Solicitation 1802-216

Cast in Place Concrete Materials and Labor

Bid Designation: Public

Williamson County, Texas

Bid 1802-216
Cast in Place Concrete Materials and Labor

Bid Number	1802-216
Bid Title	Cast in Place Concrete Materials and Labor
Bid Start Date	In Held
Bid End Date	Mar 15, 2018 3:00:00 PM CDT
Question & Answer End Date	Mar 9, 2018 5:00:00 PM CST
Bid Contact	Johnny Grimaldo Purchasing Specialist II 512-943-1553 johnny.grimaldo@wilco.org
Contract Duration	1 year
Contract Renewal	2 annual renewals
Prices Good for	365 days
Bid Comments	**Williamson County is seeking qualified companies to provide general roadway cast-in-place concrete work (material and labor) in accordance with Items 421, 423, 432, 465, 466, 467, 496, 529, and 531 of the Texas Department of Transportation, Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges 2014.**

Item Response Form

Item	1802-216-01-01 - please attach all documents to this line item
Quantity	1 each

Prices are not requested for this item.

Delivery Location: Williamson County, Texas

No Location Specified

Qty 1

Description
please attach all documents to this line item

PUBLIC ANNOUNCEMENT AND GENERAL INFORMATION

WILLIAMSON COUNTY PURCHASING DEPARTMENT
SOLICITATION 1802-216
Cast in Place Concrete Materials and Labor

BIDS MUST BE RECEIVED ON OR BEFORE:
Mar 15, 2018 3:00:00 PM CDT

BIDS WILL BE PUBLICLY OPENED:
Mar 15, 2018 3:00:00 PM CDT

Notice is hereby given that sealed Bids for the above-mentioned goods and/or services will be accepted by the Williamson County Purchasing Department. Williamson County uses BidSync to distribute and receive bids. Specifications for this IFB may be obtained by registering at www.bidsync.com.

Williamson County prefers and requests electronic submittal of this Bid.

All electronic bids must be submitted via: www.bidsync.com

Electronic bids are requested, however paper bids will currently still be received, until further notice and may be mailed or delivered to the address listed below.

Bidders are strongly encouraged to carefully read this entire IFB.

All interested Bidders are invited to submit a Bid in accordance with the Instructions and General Requirements, Bid Format, Bid Specifications, and Definitions, Terms and Conditions stated in this IFB.

Please note that a complete package must be submitted choosing one of the above two methods. Split packages submitted will be considered "unresponsive" and will not be accepted or evaluated.

Williamson County will not accept any Bids received after the submittal deadline, and shall return such Bids unopened to the Bidder.

General Information:

- If mailed or delivered in person, Bids and Bid addenda are to be delivered in sealed envelope on or before the submittal deadline, as noted in the Public Announcement and General Information listed above for this IFB, to:

  Williamson County Purchasing Department
  Attn: **BID NAME AND NUMBER**
  901 South Austin Avenue
  Georgetown, Texas 78626

  - Bidders should list the Bid Number, Bid Name, Name and Address of Bidder, and the Date of the Bid opening on the outside of the box or envelope and note "Sealed Bid Enclosed."
  - Bidder should submit one (1) original.
  - Williamson County will NOT be responsible for unmarked or improperly marked envelopes.
  - Williamson County will not accept any responsibility for Bids being delivered by third party carriers.
  - Facsimile transmittals will NOT be accepted.

- Bids will be opened publicly in a manner; however, to avoid public disclosure of contents only the names and of Bidders and prices will be read aloud.

- All submitted questions with their answers will be posted and updated on www.bidsync.com.

- It is the Bidder's responsibility to review all documents in BidSync, including any Addenda that may have been added after the document packet was originally released and posted.

  - Any Addenda and/or other information relevant to the IFB will be posted on www.bidsync.com.

  - The Williamson County Purchasing Department takes no responsibility to ensure any interested Bidder has obtained any outstanding addenda or additional information.

Williamson County – Invitation for Bid (IFB)

SECTION 1 - DEFINITIONS

Addendum/Addenda – means any written or graphic instruments issued by the County prior to the consideration of Bids which modify or interpret the Bid Documents by additions, deletions, clarifications, or corrections.

Agreement/Ensuing Agreement(s) – means the Successful Bidder may be required by the County to sign an additional Agreement containing terms necessary to ensure compliance with the IFB and the Bidder's Bid. Such Ensuing Agreement(s) shall contain the Bid specifications, terms and conditions that are derived from the IFB.

Bid Documents – means the Legal Notice, IFB including attachments, and any Addenda issued by the County prior to the consideration of any Bids.

Bid – means the completed and signed bid form, (sometimes referred to as the Price Sheet), and ALL required forms and documentation listed in the IFB package which have been submitted in accordance with the terms and conditions described in the IFB package. A Bid submitted in accordance with this IFB is irrevocable during the specified period for evaluation and acceptance of Bids unless a waiver is obtained from the Williamson County Purchasing Agent.

Bidder – means a person or entity who submits a Bid in response to this IFB.

Contract – means this IFB and the Bid of the Successful Bidder shall become a Contract between the Successful Bidder and the County once the Successful Bidder's Bid is properly accepted by the Williamson County Commissioners Court.

Commissioner's Court – means the Williamson County Commissioners Court.

County – means Williamson County, a political subdivision of the State of Texas.

Invitation for Bid (IFB) – means this document, together with the attachments thereto and any future Addenda issued by the County.

Successful Bidder – means the liable Bidder to whom the County intends to award the Contract.

SECTION 2 - BID FORMAT AND SUBMISSION

2.1 ORGANIZATION OF BID CONTENTS FOR SUBMITTAL

Each Bid should be organized and items submitted in the order described below:

A. Transmittal Letter. Please see Section 2.3, Transmittal Letter, for more information.

B. Price Sheet.

C. Conflict of Interest Questionnaire. Please see Section 2.2, Conflict of Interest, for more information in regards to this. Please note that even if you deem there to be no Conflict of Interest, this signed questionnaire must be included in your package.

D. References. Please see Section 3.15, References, for more information.

E. Bid Affidavit.

F. Form 1295. Please see Section 2.4, Certificate of Interested Parties – Form 1295.

2.2 CONFLICT OF INTEREST

No public official shall have interest in a Contract, in accordance with Vernon's Texas Codes Annotated, Local Government Code, Title 5, Subtitle C, Chapter 171, as amended.

As of January 1, 2006, all Bidders are responsible for complying with Local Government Code, Title 5, Subtitle C, Chapter 176. Additional information may be obtained from the County's website at the following link:

http://www.wilco.org/CountyDepartments/Purchasing/ConflictofInterestDisclosure/tabid/689/language/en US/Default.aspx

Each Bidder must disclose any existing or potential conflict of interest relative to the performance of the requirements of this IFB. **Examples of potential conflicts of interest may include an existing business or personal relationship between the Bidder, its principal, or any affiliate or subcontractor with the County or any other entity or person involved in any way with the project that is subject to this IFB**. Similarly, any personal or business relationship between the Bidder, the principals, or any affiliate or subcontractor with any employee, or official of the County or its suppliers must be disclosed. Any such relationship that might be perceived or represented as a conflict must be disclosed. Failure to disclose any such relationship or reveal personal relationships with the County employees or officials may be cause for termination.

The County will decide if an actual or perceived conflict should result in Bid disqualification.

By submitting a Bid in response to this IFB, all Bidders affirm they have not given, nor intend to give, at any time hereafter, any economic opportunity, future employment, gift, loan, gratuity, special discount, trip, favor, or service to a the County public servant or any employee, official or representative of same, in connection with this procurement.

Each Bidder must provide a Conflict of Interest Statement with their Bid Package. Package may be deemed incomplete without this form.

2.3 TRANSMITTAL LETTER

The Bidder should submit a Transmittal Letter that provides the following information:

A. Name and address of individual or business entity submitting the Bid.

B. Name, physical address, email address, business and fax number of the Bidder's principal contact person regarding all contractual matters relating to this IFB.

C. The Bid's Federal Employer Identification Number.

D. If the Proposal being submitted will have an effect on air quality for the County (as it relates to any state, federal, or voluntary air quality standard), then the Respondent is encouraged to provide information in narrative indicating the anticipated air quality impact. See Section 4.36, Air Quality for more information.

2.4 CERTIFICATE OF INTERESTED PARTIES – FORM 1295

As of January 1, 2016, all Successful Bidders are responsible for complying with the Texas Government Code, Section 2252.908. The law states that the County may not enter into certain contracts with a Bidder unless the Bidder submits a disclosure of interested parties to the County at the time the Bidder submits the signed Contract. The law applies only to a Contract of the County on or after January 1, 2016 that either:

A. Requires an action or vote by the Commissioners Court before the Contract may be signed (all contracts that fall under the jurisdiction of the Commissioners Court approval, such as contracts resulting from an Initiation for Bid (IFB), RFP, Request for Qualifications (RFQ), etc., excluding, but not limited to, certain Juvenile Service contracts, contracts funded with Sheriff's seized fun monies, etc.); or
B. Has a value of at least $1,000,000.

By January 1, 2016, the Texas Ethics Commission will make available on its website, a new filing application that must be used to file Form 1295. Information regarding how to use the filing application is available on the Texas Ethics Commission website at the following link:

https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm

A Respondent must:

A. Use the online application to process the required information on Form 1295.

B. Print a copy of the form which will contain a unique certification number.

C. An authorized agent of the Bidder must sign the printed copy of the form.

D. Have the form notarized.

E. File the completed Form 1295 and certification of filing (scanning and emailing form is sufficient) with Williamson County Purchasing Agent at the time the signed Contract is submitted for approval.

After the Commissioners Court award of the Contract, the County shall notify the Texas Ethics Commission, using the Texas Ethics Commission's filing application, of the receipt of the filed Form 1295 and certification of filing not later than the 30th day after the date the Contract binds all parties to the Contract. The Texas Ethics Commission will post the completed Form 1295 to its website within seven business days after receiving notice from the County.

2.5 ETHICS

The Bidder shall not accept or offer gifts or anything of value nor enter into any business arrangement with any employee, official or agent of the County.

2.6 BID SUBMITTAL DEADLINE

The Bid is due no later than the submittal date and time set forth in the Public Announcement and General Information listed in this IFB package. Contents of each Bid shall be submitted in accordance with this IFB.

2.7 DELIVERY OF BIDS

The County uses BidSync to distribute and receive Bids and proposals. It is preferred that Bids submitted electronically through BidSync; however, Bidders can submit a hard copy.

Refer to www.bidsync.com for further information on how to submit electronically.

If mailed or delivered in person, Bids and Bid Addenda are to be delivered in sealed envelope on or before the submittal deadline, as noted in the Public Announcement and General Information listed in this IFB package, to:

Williamson County Purchasing Department
Attn: **Bid Name and Number**
901 South Austin Avenue
Georgetown, Texas 78626

Also, all Bidders should list their Name and Address, and the Date of the Bid opening on the outside the box or envelope and note "Sealed Bid Enclosed." The County will not accept any Bids received after the submittal deadline, and shall return such Bids unopened to the Bidder. The County will not accept any responsibility for Bids being delivered by third party carriers.

Bids will be opened publically and the names of Bidders and pricing will be read aloud.

SECTION 3 - INSTRUCTIONS AND GENERAL REQUIREMENTS

3.1 INSTRUCTIONS

Read this document carefully, and follow all instructions and requirements. All Bidders are responsible for fulfilling all requirements and specifications. Be sure to have a clear understanding of this IFB.

General requirements apply to all advertised IFBs; however, these may be superseded, in whole or in part, by the bid specifications, Addenda and modifications issued as a part of this IFB. Be sure your Bid package is complete.

3.2 AMBIGUITY, CONFLICT, OR OTHER ERRORS IN THIS IFB

If a Bidder discovers any ambiguity, conflict, discrepancy, omission or other error in this IFB, the Bidder shall immediately notify the County Purchasing Department of such error in writing and request modification or clarification of the document.

Modifications will be made by issuing Addenda. If the Bidder fails to notify the County prior to the date and time fixed for submission of Bids of an error or ambiguity in the IFB known to the Bidder, or an error or ambiguity that reasonably should have been known to the Bidder, then the Bidder shall be deemed to have waived the error or ambiguity or its later resolution.

The County may also modify the IFB, no later than forty-eight (48) hours prior to the date and time fixed for submission of Bids, by issuance of an Addendum. All Addenda will be numbered consecutively, beginning with one (1).

3.3 NOTIFICATION OF MOST CURRENT ADDRESS

All Bidders in receipt of this IFB shall notify the Williamson County Purchasing Department of any address changes, contact person changes, and/or telephone number changes no later than forty-eight (48) hours prior to the date and time fixed for submission of Bids.

3.4 SIGNATURE OF BIDDER

A. If the Bidder is a Corporation or Limited Liability Company, the legal name of the Corporation Limited Liability Company shall be provided together with the signature of the officer or officers authorized to sign on behalf of such entity.

B. If the Bidder is a General Partnership, the true name of the firm shall be provided with the signature of each partner authorized to sign.

C. If the Bidder is a Limited Partnership, the name of the Limited Partner's General Partner shall provided with the signature of the officer authorized to sign on behalf of the General Partner.

D. If the Bidder is a Sole Proprietor(s) (individual), each Sole Proprietor(s) shall sign.

E. If signature is by an agent, other than the Sole Proprietor(s) or an officer of a Corporation, Limited Liability Company, General Partner or a member of a General Partnership, a power of attorney equivalent document must be submitted to the Williamson County Purchasing Department.

3.5 ASSUMED BUSINESS NAME

If the Bidder operates business under an Assumed Business Name, the Bidder must have on file with the Williamson County Clerk a current Assumed Name Certificate and provide a file marked copy of same.

3.6 BID OBLIGATION

The contents of the IFB, Bid, and any clarification thereof submitted by the Successful Bidder shall become part of the contractual obligation and incorporated by reference into the Contract and any Ensuing Agreement(s).

3.7 COMPLIANCE WITH IFB SPECIFICATIONS

It is intended that this IFB describe the requirements and the Bid format in sufficient detail to secure comparable Bids. Failure to comply with all provisions of the IFB may, at the sole discretion of the County, result in disqualification.

3.8 WITHDRAWAL OF BID

The Bidder may withdraw its Bid by submitting a written request with the company letterhead and the signature of an authorized individual, as described in Section 3.4, Signature of Bidder, to the Williamson County Purchasing Department any time prior to the submission deadline.

The Bidder may submit a new Bid prior to the deadline. Alterations of the Bid in any manner will not be considered if submitted after the deadline. Withdrawal of a Bid after the deadline will be subject to written approval of the Williamson County Purchasing Agent.

3.9 EVALUATION AND AWARD

The County reserves the right to use all pertinent information (also learned from sources other than disclosed in the Bid process) that might affect the County's judgment as to the appropriateness of award to the lowest and best evaluated Bid. This information may be appended to the Bid evaluation process results. Information on a Bidder from reliable sources, and not within the Bidder's Bid, may also be noted and made part of the evaluation file. The County shall have sole discretion for determining the reliability of the source.

To ensure the proper and fair evaluation of a solicitation, the County prohibits unsolicited communication initiated by the Bidder to the County Official or Employee evaluating or considering the Bids prior to the time an award has been made. Unsolicited communication may be ground for disqualifying the offending Bidder from consideration or award of the solicitation, or any future solicitation.

Communication between the Bidder and the County will be initiated by the appropriate County Official Employee in order to obtain information or clarification needed to develop a proper and accurate evaluation of the solicitation.

The County intends to award a Contract to the most responsible and responsive Bidder whose Bid will be most advantageous to the County. In accordance with Texas Government Code and Local Government Code, the County may consider, to the extent allowed by law, the following:

A. Price;
B. The Bidder's experience and reputation;
C. Quality of the Bidder's goods and/or services;
D. The Bidder's safety record;
E. The Bidder's proposed personnel;
F. The Bidder's financial capabilities; and
G. Any other relevant factors specifically listed in this IFB or authorized by law.

3.10 CONDISERATION OF LOCATION OF PRINCIPAL OFFICE

Pursuant to Texas Local Government Code, Section 271.905, in purchasing any real property or personal property that is not affixed to real property, if the County receives one or more Bids from a Bidder whose principal place of business is in Williamson County and whose Bid is within three (3) percent of the lowest Bid price received by the County from a Bidder who is not a resident of Williamson County, the County may enter into a contract with:

A. The lowest Bidder; or the Bidder whose principal place of business is in Williamson County if the Commissioners Court determines, in writing, that the local Bidder offers the County the best combination of contract price and additional economic development opportunities Williamson County created by the contract award, including the employment of residents Williamson County and increased tax revenues to Williamson County.

3.11 REJECTION OR ACCEPTANCE.

It is understood that the Commissioners Court of Williamson County, Texas, reserves the right to accept or reject any and/or all Bids for any or all goods and/or services covered in this IFB, and to waive informalities or defects in the Bid or to accept such Bid, if it shall deem to be in the best interest of the County.

Awards should be made approximately sixty (60) business days after the Bid opening date. Results may be obtained by viewing the Williamson County vendor portal at the following link:

http://www.wilco.org/CountyDepartments/Purchasing/SearchforaPastBid/tabid/5213/language/en-US/Default.aspx

3.12 RESPONSIBILITY

It is expected that a prospective Bidder will be able to affirmatively demonstrate responsibility. A prospective Bidder should be able to meet the following requirements:

A. Have adequate financial resources, or the ability to obtain such resources as required;
B. Be able to comply with the required or proposed delivery schedule;
C. Have a satisfactory record of performance that can be determined thru references provided; and
D. Be otherwise qualified and eligible to receive an award.

The County may request representation and other information sufficient to determine the Bidder's ability to meet these minimum standards listed above.

3.13 FIRM PRICING

For unit price items, all of the items listed are to be on a “per unit” basis, stating a firm price per unit or unit quantity of each item. The Bidder must submit a firm price that must be good from the date of Bid opening for the fixed period of time set out in this IFB. Unless the IFB expressly states otherwise, this period shall be until the end of the Initial Contract Period.

Bids which do not state a fixed price, or which are subject to change without notice, will not be considered. The Court may award a Contract for the period implied or expressly stated in the lowest and best Bid.

3.14 PURCHASE ORDERS

If required by the Williamson County Purchasing Department, a purchase order(s) may be generated to the Successful Bidder for goods and/or services. If a purchase order is issued, the purchase order number must appear on all itemized invoices and/or requests for payment.

3.15 SILENCE OF SPECIFICATIONS

The apparent silence of these specifications as to any detail or to the apparent omission from it of a detailed description concerning any point, shall be regarded as meaning that only the best practices are to prevail. All interpretations of these specifications shall be made on the basis of this statement.

3.16 REFERENCES

The County may require the Bidder to supply a list of at least three (3) references where like services and/or goods have been supplied by their firm within the past five (5) years, to include names, titles, phone numbers and email addresses of key personnel, and dates of performance.

The County may contact some or all of the references in order to determine the Respondent performance record on work similar to that described in this RFP. The County reserves the right to contact references other than those provided in the response and to use the information gained from them in the evaluation process.

References, if requested, should be provided in accordance with this IFB. Bid may not be deemed complete without the inclusion of requested references.

SECTION 4 - TERMS AND CONDITIONS

4.1 VENUE AND GOVERNING LAW

The Bidder hereby agrees and acknowledges that venue and jurisdiction of any suit, right, or cause of action arising out of or in connection with this IFB, the Contract and any Ensuing Agreement(s), shall lie exclusively in either Williamson County, Texas or in the Austin Division of the Western Federal District of Texas, and the parties hereto expressly consent and submit to such jurisdiction. Furthermore, except to the extent that this IFB, the Contract and any Ensuing Agreement(s) is governed by the laws of the United States, this IFB, the Contract and any Ensuing Agreement(s) shall be governed by and construed in accordance with the laws of the State of Texas, excluding, however, its choice of law rules.

4.2 INCORPORATION BY REFERENCE AND PRECEDENCE

A. The Contract shall be derived from the IFB and its Addenda (if applicable), and the Bidder's Bid. In the event of a dispute under the Contract, applicable documents will be referred to for the purpose of clarification or for additional detail in the following order of precedence:

   1. The IFB and its Addenda (if applicable); and

   2. The Bidder's Bid.

B. In the event the County requires that an Ensuing Agreement be executed following award and a dispute arises between the terms and conditions of the Ensuing Agreement, the IFB and its Addenda (if applicable), and the Bidder's Bid, applicable documents will be referred to for the purpose of clarification or for additional detail in the following order of precedence:

   1. Terms and conditions of the Ensuing Agreement;

   2. The IFB its Addenda; and

   3. The Bidder's Bid.

4.3 OWNERSHIP OF BID

Each Bid shall become the property of the County upon submittal and will not be returned to Bidders unless received after the submittal deadline.

4.4 DISQUALIFICATION OF BIDDER

Upon signing and submittal of the Bid, a Bidder offering to sell supplies, materials, services, or equipment to the County, certifies that the Bidder has not violated the antitrust laws of the State of Texas codified in Business & Commerce Code, Section 15.01, or the Federal Antitrust Laws, and has not communicated directly or indirectly the offer made to any competitor or any other person engaged in such line of business. Any or all Bids may be rejected if the County believes that collusion exists among the Bidders.

4.5 FUNDING

The County intends to budget and make sufficient funds available and authorize funds for expenditure to finance the costs of the Contract. All Bidders understand and agree that the County's payment of amounts under the Contract shall be contingent on the County receiving appropriations or other expenditure authority sufficient to allow the County, in the exercise of reasonable administrative discretion, to make payments under this Contract.

4.6 ASSIGNMENT, SUCCESSORS AND ASSIGNS

The Successful Bidder may not assign, sell, or otherwise transfer the Contract or any other rights or interests obtained under the Contract without written permission of the Commissioners Court. The Contract and any Ensuing Agreement(s) shall be binding upon and inure to the benefit of the contracting parties hereto and their respective successors and permitted assigns.

4.7 IMPLIED REQUIREMENTS

Products or services not specifically described or required in the IFB, but are necessary to provide the functional capabilities described by the Bidder, shall be implied and deemed to be included in the Bid.

4.8 TERMINATION

A. **Termination for Cause:** The County reserves the right to terminate the Contract and/or any Ensuing Agreement(s) for default if the Successful Bidder breaches any of the Bid specifications, terms and conditions, including warranties of the Bidder, if any, or if the Successful Bidder becomes insolvent or commits acts of bankruptcy. Such right of termination is in addition to and not in lieu of any other remedies the County may have at law or in equity or as may otherwise provided hereunder. Default may be construed as, but not limited to, failure to deliver the proper goods and/or services within the proper amount of time, and/or to properly perform any and all other requirements to the County's satisfaction, and/or to meet all other obligations and requirements.

B. **Termination for Convenience:** The County may terminate the Contract and/or any Ensuing Agreement(s) for convenience and without cause or further liability, upon no less than thirty (30) calendar days written notice to the Successful Bidder. The County reserves the right to extend this period if it is in the best interest of the County. In the event the County exercises its right to terminate without cause, it is understood and agreed that only the amounts due to the Successful Bidder for goods, commodities and/or services provided and expenses incurred to and including the date of termination, will be due and payable. No penalty will be assessed for the County termination for convenience.

4.9 NON-PERFORMANCE

It is the objective of the County to obtain complete and satisfactory performance of the requirements set forth herein. In addition to any other remedies available at law, in equity or that may be set out herein, failure to perform may result in a deduction of payment equal to the amount of the goods and/or services that were not provided and/or performed to the County's satisfaction.

In the event of such non-performance, the County shall have the right, but shall not be obligated, to complete the services itself or by others and/or purchase the goods from other sources. If the County elects to acquire the goods or perform the services itself or by others, pursuant to the foregoing, the Successful Bidder shall reimburse the County, within ten (10) calendar days of demand, for all costs incurred by the County (including, without limitation, applicable, general, and administrative expenses, and field overhead, and the cost of necessary equipment, materials, and field labor) in correcting the nonperformance which the Successful Bidder fails to meet pursuant to the requirements set out herein. In the event the Successful Bidder refuses to reimburse the County as set out in this provision, the County shall have the right to deduct such reimbursement amounts from any amounts that may be then owing or that may become owing in the future to the Successful Bidder.

4.10 PROPRIETARY INFORMATION AND THE TEXAS PUBLIC INFORMATION ACT

All material submitted to the County shall become public property and subject to the Texas Public Information Act upon receipt. If a Bidder does not desire proprietary information in the Bid to be disclosed, each page must be clearly identified and marked proprietary at time of submittal or, more preferably, all proprietary information may be placed in a folder or appendix and be clearly identified and marked as being proprietary. Failure to clearly identify and mark information as being proprietary as set forth under this provision will result in all unmarked information being deemed non-proprietary and available to the public. For all information that has not been clearly identified and marked as proprietary by the Bidder, the County may choose to place such information on the County's website and/or a similar public database without obtaining any type of prior consent from the Bidder.

The County will, to the extent allowed by law, endeavor to protect from public disclosure the information that has been identified and marked as proprietary. The final decision as to what information must be disclosed, however, lies with the Texas Attorney General.

To the extent, if any, that any provision in this IFB or in the Bidder's Bid is in conflict with Texas Government Code, Chapter 552, as amended (the "Public Information Act"), the same shall be of no force or effect. Furthermore, it is expressly understood, and agreed, that the County, and its officers and employees, may request advice, decisions and opinions of the Attorney General of the State of Texas in regard to the application of the Public Information Act to any items or data furnished to the County as to whether or not the same are available to the public. It is further understood that the County, and its officers and employees, shall have the right to rely on the advice, decisions and opinions of the Attorney General, and that the County, its officers and employees shall have no liability or obligation to any party hereto for the disclosure to the public, or to any person or persons, of any items or data furnished to the County by a party hereto, in reliance of any advice, decision or opinion of the Attorney General of the State of Texas.

4.11 RIGHT TO AUDIT

The Successful Bidder agrees that the County or its duly authorized representatives shall, until the expiration of three (3) years after termination or expiration of the services to be performed, have access to and the right to examine and photocopy any and all books, documents, papers and records of the Successful Bidder, which are directly pertinent to the services to be performed or goods to be delivered for the purposes of making audits, examinations, excerpts and transcriptions. The Successful Bidder agrees that the County shall have access during normal working hours to all necessary facilities and shall be provided adequate and appropriate work space in order to conduct audits in compliance with the provisions of this section. The County shall give the Successful Bidder reasonable advance notice of intended audits.

4.12 TESTING AND INSPECTIONS

The County reserves the right to inspect and test equipment, supplies, materials and goods for quality and compliance with this IFB, and ability to meet the needs of the user. Demonstration units must be available for review. Should the goods or services fail to meet requirements and/or be unavailable for evaluation, the County can deem the Bidder to be in breach and terminate the Contract and/or any Ensuing Agreement(s).

4.13 BID PREPARATION COSTS

The cost of developing Bids is the sole responsibility of the Bidders and shall not be charged to the County. There is no expressed or implied obligation for the County to reimburse the Bidders for any expense incurred in preparing a Bid in response to this IFB and the County will not reimburse the Bidders for such expenses.

4.14 INDEMNIFICATION

The Successful Bidder shall indemnify, defend and save harmless, the County, its officials, employees, agents and agent's employees from, and against, all claims, liability, and expenses including reasonable attorneys' fees, arising from activities of the Bidder, its agents, servants or employees, performed hereunder that result from the negligent act, error, or omission of the Bidder or any of the Bidder agents, servants or employees, as well as all claims of loss or damage to the Bidder's and the County property, equipment, and/or supplies.

Furthermore, the County, its officials, employees, agents and agents' employees shall not be liable for damages to the Successful Bidder arising from any act of any third party, including, but not limited to, theft. The Successful Bidder further agrees to indemnify, defend and save harmless, the County from its officials, employee, agents and agents' employees against all claims of whatever nature arising from any accident, injury, or damage whatsoever, caused to any person, or the property of any person, occurring in relation to the Successful Bidder's performance of any services requested hereunder during the term of the Contract and/or any Ensuing Agreement(s).

The Successful Bidder shall timely report all claims, demands, suits, actions, proceedings, liens or judgements to the County and shall, upon the receipt of any claim, demand, suit, action, proceeding, lien or judgement, not later than the fifteenth (15^{th}) day of each month; provide the County with a written report on each such matter, setting forth the status of each matter, the schedule or planned proceedings with respect to each matter and the cooperation or assistance, if any, of the County required by the Successful Bidder in the defense of each matter. The Successful Bidder's duty to defend, indemnify and hold the County harmless shall be absolute. It shall not abate or end by reason of the expiration or termination of the Contract and/or any Ensuing Agreement(s), unless otherwise agreed by the County in writing. The provisions of this section shall survive the termination of the Contract and shall remain in full force and effect with respect to all such matters no matter when they arise.

In the event of any dispute between the parties, as to whether a claim, demand, suit, action, proceeding, lien or judgement, that appears to have been caused by or appears to have arisen out of or in connection with acts or omissions of the County, the Bidder shall nevertheless fully defend such claim, demand, suit or action, proceeding, lien or judgement, until and unless there is a determination by a court of competent jurisdiction that the acts and omissions of the Bidder are not an issue in the matter.

The Successful Bidder's indemnification shall cover, and the Successful Bidder agrees to, indemnify the County, in the event the County is found to have been negligent for having selected the Successful Bidder to perform the work described in this request. The provision by the Successful Bidder of insurance shall not limit the liability of the Successful Bidder under the Contract and/or any Ensuing Agreement(s).

4.15 WAIVER OF SUBROGATION

The Successful Bidder and the Successful Bidder's insurance carrier waive any and all rights whatsoever with regard to subrogation against the County as an indirect party to any suit arising out of personal or property damages resulting from the Bidder's performance under this Contract and any Ensuing Agreement(s).

4.16 RELATIONSHIP OF THE PARTIES

The Successful Bidder shall be an independent contractor and shall assume all of the rights, obligations, liabilities, applicable to it as such independent contractor hereunder and any provisions herein which may appear to give the County the right to direct the Successful Bidder as to details of doing work herein covered, or to exercise a measure of control over the work, shall be deemed to mean that the Successful Bidder shall follow the desires of the County in the results of the work only. The County shall not retain or have the right to control the Successful Bidder's means, methods or details pertaining to the Successful Bidder's performance of the work. The County and the Successful Bidder hereby agree and declare that the Successful Bidder is an independent contractor and as such meets the qualifications of an "Independent Contractor" under Texas Workers Compensation Act, Texas Labor Code, Section 406.141, that the Successful Bidder is not an employee of the County, and that the Successful Bidder and its employees, agents and subcontractors shall not be entitled to workers compensation coverage or any other type of insurance coverage held by the County.

4.17 SOLE PROVIDER

The Successful Bidder agrees and acknowledges that it shall not be considered a sole provider of the goods and/or services described herein and that the County may contract with other providers of such goods and/or services if the County deems, at its sole discretion, that multiple providers of the same goods and/or services will serve the best interest of the County.

4.18 FORCE MAJEURE

If the party obligated to perform is prevented from performance by an act of war, order of legal authority, act of God, or other unavoidable cause not attributable to the fault or negligence of said party, the other party shall grant such party relief from the performance. The burden of proof for the need of such relief shall rest upon the party obligated to perform. To obtain release based on force majeure, the party obligated to perform shall file a written request with the other party.

4.19 SEVERABILITY

If any provision of this IFB, the Contract or any Ensuing Agreement(s) shall be held invalid or unenforceable by any court of competent jurisdiction, such holding shall not invalidate or render unenforceable any other provision thereof, but rather the entire IFB, Contract or any Ensuing Agreement (s) will be construed as if not containing the particular invalid or unenforceable provision or provisions, and the rights and obligation of the parties shall be construed and enforced in accordance therewith. The parties acknowledge that if any provision of this IFB, the Contract or any Ensuing Agreement(s) is determined to be invalid or unenforceable, it is the desire and intention of each that such provision be reformed and construed in such a manner that it will, to the maximum extent practicable, give effect to the intent of this IFB, the Contract or any Ensuing Agreement(s) and be deemed to be validated and enforceable.

4.20 EQUAL OPPORTUNITY

Neither party shall discriminate against any employee or applicant for employment because of race, color, sex, religion or national origin.

4.21 NOTICE

Any notice to be given shall be in writing and may be distributed by personal delivery, or by registered or certified mail, return receipt requested, addressed to the proper party, at the following address:

The County: Williamson County Purchasing Department
Attn: Purchasing Agent
901 South Austin Avenue
Georgetown, Texas 78626

The Bidder: Address set out in Bidder's Transmittal Letter.

Notices given in accordance with this provision shall be effective upon (1) receipt by the party to which notice is given, or (2) on the third (3rd) calendar day following mailing, whichever occurs first.

4.22 SALES AND USE TAX EXEMPTION

The County is a body, corporate and politic, under the laws of the State of Texas and claims exemption from sales and use taxes under Texas Tax Code, Section 151.309, as amended, and the services and/or goods subject hereof are being secured for use by the County.

4.23 COMPLIANCE WITH LAWS

The County and the Successful Bidder shall comply with all federal, state, and local laws, statutes, ordinances, rules and regulations, and the orders and decrees of any courts or administrative bodies or tribunals in any matter affecting the performance of the Contract and any Ensuing Agreement(s), including, without limitation, Workers' Compensation laws, salary and wage statutes and regulations, licensing laws and regulations. When required, the Successful Bidder shall furnish the County with certification of compliance with said laws, statues, ordinances, rules, regulations, orders, and decrees above specified.

4.24 INCORPORATION OF EXHIBITS, APPENDICES AND ATTACHMENTS

All of the Exhibits, Appendices and Attachments referred to herein are incorporated by reference as if set forth verbatim herein. Any conflicting terms in the Contract documents will be resolved at the sole discretion of the Commissioners Court.

4.25 NO WAIVER OF IMMUNITIES

Nothing herein shall be deemed to waive, modify or amend any legal defense available at law or in equity to the County, its past or present officers, employees, or agents, nor to create any legal rights or claim on behalf of any third party. The County does not waive, modify, or alter to any extent whatsoever the availability of the defense of governmental immunity under the laws of the State of Texas and of the United States.

4.26 NO WAIVER

The failure or delay of any party to enforce at any time or any period of time any of the provisions of this IFB, the Contract or any Ensuing Agreement(s) shall not constitute a present or future waiver of such provisions nor the right of either party to enforce each and every provision. Furthermore, no term or provision hereof shall be deemed waived and no breach excused unless such waiver or consent shall be in writing and signed by the party claimed to have waived or consented. Any consent by any party to, or waiver of, a breach by the other, whether expressed or implied, shall not constitute a consent to, waiver of or excuse for any other, different or subsequent breach.

4.27 CURRENT REVENUES

The obligations of the parties under the Contract and any Ensuing Agreement(s) do not constitute a general obligation or indebtedness of the County for which the County is obligated to levy, pledge, or collect any of taxation. It is understood and agreed that the County shall have the right to terminate the Contract and any Ensuing Agreement(s) at the end of any the County fiscal year if the governing body of the County does not appropriate sufficient funds as determined by the County's budget for the fiscal year in question. The County may effect such termination by giving written notice of termination to the Successful Bidder at the end of its then-current fiscal year.

4.28 FOB DESTINATION

To the extent applicable to this IFB, all of the items listed are to be Free On Board to final destination (FOB Destination) with all transportation charges if applicable to be included in the Bid, unless otherwise specified in the Invitation for Bids. The title and risk of loss of the goods shall not pass to the County until receipt and acceptance takes place at the FOB Destination point.

4.29 BINDING EFFECT

This Contract and any Ensuing Agreement(s) shall be binding upon and inure to the benefit of the parties and their respective permitted assigns and successors.

4.30 ASSIGNMENT

The Successful Bidder's interest and duties hereunder may not be assigned or delegated to a third party without the express written consent of the County.

4.31 SAFETY

The Successful Bidder is responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with any services to be provided hereunder. The safety program shall comply with all applicable requirements of the current federal Occupational Safety and Health Act and all other applicable federal, state and local laws and regulations.

4.32 GENERAL OBLIGATIONS AND RELIANCE

The Successful Bidder shall perform all services and/or provide all goods, as well as those reasonably inferable and necessary for completion and provision of services and/or goods required hereunder. The Successful Bidder shall keep the County informed of the progress and quality of the services. The Successful Bidder agrees and acknowledges that the County is relying on the Successful Bidder's represented expertise and ability to provide the goods and/or services described herein. The Successful Bidder agrees to use its best efforts, skill, judgment, and abilities to perform its obligations in accordance with the highest standards used in the profession and to further the interests of the County accordance with the County's requirements and procedures. The Successful Bidder's duties, set forth herein, shall at no time be in any way diminished by reason of any approval by the County, nor shall the Successful Bidder be released from any liability by reason of such approval by the County, it being understood that the County at all times is ultimately relying upon the Successful Bidder's skill and knowledge in performing the services and providing any goods required hereunder.

4.33 ESTIMATED QUANTITIES

To the extent applicable to this IFB, the estimated quantity of each item listed in this IFB is only estimate; the actual quantity to be purchased may be more or less. The County is not obligated purchase any minimum amount, and the County may purchase any reasonable amount greater than the estimate for the same unit price. Any limit on quantities available must be stated expressly in the Bid.

4.34 CONTRACTUAL DEVELOPMENT

The contents of the IFB and the Successful Bidder's Bid will become an integral part of the Contract, but may be modified, at the County's sole discretion, by provisions of an Ensuing Agreement. Therefore, the Bidder must agree to an inclusion of an Ensuing Agreement of the Bid specifications, terms and conditions of this IFB. If an Ensuing Agreement is required under this IFB, information relative to t Agreement will be located in the Special Provisions Section of this IFB.

4.35 SURVIVABILITY

All applicable agreements that were entered into between the Successful Bidder and the County, under the terms and conditions of the Contract and/or any Ensuing Agreement(s), shall survive the expiration or termination thereof for ninety (90) days unless a new contract has been awarded.

The County may exercise, by written notice to the Successful Bidder no later than ten (10) calendar days of the Contract expiration, this clause for emergencies only.

4.36 AIR QUALITY

In determining the overall best Bid, the County may, to the extent applicable, exercise the option granted to local governments under the Texas Local Government Code, Section 271.907.

This option allows the County to evaluate Bids and give preference to goods and/or services of a Bidder that demonstrates that the Bidder meets or exceeds any and all state or federal environmental standards, including voluntary standards, relating to air quality. If the Bid being submitted will have an effect on air quality for the County (as it relates to any state, federal, or voluntary air quality standard), then the Bidder is encouraged to provide information in narrative indicating the anticipated air quality impact. All Bidders are expected to meet all mandated state and federal air quality standards.

4.37 ENTIRE AGREEMENT

The Contract and any Ensuing Agreement(s) shall supersede all prior Agreements, written or oral between the Successful Bidder and the County and shall constitute the entire Agreement and understanding between the parties with respect to the services and/or goods to be provided. Each of the provisions herein shall be binding upon the parties and may not be waived, modified, amended or altered, except by writing signed by the Successful Bidder and the County.

4.38 PAYMENT

The County's payment for goods and services shall be governed by the Texas Government Code, Chapter 2251. An invoice shall be deemed overdue the thirty-first (31st) day after the later of the following:

A. The date the County receives the goods under the Contract;
B. The date the performance of the service under the Contract is completed; or
C. The date the Williamson County Auditor receives an invoice for the goods or services.

Interest charges for any overdue payments shall be paid by the County in accordance with Texas Government Code, Section 2251.025. More specifically, the rate of interest that shall accrue on a late payment is the rate in effect on September 1 of the County's fiscal year in which the payment becomes due. The said rate in effect on September 1 shall be equal to the sum of one (1) percent, and the prime rate published in the Wall Street Journal on the first (1st) day of July of the preceding fiscal year that does not fall on a Saturday or Sunday.

In the event that an error appears in an invoice submitted by the Successful Bidder, the County shall notify the Successful Bidder of the error not later than the twenty-first (21st) day after the date the County receives the invoice. If the error is resolved in favor of the Successful Bidder, the Successful Bidder shall be entitled to receive interest on the unpaid balance of the invoice submitted by the Successful Bidder beginning on the date that the payment for the invoice became overdue. If the error is resolved in favor of the County, the Successful Bidder shall submit a corrected invoice that must be paid in accordance within the time set forth above. The unpaid balance accrues interest as provided by the Texas Government Code, Chapter 2251, if the corrected invoice is not paid by the appropriate date.

As a minimum, invoices shall include:

A. Name, address, and telephone number of the Successful Bidder and similar information in the event the payment is to be made to a different address.

B. The County Contract, Purchase Order.

C. Identification of items or service as outlined in the Contract.

D. Quantity or quantities, applicable unit prices, total prices and total amount.

E. Any additional payment information which may be called for by the Contract.

Payment inquiries should be directed to the following address:

Williamson County Auditor's Office, Accounts Payable Department
Email: accountspayable@wilco.org
Phone: 512-943-1500

4.39 CONTRACTUAL FORMATION AND ENSUING AGREEMENT

The IFB and the Bidder's Bid, when properly accepted by the Commissioners Court, shall constitute a Contract equally binding between the Successful Bidder and the County.

If an Ensuing Agreement is required by this IFB, that information will be provided in Special Provisions section of this IFB. The Successful Bidder shall be required to execute the Agreement at the Williamson County Purchasing Department approximately ten (10) calendar days after the Successful Bidder is notified of award. The Ensuing Agreement shall be in the same form as the Agreement which is attached to the end of this IFB. The only anticipated changes in the Ensuing Agreement will be to include additional exhibits, to fill in blanks to identify the Successful Bidder, and terms relating to the compensation, or to revise the Agreement to accommodate corrections, changes in the scope of services, or changes pursuant to Addenda issued. **Bidders should raise any questions regarding the terms of the Agreement in the form of written questions or submittals as described in the Public Announcement and General Information portion of this IFB.** Because the signed Ensuing Agreement will be substantively and substantially derived from the attached Agreement, each Bidder is urged to seek independent legal counsel as to any questions about the terms, conditions or provisions contained in the Agreement *before* submitting a Bid. Again, the attached Agreement, if applicable, contains important legal provisions and is considered part and parcel of this IFB. Failure or refusal to sign aforesaid Agreement shall be grounds for the County to revoke any award which has been issued, forfeit Bid security, if applicable, and select another Bidder.

4.40 COOPERATIVE PURCHASING PROGRAM

During the term of the Contract resulting from this IFB, the County would like to afford the same prices, terms and conditions to other political subdivisions or public entities. Another entity's participation in the Contract resulting from this IFB is subject to a properly authorized Purchasing Cooperative Inter-local Agreement with the County. Any liability created by purchase orders issued against the Contract shall be the sole responsibility of the governmental agency placing the order.

4.41 INSURANCE REQUIREMENTS

To the extent applicable Insurance information will appear in the Additional Stipulations section that is in this IFB Package.

4.42 BIDDERS BOND, WARRANTY BOND, PERFORMANCE AND PAYMENT BONDS

To the extent applicable Bond information will appear in the Additional Stipulations section that is in this IFB Package.

4.43 LEGAL LIABILITY INFORMATION

The Successful Bidder shall disclose all legal liability information by listing any pending litigation anticipated litigation that your firm is involved in including, but not limited to, potential or actual legal matters with private parties and any local, state, federal or international governmental entities. The County reserves the right to consider legal liability information in the recommendation of any proposed contract to the Commissioners Court.

4.44 INCLEMENT WEATHER

In case of inclement weather or any other unforeseen event causing the County to close for business on the date of a Bid submission deadline, the Bid closing will automatically be postponed until the next business day the County is open. If inclement weather conditions or any other unforeseen event causes delays in carrier service operations, the County may issue an Addendum to all known Bidders interested in the project to extend the deadline. It will be the responsibility of the Bidder to notify the County of their interest in the project if these conditions are impacting their ability to turn in a submission within the stated deadline. The County reserves the right to make the final judgement call to extend any deadline.

4.45 CONFIDENTIALITY

The Bidder expressly agrees that it will not use any direct or incidental confidential information that may be obtained while working in a governmental setting for its own benefit, and agrees that it will not access unauthorized areas or confidential information and it will not disclose any information to unauthorized third parties, and will take care to guard the security of the information at all times.

Additional Stipulations

1 Additional Stipulations

1.1 Introduction

The Bid evaluation and selection process is detailed in this section, as are other factors, and the format in which the Price Bid of each Bid should be submitted.

1.2 Technical Contact

J. Terron Evertson, P.E. (or successor), County Engineer, Williamson County 3151 South East Inner Loop, Suite B, Georgetown, Texas shall serve as the County's Technical Contact with designated responsibility to ensure compliance with the requirements of the Contract and any Ensuing Agreement, such as, but not limited to, acceptance, inspection and delivery. The Technical Contact together with the Purchasing Department will serve as a liaison between the Williamson County Commissioners Court and the Successful Bidder.

1.3 Contract Term

The Successful Bidder shall provide the goods and/or services described herein for an initial term of twelve (12) months, beginning March 27, 2018 and ending March 26, 2019.

1.4 Contract Extensions

At the end of the current fiscal year, the Commissioners Court reserves the right to extend this contract, by mutual agreement of both parties, as it deems to be in the best interest of the County. This extension will be in twelve (12) months increments for up to an additional twenty-four (24) months, with the terms and conditions remaining the same unless if requested by the successful bidder and approved be the Commissioners Court, a price escalation at renewal time is awarded of no more than the consumer price index, All urban consumers (CPI-U), US City Average, all items, as published by the United States department of Labor, Bureau of Labor Statistics.

The yearly increase in the CPI shall be the latest index published one hundred and eighty (180) days prior to the end of the contract year. The total period of this contract, including all extension will not exceed a maximum combined period of thirty-six (36) months. The extension of this contract is contingent on the appropriation of necessary funds by Commissioners Court for the fiscal year in question. Upon the failure of Commissioners Court to so appropriate in any year, the successful bidder may elect to terminate this agreement, with no additional liability to the County. The County and successful bidder agree that termination shall be the successful bidder's sole remedy under this circumstance.

1.5 Economic Adjustment

To the extent applicable to this IFB, the Successful Bidder may submit a request for a contract pricing adjustment for approval by the County if the Bidder can show just cause substantiating an adjustment. The requested adjustment must be for goods and/or services and in no way represent an increase in the Bidder's profits, labor or other overhead. The Bidder's request must include evidence in the form of a certified statement or affidavit from the supplier or manufacturer detailing the price adjustment, the effective date for the adjustment, and any other information requested by the Purchasing Department to verify the adjustment.

An adjustment request will not become effective until after approval of the Williamson County Commissioners Court. Until then, the original contract pricing will remain unchanged. If an issue regarding an adjustment request is not resolved, the Purchasing Department reserves the right to seek competition from other sources.

Any goods or services delivered by the Successful Bidder at a not agreed upon price are done so at the Successful Bidder's risk.

Pricing must remain firm for the first three (3) months of the initial contract period. A minimum period of three (3) months must elapse between adjustment requests.

1.6 Insurance Requirements

By signing its Bid, the Bidder agrees to maintain at all times during any term of the Contract and any ensuing Agreement at Bidder's cost, insurance in accordance with this provision.

Bidder will be required to submit Certificates of Insurance **prior to contract award and any renewals.**

All certificates of insurance coverage as specified below must be provided to the following location:

Williamson County Purchasing Department
901 S Austin Ave
Georgetown, Texas 78626

Failure to comply with these Insurance Requirements may result in the termination of the Contract and any ensuing Agreement(s) between the Successful Bidder and County.

The following coverage limits shall be required at a minimum:

A. Worker's Compensation — Statutory – Texas Law

B. Employer's Liability:

Bodily Injury by Accident	$500,000 Ea. Accident
Bodily Injury by Disease	$500,000 Ea. Employee
Bodily Injury by Disease	$500,000 Policy Limit

C. Comprehensive general liability including completed operations and contractual liability insurance for bodily injury, death, or property damages in the following amounts:

COVERAGE	PER PERSON	PER OCCURRENCE
Comprehensive General Liability	$1,000,000	$1,000,000
Aggregate policy limits:	$1,000,000	

Successful Bidder's property will not be covered by any insurance that may be carried by Williamson County. Successful Bidder assumes the risk of loss on its contents and property that are situated on/in/around Williamson County property. The Successful Bidder is strongly encouraged to obtain insurance on its property to the extent deemed necessary by the Successful Bidder.

The deductible for an insurance policy required hereunder shall not exceed $100,000. **Williamson**

County shall be named as an additional insured under any policy of insurance required hereunder.

Successful Bidder shall not commence any work until it has obtained all required insurance and such insurance has been approved by County. Successful Bidder shall not allow any subcontractor(s) to commence work to be performed until all required insurance has been obtained by such subcontractor(s) and approved by County. Approval of the insurance by County shall not relieve or decrease the liability of Successful Bidder or its subcontractor(s) hereunder.

The required insurance must be written by a company approved to do business in the State of Texas with a financial standing of at least an A- rating, as reflected in Best's insurance ratings or by a similar rating system recognized within the insurance industry at the time the policy is issued. Successful Bidder shall furnish County with a certificate of coverage issued by the insurer. Successful Bidder shall not cause any insurance to be canceled nor permit any insurance to lapse. ALL INSURANCE CERTIFICATES SHALL INCLUDE A CLAUSE TO THE EFFECT THAT THE POLICY SHALL NOT BE CANCELED OR REDUCED, RESTRICTED OR LIMITED UNTIL TEN (10) CALENDAR DAYS AFTER COUNTY HAS RECEIVED WRITTEN NOTICE AS EVIDENCED BY RETURN RECEIPT OF REGISTERED OR CERTIFIED LETTER.

It is the intention of the County, and agreed to and hereby acknowledged by the Successful Bidder, that no provision of this Contract or any ensuing Agreement shall be construed to require the County to submit to mandatory arbitration or mediation in the settlement of any claim, cause of action or dispute, except as specifically required in direct connection with an insurance claim or threat of claim under an insurance policy required hereunder which absolutely requires arbitration or mediation of such claim, or as otherwise required by law or a court of law with jurisdiction over the provisions of this Contract or any ensuing Agreement.

General Notes and Technical Specifications

Definition of Terms

County: Williamson County acting through the Road and Bridge Division.

Contractor: Successful bidder of the attached Invitation for Bid.

Engineer: Williamson County Director of Road and Bridge, or designee.

Inspector: Engineer's designee assigned full, or part, time to the contractor's crew for the oversight of the work.

Specifications: Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges 2014.

TxDOT: Texas Department of Transportation

Working Day: Monday through Friday (excluding County approved holidays), if weather permits the performance of the contract (as determined by the inspector) for a continuous period of at least 6 hrs. (excluding lunch) between 8:00 A.M. and 5:00 P.M.

Control of Materials

Source Control. The Contractor shall use only materials that meet Contract requirements. Unless otherwise specified or approved by the Engineer, the Contractor shall use new materials for the work. The Contractor shall secure the Engineer's approval of the proposed source of materials to be used before their delivery to the site. Materials can be approved by the Engineer at a supply source or staging area but may be re-inspected at the job site. Contractor shall be responsible for cost of additional sampling and testing if material source changes.

Material Quality. It is the Contractor's responsibility to correct or remove materials that fail to meet the contract requirements.

Materials not meeting Contract requirements will be rejected, unless the Engineer approves corrective actions. Upon rejection by the Engineer, the Contractor must immediately remove and replace rejected materials.

If the Contractor does not comply with this Article, the County may remove and replace defective material. The cost of testing, removal, and replacement will be deducted from invoice submitted to the County.

Manufacturer Warranties. Contractor shall transfer to the County warranties and guarantees required by the Contract, from Contractor sources, or received as part of normal trade practice.

Plant Inspection and Testing. The Engineer may, but is not obligated to, inspect materials at the acquisition or manufacturing source. Material samples will be obtained and tested for compliance with quality requirements. Materials produced under County inspection are for County use only unless released in writing by the Engineer.

If inspection is at the plant, Contractor shall meet the following conditions unless otherwise specified:

- Cooperate fully and assist the Engineer during the inspection.
- Ensure the Engineer has full access to all parts of the plant used to manufacture or produce materials.
- In accordance with pertinent items and the Contract, provide a facility at the plant for use by the Engineer as an office or laboratory.

The Engineer may provide inspection for periods other than daylight hours if:

- Continuous production of materials for County use is necessary due to the production volume being handled at the plant, and
- The lighting is adequate to allow satisfactory inspection.

General Notes

All work performed and all products furnished under the provision of the Contract shall comply with requirements which pertain to the various items of work included herein as *Standard Specifications for Construction of Highways, Streets and Bridges* of the Texas Department of Transportation, adopted November, 2014, and as amended and/or updated, which is incorporated herein by reference for all purposes. In the event that any specification set out herein conflicts with the said TxDOT specifications, the specification set out herein shall control and govern.

The actual quantity required may be varied from the estimated quantities in the contract. The Contractor shall be compensated for completed work based on actual quantities per bid item.

Contractor shall begin work within ten (10) working days of the Purchase Order issue date. Purchase Orders may include additional plans describing the work and the allowable number of working days or day of completion for which work must be completed.

Final cleanup will include the removal of excess material considered detrimental to vegetation growth within the working area. Materials such as excess concrete and other materials, as specified by the Engineer, will be removed at the Contractor's expense.

Contractor shall determine the exact location of all existing utilities before commencing work and is fully responsible for any and all damages associated by Contractor's failure to locate and preserve utilities.

Contractor shall maintain positive drainage for permanent and temporary site conditions for duration of project.

Contractor shall comply with insurance requirements dictated within this contract.

Do not park equipment or make stockpiles where driver sight distance to businesses and side street intersections is obstructed, especially after work hours. If it is necessary to park where drivers' views are blocked, Contractor shall make every effort to flag traffic accordingly. Give the travelling public first priority.

If multiple days are required to complete work, Contractor shall not leave work in hazardous conditions, as determined by Engineer.

Working day charges will begin within ten (10) days after the Purchase Order issue date, but not before, and will continue in accordance with the time allotted in the Purchase Order.

Once work begins, Contractor shall continuously execute the work until completion, unless otherwise directed by Engineer.

If Contractor cannot complete work within the number of working days or day of completion as dictated on Purchase Order, Contractor shall submit a revised progress schedule to be approved by Engineer. A revised progress schedule shall be submitted in writing by the Contractor within ten (10) working days of the Purchase Order issue date. The Engineer reserves the right to reject the proposed revised progress schedule.

Nighttime, weekend and holiday work is allowed with prior approval by Engineer.

The Contractor shall perform work during appropriate weather conditions, unless otherwise directed by the Engineer. If work is performed at the Contractor's option during, or prior to, inclement weather conditions and the work is damaged, the Contractor is responsible for all costs associated with replacing the work.

All construction equipment involved in roadway work shall be equipped with a permanently mounted 360 degree revolving or strobe warning light with amber lens. This light shall have a minimum lens height of 5 inches and a diameter of 5 inches.

This light shall have a mounting height of not less than 6 feet above the roadway surface and shall be visible from all sides. This equipment shall also have attached at each side of the rear end of the vehicle an approved orange warning flag mounted not less than 6 feet above the roadway surface.

