CHAPTER 9
REINFORCED CONCRETE BOX CULVERTS

9-1 General

The culvert design begins when the Structure Design Unit receives the Culvert Survey and Hydraulic Design Report from the Hydraulics Unit. This report in conjunction with the Roadway plans shall be used to compute the culvert length, design fill, and other items that lead to the completed culvert plans.

Culverts shall be detailed as cast-in-place according to the information provided in the Culvert Standards. For all cast-in-place culverts regardless of location, the option to construct a Precast Box Culvert in lieu of the cast-in-place culvert shown on the plans is permitted except where limited by maximum design fill. The Precast Box Culvert option shall not be allowed if the maximum ~~desing~~design fill over the culvert exceeds 10 ft (3m) in Divisions 1-4, 6, 8 and 15 ft (4.5m) in Divisions 5,7, and 9-14. However, the Division Office has the final decision on whether to allow the Precast Box option, even if these requirements are met. Therefore, when attending the Preliminary Field Inspection inquire if the Precast Box option should be allowed. A note allowing the option has been provided on the culvert barrel standard drawings, so if the option is disallowed for any reason the note must be removed. ~~For culverts located in Divisions 5, 7, and 9-14 with a maximum design fill less than 10' (3.0 m), a note on the culvert barrel standard drawings allows the contractor the option of using a precast box culvert in lieu of the cast-in-place culvert shown on the plans.~~ For cast-in-place culverts, the designer is not responsible for the design of the precast option, but should include the Special Provision for Optional Precast Reinforced Concrete Box Culverts if the aforementioned criteria are satisfied.

When a precast box culvert is recommended for a project, the plans should be prepared according to supplied information and the PBC Culvert Standard.

~~Box c~~Culverts without floor slabs (three-sided culverts including con-span type structures) will be used when recommended by the Hydraulics Unit. Typically, this situation occurs when there is a high rock line (within 3-5 feet of the ground surface) ~~that would require significant rock blasting.~~to allow footings to be keyed into rock.

9-2 Culvert Length and Design Fill

Culvert lengths shall be computed for each culvert end from the centerline of roadway to the control point. The length for each end of the culvert shall be first computed as measured normal to the centerline of the roadway and shall be

comprised of three components. The first distance is from the centerline of the roadway to the edge of the roadway shoulder. The second component is the horizontal distance from the edge of the shoulder to the point where the fill slope intersects an elevation 9 inches (230 mm) above the top of culvert top slab. The final dimension is 1'-3" (380 mm) representing the culvert headwall thickness. The sum of these three dimensions is then skewed as necessary and rounded to the nearest inch (20 mm). The overall length of the culvert on the plans shall be the sum of the computed lengths for the two ends.

Figure 9-1 is a worksheet that may be used as an aid in computing culvert lengths and design fill. A computer program is also available for this purpose.

For cast-in-place culverts, compute the design fill by first locating the point of maximum fill and determining its elevation. Then compute the bed elevation below this point. Add the vertical clearance to the bed elevation to get the elevation at bottom of the top slab. Subtract the bottom of top slab elevation from the elevation of the point of maximum fill to arrive at the design fill.

For precast box culverts, the design earth cover shall be reported as the elevation difference between the point of maximum fill and the top of the top slab.

Subsurface investigations shall be requested from the ~~Geotechnical Unit~~Geotechnical Engineering Unit for all box culverts with a design fill of 50 feet (15.25 m) or more and for other box culverts deemed necessary by the Engineer. These culverts may need to be constructed with camber. Request the camber information from the ~~Soils and Foundation Section~~Geotechnical Engineering Unit. See Section 9-4 “Special Notes and Details” for the required plan note. The camber shall not exceed one half the fall from the inlet of the culvert to its outlet.

9-3 Design

Cast-in-place culvert barrels shall be designed by using the Load Factor Design Method. Culvert wing standard drawings are available and shall be used in conjunction with the culvert barrel standard drawings.

Footings must be designed for culverts without floor slabs.

The acute corners of all multiple barrel culverts outside the skew range of 45° to 135° with more than 7 feet (2.1 m) of vertical clearance shall be strengthened with a counterfort. Office standard drawings are available and shall be used in assembling culvert plans meeting the above described conditions.

For culverts with a sloped and/or tapered inlet, see the example of Figures 9-2 and 9-3.

For excessively thick culvert slabs, use a Standee bar when the clear distance between the bottom mat of transverse steel and the top mat of longitudinal steel exceeds 15 inches (380 mm). Detail the Standee bar in accordance with the CRSI "Manual of Standard Practice".

