25 metres in order to facilitate formwork removal.
- 2) The minimum fill height considered in the culvert design tables is 0.6 meters.
- 3) Soil arching factors are based only on Type B1 installation.
- 4) The Frost Penetration requirements of clause 7.8.3.4 are ignored, as OPSD 803.010 requires cover material to be specified granular, i.e. non-frost-susceptible.
- 5) Load combination (d) in CHBDC Clause 7.8.4.1, pertaining to earthquake has been excluded from this Manual.
- 6) Wheel Load Distribution Through Fill (Clause 6.9.6.) is revised as follows: "When several distribution loads overlap, the total load shall be considered as uniformly distributed over the area defined by the outside limits of the individual areas. When the dimensions of the composite distributed load area exceeds the roof area, only that portion of the distributed load on the roof area shall be considered in the design." The wording given in the code is at least unclear, or even incorrect.
- 7) Load combination in CHBDC clause 7.8.7.1 has been excluded from this Manual.
- 8) The shear checks within 2d of the face of the support using CHBDC clause 7.8.8.2.2, which refers to clause 8.10, have been excluded from this Manual.
- 9) Temperature and shrinkage requirements for maximum spacing of CHBDC Table 7.8.11.2 of 250 mm have been ignored.

9.4 **APPENDIX D: MATERIAL AND CONSTRUCTION SPECIFICATIONS FOR PRECAST REINFORCED CONCRETE BOX CULVERTS AND BOX SEWERS**

For single-cell culverts not exceeding 3 metres in span and for placement under a minimum fill depth of 600 mm, the use of precast reinforced concrete structure can be considered as an alternative.

Currently, the specification OPSS 1821 “Material Specification for Precast Reinforced Concrete Box Culverts and Box Sewers” covers the requirements for materials, design and fabrication of the single-cell precast reinforced concrete box culverts with inside spans of 1.8 to 3.0 metres, and with inside rise from 0.9 to 2.4 metres. This specification is based on the current bridge code as well as the “Prequalification Requirements for Precast Concrete Drainage Products” published by the OCPA. OPSS 422 “Construction Specification for Precast Reinforced Concrete Box Culverts and Box Sewers” covers the requirements for the installation of precast reinforced concrete box culverts and box storm sewers in open cut.

The member companies of the Ontario Concrete Pipe Association (OCPA) can however produce single-cell precast box culverts ranging in span from 900 mm to 4.2 metres and rise inside from 900 mm to 4.8 metres. Further details can be obtained from OCPA Office.

For precast culverts with less than 0.6 m of fill, a reinforced distribution slab is required to provide an improved live load shear transfer between the units, as well as an enhanced live load distribution.

9.5 APPENDIX E: METHODOLOGY USED FOR RIGID FRAME CULVERT DESIGN

9.5.1 GENERAL INFORMATION

The following design philosophy and method was the approach used to produce the Detailing Tables and Standard Drawings given in this Culvert Manual. The analysis was based on CHBDC Section 7 on Buried Structures, and the relevant clauses of Sections 3, 6 and 8.

The Assumptions, Design Criteria, Dead and Live Load Distributions, and Method of Design used are detailed in the following sections.

9.5.2 ASSUMPTIONS

| | |
|---------------------------|------------------------|
| Unit Weight of Soil | 20.0 kN/m ³ |
| Concrete..... | 24.0 kN/m ³ |
| Asphalt..... | 23.5 kN/m ³ |
| Water..... | 10.0 kN/m ³ |

Class of Concrete30 MPa

Reinforcing Steel400 MPa

Clear Cover to Reinforcing Steel as given on the Standard Drawings

Design Code CHBDC-2000

9.5.3 DESIGN CRITERIA

LOADING considered: Load Factors for ULS

1. Dead Load of Concrete Self-Weight.....[$\alpha_{max}=1.20$, $\alpha_{min}=0.90$]
2. Dead Load of Earth Fill + asphalt ($M_v=1.2$).....[$\alpha_{max}=1.25$, $\alpha_{min}=0.80$]
(only installation Type B1 considered)
3. Lateral Earth Pressure ($M_h=0.5$ or 0.3).....[$\alpha_{max}=1.25$, $\alpha_{min}=0.80$]
(only installation Type B1 considered)
4. Water Load (inside or outside of culvert).....[$\alpha_{max}=1.10$, $\alpha_{min}=0.90$]
5. Live Load (incl. DLA) – Vertical wheel load.....[$\alpha_{max}=1.70$, $\alpha_{min}=0.00$]
– Approaching wheel load..[$\alpha_{max}=1.70$, $\alpha_{min}=0.00$]

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2003 08 08

APPENDIX

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Note:

- Dead Load is always present.
- Culverts in Ontario are designed only for Type B1 installation.
- Due to vertical negative arching, the load due to earth fill is 120% of the soil weight.
- Due to horizontal arching, earth pressure coefficients are in the range between values of 0.3 and 0.5.
- Water Load can be applied
 - (a) inside the culvert (loads the walls and the bottom slab)
 - (b) inside & outside of the culvert
 - (c) outside the culvert (loads only the walls)

When Water load is applied on the outside of the culvert, the affected earth pressure height uses the submerged unit weight of soil, in addition to water pressure.