Care shall be exercised to prevent damage to all property in and around the construction zone. The Contractor shall be liable for the repair and restoration of any property damaged as a result of the contractor's prosecution of the work.

This shall include, but is not limited to, re-vegetation of all areas damaged or destroyed by construction. Contractor will be held liable and responsible for such areas until growth is reestablished to the satisfaction of the County.

Ornamental landscape plantings of trees, shrubs and grasses that are damaged or destroyed during construction shall be replaced with plant material of comparable size and quality approved by the County.

Contractor's equipment and vehicles shall not be maintained on-site during construction, except at designated maintenance sites as approved by the Inspector.

An English-speaking Superintendent shall be available on the project at all times when work is being performed. The Contractor shall provide the Inspector with contact information for the Superintendent.

Contractor shall provide at least one portable restroom near the work site(s) at all times in order to provide a bathroom to individuals providing work hereunder. Contractor shall monitor and prevent its employees and any of its subcontractors that are providing work on the project from urinating or defecating on property in, on or adjacent to the areas in which work is being performed.

ITEMS 421, 423, 432, 465, 466, 467, 529, AND 531

For any single project that requires 7 cubic yards of concrete or less, Williamson County will provide the required concrete. In such cases, Contractor shall provide labor only and payment for services will reflect labor only.

Contractor shall not use wire-mesh, welded wire reinforcing, or similar for concrete reinforcing.

ITEM 421 – Hydraulic Cement Concrete

The specifications are amended by special provision 421—035.

Overdesign requirements, as defined in section 421.4 (A) Table 6 of the specifications, for compressive strength in non-structural elements are waived.

Minimum air entrainment requirements, as defined in section 421.4 (A) 2 Table 7 of the specifications, for all classes of concrete, except S, CO and DO, are waived. For all non-structural concrete, the entrained air content shall not exceed 8%.

ITEM 423 – Retaining Walls

Retaining wall backfill limits of excavation and excess material haul-off will be subsidiary to pertinent bid item. Backfill material will be provided by the County, if necessary.

Refer to TxDOT spread footing retaining wall standard drawings.

ITEM 432 – Riprap

Typical riprap shall be placed at a 5 inch thickness, or as directed by the Engineer.

Where proposed concrete riprap ties to existing concrete riprap, Contractor shall saw cut existing, and dowel and epoxy the joint before placing proposed riprap, to be subsidiary to pertinent bid item.

ITEM 465 – Manholes and Inlets

Construction of drop inlets shall be in accordance with the TxDOT Austin District Standards.

The specifications are amended by special provision 465--001.

ITEM 466 – Headwalls and Wingwalls

For conditions where the culvert is skewed to the roadway alignment, the County will provide the appropriate plans and/or standards.

For box culverts, safety end treatment pipe runners shall be provided and installed by the County.

Before the execution of work on box culvert end treatments, details and plan sheets will be provided to the Contractor. To the extent possible, design will follow TxDOT standard plan sheets.

ITEM 467 – Safety End Treatment

Contractor shall cut extruding pipe ends, in the field, to match roadway or driveway side slope and shall use asphalt based paint on cut end.

ITEM 496 - Removing Structures

If necessary, contractor shall perform traffic control for any structure removal, as directed by the Engineer.

Item 500 – Mobilization

This item shall conform to TxDOT Specification Item 500, Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges 2004 with the following exceptions:

> **500.3 (A) is changed to:** Payment will be made upon presentation of a paid invoice for the payment bond, performance bond, and required insurance. The combined payment for bonds and insurance will be no more than 10% of the mobilization lump sum or 1% of the total Contract amount, whichever is less. However, payment will be made for the actual cost of the paid invoice when the combined payment for bonds and insurance exceeds 10% of the mobilization lump sum or 1% of the total Contract amount, whichever is less.

500.3 (B) Deleted.

ITEM 502 - Barricades, Signs and Traffic Handling

This item will not be paid for directly but shall be considered subsidiary to various bid items.

Contractor shall provide all traffic control measures to prosecute the work in conformance with the Texas Manual on Uniform Traffic Control Devices, latest edition.

The Contractor will be required to maintain a minimum of one through lane in each direction during daylight hours on all roadways, except with written approval by the Inspector. Two lane roadways shall use single lane traffic control, which will require the use of flagmen. This shall not be paid for directly, but shall be considered subsidiary to various bid items.

Flaggers must comply with all requirements outlined in TxDOT Specification Item 502.2B.

Limiting access to all side streets and driveways shall be minimized to the extent possible.

The Contractor's crew leader shall be a competent person who will be responsible and available on the project site or in the immediate area to insure compliance with the TCP.

ITEM 529 - Concrete Curb, Gutter, and Combined Curb and Gutter

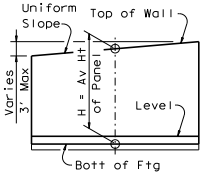
If proposed curb and gutter is to be placed adjacent to existing pavement, Contractor shall sawcut existing pavement to obtain a straight and clean edge that is absent of any chipping or flaking of existing pavement. Any damage to the edge of the pavement will be repaired by the Contractor as approved by the Engineer.

ITEM 531 - Sidewalks

Notify property owners who utilize access of sidewalk 48 hours in advance of proposed work.

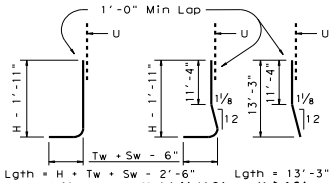
Access to property must be provided at all times by the Contractor.

Construction of sidewalks shall be accordance with the TxDOT Austin District Standards.



H DEFINITION

Wall Height "H"	PROPERTIES							REINFORCING STEEL FOR ONE 32' PANEL (DESIGN A)																												QUANTITY FOR ONE 32' PANEL		Wall Height "H"
	WALL DIMENSIONS						Max Soil Press	A_1 ~ 26 #5 at 15" c-c		A_2 ~ 25 #6 at 15" c-c		A_3 ~ 25 #7 at 15" c-c		A_4 ~ 26 #8 at 15" c-c		A_5 ~ 25 #9 at 15" c-c		A_6 ~ 25 #11 at 15" c-c		A_7 ~ 26 #11 at 15" c-c		B ~ 26 #5 at 15" c-c		C						D (#5) at 12" c-c		Dowel F at 12" c-c		H (#5) at 12" c-c		T (#5) at 12" c-c		U ~ 26 #5 at 15" c-c		CONC (CY)	REINF (LB)	
(Ft)	Fw	Tw	Sw	Hw	Ft	Kw	T/SF	Lgth	Wt	Lgth	Wt	Lgth	Wt	Lgth	Wt	Lgth	Wt	Lgth	Wt	Lgth	Wt	Lgth	Wt	Size	No	Spa	Lgth	Wt	No	Wt	No	Wt	No	Wt	No	Wt	Lgth	Wt			(Ft)
2	1'-8"	8"	1'-0"	0	9"	9"	0.11																						4	131	3	24			2	66	3'-4"	90	3.6	312	2
3	2'-0"	1'-0"	1'-0"	0	9"	9"	0.15																						6	197	4	32	2	66	2	66	5'-4"	145	5.1	506	3
4	2'-8"	1'-4"	1'-0"	4"	1'-0"	9"	0.21	3'-10"	104													3'-6"	95	#4	26	15"	1'-10"	32	8	263	6	48	2	66	2	66	7'-4"	199	7.4	873	4
5	3'-6"	1'-9"	1'-0"	9"	1'-0"	9"	0.23	5'-3"	142													4'-6"	122	#4	26	15"	2'-3"	39	10	329	7	56	2	66	3	99	8'-4"	226	9.6	1079	5
6	4'-3"	2'-2"	1'-0"	1'-1"	1'-0"	9"	0.24	6'-8"	181													5'-6"	149	#4	26	15"	2'-8"	46	12	394	8	64	3	99	3	99	8'-4"	226	11.6	1259	6
7	5'-0"	2'-6"	1'-0"	1'-6"	1'-0"	9"	0.27	8'-0"	217													6'-6"	176	#4	26	15"	3'-0"	52	14	460	9	72	3	99	3	99	8'-4"	226	13.7	1401	7
8	5'-8"	2'-10"	1'-0"	1'-10"	1'-0"	9"	0.30	9'-4"	253													7'-6"	203	#4	26	15"	3'-4"	58	16	526	10	80	3	99	4	131	8'-4"	226	15.7	1575	8
9	6'-4"	3'-2"	1'-0"	2'-2"	1'-0"	9"	0.33	10'-8"	284													8'-6"	231	#4	26	15"	3'-8"	64	18	591	11	88	3	99	4	131	8'-4"	226	17.7	1714	9
10	7'-0"	3'-6"	1'-0"	2'-6"	1'-0"	9"	0.36	12'-0"	325	4'-2"	156											9'-6"	258	#4	38	10"	4'-0"	102	20	657	12	96	4	131	4	131	8'-4"	226	19.6	2082	10
11	7'-9"	3'-10"	1'-0"	2'-11"	1'-0"	9"	0.39	13'-4"	362	5'-4"	200											10'-6"	285	#6	38	10"	4'-4"	247	22	723	13	104	4	131	5	164	8'-4"	226	21.7	2436	11
12	8'-6"	4'-3"	1'-0"	3'-3"	1'-0"	9"	0.40	14'-9"	400	6'-7"	247											11'-6"	312	#6	38	10"	4'-9"	271	24	789	14	112	4	131	5	164	8'-4"	226	23.8	2651	12
13	9'-2"	4'-7"	1'-0"	3'-7"	1'-0"	9"	0.43	16'-1"	436	7'-8"	288	6'-9"	345									12'-6"	339	#7	38	10"	5'-1"	395	26	854	15	120	5	164	6	197	8'-4"	226	25.8	3364	13
14	9'-10"	4'-11"	1'-0"	3'-11"	1'-0"	1'-0"	0.47	17'-5"	472	8'-11"	335	8'-1"	413									13'-6"	366	#8	38	10"	5'-5"	550	28	920	16	128	5	164	6	197	8'-4"	226	28.2	3771	14
15	10'-6"	5'-3"	1'-1 1/8"	4'-1 7/8"	1'-0"	1'-0"	0.50	18'-10"	511	10'-1"	379	9'-6"	485									14'-6"	393	#9	38	10"	5'-9"	743	30	986	17	136	6	197	6	197	8'-4"	226	30.3	4253	15
16	11'-2"	5'-7"	1'-2"	4'-5"	1'-3"	1'-3"	0.55	13'-3"	359	11'-2"	419	10'-11"	558	8'-5"	584							15'-6"	420	#9	38	10"	6'-1"	786	32	1051	18	144	6	197	7	230	8'-4"	226	36.0	4974	16
17	11'-10"	5'-11"	1'-3 1/8"	4'-7 7/8"	1'-3"	1'-3"	0.58	13'-3"	359	12'-5"	466	12'-4"	630	9'-10"	683							16'-6"	447	#9	38	10"	6'-5"	829	34	1117	19	152	7	230	7	230	8'-4"	226	38.5	5369	17
18	12'-6"	6'-3"	1'-4"	4'-11"	1'-6"	1'-3"	0.63	13'-3"	359	13'-7"	510	13'-9"	703	11'-2"	775							17'-6"	475	#9	38	10"	6'-9"	872	34	1117	19	152	7	230	8	263	8'-4"	226	44.3	5682	18
19	13'-3"	6'-7"	1'-5"	5'-3"	1'-6"	1'-6"	0.66	13'-3"	359	14'-9"	554	15'-2"	775	12'-8"	879							18'-6"	502	#9	38	10"	7'-2"	926	36	1183	20	160	7	230	8	263	8'-4"	226	48.1	6057	19
20	13'-10"	6'-11"	1'-6 1/4"	5'-4 3/4"	1'-6"	1'-6"	0.70	13'-3"	359	15'-11"	598	16'-7"	847	14'-1	978							19'-6"	529	#10	38	10"	7'-5"	1213	38	1248	21	168	8	263	8	263	8'-4"	226	50.9	6692	20
21	14'-6"	7'-3"	1'-7"	5'-8"	1'-9"	1'-6"	0.75	13'-3"	359	11'-2"	419	18'-0"	920	15'-5"	1070	9'-7"	815					20'-6"	556	#10	38	10"	7'-9"	1267	40	1314	22	176	8	263	9	296	8'-4"	226	57.7	7681	21
22	15'-2"	7'-7"	1'-8 1/8"	5'-10 5/8"	1'-9"	1'-6"	0.78	13'-3"	359	11'-2"	419	19'-5"	992	16'-11"	1174	10'-11"	928					21'-6"	583	#10	38	10"	8'-1"	1322	42	1380	23	184	8	263	9	296	8'-4"	226	61.0	8126	22
23	16'-0"	8'-0"	1'-9 1/4"	6'-2 3/4"	1'-9"	1'-6"	0.79	13'-3"	359	11'-2"	419	20'-11"	1069	18'-5"	1278	12'-4"	1048					22'-6"	610	#8	76	5"	8'-6"	1725	44	1446	24	192	9	296	10	329	8'-4"	226	64.8	8997	23
24	16'-6"	8'-3"	1'-10 1/8"	6'-4 7/8"	2'-0"	1'-6"	0.86	13'-3"	359	11'-2"	419	22'-3"	1137	19'-9"	1371	13'-7"	1155					23'-6"	637	#8	76	5"	8'-9"	1776	46	1511	25	200	9	296	10	329	8'-4"	226	72.4	9416	24
25	17'-3"	8'-7"	1'-11 1/4"	6'-8 3/4"	2'-0"	1'-6"	0.89	13'-3"	359	11'-2"	419	12'-2"	622	21'-2"	1469	15'-0"	1275	6'-1"	808			24'-6"	664	#8	76	5"	9'-2"	1860	48	1577	26	208	9	296	10	329	8'-4"	226	76.4	10112	25
26	18'-0"	9'-0"	2'-0 1/8"	6'-11 1/8"	2'-3"	1'-6"	0.93	13'-3"	359	11'-2"	419	12'-2"	622	22'-8"	1574	16'-4"	1388	7'-1"	941			25'-6"	692	#8	76	5"	9'-6"	1928	50	1643	27	217	10	329	11	361	8'-4"	226	85.2	10698	26
27	18'-6"	9'-4"	2'-1 1/4"	7'-0 3/4"	2'-3"	1'-6"	0.97	13'-3"	359	11'-2"	419	12'-2"	622	24'-1"	1672	17'-8"	1502	8'-1"	1074			26'-6"	719	#9	76	5"	9'-10"	2541	52	1708	28	225	10	329	11	361	8'-4"	226	89.0	11757	27
28	19'-3"	9'-7"	2'-2 3/8"	7'-5 5/8"	2'-3"	1'-9"	1.00	13'-3"	359	11'-2"	419	12'-2"	622	25'-5"	1764	19'-0"	1615	9'-1"	1206			27'-6"	746	#9	76	5"	10'-1"	2606	54	1774	29	233	10	329	12	394	8'-4"	226	94.5	12293	28
29	20'-0"	10'-0"	2'-3 1/2"	7'-8 1/2"	2'-3"	1'-9"	1.02	13'-3"	359	11'-2"	419	12'-2"	622	27'-0"	1874	20'-5"	1735	10'-1"	1339			28'-6"	773	#9	76	5"	10'-5"	2692	56	1840	30	241	11	361	12	394	8'-4"	226	99.2	12874	29
30	20'-6"	10'-4"	2'-4 5/8"	7'-9 3/8"	2'-3"	1'-9"	1.06	13'-3"	359	11'-2"	419	12'-2"	622	14'-4"	995	21'-9"	1849	11'-1"	1472	17'-0"	2348	29'-6"	800	#10	76	5"	10'-9"	3516	58	1906	31	249	11	361	12	394	8'-4"	226	103.3	15515	30
31	21'-3"	10'-7"	2'-5 3/4"	8'-2 1/4"	2'-3"	1'-9"	1.09	13'-3"	359	11'-2"	419	12'-2"	622	14'-4"	995	23'-0"	1955	12'-1"	1605	18'-4"	2533	30'-6"	827	#10	76	5"	11'-2"	3652	60	1971	32	257	11	361	13	427	8'-4"	226	108.2	16209	31
32	22'-0"	11'-0"	2'-6 1/2"	8'-5 1/2"	2'-6"	1'-9"	1.13	13'-3"	359	11'-2"	419	12'-2"	622	14'-4"	995	24'-5"	2075	13'-1"	1738	19'-10"	2740	31'-6"	854	#10	76	5"	11'-6"	3761	60	1971	32	257	12	394	13	427	8'-4"	226	118.9	16837	32



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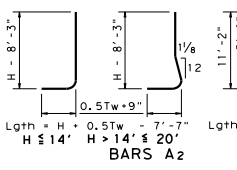

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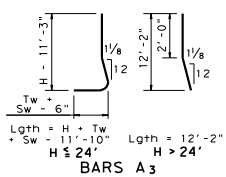

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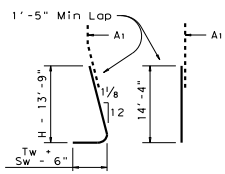

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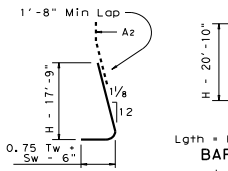

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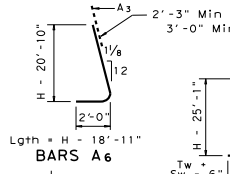

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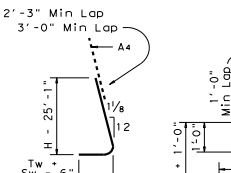

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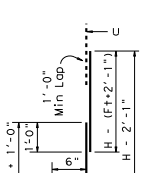
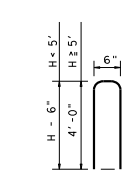
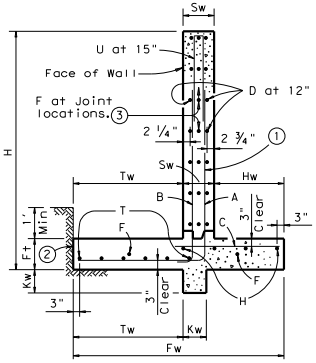


BARS B

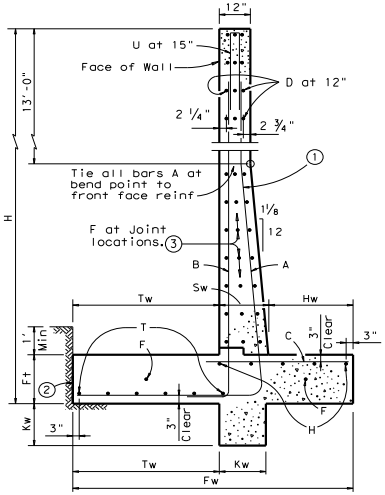


BARS U

1. Place vertical bars inside of horizontal bars (Typ both faces).
2. Place footing toe against undisturbed soil.
3. See standard RW 2 for size.

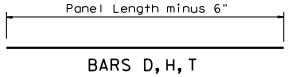


H ≤ 14'

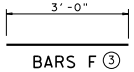


H > 14'

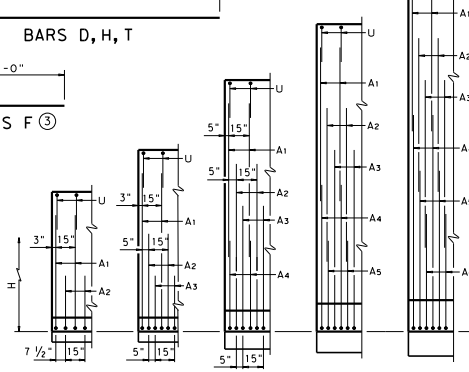
SECTIONS



BARS D, H, T



BARS F ③



PARTIAL WALL ELEVATIONS

(Showing vertical reinforcing pattern in back face)

GENERAL NOTES:
All concrete to be Class "C".
All reinforcing steel to be Grade 60.
For notes and details not shown on this sheet see sheet RW2.
Quantities are based on "H" being average height of panel.
Retaining Walls are designed to be coded as follows on Retaining Wall Layout Sheets.

HC - 21 - 28
LA - 28 - 32
- Panel Length ~ 32' is standard; 28' requires special quantities
- Average Height "H" of panel
- Design - A = no surcharge or slope above wall; B = slopes up to 4:1; C = traffic surcharge and/or slopes up to 2.5:1
- Footing pressure design ~ L = low, H = high

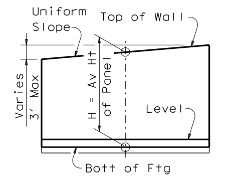
Texas Department of Transportation — Bridge Division Standard

RETAINING WALLS

RW 1(L)A

FILE:	rwstde05.dgn	DN: TxDOT	CK: TxDOT	DW: GHO	CK: MPM
©TxDOT	March 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS		DIST	COUNTY		SHEET NO.

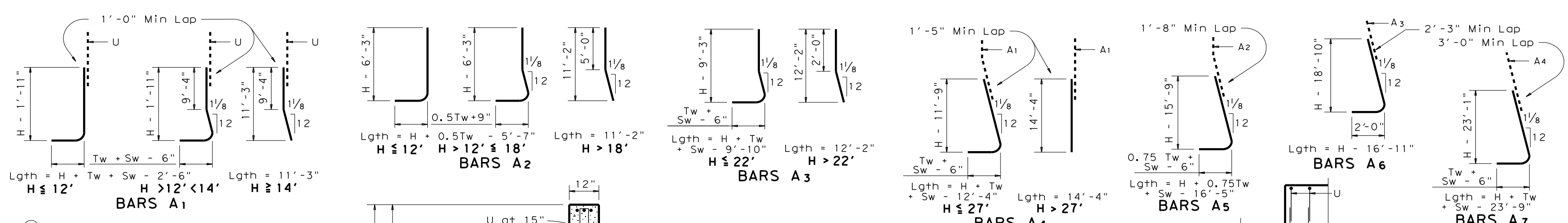
DATE:
FILE:

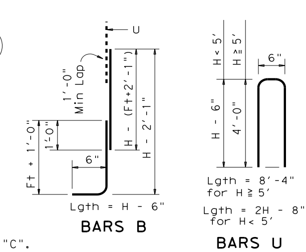


H DEFINITION

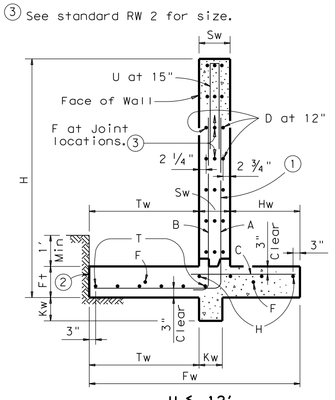
PROPERTIES / REINFORCING STEEL FOR ONE 32' PANEL (DESIGN B) / QUANTITY FOR ONE 32' PANEL

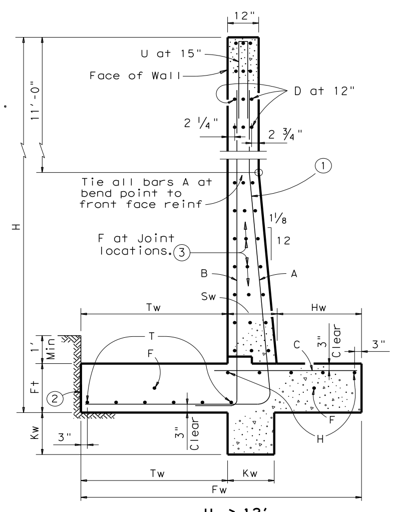
Wall Height "H" (Ft)	Fw	Tw	Sw	Hw	Ft	Kw	Max Soil Press T/SF	A1 ~ 26 #5 at 15" c-c Lgth	A1 Wt	A2 ~ 25 #6 at 15" c-c Lgth	A2 Wt	A3 ~ 25 #7 at 15" c-c Lgth	A3 Wt	A4 ~ 26 #8 at 15" c-c Lgth	A4 Wt	A5 ~ 25 #9 at 15" c-c Lgth	A5 Wt	A6 ~ 25 #11 at 15" c-c Lgth	A6 Wt	A7 ~ 26 #11 at 15" c-c Lgth	A7 Wt	B ~ 26 #5 at 15" c-c Lgth	B Wt	C Size	C No	C Spa	C Lgth	C Wt	D (#5) at 12" c-c No	D Wt	Dowel F at 12" c-c No	Dowel F Wt	H (#5) at 12" c-c No	H Wt	T (#5) at 12" c-c No	T Wt	U ~ 26 #5 at 15" c-c Lgth	U Wt	CONC (CY)	REINF (LB)	Wall Height "H" (Ft)
2	2'-8"	1'-4"	1'-0"	4"	1'-0"	9"	0.15																	#4	26	15"	1'-10"	32	4	131	4	32	2	66	2	66	3'-4"	90	5.0	418	2
3	3'-6"	1'-9"	1'-0"	9"	1'-0"	9"	0.18																	#4	26	15"	2'-3"	39	6	197	5	40	2	66	3	99	5'-4"	145	7.2	586	3
4	4'-3"	2'-2"	1'-0"	1'-1"	1'-0"	9"	0.21	4'-8"	127													3'-6"	95	#4	26	15"	2'-8"	46	8	263	6	48	3	99	3	99	7'-4"	199	9.3	976	4
5	5'-0"	2'-6"	1'-0"	1'-6"	1'-0"	9"	0.24	6'-0"	163													4'-6"	122	#4	26	15"	3'-0"	52	10	329	7	56	3	99	3	99	8'-4"	226	11.3	1146	5
6	5'-8"	2'-10"	1'-0"	1'-10"	1'-0"	9"	0.28	7'-4"	199													5'-6"	149	#4	26	15"	3'-4"	58	12	394	8	64	3	99	4	131	8'-4"	226	13.3	1321	6
7	6'-4"	3'-2"	1'-0"	2'-2"	1'-0"	9"	0.31	8'-8"	235													6'-6"	176	#4	26	15"	3'-8"	64	14	460	9	72	3	99	4	131	8'-4"	226	15.3	1463	7
8	7'-0"	3'-6"	1'-0"	2'-6"	1'-0"	9"	0.35	10'-0"	271	4'-2"	156											7'-6"	203	#4	38	10"	4'-0"	102	16	526	10	80	4	131	4	131	8'-4"	226	17.3	1825	8
9	7'-9"	3'-10"	1'-0"	2'-11"	1'-0"	9"	0.38	11'-4"	307	5'-4"	200											8'-6"	231	#6	38	10"	4'-4"	247	18	591	11	88	4	131	5	164	8'-4"	226	19.3	2185	9
10	8'-6"	4'-3"	1'-0"	3'-3"	1'-0"	9"	0.40	12'-9"	346	6'-7"	247											9'-6"	258	#6	38	10"	4'-9"	271	20	657	12	96	4	131	5	164	8'-4"	226	21.4	2396	10
11	9'-2"	4'-7"	1'-0"	3'-7"	1'-0"	9"	0.43	14'-1"	382	7'-8"	288	6'-9"	345									10'-6"	285	#7	38	10"	5'-1"	395	22	723	13	104	5	164	6	197	8'-4"	226	23.4	3103	11
12	9'-10"	4'-11"	1'-0"	3'-11"	1'-0"	1'-0"	0.46	15'-5"	418	8'-11"	335	8'-1"	413									11'-6"	312	#8	38	10"	5'-5"	550	24	789	14	112	5	164	6	197	8'-4"	226	25.9	3515	12
13	10'-6"	5'-3"	1'-1 1/8"	4'-1 7/8"	1'-0"	1'-0"	0.50	16'-10"	456	10'-1"	379	9'-6"	485									12'-6"	339	#9	38	10"	5'-9"	743	26	854	15	120	6	197	6	197	8'-4"	226	27.9	3996	13
14	11'-2"	5'-7"	1'-2"	4'-5"	1'-3"	1'-3"	0.55	11'-3"	307	11'-2"	419	10'-11"	558	8'-5"	584							13'-6"	366	#9	38	10"	6'-1"	786	28	920	16	128	6	197	7	230	8'-4"	226	33.7	4721	14
15	11'-10"	5'-11"	1'-3 1/8"	4'-7 7/8"	1'-3"	1'-3"	0.59	11'-3"	307	12'-5"	466	12'-4"	630	9'-10"	683							14'-6"	393	#9	38	10"	6'-5"	829	30	986	17	136	7	230	7	230	8'-4"	226	36.1	5116	15
16	12'-6"	6'-3"	1'-4"	4'-11"	1'-6"	1'-3"	0.64	11'-3"	307	13'-7"	510	13'-9"	703	11'-2"	775							15'-6"	420	#9	38	10"	6'-9"	872	30	986	17	136	7	230	8	263	8'-4"	226	41.9	5427	16
17	13'-3"	6'-7"	1'-5"	5'-3"	1'-6"	1'-6"	0.67	11'-3"	307	14'-9"	554	15'-2"	775	12'-8"	879							16'-6"	447	#9	38	10"	7'-2"	926	32	1051	18	144	7	230	8	263	8'-4"	226	45.7	5802	17
18	13'-10"	6'-11"	1'-6 1/4"	5'-4 3/4"	1'-6"	1'-6"	0.71	11'-3"	307	15'-11"	598	16'-7"	847	14'-1	978							17'-6"	475	#10	38	10"	7'-5"	1213	34	1117	19	152	8	263	8	263	8'-4"	226	48.5	6439	18
19	14'-6"	7'-3"	1'-7"	5'-8"	1'-9"	1'-6"	0.76	11'-3"	307	11'-2"	419	18'-0"	920	15'-5"	1070	9'-7"	815					18'-6"	502	#10	38	10"	7'-9"	1267	36	1183	20	160	8	263	9	296	8'-4"	226	55.4	7428	19
20	15'-2"	7'-7"	1'-8 1/8"	5'-10 7/8"	1'-9"	1'-6"	0.80	11'-3"	307	11'-2"	419	19'-5"	992	16'-11"	1174	10'-11"	928					19'-6"	529	#10	38	10"	8'-1"	1322	38	1248	21	168	8	263	9	296	8'-4"	226	58.7	7872	20
21	16'-0"	8'-0"	1'-9 1/4"	6'-2 3/4"	1'-9"	1'-6"	0.81	11'-3"	307	11'-2"	419	20'-11"	1069	18'-5"	1278	12'-4"	1048					20'-6"	556	#8	76	5"	8'-6"	1725	40	1314	22	176	9	296	10	329	8'-4"	226	62.4	8743	21
22	16'-6"	8'-3"	1'-10 1/8"	6'-4 7/8"	2'-0"	1'-6"	0.88	11'-3"	307	11'-2"	419	22'-3"	1137	19'-9"	1371	13'-7"	1155					21'-6"	583	#8	76	5"	8'-9"	1776	42	1380	23	184	9	296	10	329	8'-4"	226	70.0	9163	22
23	17'-3"	8'-7"	1'-11 1/4"	6'-8 3/4"	2'-0"	1'-6"	0.91	11'-3"	307	11'-2"	419	12'-2"	622	21'-2"	1469	15'-0"	1275	6'-1"	808			22'-6"	610	#8	76	5"	9'-2"	1860	44	1446	24	192	9	296	10	329	8'-4"	226	74.0	9859	23
24	18'-0"	9'-0"	2'-0 1/8"	6'-11 7/8"	2'-3"	1'-6"	0.95	11'-3"	307	11'-2"	419	12'-2"	622	22'-8"	1574	16'-4"	1388	7'-1"	941			23'-6"	637	#8	76	5"	9'-6"	1928	46	1511	25	200	10	329	11	361	8'-4"	226	82.9	10443	24
25	18'-6"	9'-4"	2'-1 1/4"	7'-0 3/4"	2'-3"	1'-6"	0.99	11'-3"	307	11'-2"	419	12'-2"	622	24'-1"	1672	17'-8"	1502	8'-1"	1074			24'-6"	664	#9	76	5"	9'-10"	2541	48	1577	26	208	10	329	11	361	8'-4"	226	86.6	11502	25
26	19'-3"	9'-7"	2'-2 3/8"	7'-5 5/8"	2'-3"	1'-9"	1.03	11'-3"	307	11'-2"	419	12'-2"	622	25'-5"	1764	19'-0"	1615	9'-1"	1206			25'-6"	692	#9	76	5"	10'-1"	2606	50	1643	27	217	10	329	12	394	8'-4"	226	92.1	12040	26
27	20'-0"	10'-0"	2'-3 1/2"	7'-8 1/2"	2'-3"	1'-9"	1.05	11'-3"	307	11'-2"	419	12'-2"	622	27'-0"	1874	20'-5"	1735	10'-1"	1339			26'-6"	719	#9	76	5"	10'-5"	2692	52	1708	28	225	11	361	12	394	8'-4"	226	96.8	12621	27
28	20'-6"	10'-4"	2'-4 5/8"	7'-9 3/8"	2'-3"	1'-9"	1.09	11'-3"	307	11'-2"	419	12'-2"	622	14'-4"	995	21'-9"	1849	11'-1"	1472	17'-0"	2348	27'-6"	746	#10	76	5"	10'-9"	3516	54	1774	29	233	11	361	12	394	8'-4"	226	100.9	15261	28
29	21'-3"	10'-7"	2'-5 3/4"	8'-2 1/4"	2'-3"	1'-9"	1.12	11'-3"	307	11'-2"	419	12'-2"	622	14'-4"	995	23'-0"	1955	12'-1"	1605	18'-4"	2533	28'-6"	773	#10	76	5"	11'-2"	3652	56	1840	30	241	11	361	13	427	8'-4"	226	105.8	15955	29
30	22'-0"	11'-0"	2'-6 1/2"	8'-5 1/2"	2'-6"	1'-9"	1.16	11'-3"	307	11'-2"	419	12'-2"	622	14'-4"	995	24'-5"	2075	13'-1"	1738	19'-10"	2740	29'-6"	800	#10	76	5"	11'-6"	3761	56	1840	30	241	12	394	13	427	8'-4"	226	116.5	16584	30



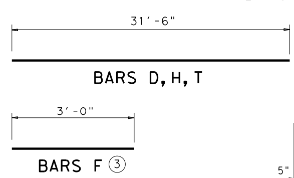


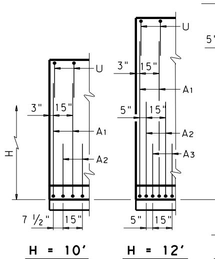
1. Place vertical bars inside of horizontal bars (Typ both faces).
2. Place footing toe against undisturbed soil.
3. See standard RW 2 for size.

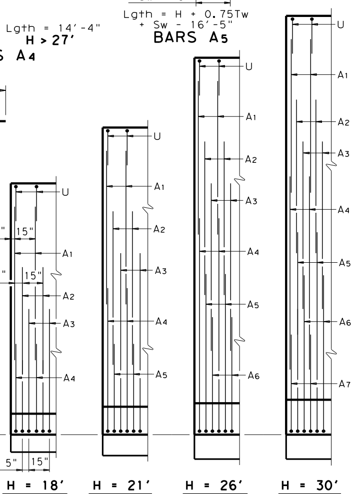




SECTIONS







PARTIAL WALL ELEVATIONS

(Showing vertical reinforcing pattern in back face)

GENERAL NOTES:

All concrete to be Class "C".
All reinforcing steel to be Grade 60.
For notes and details not shown on this sheet see sheet RW2.
Quantities are based on "H" being average height of panel.
Retaining Walls are designed to be coded as follows on Retaining Wall Layout Sheets.

HC - 21 - 28
LA - 28 - 32

- Panel Length ~ 32' is standard; 28' requires special quantities
- Average Height "H" of panel
- Design - A = no surcharge or slope above wall
  - B = slopes up to 4:1
  - C = traffic surcharge and/or slopes up to 2.5:1
- Footing pressure design ~ L = low, H = high

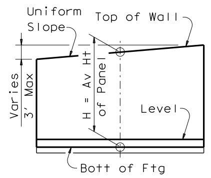
Texas Department of Transportation — Bridge Division Standard

RETAINING WALLS

RW 1(L)B

FILE: rwstde06.dgn	DN: TxDOT	CK: TxDOT	DW: GHO	CK: MPM
©TxDOT March 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS	DIST	COUNTY		SHEET NO.

DATE:
FILE:

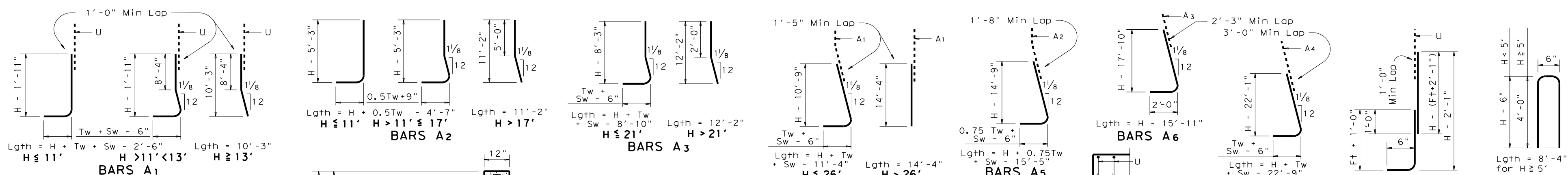


H DEFINITION

PROPERTIES / REINFORCING STEEL FOR ONE 32' PANEL (DESIGN C)

Wall Height "H" (Ft)	Fw	Tw	Sw	Hw	Ft	Kw	Max Soil Press T/SF	A1 ~ 26 #5 at 15" c-c Lgth	A1 Wt	A2 ~ 25 #6 at 15" c-c Lgth	A2 Wt	A3 ~ 25 #7 at 15" c-c Lgth	A3 Wt	A4 ~ 26 #8 at 15" c-c Lgth	A4 Wt	A5 ~ 25 #9 at 15" c-c Lgth	A5 Wt
2	3'-6"	1'-9"	1'-0"	9"	1'-0"	9"	0.14										
3	4'-3"	2'-2"	1'-0"	1'-1"	1'-0"	9"	0.17										
4	5'-0"	2'-6"	1'-0"	1'-6"	1'-0"	9"	0.20	5'-0"	136								
5	5'-8"	2'-10"	1'-0"	1'-10"	1'-0"	9"	0.24	6'-4"	172								
6	6'-4"	3'-2"	1'-0"	2'-2"	1'-0"	9"	0.28	7'-8"	208								
7	7'-0"	3'-6"	1'-0"	2'-6"	1'-0"	9"	0.32	9'-0"	244	4'-2"	156						
8	7'-9"	3'-10"	1'-0"	2'-11"	1'-0"	9"	0.35	10'-4"	280	5'-4"	200						
9	8'-6"	4'-3"	1'-0"	3'-3"	1'-0"	9"	0.37	11'-9"	319	6'-7"	247						
10	9'-2"	4'-7"	1'-0"	3'-7"	1'-0"	9"	0.41	13'-1"	355	7'-8"	288	6'-9"	345				
11	9'-10"	4'-11"	1'-0"	3'-11"	1'-0"	1'-0"	0.44	14'-5"	391	8'-11"	335	8'-1"	413				
12	10'-6"	5'-3"	1'-1 1/8"	4'-1 7/8"	1'-0"	1'-0"	0.45	15'-10"	429	10'-1"	379	9'-6"	485				
13	11'-2"	5'-7"	1'-2"	4'-5"	1'-3"	1'-3"	0.54	10'-3"	278	11'-2"	419	10'-11"	558	8'-5"	584		
14	11'-10"	5'-11"	1'-3 1/8"	4'-7 7/8"	1'-3"	1'-3"	0.57	10'-3"	278	12'-5"	466	12'-4"	630	9'-10"	683		
15	12'-6"	6'-3"	1'-4"	4'-11"	1'-6"	1'-3"	0.63	10'-3"	278	13'-7"	510	13'-9"	703	11'-2"	775		
16	13'-3"	6'-7"	1'-5"	5'-3"	1'-6"	1'-6"	0.66	10'-3"	278	14'-9"	554	15'-2"	775	12'-8"	879		
17	13'-10"	6'-11"	1'-6 1/4"	5'-4 3/4"	1'-6"	1'-6"	0.70	10'-3"	278	15'-11"	598	16'-7"	847	14'-1	978		
18	14'-6"	7'-3"	1'-7"	5'-8"	1'-9"	1'-6"	0.76	10'-3"	278	11'-2"	419	18'-0"	920	15'-5"	1070	9'-7"	815
19	15'-2"	7'-7"	1'-8 1/8"	5'-10 7/8"	1'-9"	1'-6"	0.79	10'-3"	278	11'-2"	419	19'-5"	992	16'-11"	1174	10'-11"	928
20	16'-0"	8'-0"	1'-9 1/4"	6'-2 3/4"	1'-9"	1'-6"	0.80	10'-3"	278	11'-2"	419	20'-11"	1069	18'-5"	1278	12'-4"	1048
21	16'-6"	8'-3"	1'-10 1/8"	6'-4 7/8"	2'-0"	1'-6"	0.88	10'-3"	278	11'-2"	419	22'-3"	1137	19'-9"	1371	13'-7"	1155
22	17'-3"	8'-7"	1'-11 1/4"	6'-8 3/4"	2'-0"	1'-6"	0.91	10'-3"	278	11'-2"	419	12'-2"	622	21'-2"	1469	15'-0"	1275
23	18'-0"	9'-0"	2'-0 1/8"	6'-11 7/8"	2'-3"	1'-6"	0.95	10'-3"	278	11'-2"	419	12'-2"	622	22'-8"	1574	16'-4"	1388
24	18'-6"	9'-4"	2'-1 1/4"	7'-0 3/4"	2'-3"	1'-6"	0.99	10'-3"	278	11'-2"	419	12'-2"	622	24'-1"	1672	17'-8"	1502
25	19'-3"	9'-7"	2'-2 3/8"	7'-5 5/8"	2'-3"	1'-9"	1.03	10'-3"	278	11'-2"	419	12'-2"	622	25'-5"	1764	19'-0"	1615
26	20'-0"	10'-0"	2'-3 1/2"	7'-8 1/2"	2'-3"	1'-9"	1.05	10'-3"	278	11'-2"	419	12'-2"	622	27'-0"	1874	20'-5"	1735
27	20'-6"	10'-4"	2'-4 5/8"	7'-9 3/8"	2'-3"	1'-9"	1.09	10'-3"	278	11'-2"	419	12'-2"	622	14'-4"	995	21'-9"	1849
28	21'-3"	10'-7"	2'-5 3/4"	8'-2 1/4"	2'-3"	1'-9"	1.13	10'-3"	278	11'-2"	419	12'-2"	622	14'-4"	995	23'-0"	1955
29	22'-0"	11'-0"	2'-6 1/2"	8'-5 1/2"	2'-6"	1'-9"	1.17	10'-3"	278	11'-2"	419	12'-2"	622	14'-4"	995	24'-5"	2075

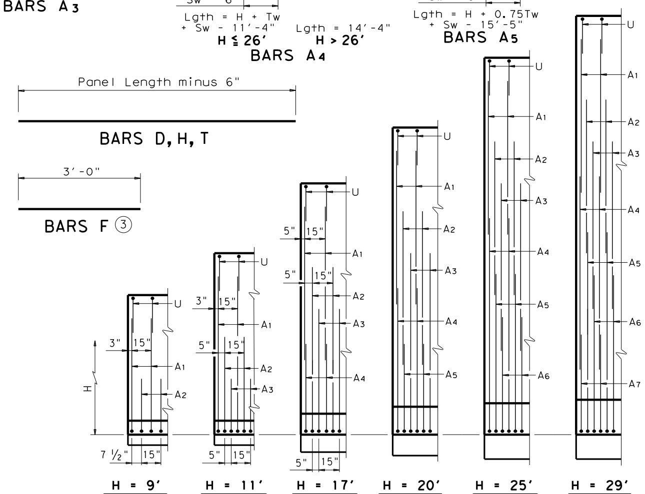
Wall Height "H" (Ft)	A6 ~ 25 #11 at 15" c-c Lgth	A6 Wt	A7 ~ 26 #11 at 15" c-c Lgth	A7 Wt	B ~ 26 #5 at 15" c-c Lgth	B Wt	C Size	C No	C Spa	C Lgth	C Wt	D (#5) at 12" c-c No	D Wt	Dowel F at 12" c-c No	Dowel F Wt	H (#5) at 12" c-c No	H Wt	T (#5) at 12" c-c No	T Wt	U ~ 26 #5 at 15" c-c Lgth	U Wt	Quantity for one 32' Panel CONC (CY)	REINF (LB)	Wall Height "H" (Ft)
2							#4	26	15"	2'-3"	39	4	131	4	32	2	66	3	99	3'-4"	90	6.0	458	2
3							#4	26	15"	2'-8"	46	6	197	5	40	3	99	3	99	5'-4"	145	8.1	626	3
4					3'-6"	95	#4	26	15"	3'-0"	52	8	263	6	48	3	99	3	99	7'-4"	199	10.1	991	4
5					4'-6"	122	#4	26	15"	3'-4"	58	10	329	7	56	3	99	4	131	8'-4"	226	12.1	1193	5
6					5'-6"	149	#4	26	15"	3'-8"	64	12	394	8	64	3	99	4	131	8'-4"	226	14.1	1336	6
7					6'-6"	176	#4	38	10"	4'-0"	102	14	460	9	72	4	131	4	131	8'-4"	226	16.1	1698	7
8					7'-6"	203	#6	38	10"	4'-4"	247	16	526	10	80	4	131	5	164	8'-4"	226	18.1	2056	8
9					8'-6"	231	#6	38	10"	4'-9"	271	18	591	11	88	4	131	5	164	8'-4"	226	20.2	2268	9
10					9'-6"	258	#7	38	10"	5'-1"	395	20	657	12	96	5	164	6	197	8'-4"	226	22.2	2981	10
11					10'-6"	285	#8	38	10"	5'-5"	550	22	723	13	104	5	164	6	197	8'-4"	226	24.7	3382	11
12					11'-6"	312	#9	38	10"	5'-9"	743	24	789	14	112	6	197	6	197	8'-4"	226	26.7	3868	12
13					12'-6"	339	#9	38	10"	6'-1"	786	26	854	15	120	6	197	7	230	8'-4"	226	32.5	4591	13
14					13'-6"	366	#9	38	10"	6'-5"	829	28	920	16	128	7	230	7	230	8'-4"	226	34.9	4986	14
15					14'-6"	393	#9	38	10"	6'-9"	872	28	920	16	128	7	230	8	263	8'-4"	226	40.8	5298	15
16					15'-6"	420	#9	38	10"	7'-2"	926	30	986	17	136	7	230	8	263	8'-4"	226	44.5	5672	16
17					16'-6"	447	#10	38	10"	7'-5"	1213	32	1051	18	144	8	263	8	263	8'-4"	226	47.3	6308	17
18					17'-6"	475	#10	38	10"	7'-9"	1267	34	1117	19	152	8	263	9	296	8'-4"	226	54.2	7298	18
19					18'-6"	502	#10	38	10"	8'-1"	1322	36	1183	20	160	8	263	9	296	8'-4"	226	57.5	7743	19
20					19'-6"	529	#8	76	5"	8'-6"	1725	38	1248	21	168	9	296	10	329	8'-4"	226	61.3	8613	20
21					20'-6"	556	#8	76	5"	8'-9"	1776	40	1314	22	176	9	296	10	329	8'-4"	226	68.8	9033	21
22	6'-1"	808			21'-6"	583	#8	76	5"	9'-2"	1860	42	1380	23	184	9	296	10	329	8'-4"	226	72.8	9729	22
23	7'-1"	941			22'-6"	610	#8	76	5"	9'-6"	1928	44	1446	24	192	10	329	11	361	8'-4"	226	81.7	10314	23
24	8'-1"	1074			23'-6"	637	#9	76	5"	9'-10"	2541	46	1511	25	200	10	329	11	361	8'-4"	226	85.4	11372	24
25	9'-1"	1206			24'-6"	664	#9	76	5"	10'-1"	2606	48	1577	26	208	10	329	12	394	8'-4"	226	91.0	11909	25
26	10'-1"	1339			25'-6"	692	#9	76	5"	10'-5"	2692	50	1643	27	217	11	361	12	394	8'-4"	226	95.6	12491	26
27	11'-1"	1472	17'-0"	2348	26'-6"	719	#10	76	5"	10'-9"	3516	52	1708	28	225	11	361	12	394	8'-4"	226	99.7	15132	27
28	12'-1"	1605	18'-4"	2533	27'-6"	746	#10	76	5"	11'-2"	3652	54	1774	29	233	11	361	13	427	8'-4"	226	104.6	15825	28
29	13'-1"	1738	19'-10"	2740	28'-6"	773	#10	76	5"	11'-6"	3761	54	1774	29	233	12	394	13	427	8'-4"	226	115.3	16454	29

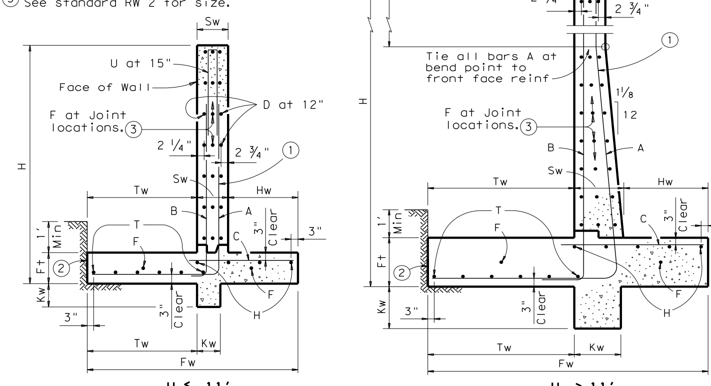


① Place vertical bars inside of horizontal bars (Typ both faces).

② Place footing toe against undisturbed soil.

③ See standard RW 2 for size.





SECTIONS

PARTIAL WALL ELEVATIONS

(Showing vertical reinforcing pattern in back face)

GENERAL NOTES:

All concrete to be Class "C".
All reinforcing steel to be Grade 60.
For notes and details not shown on this sheet see sheet RW2.
Quantities are based on "H" being average height of panel.
Retaining Walls are designed to be coded as follows on Retaining Wall Layout Sheets.

HC - 21 - 28
LA - 28 - 32

- Panel Length ~ 32' is standard; 28' requires special quantities
- Average Height "H" of panel
- Design - A = no surcharge or slope above wall
  - B = slopes up to 4:1
  - C = traffic surcharge and/or slopes up to 2.5:1
- Footing pressure design ~ L = low, H = high

Texas Department of Transportation
Bridge Division Standard

RETAINING WALLS

RW 1(L)C

FILE: rwstde07.dgn	DN: TxDOT	CK: TxDOT	DW: GHO	CK: MPM
©TxDOT March 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS	DIST	COUNTY		SHEET NO.

DATE:
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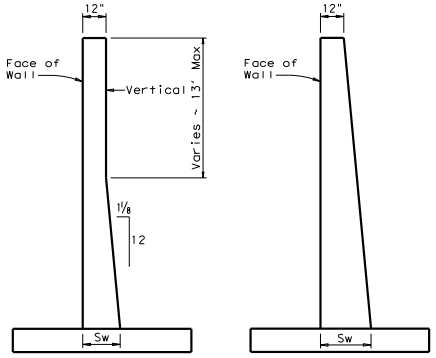
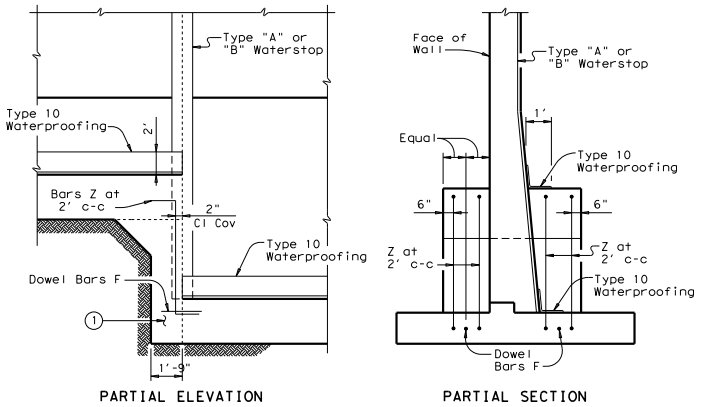


AS DETAILED ALL HEIGHTS
(Basis for payment)

FRONT FACE VERTICAL BACK FACE SLOPED

ALTERNATE STEM SLOPE DETAILS

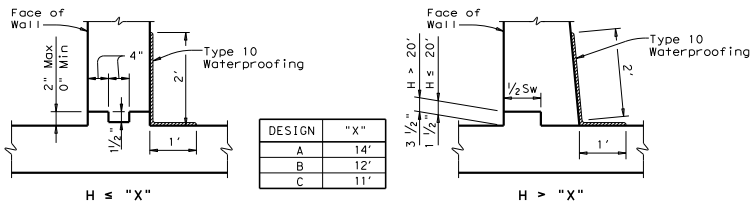
Walls with slopes other than those shown may be used after approval by the Engineer. Sw shall not be less than shown in Table on Sheet 1. No payment will be made for excess concrete due to changing of slope of wall stem.



PARTIAL ELEVATION PARTIAL SECTION

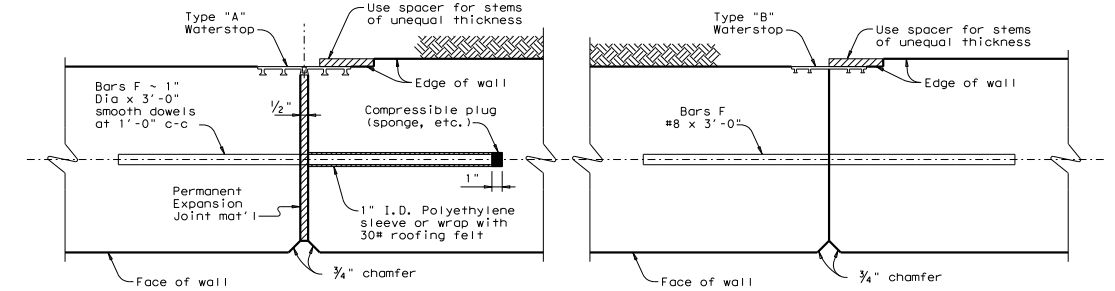
SHOWING WATERSTOP AT FOOTING JOINT

(1) Unreinforced Class "C" Concrete when difference in top of footing elevations is less than 6'. Omit when Dowel Bars F can be placed between adjacent footings with 4" cover top and bottom.