9-4 Assembly of Culvert Standards

General

Culvert barrel and wing standard drawings have been prepared and should be used in conjunction with the barrel section cell tutorial when preparing plans for cast-in-place culverts. When appropriate, the partial plan view of the Culvert barrel standards shall be modified to reflect the use of tapered outlet wings. Show the splice length chart from the computer printout on the plans. Culvert Standard PBC shall be used when precast box culverts are required for a project.

Cast-In-Place Culverts

General

For example plans for a single box culvert, see Figures 9-4 through 9-6.

Cast-in-place culverts shall be paid on a cubic yard (cubic meter) basis for "Class A Concrete" and in lbs (kg) of "Reinforcing Steel".

Location Sketch

The following items should be included:

- Location sketch oriented on the plan sheet so that the centerline of the roadway is vertical with stations increasing from the bottom to the top of the sketch.
- Line designation (-L-, -Y-, etc.)
- North arrow
- Existing structures, roads, buildings, and drainage pipes shown with a dashed line. Show existing wood lines, stream outlines, and other terrain features.
- Proposed culvert outline shown as a solid line
- Skew angle
- Name of stream
- Flow direction of stream
- Destination arrows on road
- Centerline station of culvert
- Roadway grade point elevations at the centerline of culvert, bed elevation of culvert beneath the reference station, and roadway fill slopes. This information should be placed at the bottom of the location sketch in the following manner:

Grade Point Elev. @ Station _____= _____
Bed Elev. @ Station_____ = _____
Roadway Slopes _____:1

- Top of the footing elevation for culverts without floor slabs only.

Hydraulic Data

The following information, attained from the Culvert Survey and Hydraulic Design Report, shall be shown near the location sketch.

- Design Discharge
- Frequency of Design Flood
- Design High Water Elevation
- Drainage Area
- Basic Discharge (Q100)
- Basic High Water Elevation

In addition to the above data, show the Overtopping Flood Data for all Federal Aid bridges and for other bridges when data is provided.

Overtopping Flood Data
Overtopping Discharge
Frequency of Overtopping Flood
Overtopping Flood Elevation

In case Overtopping Flood Data is not required, the Hydraulics Unit will provide a note to that effect on the Bridge Survey and Hydraulic Design Report. This note should be placed on the plans.

The high water elevation shown in the Culvert Survey Report applies to the inlet end of the culvert. Since this is based on the estimated length of culvert as shown in the Culvert Survey Report sketch, rather than the final computed length, adjustments should be made to the high water elevation based on the actual length shown on the plans. This adjusted elevation should be shown to the nearest tenth of a foot (hundredth of a meter).

Adjustment in the high water elevation can be made as a direct variation of the grade of stream bed as indicated in the Culvert Survey Report. Thus, if the upstream end of a box culvert on a 1.2% grade is 8'-4" (2540 mm) longer than the Culvert Survey Report shows, the high-water elevation should be raised 0.1 feet (30 mm). If this change in elevation adjustment is greater than 0.1 feet (30 mm), contact the Hydraulics Unit for their review and approval.

Section of Barrel

The barrel section shall be shown on the plans. For single barrel culverts with a vertical clearance of 8 feet (2.54 m) or less, detail continuous high chair uppers (CHCU) in the top slab to support the corner 'A' bars.

Bench Mark

Show the bench mark description and its elevation in or adjacent to the location sketch for all culvert plans.

'C' Bars in Barrel

The actual number of 'C' bars shall be shown in the barrel section. Add the following note near the barrel section:

There are _____ 'C' bars in section of barrel.

Centerline Profile

Show the centerline profile on the plans. The Hydraulics Unit should include the profile in the Culvert Survey and Hydraulic Design Report. If more details are required, contact the Hydraulics Unit.

Weep Hole Location

The dimension from the bed elevation to the weep hole shall be shown on the "Culvert Section Normal to Roadway" detail for all culverts. To compute this dimension, find the difference between the normal flow line and the centerline bed elevation, as shown on the Culvert Survey Report, add 6 inches (150 mm) and then round to the next ½ inch (10 mm).

Construction Joints for Cast-In-Place Culverts

Bottom Slab of Multiple Barrel Culverts

Call for a permitted construction joint in the bottom slab of all multiple barrel culverts 12 inches (300 mm) from an interior wall and place the following note on the plans:

Steel in the bottom slab may be spliced at the permitted construction joint at the Contractor's option. Extra weight of steel due to the splices will be paid for by the Contractor.