- Live Load is applied either as the wheel loads of a truck(s) acting Vertically and distributed to the top of the culvert through the soil, or as Approaching wheel loads applied through the soil to one or both sides of the culvert as lateral earth pressure. Vertical and Approaching wheel loads are not applied at the same time.

LOADING COMBINATIONS:

According to Section 7 of the CHBDC, and without consideration of Earthquake loading, the following 3 Load Combinations at ULS were considered:

L.C.#1 = Dead Load^(concrete + earth fill)+E.P.^(min)+Water+Live Load^(vertical)

L.C.#2 = Dead Load^(concrete + earth fill)+E.P.^(max)+Water+Live Load^(vertical)

L.C.#3 = Dead Load^(concrete + earth fill)+E.P.^(min)+Water+Live Load^(approaching)

where E.P. = Lateral Earth Pressure

With each of the Loading Combinations, the Load Factors are chosen for each individual load and combined in such a way as to produce maximum load effects such as Moments, Shears, Axial Forces and Reactions. In general, one loading will maximise the vertical and minimise the horizontal loading, while another loading will maximise the horizontal and

minimise the vertical loading. Operating between these two extremes are as many other load combinations as are required to consider every possible case. If a computer program such as OMBAS or CANBAS does the analysis, the extreme (governing) values can be selected from the envelope of results. If the analysis were done manually or by a computer program that needs additional manual input, a preliminary analysis in addition to an accurate prediction of deflected shapes and moment diagrams due to relative loadings would be an asset.

The load combination of CHBDC clause 7.8.7.1 has been excluded from this Manual.

9.5.4 DEAD AND LIVE LOAD DISTRIBUTIONS

DEAD LOAD DISTRIBUTION:

According to CHBDC, and documented by considerable research results, arching takes place in the soil in both the vertical as well as the horizontal directions.

Unless special construction techniques are utilised, the soil weight transfer from above the culvert to the top of the culvert (vertical loading) exhibits negative arching, resulting in a 20% increase in effective soil weight loading applied. This Culvert Manual does not consider any special construction techniques whereby the applied loading could be reduced. Numerous research papers discuss the possible methods (such as using some depth of compressible material directly on top of the culvert) whereby a portion of the settling fill above the culvert transfers a portion of its weight away from the culvert to the adjacent fill, reducing the actual soil weight that gets applied to the culvert.

In the horizontal direction, the effect of arching is such that it can be described in the traditional equivalent fluid pressure approach as having minimum and maximum coefficients of 0.3 and 0.5, for Type B1 installation.

LIVE LOAD DISTRIBUTION:

With respect to the direction of the Truck travel, the Live Load (wheel loads) is distributed in both the Transverse and Longitudinal directions. This distribution starts from the footprint dimensions of the truck wheel load(s), 600 mm (transverse) x 250 mm (longitudinal).

For distribution in the Transverse direction, 2 trucks in adjacent 3.0 m lanes, reduced to 90% because of multi-lane loading, represents the

governing (maximum) loading. The DLA varies according to the depth of fill. The width of distribution, at any depth H, is equal to the maximum extent of all 4 wheel loads distributed according to $[0.6 \text{ m} + 1.75H]$.

For distribution in the Longitudinal direction, the *nominal* width of distribution, at any depth H, is equal to the maximum extent of the wheels from axles 2 and 3 of the CHBDC truck, distributed according to $[0.25 \text{ m} + 1.75H]$. However, deviating from CHBDC, when the Live Load distribution overlaps and goes beyond the width of the culvert, for the *actual* width of distribution, apply to the culvert only the portion of the loading that is directly above the culvert.

9.5.5 METHOD OF ANALYSIS / DESIGN

1. With the aid of OMBAS modified for CHBDC, and based on the governing load combinations, the Bending Moment envelope, Shear, Axial Force and Reactions were calculated.
2. Based on assumed concrete thickness, reinforcing area and length of bars, the capacity of the relevant section was calculated, (as PxM interaction) and compared to the applied Moment and Axial Load.
3. Shear was checked, by comparing applied force to shear capacity in accordance with CHBDC section 8, clauses 8.9.3 and 8.9.4. The shear within $2d$ of the face of the support was not checked using clause CHBDC clause 8.10.
4. Sliding was checked, for open-footing culverts, using factored horizontal reaction and unfactored vertical reaction.
5. The assumed reinforcing, lap and embedment length required, was checked.
6. If any criteria was not satisfied, the relevant detail was modified and calculations repeated until all code requirements were met.

9.5.6 TEMPERATURE AND SHRINKAGE STEEL

The maximum spacing of temperature and shrinkage steel was established as 300 mm in lieu of the requirements of Table 7.8.11.2 of CHBDC.

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