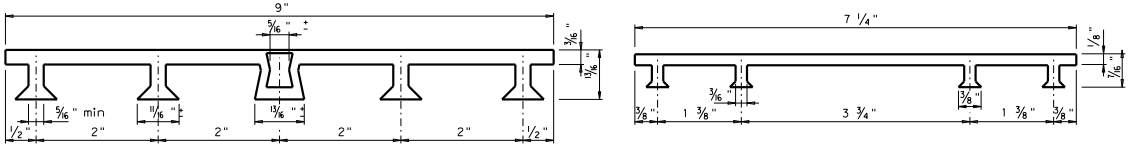


DESIGN	"X"
A	14'
B	12'
C	11'

JOINT AND WATERSTOP DETAILS

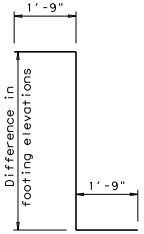


EXPANSION JOINT CONSTRUCTION JOINT



PVC WATERSTOP TYPE "A" PVC WATERSTOP TYPE "B"

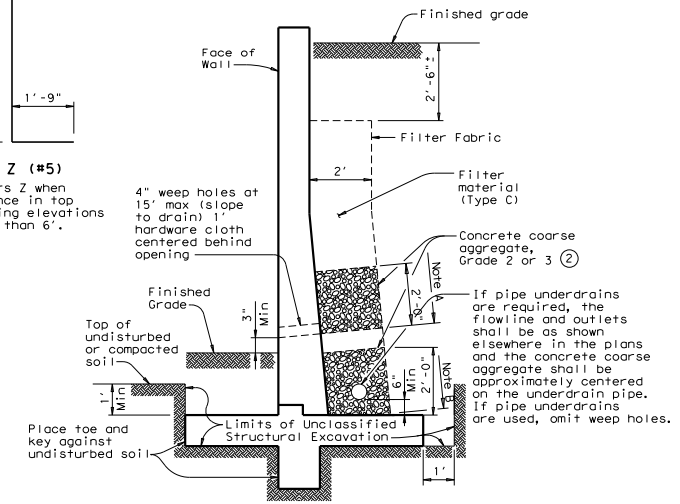
Note: Dimensions and shapes may vary slightly depending on manufacturer.



BARS Z (#5)

Omit Bars Z when difference in top of footing elevations is less than 6'.

(2) Crushed blast furnace slag, recycled crushed hydraulic cement concrete or combination there of may not be used.



DRAINAGE DETAILS AND EXCAVATION DIAGRAM

Note A: Stop coarse aggregate at this level when weep holes are used.

Note B: Use coarse aggregate to here with filter material above when underdrains are used.

GENERAL NOTES:

Walls are designed assuming unit weight of soil = 120 pcf, and coefficient of horizontal earth pressure = 0.33.

Walls are designed to provide a minimum factor of safety against sliding of 1.5. The undisturbed or compacted soil depth in front of walls, from bottom of Key up, shall not be less than Kw + Ft + 1'.

Retaining walls are detailed to be placed on grades up thru 10% with footing level, with no changes in reinforcing steel. Steeper grades can be accommodated by shortening Bars A1 and B and increasing length of legs of Bars U by the same amount. No change in Quantities will be involved

Retaining walls may be placed on Horizontal Curves by adjusting lengths of footing Bars T and H. Minor revisions of Concrete Quantities may be required.

Designed in accordance with current AASHTO Standard and Interim Specifications.

All concrete to be Class "C".

All reinforcing steel to be Grade 60.

Texas Department of Transportation — Bridge Division Standard

RETAINING WALL MISCELLANEOUS DETAILS

RW 2

FILE:	rwstdet1.dgn	DN: TxDOT	CK: TxDOT	DW: JGD	CK: MJG
©TxDOT	March 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS					
04-11: Added Note 2.		DIST	COUNTY		SHEET NO.

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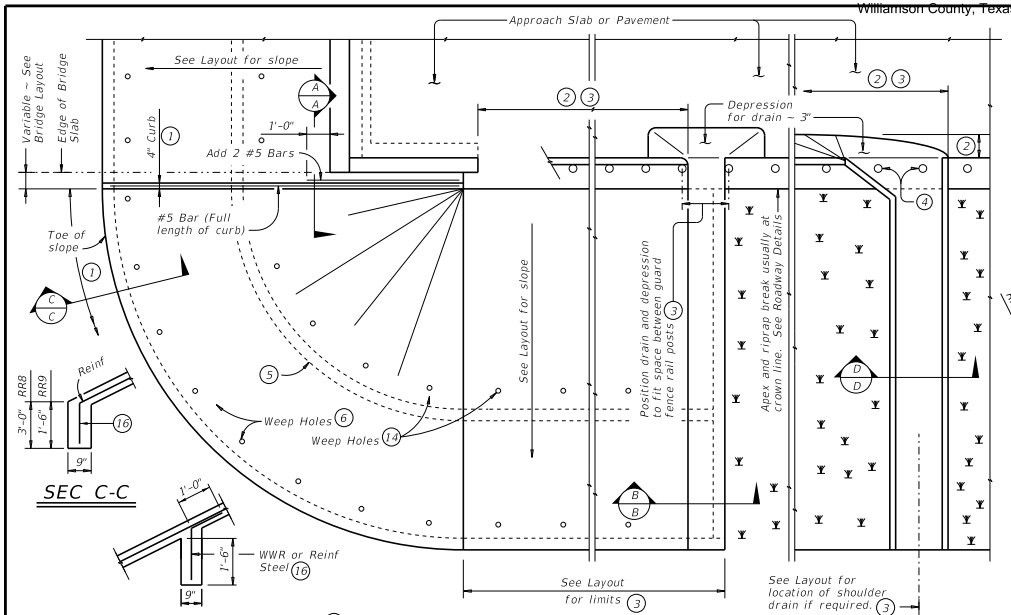
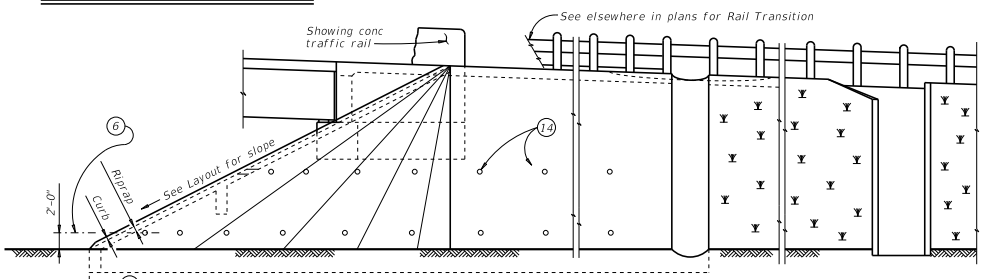
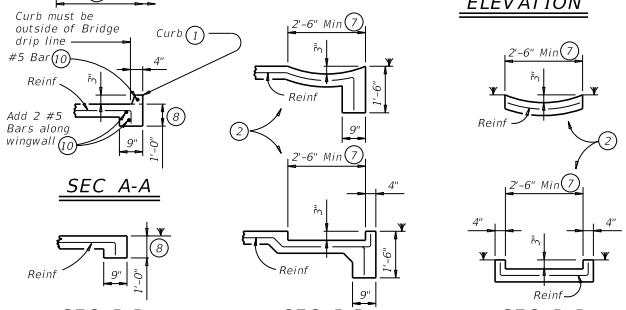


PLAN



ELEVATION

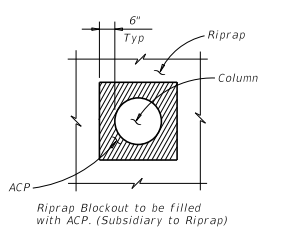


SEC A-A

SEC B-B
(No Drain)

SEC B-B
(Shoulder Drain integral with riprap)

SEC D-D
(Shoulder Drain)

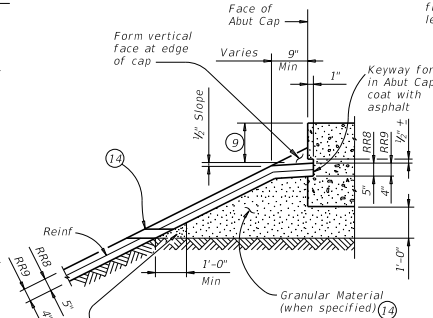


Riprap Blockout to be filled with ACP. (Subsidiary to Riprap)

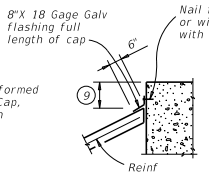
RIPRAP DETAIL AT COLUMNS
(As directed by the Engineer)

SEC C-C

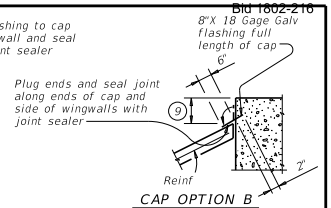
INTERMEDIATE TOEWALL



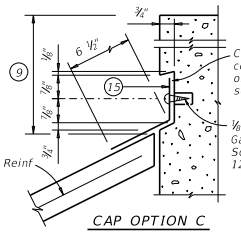
SHOWING KEYWAY OPTION



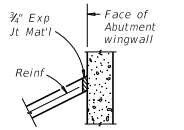
CAP OPTION A



CAP OPTION B

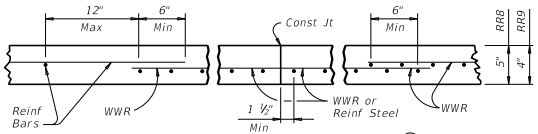


CAP OPTION C



SECT THRU RIPRAP AT WINGWALL (12)

SECTIONS THRU RIPRAP AT CAP (11)



REINFORCEMENT DETAILS (13)

See General Notes for optional sythetic fiber reinforcement.

1. When riprap is shown extended around header on layout, extend slab and toewall as shown and eliminate 4" curb.
2. Limits and configuration of drains and depressions are as shown elsewhere in plans or as directed by the Engineer.
3. Location of shoulder drain must consider limitations imposed by rail transition. Do not locate shoulder drains at expansion joints between approach slab and concrete pavement.
4. See details elsewhere in plans for installation of guard fence posts through concrete riprap.
5. Provide intermediate toewall only when designated elsewhere in the plans or included in the specifications.
6. Provide lower level of 2" Dia weep holes at 10' c-c backed by 1 CF packet of gravel and galvanized hardware cloth at all locations unless directed by the Engineer to eliminate.
7. Use wider or other drain configurations if shown elsewhere in plans or if directed by the Engineer.
8. Wall extension may be reduced or modified if approved by the Engineer. Increase wall extension to 1'-6" whenever the optional intermediate toewall is called for in the plans.
9. Top of cap to top of riprap dimension varies as directed by the Engineer. Should be 9" Min for beam/slab type bridges and 1'-6" for slab span, box beam, or slab beam bridges.
10. #5 bars shown are required even when synthetic fiber reinforcing option is selected.
11. Provide sealing option for joint between the face of cap and riprap as designated by the Engineer or as shown elsewhere on plans.
12. Flashing (shown in Cap Option A) may be used at wingwall in addition to Exp Jt Mat'l if shown on plans or directed by the Engineer.
13. Provide #3 reinforcing bars at 18" Spa c-c. Provide Welded Wire Reinforcement (WWR) as 6x6-D3xD3. Combinations of WWR and reinforcing bars may be used if both are permitted. Use lap splices of a minimum 6 inches, measured from the transverse wire of WWR, and the ends of reinforcing bars.
14. If granular material is specified, provide upper level of 2" Dia weep holes at 10' c-c backed by galvanized hardware cloth.
15. 8" x 18 Gage Galv Sheet Metal
16. Provide WWR or #3 bars, with 1'-0" extension into slope.

GENERAL NOTES:

Provide Class "B" concrete with a minimum compressive strength of 2,000 psi unless noted elsewhere in plans.

Provide Grade 60 reinforcing steel.

Provide synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) in lieu of steel reinforcing in riprap concrete unless noted otherwise.

Install construction joints or grooved joints extending the full slant slope height at intervals of approximately 20 feet unless otherwise directed by the Engineer.

Hardware cloth, loose grade stone behind weep holes, flashing, or other sealing material are subsidiary to the bid item "Riprap".

Use reinforcing bars, deformed Welded Wire Reinforcing (WWR), or any suitable combination of both types for riprap reinforcing, unless specified elsewhere in the plans.

See Layout for limits of riprap.

RR8 is to be used on stream crossings.

RR9 is to be used on other embankments.

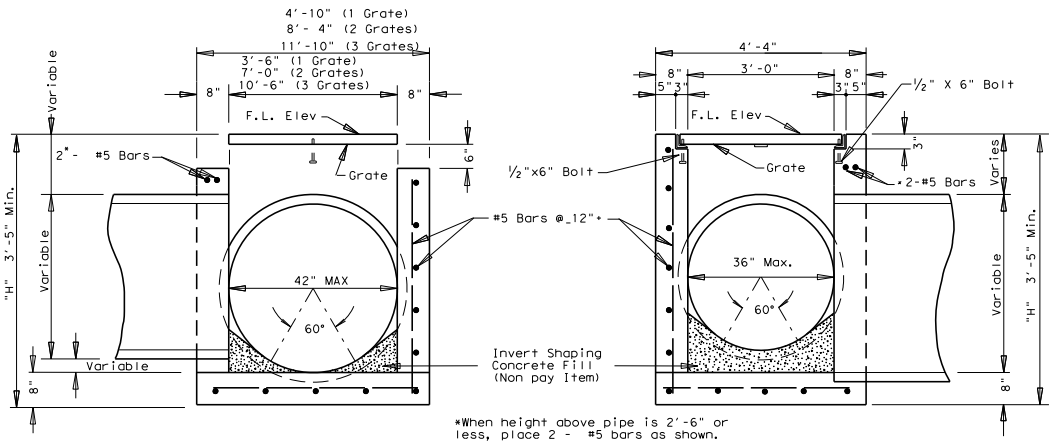
FOR CONTRACTOR'S INFORMATION ONLY:
5" of RR8 = 0.015 CY/SF
4" of RR9 = 0.012 CY/SF
#3 Reinf at 18" c-c = 0.501 Lbs/SF
6x6-D3xD3 = 0.408 Lbs/SF

Texas Department of Transportation
Bridge Division Standard

CONCRETE RIPRAP AND SHOULDER DRAINS
EMBANKMENTS AT BRIDGE ENDS (TYPES RR8 & RR9)

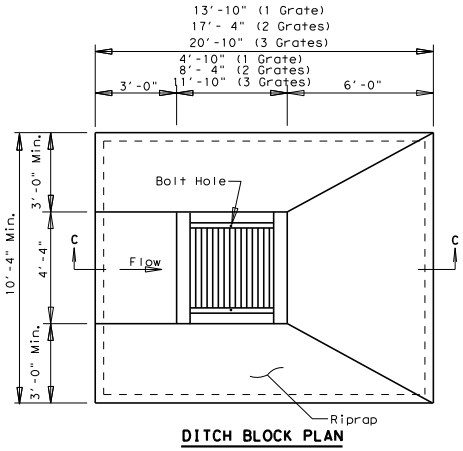
CRR

FILE: crrstde1.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT January 2015	CONT	SECT	JOB	HIGHWAY
REVISIONS				
	DIST	COUNTY		SHEET NO.

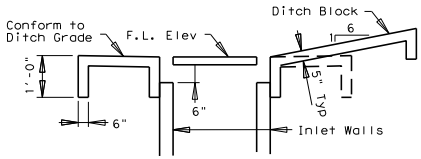


SECTION A-A

SECTION B-B

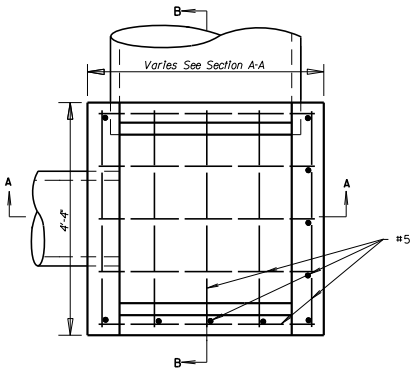


DITCH BLOCK PLAN

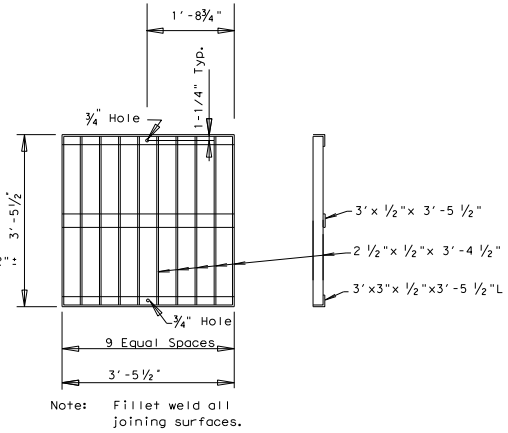


SECTION C-C

RIPRAP DETAILS



PLAN



Note: Fillet weld all joining surfaces.

GRATE DETAILS

GENERAL NOTES:

Use Class "A" Concrete for Drop Inlets.

Install Mounting Bolts as directed. Use galvanized Bolts, Nuts and Washers.

Place Riprap Concrete Class "B" and Grates in accordance with Item 432, "Riprap" and Item 471, "Frames, Grates, Rings and Covers." Consider these items subsidiary to pertinent Items.

For installation on Box Culverts, adjustments may be made by the Engineer to fit unusual conditions.

Place Riprap Concrete Class "B" as soon as practical to minimize erosion.

Use WWF 6X6-W2.9X2.9 Reinforcement for Riprap.

Ensure connecting pipes enters within 10 degrees of normal to inlet wall. Use pipe elbow or curved approach alignment as necessary to meet this requirement.

Consider Excavation and Backfill subsidiary to pertinent Item.

Texas Department of Transportation
Austin District Design

DROP INLET DETAILS TYPE I

Austin District Standard

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REVISIONS 3/03 District Update 9/04 2004 Update	AUS	6		
	COUNTY	CONTROL	SECT	JOB	HIGHWAY
					p. 38

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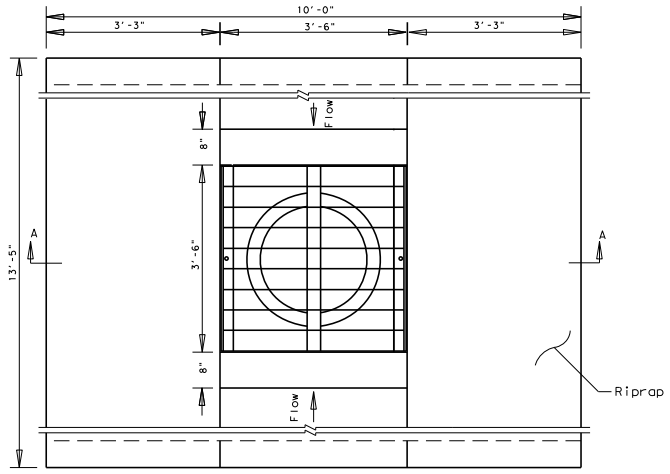

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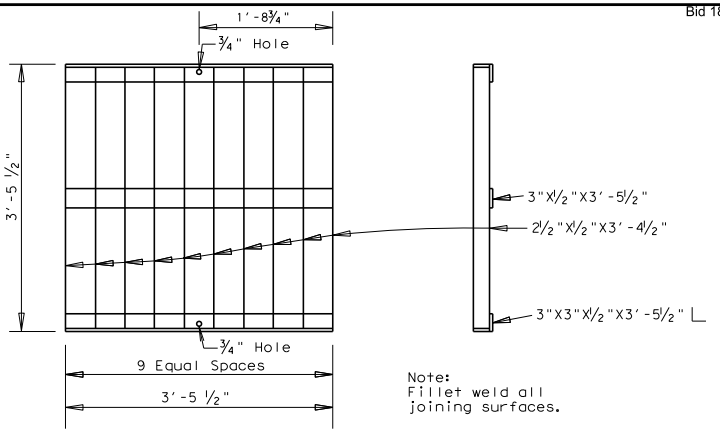
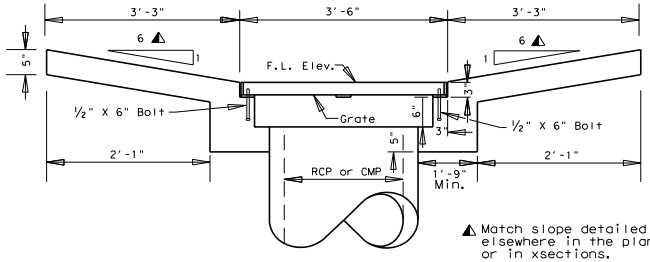
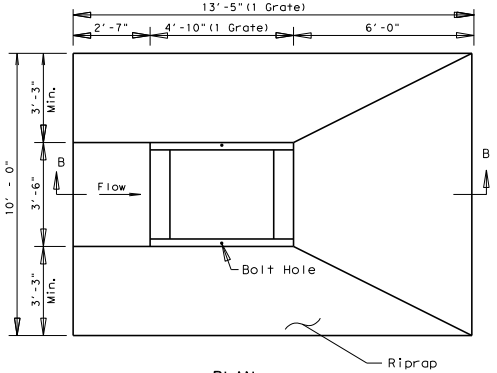


GRATE DETAILS



⚠ Match slope detailed elsewhere in the plans or in xsections.

SECTION A-A



PLAN
DITCH BLOCK
(SEE SECTION B-B)

GENERAL NOTES:

Install Mounting Bolts as directed.
Use Bolts, Nuts and Washers that are galvanized.

For installation on Box Culverts, adjustments may be made by the Engineer to fit unusual conditions.

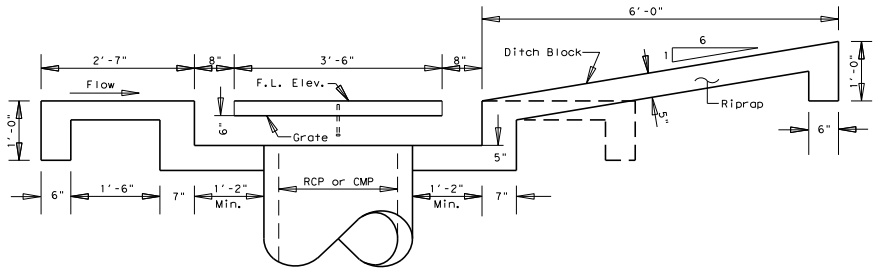
Place Standpipe, Riprap Concrete Class "B" and Grate in accordance with Item 460, "Corrugated Metal Pipe" or Item 464, "Reinforced Concrete Pipe", Item 432, "Riprap" and Item 471, "Frames, Grates, Rings and Covers." Consider Riprap and Grate(s) subsidiary to pertinent Items. Payment for length of Standpipe will be paid for under Item 460, "Corrugated Metal Pipe" or Item 464, "Reinforced Concrete Pipe." Length of Standpipe shall be as shown elsewhere on the plans.

Consider connections of the Standpipe to new or existing structures subsidiary to pertinent Items.

Place Riprap Concrete Class "B" as soon as practical to minimize erosion.

Use WWF 6X6-W2.9XW2.9 Reinforcement for Riprap.

Consider Excavation and Backfill subsidiary to pertinent Item.



SECTION B-B

TYPICAL PIPE INLET

Texas Department of Transportation
Austin District Design

DROP INLET DETAILS TYPE II

Austin District Standard

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REVISIONS	AUS	6		
3/03 District Update	COUNTY		CONTROL SECT JOB	HIGHWAY
9/04 2004 Update				p.39

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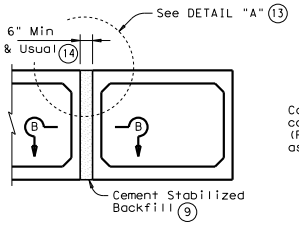
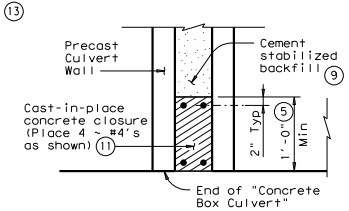
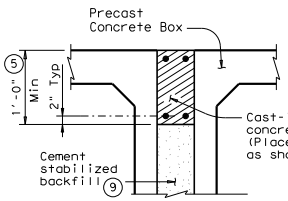


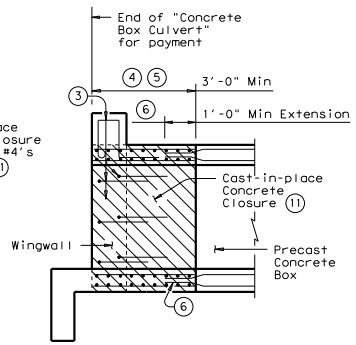
MULTIPLE UNIT PLACEMENT



SECTION B-B

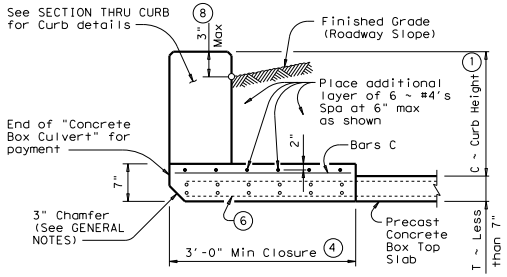


DETAIL "A" (13)

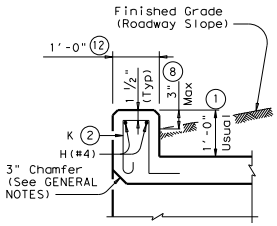


WINGWALL CONNECTION

(Also applies to Safety End Treatment)

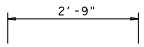


SECTION THRU TOP SLABS LESS THAN 7"

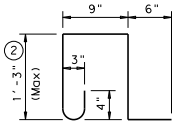


SECTION THRU CURB

(10) QUANTITIES PER FOOT OF CURB	
Reinforcing Steel	4.18 Lb
Concrete	0.037 CY



BARS C ~ #4
(Spa = 1'-0" Max)



BARS K ~ #4
(Spa = 1'-0" Max)
(Length = 4'-3")

1. 0" min to 5'-0" max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail, bicycle rail or curbs taller than 1'-0", refer to ECD standard. For structures with T6 traffic rail, refer to T6-CM standard. For structures with traffic rail, other than T6, refer to RAC standard.
2. For curbs less than 1'-0" high, tilt Bars K or reduce bar height as necessary to maintain cover. For curbs less than 3" high, Bars K may be omitted.
3. Curb, Wingwall or Safety End Treatment reinforcing shall extend into concrete closure. Any reinforcing that does not fit into the closure shall be bent or trimmed as necessary.
4. Cast-in-place concrete closure shall be 3'-0" min. Boxes shall be cast short or broken back in the field. All reinforcing in the closure shall be the same size and spacing as in the precast box section. Except where shown otherwise, the cast-in-place closure shall be flush with the inside and outside faces of the precast box section.
5. For multiple unit placements the length of the closure for the interior walls may be adjusted as necessary. The length of the top slab, bottom slab, and exterior wall closure shall not be less than 3'-0". See Section B-B detail when interior walls are cast full length.
6. Precast box reinforcing shall extend a minimum of 1'-0" into concrete closure (Typ).
7. Bands of reinforcing matching the inside and outside face reinforcing shall be placed in the gaps of the top and bottom slabs. A band matching the outside face reinforcing of the wall shall be placed in the gaps of the walls (placed in the outside face only). The bands shall be tack welded to the exposed reinforcing at each point of contact.
8. For vehicle safety, the following requirements must be met:
   - For structures without bridge rail, curbs shall project no more than 3" above finished grade.
   - For structures with bridge rail, curbs shall be flush with finished grade.

   Curb heights shall be reduced, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
9. Cement Stabilized Backfill between boxes is considered part of the Box Culvert for payment.
10. All curb concrete and reinforcing is considered part of the Box Culvert for payment.
11. Any additional concrete and reinforcing required for the closures shall be considered as subsidiary to the Concrete Box Culvert.
12. 1'-0" typical. 2'-0" when RAC standard is referred to elsewhere in the plans.
13. For multiple unit placement with overlay, with 1 to 2 course surface treatment, or with the top slab as the final riding surface, provide wall closure as shown in DETAIL "A".
14. This dimension may be increased with approval of the Engineer to allow the precast boxes to be tunneled or jacked in accordance with Item 476, "Jacking, Boring, or Tunneling Pipe or Box". No payment will be made for any additional material in the gap between adjacent boxes.

GENERAL NOTES:

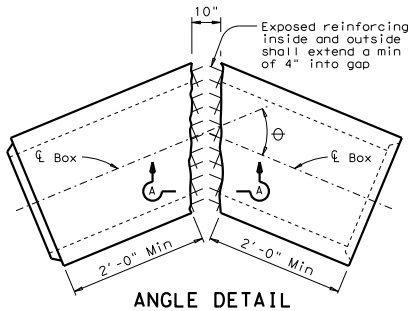
Designed according to AASHTO LRFD Specifications.

All closure concrete shall be Class "C" with a minimum compressive strength of 3600 psi and shall be placed according to the Item, "Concrete Structures".

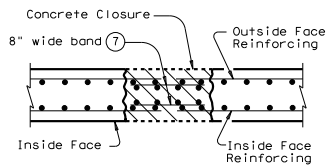
Any additional concrete required for the closures shall be considered as subsidiary to the Concrete Box Culvert.

Refer to the Single Box Culverts Precast standard for details not shown.

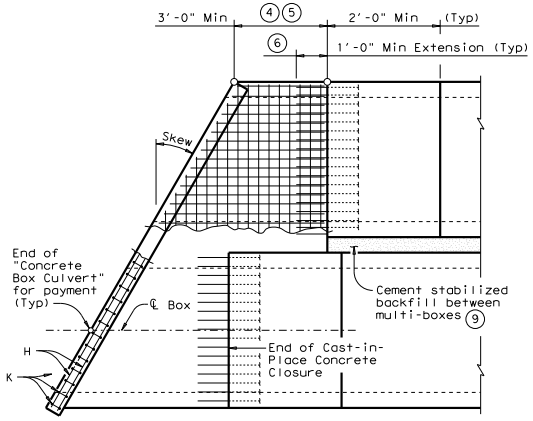
The bottom edge of the top slab closure shall be chamfered 3 inches at the entrance.



ANGLE DETAIL



SECTION A-A



PLAN OF SKEWED ENDS

(Showing multi-box placement)

HL93 LOADING

Texas Department of Transportation — Bridge Division Standard

BOX CULVERTS PRECAST MISCELLANEOUS DETAILS

SCP-MD

FILE: scpmdste.dgn	DN: GAF	CK: LMW	DW: BWH/TxDOT	CK: GAF
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REVISIONS				
	DIST	COUNTY		SHEET NO.

DATE:
FILE:

TABLE OF DIMENSIONS & REINFORCING STEEL
(Wings for One Structure End)

Dimensions					Variable Reinforcing				Estimated Quantities per ft of wing length (2~Wings) ③	
					Bars J1		Bars J2			
Maximum Wingwall Height Hw	W	X	Y	Z	Size	Spa	Size	Spa	Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	33.73	0.248
3'-0"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	37.07	0.261
3'-6"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	37.74	0.273
4'-0"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	38.41	0.285
4'-6"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	41.75	0.330
5'-0"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	45.09	0.343
5'-6"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	45.75	0.355
6'-0"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	46.42	0.367
7'-0"	3'- 8"	1'- 9"	1'- 3"	7"	#4	1'-0"	#4	1'-0"	52.77	0.414
8'-0"	4'- 2"	2'- 0"	1'- 6"	8"	#5	1'-0"	#4	1'-0"	60.19	0.486
9'-0"	4'- 8"	2'- 3"	1'- 9"	8"	#4	6"	#4	6"	81.49	0.535
10'-0"	5'- 2"	2'- 6"	2'- 0"	8"	#5	6"	#4	6"	97.25	0.584
11'-0"	5'- 8"	2'- 9"	2'- 3"	8"	#6	6"	#5	6"	133.65	0.634
12'-0"	6'- 2"	3'- 0"	2'- 6"	9"	#7	6"	#5	6"	162.29	0.721
13'-0"	6'- 8"	3'- 3"	2'- 9"	11"	#7	6"	#5	6"	178.80	0.856
14'-0"	7'- 2"	3'- 6"	3'- 0"	1'- 0"	#8	6"	#5	6"	216.78	0.959
15'-0"	7'- 8"	4'- 0"	3'- 0"	1'- 1"	#9	6"	#6	6"	283.06	1.068
16'-0"	8'- 2"	4'- 6"	3'- 0"	1'- 3"	#9	6"	#6	6"	297.02	1.234

TABLE OF WINGWALL REINFORCING (2~Wings)

Bar	Size	No.	Spa
D	#5	~	1'-0"
E	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	4	~
M	#4	4	~
P	#4	~	1'-0"
R	#5	6	~
V	#4	~	1'-0"

TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES

Bar	Size	No.	Spa
L	#4	~	1'-6"
Q	#4	1	~
Reinf (Lb/Ft)			2.45
Conc (CY/Ft)			0.037

WING DIMENSION CALCULATIONS:

Formulas: (All values are in Feet)

Hw = H + T + C - 0.250'

Lw = (Hw - 0.333') (SL)

For Cast-in-place culverts:

Ltw = (N) (S) + (N+1) (U)

For Precast culverts:

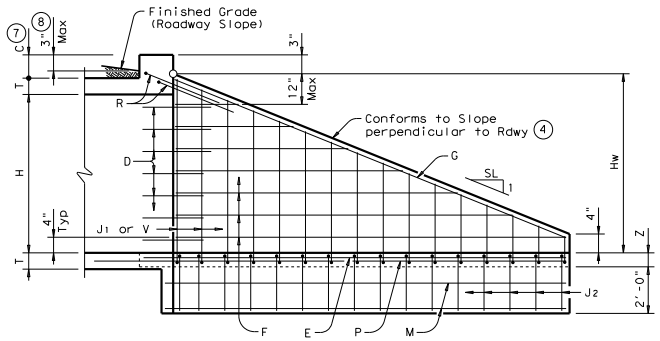
Ltw = (N) (2U + S) + (N - 1) (0.5')

Total Wingwall Area (Two Wings ~ S.F.) = (Hw + 0.333') (Lw)

Hw = Height of Wingwall
SL:1 = Side Slope Ratio (Horizontal:1 Vertical)
Lw = Length of Wingwall
Ltw = Culvert Toewall Length
N = Number of Culvert Spans

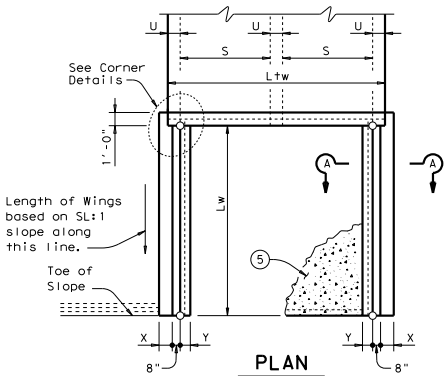
See applicable box culvert standard for H, S, T, and U values.

1. Extend Bars P 3'-0" minimum into bottom slab of Box Culvert.
2. Adjust to fit as necessary to maintain 1 1/4" clear cover and 4" minimum between bars.
3. Quantities shown are based on an average wing height for two wings (one structure end). To determine total quantities for two wings multiply the tabulated values by Lw.
4. Recommended values of Slope are: 2:1, 3:1, 4:1, & 6:1.
5. When shown elsewhere on the plans, a 5" deep concrete riprap shall be constructed. Payment for riprap shall be as required by Item 432, "Riprap". Unless otherwise shown on the plans or directed by the Engineer, the riprap shall have a 6" wide by 1'-6" deep reinforced concrete toewall along all edges adjacent to natural ground; the toewall shall be reinforced by extending typical riprap reinforcing into the toewall; construction joints or grooved joints, oriented in the direction of flow, shall extend across the full distance of the riprap, at intervals of approximately 20'. When such riprap is provided, the culvert toewall shown in SECTION B-B will not be required.
6. At Contractor's option, Culvert Toewall may be ended flush with Wingwall Toewall. Adjust reinforcing from that shown as necessary.
7. 0" min to 5'-0" max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail, bicycle rail or curbs taller than 1'-0", refer to ECD standard. For structures with T6 bridge rail, refer to T6-CM standard. For structures with traffic rail, other than T6, refer to RAC standard.
8. For vehicle safety, curb heights and wall heights shall be reduced, if necessary, to provide a maximum 3" projection above finished grade. No changes will be made in quantities and no additional compensation will be allowed for this work.



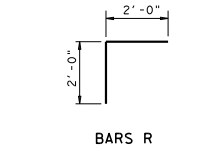
INSIDE ELEVATION

(Showing reinforcing. Culvert and Culvert Toewall reinforcing not shown for clarity.)

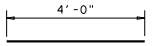


PLAN

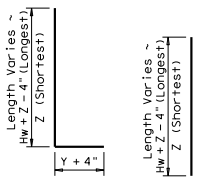
(Showing Dimensions)



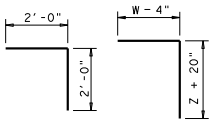
BARS R



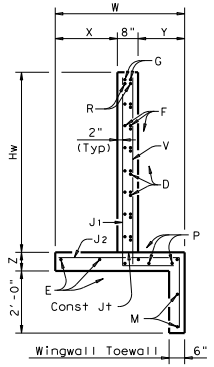
BARS D



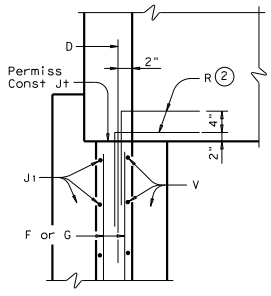
BARS J1 BARS V



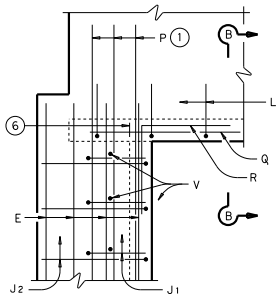
BARS L BARS J2



SECTION A-A

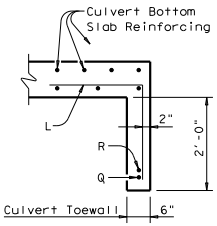


WINGWALL



FOOTING AND TOEWALL

CORNER DETAILS



SECTION B-B ⑤

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

All reinforcing steel shall be Grade 60.

Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

All reinforcing bars shall be adjusted to provide a minimum of 1 1/4" clear cover.

When structure is founded on solid rock, depth of toewalls for culverts and wingwalls may be reduced or eliminated as directed by the Engineer.

See BCS sheet for additional dimensions and information.

The quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for Contractor's information only.

Texas Department of Transportation — Bridge Division Standard

CONCRETE WINGWALLS WITH STRAIGHT WINGS FOR 0° SKEW BOX CULVERTS

SW-0

FILE: sw-0std.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: GAF
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REVISIONS				
11-10: Add note for synthetic fibers.	DIST	COUNTY		SHEET NO.

DATE:
FILE:

TABLE OF DIMENSIONS & REINFORCING STEEL
(Wings for One Structure End)

Dimensions					Variable Reinforcing				Estimated Quantities per ft of wing length (2~Wings) ③	
					Bars J1		Bars J2			
Maximum Wingwall Height Hw	W	X	Y	Z	Size	Spa	Size	Spa	Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	33.73	0.248
3'-0"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	37.07	0.261
3'-6"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	37.74	0.273
4'-0"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	38.41	0.285
4'-6"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	41.75	0.330
5'-0"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	45.09	0.343
5'-6"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	45.75	0.355
6'-0"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	46.42	0.367
7'-0"	3'- 8"	1'- 9"	1'- 3"	7"	#4	1'-0"	#4	1'-0"	52.77	0.414
8'-0"	4'- 2"	2'- 0"	1'- 6"	8"	#5	1'-0"	#4	1'-0"	60.19	0.486
9'-0"	4'- 8"	2'- 3"	1'- 9"	8"	#4	6"	#4	6"	81.49	0.535
10'-0"	5'- 2"	2'- 6"	2'- 0"	8"	#5	6"	#4	6"	97.25	0.584
11'-0"	5'- 8"	2'- 9"	2'- 3"	8"	#6	6"	#5	6"	133.65	0.634
12'-0"	6'- 2"	3'- 0"	2'- 6"	9"	#7	6"	#5	6"	162.29	0.721
13'-0"	6'- 8"	3'- 3"	2'- 9"	11"	#7	6"	#5	6"	178.80	0.856
14'-0"	7'- 2"	3'- 6"	3'- 0"	1'- 0"	#8	6"	#5	6"	216.78	0.959
15'-0"	7'- 8"	4'- 0"	3'- 0"	1'- 1"	#9	6"	#6	6"	283.06	1.068
16'-0"	8'- 2"	4'- 6"	3'- 0"	1'- 3"	#9	6"	#6	6"	297.02	1.234

TABLE OF WINGWALL REINFORCING (2~Wings)

Bar	Size	No.	Spa
D	#5	~	1'-0"
E	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	4	~
M	#4	4	~
P	#4	~	1'-0"
R	#5	6	~
V	#4	~	1'-0"

TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES

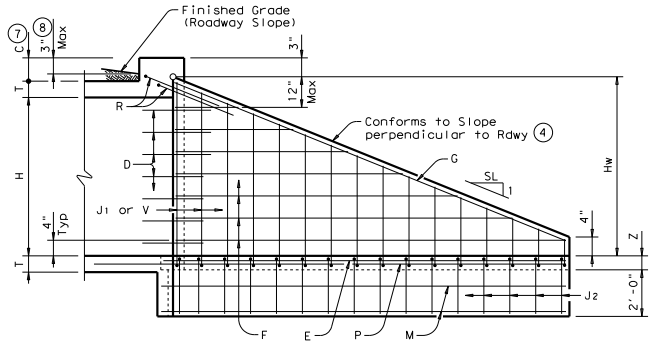
Bar	Size	No.	Spa
L	#4	~	1'-6"
Q	#4	1	~
Reinf (Lb/Ft)			2.45
Conc (CY/Ft)			0.037

WING DIMENSION CALCULATIONS:

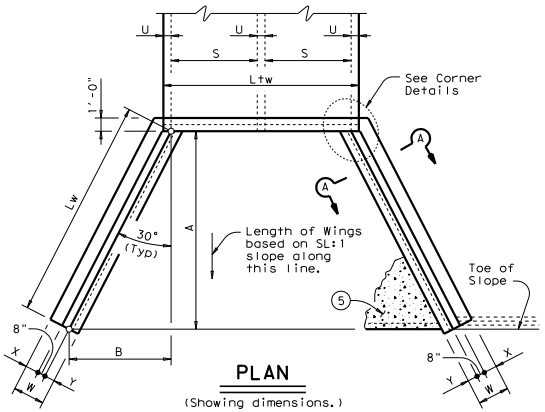
Formulas: (All values are in Feet)
Hw = H + T + C - 0.250'
A = (Hw - 0.333') (SL)
B = (A) Tangent (30°)
Lw = (A) ÷ Cosine (30°)
For Cast-in-place culverts:
Ltw = (N) (S) + (N+1) (U)
For Precast culverts:
Ltw = (N) (2U+S) + (N-1) (0.500')
Total Wingwall Area (Two Wings ~ S.F.) = (Hw + 0.333') (Lw)

Hw = Height of Wingwall
SL:1 = Side Slope Ratio (Horizontal:1 Vertical)
Lw = Length of Wingwall
Ltw = Culvert Toewall Length
N = Number of Culvert Spans

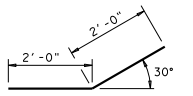
See applicable box culvert standard for H, S, T, and U values.



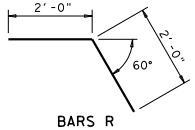
INSIDE ELEVATION
(Showing reinforcing. Culvert and Culvert Toewall reinforcing not shown for clarity.)



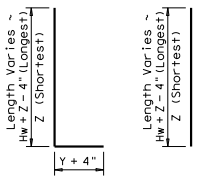
PLAN
(Showing dimensions.)



BARS D

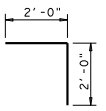


BARS R

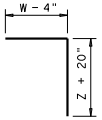


BARS J1

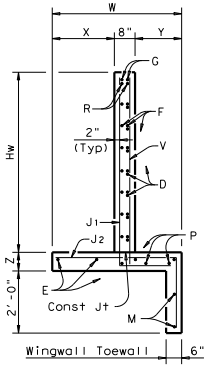
BARS V



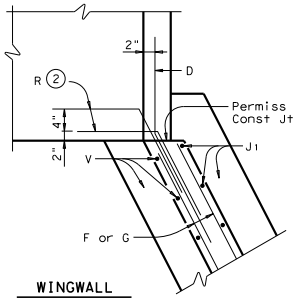
BARS L



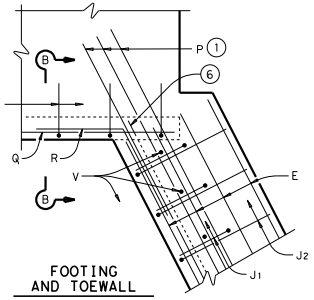
BARS J2



SECTION A-A

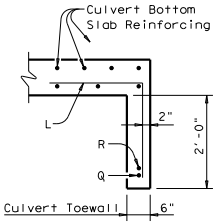


WINGWALL



FOOTING AND TOEWALL

CORNER DETAILS
(Culvert and Culvert Toewall reinforcing not shown for clarity.)



SECTION B-B ⑤

① Extend Bars P 3'-0" minimum into bottom slab of Box Culvert.
② Adjust to fit as necessary to maintain 1 ¼" clear cover and 4" minimum between bars.
③ Quantities shown are based on an average wing height for two wings (one structure end). To determine total quantities for two wings multiply the tabulated values by Lw.
④ Recommended values of Slope are: 2:1, 3:1, 4:1, & 6:1.
⑤ When shown elsewhere on the plans, a 5" deep concrete riprap shall be constructed. Payment for riprap shall be as required by Item 432, "Riprap". Unless otherwise shown on the plans or directed by the Engineer, the riprap shall have a 6" wide by 1'-6" deep reinforced concrete toewall along all edges adjacent to natural ground; the toewall shall be reinforced by extending typical riprap reinforcing into the toewall; construction joints or grooved joints, oriented in the direction of flow, shall extend across the full distance of the riprap, at intervals of approximately 20'. When such riprap is provided, the culvert toewall shown in SECTION B-B will not be required.
⑥ At Contractor's option, Culvert Toewall may be ended flush with Wingwall Toewall. Adjust reinforcing from that shown as necessary.
⑦ 0" min to 5'-0" max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail, bicycle rail or curbs taller than 1'-0", refer to ECD standard. For structures with T6 bridge rail, refer to T6-CM standard. For structures with traffic rail, other than T6, refer to RAC standard.
⑧ For vehicle safety, curb heights and wall heights shall be reduced, if necessary, to provide a maximum 3" projection above finished grade. No changes will be made in quantities and no additional compensation will be allowed for this work.

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.
All reinforcing steel shall be Grade 60.
Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.
All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.
All reinforcing bars shall be adjusted to provide a minimum of 1 ¼" clear cover.
When structure is founded on solid rock, depth of toewalls for culverts and wingwalls may be reduced or eliminated as directed by the Engineer.
See BCS sheet for additional dimensions and information.
The quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for Contractor's information only.

Texas Department of Transportation — Bridge Division Standard

CONCRETE WINGWALLS WITH FLARED WINGS FOR 0° SKEW BOX CULVERTS

FW-0

FILE: fw-0std.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: GAF
©TxDOT February 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS				
11-10- Add note for synthetic fibers.	DIST	COUNTY		SHEET NO.

DATE:
FILE:

TABLE OF DIMENSIONS & REINFORCING STEEL
(Wings for One Structure End)

Maximum Wingwall Height Hw	W	X	Y	Z	Variable Reinforcing Bars J1 Size	Bars J1 Spa	Bars J2 Size	Bars J2 Spa	Estimated Quantities per ft of wing length (2~Wings) Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	33.73	0.248
3'-0"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	37.07	0.261
3'-6"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	37.74	0.273
4'-0"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	38.41	0.285
4'-6"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	41.75	0.330
5'-0"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	45.09	0.343
5'-6"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	45.75	0.355
6'-0"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	46.42	0.367
7'-0"	3'- 8"	1'- 9"	1'- 3"	7"	#4	1'-0"	#4	1'-0"	52.77	0.414
8'-0"	4'- 2"	2'- 0"	1'- 6"	8"	#5	1'-0"	#4	1'-0"	60.19	0.486
9'-0"	4'- 8"	2'- 3"	1'- 9"	8"	#4	6"	#4	6"	81.49	0.535
10'-0"	5'- 2"	2'- 6"	2'- 0"	8"	#5	6"	#4	6"	97.25	0.584
11'-0"	5'- 8"	2'- 9"	2'- 3"	8"	#6	6"	#5	6"	133.65	0.634
12'-0"	6'- 2"	3'- 0"	2'- 6"	9"	#7	6"	#5	6"	162.29	0.721
13'-0"	6'- 8"	3'- 3"	2'- 9"	11"	#7	6"	#5	6"	178.80	0.856
14'-0"	7'- 2"	3'- 6"	3'- 0"	1'- 0"	#8	6"	#5	6"	216.78	0.959
15'-0"	7'- 8"	4'- 0"	3'- 0"	1'- 1"	#9	6"	#6	6"	283.06	1.068
16'-0"	8'- 2"	4'- 6"	3'- 0"	1'- 3"	#9	6"	#6	6"	297.02	1.234

TABLE OF WINGWALL REINFORCING (2~Wings)

Bar	Size	No.	Spa
DL	#5	~	1'-0"
DS	#5	~	1'-0"
E	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	4	~
M	#4	4	~
P	#4	~	1'-0"
RS	#5	3	~
RL	#5	3	~
V	#4	~	1'-0"

TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES

Bar	Size	No.	Spa
L	#4	~	1'-6"
Q	#4	1	~
Reinf (Lb/Ft)			2.45
Conc (CY/Ft)			0.037

WING DIMENSION CALCULATIONS:

Formulas: (All values are in Feet)

Hw = H + T + C − 0.250′

A = (Hw − 0.333′) (SL)

B = (A) [Tangent (θ + 15°)]

Lw = (A) ÷ [Cosine (θ + 15°)]

For Cast-in-place culverts:

Ltw = [(N) (S) + (N + 1) (U)] ÷ (Cosine θ)

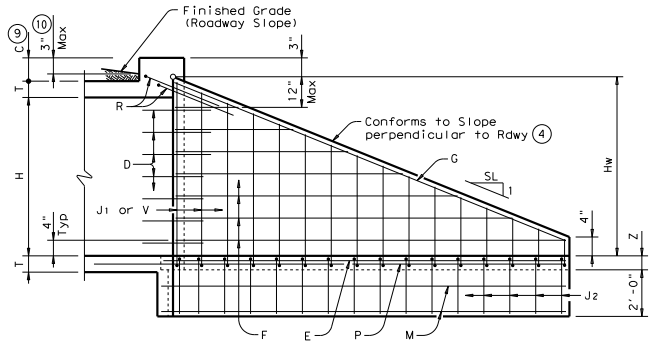
For Precast culverts:

Ltw = [(N) (2U + S) + (N − 1) (0.500′)] ÷ (Cosine θ)

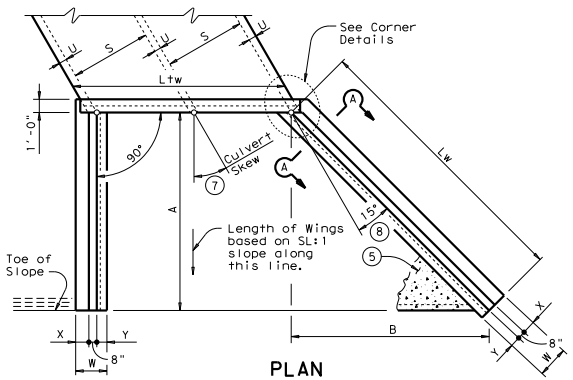
Total Wingwall Area (Two Wings ~ S.F.) = (0.5) (Hw + 0.333′) (Lw + A)

Hw = Height of Wingwall
SL:1 = Side Slope Ratio (Horizontal:1 Vertical)
A = Length of Short Wingwall
Lw = Length of Long Wingwall
Ltw = Culvert Toewall Length
N = Number of Culvert Spans
θ = Culvert Skew

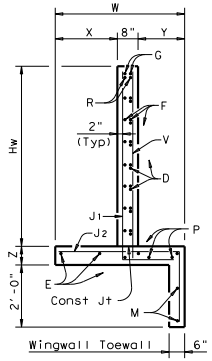
See applicable box culvert standard for H, S, T, and U values.



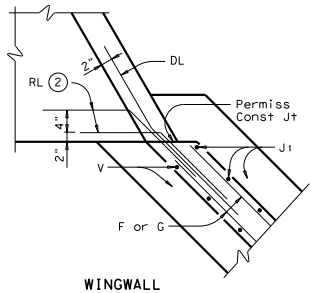
INSIDE ELEVATION
(Showing reinforcing. Culvert and Culvert Toewall reinforcing not shown for clarity.)



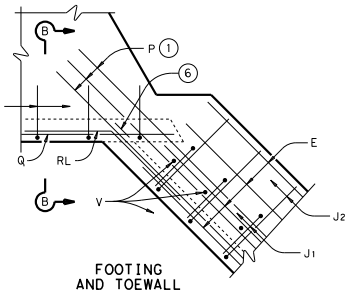
PLAN
(Showing dimensions and 30° Skew.)



SECTION A-A

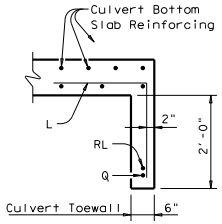


WINGWALL

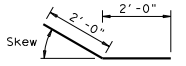


FOOTING AND TOEWALL

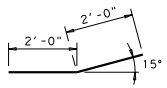
CORNER DETAILS
(Culvert and Culvert Toewall reinforcing not shown for clarity.)



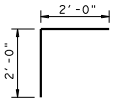
SECTION B-B (5)



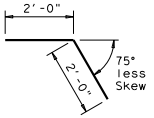
BARS DS (Short Wing)



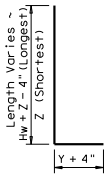
BARS DL (Long Wing)



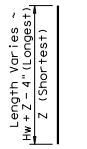
BARS RS (Short Wing)



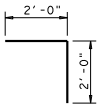
BARS RL (Long Wing)



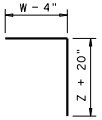
BARS J1



BARS V



BARS L



BARS J2

1. Extend Bars P 3'-0" minimum into bottom slab of Box Culvert.
2. Adjust to fit as necessary to maintain 1 ¼" clear cover and 4" minimum between bars.
3. Quantities shown are based on an average wing height for two wings (one structure end). To determine total quantities for two wings multiply the tabulated values by 0.5 x (A+Lw).
4. Recommended values of Slope are: 2:1, 3:1, 4:1, & 6:1.
5. When shown elsewhere on the plans, a 5" deep concrete riprap shall be constructed. Payment for riprap shall be as required by Item 432, "Riprap". Unless otherwise shown on the plans or directed by the Engineer, the riprap shall have a 6" wide by 1'-6" deep reinforced concrete toewall along all edges adjacent to natural ground; the toewall shall be reinforced by extending typical riprap reinforcing into the toewall; construction joints or grooved joints, oriented in the direction of flow, shall extend across the full distance of the riprap, at intervals of approximately 20'. When such riprap is provided, the culvert toewall shown in SECTION B-B will not be required.
6. At Contractor's option, Culvert Toewall may be ended flush with Wingwall Toewall. Adjust reinforcing from that shown as necessary.
7. Applicable values of of Skew are: 15°, 30°, and 45°.
8. Typical wingwall angle for all skews.
9. 0" min to 5'-0" max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail, bicycle rail or curbs taller than 1'-0", refer to ECD standard. For structures with T6 bridge rail, refer to T6-CM standard. For structures with traffic rail, other than T6, refer to RAC standard.
10. For vehicle safety, curb heights and wall heights shall be reduced, if necessary, to provide a maximum 3" projection above finished grade. No changes will be made in quantities and no additional compensation will be allowed for this work.