For culverts constructed in stages, detail a construction joint in the bottom slab consistent with the staging plans proposed by the Roadside Environmental and Hydraulics Units.

Bottom of Fillets

For culverts with a vertical clearance of 4 feet (1.2 m) or less, no construction joint shall be permitted at the bottom of fillets and the following notation with an arrow to the bottom of fillets should be shown on the plans in the "Section of Barrel":

No construction joint permitted.

For culverts with a vertical clearance greater than 4 feet (1.2 m) through 8 feet (2.4 m), a construction joint at the bottom fillets is optional and the following notation with an arrow to the bottom of fillets should be shown on the plans in the "Section of Barrel":

Permitted Construction Joint

For culverts with a vertical clearance of 9 ft (2.7 m) or greater, a construction joint is required at the bottom of fillets and the following notation with an arrow to the bottom of fillets should be shown on the plans in the "Section of Barrel":

Construction Joint

If necessary, modify the notes on the culvert barrel standard drawings.

Transverse Joints In Barrel

Transverse construction joints shall be used in culverts exceeding 70 feet (21 m) in length. These joints shall be parallel to the main slab steel. Reinforcing steel shall not be cut or spaced to fit the joints. Where transverse construction joints are required, show a typical joint on the plans with a reference to the following note:

Transverse construction joints shall be used in the barrel, spaced to limit the pours to a maximum of 70 feet *(21.0 m)****. Location of joints shall be subject to approval of the Engineer.***

Culvert Extensions

For culvert extensions, the wall thickness shall be a minimum of 8 inches (205 mm).

When extending culverts, detail #6 (#19) dowels at 1'-6" (450 mm) centers for the top and bottom slabs and exterior walls. See Figure 9-7. Place the following notes on the plans:

Dowels shall be used to connect the culvert extension to the existing culvert as shown. For note regarding setting of dowels, see Sheet SN *(Sheet SNSM)****.***

If approved by the Engineer, the Contractor may use the existing wings as temporary shoring for the construction of the culvert extensions. In this case, the bottom slab of the extension shall be poured at least 72 hours prior to cutting the wings. The wings may be cut earlier provided the slab

***concrete strength has reached a minimum compressive strength of 1500 psi** (10.3 MPa).*

Precast Box Culverts

General

A precast box culvert shall be detailed when recommended by the Hydraulics Unit or the Division Office~~Bridge Replacement Unit~~ and may be used in other situations. When the planning report requires a Precast Box Culvert to satisfy staging and time requirements, a cast-in-place culvert option shall still be designed and detailed in the plans. In this occurrence, place the following note on the plans:

> ***The Contractor may choose to construct a cast-in-place culvert in accordance with the included plans at no additional cost to the department. The contract requirements with respect to construction staging and time shall be satisfied regardless of whether a precast or cast-in-place culvert is constructed.***

Precast box culverts shall not be detailed for use as a pedestrian underpass. If the precast option was available, remove the standard note allowing the precast option and replace it with the following note:

> ***No precast reinforced box culvert option will be allowed.***

~~The option to construct a precast box culvert in lieu of the cast-in-place culvert shown in the plans is permitted in all Divisions, except where limited by maximum design fill. The precast box culvert option shall not be allowed if the maximum design fill over the culvert exceeds 10 ft (3 m) in Division 1-4, 6, 8, and 15 ft (4.5 m) in Divisions 5, 7, and 9-14.~~

When a precast reinforced concrete box culvert is called for on the plans, the Contractor will submit the design. Detail only the size and length of the culvert, the number of boxes, the cast-in-place headwall, the cast-in-place wings, and the guardrail attachment, if required. Do not detail slab thickness, wall thickness, or barrel reinforcement other than the 'D' bars that dowel into the cast-in-place headwall and curtain wall. When determining the length of the culvert, assume both the wall and slab thickness to be one-twelfth of the horizontal clear span of one barrel, but do not detail it as such.

~~When the planning report requires a precast box culvert to satisfy staging and time requirements, a cast-in-place culvert option shall still be designed and detailed in the plans. In this occurrence, place the following note on the plans:~~

> ~~***The contractor may choose to construct a cast-in-place culvert in accordance with the included plans at no additional cost to the***~~

~~*department. The contract requirements with respect to construction staging and time shall be satisfied regardless of whether a precast or cast-in-place culvert is constructed.*~~

See "Turned Back Wing Standards" of this section for the use of wing standard drawings with precast box culverts.