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

All reinforcing steel shall be Grade 60.

Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

All reinforcing bars shall be adjusted to provide a minimum of 1 ¼" clear cover.

When structure is founded on solid rock, depth of toewalls for culverts and wingwalls may be reduced or eliminated as directed by the Engineer.

See BCS sheet for additional dimensions and information.

The quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for Contractor's information only.

Texas Department of Transportation — Bridge Division Standard

CONCRETE WINGWALLS WITH FLARED WINGS FOR SKEWED BOX CULVERTS

FW-S

FILE: fw-sstde.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: GAF
©TxDOT February 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS 11-10: Add note for synthetic fibers.	DIST	COUNTY		SHEET NO.

DATE:
FILE:

2/13/2018 9:30 AM

TABLE OF DIMENSIONS & REINFORCING STEEL
(Wings for One Structure End)

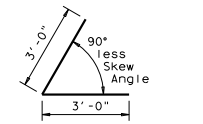
Dimensions					Variable Reinforcing				Estimated ④ Quantities per ft of Wing (2~Wings)		Estimated Quantities per ft of Toewall (1~Toewall)	
					Bars J1		Bars J2					
Maximum Wingwall Height Hw	W	X	Y	Z	Size	Spa	Size	Spa	Reinf (Lb/Ft)	Conc (CY/Ft)	Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'-10"	10"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	48.64	0.406	6.85	0.071
2'-9"	2'-10"	10"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	49.31	0.424	6.85	0.071
3'-0"	2'-10"	10"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	49.98	0.444	6.85	0.071
3'-3"	2'-10"	10"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	53.32	0.462	6.85	0.071
3'-6"	2'-10"	10"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	53.98	0.480	6.85	0.071
4'-0"	3'- 2"	1'- 2"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	55.77	0.532	6.85	0.071
4'-6"	3'- 2"	1'- 2"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	59.77	0.568	6.85	0.071
5'-0"	3'- 9"	1'- 7"	1'- 2"	7"	#4	1'-0"	#4	1'-0"	63.45	0.632	6.96	0.075
5'-6"	3'- 9"	1'- 7"	1'- 2"	7"	#4	1'-0"	#4	1'-0"	67.46	0.668	6.96	0.075
6'-0"	4'- 4"	2'- 0"	1'- 4"	7"	#5	1'-0"	#5	1'-0"	80.67	0.730	7.07	0.078
6'-6"	4'- 4"	2'- 0"	1'- 4"	7"	#5	1'-0"	#5	1'-0"	85.05	0.768	7.07	0.078
7'-0"	5'- 0"	2'- 3"	1'- 9"	8"	#5	1'-0"	#5	1'-0"	92.15	0.864	8.07	0.093
7'-6"	5'- 0"	2'- 3"	1'- 9"	8"	#5	1'-0"	#5	1'-0"	96.54	0.902	8.07	0.093
8'-0"	5'- 6"	2'- 8"	1'-10"	8"	#5	6"	#5	6"	139.04	0.962	8.13	0.095
8'-6"	5'- 6"	2'- 8"	1'-10"	8"	#5	6"	#5	6"	144.47	1.000	8.13	0.095
9'-6"	6'- 0"	2'-10"	2'- 2"	9"	#5	6"	#5	6"	156.93	1.136	8.41	0.110
10'-6"	6'- 5"	3'- 0"	2'- 5"	9"	#6	6"	#5	6"	196.27	1.234	8.57	0.117
11'-6"	7'- 2"	3'- 6"	2'- 8"	11"	#6	6"	#6	6"	230.13	1.438	9.52	0.140
12'-6"	7'- 8"	3'- 9"	2'-11"	1'- 0"	#7	6"	#6	6"	283.41	1.592	9.74	0.157
13'-6"	8'- 2"	4'- 0"	3'- 2"	1'- 2"	#8	6"	#6	6"	348.72	1.804	10.02	0.186
14'-6"	8'-10"	4'- 5"	3'- 5"	1'- 4"	#9	6"	#6	6"	432.94	2.046	10.30	0.218
15'-6"	9'- 6"	4'-10"	3'- 8"	1'- 6"	#9	6"	#7	6"	489.52	2.302	11.24	0.253
16'-0"	9'-11"	5'- 0"	3'-11"	1'- 7"	#9	6"	#7	6"	505.72	2.448	11.47	0.279

TABLE OF WINGWALL REINFORCING (2~Wings)

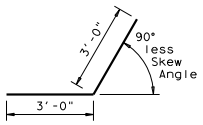
Bar	Size	No.	Spa
D1	#6	~	1'-0"
D2	#6	~	1'-0"
E1	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	~	8"
M1	#4	4	~
P	#4	~	1'-0"
V	#4	~	1'-0"

TABLE OF TOEWALL REINFORCING

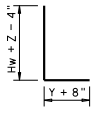
Bar	Size	No	Spa
J3	#4	~	1'-0"
M2	#4	2	~
E2	#4	~	1'-0"



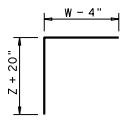
BARS D1



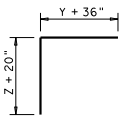
BARS D2



BARS J1



BARS J2



BARS J3

BARS V

WING DIMENSION CALCULATIONS:

Formulas: (All values are in Feet)

Hw = H + T + C
Lw = (Hw) (SL) ÷ Cosine θ for Ty PW-1
= (Hw - 1') (SL) ÷ Cosine θ for Ty PW-2 and Hw ≥ 4'
= (Hw - 0.5') (SL) ÷ Cosine θ for Ty PW-2 and Hw < 4'

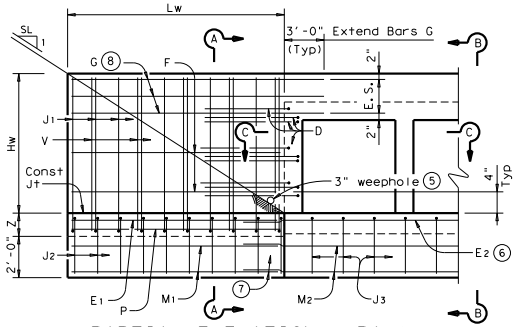
For Cast-in-place culverts:
Ltw = [(N) (S) + (N + 1) (U)] ÷ Cosine θ

For Precast culverts:
Ltw = [(N) (2 U + S) + (N - 1) (0.5')] ÷ Cosine θ
Total Wingwall Area (Two Wings ~ SF)
= (2)(Hw)(Lw) for Ty PW-1
= (2)(Hw)(Lw) - 6 SF for Ty PW-2 and Hw ≥ 4'
= (2)(Hw)(Lw) - 1.5 SF for Ty PW-2 and Hw < 4'

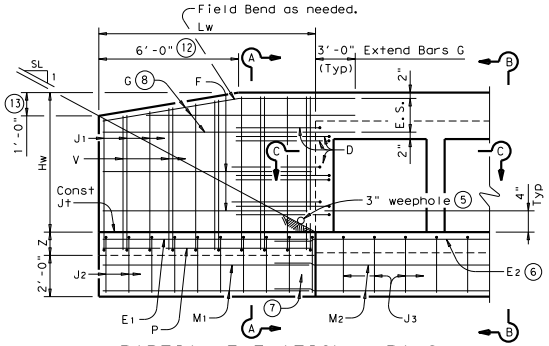
Hw = Height of Wingwall
Lw = Length of Wingwall
Ltw = Culvert Toewall Length
N = Number of Culvert Spans
SL:1 = Channel Slope ratio. (Horizontal: 1 Vertical, Usual value is 2:1)
θ = Culvert Skew

See applicable box culvert standard for S, H, T and U values.

1. Skew Angle = 0°
2. At discharge end, chamfer may be ¾".
3. For 15° Skew ~ 1"
   For 30° Skew ~ 2"
   For 45° Skew ~ 3"
4. Quantities shown are for two Type PW-1 wings. Adjust concrete volume for Type PW-2 wings. To determine estimated quantities for two wings, multiply the tabulated values by Lw. Quantities shown do not include weight of Bars D.
5. Provide weepholes for Hw = 5'-0" and greater. Fill around weepholes with coarse gravel.
6. Extend Bars E2 1'-6" minimum into the wingwall footing.
7. Lap Bars M1 1'-6" minimum with Bars M2.
8. Bars G equally spaced at 8" maximum, place as shown. Provide at least two pair Bars G per wing.
9. 0" min to 5'-0" max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail, bicycle rail or curbs taller than 1'-0", refer to ECD standard. For structures with T6 bridge rail, refer to T6-CM standard. For structures with traffic rail, other than T6, refer to RAC standard.
10. For vehicle safety, the following requirements must be met:
    - For structures without bridge rail, curbs cannot project more than 3" above finished grade.
    - For structures with bridge rail, build curbs flush with finished grade.
    Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
11. 1'-0" typical. 2'-0" typical when RAC standard is referenced elsewhere in the plans.
12. 3'-0" for Hw < 4'.
13. 6" for Hw < 4'.



PARTIAL ELEVATION - PW-1



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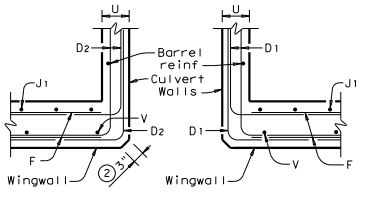
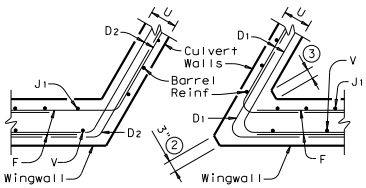


SECTION C-C



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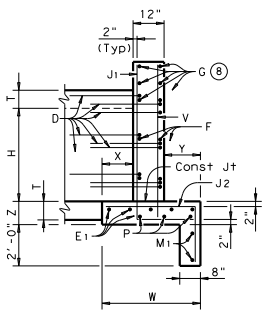
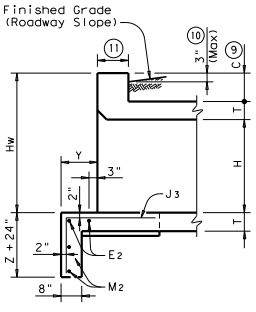
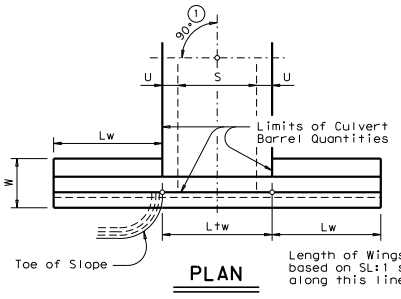


SECTION A-A
(Showing Wing Reinf)

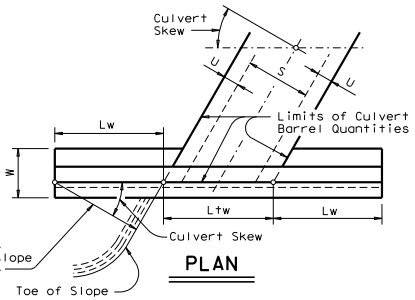


SECTION B-B
(Showing Wing Reinf)



PLAN

DETAILS FOR NON-SKEWED BOX CULVERTS



PLAN

DETAILS FOR SKEWED BOX CULVERTS
(Showing 30° Skew)

GENERAL NOTES:

Designed in accordance with AASHTO LRFD Bridge Design Specifications.

Provide Class "C" Concrete (f'c = 3,600 psi Min) and Grade 60 reinforcing steel.

Provide 1½" Min clear cover to reinforcing steel.

Depth of toewalls for wingwalls and culverts may be reduced or eliminated when founded on solid rock, when directed by the Engineer.

See BCS sheet for wingwall type and additional dimensions and information.

The quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for the Contractor's information only.

DESIGNER NOTES:

Type PW-1 can be used for all applications and must be used if railing is to be mounted to the wingwall.

Type PW-2 can only be used for applications without a railing mounted to the wingwall.

Texas Department of Transportation — Bridge Division Standard

CONCRETE WINGWALLS
WITH PARALLEL WINGS FOR BOX CULVERTS TYPES PW-1 AND PW-2

PW

FILE: pwstde01.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: GAF
©TxDOT February 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS				
11-10: Reinforcing Quantities. 01-12: PW-1 & PW-2.	DIST	COUNTY		SHEET NO.

DATE:
FILE:

2/13/2018 9:30 AM

TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL (4)

SLOPE	DIA. OF PIPE, D	Values for one Pipe			Values to be added for each addt'l Pipe		
		W	Reinf (Lbs)	Conc (CY) (1)	W	Reinf (Lbs)	Conc (CY) (1)
2:1	12"	9'- 0"	122	1.1	1'- 9"	15	0.2
	15"	10'- 3"	136	1.3	2'- 2"	16	0.2
	18"	11'- 6"	163	1.5	2'- 8"	19	0.3
	21"	12'- 9"	200	1.8	3'- 1"	31	0.4
	24"	14'- 0"	217	2.1	3'- 7"	34	0.4
	27"	15'- 3"	254	2.4	3'-11"	37	0.5
	30"	16'- 6"	272	2.7	4'- 4"	40	0.6
	33"	17'- 9"	314	3.1	4'- 8"	43	0.6
	36"	19'- 0"	371	3.9	5'- 1"	46	0.8
	42"	21'- 6"	442	4.9	5'-10"	52	1.0
	48"	25'- 0"	569	6.4	6'- 7"	59	1.3
	54"	27'- 6"	701	7.5	7'- 6"	82	1.6
	60"	30'- 0"	794	8.8	8'- 3"	90	1.8
	66"	32'- 6"	894	10.2	8'- 9"	96	2.0
	72"	35'- 0"	1055	11.7	9'- 4"	103	2.3
3:1	12"	13'- 0"	175	1.6	1'- 9"	14	0.2
	15"	14'- 9"	193	1.9	2'- 2"	17	0.2
	18"	16'- 6"	228	2.2	2'- 8"	19	0.3
	21"	18'- 3"	299	2.6	3'- 1"	31	0.4
	24"	20'- 0"	323	3.0	3'- 7"	33	0.4
	27"	21'- 9"	371	3.5	3'-11"	37	0.5
	30"	23'- 6"	415	4.0	4'- 4"	40	0.5
	33"	25'- 3"	469	4.6	4'- 8"	43	0.6
	36"	27'- 0"	556	5.7	5'- 1"	46	0.8
	42"	30'- 6"	675	7.1	5'-10"	52	1.0
	48"	35'- 6"	837	9.2	6'- 7"	59	1.3
	54"	39'- 0"	1015	11.0	7'- 6"	84	1.6
	60"	42'- 6"	1171	12.9	8'- 3"	91	1.8
	66"	46'- 0"	1298	14.9	8'- 9"	98	2.0
	72"	49'- 6"	1561	17.1	9'- 4"	103	2.3
4:1	12"	17'- 0"	229	2.0	1'- 9"	15	0.2
	15"	19'- 3"	266	2.4	2'- 2"	17	0.2
	18"	21'- 6"	308	2.9	2'- 8"	19	0.3
	21"	23'- 9"	382	3.5	3'- 1"	31	0.3
	24"	26'- 0"	430	3.9	3'- 7"	34	0.4
	27"	28'- 3"	486	4.7	3'-11"	37	0.5
	30"	30'- 6"	539	5.2	4'- 4"	40	0.6
	33"	32'- 9"	603	6.0	4'- 8"	42	0.6
	36"	35'- 0"	738	7.5	5'- 1"	47	0.8
	42"	39'- 6"	881	9.3	5'-10"	52	1.0
	48"	46'- 0"	1102	12.1	6'- 7"	61	1.3
	54"	50'- 6"	1364	14.4	7'- 6"	84	1.6
	60"	55'- 0"	1547	16.9	8'- 3"	91	1.8
	66"	59'- 6"	1741	19.5	8'- 9"	98	2.0
	72"	64'- 0"	2069	22.4	9'- 4"	102	2.3
6:1	12"	25'- 0"	336	3.0	1'- 9"	14	0.2
	15"	28'- 3"	384	3.6	2'- 2"	17	0.2
	18"	31'- 6"	452	4.2	2'- 8"	19	0.3
	21"	34'- 9"	581	5.1	3'- 1"	31	0.4
	24"	38'- 0"	644	5.8	3'- 7"	34	0.4
	27"	41'- 3"	737	6.9	3'-11"	37	0.5
	30"	44'- 6"	807	7.7	4'- 4"	39	0.6
	33"	47'- 9"	912	8.9	4'- 8"	44	0.6
	36"	51'- 0"	1108	11.0	5'- 1"	48	0.8
	42"	57'- 6"	1318	13.7	5'-10"	54	1.0
	48"	67'- 0"	1674	17.9	6'- 7"	59	1.3
	54"	73'- 6"	2064	21.3	7'- 6"	83	1.6
	60"	80'- 0"	2343	24.9	8'- 3"	89	1.8
	66"	86'- 6"	2635	28.9	8'- 9"	96	2.0
	72"	93'- 0"	3123	33.1	9'- 4"	101	2.3

DATE:
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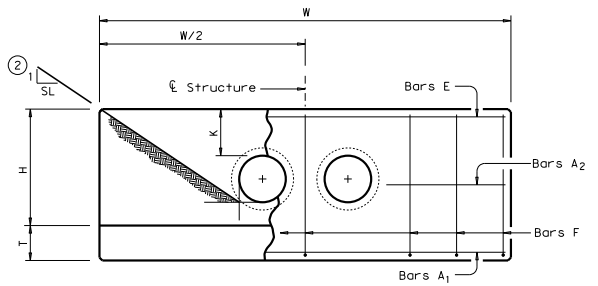
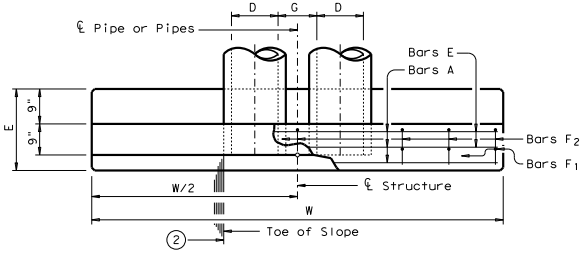
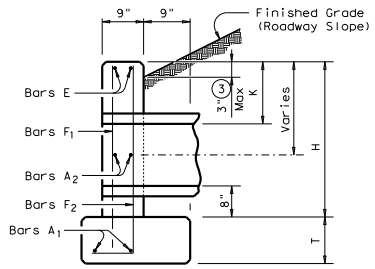


ELEVATION



PLAN OF NON-SKEWED PIPES



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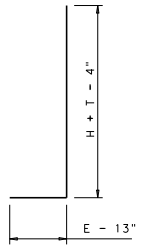


BARS F2

(1) Quantities shown are for concrete pipe and will increase slightly for metal pipe installations.

(2) Indicated slope is perpendicular to centerline Pipe or Pipes.

(3) For vehicle safety, curbs shall project no more than 3" above finished grade. Curb heights shall be reduced, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

(4) Quantities shown are for one structure end only (one headwall).

TABLE OF CONSTANT DIMENSIONS

DIA. OF PIPE, D	G	K	H	T	E
12"	9"	1'- 0"	2'- 8"	9"	1'- 9"
15"	11"	1'- 0"	2'-11"	9"	1'- 9"
18"	1'- 2"	1'- 0"	3'- 2"	9"	1'- 9"
21"	1'- 4"	1'- 0"	3'- 5"	9"	2'- 0"
24"	1'- 7"	1'- 0"	3'- 8"	9"	2'- 0"
27"	1'- 8"	1'- 0"	3'-11"	9"	2'- 3"
30"	1'-10"	1'- 0"	4'- 2"	9"	2'- 3"
33"	1'-11"	1'- 0"	4'- 5"	9"	2'- 6"
36"	2'- 1"	1'- 0"	4'- 8"	1'- 0"	2'- 6"
42"	2'- 4"	1'- 0"	5'- 2"	1'- 0"	2'- 9"
48"	2'- 7"	1'- 3"	5'-11"	1'- 0"	3'- 0"
54"	3'- 0"	1'- 3"	6'- 5"	1'- 0"	3'- 3"
60"	3'- 3"	1'- 3"	6'-11"	1'- 0"	3'- 6"
66"	3'- 3"	1'- 3"	7'- 5"	1'- 0"	3'- 9"
72"	3'- 4"	1'- 3"	7'-11"	1'- 0"	4'- 0"

TABLE OF REINFORCING STEEL (4)

Bar	Size	Spa	No.
A1	# 5	~	2
A2	# 5	1'-6"	~
E	# 5	~	2
F	# 5	1'-0"	~

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

Reinforcing steel shall be placed with the center of the outside layer of bars 2" from the surface of the concrete.

All reinforcing steel shall be Grade 60.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

No bridge rails of any type may be mounted directly to these culvert headwalls.

Texas Department of Transportation

Bridge Division Standard

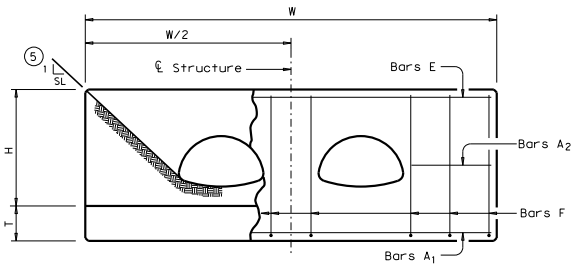
CONCRETE HEADWALLS WITH PARALLEL WINGS FOR NON-SKEWED PIPE CULVERTS

CH-PW-0

FILE: chpw0ste.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: GAF
©TxDOT February 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS				
	DIST.	COUNTY		SHEET NO.

TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL (4)

SLOPE	DESIGN	SIZE OF PIPE ARCH Span	SIZE OF PIPE ARCH Rise	Values for one Pipe W	Values for one Pipe Reinf (Lbs) (1)	Values for one Pipe Conc (CY) (2)	Values to be added for each addt'l Pipe W	Values to be added for each addt'l Pipe Reinf (Lbs) (1)	Values to be added for each addt'l Pipe Conc (CY) (2)
2:1	1	17"	13"	9'- 9"	130	1.1	2'- 5"	28	0.3
	2	21"	15"	10'- 9"	139	1.3	2'-11"	33	0.3
	3	28"	20"	13'- 0"	184	1.8	3'- 9"	43	0.5
	4	35"	24"	14'-11"	249	2.2	4'- 7"	50	0.6
	5	42"	29"	17'- 2"	311	3.2	5'- 5"	69	0.9
	6	49"	33"	19'- 1"	342	3.8	6'- 3"	77	1.1
	7	57"	38"	21'- 5"	438	4.7	7'- 2"	86	1.4
	8	64"	43"	23'- 8"	508	5.6	8'- 2"	110	1.6
	9	71"	47"	25'- 7"	577	6.5	9'- 1"	120	2.0
3:1	1	17"	13"	13'-11"	182	1.6	2'- 5"	28	0.3
	2	21"	15"	15'- 3"	196	1.8	2'-11"	33	0.3
	3	28"	20"	18'- 4"	270	2.6	3'- 9"	42	0.5
	4	35"	24"	20'-11"	356	3.2	4'- 7"	50	0.6
	5	42"	29"	24'- 0"	434	4.5	5'- 5"	70	0.9
	6	49"	33"	26'- 7"	499	5.4	6'- 3"	77	1.1
	7	57"	38"	29'- 9"	628	6.7	7'- 2"	87	1.4
	8	64"	43"	32'-10"	715	7.9	8'- 2"	111	1.6
	9	71"	47"	35'- 5"	798	9.2	9'- 1"	120	2.0
4:1	1	17"	13"	18'- 1"	236	2.1	2'- 5"	28	0.3
	2	21"	15"	19'- 9"	268	2.4	2'-11"	33	0.3
	3	28"	20"	23'- 8"	336	3.3	3'- 9"	42	0.5
	4	35"	24"	26'-11"	460	4.2	4'- 7"	50	0.6
	5	42"	29"	30'-10"	557	5.8	5'- 5"	69	0.9
	6	49"	33"	34'- 1"	653	6.9	6'- 3"	78	1.1
	7	57"	38"	38'- 1"	819	8.6	7'- 2"	87	1.4
	8	64"	43"	42'- 0"	950	10.2	8'- 2"	111	1.7
	9	71"	47"	45'- 3"	1053	11.9	9'- 1"	120	2.0
6:1	1	17"	13"	26'- 5"	343	3.1	2'- 5"	29	0.3
	2	21"	15"	28'- 9"	381	3.5	2'-11"	33	0.3
	3	28"	20"	34'- 4"	504	4.9	3'- 9"	42	0.5
	4	35"	24"	38'-11"	673	6.1	4'- 7"	50	0.6
	5	42"	29"	44'- 6"	823	8.5	5'- 5"	70	0.9
	6	49"	33"	49'- 1"	945	10.1	6'- 3"	78	1.1
	7	57"	38"	54'- 9"	1227	12.5	7'- 2"	87	1.4
	8	64"	43"	60'- 4"	1399	14.8	8'- 2"	110	1.7
	9	71"	47"	64'-11"	1563	17.3	9'- 1"	119	2.0



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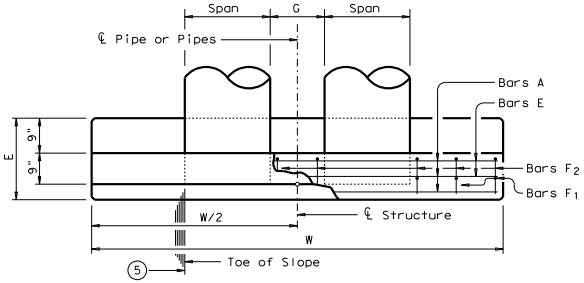
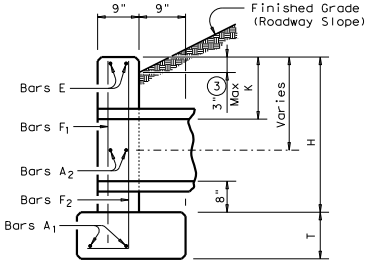


PLAN



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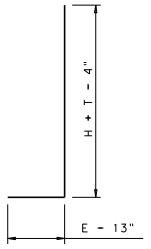


BARS F2

(1) Total quantities include one 15" lap for all bars over 60 ft in length.

(2) Quantities shown are for metal pipe and will decrease slightly for concrete pipe installations.

(3) For vehicle safety, curbs shall project no more than 3" above finished grade. Curb heights shall be reduced, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

(4) Quantities shown are for one structure end only (one headwall).

(5) Indicated slope is perpendicular to centerline Pipe or Pipes.

TABLE OF DIMENSIONS NOT VARIED WITH SLOPE

DESIGN	SIZE OF PIPE ARCH Span	SIZE OF PIPE ARCH Rise	G	K	H	T	E
1	17"	13"	1'- 0"	1'- 0"	2'- 7"	10"	1'- 6"
2	21"	15"	1'- 2"	1'- 0"	2'- 9"	10"	1'- 6"
3	28"	20"	1'- 5"	1'- 0"	3'- 2"	10"	1'-10"
4	35"	24"	1'- 8"	1'- 0"	3'- 6"	10"	2'- 0"
5	42"	29"	1'-11"	1'- 0"	3'-11"	1'- 0"	2'- 4"
6	49"	33"	2'- 2"	1'- 0"	4'- 3"	1'- 0"	2'- 6"
7	57"	38"	2'- 5"	1'- 0"	4'- 8"	1'- 0"	2'-10"
8	64"	43"	2'-10"	1'- 0"	5'- 1"	1'- 0"	3'- 0"
9	71"	47"	3'- 2"	1'- 0"	5'- 5"	1'- 0"	3'- 4"

TABLE OF REINFORCING STEEL (4)

Bar	Size	Spa	No.
A1	# 5	~	2
A2	# 5	1'-6"	~
E	# 5	~	2
F	# 5	1'-0"	~

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

Reinforcing steel shall be placed with the center of the outside layer of bars 2" from the surface of the concrete.

All reinforcing steel shall be Grade 60.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

No bridge rails of any type may be mounted directly to these culvert headwalls.

Texas Department of Transportation — Bridge Division Standard

CONCRETE HEADWALLS WITH PARALLEL WINGS FOR NON-SKEWED ARCH PIPE CULVERTS

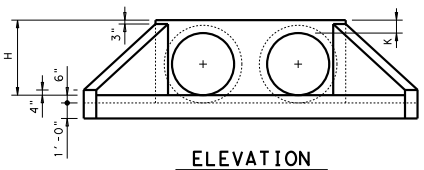
CH-PW-A-0

FILE: chpa0ste.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: GAF
©TxDOT February 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS 11-10: Removed Bars T.	DIST	COUNTY		SHEET NO.

DATE:
FILE:

TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL (4)

SLOPE	DIA. OF PIPE, D	Values for one Pipe						Values to be added for each add'l Pipe		
		W	X	Y	L	Reinf (Lbs)	Conc (CY) (1)	X and W	Reinf (Lbs)	Conc (CY) (1)
2:1	12"	4'- 7 ½"	2'- 6"	2'-10"	3'- 3 ¼"	84	0.6	1'- 9"	20	0.2
	15"	5'- 5 ¾"	2'- 9 ½"	3'- 4"	3'-10 ¼"	99	0.7	2'- 2"	24	0.3
	18"	6'- 4 ¼"	3'- 1"	3'-10"	4'- 5"	120	0.9	2'- 8"	32	0.3
	21"	7'- 2 ¾"	3'- 4 ½"	4'- 4"	5'- 0"	137	1.1	3'- 1"	43	0.4
	24"	8'- 2 ½"	3'- 9 ½"	4'-10"	5'- 7"	158	1.3	3'- 7"	50	0.5
	27"	9'- 1"	4'- 1"	5'- 4"	6'- 2"	173	1.5	3'-11"	56	0.6
	30"	9'-11 ½"	4'- 4 ½"	5'-10"	6'- 8 ¾"	197	1.7	4'- 4"	65	0.8
	33"	10'-10"	4'- 8"	6'- 4"	7'- 3 ¾"	216	2.0	4'- 8"	71	0.9
	36"	11'- 8 ¼"	4'-11 ½"	6'-10"	7'-10 ¾"	241	2.2	5'- 1"	81	1.0
	42"	13'- 5 ¼"	5'- 6 ½"	7'-10"	9'- 0 ½"	290	2.8	5'-10"	97	1.3
	48"	15'- 9"	6'- 1 ½"	9'- 4"	10'- 9 ¼"	350	3.8	6'- 7"	117	1.7
	54"	17'- 5 ¾"	6'- 8 ½"	10'- 4"	11'-11 ¼"	415	4.5	7'- 6"	151	2.1
	60"	19'- 2 ¾"	7'- 3 ½"	11'- 4"	13'- 1"	469	5.3	8'- 3"	174	2.5
	66"	20'-11 ½"	7'-10 ½"	12'- 4"	14'- 3"	530	6.2	8'- 9"	194	2.9
	72"	22'- 8 ½"	8'- 5 ½"	13'- 4"	15'- 4 ¾"	587	7.1	9'- 4"	213	3.3
3:1	12"	6'- 3"	2'- 6"	4'- 3"	4'-11"	114	0.8	1'- 9"	22	0.2
	15"	7'- 5"	2'- 9 ½"	5'- 0"	5'- 9 ¼"	133	1.1	2'- 2"	28	0.3
	18"	8'- 6 ¾"	3'- 1"	5'- 9"	6'- 7 ¾"	166	1.3	2'- 8"	37	0.5
	21"	9'- 8 ¾"	3'- 4 ½"	6'- 6"	7'- 6"	189	1.6	3'- 1"	48	0.6
	24"	11'- 0"	3'- 9 ½"	7'- 3"	8'- 4 ½"	221	2.0	3'- 7"	58	0.7
	27"	12'- 2"	4'- 1"	8'- 0"	9'- 2 ¾"	245	2.3	3'-11"	67	0.8
	30"	13'- 4"	4'- 4 ½"	8'- 9"	10'- 1 ¼"	287	2.7	4'- 4"	77	1.0
	33"	14'- 5 ¾"	4'- 8"	9'- 6"	10'-11 ¾"	310	3.1	4'- 8"	84	1.2
	36"	15'- 7 ¾"	4'-11 ½"	10'- 3"	11'-10"	343	3.5	5'- 1"	96	1.4
	42"	17'-11 ½"	5'- 6 ½"	11'- 9"	13'- 6 ¾"	424	4.5	5'-10"	119	1.7
	48"	21'- 1 ¾"	6'- 1 ½"	14'- 0"	16'- 2"	527	6.1	6'- 7"	146	2.3
	54"	23'- 5 ½"	6'- 8 ½"	15'- 6"	17'-10 ¾"	618	7.3	7'- 6"	186	2.9
	60"	25'- 9 ¼"	7'- 3 ½"	17'- 0"	19'- 7 ½"	707	8.7	8'- 3"	219	3.4
	66"	28'- 1"	7'-10 ½"	18'- 6"	21'- 4 ¼"	797	10.1	8'- 9"	242	3.9
	72"	30'- 4 ¾"	8'- 5 ½"	20'- 0"	23'- 1 ¼"	910	11.7	9'- 4"	272	4.4
4:1	12"	7'-10 ¾"	2'- 6"	5'- 8"	6'- 6 ½"	144	1.1	1'- 9"	24	0.3
	15"	9'- 4"	2'- 9 ½"	6'- 8"	7'- 8 ½"	177	1.5	2'- 2"	32	0.4
	18"	10'- 9 ½"	3'- 1"	7'- 8"	8'-10 ¼"	217	1.9	2'- 8"	42	0.5
	21"	12'- 2 ¾"	3'- 4 ½"	8'- 8"	10'- 0"	254	2.3	3'- 1"	57	0.7
	24"	13'- 9 ½"	3'- 9 ½"	9'- 8"	11'- 2"	295	2.8	3'- 7"	67	0.9
	27"	15'- 3"	4'- 1"	10'- 8"	12'- 3 ¾"	328	3.3	3'-11"	77	1.0
	30"	16'- 8 ¼"	4'- 4 ½"	11'- 8"	13'- 5 ¾"	379	3.8	4'- 4"	89	1.3
	33"	18'- 1 ¾"	4'- 8"	12'- 8"	14'- 7 ½"	417	4.5	4'- 8"	101	1.4
	36"	19'- 7"	4'-11 ½"	13'- 8"	15'- 9 ¼"	464	5.1	5'-1"	115	1.7
	42"	22'- 5 ¾"	5'- 6 ½"	15'- 8"	18'- 1"	575	6.5	5'-10"	141	2.1
	48"	26'- 6 ¼"	6'- 1 ½"	18'- 8"	21'- 6 ¾"	720	8.9	6'- 7"	175	2.8
	54"	29'- 5"	6'- 8 ½"	20'- 8"	23'-10 ¼"	863	10.7	7'- 6"	226	3.6
	60"	32'- 3 ¾"	7'- 3 ½"	22'- 8"	26'- 2"	984	12.7	8'- 3"	264	4.3
	66"	35'- 2 ½"	7'-10 ½"	24'- 8"	28'- 5 ¾"	1126	14.9	8'- 9"	300	4.9
	72"	38'- 1 ¼"	8'- 5 ½"	26'- 8"	30'- 9 ½"	1283	17.3	9'- 4"	334	5.6
6:1	12"	11'- 2"	2'- 6"	8'- 6"	9'- 9 ¾"	220	1.9	1'- 9"	28	0.4
	15"	13'- 2 ¼"	2'- 9 ½"	10'- 0"	11'- 6 ½"	264	2.5	2'- 2"	37	0.5
	18"	15'- 2 ½"	3'- 1"	11'- 6"	13'- 3 ¼"	326	3.2	2'- 8"	50	0.7
	21"	17'- 2 ¾"	3'- 4 ½"	13'- 0"	15'- 0 ¼"	381	3.9	3'- 1"	69	0.9
	24"	19'- 4 ½"	3'- 9 ½"	14'- 6"	16'- 9"	447	4.8	3'- 7"	80	1.2
	27"	21'- 4 ¾"	4'- 1"	16'- 0"	18'- 5 ¾"	506	5.7	3'-11"	96	1.4
	30"	23'- 5 ¼"	4'- 4 ½"	17'- 6"	20'- 2 ½"	587	6.7	4'- 4"	110	1.7
	33"	25'- 5 ½"	4'- 8"	19'- 0"	21'-11 ¼"	667	7.8	4'- 8"	127	2.0
	36"	27'- 5 ¾"	4'-11 ½"	20'- 6"	23'- 8"	727	9.0	5'- 1"	144	2.3
	42"	31'- 6 ¼"	5'- 6 ½"	23'- 6"	27'- 1 ½"	914	11.5	5'-10"	179	3.0
	48"	37'- 3 ½"	6'- 1 ½"	28'- 0"	32'- 4"	1181	15.9	6'- 7"	231	4.0
	54"	41'- 4 ¼"	6'- 8 ½"	31'- 0"	35'- 9 ½"	1412	19.2	7'- 6"	300	5.0
	60"	45'- 4 ¾"	7'- 3 ½"	34'- 0"	39'- 3"	1619	22.9	8'- 3"	353	6.0



ELEVATION
Showing dimensions

(1) Quantities shown are for concrete pipe and will increase slightly for metal pipe installations.

(2) For vehicle safety, curbs shall project no more than 3" above finished grade. Curb heights shall be reduced, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

(3) Provide a 1'-0" footing as shown where required to maintain 4" Min cover for pipes.

(4) Quantities shown are for one structure end only (one headwall).

(5) Min Length = $6" + 3" \times \left(\frac{12 \times H - 7}{12 \times L}\right)$

Max Length = $12 \times H - 3" \times \left(\frac{12 \times H - 7}{12 \times L}\right) - 1"$

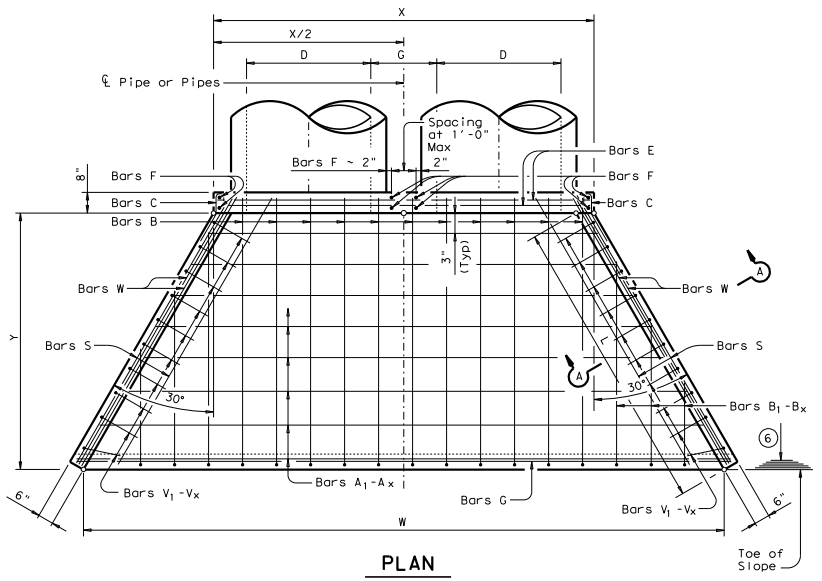
(6) Lengths of wings based on SL:1 Slope along this line.

TABLE OF REINFORCING STEEL (4)

Bar	Size	Spa	No.
A	# 4	1'-0"	~
B	# 3	1'-6"	~
C	# 4	1'-0"	~
D	# 3	1'-0"	~
E	# 5	~	4
F	# 5	~	~
G	# 3	~	2
S	# 4	~	6
V	# 4	1'-0"	~
W	# 5	~	4

TABLE OF CONSTANT DIMENSIONS

DIA OF PIPE, D	G	K	H
12"	9"	1'- 0"	2'- 0"
15"	11"	1'- 0"	2'- 3"
18"	1'- 2"	1'- 0"	2'- 6"
21"	1'- 4"	1'- 0"	2'- 9"
24"	1'- 7"	1'- 0"	3'- 0"
27"	1'- 8"	1'- 0"	3'- 3"
30"	1'-10"	1'- 0"	3'- 6"
33"	1'-11"	1'- 0"	3'- 9"
36"	2'- 1"	1'- 0"	4'- 0"
42"	2'- 4"	1'- 0"	4'- 6"
48"	2'- 7"	1'- 3"	5'- 3"
54"	3'- 0"	1'- 3"	5'- 9"
60"	3'- 3"	1'- 3"	6'- 3"
66"	3'- 3"	1'- 3"	6'- 9"
72"	3'- 4"	1'- 3"	7'- 3"



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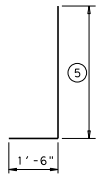
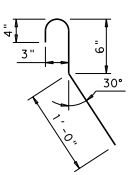
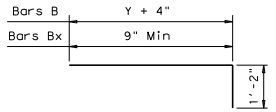


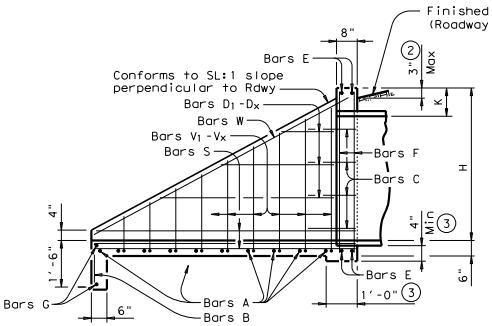
BARS V



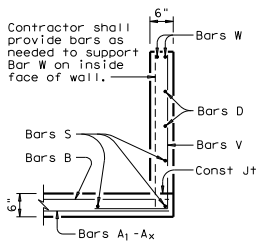
BARS C
(2'-0" long)



BARS B & B1-Bx



TYPICAL WING ELEVATION



SECTION A-A

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

Reinforcing steel shall be placed with the center of the outside layer of bars 2" from the surface of the concrete.

All reinforcing steel shall be Grade 60.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

No bridge rails of any type may be mounted directly to these culvert headwalls.

Texas Department of Transportation | Bridge Division Standard

CONCRETE HEADWALLS WITH FLARED WINGS FOR 0° SKEW PIPE CULVERTS

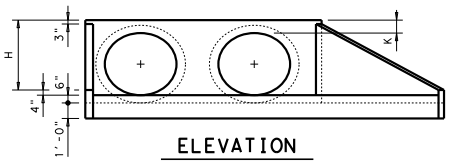
CH-FW-0

FILE: chfw00se.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: GAF
©TxDOT February 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS				
	DIST	COUNTY		SHEET NO.

DATE:
FILE:

TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL (4)

SLOPE	DIA. OF PIPE, D	Values for one Pipe W	X	Y	L	Reinf (Lbs)	Conc (CY) (1)	Values to be added for each add'l Pipe X and W	Reinf (Lbs)	Conc (CY) (1)
2:1	12"	4'- 9"	3'- 1 ½"	2'-10"	4'- 0"	90	0.6	2'- 0 ¼"	22	0.2
	15"	5'- 6 ¾"	3'- 5 ¼"	3'- 4"	4'- 8 ½"	102	0.8	2'- 6"	28	0.3
	18"	6'- 4 ¾"	3'- 9 ¼"	3'-10"	5'- 5"	129	0.9	3'- 1"	41	0.4
	21"	7'- 2 ¾"	4'- 1 ¼"	4'- 4"	6'- 1 ½"	144	1.1	3'- 6 ¾"	47	0.5
	24"	8'- 2 ½"	4'- 7"	4'-10"	6'-10"	164	1.4	4'- 1 ¾"	57	0.6
	27"	9'- 0 ½"	4'-11"	5'- 4"	7'- 6 ½"	178	1.6	4'- 6 ¼"	62	0.7
	30"	9'-10 ½"	5'- 3"	5'-10"	8'- 3"	212	1.8	5'- 0"	72	0.9
	33"	10'- 8 ¾"	5'- 7"	6'- 4"	8'-11 ½"	225	2.1	5'- 4 ¾"	79	1.0
	36"	11'- 6 ¾"	5'-11 ¼"	6'-10"	9'- 8"	250	2.4	5'-10 ½"	90	1.2
	42"	13'- 2 ¾"	6'- 7 ¼"	7'-10"	11'- 1"	304	3.0	6'- 8 ¾"	109	1.5
	48"	15'- 4 ¾"	7'- 3 ¼"	9'- 4"	13'- 2 ½"	369	4.0	7'- 7 ¼"	142	2.0
	54"	17'- 1"	7'-11 ½"	10'- 4"	14'- 7 ¼"	429	4.7	8'- 8"	170	2.5
	60"	18'- 9"	8'- 7 ½"	11'- 4"	16'- 0 ¼"	484	5.6	9'- 6 ¼"	194	2.9
	66"	20'- 5"	9'- 3 ½"	12'- 4"	17'- 5 ¼"	550	6.5	10'- 1 ¼"	217	3.3
	72"	22'- 1 ¼"	9'-11 ¾"	13'- 4"	18'-10 ¼"	614	7.5	10'- 9 ¼"	239	3.7
3:1	12"	6'- 2"	3'- 1 ½"	4'- 3"	6'- 0"	118	0.9	2'- 0 ¼"	24	0.3
	15"	7'- 2 ¾"	3'- 5 ¼"	5'- 0"	7'- 0 ¾"	142	1.1	2'- 6"	31	0.4
	18"	8'- 3 ¾"	3'- 9 ¼"	5'- 9"	8'- 1 ½"	179	1.4	3'- 1"	46	0.5
	21"	9'- 4 ¾"	4'- 1 ¼"	6'- 6"	9'- 2 ¼"	197	1.7	3'- 6 ¾"	53	0.7
	24"	10'- 7 ½"	4'- 7"	7'- 3"	10'- 3"	227	2.1	4'- 1 ¾"	65	0.8
	27"	11'- 8 ½"	4'-11"	8'- 0"	11'- 3 ¾"	255	2.4	4'- 6 ¼"	75	1.0
	30"	12'- 9 ½"	5'- 3"	8'- 9"	12'- 4 ½"	298	2.8	5'- 0"	86	1.2
	33"	13'-10 ¾"	5'- 7"	9'- 6"	13'- 5 ¼"	322	3.2	5'- 4 ¾"	94	1.3
	36"	14'-11 ¾"	5'-11 ¼"	10'- 3"	14'- 6"	355	3.7	5'-10 ½"	108	1.5
	42"	17'- 1 ¾"	6'- 7 ¼"	11'- 9"	16'- 7 ½"	441	4.6	6'- 8 ¾"	133	2.0
	48"	20'- 0 ¾"	7'- 3 ¼"	14'- 0"	19'- 9 ½"	542	6.2	7'- 7 ¼"	176	2.7
	54"	22'- 3"	7'-11 ½"	15'- 6"	21'-11"	626	7.5	8'- 8"	211	3.3
	60"	24'- 5"	8'- 7 ½"	17'- 0"	24'- 0 ½"	725	8.9	9'- 6 ¼"	246	3.9
	66"	26'- 7"	9'- 3 ½"	18'- 6"	26'- 2"	821	10.4	10'- 1 ¼"	274	4.5
	72"	28'- 9 ¼"	9'-11 ¾"	20'- 0"	28'- 3 ½"	930	12.0	10'- 9 ¼"	309	5.1
4:1	12"	7'- 7"	3'- 1 ½"	5'- 8"	8'- 0 ¼"	156	1.2	2'- 0 ¼"	28	0.3
	15"	8'-10 ¾"	3'- 5 ¼"	6'- 8"	9'- 5 ¼"	183	1.5	2'- 6"	36	0.5
	18"	10'- 2 ¾"	3'- 9 ¼"	7'- 8"	10'-10"	228	1.9	3'- 1"	52	0.6
	21"	11'- 6 ¾"	4'- 1 ¼"	8'- 8"	12'- 3"	264	2.3	3'- 6 ¾"	63	0.8
	24"	13'- 0 ½"	4'- 7"	9'- 8"	13'- 8"	301	2.8	4'- 1 ¾"	75	1.0
	27"	14'- 4 ½"	4'-11"	10'- 8"	15'- 1"	339	3.4	4'- 6 ¼"	87	1.2
	30"	15'- 8 ½"	5'- 3"	11'- 8"	16'- 6"	394	3.9	5'- 0"	99	1.4
	33"	17'- 0 ¾"	5'- 7"	12'- 8"	17'-11"	432	4.5	5'- 4 ¾"	112	1.7
	36"	18'- 4 ¾"	5'-11 ¼"	13'- 8"	19'- 4"	479	5.2	5'-10 ½"	128	1.9
	42"	21'- 0 ¾"	6'- 7 ¼"	15'- 8"	22'- 1 ¾"	587	6.6	6'- 8 ¾"	158	2.5
	48"	24'- 8 ¾"	7'- 3 ¼"	18'- 8"	26'- 4 ¾"	738	8.9	7'- 7 ¼"	211	3.3
	54"	27'- 5"	7'-11 ½"	20'- 8"	29'- 2 ¾"	871	10.8	8'- 8"	257	4.1
	60"	30'- 1"	8'- 7 ½"	22'- 8"	32'- 0 ¾"	999	12.8	9'- 6 ¼"	297	4.9
	66"	32'- 9"	9'- 3 ½"	24'- 8"	34'-10 ½"	1139	14.9	10'- 1 ¼"	340	5.6
	72"	35'- 5 ¼"	9'-11 ¾"	26'- 8"	37'- 8 ½"	1290	17.3	10'- 9 ¼"	378	6.4
6:1	12"	10'- 5"	3'- 1 ½"	8'- 6"	12'- 0 ¼"	223	1.9	2'- 0 ¼"	32	0.4
	15"	12'- 2 ¾"	3'- 5 ¼"	10'- 0"	14'- 1 ¾"	273	2.5	2'- 6"	43	0.6
	18"	14'- 0 ¾"	3'- 9 ¼"	11'- 6"	16'- 3 ¼"	336	3.2	3'- 1"	61	0.8
	21"	15'-10 ¾"	4'- 1 ¼"	13'- 0"	18'- 4 ½"	396	3.9	3'- 6 ¾"	76	1.1
	24"	17'-10 ½"	4'- 7"	14'- 6"	20'- 6"	450	4.8	4'- 1 ¾"	91	1.4
	27"	19'- 8 ½"	4'-11"	16'- 0"	22'- 7 ½"	519	5.7	4'- 6 ¼"	108	1.6
	30"	21'- 6 ½"	5'- 3"	17'- 6"	24'- 9"	595	6.6	5'- 0"	124	2.0
	33"	23'- 4 ¾"	5'- 7"	19'- 0"	26'-10 ½"	674	7.7	5'- 4 ¾"	143	2.3
	36"	25'- 2 ¾"	5'-11 ¼"	20'- 6"	29'- 0"	737	8.8	5'-10 ½"	162	2.7
	42"	28'-10 ¾"	6'- 7 ¼"	23'- 6"	33'- 2 ¾"	920	11.3	6'- 8 ¾"	202	3.5
	48"	34'- 0 ¾"	7'- 3 ¼"	28'- 0"	39'- 7 ¼"	1189	15.5	7'- 7 ¼"	274	4.6



ELEVATION

Showing dimensions

(1) Quantities shown are for concrete pipe and will increase slightly for metal pipe installations.

(2) For vehicle safety, curbs shall project no more than 3" above finished grade. Curb heights shall be reduced, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

(3) Provide a 1'-0" footing as shown where required to maintain 4" Min cover for pipes.

(4) Quantities shown are for one structure end only (one headwall).

(5) Min Length = 6" + 3" x $\left(\frac{12 \times H - 7}{12 \times L}\right)$

Max Length = 12 x H - 3" x $\left(\frac{12 \times H - 7}{12 \times L}\right)$ - 1"

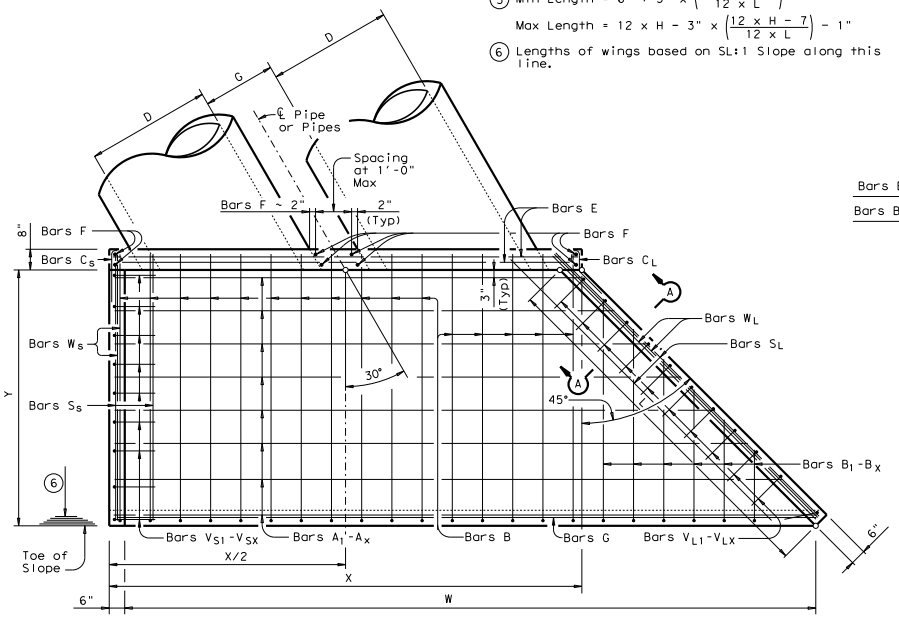
(6) Lengths of wings based on SL:1 Slope along this line.

TABLE OF REINFORCING STEEL (4)

Bar	Size	Spa	No.
A	# 4	1'-0"	~
B	# 3	1'-6"	~
CL	# 4	1'-0"	~
CS	# 4	1'-0"	~
D	# 3	1'-0"	~
E	# 5	~	4
F	# 5	~	~
G	# 3	~	2
SL	# 4	~	3
SS	# 4	~	3
V	# 4	1'-0"	~
WL	# 5	~	2
WS	# 5	~	2

TABLE OF CONSTANT DIMENSIONS

DIA OF PIPE, D	G	K	H
12"	9"	1'- 0"	2'- 0"
15"	11"	1'- 0"	2'- 3"
18"	1'- 2"	1'- 0"	2'- 6"
21"	1'- 4"	1'- 0"	2'- 9"
24"	1'- 7"	1'- 0"	3'- 0"
27"	1'- 8"	1'- 0"	3'- 3"
30"	1'-10"	1'- 0"	3'- 6"
33"	1'-11"	1'- 0"	3'- 9"
36"	2'- 1"	1'- 0"	4'- 0"
42"	2'- 4"	1'- 0"	4'- 6"
48"	2'- 7"	1'- 3"	5'- 3"
54"	3'- 0"	1'- 3"	5'- 9"
60"	3'- 3"	1'- 3"	6'- 3"
66"	3'- 3"	1'- 3"	6'- 9"
72"	3'- 4"	1'- 3"	7'- 3"



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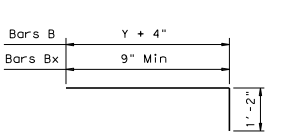
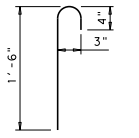


BARS B & B_1-B_X



BARS C_S
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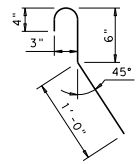

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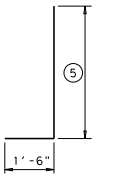
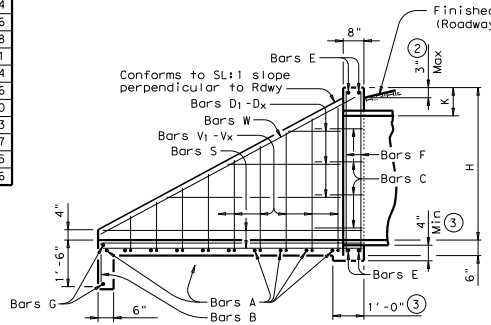
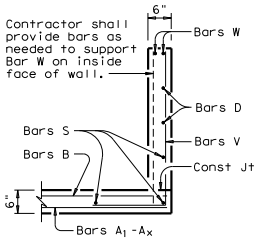


BARS V_S & V_L



TYPICAL WING ELEVATION



SECTION A-A

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

Reinforcing steel shall be placed with the center of the outside layer of bars 2" from the surface of the concrete.

All reinforcing steel shall be Grade 60.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

No bridge rails of any type may be mounted directly to these culvert headwalls.

Texas Department of Transportation

Bridge Division Standard

CONCRETE HEADWALLS WITH FLARED WINGS FOR 30° SKEW PIPE CULVERTS

CH-FW-30

FILE: chfw30se.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: GAF
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	DIST	COUNTY		SHEET NO.

DATE:
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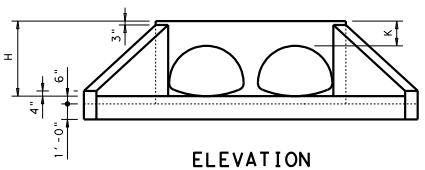
TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL (4)

SLOPE	DESIGN	SIZE OF PIPE ARCH		Values for one Pipe						Values to be added for each addt'l Pipe		
		Span	Rise	W	X	Y	L	Reinf (Lbs)	Conc (CY) (1)	X and W	Reinf (Lbs)	Conc (CY) (1)
2:1	1	17"	13"	5'- 0 ½"	2'- 8 ¾"	3'- 0"	3'- 5 ½"	91	0.6	2'- 5"	35	0.3
	2	21"	15"	5'- 9 ¼"	3'- 0 ¾"	3'- 4"	3'-10 ¼"	107	0.8	2'-11"	42	0.4
	3	28"	20"	7'- 3 ¾"	3'- 7 ¾"	4'- 2"	4'- 9 ¾"	148	1.1	3'- 9"	57	0.6
	4	35"	24"	8'- 8"	4'- 2 ¾"	4'-10"	5'- 7"	174	1.4	4'- 7"	73	0.8
	5	42"	29"	10'- 2 ½"	4'- 9 ¾"	5'- 8"	6'- 6 ½"	204	1.8	5'- 5"	98	1.0
	6	49"	33"	11'- 6 ¾"	5'- 4 ¾"	6'- 4"	7'- 3 ¾"	243	2.2	6'- 3"	113	1.3
	7	57"	38"	13'- 2 ¼"	6'- 0 ¾"	7'- 2"	8'- 3 ¼"	279	2.7	7'- 2"	134	1.6
	8	64"	43"	14'- 8 ¾"	6'- 7 ¾"	8'- 0"	9'- 2 ¾"	327	3.2	8'- 2"	168	2.0
	9	71"	47"	16'- 1"	7'- 2 ¾"	8'- 8"	10'- 0"	371	3.7	9'- 1"	192	2.4
3:1	1	17"	13"	6'- 9 ¼"	2'- 8 ¾"	4'- 6"	5'- 2 ¼"	127	0.9	2'- 5"	38	0.4
	2	21"	15"	7'- 8 ¼"	3'- 0 ¾"	5'- 0"	5'- 9 ¼"	142	1.1	2'-11"	48	0.5
	3	28"	20"	9'- 8 ½"	3'- 7 ¾"	6'- 3"	7'- 2 ½"	201	1.6	3'- 9"	64	0.7
	4	35"	24"	11'- 5 ½"	4'- 2 ¾"	7'- 3"	8'- 4 ½"	237	2.1	4'- 7"	83	1.0
	5	42"	29"	13'- 5 ¾"	4'- 9 ¾"	8'- 6"	9'- 9 ¾"	295	2.7	5'- 5"	113	1.3
	6	49"	33"	15'- 2 ¾"	5'- 4 ¾"	9'- 6"	10'-11 ¾"	339	3.3	6'- 3"	130	1.7
	7	57"	38"	17'- 4"	6'- 0 ¾"	10'- 9"	12'- 5"	394	4.2	7'- 2"	159	2.1
	8	64"	43"	19'- 4 ¼"	6'- 7 ¾"	12'- 0"	13'-10 ¼"	471	5.1	8'- 2"	199	2.6
	9	71"	47"	21'- 1 ¼"	7'- 2 ¾"	13'- 0"	15'- 0 ¼"	523	5.9	9'- 1"	226	3.1
4:1	1	17"	13"	8'- 6 ¼"	2'- 8 ¾"	6'- 0"	6'-11"	165	1.3	2'- 5"	42	0.4
	2	21"	15"	9'- 7 ¼"	3'- 0 ¾"	6'- 8"	7'- 8 ½"	185	1.6	2'-11"	53	0.6
	3	28"	20"	12'- 1 ½"	3'- 7 ¾"	8'- 4"	9'- 7 ½"	253	2.3	3'- 9"	72	0.9
	4	35"	24"	14'- 3"	4'- 2 ¾"	9'- 8"	11'- 2"	311	2.9	4'- 7"	94	1.2
	5	42"	29"	16'- 9"	4'- 9 ¾"	11'- 4"	13'- 1"	375	3.9	5'- 5"	125	1.6
	6	49"	33"	18'-10 ½"	5'- 4 ¾"	12'- 8"	14'- 7 ½"	449	4.7	6'- 3"	152	2.0
	7	57"	38"	21'- 5 ½"	6'- 0 ¾"	14'- 4"	16'- 6 ¾"	526	5.9	7'- 2"	180	2.6
	8	64"	43"	23'-11 ¾"	6'- 7 ¾"	16'- 0"	18'- 5 ¾"	625	7.2	8'- 2"	229	3.2
	9	71"	47"	26'- 1 ¼"	7'- 2 ¾"	17'- 4"	20'- 0 ¼"	698	8.4	9'- 1"	261	3.9
6:1	1	17"	13"	11'-11 ¾"	2'- 8 ¾"	9'- 0"	10'- 4 ¾"	239	2.1	2'- 5"	49	0.6
	2	21"	15"	13'- 5 ½"	3'- 0 ¾"	10'- 0"	11'- 6 ½"	272	2.6	2'-11"	61	0.8
	3	28"	20"	16'-11 ¼"	3'- 7 ¾"	12'- 6"	14'- 5 ¼"	388	3.8	3'- 9"	87	1.2
	4	35"	24"	19'-10"	4'- 2 ¾"	14'- 6"	16'- 9"	464	5.0	4'- 7"	112	1.6
	5	42"	29"	23'- 3 ½"	4'- 9 ¾"	17'- 0"	19'- 7 ½"	581	6.6	5'- 5"	154	2.2
	6	49"	33"	26'- 2 ¼"	5'- 4 ¾"	19'- 0"	21'-11 ¼"	705	8.2	6'- 3"	187	2.8
	7	57"	38"	29'- 9"	6'- 0 ¾"	21'- 6"	24'-10"	846	10.3	7'- 2"	233	3.5
	8	64"	43"	33'- 2 ½"	6'- 7 ¾"	24'- 0"	27'- 8 ½"	990	12.6	8'- 2"	289	4.4
	9	71"	47"	36'- 1 ¼"	7'- 2 ¾"	26'- 0"	30'- 0 ¼"	1119	14.7	9'- 1"	336	5.3



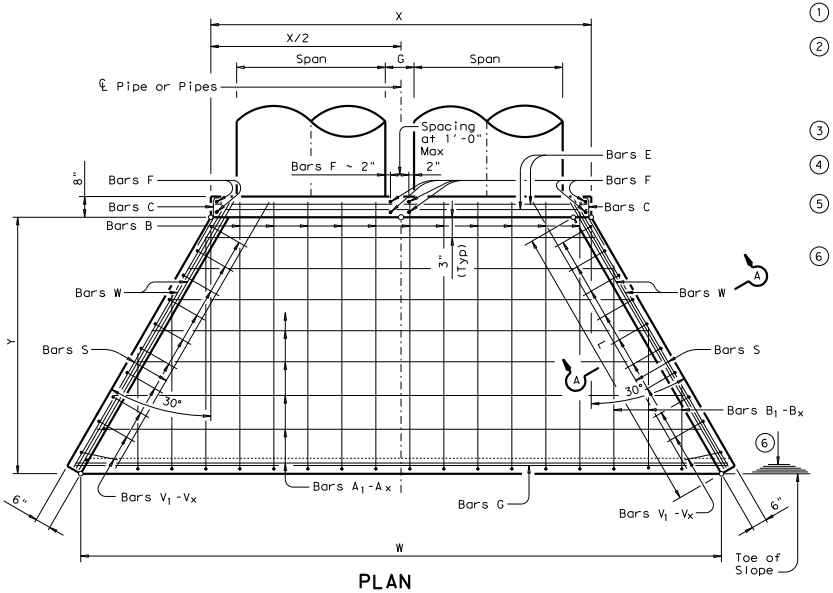
ELEVATION
Showing dimensions

TABLE OF REINFORCING STEEL (4)

Bar	Size	Spa	No.
A	# 4	1'-0"	~
B	# 3	1'-6"	~
C	# 4	1'-0"	~
D	# 3	1'-0"	~
E	# 5	~	4
F	# 5	~	~
G	# 3	~	2
S	# 4	~	6
V	# 4	1'-0"	~
W	# 5	~	4

TABLE OF DIMENSIONS NOT VARIED WITH SLOPE

DESIGN	SIZE OF PIPE ARCH		G	K	H
	Span	Rise			
1	17"	13"	1'- 0"	1'- 0"	2'- 1"
2	21"	15"	1'- 2"	1'- 0"	2'- 3"
3	28"	20"	1'- 5"	1'- 0"	2'- 8"
4	35"	24"	1'- 8"	1'- 0"	3'- 0"
5	42"	29"	1'-11"	1'- 0"	3'- 5"
6	49"	33"	2'- 2"	1'- 0"	3'- 9"
7	57"	38"	2'- 5"	1'- 0"	4'- 2"
8	64"	43"	2'-10"	1'- 0"	4'- 7"
9	71"	47"	3'- 2"	1'- 0"	4'-11"



PLAN

(1) Quantities shown are for metal pipe and will decrease slightly for concrete pipe installations.

(2) For vehicle safety, curbs shall project no more than 3" above finished grade. Curb heights shall be reduced, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

(3) Provide a 1'-0" footing as shown where required to maintain 4" Min cover for pipes.

(4) Quantities shown are for one structure end only (one headwall).

(5) Min Length = 6" + 3" x $\left(\frac{12 \times H - 7}{12 \times L}\right)$

Max Length = 12 x H - 3" x $\left(\frac{12 \times H - 7}{12 \times L}\right)$ - 1"

(6) Lengths of wings based on SL:1 Slope along this line.

GENERAL NOTES:

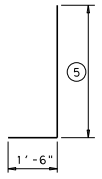
Designed according to AASHTO LRFD Specifications.

Reinforcing steel shall be placed with the center of the outside layer of bars 2" from the surface of the concrete.

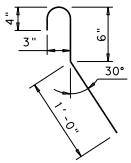
All reinforcing steel shall be Grade 60.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

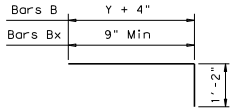
No bridge rails of any type may be mounted directly to these culvert headwalls.



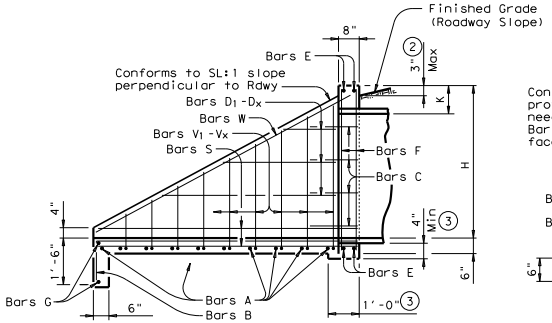
BARS V



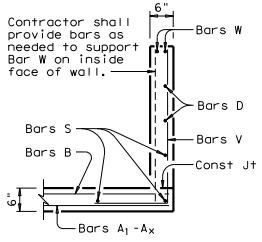
BARS C
(2'-0" long)



BARS B & B1 -Bx



TYPICAL WING ELEVATION



SECTION A-B

Texas Department of Transportation
Bridge Division Standard

CONCRETE HEADWALLS WITH FLARED WINGS FOR 0° SKEW ARCH PIPE CULVERTS

CH-FW-A-0

FILE: chfa00se.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: GAF
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REVISIONS	DIST	COUNTY		SHEET NO.

DATE:
FILE:

TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL (4)

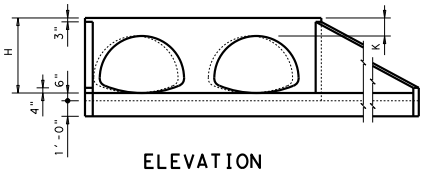
SLOPE DESIGN		SIZE OF PIPE ARCH		Values for one Pipe						Values to be added for each addt'l Pipe		
		Span	Rise	W	X	Y	L	Reinf (Lbs)	Conc (CY) (1)	X and W	Reinf (Lbs)	Conc (CY) (1)
2:1	1	17"	13"	5'- 4 ¾"	3'- 7 ¼"	3'- 0"	4'- 3"	105	0.7	2'- 9 ½"	39	0.4
	2	21"	15"	6'- 1 ¼"	3'-11 ¾"	3'- 4"	4'- 8 ½"	116	0.9	3'- 4 ½"	46	0.5
	3	28"	20"	7'- 7 ½"	4'- 8"	4'- 2"	5'-10 ¾"	154	1.2	4'- 4"	65	0.7
	4	35"	24"	8'-11 ½"	5'- 4"	4'-10"	6'-10"	186	1.5	5'- 3 ½"	88	0.9
	5	42"	29"	10'- 5 ½"	6'- 0"	5'- 8"	8'- 0 ¼"	224	2.0	6'- 3"	109	1.2
	6	49"	33"	11'- 9 ¾"	6'- 8 ¼"	6'- 4"	8'-11 ½"	255	2.4	7'- 2 ½"	124	1.5
	7	57"	38"	13'- 5"	7'- 5 ½"	7'- 2"	10'- 1 ¾"	300	2.9	8'- 3 ¼"	149	1.9
	8	64"	43"	14'-11"	8'- 1 ½"	8'- 0"	11'- 3 ¾"	347	3.5	9'- 5 ¼"	186	2.3
	9	71"	47"	16'- 3"	8'- 9 ½"	8'- 8"	12'- 3"	392	4.1	10'- 5 ¾"	215	2.8
3:1	1	17"	13"	6'-10 ¾"	3'- 7 ¼"	4'- 6"	6'- 4 ¼"	136	1.1	2'- 9 ½"	41	0.4
	2	21"	15"	7'- 9 ¼"	3'-11 ¾"	5'- 0"	7'- 0 ¾"	156	1.3	3'- 4 ½"	52	0.6
	3	28"	20"	9'- 8 ½"	4'- 8"	6'- 3"	8'-10"	207	1.8	4'- 4"	72	0.8
	4	35"	24"	11'- 4 ½"	5'- 4"	7'- 3"	10'- 3"	251	2.3	5'- 3 ½"	98	1.1
	5	42"	29"	13'- 3 ½"	6'- 0"	8'- 6"	12'- 0 ¼"	309	2.9	6'- 3"	126	1.5
	6	49"	33"	14'-11 ¾"	6'- 8 ¼"	9'- 6"	13'- 5 ¼"	355	3.6	7'- 2 ½"	145	1.9
	7	57"	38"	17'- 0"	7'- 5 ½"	10'- 9"	15'- 2 ½"	423	4.4	8'- 3 ¼"	178	2.4
	8	64"	43"	18'-11"	8'- 1 ½"	12'- 0"	16'-11 ¾"	492	5.4	9'- 5 ¼"	221	3.0
	9	71"	47"	20'- 7"	8'- 9 ½"	13'- 0"	18'- 4 ¾"	549	6.2	10'- 5 ¾"	255	3.6
4:1	1	17"	13"	8'- 4 ¾"	3'- 7 ¼"	6'- 0"	8'- 5 ¾"	175	1.4	2'- 9 ½"	46	0.5
	2	21"	15"	9'- 5 ¼"	3'-11 ¾"	6'- 8"	9'- 5 ¼"	198	1.7	3'- 4 ½"	58	0.7
	3	28"	20"	11'- 9 ½"	4'- 8"	8'- 4"	11'- 9 ½"	266	2.4	4'- 4"	81	1.0
	4	35"	24"	13'- 9 ½"	5'- 4"	9'- 8"	13'- 8"	328	3.1	5'- 3 ½"	112	1.4
	5	42"	29"	16'- 1 ½"	6'- 0"	11'- 4"	16'- 0 ¼"	390	4.1	6'- 3"	139	1.8
	6	49"	33"	18'- 1 ¾"	6'- 8 ¼"	12'- 8"	17'-11"	469	4.9	7'- 2 ½"	170	2.3
	7	57"	38"	20'- 7"	7'- 5 ½"	14'- 4"	20'- 3 ¼"	547	6.2	8'- 3 ¼"	204	3.0
	8	64"	43"	22'-11"	8'- 1 ½"	16'- 0"	22'- 7 ½"	650	7.5	9'- 5 ¼"	256	3.7
	9	71"	47"	24'-11"	8'- 9 ½"	17'- 4"	24'- 6 ¼"	723	8.7	10'- 5 ¾"	295	4.4
6:1	1	17"	13"	11'- 4 ¾"	3'- 7 ¼"	9'- 0"	12'- 8 ¾"	252	2.2	2'- 9 ½"	53	0.7
	2	21"	15"	12'- 9 ¼"	3'-11 ¾"	10'- 0"	14'- 1 ¾"	291	2.7	3'- 4 ½"	68	0.9
	3	28"	20"	15'-11 ½"	4'- 8"	12'- 6"	17'- 8 ¼"	397	3.9	4'- 4"	100	1.3
	4	35"	24"	18'- 7 ½"	5'- 4"	14'- 6"	20'- 6"	480	5.1	5'- 3 ½"	132	1.8
	5	42"	29"	21'- 9 ½"	6'- 0"	17'- 0"	24'- 0 ½"	596	6.7	6'- 3"	172	2.5
	6	49"	33"	24'- 5 ¾"	6'- 8 ¼"	19'- 0"	26'-10 ½"	717	8.2	7'- 2 ½"	212	3.2
	7	57"	38"	27'- 9"	7'- 5 ½"	21'- 6"	30'- 5"	853	10.4	8'- 3 ¼"	264	4.1
	8	64"	43"	30'-11"	8'- 1 ½"	24'- 0"	33'-11 ¼"	1009	12.6	9'- 5 ¼"	325	5.1
	9	71"	47"	33'- 7"	8'- 9 ½"	26'- 0"	36'- 9 ¼"	1139	14.7	10'- 5 ¾"	382	6.1

TABLE OF REINFORCING STEEL (4)

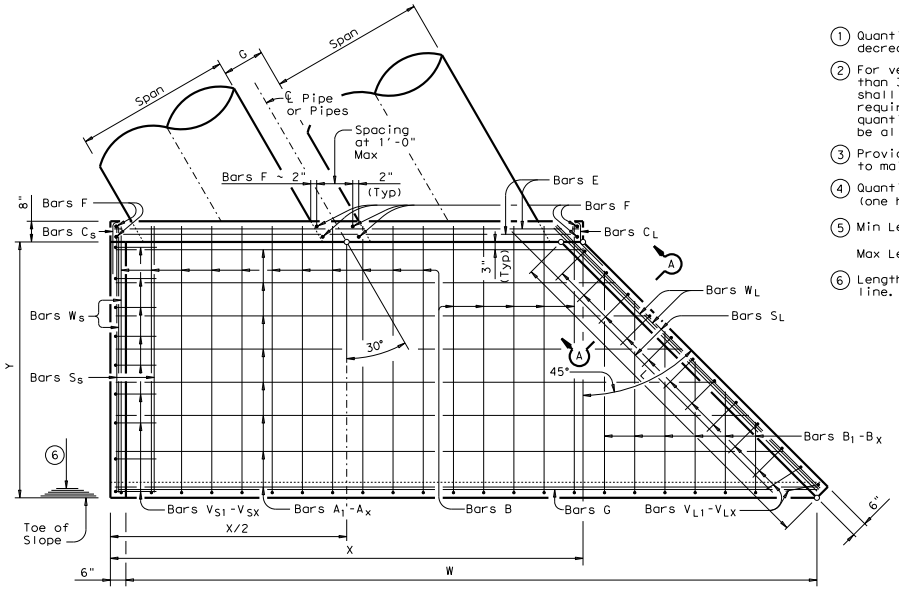
Bar	Size	Spa	No.
A	# 4	1'-0"	~
B	# 3	1'-6"	~
C	# 4	1'-0"	~
D	# 3	1'-0"	~
E	# 5	~	4
F	# 5	~	~
G	# 3	~	2
S	# 4	~	6
V	# 4	1'-0"	~
W	# 5	~	4

TABLE OF DIMENSIONS NOT VARIED WITH SLOPE

DESIGN	SIZE OF PIPE ARCH Span	SIZE OF PIPE ARCH Rise	G	K	H
1	17"	13"	1'- 0"	1'- 0"	2'- 1"
2	21"	15"	1'- 2"	1'- 0"	2'- 3"
3	28"	20"	1'- 5"	1'- 0"	2'- 8"
4	35"	24"	1'- 8"	1'- 0"	3'- 0"
5	42"	29"	1'-11"	1'- 0"	3'- 5"
6	49"	33"	2'- 2"	1'- 0"	3'- 9"
7	57"	38"	2'- 5"	1'- 0"	4'- 2"
8	64"	43"	2'-10"	1'- 0"	4'- 7"
9	71"	47"	3'- 2"	1'- 0"	4'-11"



ELEVATION
Showing dimensions



PLAN

1 Quantities shown are for metal pipe and will decrease slightly for concrete pipe installations.

2 For vehicle safety, curbs shall project no more than 3" above finished grade. Curb heights shall be reduced, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

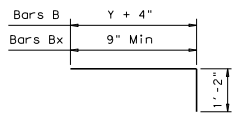
3 Provide a 1'-0" footing as shown where required to maintain 4" Min cover for pipes.

4 Quantities shown are for one structure end only (one headwall).

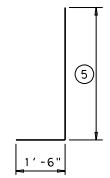
5 Min Length = 6" + 3" x $\left(\frac{12 \times H - 7}{12 \times L}\right)$

Max Length = 12 x H - 3" x $\left(\frac{12 \times H - 7}{12 \times L}\right)$ - 1"

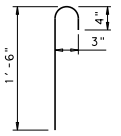
6 Lengths of wings based on SL:1 Slope along this line.



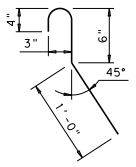
BARS B & B_1-B_X



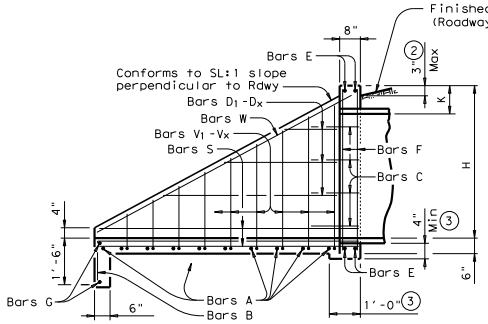
BARS V_S & V_L



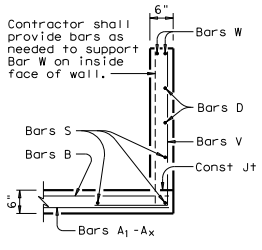
BARS C_S
(2'-0" long)



BARS C_L
(2'-0" long)



TYPICAL WING ELEVATION



SECTION A-A

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

Reinforcing steel shall be placed with the center of the outside layer of bars 2" from the surface of the concrete.

All reinforcing steel shall be Grade 60.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

No bridge rails of any type may be mounted directly to these culvert headwalls.

Texas Department of Transportation — Bridge Division Standard

CONCRETE HEADWALLS WITH FLARED WINGS FOR 30° SKEW ARCH PIPE CULVERTS

CH-FW-A-30

FILE:	chfa30se.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: GAF
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REVISIONS					
		DIST	COUNTY		SHEET NO.
					p. 50

DATE:
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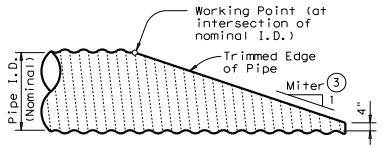
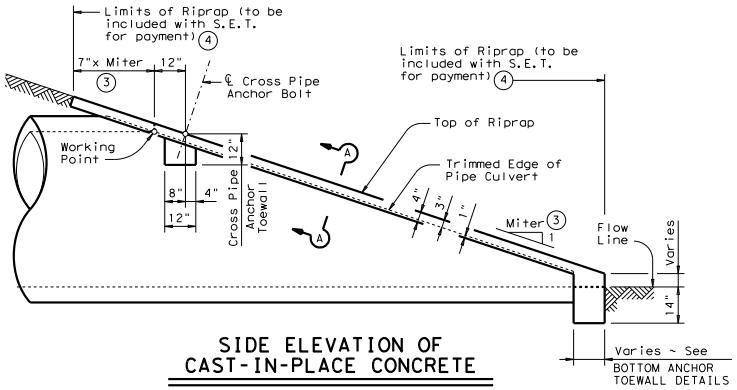


NOTE: All Pipe Runners, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

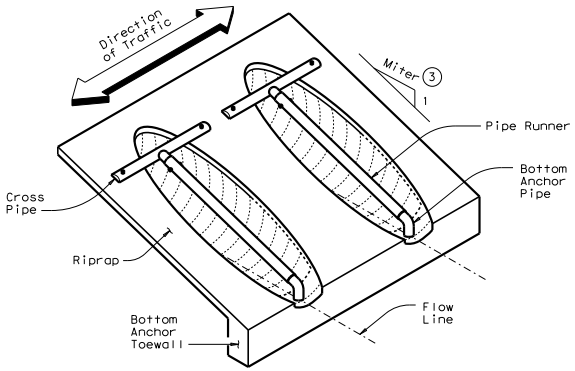
SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

(Showing Corrugated Metal Pipe Culvert. Details of Concrete Pipe Culvert are similar.)



SIDE ELEVATION OF CAST-IN-PLACE CONCRETE

(Showing Concrete Pipe Culvert. Details of Corrugated Metal Pipe Culvert are similar. Pipe Runners not shown for clarity)



ISOMETRIC VIEW OF TYPICAL INSTALLATION

(Showing installation with no skew.)

CROSS PIPE LENGTHS & PIPE RUNNER LENGTHS (1)(2)

Nominal Culvert I.D.	Pipe Culvert Spa ~ G	Cross Pipe Length	Pipe Runner Length											
			3:1 Side Slope				4:1 Side Slope				6:1 Side Slope			
			0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew
24"	1'- 7"	3'- 5"	N/A	N/A	N/A	5'-10"	N/A	N/A	N/A	8'- 1"	N/A	N/A	N/A	12'- 9"
27"	1'- 8"	3'- 8"	N/A	N/A	5'- 5"	6'-11"	N/A	N/A	7'- 7"	9'- 7"	N/A	N/A	11'-11"	14'-11"
30"	1'-10"	3'-11"	N/A	N/A	6'- 4"	8'- 0"	N/A	N/A	8'- 9"	11'- 0"	N/A	N/A	13'- 8"	17'- 0"
33"	1'-11"	4'- 2"	6'- 2"	6'- 5"	7'- 3"	9'- 1"	8'- 6"	8'-10"	10'- 0"	12'- 5"	13'- 3"	13'- 9"	15'- 5"	19'- 2"
36"	2'- 1"	4'- 5"	6'-11"	7'- 3"	8'- 2"	10'- 2"	9'- 6"	9'-11"	11'- 2"	13'-10"	14'- 9"	15'- 3"	17'- 2"	21'- 3"
42"	2'- 4"	4'-11"	8'- 6"	8'-10"	9'-11"	12'- 4"	11'- 7"	12'- 0"	13'- 6"	16'- 8"	17'- 9"	18'- 5"	20'- 8"	25'- 7"
48"	2'- 7"	5'- 5"	10'- 1"	10'- 5"	11'- 9"	N/A	13'- 7"	14'- 2"	15'-10"	N/A	20'- 9"	21'- 6"	24'- 2"	N/A
54"	3'- 0"	5'-11"	11'- 8"	12'- 1"	N/A	N/A	15'- 8"	16'- 3"	N/A	N/A	23'-10"	24'- 8"	N/A	N/A
60"	3'- 3"	6'- 5"	13'- 3"	N/A	N/A	N/A	17'- 9"	N/A	N/A	N/A	26'-10"	N/A	N/A	N/A

TYPICAL PIPE CULVERT MITERS (3)

Side Slope	0° Skew	15° Skew	30° Skew	45° Skew
3:1	3:1	3.106:1	3.464:1	4.243:1
4:1	4:1	4.141:1	4.619:1	5.657:1
6:1	6:1	6.212:1	6.928:1	8.485:1

CONDITIONS WHERE PIPE RUNNERS ARE NOT REQUIRED (2)

Nominal Culvert I.D.	Single Pipe Culvert	Multiple Pipe Culverts
12" thru 21"	Skews thru 45°	Skews thru 45°
24"	Skews thru 45°	Skews thru 30°
27"	Skews thru 30°	Skews thru 15°
30"	Skews thru 15°	Skews thru 15°
33"	Skews thru 15°	Always required
36"	Normal (No Skew)	Always required
42" to 60"	Always required	Always required

STANDARD PIPE SIZES & MAX PIPE RUNNER LENGTHS (1)

Pipe Size	Pipe O.D.	Pipe I.D.	Max Pipe Runner Length
2" STD	2.375"	2.067"	N/A
3" STD	3.500"	3.068"	10'- 0"
4" STD	4.500"	4.026"	19'- 8"
5" STD	5.563"	5.047"	34'- 2"

ESTIMATED CONCRETE RIPRAP QUANTITIES (CY) (5)

Nominal Culvert I.D.	3:1 Side Slope				4:1 Side Slope				6:1 Side Slope			
	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew
12"	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.7	0.7	0.7	0.8
15"	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.9
18"	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.8	0.9	1.0
21"	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.9	0.9	0.9	1.0	1.2
24"	0.6	0.7	0.7	0.8	0.8	0.8	0.8	1.0	1.0	1.0	1.1	1.3
27"	0.7	0.7	0.8	0.9	0.8	0.9	0.9	1.1	1.1	1.1	1.2	1.4
30"	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.2	1.2	1.2	1.3	1.6
33"	0.8	0.8	0.9	1.0	1.0	1.0	1.1	1.3	1.3	1.4	1.5	1.7
36"	0.9	0.9	0.9	1.1	1.1	1.1	1.2	1.4	1.4	1.5	1.6	1.8
42"	1.0	1.0	1.1	1.3	1.2	1.3	1.3	1.6	1.6	1.7	1.8	2.1
48"	1.1	1.1	1.2	N/A	1.4	1.4	1.5	N/A	1.9	1.9	2.1	N/A
54"	1.3	1.3	N/A	N/A	1.6	1.6	N/A	N/A	2.1	2.1	N/A	N/A
60"	1.4	N/A	N/A	N/A	1.7	N/A	N/A	N/A	2.3	N/A	N/A	N/A

(1) Size of Pipe Runner shall be as shown in the tables. Cross Pipe shall be the same size as the Pipe Runner. Cross Pipe Stub Out and Bottom Anchor Pipe shall be the next smaller size pipe as shown in the STANDARD PIPE SIZES table.

(2) This standard allows for the placement of only one pipe runner across each culvert pipe opening. In order to limit the clear opening to be traversed by an errant vehicle, the following conditions must be met:

For 60" culvert pipes, the skew must not exceed 0°.
For 54" culvert pipes, the skew must not exceed 15°.
For 48" culvert pipes, the skew must not exceed 30°.
For all culvert pipe sizes 42" and less, the skew must not exceed 45°.

If the above conditions cannot be met, the designer should consider using a safety end treatment with flared wings. For further information, refer to the TxDOT "Roadway Design Manual".

(3) Miter = Slope of Mitered Pipe Culvert End

(4) Riprap placed beyond the limits shown will be paid as Concrete Riprap in accordance with Item 432, "Riprap".

(5) Quantities shown are for one end of one reinforced Concrete Pipe Culvert. For multiple Pipe Culverts or for Corrugated Metal Pipe Culverts, quantities will need to be adjusted. Riprap quantities are for Contractor's information only.

DATE:
FILE:

SHEET 1 OF 2

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT

FOR 12" DIA TO 60" DIA PIPE CULVERTS
TYPE II ~ CROSS DRAINAGE

SETP-CD

FILE: setpcdse.dgn	DN: GAF	CK: CAT	DW: JRP	CK: GAF
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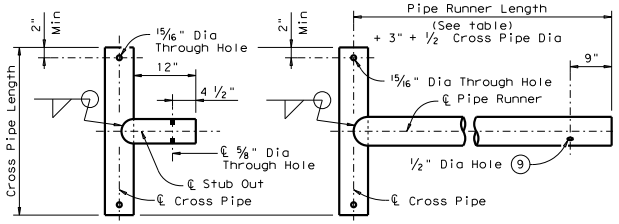
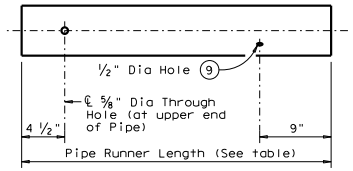
REVISIONS				
11-10: Add note for synthetic fibers.	DIST	COUNTY		SHEET NO.



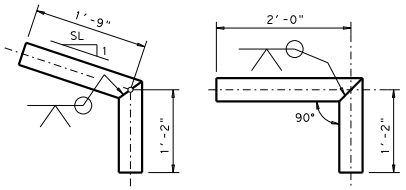
OPTION A1 OPTION A2

CROSS PIPE AND CONNECTIONS DETAILS



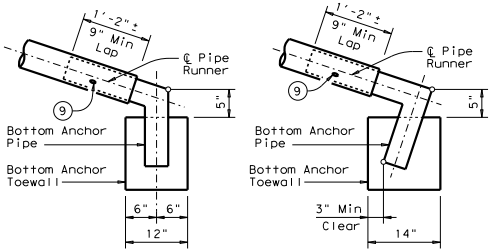
NOTE: The separate Pipe Runner shown is required when Cross Pipe Connection Option A1 is used.

PIPE RUNNER DETAILS



OPTION B1 OPTION B2

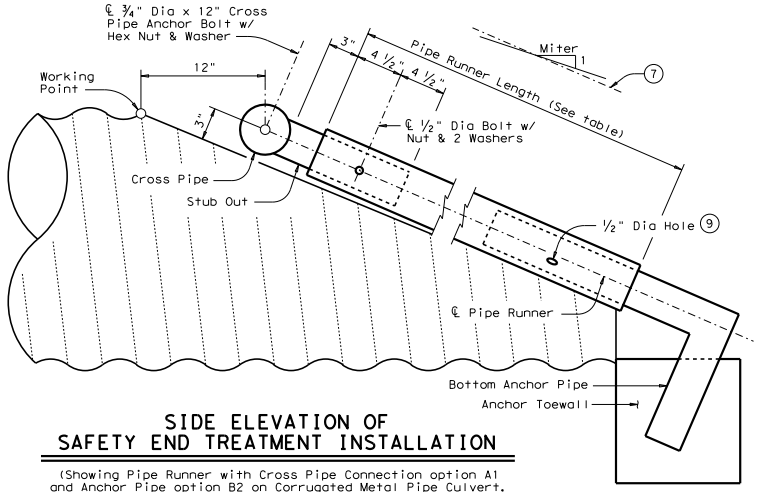
BOTTOM ANCHOR PIPE DETAILS (10)



OPTION B1 OPTION B2

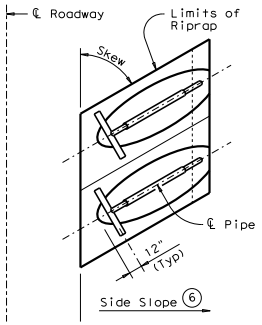
BOTTOM ANCHOR TOEWALL DETAILS

(Culvert & Riprap not shown for clarity)

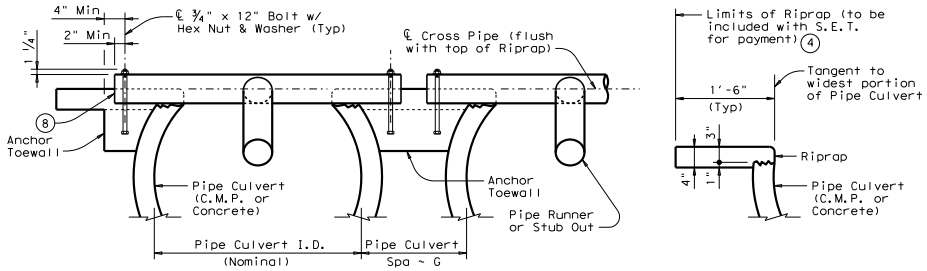


SIDE ELEVATION OF SAFETY END TREATMENT INSTALLATION

(Showing Pipe Runner with Cross Pipe Connection option A1 and Anchor Pipe option B2 on Corrugated Metal Pipe Culvert. Concrete Pipe Culvert details are similar. Riprap not shown for clarity)



PLAN OF SKEWED INSTALLATION



SHOWING CROSS PIPE & ANCHOR TOEWALL

SHOWING TYPICAL PIPE CULVERT & RIPRAP

SECTION A-A

(4) Riprap placed beyond the limits shown will be paid as Concrete Riprap in accordance with Item 432, "Riprap".

(6) Recommended values of side slope are 3:1, 4:1, & 6:1. All quantities, calculations, and dimensions shown herein are based on these recommended values. Slope of 3:1 or flatter is required for vehicle safety.

(7) Note that actual slope of Pipe Runner may vary slightly from Side Slope of Riprap and trimmed Culvert Pipe edge.

(8) Care shall be taken to ensure that Riprap concrete does not flow into the Cross Pipe so as to permit disassembly of the bolted connection to allow cleanout access.

(9) After installation, the 1/2" hole shall be inspected to ensure that the lap of the Pipe Runner with the Bottom Anchor Pipe is adequate.

(10) At fabricator's option, a heat bend to a smooth 5" radius or a manufactured elbow (of the same material as the Runner) may be substituted for the mitered and welded joint in the Bottom Anchor Pipe.

GENERAL NOTES:

Pipe Runners are designed for a traversing load of 1,800 pounds at yield as recommended by Research Report 280-1, "Safety Treatment of Roadside Cross-Drainage Structures", Texas Transportation Institute, March 1981.

The Safety End Treatments shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the Pipe Runners.

Riprap and all necessary inverts shall be Concrete Riprap conforming to the requirements of Item 432, "Riprap".

Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.

Payment for riprap and toewall is included in the Price Bid for each Safety End Treatment.

Pipe Runners, Cross Pipes, and Anchor Pipes shall conform to the requirements of ASTM A53 (Type E or S, Grade B), ASTM A500 (Grade B), or API 5LX52.

Bolts and nuts shall conform to ASTM A307.

All steel components, except concrete reinforcing, shall be galvanized after fabrication. Galvanizing damaged during transport or construction shall be repaired in accordance with the specifications.

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT

FOR 12" DIA TO 60" DIA PIPE CULVERTS TYPE II ~ CROSS DRAINAGE

SETP-CD

FILE: setpcdse.dgn	DN: GAF	CK: CAT	DW: JRP	CK: GAF
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REVISIONS				
11-10: Add note for synthetic fibers.	DIST	COUNTY		SHEET NO.

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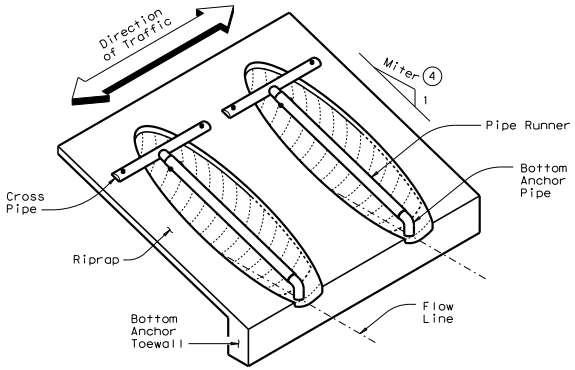
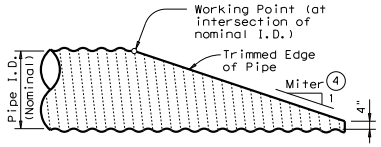


ISOMETRIC VIEW OF TYPICAL INSTALLATION

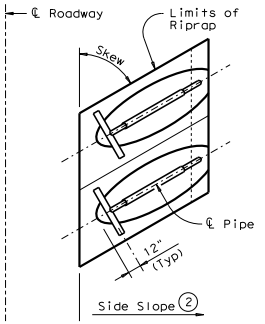
(Showing installation with no skew.)



NOTE: All Pipe Runners, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

(Showing Corrugated Metal Pipe Culvert. Details of Concrete Pipe Culvert are similar.)



PLAN OF SKEWED INSTALLATION

(1) (3)

CROSS PIPE LENGTHS, PIPE RUNNER LENGTHS, & REQUIRED PIPE SIZES

CORRUGATED METAL PIPE CULVERTS

Design	Pipe Culvert Span	Pipe Culvert Rise	Pipe Culvert Spa ~ G	Cross Pipe Length	Pipe Runner Length											
					3:1 Side Slope				4:1 Side Slope				6:1 Side Slope			
					0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew
1	17"	13"	1'- 0"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	21"	15"	1'- 2"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3	28"	20"	1'- 5"	3'- 9"	N/A	N/A	3'- 5"	4'- 7"	N/A	N/A	4'-11"	6'- 5"	N/A	N/A	7'-11"	10'- 2"
4	35"	24"	1'- 8"	4'- 4"	3'-10"	4'- 0"	4'- 7"	6'- 0"	5'- 5"	5'- 8"	6'- 6"	8'- 4"	8'- 8"	9'- 1"	10'- 3"	12'-11"
5	42"	29"	1'-11"	4'-11"	5'- 1"	5'- 4"	6'- 1"	7'-10"	7'- 2"	7'- 5"	8'- 6"	10'- 9"	11'- 2"	11'- 8"	13'- 2"	16'- 6"
6	49"	33"	2'- 2"	5'- 6"	6'- 2"	6'- 5"	7'- 4"	N/A	8'- 6"	8'-10"	10'- 0"	N/A	13'- 3"	13'- 9"	15'- 6"	N/A
7	57"	38"	2'- 5"	6'- 2"	7'- 6"	7'- 9"	N/A	N/A	10'- 2"	10'- 7"	N/A	N/A	15'- 9"	16'- 4"	N/A	N/A

CONCRETE PIPE CULVERTS

Design	Pipe Culvert Span	Pipe Culvert Rise	Pipe Culvert Spa ~ G	Cross Pipe Length	Pipe Runner Length											
					3:1 Side Slope				4:1 Side Slope				6:1 Side Slope			
					0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew
1	22"	13 ½"	1'- 0"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	26"	15 ½"	1'- 2"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3	28 ½"	18"	1'- 5"	3'-9 ½"	N/A	N/A	2'-10"	3'-10"	N/A	N/A	4'- 2"	5'- 5"	N/A	N/A	6'- 9"	8'- 9"
4	36 ¼"	22 ½"	1'- 8"	4'-5 ¼"	3'- 5"	3'- 7"	4'- 2"	5'- 6"	4'-11"	5'- 1"	5'-11"	7'- 7"	7'-11"	8'- 3"	9'- 5"	11'-11"
5	43 ¾"	26 ⅝"	1'-11"	5'-0 ¾"	4'- 6"	4'- 8"	5'- 5"	6'-11"	6'- 4"	6'- 7"	7'- 6"	9'- 7"	10'- 0"	10'- 5"	11'- 9"	14'-10"
6	51 ⅛"	31 ⅝"	2'- 2"	5'- 8"	5'- 9"	6'- 0"	6'-10"	N/A	7'-11"	8'- 3"	9'- 4"	N/A	12'- 4"	12'-10"	14'- 6"	N/A
7	58 ½"	36"	2'- 5"	6'-3 ½"	6'-11"	7'- 3"	N/A	N/A	9'- 6"	9'-11"	N/A	N/A	14'- 9"	15'- 4"	N/A	N/A

TYPICAL PIPE CULVERT MITERS (4)

Side Slope	0° Skew	15° Skew	30° Skew	45° Skew
3:1	3:1	3.106:1	3.464:1	4.243:1
4:1	4:1	4.141:1	4.619:1	5.657:1
6:1	6:1	6.212:1	6.928:1	8.485:1

STANDARD PIPE SIZES & MAX PIPE RUNNER LENGTHS (1)

Pipe Size	Pipe O.D.	Pipe I.D.	Max Pipe Runner Length
2" STD	2.375"	2.067"	N/A
3" STD	3.500"	3.068"	10'- 0"
4" STD	4.500"	4.026"	19'- 8"
5" STD	5.563"	5.047"	34'- 2"

CONDITIONS WHERE PIPE RUNNERS ARE NOT REQUIRED (3)

Design	Single Pipe Culvert	Multiple Pipe Culverts
1 & 2	Skews thru 45°	Skews thru 45°
3	Skews thru 30°	Skews thru 15°
4	Normal (No Skew)	Always required
5 thru 7	Always required	Always required

(1) Size of Pipe Runner shall be as shown in the tables. Cross Pipe shall be the same size as the Pipe Runner. Cross Pipe Stub Out and Bottom Anchor Pipe shall be the next smaller size pipe as shown in the STANDARD PIPE SIZES table.

(2) Recommended values of slope are 3:1, 4:1, & 6:1. All quantities, calculations, and dimensions shown herein are based on these recommended values. Slope of 3:1 or flatter is required for vehicle safety.

(3) This standard allows for the placement of only one pipe runner across each culvert pipe opening. In order to limit the clear opening to be traversed by an errant vehicle, the following conditions must be met:

For Design 1 through 5 culvert pipe sizes, the skew must not exceed 45°.
For Design 6 culvert pipes, the skew must not exceed 30°.
For Design 7 culvert pipes, the skew must not exceed 15°.

If the above conditions cannot be met, the designer should consider using a safety end treatment with flared wings. For further information, refer to the TxDOT "Roadway Design Manual".

(4) Miter = Slope of Mitered Pipe Culvert End

GENERAL NOTES:

Pipe Runners are designed for a traversing load of 1,800 pounds at yield as recommended by Research Report 280-1, "Safety Treatment of Roadside Cross-Drainage Structures", Texas Transportation Institute, March 1981.

The Safety End Treatments shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the Pipe Runners.

Riprap and all necessary inverts shall be Concrete Riprap conforming to the requirements of Item 432, "Riprap".

Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.

Payment for riprap and toewall is included in the Price Bid for each Safety End Treatment.

Pipe Runners, Cross Pipes, and Anchor Pipes shall conform to the requirements of ASTM A53 (Type E or S, Grade B), ASTM A500 (Grade B), or API 5LX52.

Bolts and nuts shall conform to ASTM A307.

All steel components, except concrete reinforcing, shall be galvanized after fabrication. Galvanizing damaged during transport or construction shall be repaired in accordance with the specifications.

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT

FOR DESIGN 1 TO 7
ARCH PIPE CULVERTS
TYPE II ~ CROSS DRAINAGE

SETP-CD-A

FILE: setpcase.dgn	DN: GAF	CK: CAT	DW: JRP	CK: GAF
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REVISIONS				
11-10: Add note for synthetic fibers.	DIST	COUNTY		SHEET NO.

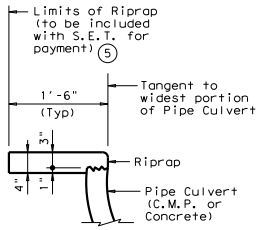
ESTIMATED CONCRETE RIPRAP QUANTITIES (CY) (6)
BOTH CORRUGATED METAL PIPE CULVERTS AND CONCRETE PIPE CULVERTS

Design	3:1 Side Slope				4:1 Side Slope				6:1 Side Slope			
	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew
1	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.9
2	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.8	0.8	1.0
3	0.6	0.6	0.7	0.8	0.7	0.7	0.8	0.9	0.9	1.0	1.0	1.2
4	0.7	0.7	0.8	0.9	0.8	0.9	0.9	1.0	1.1	1.1	1.2	1.4
5	0.8	0.8	0.9	1.0	1.0	1.0	1.1	1.2	1.3	1.3	1.4	1.7
6	0.9	1.0	1.0	N/A	1.1	1.1	1.2	N/A	1.4	1.5	1.6	N/A
7	1.0	1.1	N/A	N/A	1.3	1.3	N/A	N/A	1.7	1.7	N/A	N/A

(4) Miter = Slope of Mitered Pipe Culvert End

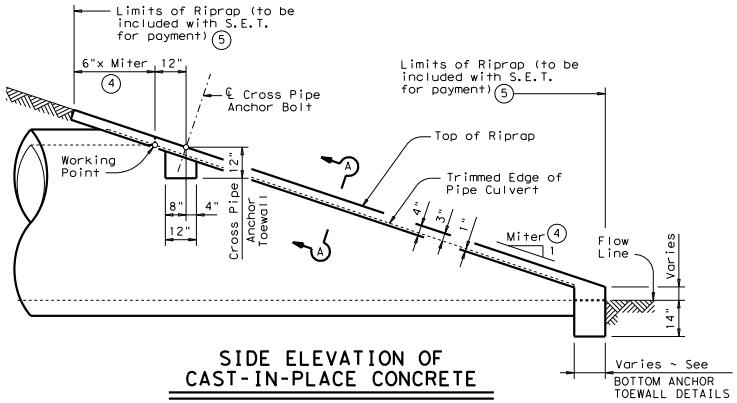
(5) Riprap placed beyond the limits shown will be paid as Concrete Riprap in accordance with Item 432, "Riprap".

(6) Quantities shown are for one end of one Pipe Culvert. For multiple Pipe Culverts, quantities will need to be adjusted. Riprap quantities are for Contractor's information only.



SHOWING TYPICAL PIPE CULVERT & RIPRAP

SECTION A-A



SIDE ELEVATION OF CAST-IN-PLACE CONCRETE

(Showing Concrete Pipe Culvert.
Details of Corrugated Metal Pipe Culvert are similar.
Pipe Runners not shown for clarity)

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT
FOR DESIGN 1 TO 7
ARCH PIPE CULVERTS
TYPE II ~ CROSS DRAINAGE

SETP-CD-A

FILE: setpcase.dgn	DN: GAF	CK: CAT	DW: JRP	CK: GAF
©TxDOT February 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS				
11-10: Add note for synthetic fibers.	DIST.	COUNTY		SHEET NO.

DATE:
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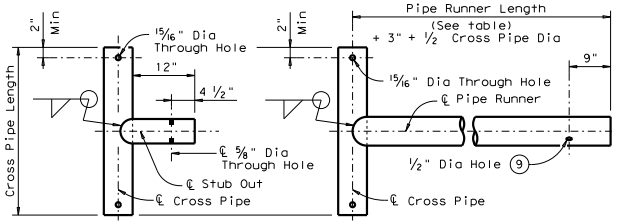
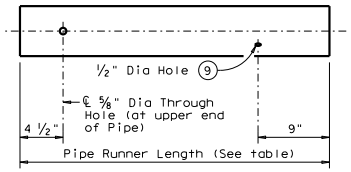


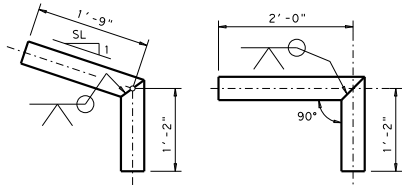
OPTION A1 OPTION A2

CROSS PIPE AND CONNECTIONS DETAILS



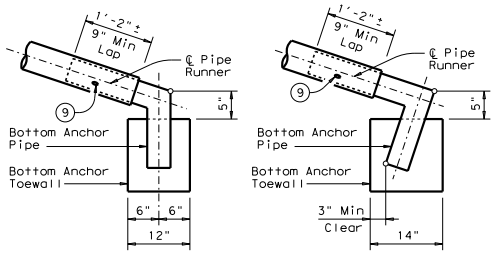
NOTE: The separate Pipe Runner shown is required when Cross Pipe Connection Option A1 is used.

PIPE RUNNER DETAILS



OPTION B1 OPTION B2

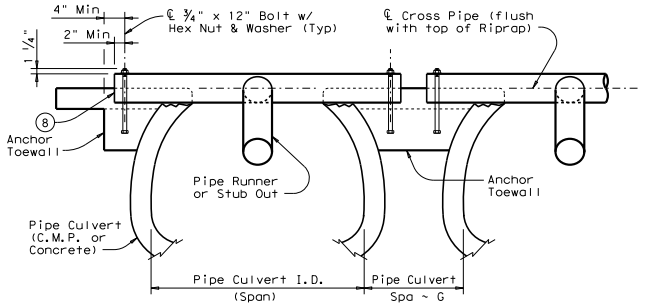
BOTTOM ANCHOR PIPE DETAILS (10)



OPTION B1 OPTION B2

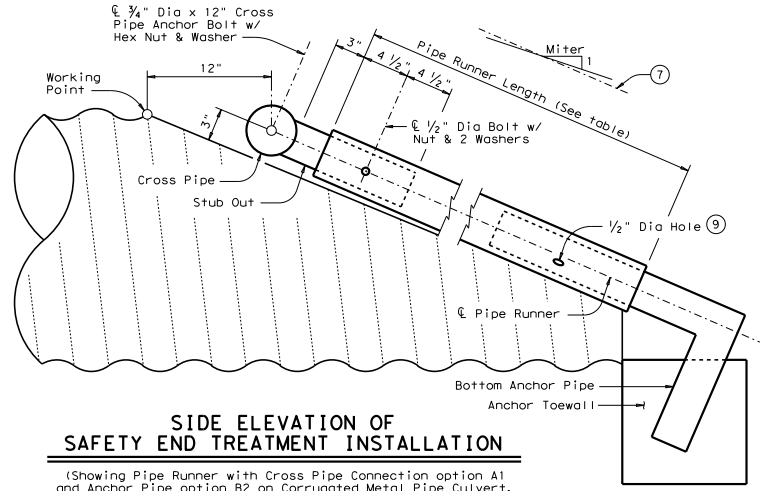
BOTTOM ANCHOR TOEWALL DETAILS

(Culvert & Riprap not shown for clarity)



SHOWING CROSS PIPE & ANCHOR TOEWALL

SECTION A-A



SIDE ELEVATION OF SAFETY END TREATMENT INSTALLATION

(Showing Pipe Runner with Cross Pipe Connection option A1 and Anchor Pipe option B2 on Corrugated Metal Pipe Culvert. Concrete Pipe Culvert details are similar. Riprap not shown for clarity)

(7) Note that actual slope of Pipe Runner may vary slightly from Side Slope of Riprap and trimmed Culvert Pipe edge.