For example of precast box culvert, see Figures 9-8 through 9-10.

Precast box culverts shall be paid for on a lump sum basis for "Precast Reinforced Concrete Box Culvert at Station _____".

Location Sketch

The information provided for a precast box culvert shall be the same as that provided for the cast-in-place culverts.

Section of Barrel

The barrel section shall be shown on the PCB Culvert Standard.

Bench Mark

Show the bench mark description and its elevation in or adjacent to the location sketch for all precast box culvert plans.

Centerline Profile

Show the centerline profile on the plans. The Hydraulics Unit should include the profile in the Culvert Survey Report. If more details are required, contact the Hydraulics Unit.

Weep Hole Location

The determination of weep hole locations shall be as described for cast-in-place culverts. The dimension from the bed elevation to the weep hole shall be shown in the elevation view of the "Typical Precast Unit" detail.

Plan Details

Complete or include the following items on the PBC Culvert Standard:

- Typical Section - Show the width and height of the box.
- Elevation - Show the length of the culvert
- Standard Notes - Enter the design earth cover.
- Plan View - Delete the view that is not applicable to the project.

- Bill of Material and Bar Schedule
- Skewed Precast Box Culverts - Select the appropriate detail from Figure 9-11.

Detail a 3 inch (75 mm) space between lines of multiple precast box culverts.

For multiple barrel precast box culverts, place the following note on the plans:

One permitted construction joint will be allowed in the end curtain wall.

Precast Three-Sided Culverts

Use a three-sided precast culvert when indicated on the Hydraulic Survey Report. When a precast three-sided culvert is called for on the plans, the Contractor will submit the design for the barrel section, foundation, and cast-in-place wing walls and headwalls. Detail the plans showing both the arch and flat-top shaped sections unless otherwise indicated. Detail the size (opening), length, and number of cells. For the purpose of calculating culvert length, assume the slab thickness to be one-twelfth of the horizontal clear span, but do not detail on the plans. Include foundation design parameters and notes provided by the Soils and Foundations Unit in the plans.

Turned Back Wing Standards

Turned back wing standard drawings have been prepared using 2:1 wing slopes. For unusual skew conditions, see Figures 9-12 and 9-13 for wing layout details.

A 1 inch (25 mm) expansion joint shall be provided in the wings of all cast-in-place culverts. The wing standard drawings incorporate this expansion joint. A strip of filter fabric shall be placed on the fill face side of the wing along this expansion joint to prevent the migration of fine material through the joint. Place the following note on the plans:

A 3 foot** (900 mm) **strip of filter fabric shall be attached to the fill face of the wing covering the entire length of the expansion joint.

For an example of the wing standard drawing, see Figure 9-106.

For precast box culverts, the wing standard drawings shall be modified as follows:

- The 1 inch (25 mm) expansion joint material shall be provided at the junction of the wing and the precast end unit, rather than in the wing.
- For wings on skewed precast box culverts, place the following note on the wing standard drawing:

  If the option of 90° skewed ends of the precast box is used, dimensions marked with an asterisk will need adjustment.

When this note is used, an asterisk shall be placed on the dimensions locating the intersection of the wing and curtain wall footings and the start of the wing slope.

For an example of a wing for a precast box culvert, see Figure 9-10.

Tapered Outlet Wings

Typically, outlet wings for reinforced concrete box culverts and culvert extensions shall be tapered extensions of the exterior barrel walls. Do not use tapered outlet wings in conjunction with bottomless culverts or when the Hydraulics Unit requires standard turned back wings. For barrel heights greater than 10 feet (3.0 m) or skews outside the range of 45° to 135°, design outlet wings on a case by case basis. Do not use tapered outlet wings when a low flow channel is included in the culvert design.

The slope of the wing shall match the roadway fill slope along the skew. A concrete apron shall extend the bottom slab of the barrel and connect the outlet wings. The thickness of the apron shall match the thickness of the bottom slab of the barrel. Details for the tapered outlet wings are provided in Figures 9-~~13a~~ 14 through 9-~~13b~~15.

The length of the wing shall be determined by extending the outlet wing until it intersects a plane 1'-6" (460 mm) above the apron. Adjust the wing length to the nearest inch (20 mm). Provide weepholes in the outlet wings as necessary to continue the weephole spacing from the barrel.