(8) Care shall be taken to ensure that Riprap concrete does not flow into the Cross Pipe so as to permit disassembly of the bolted connection to allow cleanout access.

(9) After installation, the 1/2" hole shall be inspected to ensure that the lap of the Pipe Runner with the Bottom Anchor Pipe is adequate.

(10) At fabricator's option, a heat bend to a smooth 5" radius or a manufactured elbow (of the same material as the Runner) may be substituted for the mitered and welded joint in the Bottom Anchor Pipe.

SHEET 3 OF 3

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT

FOR DESIGN 1 TO 7
ARCH PIPE CULVERTS
TYPE II ~ CROSS DRAINAGE

SETP-CD-A

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REVISIONS				
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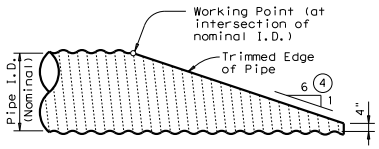
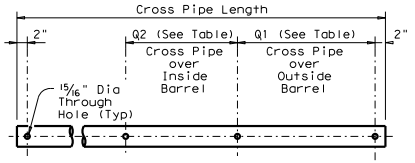


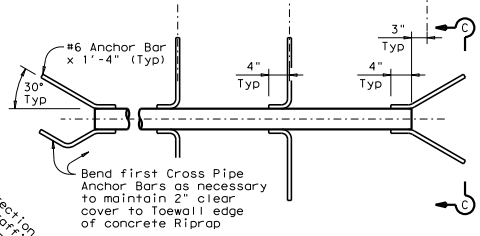
NOTE: All Cross Pipes, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

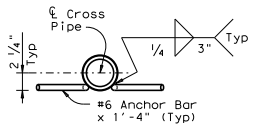
(Showing Corrugated Metal Pipe Culvert.)
(Details at Concrete Pipe Culvert are similar.)



PIPE W/ BOLTED ANCHOR

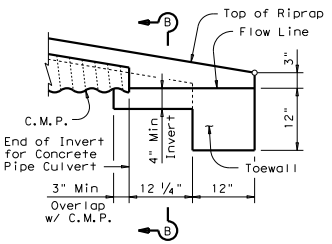


PIPE W/ ANCHOR BARS



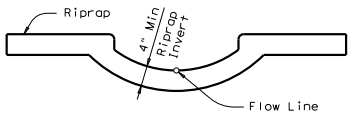
SECTION C-C

CROSS PIPE DETAILS



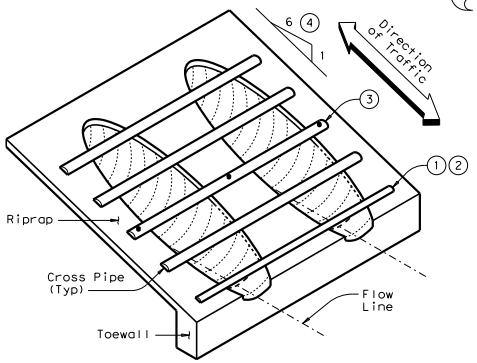
DETAIL "A"

(Showing Invert with Corrugated Metal Pipe Culvert. Concrete Pipe Culvert details are similar. Cross Pipes not shown for clarity.)



SECTION B-B

(Cross Pipes not shown for clarity.)



ISOMETRIC VIEW OF TYPICAL INSTALLATION

CROSS PIPE LENGTHS, REQUIRED PIPE SIZES, & RIPRAP QUANTITIES (2)

Nominal Culvert I.D.	Conc Riprap (CY) (6)	Pipe Culvert Spa ~ G	Single Barrel ~ Q1	Multi-Barrel ~ Q1	Q2	Conditions for use of Cross Pipes	Cross Pipe Size
12"	0.6	9"	N/A	2'- 1"	1'- 9"	3 or more Pipe Culverts	3" Std (3.500" O.D.)
15"	0.7	11"	N/A	2'- 5"	2'- 2"		
18"	0.8	1'- 2"	N/A	2'-10"	2'- 8"		
21"	0.9	1'- 4"	N/A	3'- 2"	3'- 1"		
24"	0.9	1'- 7"	N/A	3'- 6"	3'- 7"		
27"	1.0	1'- 8"	N/A	3'-10"	3'-11"	3 or more Pipe Culverts	3 1/2" Std (4.000" O.D.)
30"	1.1	1'-10"	N/A	4'- 2"	4'- 4"	2 or more Pipe Culverts	
33"	1.2	1'-11"	4'- 2"	4'- 5"	4'- 8"	All Pipe Culverts	
36"	1.3	2'- 1"	4'- 5"	4'- 9"	5'- 1"	All Pipe Culverts	4" Std (4.500" O.D.)
42"	1.5	2'- 4"	4'-11"	5'- 5"	5'-10"		
48"	1.7	2'- 7"	5'- 5"	6'- 0"	6'- 7"	All Pipe Culverts	5" Std (5.563" O.D.)
54"	2.0	3'- 0"	5'-11"	6'- 9"	7'- 6"		
60"	2.2	3'- 3"	6'- 5"	7'- 4"	8'- 3"		
66"	2.4	3'- 3"	6'-11"	7'-10"	8'- 9"		
72"	2.7	3'- 4"	7'- 5"	8'- 5"	9'- 4"		

(1) The proper installation of the first Cross Pipe is critical for vehicle safety. The top of the first Cross Pipe must be placed at no more than 6" above the flow line.

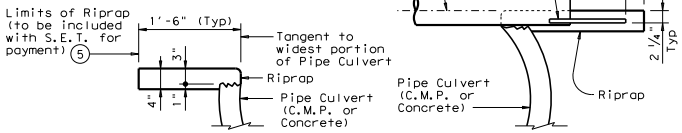
(2) Size of Cross Pipes, except the first bottom pipe, shall be as shown in the PIPE SIZE table. The first bottom pipe shall be 3 1/2" Standard Pipe (4" O.D.).

(3) The third Cross Pipe from the bottom of the Culvert shall always be installed using a bolted connection. Care shall be taken to ensure that Riprap concrete does not flow into the Cross Pipe so as to permit disassembly of the bolted connection to allow cleanout access. At the Contractor's option, all other Cross Pipes may also be installed using the bolted connection details.

(4) Match Cross Slope as shown elsewhere in the plans. Cross Slope of 6:1 or flatter is required for vehicle safety.

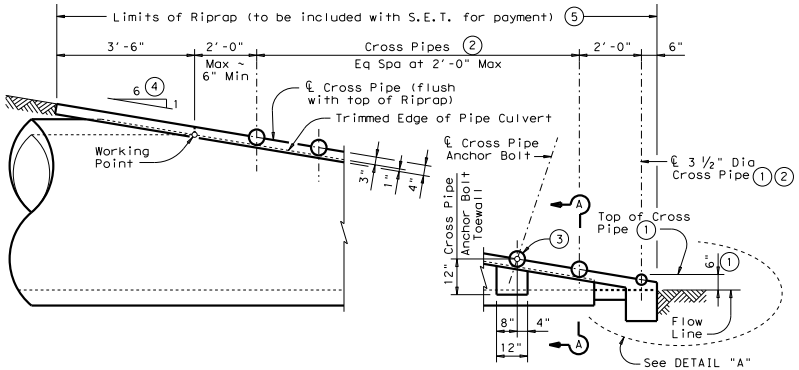
(5) Riprap placed beyond the limits shown will be paid as Concrete Riprap in accordance with Item 432, "Riprap".

(6) Quantities shown are for one end of one reinforced Concrete Pipe Culvert. For multiple pipe culverts or for Corrugated Metal Pipe Culverts, quantities will need to be adjusted. Riprap quantities are for Contractor's information only.



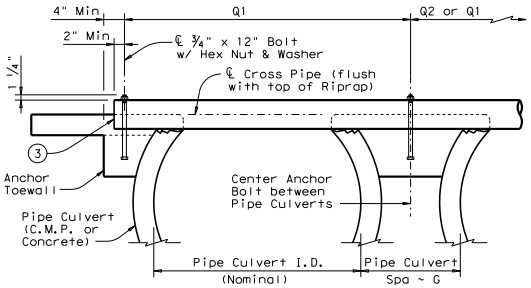
SHOWING TYPICAL PIPE CULVERT & RIPRAP

SHOWING CROSS PIPE WITH ANCHOR BAR



SIDE ELEVATION OF CAST-IN-PLACE CONCRETE

(Showing Concrete Pipe Culvert.)
(Details at Corrugated Metal Pipe Culvert are similar.)



SHOWING CROSS PIPE WITH BOLTED ANCHOR

SECTION A-A

GENERAL NOTES:

Cross Pipes are designed for a traversing load of 10,000 pounds at yield as recommended by Research Report 280-2F, "Safety Treatment of Roadside Parallel-Drainage Structures", Texas Transportation Institute, March 1981.

Safety End Treatments shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the Cross Pipes.

Riprap and all necessary inverts shall be Concrete Riprap conforming to the requirements of Item 432, "Riprap".

Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.

Payment for riprap and toewall is included in the Price Bid for each Safety End Treatment.

Cross Pipes shall conform to the requirements of ASTM A53 (Type E or S, Grade B), ASTM A500 (Grade B), or API 5LX52.

Bolts and nuts shall conform to ASTM A307.

All steel components, except concrete reinforcing, shall be galvanized after fabrication. Galvanizing damaged during transport or construction shall be repaired in accordance with the specifications.

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT

FOR 12" DIA TO 72" DIA PIPE CULVERTS
TYPE II ~ PARALLEL DRAINAGE

SETP-PD

FILE: setpdse.dgn	DN: GAF	CK: CAT	DW: JRP	CK: GAF
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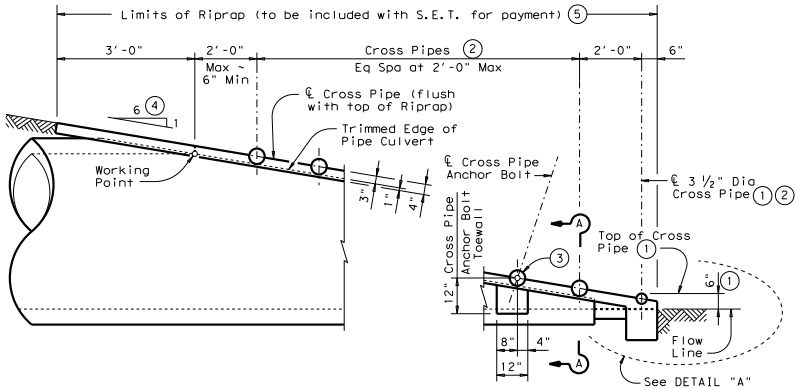


SIDE ELEVATION OF CAST-IN-PLACE CONCRETE

(Showing Concrete Pipe Culvert.)
(Details at Corrugated Metal Pipe Culvert are similar.)

CROSS PIPE LENGTHS & REQUIRED PIPE SIZES 2

CORRUGATED METAL PIPE CULVERTS

Design	Conc Riprap (CY) 6	Pipe Culvert Span	Pipe Culvert Rise	Pipe Culvert Spa ~ G	Single Barrel ~ Q1	Multi-Barrel ~ Q1	Q2	Conditions for use of Cross Pipes	Cross Pipe Size
1	0.6	17"	13"	1'- 0"	N/A	2'- 8"	2'- 5"	3 or more Pipe Culverts	3" Std (3.500" O.D.)
2	0.7	21"	15"	1'- 2"	N/A	3'- 1"	2'-11"		
3	0.9	28"	20"	1'- 5"	N/A	3'- 9"	3'- 9"	3 or more Pipe Culverts	3 ½" Std (4.000" O.D.)
4	1.0	35"	24"	1'- 8"	4'- 4"	4'- 6"	4'- 7"	All Pipe Culverts	4" Std (4.500" O.D.)
5	1.2	42"	29"	1'-11"	4'-11"	5'- 2"	5'- 5"		
6	1.4	49"	33"	2'- 2"	5'- 6"	5'-11"	6'- 3"	All Pipe Culverts	5" Std (5.563" O.D.)
7	1.6	57"	38"	2'- 5"	6'- 2"	6'- 8"	7'- 2"		
8	1.8	64"	43"	2'-10"	6'- 9"	7'- 6"	8'- 2"		
9	1.9	71"	47"	3'- 2"	7'- 4"	8'- 3"	9'- 1"		

CONCRETE PIPE CULVERTS

Design	Conc Riprap (CY) 6	Pipe Culvert Span	Pipe Culvert Rise	Pipe Culvert Spa ~ G	Single Barrel ~ Q1	Multi-Barrel ~ Q1	Q2	Conditions for use of Cross Pipes	Cross Pipe Size
1	0.6	22"	13 ½"	1'- 0"	N/A	3'- 1"	2'-10"	3 or more Pipe Culverts	3" Std (3.500" O.D.)
2	0.7	26"	15 ½"	1'- 2"	N/A	3'- 6"	3'- 4"		
3	0.9	28 ½"	18"	1'- 5"	N/A	3'-10"	3'-9 ½"	3 or more Pipe Culverts	3 ½" Std (4.000" O.D.)
4	1.0	36 ¼"	22 ½"	1'- 8"	4'- 5"	4'- 7"	4'-8 ¼"	All Pipe Culverts	4" Std (4.500" O.D.)
5	1.2	43 ¾"	26 ⅝"	1'-11"	5'- 1"	5'- 4"	5'-6 ¾"		
6	1.4	51 ⅛"	31 ⅝"	2'- 2"	5'- 8"	6'- 1"	6'-5 ¼"	All Pipe Culverts	5" Std (5.563" O.D.)
7	1.6	58 ½"	36"	2'- 5"	6'- 4"	6'-10"	7'-3 ½"		
8	1.8	65"	40"	2'-10"	6'-10"	7'- 7"	8'- 3"		
9	1.9	73"	45"	3'- 2"	7'- 6"	8'- 5"	9'- 3"		

1. The proper installation of the first Cross Pipe is critical for vehicle safety. The top of the first Cross Pipe must be placed at no more than 6" above the flow line.
2. Size of Cross Pipes, except the first bottom pipe, shall be as shown in the PIPE SIZE table. The first bottom pipe shall be 3 ½" Standard Pipe (4" O.D.).
3. The third Cross Pipe from the bottom of the Culvert shall always be installed using a bolted connection. Care shall be taken to ensure that Riprap concrete does not flow into the Cross Pipe so as to permit disassembly of the bolted connection to allow cleanout access. At the Contractor's option, all other Cross Pipes may also be installed using the bolted connection details.
4. Match Cross Slope as shown elsewhere in the plans. Cross Slope of 6:1 or flatter is required for vehicle safety.
5. Riprap placed beyond the limits shown will be paid as Concrete Riprap in accordance with Item 432, "Riprap".
6. Quantities shown are for one end of one Pipe Culvert. For multiple Pipe Culverts, quantities will need to be adjusted. Riprap quantities are for Contractor's information only.

GENERAL NOTES:

Cross Pipes are designed for a traversing load of 10,000 pounds at yield as recommended by Research Report 280-2F, "Safety Treatment of Roadside Parallel-Drainage Structures", Texas Transportation Institute, March 1981.

Safety End Treatments shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the Cross Pipes.

Riprap and all necessary inverts shall be Concrete Riprap conforming to the requirements of Item 432, "Riprap".

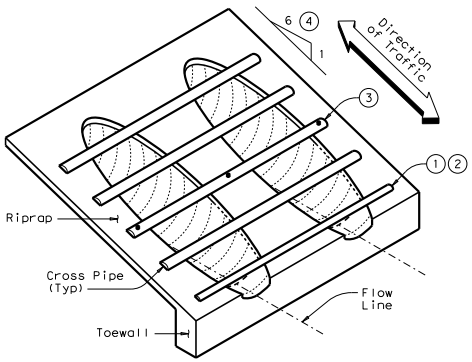
Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.

Payment for riprap and toewall is included in the Price Bid for each Safety End Treatment.

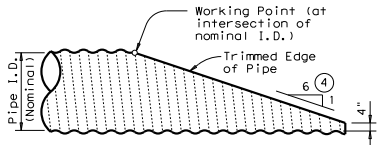
Cross Pipes shall conform to the requirements of ASTM A53 (Type E or S, Grade B), ASTM A500 (Grade B), or API 5LX52.

Bolts and nuts shall conform to ASTM A307.

All steel components, except concrete reinforcing, shall be galvanized after fabrication. Galvanizing damaged during transport or construction shall be repaired in accordance with the specifications.



ISOMETRIC VIEW OF TYPICAL INSTALLATION



NOTE: All Cross Pipes, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

(Showing Corrugated Metal Pipe Culvert.)
(Details at Concrete Pipe Culvert are similar.)

DATE:
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SHEET 1 OF 2

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT

FOR DESIGN 1 TO 9
ARCH PIPE CULVERTS
TYPE II ~ PARALLEL DRAINAGE

SETP-PD-A

FILE: setppase.dgn	DN: GAF	CK: TxDOT	DW: JRP	CK: GAF
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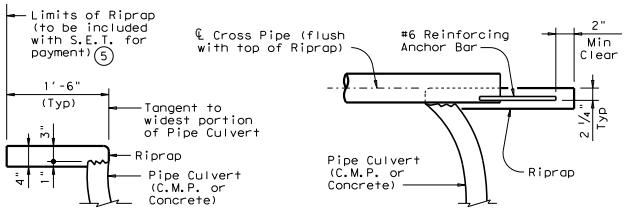
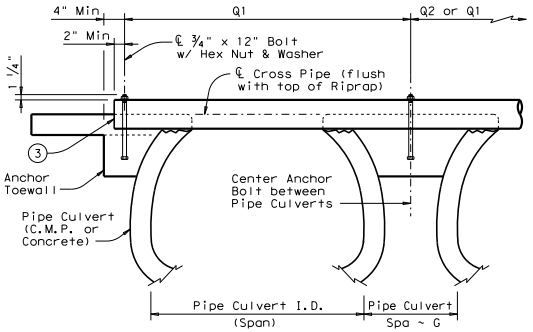


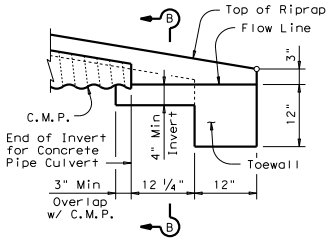
SHOWING TYPICAL PIPE CULVERT & RIPRAP

SHOWING CROSS PIPE WITH ANCHOR BAR



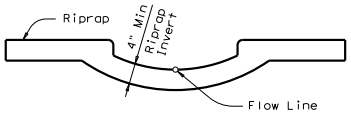
SHOWING CROSS PIPE WITH BOLTED ANCHOR

SECTION A-A



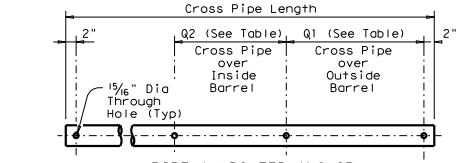
DETAIL "A"

(Showing Invert with Corrugated Metal Pipe Culvert. Concrete Pipe Culvert details are similar. Cross Pipes not shown for clarity.)

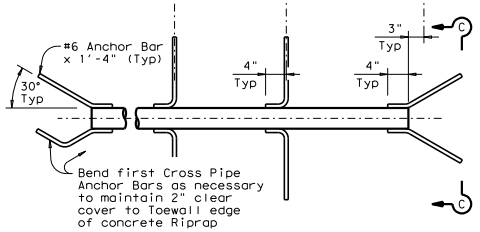


SECTION B-B

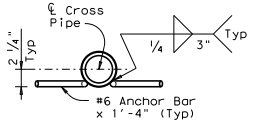
(Cross Pipes not shown for clarity.)



PIPE W/ BOLTED ANCHOR



PIPE W/ ANCHOR BARS



SECTION C-C

CROSS PIPE DETAILS

SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT

FOR DESIGN 1 TO 9
ARCH PIPE CULVERTS
TYPE II ~ PARALLEL DRAINAGE

SETP-PD-A

FILE: setppase.dgn	DN: GAF	CK: TxDOT	DW: JRP	CK: GAF
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REVISIONS				
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TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL (4)

SLOPE	DIA. OF PIPE, D	Values for one pipe						Values to be added for each addt'l pipe		
		W	X	Y	L	Reinf (Lbs)	Conc (CY) (1)	X and W	Reinf (Lbs)	Conc (CY) (1)
3:1	33"	14'- 5 3/4"	4'- 8"	9'- 6"	10'-11 3/4"	310	3.4	4'- 8"	84	1.2
	36"	15'- 7 3/4"	4'-11 1/2"	10'- 3"	11'-10"	343	3.8	5'- 1"	96	1.4
	42"	17'-11 1/2"	5'- 6 1/2"	11'- 9"	13'- 6 3/4"	424	4.9	5'-10"	119	1.8
	48"	21'- 1 3/4"	6'- 1 1/2"	14'- 0"	16'- 2"	527	6.5	6'- 7"	146	2.4
	54"	23'- 5 1/2"	6'- 8 1/2"	15'- 6"	17'-10 3/4"	618	7.8	7'- 6"	186	3.0
	60"	25'- 9 1/4"	7'- 3 1/2"	17'- 0"	19'- 7 1/2"	707	9.2	8'- 3"	219	3.5
	66"	28'- 1"	7'-10 1/2"	18'- 6"	21'- 4 1/4"	797	10.7	8'- 9"	242	4.0
	72"	30'- 4 3/4"	8'- 5 1/2"	20'- 0"	23'- 1 1/4"	910	12.3	9'- 4"	272	4.6
4:1	33"	18'- 1 3/4"	4'- 8"	12'- 8"	14'- 7 1/2"	417	4.8	4'- 8"	101	1.5
	36"	19'- 7"	4'-11 1/2"	13'- 8"	15'- 9 1/4"	464	5.5	5'-1"	115	1.7
	42"	22'- 5 3/4"	5'- 6 1/2"	15'- 8"	18'- 1"	575	7.0	5'-10"	141	2.2
	48"	26'- 6 1/4"	6'- 1 1/2"	18'- 8"	21'- 6 3/4"	720	9.4	6'- 7"	175	3.0
	54"	29'- 5"	6'- 8 1/2"	20'- 8"	23'-10 1/4"	863	11.3	7'- 6"	226	3.7
	60"	32'- 3 3/4"	7'- 3 1/2"	22'- 8"	26'- 2"	984	13.4	8'- 3"	264	4.4
	66"	35'- 2 1/2"	7'-10 1/2"	24'- 8"	28'- 5 3/4"	1126	15.6	8'- 9"	300	5.0
	72"	38'- 1 1/4"	8'- 5 1/2"	26'- 8"	30'- 9 1/2"	1283	18.0	9'- 4"	334	5.7
6:1	33"	25'- 5 1/2"	4'- 8"	19'- 0"	21'-11 1/4"	667	8.3	4'- 8"	127	2.1
	36"	27'- 5 3/4"	4'-11 1/2"	20'- 6"	23'- 8"	727	9.5	5'- 1"	144	2.4
	42"	31'- 6 1/4"	5'- 6 1/2"	23'- 6"	27'- 1 1/2"	914	12.1	5'-10"	179	3.1
	48"	37'- 3 1/2"	6'- 1 1/2"	28'- 0"	32'- 4"	1181	16.6	6'- 7"	231	4.1
	54"	41'- 4 1/4"	6'- 8 1/2"	31'- 0"	35'- 9 1/2"	1412	20.0	7'- 6"	300	5.1
	60"	45'- 4 3/4"	7'- 3 1/2"	34'- 0"	39'- 3"	1619	23.8	8'- 3"	353	6.1

(1) Quantities shown are for concrete pipe and will increase slightly for Metal Pipe installation.

(2) For vehicle safety, curbs shall project no more than 3" above finished grade. Curb heights shall be reduced, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

(3) Provide a 1'-0" footing as shown where required to maintain 4" minimum cover for pipes.

(4) Quantities shown are for one structure end. (One headwall)

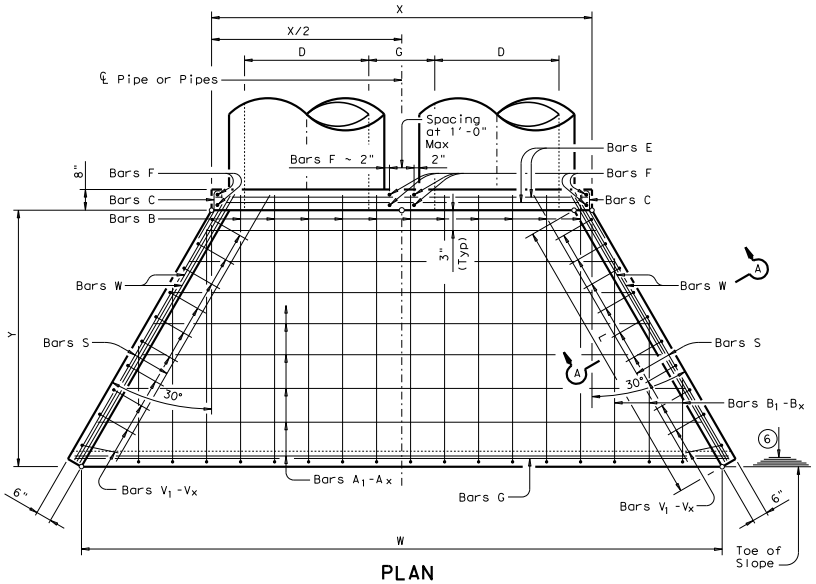
(5) Min Length = 6" + 3" x $\left(\frac{12 \times H - 7}{12 \times L}\right)$

Max Length = 12 x H - 3" x $\left(\frac{12 \times H - 7}{12 \times L}\right)$ - 1"

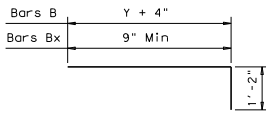
(6) Lengths of wings based on SL:1 Slope along this line.

ELEVATION

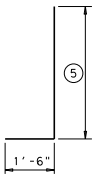
Showing dimensions



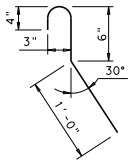
PLAN



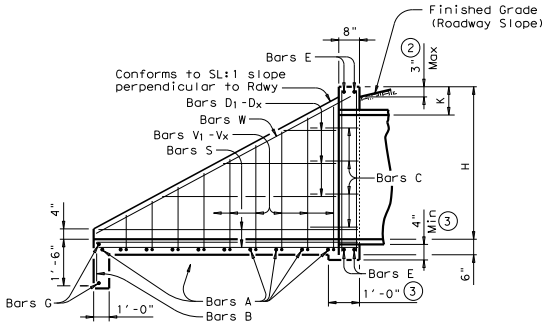
BARS B & B1-Bx



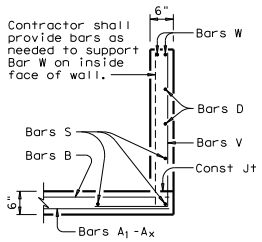
BARS V



BARS C
(2'-0" long)



TYPICAL WING ELEVATION



SECTION A-A

TABLE OF (4) REINFORCING STEEL

Bar	Size	Spa	No.
A	# 4	1'-0"	~
B	# 3	1'-6"	~
C	# 4	1'-0"	~
D	# 3	1'-0"	~
E	# 5	~	4
F	# 5	~	~
G	# 3	~	2
S	# 4	~	6
V	# 4	1'-0"	~
W	# 5	~	4

TABLE OF CONSTANT DIMENSIONS

DIA. OF PIPE, D	G	K	H
33"	1'-11"	1'- 0"	3'- 9"
36"	2'- 1"	1'- 0"	4'- 0"
42"	2'- 4"	1'- 0"	4'- 6"
48"	2'- 7"	1'- 3"	5'- 3"
54"	3'- 0"	1'- 3"	5'- 9"
60"	3'- 3"	1'- 3"	6'- 3"
66"	3'- 3"	1'- 3"	6'- 9"
72"	3'- 4"	1'- 3"	7'- 3"

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

The Safety End Treatment shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the pipe runners.

The Safety Pipe Runners are designed for a traversing load of 1,800 pounds at yield as recommended by Research Report 280-1, "Safety Treatment of Roadside Cross-Drainage Structures", Texas Transportation Institute, March 1981.

Reinforcing steel shall be placed with the center of the outside layer of bars 2" from the surface of the concrete.

All reinforcing steel shall be Grade 60.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

All bolts, nuts, washers, brackets, angles and pipe runners are considered parts of the Safety End Treatment for payment.

Pipe Runners shall conform to the requirements of ASTM A53 (Type E or S, Grade B), ASTM A500 (Grade B), or API 5LX52.

Bolts and nuts shall conform to ASTM A307. Steel plates shall conform to ASTM A36. All steel components, except reinforcing, shall be galvanized. Galvanizing damaged during transport or construction shall be repaired in accordance with the specifications.

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SHEET 1 OF 3

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 0 SKEW PIPE CULVERTS
TYPE I ~ CROSS DRAINAGE

SETP-FW-0

FILE: setpf0se.dgn	DN: GAF	CK: CAT	DW: BWH	CK: GAF
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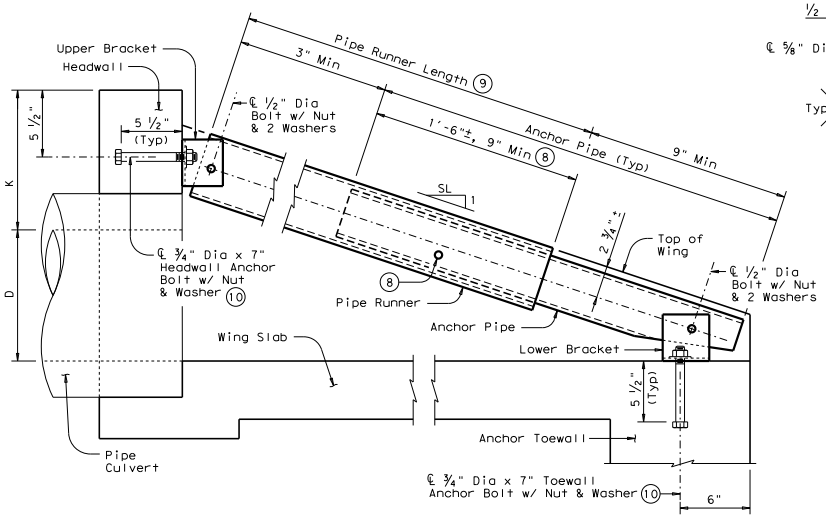
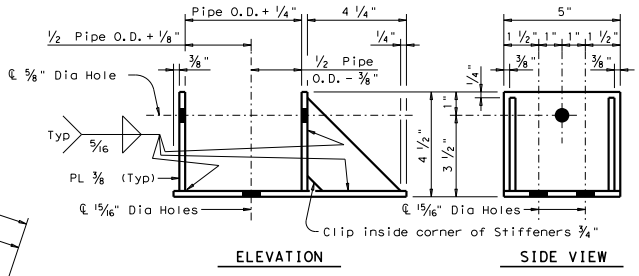
REVISIONS				
	DIST.	COUNTY		SHEET NO.



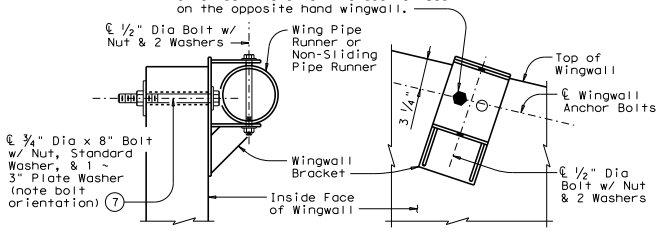
SECTION B-B

(Showing Headwall Pipe Runner. Except for upper bracket, Wingwall Pipe Runners are similar.)



ELEVATION SIDE VIEW

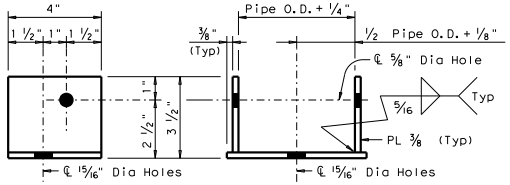
¾" Anchor Bolt shall be installed in hole nearest to the headwall. Other bolt hole is intended for use on the opposite hand wingwall.



SECTION C-C (Showing installed bracket.) ELEVATION (Showing installed bracket normal to Wall. Pipe not shown for clarity.)

NOTE: Wingwall Bracket shall match the Upper Bracket size.

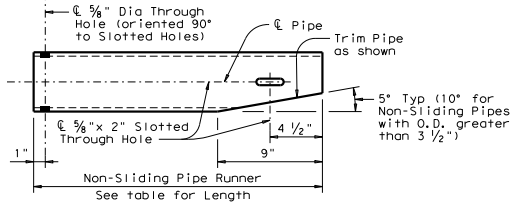
WINGWALL BRACKET DETAILS



SIDE VIEW ELEVATION

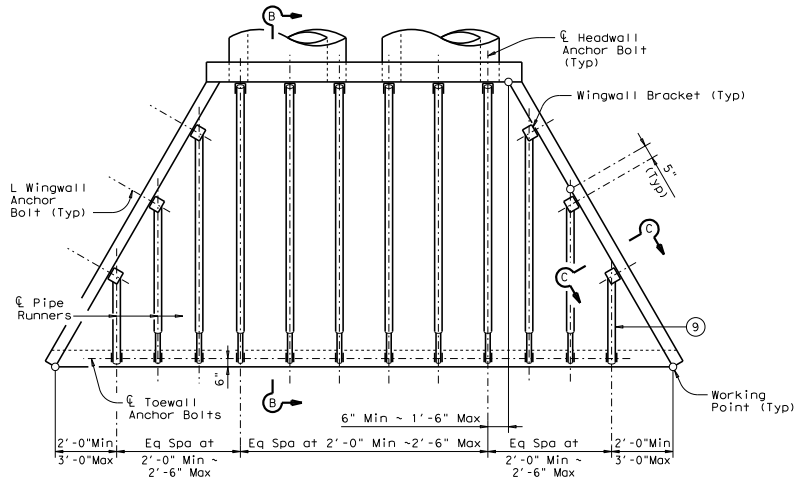
NOTE: Upper and Lower Brackets shall, except for the Brackets used with Non-Sliding Pipe Runners, match the required pipe diameters as shown in the table.

UPPER & LOWER BRACKET DETAILS



Note: Pipe size shall be same as required for headwall pipe runner. Adjust the corresponding Lower Bracket accordingly.

NON-SLIDING PIPE RUNNER DETAILS (9)



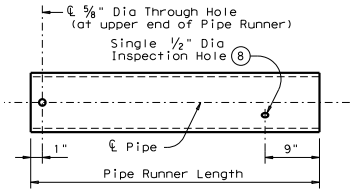
PIPE RUNNER PLAN

(7) At Contractor's option, ⅞" diameter hole may be formed or cored drilled. Percussion drilling is not permitted. Adjust placement of reinforcing steel as necessary to avoid bolt holes.

(8) After installation of the Pipe Runner, the ½" inspection hole shall be utilized to ensure that the lap of the Anchor Pipe with the Pipe Runner is adequate.

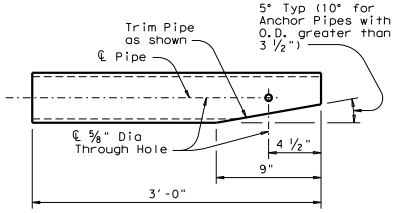
(9) Non-Sliding Pipe Runners are used for those installations that would require Pipe Runner lengths of 1'-9" or less. The Non-Sliding Pipe Runner, when required, replaces the outermost Pipe Runner and Anchor Pipe. See table on Sheet 3 of 3 to determine if the Non-Sliding Pipe Runner is required.

(10) At Contractor's option, an epoxy anchorage system may be used. Anchorage system chosen must be able to achieve an ultimate tensile resistance of 20 kips. Anchor diameter shall be ¾". The Contractor must provide evidence to the Engineer that this can be achieved. Evidence of adequate tensile resistance can be based on the manufacturer's published values of ultimate tensile strength (anchor spacing and edge distance must be accounted for). Anchor installation, including hole size, drilling, and clean-out, must be in accordance with the manufacturer's recommendations.



Note: Pipe diameter required for Headwall pipe runner shall also be used for wingwall pipe runner.

PIPE RUNNER DETAILS



ANCHOR PIPE DETAILS

SHEET 2 OF 3

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 0 SKEW PIPE CULVERTS
TYPE I ~ CROSS DRAINAGE

SETP-FW-0

FILE: setpf0se.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: GAF
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Side Slope	Pipe Culvert Dia (In)	L1 (Ft-In)	P1 (Ft-In)	Number of Spaces in L3	L3 Overall Dimension (Ft-In)	P2 (Ft-In)	Number of Spaces in L4	L4 Overall Dimension (Ft-In)	Headwall Pipe Runner Length (Ft-In)	No. of Wing Pipes (12)	Longest Wingwall Pipe Runner Length (Ft-In)	Shortest Wingwall Pipe Runner Length (Ft-In)	Non-Sliding Pipe Length (Ft-In)	Pipe Runner Size (13)	Total Length of Wingwall Pipe Runners (Ft-In) (12)
3:1	33"	9"	2'- 0"	2	4'- 2 3/4"	3'- 7"	1	4'- 2 3/4"	8'- 4"	4	5'- 5 1/2"	N/A	3'- 1"	3" STD	17'- 1"
	36"	9"	2'- 0"	2	4'- 8"	3'- 7"	1	4'- 8"	9'- 1 1/2"	4	5'-10 1/4"	N/A	3'- 1"	3" STD	17'-10 1/2"
	42"	1'- 0"	3'- 0"	2	4'- 9 1/2"	5'- 7"	1	4'- 9 1/2"	10'- 8 1/4"	4	7'- 9 1/2"	3'- 5"	N/A	4" STD	22'- 5"
	48"	1'- 3"	2'- 0"	3	7'- 4"	3'- 7"	2	9'- 9 1/4"	13'- 0 3/4"	6	10'- 6 1/4"	6'- 0 3/4"	3'- 1"	4" STD	39'- 4"
	54"	6"	2'- 0"	3	7'- 5 1/2"	3'- 7"	2	9'-11 1/4"	14'- 7 3/4"	6	10'- 8"	6'- 1 1/2"	3'- 1"	4" STD	39'- 9"
	60"	9"	2'- 0"	4	8'- 6 3/4"	3'- 7"	3	12'-10 1/4"	16'- 2 3/4"	8	13'- 3 3/4"	5'- 6"	3'- 1"	4" STD	62'- 7 1/4"
	66"	1'- 0"	2'- 0"	4	9'- 8 1/4"	3'- 7"	3	14'- 6 1/4"	17'- 9 3/4"	8	14'-10 1/4"	6'- 0"	3'- 1"	4" STD	68'- 8 3/4"
	72"	1'- 3"	3'- 0"	4	9'- 9 1/2"	5'- 7"	3	14'- 8 1/4"	19'- 4 3/4"	8	16'-10"	3'- 5"	N/A	5" STD	81'- 0"
4:1	33"	9"	2'- 0"	3	6'- 0 3/4"	3'- 7"	2	8'- 1"	11'- 4 1/2"	6	8'- 8 3/4"	5'- 1 1/4"	3'- 0"	4" STD	33'- 8"
	36"	9"	2'- 0"	3	6'- 7 3/4"	3'- 7"	2	8'-10 1/4"	12'- 4 3/4"	6	9'- 5"	5'- 5 1/2"	3'- 0"	4" STD	35'- 9"
	42"	1'- 0"	2'- 9"	3	7'- 3 1/2"	5'- 1"	2	9'- 8 3/4"	14'- 5 1/2"	6	11'- 6 1/4"	2'-10 1/4"	N/A	4" STD	43'- 1 1/2"
	48"	1'- 3"	2'- 3"	4	9'- 9 1/4"	4'- 1"	3	14'- 8"	17'- 6 3/4"	8	15'- 0 1/2"	1'-11 1/2"	N/A	4" STD	68'- 0"
	54"	6"	2'- 6"	4	9'-11 1/4"	4'- 7"	3	14'-10 3/4"	19'- 7 1/2"	8	15'- 8 1/4"	2'- 4 3/4"	N/A	5" STD	72'- 4"
	60"	9"	2'- 0"	5	11'-10"	3'- 7"	4	18'-11 1/4"	21'- 8 1/4"	10	18'- 5"	5'- 8 3/4"	3'- 0"	5" STD	102'- 7"
	66"	1'- 0"	2'- 9"	5	12'- 6"	5'- 1"	4	19'-11 3/4"	23'- 9"	10	20'- 8 1/4"	2'-10 1/4"	N/A	5" STD	117'- 8 1/2"
	72"	1'- 3"	2'- 0"	6	14'- 7 3/4"	3'- 7"	5	24'- 5"	25'- 9 3/4"	12	23'- 3 1/2"	5'-10 1/4"	3'- 0"	5" STD	151'- 8 3/4"
6:1	33"	9"	2'- 0"	4	9'- 8 3/4"	3'- 7"	3	14'- 7"	17'- 7"	8	14'- 3"	5'- 8 1/2"	2'-11 1/2"	4" STD	65'- 9 1/2"
	36"	9"	2'- 9"	4	9'-10"	5'- 1"	3	14'- 9"	19'- 1 1/4"	8	15'- 8 3/4"	2'- 9 1/4"	N/A	5" STD	74'- 0"
	42"	1'- 0"	2'- 3"	5	12'- 3 3/4"	4'- 1"	4	19'- 8 1/2"	22'- 1 3/4"	10	19'- 2 1/4"	1'-10 3/4"	N/A	5" STD	105'- 5"
	48"	1'- 3"	2'- 6"	6	14'-11"	4'- 7"	5	24'-10 1/4"	26'- 8 1/2"	12	24'- 1 3/4"	2'- 4"	N/A	5" STD	158'-10 1/2"
	54"	6"	2'- 0"	7	16'- 4 3/4"	3'- 7"	6	28'- 1 1/4"	29'- 9"	14	26'- 1 1/2"	5'- 6 3/4"	2'-11 1/2"	5" STD	196'- 0 1/2"
	60"	9"	3'- 0"	7	17'- 4 1/2"	5'- 7"	6	29'- 9 1/2"	32'- 9 1/2"	14	29'- 4 1/4"	3'- 2 1/2"	N/A	5" STD	227'-11 1/4"

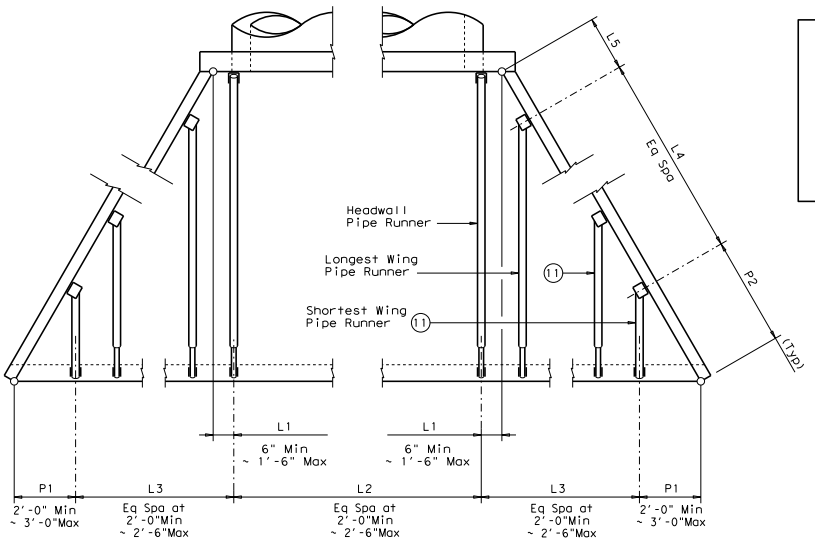
(11) If the outermost Wing Pipe Runner is a Non-Sliding Pipe Runner, the next outermost Wing Pipe Runner shall be considered the Shortest.

(12) Quantities shown include, if present, the Non-Sliding Pipes.

(13) Anchor Pipe size shall be the next smaller size than the Pipe Runner size.

STANDARD PIPE RUNNER AND ANCHOR PIPE SIZES (13)

Pipe Size	Pipe O.D.	Pipe I.D.
2" STD	2.375"	2.067"
3" STD	3.500"	3.068"
4" STD	4.500"	4.026"
5" STD	5.563"	5.047"



PIPE RUNNER LAYOUT

TOTAL PIPE LENGTHS FORMULAS:

$$\text{Total Length of All Pipe Runners} = \text{Total Length of Wingwall Pipe Runners} + \left(\text{No. of Headwall Pipe Runners}\right)\left(\text{Headwall Pipe Runner Length}\right)$$

$$\text{Total Length of All Anchor Pipes} = \left(3.000'\right)\left(\text{No. of Wing Pipe Runners} + \text{No. of Headwall Pipe Runners} - \text{No. of Non-Sliding Pipe Runners}\right)$$

SPECIAL NOTE:

Note that the tabular quantities are given for estimating purposes only. It is likely that these quantities will change due to field conditions. Therefore, all dimensions shall be verified by the Contractor in the field prior to fabrication of the Safety End Treatment components.

Pipe Culvert Dia (In)	Number of Pipe Culverts	No. of L2 Spaces	L2 Overall Dimension (Ft-In)	Number of Headwall Pipes
33"	1	1	2'- 0 1/4"	2
	2	3	6'- 8 1/4"	4
	3	5	11'- 4 1/4"	6
	4	7	16'- 0 1/4"	8
	5	9	20'- 8 1/4"	10
	6	11	25'- 4 1/4"	12
36"	1	1	2'- 3 3/4"	2
	2	3	7'- 4 3/4"	4
	3	5	12'- 5 3/4"	6
	4	7	17'- 6 3/4"	8
	5	10	22'- 7 3/4"	11
	6	12	27'- 8 3/4"	13
42"	1	1	2'- 4 3/4"	2
	2	4	8'- 2 3/4"	5
	3	6	14'- 0 3/4"	7
	4	8	19'-10 3/4"	9
	5	11	25'- 8 3/4"	12
	6	13	31'- 6 3/4"	14
48"	1	1	2'- 5 3/4"	2
	2	4	9'- 0 3/4"	5
	3	7	15'- 7 3/4"	8
	4	9	22'- 2 3/4"	10
	5	12	28'- 9 3/4"	13
	6	15	35'- 4 3/4"	16
54"	1	2	4'- 6 3/4"	3
	2	5	12'- 0 3/4"	6
	3	8	19'- 6 3/4"	9
	4	11	27'- 0 3/4"	12
	5	14	34'- 6 3/4"	15
	6	17	42'- 0 3/4"	18
60"	1	2	4'- 7 3/4"	3
	2	6	12'-10 3/4"	7
	3	9	21'- 1 3/4"	10
	4	12	29'- 4 3/4"	13
	5	16	37'- 7 3/4"	17
	6	19	45'-10 3/4"	20
66"	1	2	4'- 8 3/4"	3
	2	6	13'- 5 3/4"	7
	3	9	22'- 2 3/4"	10
	4	13	30'-11 3/4"	14
	5	16	39'- 8 3/4"	17
	6	20	48'- 5 3/4"	21
72"	1	2	4'- 9 3/4"	3
	2	6	14'- 1 3/4"	7
	3	10	23'- 5 3/4"	11
	4	14	32'- 9 3/4"	15
	5	17	42'- 1 3/4"	18
	6	21	51'- 5 3/4"	22

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Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 0 SKEW PIPE CULVERTS
TYPE I ~ CROSS DRAINAGE

SETP-FW-0

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REVISIONS				
	DIST.	COUNTY		SHEET NO.

TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL (4)

SLOPE	DIA. OF PIPE, D	Values for one pipe W	X	Y	L	Reinf (Lbs)	Conc (CY) (1)	Values to be added for each add'l pipe X and W	Reinf (Lbs)	Conc (CY) (1)
3:1	24"	10'- 7 ½"	4'- 7"	7'- 3"	10'- 3"	227	2.3	4'- 1 ¾"	65	0.9
	27"	11'- 8 ½"	4'-11"	8'- 0"	11'- 3 ¾"	255	2.7	4'- 6 ¼"	75	1.0
	30"	12'- 9 ½"	5'- 3"	8'- 9"	12'- 4 ½"	298	3.1	5'- 0"	86	1.2
	33"	13'-10 ¾"	5'- 7"	9'- 6"	13'- 5 ¼"	322	3.5	5'- 4 ¾"	94	1.4
	36"	14'-11 ¾"	5'-11 ¼"	10'- 3"	14'- 6"	355	4.0	5'-10 ½"	108	1.6
	42"	17'- 1 ¾"	6'- 7 ¼"	11'- 9"	16'- 7 ½"	441	5.0	6'- 8 ¾"	133	2.1
	48"	20'- 0 ¾"	7'- 3 ¼"	14'- 0"	19'- 9 ½"	542	6.6	7'- 7 ¼"	176	2.8
	54"	22'- 3"	7'-11 ½"	15'- 6"	21'-11"	626	7.9	8'- 8"	211	3.5
	60"	24'- 5"	8'- 7 ½"	17'- 0"	24'- 0 ½"	725	9.4	9'- 6 ¼"	246	4.1
	66"	26'- 7"	9'- 3 ½"	18'- 6"	26'- 2"	821	10.9	10'- 1 ¼"	274	4.6
	72"	28'- 9 ¼"	9'-11 ¾"	20'- 0"	28'- 3 ½"	930	12.5	10'- 9 ¼"	309	5.3
4:1	24"	13'- 0 ½"	4'- 7"	9'- 8"	13'- 8"	301	3.1	4'- 1 ¾"	75	1.1
	27"	14'- 4 ½"	4'-11"	10'- 8"	15'- 1"	339	3.7	4'- 6 ¼"	87	1.3
	30"	15'- 8 ½"	5'- 3"	11'- 8"	16'-6"	394	4.2	5'- 0"	99	1.5
	33"	17'- 0 ¾"	5'- 7"	12'- 8"	17'-11"	432	4.9	5'- 4 ¾"	112	1.7
	36"	18'- 4 ¾"	5'-11 ¼"	13'- 8"	19'- 4"	479	5.5	5'-10 ½"	128	2.0
	42"	21'- 0 ¾"	6'- 7 ¼"	15'- 8"	22'- 1 ¾"	587	7.0	6'- 8 ¾"	158	2.6
	48"	24'- 8 ¾"	7'- 3 ¼"	18'- 8"	26'- 4 ¾"	738	9.4	7'- 7 ¼"	211	3.4
	54"	27'- 5"	7'-11 ½"	20'- 8"	29'- 2 ¾"	871	11.3	8'- 8"	257	4.3
	60"	30'- 1"	8'- 7 ½"	22'- 8"	32'- 0 ¾"	999	13.3	9'- 6 ¼"	297	5.1
	66"	32'- 9"	9'- 3 ½"	24'- 8"	34'-10 ½"	1139	15.6	10'- 1 ¼"	340	5.8
	72"	35'- 5 ¼"	9'-11 ¾"	26'- 8"	37'- 8 ½"	1290	18.0	10'- 9 ¼"	378	6.6
6:1	24"	17'-10 ½"	4'- 7"	14'- 6"	20'- 6"	450	5.1	4'- 1 ¾"	91	1.5
	27"	19'- 8 ½"	4'-11"	16'- 0"	22'- 7 ½"	519	6.0	4'- 6 ¼"	108	1.7
	30"	21'- 6 ½"	5'- 3"	17'- 6"	24'- 9"	595	7.1	5'- 0"	124	2.0
	33"	23'- 4 ¾"	5'- 7"	19'- 0"	26'-10 ½"	674	8.2	5'- 4 ¾"	143	2.4
	36"	25'- 2 ¾"	5'-11 ¼"	20'- 6"	29'- 0"	737	9.3	5'-10 ½"	162	2.8
	42"	28'-10 ¾"	6'- 7 ¼"	23'- 6"	33'- 2 ¾"	920	11.9	6'- 8 ¾"	202	3.6
	48"	34'- 0 ¾"	7'- 3 ¼"	28'- 0"	39'- 7 ¼"	1189	16.2	7'- 7 ¼"	274	4.7

(1) Quantities shown are for concrete pipe and will increase slightly for Metal Pipe installation.

(2) For vehicle safety, curbs shall project no more than 3" above finished grade. Curb heights shall be reduced, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

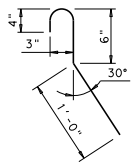
(3) Provide a 1'-0" footing as shown where required to maintain 4" minimum cover for pipes.

(4) Quantities shown are for one structure end. (One headwall)

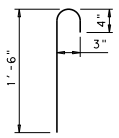
(5) Min Length = 6" + 3" x $\left(\frac{12 \times H - 7}{12 \times L}\right)$

Max Length = 12 x H - 3" x $\left(\frac{12 \times H - 7}{12 \times L}\right)$ - 1"

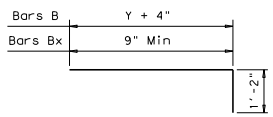
(6) Lengths of wings based on SL:1 Slope along this line.



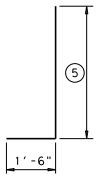
BARS C_L
(2'-0" long)



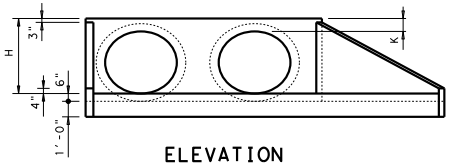
BARS C_S
(2'-0" long)



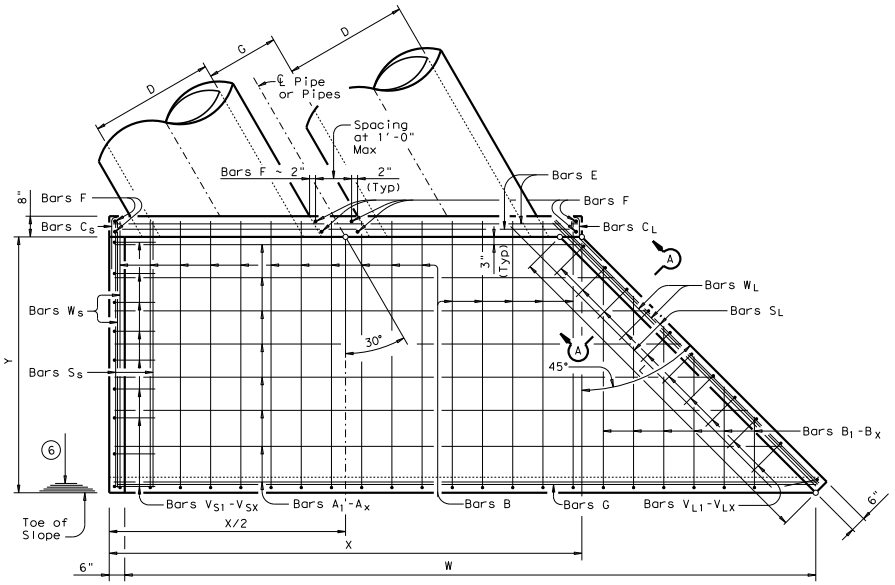
BARS B & B_1-B_X



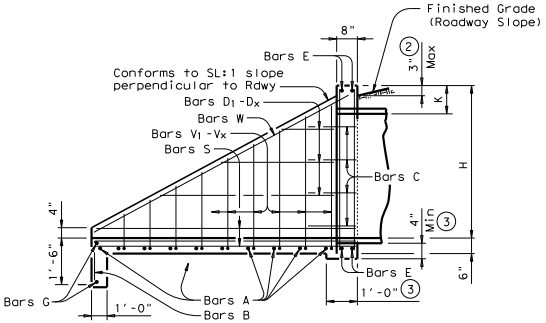
BARS V_S & V_L



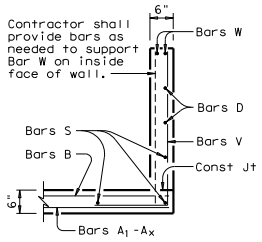
ELEVATION



PLAN



TYPICAL WING ELEVATION



SECTION A-A

TABLE OF (4) REINFORCING STEEL

Bar	Size	Spa	No.
A	# 4	1'-0"	~
B	# 3	1'-6"	~
CL	# 4	1'-0"	~
CS	# 4	1'-0"	~
D	# 3	1'-0"	~
E	# 5	~	4
F	# 5	~	~
G	# 3	~	2
SL	# 4	~	3
SS	# 4	~	3
V	# 4	1'-0"	~
WL	# 5	~	2
WS	# 5	~	2

TABLE OF CONSTANT DIMENSIONS

DIA OF PIPE, D	G	K	H
24"	1'- 7"	1'- 0"	3'- 0"
27"	1'- 8"	1'- 0"	3'- 3"
30"	1'-10"	1'- 0"	3'- 6"
33"	1'-11"	1'- 0"	3'- 9"
36"	2'- 1"	1'- 0"	4'- 0"
42"	2'- 4"	1'- 0"	4'- 6"
48"	2'- 7"	1'- 3"	5'- 3"
54"	3'- 0"	1'- 3"	5'- 9"
60"	3'- 3"	1'- 3"	6'- 3"
66"	3'- 3"	1'- 3"	6'- 9"
72"	3'- 4"	1'- 3"	7'- 3"

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

The Safety End Treatment shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the pipe runners.

The Safety Pipe Runners are designed for a traversing load of 1,800 pounds at yield as recommended by Research Report 280-1, "Safety Treatment of Roadside Cross-Drainage Structures", Texas Transportation Institute, March 1981.

Reinforcing steel shall be placed with the center of the outside layer of bars 2" from the surface of the concrete.

All reinforcing steel shall be Grade 60.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

All bolts, nuts, washers, brackets, angles and pipe runners are considered parts of the Safety End Treatment for payment.

Pipe Runners shall conform to the requirements of ASTM A53 (Type E or S, Grade B), ASTM A500 (Grade B), or API 5LX52.

Bolts and nuts shall conform to ASTM A307. Steel plates shall conform to ASTM A36. All steel components, except reinforcing, shall be galvanized. Galvanizing damaged during transport or construction shall be repaired in accordance with the specifications.

DATE:
FILE:

SHEET 1 OF 3

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 30° SKEW PIPE CULVERTS
TYPE I ~ CROSS DRAINAGE

SETP-FW-30

FILE: stpf30se.dgn	DN: GAF	CK: CAT	DW: BWH	CK: GAF
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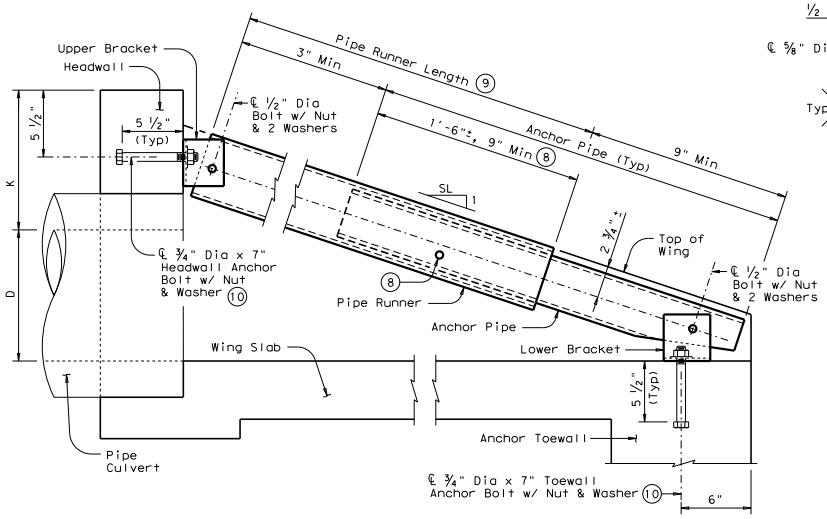
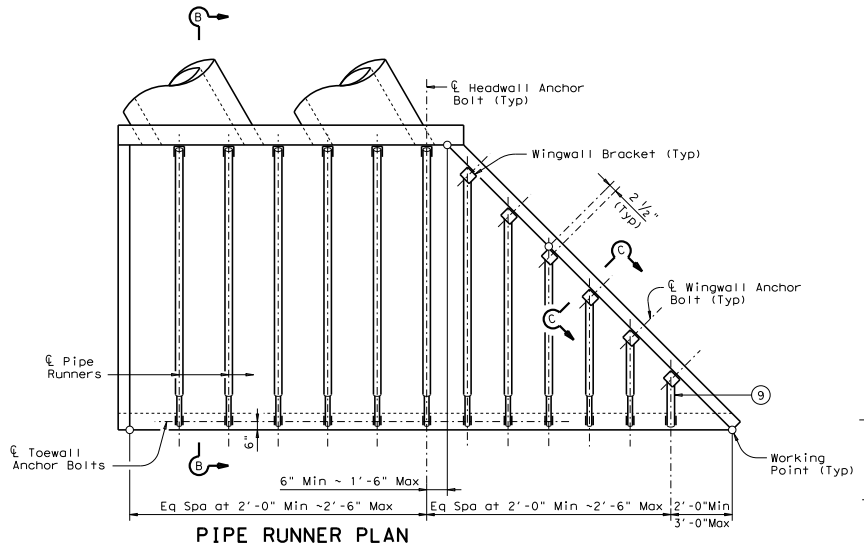
REVISIONS				
	DIST	COUNTY		SHEET NO.

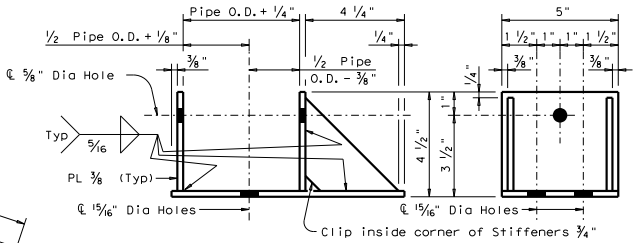


SECTION B-B

(Showing Headwall Pipe Runner. Except for upper bracket, Wingwall Pipe Runners are similar.)

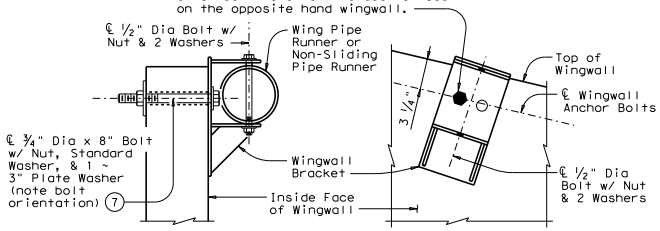


PIPE RUNNER PLAN



ELEVATION SIDE VIEW

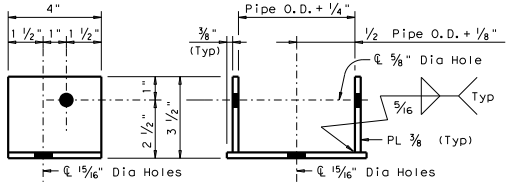
¾" Anchor Bolt shall be installed in hole nearest to the headwall. Other bolt hole is intended for use on the opposite hand wingwall.



SECTION C-C (Showing installed bracket.) ELEVATION (Showing installed bracket normal to Wall. Pipe not shown for clarity.)

NOTE: Wingwall Bracket shall match the Upper Bracket size.

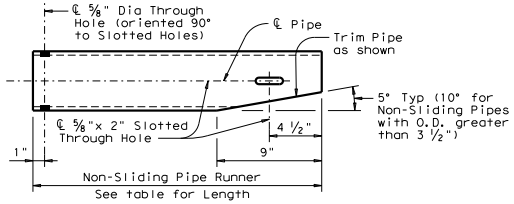
WINGWALL BRACKET DETAILS



SIDE VIEW ELEVATION

NOTE: Upper and Lower Brackets shall, except for the Brackets used with Non-Sliding Pipe Runners, match the required pipe diameters as shown in the table.

UPPER & LOWER BRACKET DETAILS



Note: Pipe size shall be same as required for headwall pipe runner. Adjust the corresponding Lower Bracket accordingly.

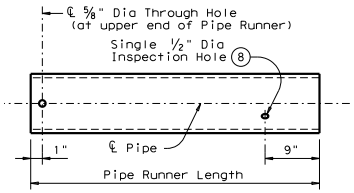
NON-SLIDING PIPE RUNNER DETAILS (9)

(7) At Contractor's option, ⅞" diameter hole may be formed or cored drilled. Percussion drilling is not permitted. Adjust placement of reinforcing steel as necessary to avoid bolt holes.

(8) After installation of the Pipe Runner, the ½" inspection hole shall be utilized to ensure that the lap of the Anchor Pipe with the Pipe Runner is adequate.

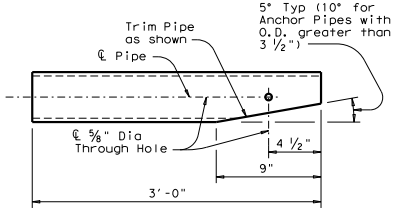
(9) Non-Sliding Pipe Runners are used for those installations that would require Pipe Runner lengths of 1'-9" or less. The Non-Sliding Pipe Runner, when required, replaces the outermost Pipe Runner and Anchor Pipe. See table on Sheet 3 of 3 to determine if the Non-Sliding Pipe Runner is required.

(10) At Contractor's option, an epoxy anchorage system may be used. Anchorage system chosen must be able to achieve an ultimate tensile resistance of 20 kips. Anchor diameter shall be ¾". The Contractor must provide evidence to the Engineer that this can be achieved. Evidence of adequate tensile resistance can be based on the manufacturer's published values of ultimate tensile strength (anchor spacing and edge distance must be accounted for). Anchor installation, including hole size, drilling, and clean-out, must be in accordance with the manufacturer's recommendations.



Note: Pipe diameter required for Headwall pipe runner shall also be used for wingwall pipe runner.

PIPE RUNNER DETAILS



ANCHOR PIPE DETAILS

SHEET 2 OF 3

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 30° SKEW PIPE CULVERTS
TYPE I ~ CROSS DRAINAGE

SETP-FW-30

FILE: stpf30se.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: GAF
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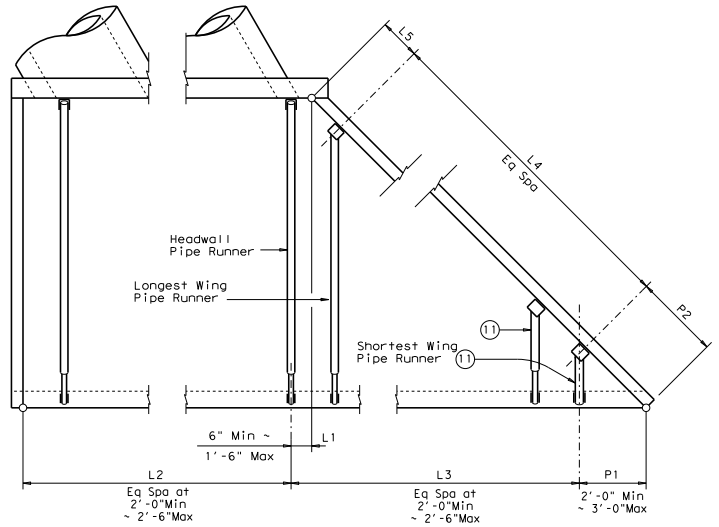
Pipe Culvert Dia (In)	Number of Pipe Culverts	No. of L2 Spaces	L2 Overall Dimension (Ft-In)	Number of Headwall Pipes
24"	1	1	2'- 4 1/2"	1
	2	3	6'- 6 1/4"	3
	3	5	10'- 8"	5
	4	6	14'- 9 3/4"	6
	5	8	18'-11 1/2"	8
	6	10	23'- 1 1/4"	10
27"	1	1	2'- 5 1/2"	1
	2	3	6'-11 3/4"	3
	3	5	11'- 6"	5
	4	7	16'- 0 1/4"	7
	5	9	20'- 6 1/2"	9
	6	10	25'- 0 3/4"	10
30"	1	1	2'- 6 1/2"	1
	2	3	7'- 6 1/2"	3
	3	5	12'- 6 1/2"	5
	4	7	17'- 6 1/2"	7
	5	9	22'- 6 1/2"	9
	6	11	27'- 6 1/2"	11
33"	1	2	3'-10 1/2"	2
	2	4	9'- 3 1/4"	4
	3	6	14'- 8"	6
	4	9	20'- 0 3/4"	9
	5	11	25'- 5 1/2"	11
	6	13	30'-10 1/4"	13
36"	1	2	3'-11 3/4"	2
	2	4	9'-10 1/4"	4
	3	7	15'- 8 3/4"	7
	4	9	21'- 7 1/4"	9
	5	11	27'- 5 3/4"	11
	6	14	33'- 4 1/4"	14
42"	1	2	4'-10 3/4"	2
	2	5	11'- 7 1/2"	5
	3	8	18'- 4 1/4"	8
	4	11	25'- 1"	11
	5	13	31'- 9 3/4"	13
	6	16	38'- 6 1/2"	16
48"	1	2	4'- 9 3/4"	2
	2	5	12'- 5"	5
	3	8	20'- 0 1/4"	8
	4	12	27'- 7 1/2"	12
	5	15	35'- 2 3/4"	15
	6	18	42'-10"	18
54"	1	3	6'- 3"	3
	2	6	14'-11"	6
	3	10	23'- 7"	10
	4	13	32'- 3"	13
	5	17	40'-11"	17
	6	20	49'- 7"	20
60"	1	3	6'-11"	3
	2	7	16'- 5 1/4"	7
	3	11	25'-11 1/2"	11
	4	15	35'- 5 3/4"	15
	5	19	45'- 0"	19
	6	22	54'- 6 1/4"	22
66"	1	3	7'- 4"	3
	2	7	17'- 5 1/4"	7
	3	11	27'- 6 1/2"	11
	4	16	37'- 7 3/4"	16
	5	20	47'- 9"	20
	6	24	57'-10 1/4"	24
72"	1	3	7'- 3 1/4"	3
	2	8	18'- 0 1/2"	8
	3	12	28'- 9 3/4"	12
	4	16	39'- 7"	16
	5	21	50'- 4 1/4"	21
	6	25	61'- 1 1/2"	25

Side Slope	Pipe Culvert Dia (In)	L1 (Ft-In)	P1 (Ft-In)	Number of Spaces in L3	L3 Overall Dimension (Ft-In)	P2 (Ft-In)	Number of Spaces in L4	L4 Overall Dimension (Ft-In)	Headwall Pipe Runner Length (Ft-In)	No. of Wing Pipes (12)	Longest Wingwall Pipe Runner Length (Ft-In)	Shortest Wingwall Pipe Runner Length (Ft-In)	Non-Sliding Pipe Length (Ft-In)	Pipe Runner Size (13)	Total Length of Wingwall Pipe Runners (Ft-In) (12)
3:1	24"	1'- 0"	2'- 0"	3	6'- 3"	2'- 7 1/2"	2	5'-10 3/4"	5'-11 1/2"	3	4'- 5 1/4"	2'- 3"	1'- 6 1/2"	3" STD	8'- 2 3/4"
	27"	1'- 3"	2'- 0"	3	7'- 3"	2'- 7 1/2"	2	6'-10"	6'- 9"	3	5'- 1 3/4"	2'- 7"	1'- 6 1/2"	3" STD	9'- 3 1/4"
	30"	1'- 6"	3'- 0"	3	7'- 3"	4'- 0 1/2"	2	6'-10"	7'- 6 1/2"	3	6'- 2 1/4"	3'- 7 3/4"	2'- 7 1/4"	3" STD	12'- 5 1/4"
	33"	6"	2'- 6"	3	7'- 6"	3'- 4"	2	7'- 0 3/4"	8'- 4"	3	5'-10"	3'- 2 1/2"	2'- 0 3/4"	3" STD	11'- 1 1/4"
	36"	9"	2'- 0"	4	9'- 0"	2'- 7 1/2"	3	9'- 6 1/2"	9'- 1 1/2"	4	7'- 2"	2'- 5"	1'- 6 1/2"	4" STD	15'-11"
	42"	6"	2'- 3"	4	10'- 0"	2'-11 3/4"	3	10'- 7 1/4"	10'- 8 1/4"	4	8'- 2 1/2"	2'-11 1/4"	1'- 9 3/4"	4" STD	18'- 6 1/2"
	48"	1'- 3"	2'- 9"	5	12'- 6"	3'- 8 1/4"	4	14'- 1 3/4"	13'- 0 3/4"	5	11'- 4 1/2"	3'- 5 3/4"	2'- 4"	4" STD	32'- 0 1/2"
	54"	6"	2'- 0"	6	14'- 0"	2'- 7 1/2"	5	16'- 6"	14'- 7 3/4"	6	12'- 4"	2'- 6"	1'- 6 1/2"	4" STD	38'- 7 1/2"
	60"	6"	2'- 6"	6	15'- 0"	3'- 4"	5	17'- 8"	16'- 2 3/4"	6	13'- 9"	3'- 2 1/2"	2'- 0 3/4"	4" STD	44'- 5 1/2"
	66"	9"	2'- 0"	7	17'- 3"	2'- 7 1/2"	6	20'-11"	17'- 9 3/4"	7	15'- 7 1/2"	2'- 7 3/4"	1'- 6 1/2"	4" STD	56'- 4 1/4"
	72"	1'- 6"	2'- 0"	8	19'- 6"	2'- 7 1/2"	7	24'- 1 1/2"	19'- 4 3/4"	8	18'- 0 1/4"	2'- 7 1/4"	1'- 6 1/2"	5" STD	73'- 8 3/4"
4:1	24"	1'- 0"	2'- 0"	4	8'- 8"	2'- 7 1/2"	3	9'- 2 1/4"	8'- 3 1/4"	4	6'- 8 1/2"	2'- 2 3/4"	1'- 6"	3" STD	14'-11"
	27"	1'- 3"	2'- 0"	4	9'-11"	2'- 7 1/2"	3	10'- 6 1/4"	9'- 3 3/4"	4	7'- 8"	2'- 6 3/4"	1'- 6"	4" STD	16'-10 1/4"
	30"	1'- 6"	2'- 0"	5	11'- 2"	2'- 7 1/2"	4	12'- 7 1/2"	10'- 4"	5	9'- 2 1/2"	2'- 3 1/2"	1'- 6"	4" STD	24'- 6"
	33"	6"	2'- 0"	5	11'- 2"	2'- 7 1/2"	4	12'- 7 1/2"	11'- 4 1/2"	5	9'- 2 1/2"	2'- 3 1/2"	1'- 6"	4" STD	24'- 6"
	36"	9"	2'- 0"	5	12'- 5"	2'- 7 1/2"	4	14'- 0 1/2"	12'- 4 3/4"	5	10'- 3"	2'- 6 3/4"	1'- 6"	4" STD	27'- 1 1/2"
	42"	6"	2'- 0"	6	14'- 2"	2'- 7 1/2"	5	16'- 8 1/4"	14'- 5 1/2"	6	12'- 2"	2'- 5 1/4"	1'- 6"	4" STD	38'- 0 1/4"
	48"	1'- 3"	2'- 6"	7	17'- 5"	3'- 4"	6	21'- 1 1/4"	17'- 6 3/4"	7	15'-10 3/4"	3'- 1"	2'- 0 1/4"	4" STD	58'-11 1/2"
	54"	6"	2'- 0"	8	19'- 2"	2'- 7 1/2"	7	23'- 8 1/2"	19'- 7 1/2"	8	17'- 3 1/2"	2'- 5 3/4"	1'- 6"	5" STD	70'- 8 1/2"
	60"	6"	2'- 0"	9	21'- 2"	2'- 7 1/2"	8	26'- 7 1/4"	21'- 8 1/4"	9	19'- 4 3/4"	2'- 5"	1'- 6"	5" STD	88'- 9"
	66"	9"	3'- 0"	9	22'- 5"	4'- 0 1/2"	8	28'- 2"	23'- 9"	9	21'- 7"	3'- 7 1/4"	2'- 6 1/4"	5" STD	103'- 3 1/4"
	72"	1'- 6"	2'- 0"	11	26'- 2"	2'- 7 1/2"	10	33'- 7 3/4"	25'- 9 3/4"	11	24'- 6 1/4"	2'- 5 1/2"	1'- 6"	5" STD	136'- 4 3/4"
6:1	24"	1'- 0"	3'- 0"	5	12'- 6"	4'- 0 1/2"	4	14'- 1 3/4"	13'- 0 1/4"	5	11'- 1 1/2"	3'- 6 1/4"	2'- 5 3/4"	4" STD	31'- 9 1/4"
	27"	1'- 3"	2'- 3"	6	15'- 0"	2'-11 3/4"	5	17'- 8"	14'- 6 1/2"	6	12'-10 3/4"	2'- 9"	1'- 8 1/2"	4" STD	40'-10"
	30"	1'- 6"	2'- 0"	7	17'- 0"	2'- 7 1/2"	6	20'- 7 1/4"	16'- 0 3/4"	7	14'- 9"	2'- 5 1/2"	1'- 5 1/2"	4" STD	53'- 0 1/4"
	33"	6"	2'- 0"	7	17'- 6"	2'- 7 1/2"	6	21'- 2 1/2"	17'- 7"	7	15'- 2"	2'- 6"	1'- 5 1/2"	4" STD	54'- 5 1/2"
	36"	9"	2'- 0"	8	19'- 3"	2'- 7 1/2"	7	23'- 9 3/4"	19'- 1 1/4"	8	17'- 0 1/2"	2'- 4 3/4"	1'- 5 1/2"	5" STD	69'- 6"
	42"	6"	2'- 0"	9	22'- 0"	2'- 7 1/2"	8	27'- 7 3/4"	22'- 1 3/4"	9	19'- 9 1/2"	2'- 5 1/4"	1'- 5 1/2"	5" STD	90'- 4 1/2"
	48"	1'- 3"	2'- 0"	11	27'- 3"	2'- 7 1/2"	10	35'- 0 1/4"	26'- 8 1/2"	11	25'- 1"	2'- 5 3/4"	1'- 5 1/2"	5" STD	139'- 3 1/4"

(11) If the outermost Wing Pipe Runner is a Non-Sliding Pipe Runner, the next outermost Wing Pipe Runner shall be considered the Shortest.

(12) Quantities shown include, if present, the Non-Sliding Pipes.

(13) Anchor Pipe size shall be the next smaller size than the Pipe Runner size.



PIPE RUNNER LAYOUT

Note: Left forward culvert skew shown, actual culvert skew may be opposite hand.

SPECIAL NOTE:

Note that the tabular quantities are given for estimating purposes only. It is likely that these quantities will change due to field conditions. Therefore, all dimensions shall be verified by the Contractor in the field prior to fabrication of the Safety End Treatment components.

STANDARD PIPE RUNNER AND ANCHOR PIPE SIZES (13)

Pipe Size	Pipe O.D.	Pipe I.D.
2" STD	2.375"	2.067"
3" STD	3.500"	3.068"
4" STD	4.500"	4.026"
5" STD	5.563"	5.047"

TOTAL PIPE LENGTHS FORMULAS:

$$\text{Total Length of All Pipe Runners} = \text{Total Length of Wingwall Pipe Runners} + \left(\text{No. of Headwall Pipe Runners}\right)\left(\text{Headwall Pipe Runner Length}\right)$$

$$\text{Total Length of All Anchor Pipes} = \left(3.000'\right)\left(\text{No. of Wing Pipe Runners} + \text{No. of Headwall Pipe Runners} - \text{No. of Non-Sliding Pipe Runners}\right)$$

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SHEET 3 OF 3

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 30° SKEW PIPE CULVERTS
TYPE I ~ CROSS DRAINAGE

SETP-FW-30

FILE: stpf30se.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: GAF
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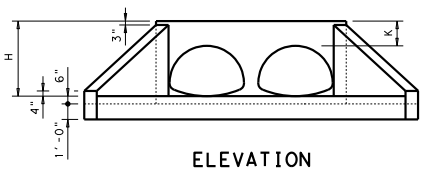
	DIST	COUNTY		SHEET NO.

TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL (4)

SLOPE	DESIGN	SIZE OF PIPE ARCH		Values for one Pipe						Values to be added for each addt'l Pipe		
		Span	Rise	W	X	Y	L	Reinf (Lbs)	Conc (CY) (1)	X and W	Reinf (Lbs)	Conc (CY) (1)
3:1	4	35"	24"	11'- 5 ½"	4'- 2 ¾"	7'- 3"	8'- 4 ½"	237	2.1	4'- 7"	83	1.0
	5	42"	29"	13'- 5 ¾"	4'- 9 ¾"	8'- 6"	9'- 9 ¾"	295	2.7	5'- 5"	113	1.3
	6	49"	33"	15'- 2 ¾"	5'- 4 ¾"	9'- 6"	10'-11 ¾"	339	3.3	6'- 3"	130	1.7
	7	57"	38"	17'- 4"	6'- 0 ¾"	10'- 9"	12'- 5"	394	4.2	7'- 2"	159	2.1
	8	64"	43"	19'- 4 ¼"	6'- 7 ¾"	12'- 0"	13'-10 ¼"	471	5.1	8'- 2"	199	2.6
	9	71"	47"	21'- 1 ¼"	7'- 2 ¾"	13'- 0"	15'- 0 ¼"	523	5.9	9'- 1"	226	3.1
4:1	4	35"	24"	14'- 3"	4'- 2 ¾"	9'- 8"	11'- 2"	311	2.9	4'- 7"	94	1.2
	5	42"	29"	16'- 9"	4'- 9 ¾"	11'- 4"	13'- 1"	375	3.9	5'- 5"	125	1.6
	6	49"	33"	18'-10 ½"	5'- 4 ¾"	12'- 8"	14'- 7 ½"	449	4.7	6'- 3"	152	2.0
	7	57"	38"	21'- 5 ½"	6'- 0 ¾"	14'- 4"	16'- 6 ¾"	526	5.9	7'- 2"	180	2.6
	8	64"	43"	23'-11 ¾"	6'- 7 ¾"	16'- 0"	18'- 5 ¾"	625	7.2	8'- 2"	229	3.2
	9	71"	47"	26'- 1 ¼"	7'- 2 ¾"	17'- 4"	20'- 0 ¼"	698	8.4	9'- 1"	261	3.9
6:1	4	35"	24"	19'-10"	4'- 2 ¾"	14'- 6"	16'- 9"	464	5.0	4'- 7"	112	1.6
	5	42"	29"	23'- 3 ½"	4'- 9 ¾"	17'- 0"	19'- 7 ½"	581	6.6	5'- 5"	154	2.2
	6	49"	33"	26'- 2 ¼"	5'- 4 ¾"	19'- 0"	21'-11 ¼"	705	8.2	6'- 3"	187	2.8
	7	57"	38"	29'- 9"	6'- 0 ¾"	21'- 6"	24'-10"	846	10.3	7'- 2"	233	3.5
	8	64"	43"	33'- 2 ½"	6'- 7 ¾"	24'- 0"	27'- 8 ½"	990	12.6	8'- 2"	289	4.4
	9	71"	47"	36'- 1 ¼"	7'- 2 ¾"	26'- 0"	30'- 0 ¼"	1119	14.7	9'- 1"	336	5.3



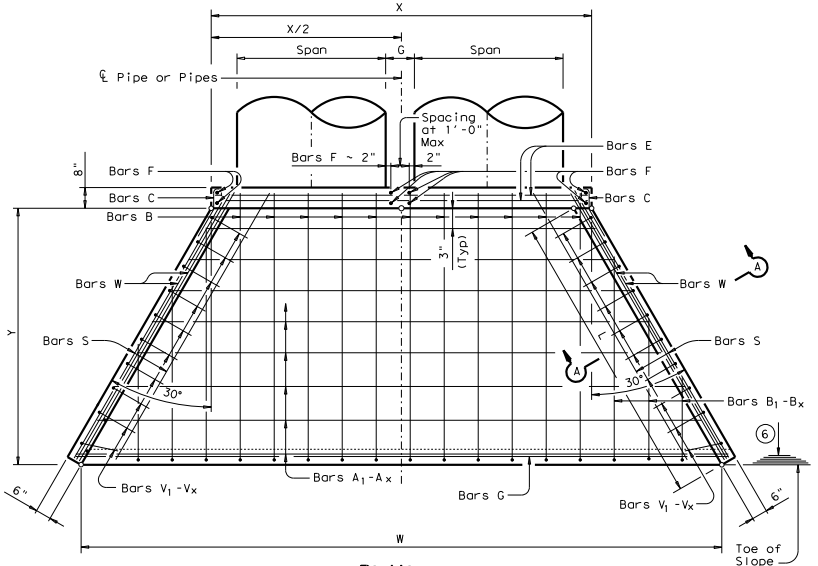
ELEVATION
Showing dimensions

TABLE OF (4) REINFORCING STEEL

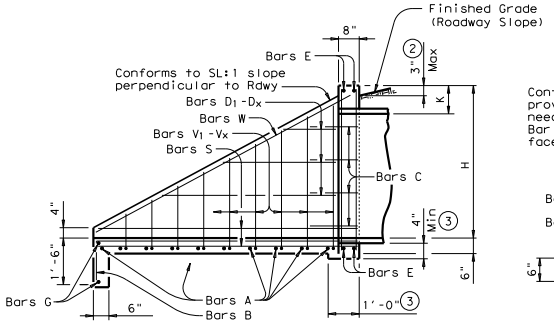
Bar	Size	Spa	No.
A	# 4	1'-0"	~
B	# 3	1'-6"	~
C	# 4	1'-0"	~
D	# 3	1'-0"	~
E	# 5	~	4
F	# 5	~	~
G	# 3	~	2
S	# 4	~	6
V	# 4	1'-0"	~
W	# 5	~	4

TABLE OF DIMENSIONS NOT VARIED WITH SLOPE

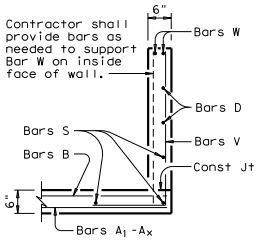
DESIGN	SIZE OF PIPE ARCH		G	K	H
	Span	Rise			
4	35"	24"	1'- 8"	1'- 0"	3'- 0"
5	42"	29"	1'-11"	1'- 0"	3'- 5"
6	49"	33"	2'- 2"	1'- 0"	3'- 9"
7	57"	38"	2'- 5"	1'- 0"	4'- 2"
8	64"	43"	2'-10"	1'- 0"	4'- 7"
9	71"	47"	3'- 2"	1'- 0"	4'-11"



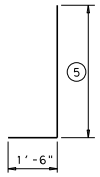
PLAN



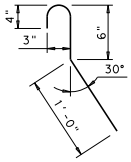
TYPICAL WING ELEVATION



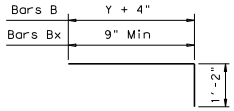
SECTION A-A



BARS V



BARS C
(2'-0" long)



BARS B & B1 -Bx

(1) Quantities shown are for metal pipe and will decrease slightly for concrete pipe installations.

(2) For vehicle safety, curbs shall project no more than 3" above finished grade. Curb heights shall be reduced, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

(3) Provide a 1'-0" footing as shown where required to maintain 4" Min cover for pipes.

(4) Quantities shown are for one structure end only (one headwall).

(5) Min Length = $6" + 3" \times \left(\frac{12 \times H - 7}{12 \times L}\right)$

Max Length = $12 \times H - 3" \times \left(\frac{12 \times H - 7}{12 \times L}\right) - 1"$

(6) Lengths of wings based on SL:1 Slope along this line.

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

The Safety End Treatment shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the pipe runners.

The Safety Pipe Runners are designed for a traversing load of 1,800 pounds at yield as recommended by Research Report 280-1, "Safety Treatment of Roadside Cross-Drainage Structures", Texas Transportation Institute, March 1981.

Reinforcing steel shall be placed with the center of the outside layer of bars 2" from the surface of the concrete.

All reinforcing steel shall be Grade 60.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

All bolts, nuts, washers, brackets, angles and pipe runners are considered parts of the Safety End Treatment for payment.

Pipe Runners shall conform to the requirements of ASTM A53 (Type E or S, Grade B), ASTM A500 (Grade B), or API 5LX52.

Bolts and nuts shall conform to ASTM A307. Steel plates shall conform to ASTM A36. All steel components, except reinforcing, shall be galvanized. Galvanizing damaged during transport or construction shall be repaired in accordance with the specifications.

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SHEET 1 OF 3

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 0° SKEW ARCH PIPE CULVERTS
TYPE I ~ CROSS DRAINAGE

SETP-FW-A-0

FILE:	stpa00se.dgn	DN: GAF	CK: CAT	DW: BWH	CK: GAF
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REVISIONS					
11-10: Removed Bars T.		DIST.	COUNTY		SHEET NO.

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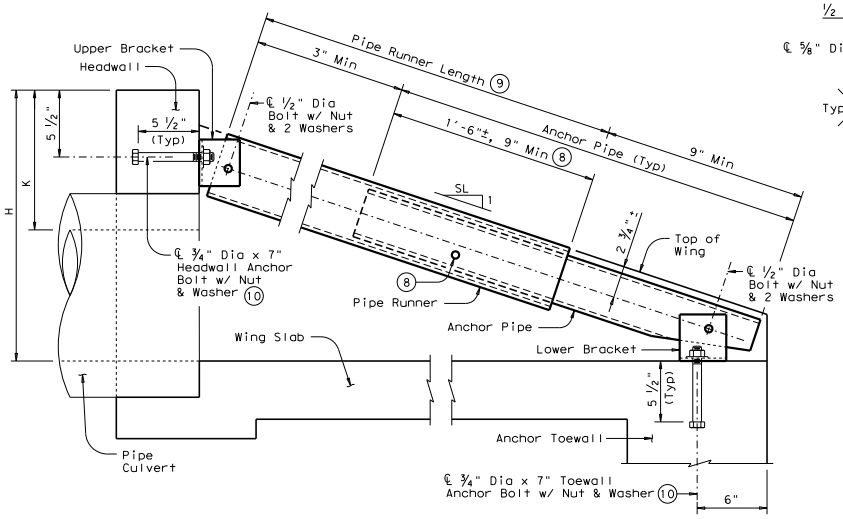
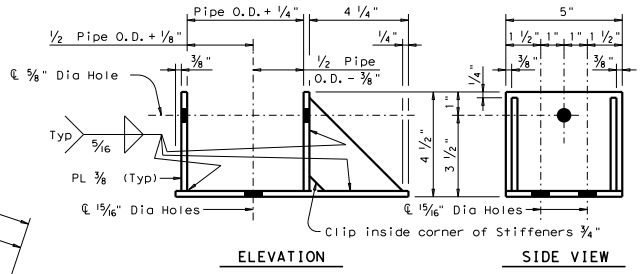
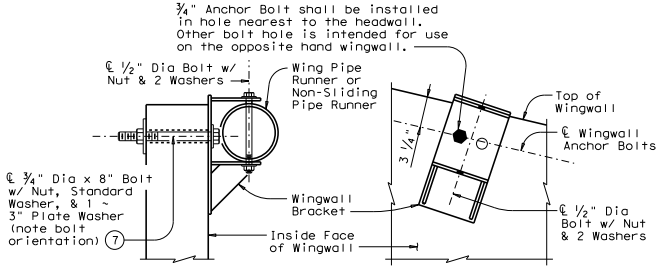


SECTION B-B

(Showing Headwall Pipe Runner. Except for upper bracket, Wingwall Pipe Runners are similar.)



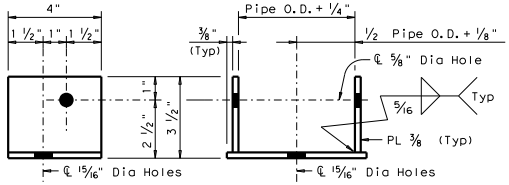
ELEVATION SIDE VIEW



SECTION C-C (Showing installed bracket.) ELEVATION (Showing installed bracket normal to Wall. Pipe not shown for clarity.)

NOTE: Wingwall Bracket shall match the Upper Bracket size.

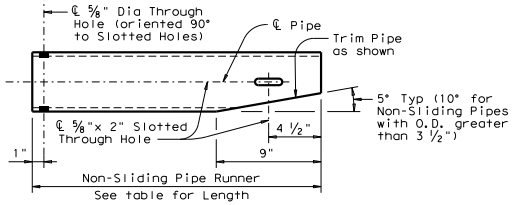
WINGWALL BRACKET DETAILS



SIDE VIEW ELEVATION

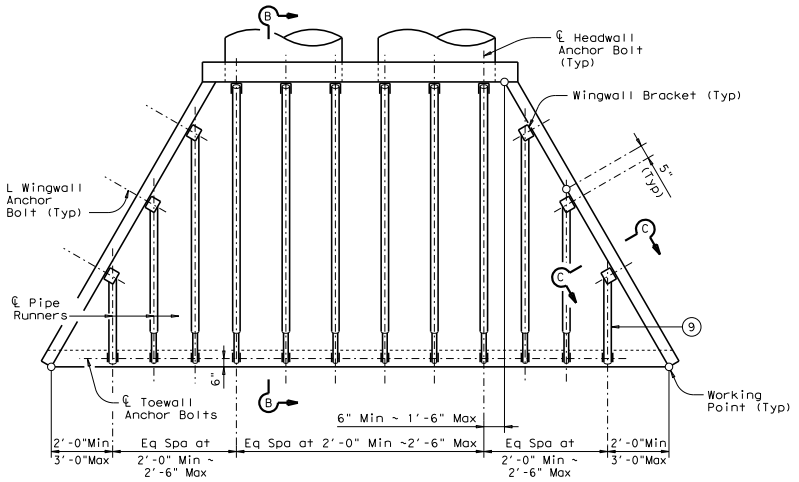
NOTE: Upper and Lower Brackets shall, except for the Brackets used with Non-Sliding Pipe Runners, match the required pipe diameters as shown in the table.

UPPER & LOWER BRACKET DETAILS



Note: Pipe size shall be same as required for headwall pipe runner. Adjust the corresponding Lower Bracket accordingly.

NON-SLIDING PIPE RUNNER DETAILS (9)



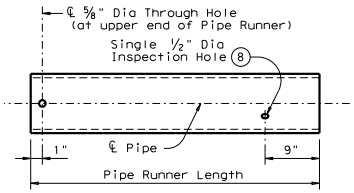
PIPE RUNNER PLAN

(7) At Contractor's option, ⅞" diameter hole may be formed or cored drilled. Percussion drilling is not permitted. Adjust placement of reinforcing steel as necessary to avoid bolt holes.

(8) After installation of the Pipe Runner, the ½" inspection hole shall be utilized to ensure that the lap of the Anchor Pipe with the Pipe Runner is adequate.

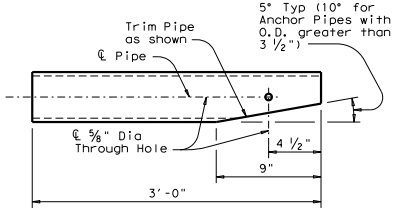
(9) Non-Sliding Pipe Runners are used for those installations that would require Pipe Runner lengths of 1'-9" or less. The Non-Sliding Pipe Runner, when required, replaces the outermost Pipe Runner and Anchor Pipe. See table on Sheet 3 of 3 to determine if the Non-Sliding Pipe Runner is required.

(10) At Contractor's option, an epoxy anchorage system may be used. Anchorage system chosen must be able to achieve an ultimate tensile resistance of 20 kips. Anchor diameter shall be ¾". The Contractor must provide evidence to the Engineer that this can be achieved. Evidence of adequate tensile resistance can be based on the manufacturer's published values of ultimate tensile strength (anchor spacing and edge distance must be accounted for). Anchor installation, including hole size, drilling, and clean-out, must be in accordance with the manufacturer's recommendations.



Note: Pipe diameter required for Headwall pipe runner shall also be used for wingwall pipe runner.

PIPE RUNNER DETAILS



ANCHOR PIPE DETAILS

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 0° SKEW ARCH PIPE CULVERTS
TYPE I ~ CROSS DRAINAGE

SETP-FW-A-0

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REVISIONS					
11-10: Removed Bars 7.		DIST	COUNTY		SHEET NO.

2/13/2018 9:30 AM

Side Slope	Arch Pipe Culvert Design	L1 (Ft-In)	P1 (Ft-In)	Number of Spaces in L3	L3 Overall Dimension (Ft-In)	P2 (Ft-In)	Number of Spaces in L4	L4 Overall Dimension (Ft-In)	Headwall Pipe Runner Length (Ft-In)	No. of Wing Pipes (12)	Longest Wingwall Pipe Runner Length (Ft-In)	Shortest Wingwall Pipe Runner Length (Ft-In)	Non-Sliding Pipe Length (Ft-In)	Pipe Runner Size (13)	Total Length of Wingwall Pipe Runners (Ft-In) (12)
3:1	4	6"	2'- 3"	1	2'- 5 1/4"	4'- 1"	0	N/A	5'-11 1/2"	2	2'- 0 1/2"	2'- 0 1/2"	N/A	3" STD	4'- 1"
	5	7"	3'- 0"	1	2'- 6"	5'- 7"	0	N/A	7'- 3 1/4"	2	3'- 5"	3'- 5"	N/A	3" STD	6'-10"
	6	1'- 0"	2'- 0"	2	4'- 5 3/4"	3'- 7"	1	4'- 5 3/4"	8'- 4"	4	5'- 8 1/4"	5'- 8 1/4"	3'- 1"	4" STD	17'- 6 1/2"
	7	1'- 3"	2'- 6"	2	4'-11 1/2"	4'- 7"	1	4'-11 1/2"	9'- 7 3/4"	4	7'- 0 1/4"	2'- 6"	N/A	4" STD	19'- 0 1/2"
	8	6"	2'- 6"	2	4'-11 1/4"	4'- 7"	1	4'-11 1/4"	10'-11 1/2"	4	7'- 0"	2'- 6"	N/A	4" STD	19'- 0"
	9	9"	2'- 0"	3	6'- 3"	3'- 7"	2	8'- 4"	12'- 0 1/4"	6	9'- 2 1/2"	5'- 4 3/4"	3'- 1"	4" STD	35'- 4 1/2"
4:1	4	6"	2'- 0"	2	4'- 1"	3'- 7"	1	4'- 1"	8'- 3 1/4"	4	5'- 1 3/4"	5'- 1 3/4"	3'- 0"	4" STD	16'- 3 1/2"
	5	7"	2'- 2"	2	4'-11 1/2"	3'-11"	1	4'-11 1/2"	10'- 0"	4	6'- 2 3/4"	1'- 9 3/4"	N/A	4" STD	16'- 1"
	6	1'- 0"	2'- 0"	3	6'- 3 3/4"	3'- 7"	2	8'- 5"	11'- 4 1/2"	6	9'- 0 1/4"	5'- 3 1/4"	3'- 0"	4" STD	34'- 7"
	7	1'- 3"	2'- 0"	3	7'- 6 1/4"	3'- 7"	2	10'- 0 1/2"	13'- 1"	6	10'- 5 1/2"	5'-11 3/4"	3'- 0"	4" STD	38'-10 1/2"
	8	6"	2'- 3"	3	7'- 5 3/4"	4'- 1"	2	9'-11 3/4"	14'- 9 3/4"	6	10'-10 1/4"	1'-11 1/2"	N/A	5" STD	38'- 5 1/4"
	9	9"	2'- 0"	4	8'- 9"	3'- 7"	3	13'- 1 3/4"	16'- 2 1/4"	8	13'- 2 3/4"	5'- 5"	3'- 0"	5" STD	61'-11 1/4"
6:1	4	6"	2'- 0"	3	6'-10 1/2"	3'- 7"	2	9'- 2"	13'- 0 1/4"	6	9'- 6"	5'- 5 3/4"	2'-11 1/2"	4" STD	35'-10 1/2"
	5	7"	3'- 0"	3	7'- 4 3/4"	5'- 7"	2	9'-10 1/4"	15'- 6 1/2"	6	11'-10 1/2"	3'- 2 1/2"	N/A	5" STD	45'- 3"
	6	1'- 0"	2'- 0"	4	9'-11 3/4"	3'- 7"	3	14'-11 1/2"	17'- 7"	8	14'- 7"	5'-10"	2'-11 1/2"	5" STD	67'- 2"
	7	1'- 3"	2'- 0"	5	11'- 8"	3'- 7"	4	18'- 8"	20'- 1 1/4"	10	17'-10"	5'- 6 1/2"	2'-11 1/2"	5" STD	99'- 5"
	8	6"	2'- 0"	5	12'- 4 1/4"	3'- 7"	4	19'- 9 1/4"	22'- 7 3/4"	10	18'- 9 3/4"	5'- 9 1/2"	2'-11 1/2"	5" STD	104'- 4"
	9	9"	2'- 0"	6	13'- 9 1/4"	3'- 7"	5	22'-11 1/4"	24'- 8"	12	21'- 7"	5'- 5 3/4"	2'-11 1/2"	5" STD	141'- 2 3/4"

(11) If the outermost Wing Pipe Runner is a Non-Sliding Pipe Runner, the next outermost Wing Pipe Runner shall be considered the Shortest.

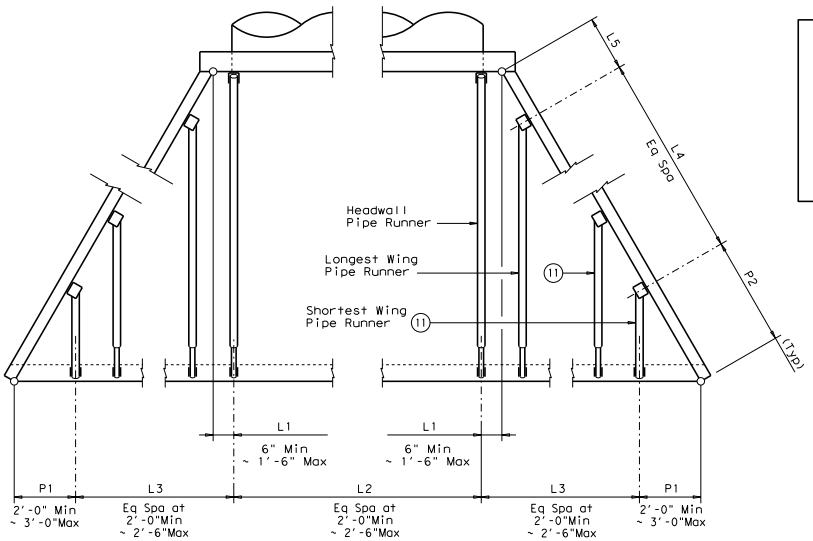
(12) Quantities shown include, if present, the Non-Sliding Pipes.

(13) Anchor Pipe size shall be the next smaller size than the Pipe Runner size.

Arch Pipe Culvert Design	Number of Pipe Culverts	No. of L2 Spaces	L2 Overall Dimension (Ft-In)	Number of Headwall Pipes
4	1	1	2'- 1"	2
	2	3	6'- 8"	4
	3	5	11'- 3"	6
	4	7	15'-10"	8
	5	9	20'- 5"	10
	6	10	25'- 0"	11
5	1	1	2'- 6"	2
	2	4	7'-11"	5
	3	6	13'- 4"	7
	4	8	18'- 9"	9
	5	10	24'- 2"	11
	6	12	29'- 7"	13
6	1	1	2'- 3"	2
	2	4	8'- 6"	5
	3	6	14'- 9"	7
	4	9	21'- 0"	10
	5	11	27'- 3"	12
	6	14	33'- 6"	15
7	1	1	2'- 5"	2
	2	4	9'- 7"	5
	3	7	16'- 9"	8
	4	10	23'-11"	11
	5	13	31'- 1"	14
	6	16	38'- 3"	17
8	1	2	4'- 6"	3
	2	6	12'- 8"	7
	3	9	20'-10"	10
	4	12	29'- 0"	13
	5	15	37'- 2"	16
	6	19	45'- 4"	20
9	1	2	4'- 7"	3
	2	6	13'- 8"	7
	3	10	22'- 9"	11
	4	13	31'-10"	14
	5	17	40'-11"	18
	6	20	50'- 0"	21

STANDARD PIPE RUNNER AND ANCHOR PIPE SIZES (13)

Pipe Size	Pipe O.D.	Pipe I.D.
2" STD	2.375"	2.067"
3" STD	3.500"	3.068"
4" STD	4.500"	4.026"
5" STD	5.563"	5.047"



PIPE RUNNER LAYOUT

TOTAL PIPE LENGTHS FORMULAS:

$$\text{Total Length of All Pipe Runners} = \text{Total Length of Wingwall Pipe Runners} + \left(\text{No. of Headwall Pipe Runners}\right)\left(\text{Headwall Pipe Runner Length}\right)$$

$$\text{Total Length of All Anchor Pipes} = \left(3.000'\right)\left(\text{No. of Wing Pipe Runners} + \text{No. of Headwall Pipe Runners} - \text{No. of Non-Sliding Pipe Runners}\right)$$

SPECIAL NOTE:

Note that the tabular quantities are given for estimating purposes only. It is likely that these quantities will change due to field conditions. Therefore, all dimensions shall be verified by the Contractor in the field prior to fabrication of the Safety End Treatment components.

DATE:
FILE:

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 0° SKEW ARCH PIPE CULVERTS
TYPE I ~ CROSS DRAINAGE

SETP-FW-A-0

FILE: stpa00se.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: GAF
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11-10: Removed Bars 7.	DIST.	COUNTY		SHEET NO.

TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL (4)

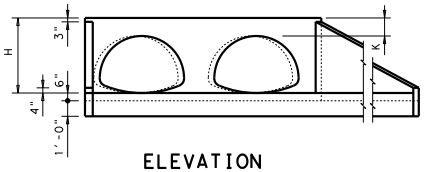
SLOPE DESIGN		SIZE OF PIPE ARCH		Values for one Pipe						Values to be added for each addt'l Pipe		
		Span	Rise	W	X	Y	L	Reinf (Lbs)	Conc (CY) (1)	X and W	Reinf (Lbs)	Conc (CY) (1)
3:1	3	28"	20"	9'- 8 ½"	4'- 8"	6'- 3"	8'-10"	207	1.8	4'-4"	72	0.8
	4	35"	24"	11'- 4 ½"	5'- 4"	7'- 3"	10'- 3"	251	2.3	5'- 3 ½"	98	1.1
	5	42"	29"	13'- 3 ½"	6'- 0"	8'- 6"	12'- 0 ¼"	309	2.9	6'- 3"	126	1.5
	6	49"	33"	14'-11 ¾"	6'- 8 ¼"	9'- 6"	13'- 5 ¼"	355	3.6	7'- 2 ½"	145	1.9
	7	57"	38"	16'-12"	7'- 5 ½"	10'- 9"	15'- 2 ½"	423	4.4	8'- 3 ¼"	178	2.4
	8	64"	43"	18'-11"	8'- 1 ½"	12'- 0"	16'-11 ¾"	492	5.4	9'- 5 ¼"	221	3.0
	9	71"	47"	20'- 7"	8'- 9 ½"	13'- 0"	18'- 4 ¾"	549	6.2	10'- 5 ¾"	255	3.6
4:1	3	28"	20"	11'- 9 ½"	4'- 8"	8'- 4"	11'- 9 ½"	266	2.4	4'- 4"	81	1.0
	4	35"	24"	13'- 9 ½"	5'- 4"	9'- 8"	13'- 8"	328	3.1	5'- 3 ½"	112	1.4
	5	42"	29"	16'- 1 ½"	6'- 0"	11'- 4"	16'- 0 ¼"	390	4.1	6'- 3"	139	1.8
	6	49"	33"	18'- 1 ¾"	6'- 8 ¼"	12'- 8"	17'-11"	469	4.9	7'- 2 ½"	170	2.3
	7	57"	38"	20'- 7"	7'- 5 ½"	14'- 4"	20'- 3 ¼"	547	6.2	8'- 3 ¼"	204	3.0
	8	64"	43"	22'-11"	8'- 1 ½"	16'- 0"	22'- 7 ½"	650	7.5	9'- 5 ¼"	256	3.7
	9	71"	47"	24'-11"	8'- 9 ½"	17'- 4"	24'- 6 ¼"	723	8.7	10'- 5 ¾"	295	4.4
6:1	3	28"	20"	15'-11 ½"	4'- 8"	12'- 6"	17'- 8 ¼"	397	3.9	4'- 4"	100	1.3
	4	35"	24"	18'- 7 ½"	5'- 4"	14'- 6"	20'- 6"	480	5.1	5'- 3 ½"	132	1.8
	5	42"	29"	21'- 9 ½"	6'- 0"	17'- 0"	24'- 0 ½"	596	6.7	6'- 3"	172	2.5
	6	49"	33"	24'- 5 ¾"	6'- 8 ¼"	19'- 0"	26'-10 ½"	717	8.2	7'- 2 ½"	212	3.2
	7	57"	38"	27'- 9"	7'- 5 ½"	21'- 6"	30'- 5"	853	10.4	8'- 3 ¼"	264	4.1
	8	64"	43"	30'-11"	8'- 1 ½"	24'- 0"	33'-11 ¼"	1009	12.6	9'- 5 ¼"	325	5.1
	9	71"	47"	33'- 7"	8'- 9 ½"	26'- 0"	36'- 9 ¼"	1139	14.7	10'- 5 ¾"	382	6.1

TABLE OF (4) REINFORCING STEEL

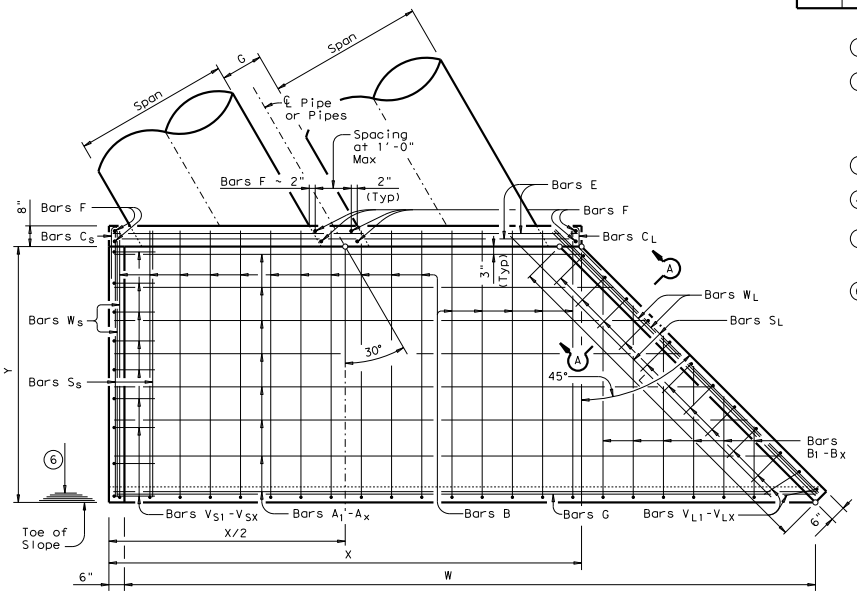
Bar	Size	Spa	No.
A	# 4	1'-0"	~
B	# 3	1'-6"	~
C	# 4	1'-0"	~
D	# 3	1'-0"	~
E	# 5	~	4
F	# 5	~	~
G	# 3	~	2
S	# 4	~	6
V	# 4	1'-0"	~
W	# 5	~	4

TABLE OF DIMENSIONS NOT VARIED WITH SLOPE

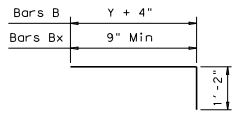
DESIGN	SIZE OF PIPE ARCH Span	Rise	G	K	H
3	28"	20"	1'- 5"	1'- 0"	2'- 8"
4	35"	24"	1'- 8"	1'- 0"	3'- 0"
5	42"	29"	1'-11"	1'- 0"	3'- 5"
6	49"	33"	2'- 2"	1'- 0"	3'- 9"
7	57"	38"	2'- 5"	1'- 0"	4'- 2"
8	64"	43"	2'-10"	1'- 0"	4'- 7"
9	71"	47"	3'- 2"	1'- 0"	4'-11"



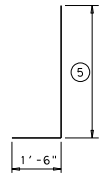
ELEVATION
Showing dimensions



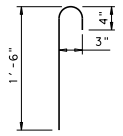
PLAN



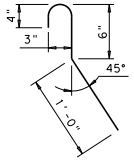
BARS B & B1-Bx



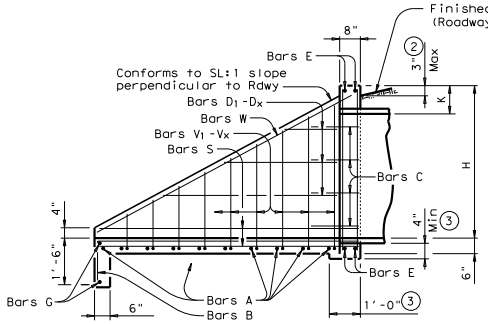
BARS Vs & VL



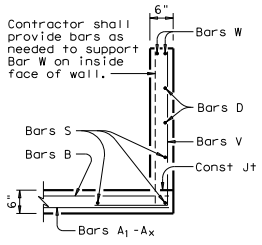
BARS CS
(2'-0" long)



BARS CL
(2'-0" long)



TYPICAL WING ELEVATION



SECTION A-A

(1) Quantities shown are for metal pipe and will decrease slightly for concrete pipe installations.