Detail #6 (#19) dowel bars and #4 (#13) horizontal bars to extend the pattern of 'C' bars from the exterior barrel walls. Continue the spacing of the 'C' bars and 'A' bars in the barrel throughout the apron. The vertical leg of the 'A2' bars shall be modified at the end of the apron to provide adequate clearance to the top of the wing. The 'V' bars in the wings shall match the spacing of the 'A2' bars in the apron. Detail a curtain wall at the end of the apron. The size of the 'S' bars in the curtain wall shall match that of the 'S' bars in the headwall.

Unless otherwise dictated by the Hydraulics Unit, provide filter fabric and Class I rip rap within the limits of Figure 9-~~13c~~16. Include the entire area of the concrete apron and tapered wings in the calculation of required foundation conditioning material. Include in the Total Structure Quantities two special culvert pay items for "Filter Fabric for Drainage" in square yards (square meters) and "Plain Rip Rap, Class I (2'-0" thick) (600 mm thick)" in tons (metric tons).

Place the following note on the plans:

> ***At the Contractor's option the vertical construction joint between the outlet wings and the barrel may be eliminated and the 'C' bars in the barrel may be extended to replace the 'D' and 'H' bars in the wings and slab.***

Culvert Excavation

Culvert excavation shall be computed in accordance with Figure 9-~~14~~ 17 and included as a lump sum item on the plans, estimates and proposals for box culverts with floor slabs. Culvert excavation for box culverts with floor slabs shall be shown on a lump sum basis for "Culvert Excavation, Station _____" in the estimate and on the plans.

For precast culverts, calculate culvert excavation based on a wall and slab thickness equal to 10% of the horizontal clear span of one barrel.

For those culverts that require the removal of unsuitable material, the limits of the culvert excavation shall include the undercut excavation.

For culverts without a floor slab, the excavation for the footing shall be computed and listed in the Bill of Material as "Foundation Excavation" instead of "Culvert Excavation".

Unsuitable Material

When the bottom of the culvert is above the limits of unsuitable material, show the following notes on the culvert plans:

No work shall be done on the culvert at Sta. _____ until the area of the box culvert has been undercut to Elev. ____ and unsuitable material replaced with suitable material, properly compacted to the elevation of the bottom of the proposed floor slab. The limits of this undercut excavation shall be at least the limits of the box culvert including the wings. No separate payment will be made for any temporary sheeting, undercut, or unsuitable material replacement as required to construct the proposed culvert. Payment is included in the lump sum price for Culvert Excavation.

Foundation Condition-ing Material

For all box culvert foundations, use a 12 inch (300 mm) blanket of Foundation Conditioning Material under the entire area of the floor slab. Do not compute a quantity for standard turned back wings. Use a weight of 1.904 tons/yd^3 (2.26 metric tons/m^3) for this material. This material shall be included in the Bill of Material on a ton (metric ton) basis for "Foundation Conditioning Material, Box Culvert" and rounded to the nearest ton.

When calculating a quantity of foundation conditioning material for precast culverts, assume a wall thickness equal to 10% of the horizontal clear span of one barrel.

Low Flow Channels

When the Culvert Survey and Hydraulic Design Report calls for a low flow channel, the plans shall be detailed to show a plan view of the culvert specifying sill locations as determined by the Culvert Survey and Hydraulic Design Report. The height of the sill at the entrance of the other barrel(s), bed material, and

maximum stone size shall be as dictated by the Culvert Survey and Hydraulics Design Report. The bed material shall be labeled in the plan view drawing and the following note shall be placed on the plans:

Bed material placed between sills in the culvert shall provide a continuous low flow channel between the lower sills. The material shall be natural stone with a gradation size similar to that of Class __ Rip Rap. Stones larger than ___ inches** (mm) **shall not be placed within the low flow channel. Bed material is subject to approval by the Engineer.

The quantity of rip rap, in tons (metric tons), shall be listed in the Total Quantities section of the culvert plan sheets. When preparing an estimate, include the rip rap as a special culvert pay item for "Plain Rip Rap, Class ___".

See Figure 9-~~15~~ 18 for typical culvert sill details.

Special Notes and Details

Assumed Live Load = HS20** (MS18) **or Alternate Loading.

For culvert diversion details and pay item, see Erosion Control Plans.

For all metric projects,

All dimensions are in millimeters unless otherwise noted.

All elevations are in meters.

Show the TIP number, county and the culvert identification station in the spaces over the title block. Show the Federal Aid Project Number (if applicable) in the upper right hand corner of the first sheet for each culvert.

For Federal Aid projects,

The Contractor shall provide independent assurance samples of reinforcing steel as follows: For projects requiring up to 400 tons** (360,000 kg) **of reinforcing steel, one 30 inch** (760 mm) **sample of each size bar used, and for projects requiring over 400 tons** (360,000 kg) **of reinforcing steel, two 30 inch** (760 mm) **samples of each size bar used. The bars from which the samples are taken must then be spliced with replacement bars of the size and length of the sample, plus a minimum lap splice of thirty bar diameters.

For major culverts, those defined as having a total interior opening of 20 ft (6 m) or greater measured along the centerline of roadway, use the following above the title block:

Bridge No._____

If a culvert is replacing an existing bridge, the following note must be placed over the title block:

Replaces Bridge No. _____.

One of the following notes should also be placed on the plans:

(After serving as a temporary structure) ***the existing structure consisting of*** *(number, length and type of spans; clear roadway width and type of floor)* ***on*** *(type of substructure)* ***and located*** *(distance up or downstream from proposed structure)* ***shall be removed. The existing bridge is presently posted below the legal load limit. Should the structural integrity of the bridge further deteriorate, this load limitation may be reduced as found necessary during the life of the project.*** (When a special circumstance exists warranting a Special Provision, add to the note: ***See Special Provision for _____.****)*

(After serving as a temporary structure) ***the existing structure consisting of*** *(number, length and type of spans; clear roadway width and type of floor)* ***on*** *(type of substructure)* ***and located*** *(distance up or downstream from proposed structure)* ***shall be removed. The existing bridge is presently not posted for load limit. Should the structural integrity of the bridge deteriorate during construction of the proposed structure, a load limit may be posted and may be reduced as found necessary during the life of the project.*** (When a special circumstance exists warranting a Special Provision, add to the note: ***See Special Provision for _____.****)*

Where an opening is required in the top slab for a catch basin, provide for 4 inch (100 mm) corner fillets and call for the steel in the opening to be cut and bent up if the catch basin is reinforced. Provide extra bars to reinforce the opening if required.

Where it is necessary to provide for pipes through the sidewalls of culverts, the reinforcing steel shall be bent around the pipe and the area reinforced with additional bars. Place the following note on the plans:

The _____ ϕ pipe through the sidewall of the culvert shall be located by the Engineer. The reinforcing steel shall be field bent as necessary to clear pipe.

If possible, do not locate pipes through culvert walls or wing walls. If it is necessary to run the pipe into the culvert, consider carrying it through the top slab by way of a junction box. Another alternate would be to construct a junction box adjacent to the culvert so that a length of pipe may be run perpendicularly into the culvert wall.

If scour is prevalent, rip rap may be used in the front of the culvert wing. This recommendation will be provided on the Culvert Survey and Hydraulics Design Report. Detail rip rap, if used, approximately 3 feet (900 mm) above the wing footing.

The headwall skew angle on arch culverts shall not exceed 20° regardless of the culvert skew.

When preparing the plans for arch culverts or box culverts with a top slab thickness of 18 inches (455 mm) or greater, place the following note on the first culvert sheet:

Detailed drawings for falsework and forms for this _____ shall be submitted. See Sheet SN** (Sheet SNSM)**.

When the ~~Soils and Foundation Section~~Geotechnical Engineering Unit provides a required camber, place the note on the plans:

The reinforced concrete box culvert shall be constructed with ____ inches** (mm) **of camber to account for anticipated settlement.

Guardrail Anchor Assemblies

Provisions for anchoring guardrail to RCBC slabs shall be made when the fill above the top slab at the location of the guardrail posts is less than 3.5 feet (1.070 m). However, if the skewed width of the culvert (including walls) is less than ~~18'-3~~23'-8" (~~5.56~~7.21 m), use an alternative guardrail design with a guardrail post spacing of up to ~~18'-9~~25'-0" (~~5.72~~7.62 m). See Roadway Standard Drawing 862.01 sheet 9 of 11. This method eliminates the need for anchoring guardrail to the culvert. The Project Engineer must coordinate with the Roadway Design Unit to ensure the Roadway plans are properly detailed.

See Standard GRA1 and Figure 9-~~16~~19 for guardrail anchorage details. For guardrail anchor assemblies on precast box culverts, see Figure 9-~~17~~20. Guardrail anchor assembly details shall be included in the plans for attachment of guardrail to RCBC slabs.

The guardrail anchor assemblies shall be spaced at 6'-3" (1.905 m) centers.

See the Roadway Standards for details of the guardrail, post and post base plate.

The Roadway Design Unit shall be furnished with the guardrail anchor assembly spacings used on each RCBC.