(2) For vehicle safety, curbs shall project no more than 3" above finished grade. Curb heights shall be reduced, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

(3) Provide a 1'-0" footing as shown where required to maintain 4" Min cover for pipes.

(4) Quantities shown are for one structure end only (one headwall).

(5) Min Length = $6" + 3" \times \left(\frac{12 \times H - 7}{12 \times L}\right)$

Max Length = $12 \times H - 3" \times \left(\frac{12 \times H - 7}{12 \times L}\right) - 1"$

(6) Lengths of wings based on SL:1 Slope along this line.

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

The Safety End Treatment shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the pipe runners.

The Safety Pipe Runners are designed for a traversing load of 1,800 pounds at yield as recommended by Research Report 280-1, "Safety Treatment of Roadside Cross-Drainage Structures", Texas Transportation Institute, March 1981.

Reinforcing steel shall be placed with the center of the outside layer of bars 2" from the surface of the concrete.

All reinforcing steel shall be Grade 60.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

All bolts, nuts, washers, brackets, angles and pipe runners are considered parts of the Safety End Treatment for payment.

Pipe Runners shall conform to the requirements of ASTM A53 (Type E or S, Grade B), ASTM A500 (Grade B), or API 5LX52.

Bolts and nuts shall conform to ASTM A307. Steel plates shall conform to ASTM A36. All steel components, except reinforcing, shall be galvanized. Galvanizing damaged during transport or construction shall be repaired in accordance with the specifications.

DATE:
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SHEET 1 OF 3

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 30° SKEW ARCH PIPE CULVERTS
TYPE I ~ CROSS DRAINAGE

SETP-FW-A-30

FILE:	stpa30se.dgn	DN: GAF	CK: CAT	DW: BWH	CK: GAF
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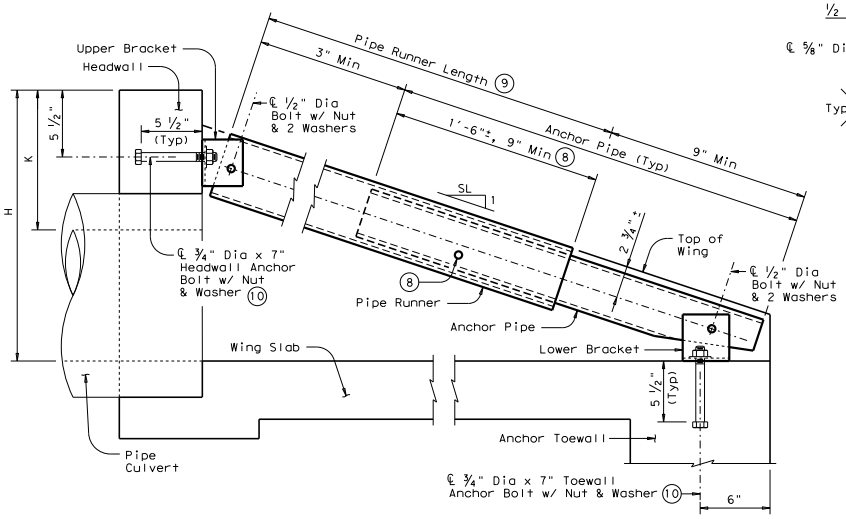
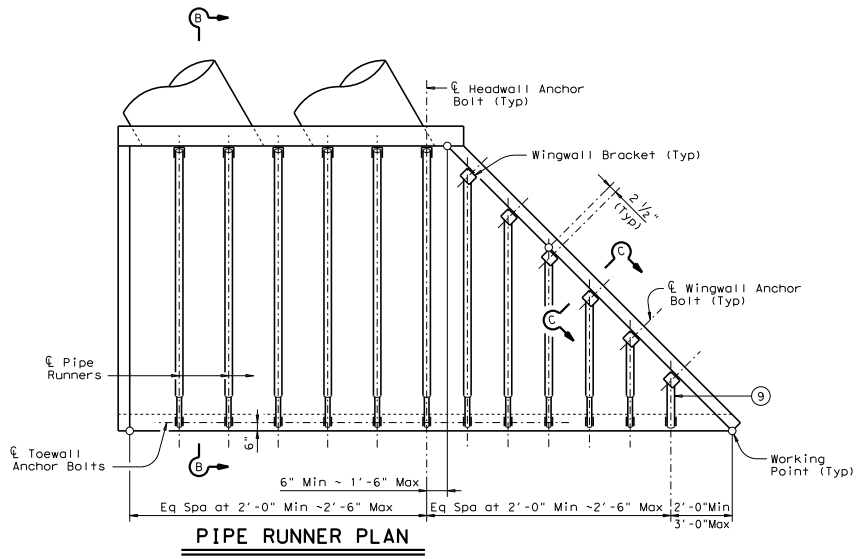
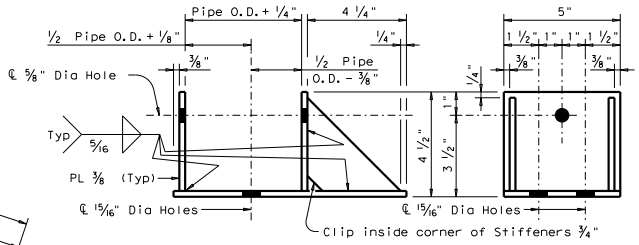


SECTION B-B

(Showing Headwall Pipe Runner. Except for upper bracket, Wingwall Pipe Runners are similar.)

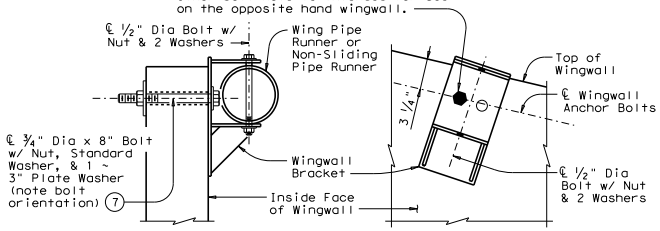


PIPE RUNNER PLAN



ELEVATION SIDE VIEW

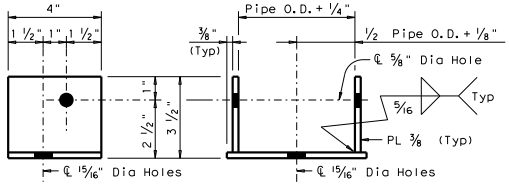
¾" Anchor Bolt shall be installed in hole nearest to the headwall. Other bolt hole is intended for use on the opposite hand wingwall.



SECTION C-C (Showing installed bracket.) ELEVATION (Showing installed bracket normal to Wall. Pipe not shown for clarity.)

NOTE: Wingwall Bracket shall match the Upper Bracket size.

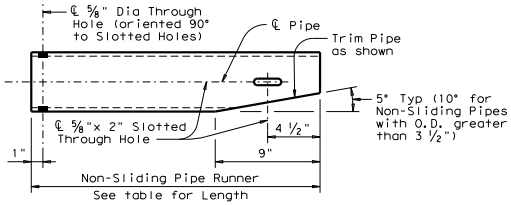
WINGWALL BRACKET DETAILS



SIDE VIEW ELEVATION

NOTE: Upper and Lower Brackets shall, except for the Brackets used with Non-Sliding Pipe Runners, match the required pipe diameters as shown in the table.

UPPER & LOWER BRACKET DETAILS



Note: Pipe size shall be same as required for headwall pipe runner. Adjust the corresponding Lower Bracket accordingly.

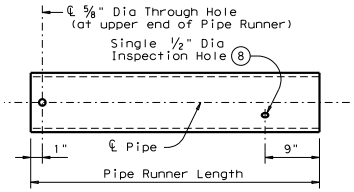
NON-SLIDING PIPE RUNNER DETAILS (9)

(7) At Contractor's option, ⅛" diameter hole may be formed or cored drilled. Percussion drilling is not permitted. Adjust placement of reinforcing steel as necessary to avoid bolt holes.

(8) After installation of the Pipe Runner, the ½" inspection hole shall be utilized to ensure that the lap of the Anchor Pipe with the Pipe Runner is adequate.

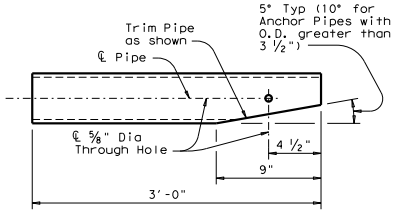
(9) Non-Sliding Pipe Runners are used for those installations that would require Pipe Runner lengths of 1'-9" or less. The Non-Sliding Pipe Runner, when required, replaces the outermost Pipe Runner and Anchor Pipe. See table on Sheet 3 of 3 to determine if the Non-Sliding Pipe Runner is required.

(10) At Contractor's option, an epoxy anchorage system may be used. Anchorage system chosen must be able to achieve an ultimate tensile resistance of 20 kips. Anchor diameter shall be ¾". The Contractor must provide evidence to the Engineer that this can be achieved. Evidence of adequate tensile resistance can be based on the manufacturer's published values of ultimate tensile strength (anchor spacing and edge distance must be accounted for). Anchor installation, including hole size, drilling, and clean-out, must be in accordance with the manufacturer's recommendations.



Note: Pipe diameter required for Headwall pipe runner shall also be used for wingwall pipe runner.

PIPE RUNNER DETAILS



ANCHOR PIPE DETAILS

SHEET 2 OF 3

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 30° SKEW ARCH PIPE CULVERTS
TYPE I ~ CROSS DRAINAGE

SETP-FW-A-30

FILE: stpa30se.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: GAF
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Arch Pipe Culvert Design	Number of Pipe Culverts	No. of L2 Spaces	L2 Overall Dimension (Ft-In)	Number of Headwall Pipes
3	1	1	2'- 5 1/2"	1
	2	3	6'- 9 1/2"	3
	3	5	11'- 1 1/2"	5
	4	7	15'- 5 1/2"	7
	5	8	19'- 9 1/2"	8
	6	10	24'- 1 1/2"	10
4	1	2	3'- 7 1/2"	2
	2	4	8'-11"	4
	3	6	14'- 2 1/2"	6
	4	8	19'- 6"	8
	5	10	24'- 9 1/2"	10
	6	12	30'- 1"	12
5	1	2	4'- 3 1/2"	2
	2	5	10'- 6 1/2"	5
	3	7	16'- 9 1/2"	7
	4	10	23'- 0 1/2"	10
	5	12	29'- 3 1/2"	12
	6	15	35'- 6 1/2"	15
6	1	2	4'-10 1/4"	2
	2	5	12'- 0 3/4"	5
	3	8	19'- 3 1/4"	8
	4	11	26'- 5 3/4"	11
	5	14	33'- 8 1/4"	14
	6	17	40'-10 3/4"	17
7	1	2	5'- 0"	2
	2	6	13'- 3 1/4"	6
	3	9	21'- 6 1/2"	9
	4	12	29'- 9 3/4"	12
	5	16	38'- 1"	16
	6	19	46'- 4 1/4"	19
8	1	3	6'- 5"	3
	2	7	15'-10 1/4"	7
	3	11	25'- 3 1/2"	11
	4	14	34'- 8 3/4"	14
	5	18	44'- 2"	18
	6	22	53'- 7 1/4"	22
9	1	3	7'- 1"	3
	2	7	17'- 6 3/4"	7
	3	12	28'- 0 1/2"	12
	4	16	38'- 6 1/4"	16
	5	20	49'- 0"	20
	6	24	59'- 5 3/4"	24

Side Slope	Arch Pipe Culvert Design	L1 (Ft-In)	P1 (Ft-In)	Number of Spaces in L3	L3 Overall Dimension (Ft-In)	P2 (Ft-In)	Number of Spaces in L4	L4 Overall Dimension (Ft-In)	Headwall Pipe Runner Length (Ft-In)	No. of Wing Pipes (12)	Longest Wingwall Pipe Runner Length (Ft-In)	Shortest Wingwall Pipe Runner Length (Ft-In)	Non-Sliding Pipe Length (Ft-In)	Pipe Runner Size (13)	Total Length of Wingwall Pipe Runners (Ft-In) (12)
3:1	3	1'- 0"	2'- 3"	2	5'- 0"	2'-11 3/4"	1	3'- 6 1/2"	4'-10 3/4"	2	2'-11 1/4"	2'-11 1/4"	1'- 9 3/4"	3" STD	4'- 9"
	4	6"	2'- 9"	2	5'- 0"	3'- 8 1/4"	1	3'- 6 1/2"	5'-11 1/2"	2	3'- 5 3/4"	3'- 5 3/4"	2'- 4"	3" STD	5'- 9 3/4"
	5	6"	2'- 0"	3	7'- 0"	2'- 7 1/2"	2	6'- 7 1/4"	7'- 3 1/4"	3	4'-11 1/2"	2'- 6"	1'- 6 1/2"	3" STD	9'- 0"
	6	7 1/2"	2'- 9"	3	7'- 4 1/2"	3'- 8 1/4"	2	6'-11 1/2"	8'- 4"	3	6'- 0 1/4"	3'- 5"	2'- 4"	3" STD	11'- 9 1/4"
	7	1'- 3"	2'- 0"	4	10'- 0"	2'- 7 1/2"	3	10'- 7 1/4"	9'- 7 3/4"	4	7'-11 1/2"	2'- 8 1/4"	1'- 6 1/2"	3" STD	17'- 6 1/4"
	8	6"	2'- 6"	4	10'- 0"	3'- 4"	3	10'- 7 1/4"	10'-11 1/2"	4	8'- 5 3/4"	3'- 2 1/2"	2'- 0 3/4"	4" STD	19'- 7 1/4"
	9	6"	2'- 0"	5	11'- 6"	2'- 7 1/2"	4	13'- 0"	12'- 0 1/4"	5	9'- 9"	2'- 5 3/4"	1'- 6 1/2"	4" STD	26'- 0"
4:1	3	1'- 0"	2'- 0"	3	7'- 4"	2'- 7 1/2"	2	6'-11"	6'-10 3/4"	3	5'- 0 1/2"	2'- 6 1/4"	1'- 6"	3" STD	9'- 0 3/4"
	4	6"	2'- 9"	3	7'- 5"	3'- 8 1/4"	2	7'- 0"	8'- 3 1/4"	3	5'-10 1/2"	3'- 3 3/4"	2'- 3 1/4"	3" STD	11'- 5 1/2"
	5	6"	2'- 0"	4	9'-10"	2'- 7 1/2"	3	10'- 5 1/4"	10'- 0"	4	7'- 7 1/4"	2'- 6 1/2"	1'- 6"	4" STD	16'- 8 3/4"
	6	7 1/2"	2'- 0"	5	11'- 3 1/2"	2'- 7 1/2"	4	12'- 9 1/4"	11'- 4 1/2"	5	9'- 3 3/4"	2'- 4"	1'- 6"	4" STD	24'- 9 1/2"
	7	1'- 3"	2'- 0"	6	13'- 7"	2'- 7 1/2"	5	16'- 0"	13'- 1"	6	11'- 8"	2'- 4"	1'- 6"	4" STD	36'- 6"
	8	6"	2'- 0"	6	14'- 6"	2'- 7 1/2"	5	17'- 1"	14'- 9 3/4"	6	12'- 5 1/2"	2'- 6"	1'- 6"	4" STD	38'-10 3/4"
	9	6"	3'- 0"	6	14'-10"	4'- 0 1/2"	5	17'- 5 3/4"	16'- 2 1/4"	6	13'- 9 1/4"	3'- 7"	2'- 6 1/4"	4" STD	45'-11"
6:1	3	1'- 0"	2'- 0"	5	11'- 6"	2'- 7 1/2"	4	13'- 0"	10'-11 3/4"	5	9'- 3 1/2"	2'- 3 1/2"	1'- 5 1/2"	4" STD	24'- 7 1/2"
	4	6"	3'- 0"	5	12'- 0"	4'- 0 1/2"	4	13'- 7"	13'- 0 1/4"	5	10'- 8 1/2"	3'- 5"	2'- 5 3/4"	4" STD	30'- 8 3/4"
	5	6"	2'- 6"	6	15'- 0"	3'- 4"	5	17'- 8"	15'- 6 1/2"	6	13'- 1 3/4"	3'- 0"	1'-11 3/4"	4" STD	42'- 4 1/4"
	6	7 1/2"	2'- 3"	7	17'- 4 1/2"	2'-11 3/4"	6	21'- 0 3/4"	17'- 7"	7	15'- 3 3/4"	2'- 8 3/4"	1'- 8 1/2"	4" STD	55'-10"
	7	1'- 3"	2'- 9"	8	20'- 0"	3'- 8 1/4"	7	24'- 9"	20'- 1 1/4"	8	18'- 5 3/4"	3'- 3 1/4"	2'- 2 3/4"	4" STD	78'- 4 1/4"
	8	6"	2'- 0"	9	22'- 6"	2'- 7 1/2"	8	28'- 3 1/4"	22'- 7 3/4"	9	20'- 3"	2'- 6"	1'- 5 1/2"	5" STD	92'- 5 1/2"
	9	6"	2'- 0"	10	24'- 6"	2'- 7 1/2"	9	31'- 2 1/4"	24'- 8"	10	22'- 4"	2'- 5 1/2"	1'- 5 1/2"	5" STD	113'- 0 1/4"

(11) If the outermost Wing Pipe Runner is a Non-Sliding Pipe Runner, the next outermost Wing Pipe Runner shall be considered the Shortest.

(12) Quantities shown include, if present, the Non-Sliding Pipes.

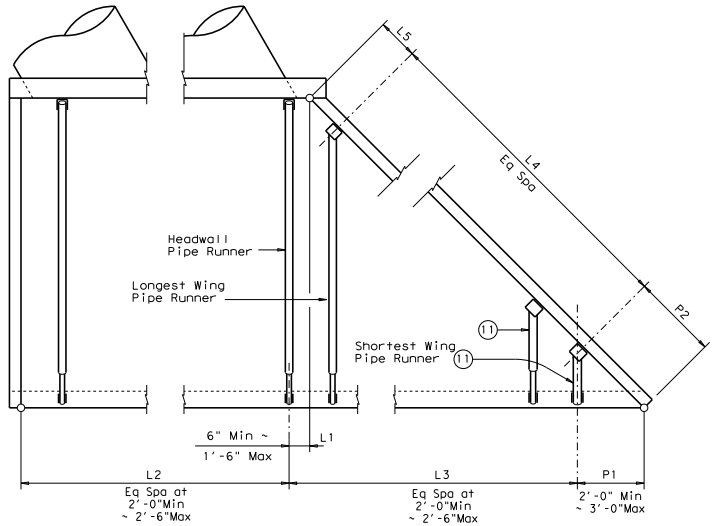
(13) Anchor Pipe size shall be the next smaller size than the Pipe Runner size.

SPECIAL NOTE:

Note that the tabular quantities are given for estimating purposes only. It is likely that these quantities will change due to field conditions. Therefore, all dimensions shall be verified by the Contractor in the field prior to fabrication of the Safety End Treatment components.

STANDARD PIPE RUNNER AND ANCHOR PIPE SIZES (13)

Pipe Size	Pipe O.D.	Pipe I.D.
2" STD	2.375"	2.067"
3" STD	3.500"	3.068"
4" STD	4.500"	4.026"
5" STD	5.563"	5.047"



PIPE RUNNER LAYOUT

Note: Left forward culvert skew shown, actual culvert skew may be opposite hand.

TOTAL PIPE LENGTHS FORMULAS:

$$\text{Total Length of All Pipe Runners} = \text{Total Length of Wingwall Pipe Runners} + \left(\text{No. of Headwall Pipe Runners}\right)\left(\text{Headwall Pipe Runner Length}\right)$$

$$\text{Total Length of All Anchor Pipes} = \left(3.000'\right)\left(\text{No. of Wing Pipe Runners} + \text{No. of Headwall Pipe Runners} - \text{No. of Non-Sliding Pipe Runners}\right)$$

DATE:
FILE:

SHEET 3 OF 3

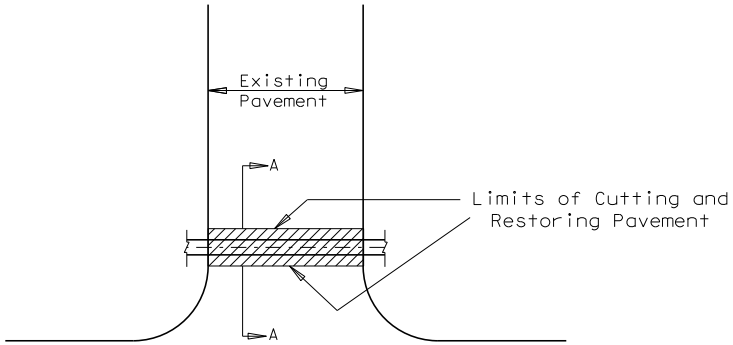
Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

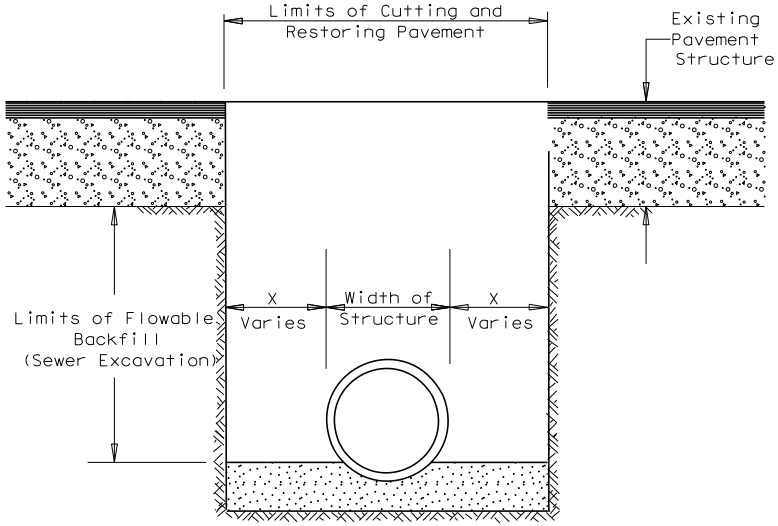
FOR 30° SKEW ARCH PIPE CULVERTS
TYPE I ~ CROSS DRAINAGE

SETP-FW-A-30

FILE: stpa30se.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: GAF
©TxDOT February 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS				
11-10: Removed Bars T.	DIST	COUNTY		SHEET NO.



PLAN VIEW
N.T.S.



SECTION A-A
N.T.S.

TABLE OF STANDARD EXCAVATION WIDTHS FOR RC PIPE			
PIPE		X	WIDTH OF CUTTING AND RESTORING PAVEMENT
ID	OD		
18"	22 ½"	1'	3.88'
24"	29 ½"	1'	4.46'
30"	37"	1'	5.08'
36"	44"	1'	5.67'
42"	51"	1'	6.25'
48"	58"	2'	8.83'
54"	65"	2'	9.42'
60"	72"	2'	10.00'
66"	79"	2'	10.58'
72"	86"	2'	11.17'
78"	93"	2'	11.75'
84"	100"	2'	12.33'
96"	114"	2'	13.50'

Provide width of Cutting and Restoring Pavement for installation of storm drain structures as the overall width of the structure plus:

- 2 feet for structures with and inside dimension of 42" or less, or,
- 4 feet for structures with and inside dimension greater than 42".

GENERAL NOTES:

Consider any work performed to repair damage to the existing pavement outside the limits shown subsidiary to the pertinent Items.

Replacement material will be an Asphalt Stabilized paving material, Flowable Backfill or Class A Concrete as required by existing conditions or an equivalent material as directed. Ensure that the thickness of the replacement material(s) is equivalent to the thickness of the existing pavement structure.

Payment for Cutting and Restoring Pavement as shown shall be made at the unit price bid for "Cutting and Restoring Pavement."

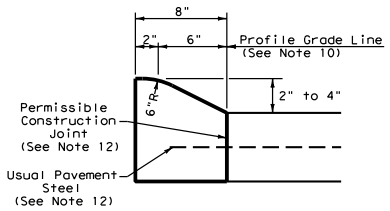
Texas Department of Transportation
Austin District Design

CUTTING AND RESTORING PAVEMENT DETAILS

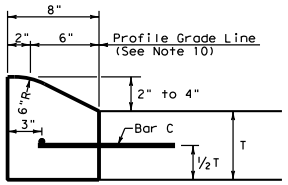
Austin District Standard

REVISIONS	DIST	FED REG	FEDERAL AID PROJECT •	SHEET
3/03 District Update	AUS	6		
9/04 2004 Update	COUNTY		CONTROL SECT JOB	HIGHWAY

FILE: CRPVMT-04.dgn



TYPE I CURB (MONOLITHIC)
2" - 4" HEIGHT



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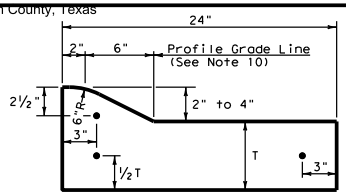
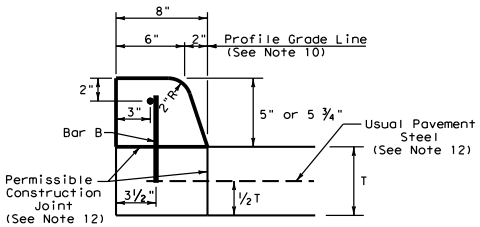
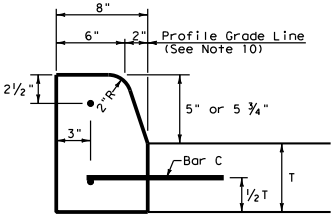
2" - 4" HEIGHT



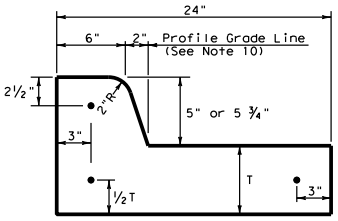
TYPE I CURB AND GUTTER
2" - 4" HEIGHT



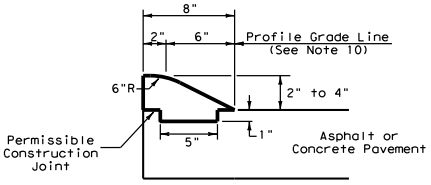
TYPE II CURB (MONOLITHIC)
5" - 5 ¾" HEIGHT



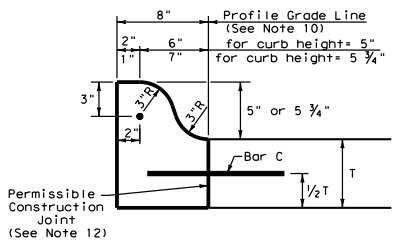
TYPE II CURB
5" - 5 ¾" HEIGHT



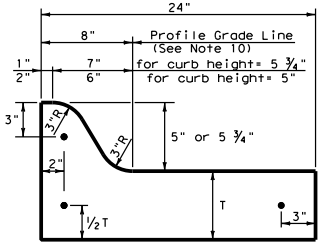
TYPE II CURB AND GUTTER
5" - 5 ¾" HEIGHT



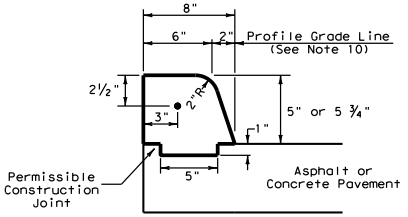
TYPE III CURB (KEYED)
2" - 4" HEIGHT



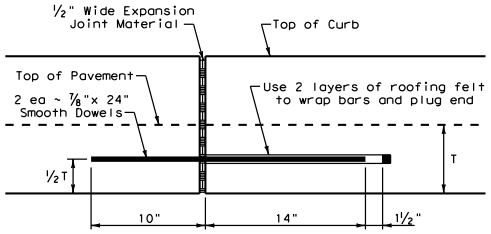
TYPE IIa CURB
5" - 5 ¾" HEIGHT



TYPE IIa CURB AND GUTTER
5" - 5 ¾" HEIGHT

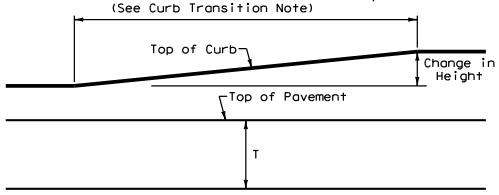


TYPE IV CURB (KEYED)
5" - 5 ¾" HEIGHT



EXPANSION JOINT DETAIL

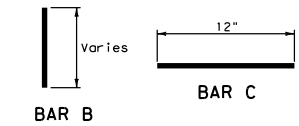
Curb Transition Note:
Field conditions may require a longer or shorter transition, and shall be shown elsewhere in the plans, or as directed by the Engineer.



CURB TRANSITION
Note: To be paid for as Highest Curb

General Notes

1. All materials and construction shall be in accordance with Item 529, "Concrete Curb, Gutter, and Combined Curb and Gutter."
2. Concrete shall be Class A.
3. When reinforcing bars are used, they shall be No.4 unless otherwise shown. The use of synthetic fiber in lieu of steel reinforcing is acceptable, provided the fiber producer is on the Department Producer List (MPL), maintained by TxDOT, Construction Division.
4. Round exposed sharp edges with a rounding tool, to a minimum radius of ¼inch.
5. All existing curbs and driveways to be removed shall be sawed or removed at existing joints.
6. Where concrete curb is placed on existing concrete pavement, the pavement shall be drilled and the reinforcing bars grouted in place.
7. Expansion and contraction joints shall be constructed to match pavement joints in all curbs and curb and gutter adjacent to jointed concrete pavement. Where placement of curb or curb and gutter is not adjacent to concrete pavement, expansion joints shall be provided at structures, curb returns at streets, and at locations directed by The Engineer.
8. Vertical and horizontal dowel bars and transverse reinforcing bars shall be placed at four feet C~C.
9. Dimension 'T' shown is the thickness of concrete pavement. When curb is installed adjacent to flexible pavement dimension 'T' is 8" maximum.
10. Usual profile grade line. Refer to typical sections and plan-profile sheets for exact locations.
11. One-half inch expansion joint material shall be provided where curb or curb and gutter is adjacent to sidewalk or riprap.
12. When vertical permissible construction joints are used, resulting in a longitudinal construction joint in the pavement, the longitudinal pavement steel shall be placed in accordance with pavement details shown elsewhere in the plans for longitudinal construction joints. Reinforcing steel for curb section shall then conform to that required for concrete curb.



BAR B BAR C

Texas Department of Transportation — Design Division Standard

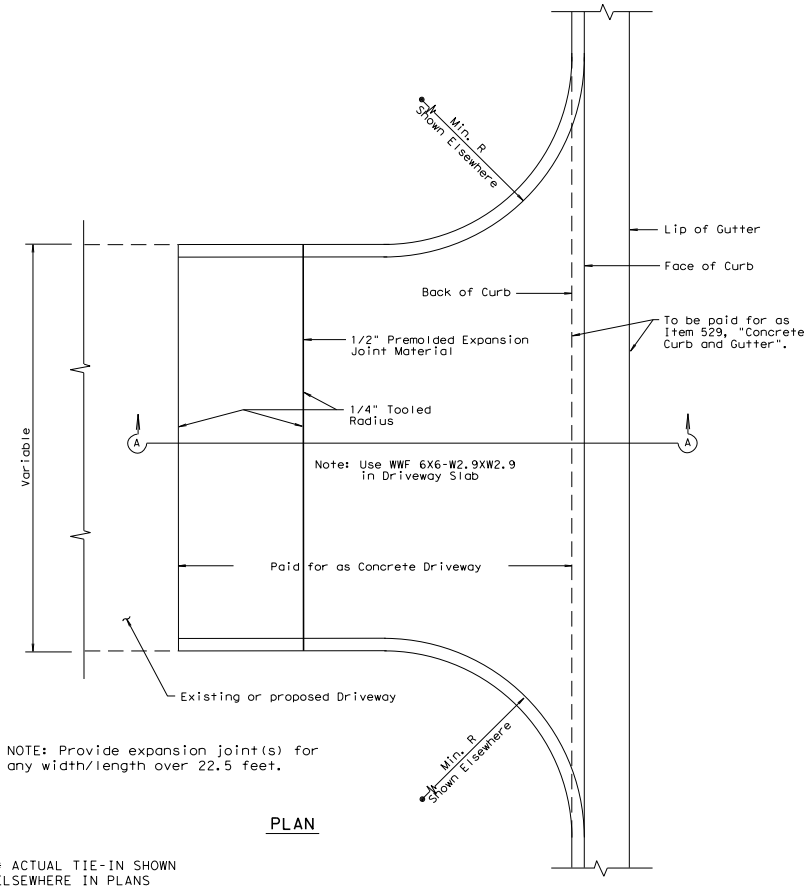
CONCRETE CURB AND CURB AND GUTTER

CCCG-12

FILE: cccg12.dgn	DN: TxDOT	CK: AM	DW: VP	CK: VP	
© TxDOT: 1995	CONT	SECT	JOB	HIGHWAY	
REVISIONS UPDATED 2012 - VP					
	DIST	COUNTY		SHEET NO.	

DATE:
FILE:

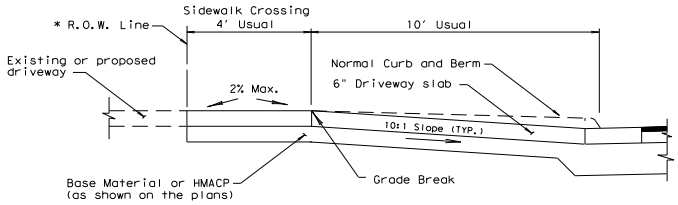
2/13/2015 9:30 AM



NOTE: Provide expansion joint(s) for any width/length over 22.5 feet.

PLAN

* ACTUAL TIE-IN SHOWN ELSEWHERE IN PLANS OR AS DIRECTED.



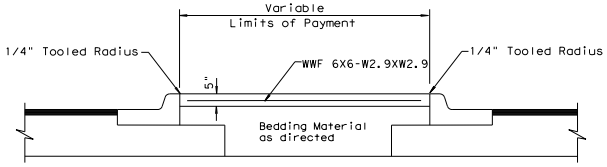
SECTION A-A

CONCRETE DRIVEWAY DETAILS

Payment for Driveways will be in accordance with Item 530, "Driveways".

Ensure grade break does not exceed 8% unless otherwise directed.

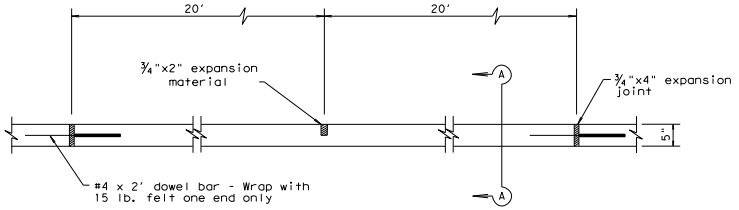
Provide absolute minimum sidewalk crossing width of 3' for driveway width of 20' or less.



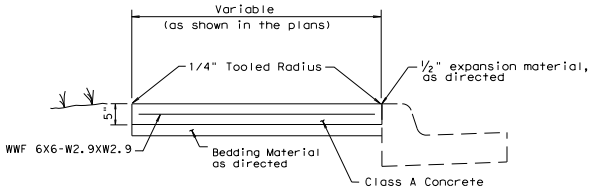
RIPRAP MEDIAN DETAIL

Use Class B Concrete for Riprap.

Payment of Riprap Median will be in accordance with Item 432, "Riprap".



ELEVATION



SECTION A-A

SIDEWALK DETAILS

Place a 3/4" expansion joint at 40' (max.) intervals and at sidewalk ends.

Expansion joints will be continuous with adjacent curb and gutter joints.

Place a 1/4" tooled radius at all joints.

Ensure the cross slope of the sidewalk does not exceed 2%.

Payment for sidewalk will be in accordance with Item 531, "Sidewalks".

See Statewide PED standard for additional pedestrian element criteria.

Texas Department of Transportation
Austin District Design

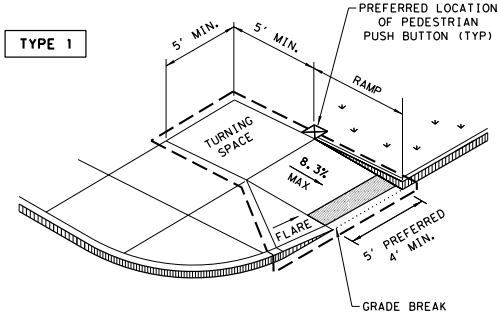
CONCRETE DRIVEWAYS, SIDEWALKS AND RIPRAP MEDIANS

AUSTIN DISTRICT STANDARD

© TxDOT 2002	DIST	FED REG	FEDERAL AID PROJECT •	SHEET
REVISIONS 4/03 District Update 9/04 2004 Update	AUS	6		
	COUNTY	CONTROL	JOB	HIGHWAY
				p.73

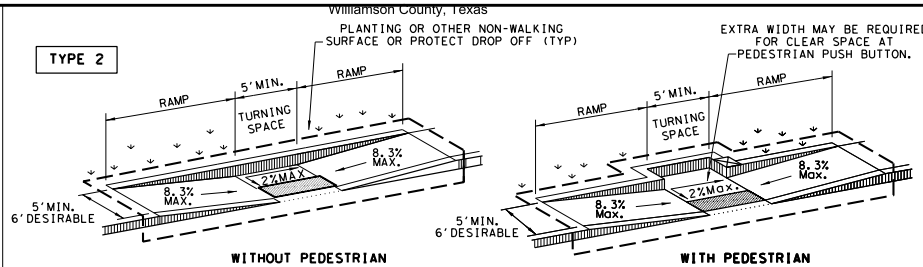
FILE: CDSR-04.dgn

TYPE 1



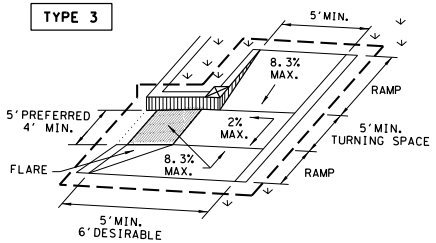
PERPENDICULAR CURB RAMP

TYPE 2

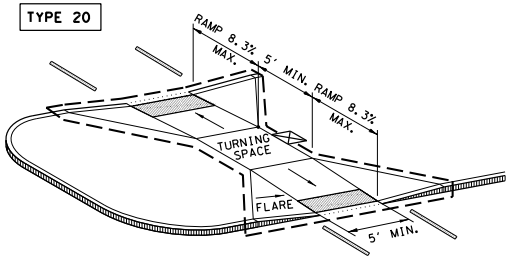


PARALLEL CURB RAMP

TYPE 3

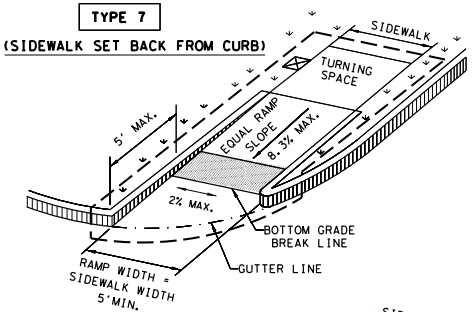


TYPE 20

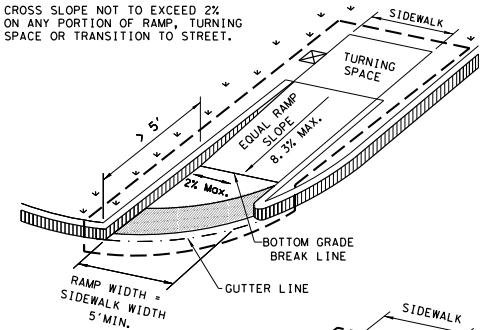


CURB RAMPS AT MEDIAN ISLANDS

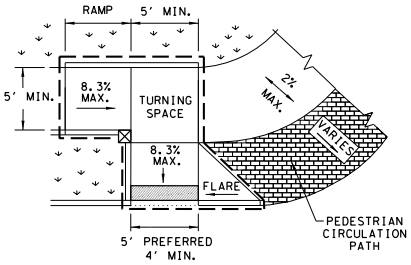
TYPE 7
(SIDEWALK SET BACK FROM CURB)



CROSS SLOPE NOT TO EXCEED 2% ON ANY PORTION OF RAMP, TURNING SPACE OR TRANSITION TO STREET.

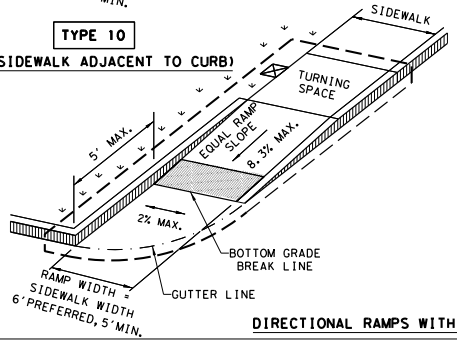


TYPE 6

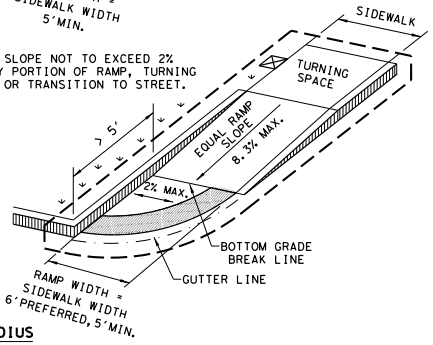


COMBINATION CURB RAMPS

TYPE 10
(SIDEWALK ADJACENT TO CURB)

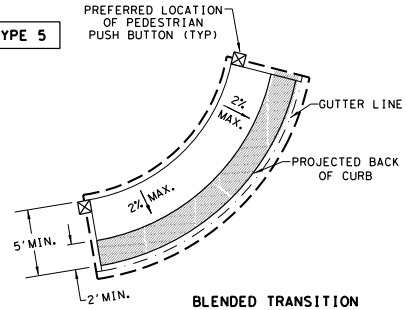


CROSS SLOPE NOT TO EXCEED 2% ON ANY PORTION OF RAMP, TURNING SPACE OR TRANSITION TO STREET.



DIRECTIONAL RAMPS WITHIN RADIUS

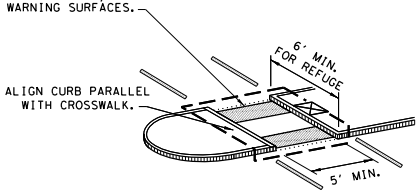
TYPE 5



BLENDED TRANSITION
(FLUSH LANDING)

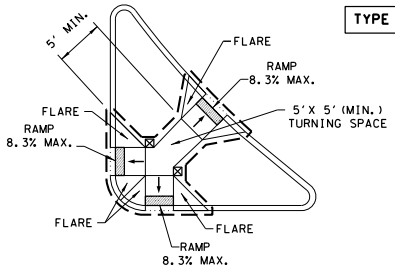
TYPE 21

INSTALL DETECTABLE WARNING SURFACE AT EACH END OF THE CUT-THROUGH RAMP WITH A MINIMUM 2' USUAL SIDEWALK SURFACE BETWEEN. IF MEDIAN IS LESS THAN 6' WIDE, ELIMINATE DETECTABLE WARNING SURFACES.

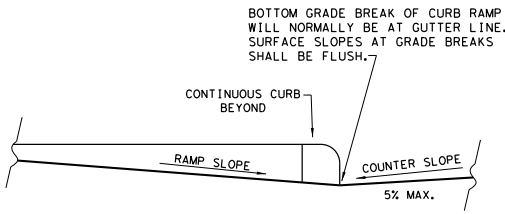


NOTE: CURB DETAILS ARE SHOWN ELSEWHERE IN THE PLANS.

TYPE 22



COMBINATION ISLAND RAMPS



TYPICAL SECTION OF PERPENDICULAR CURB RAMP AT CONNECTION TO ROADWAY

NOTES / LEGEND:

SEE GENERAL NOTES ON SHEET 2 OF 4 FOR MORE INFORMATION.

DENOTES PLANTING OR NON-WALKING SURFACE NOT PART OF PEDESTRIAN CIRCULATION PATH.

DETECTABLE WARNING SURFACE

DENOTES PREFERRED LOCATION OF PEDESTRIAN PUSH BUTTON IF APPLICABLE.

GUTTER LINE

GRADE BREAK

RAMP LIMITS OF PAYMENT

Texas Department of Transportation

Design Division Standard

PEDESTRIAN FACILITIES CURB RAMPS

PED-18

FILE: ped18	DN: TxDOT	CK: VP	CK: KM	CK: PK & JG
© TxDOT: MARCH, 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS				
REVISED 08,2005	DIST	COUNTY		SHEET NO.
REVISED 06,2012				
REVISED 01,2018				

DATE:
FILE:

GENERAL NOTES

CURB RAMPS

1. Install a curb ramp or blended transition at each pedestrian street crossing.
2. All slopes shown are maximum allowable. Cross slopes of 1.5% and lesser running should be used. Adjust curb ramp length or grade of approach sidewalks as directed.
3. Maximum allowable cross slope on sidewalk and curb ramp surfaces is 2%.
4. The minimum sidewalk width is 5'. Where the sidewalk is adjacent to the back of curb, a 6' sidewalk width is desirable. Where a 5' sidewalk cannot be provided due to site constraints, sidewalk width may be reduced to 4' for short distances. 5'x 5' passing areas at intervals not to exceed 200' are required.
5. Turning Spaces shall be 5'x 5' minimum. Cross slope shall be maximum 2%.
6. Clear space at the bottom of curb ramps shall be a minimum of 4'x 4' wholly contained within the crosswalk and wholly outside the parallel vehicular travel path.
7. Provide flared sides where the pedestrian circulation path crosses the curb ramp. Flared sides shall be sloped at 10% maximum, measured parallel to the curb. Returned curbs may be used only where pedestrians would not normally walk across the ramp, either because the adjacent surface is planted, substantially obstructed, or otherwise protected.
8. Additional information on curb ramp location, design, light reflective value and texture may be found in the latest draft of the Proposed Guidelines for Pedestrian Facilities in the Public Right of Way (PROWAG) as published by the U.S. Architectural and Transportation Barriers Compliance Board (Access Board).
9. To serve as a pedestrian refuge area, the median should be a minimum of 6' wide, measured from back of curbs. Medians should be designed to provide accessible passage over or through them.
10. Small channelization islands, which do not provide a minimum 5'x 5' landing at the top of curb ramps, shall be cut through level with the surface of the street.
11. Crosswalk dimensions, crosswalk markings and stop bar locations shall be as shown elsewhere in the plans. At intersections where crosswalk markings are not required, curb ramps shall align with theoretical crosswalks unless otherwise directed.
12. Provide curb ramps to connect the pedestrian access route at each pedestrian street crossing. Handrails are not required on curb ramps.
13. Curb ramps and landings shall be constructed and paid for in accordance with Item 531 "Sidewalks".
14. Place concrete at a minimum depth of 5" for ramps, flares and landings, unless otherwise directed.
15. Furnish and install No. 3 reinforcing steel bars at 18" o.c. both ways, unless otherwise directed.
16. Provide a smooth transition where the curb ramps connect to the street.
17. Curbs shown on sheet 1 within the limits of payment are considered part of the curb ramp for payment, whether it is concrete curb, gutter, or combined curb and gutter.
18. Existing features that comply with applicable standards may remain in place unless otherwise shown on the plans.

DETECTABLE WARNING MATERIAL

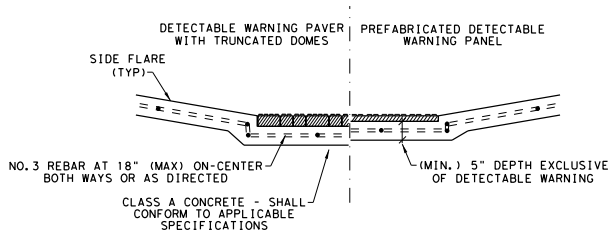
19. Curb ramps must contain a detectable warning surface that consists of raised truncated domes complying with PROWAG. The surface must contrast visually with adjoining surfaces, including side flares. Furnish and install an approved cast-in-place dark brown or dark red detectable warning surface material adjacent to uncolored concrete, unless specified elsewhere in the plans.
20. Detectable Warning Materials must meet TxDOT Departmental Materials Specification DMS 4350 and be listed on the Material Producer List. Install products in accordance with manufacturer's specifications.
21. Detectable warning surfaces must be firm, stable and slip resistant.
22. Detectable warning surfaces shall be a minimum of 24 inches in depth in the direction of pedestrian travel, and extend the full width of the curb ramp or landing where the pedestrian access route enters the street.
23. Detectable warning surfaces shall be located so that the edge nearest the curb line is at the back of curb and neither end of that edge is greater than 5 feet from the back of curb. Detectable warning surfaces may be curved along the corner radius.
24. Shaded areas on Sheet 1 of 4 indicate the approximate location for the detectable warning surface for each curb ramp type.

DETECTABLE WARNING PAVERS (IF USED)

25. Furnish detectable warning paver units meeting all requirements of ASTM C-936, C-33. Lay in a two by two unit basket weave pattern or as directed.
26. Lay full-size units first followed by closure units consisting of at least 25 percent (25%) of a full unit. Cut detectable warning paver units using a power saw.

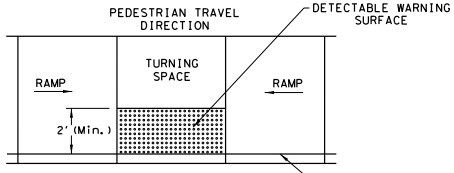
SIDEWALKS

27. Provide clear ground space at operable parts, including pedestrian push buttons. Operable parts shall be placed within unobstructed reach range specified in PROWAG section R406.
28. Place traffic signal or illumination poles, ground boxes, controller boxes, signs, drainage facilities and other items so as not to obstruct the pedestrian access route or clear ground space.
29. Street grades and cross slopes shall be as shown elsewhere in the plans.
30. Changes in level greater than 1/4 inch are not permitted.
31. The least possible grade should be used to maximize accessibility. The running slope of sidewalks and crosswalks within the public right of way may follow the grade of the parallel roadway. Where a continuous grade greater than five percent (5%) must be provided, handrails may be desirable to improve accessibility. Handrails may also be needed to protect pedestrians from potentially hazardous conditions. If provided, handrails shall comply with PROWAG R409.
32. Handrail extensions shall not protrude into the usable landing area or into intersecting pedestrian routes.
33. Driveways and turnouts shall be constructed and paid for in accordance with Item "Intersections, Driveways and Turnouts". Sidewalks shall be constructed and paid for in accordance with Item, "Sidewalks".
34. Sidewalk details are shown elsewhere in the plans.

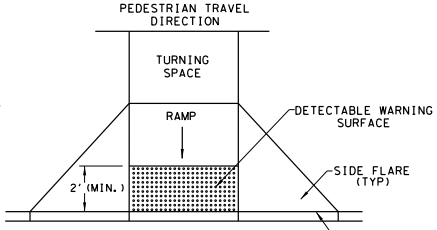


SECTION VIEW DETAIL
CURB RAMP AT DETECTIBLE WARNINGS

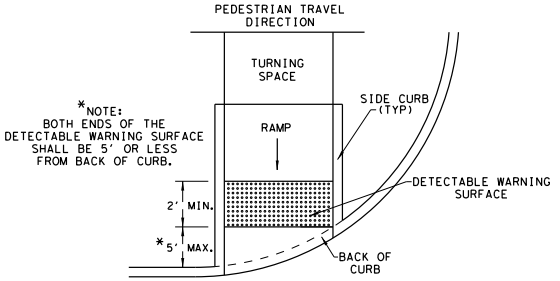
DETECTABLE WARNING SURFACE DETAILS



PARALLEL CURB RAMP
TYPICAL PLACEMENT OF DETECTABLE WARNING SURFACE ON LANDING AT STREET EDGE.



PERPENDICULAR CURB RAMP
TYPICAL PLACEMENT OF DETECTABLE WARNING SURFACE ON SLOPING RAMP RUN.



DIRECTIONAL CURB RAMP
TYPICAL PLACEMENT OF DETECTABLE WARNING SURFACE ON SLOPING RAMP RUN.

SHEET 2 OF 4

Texas Department of Transportation — Design Division Standard

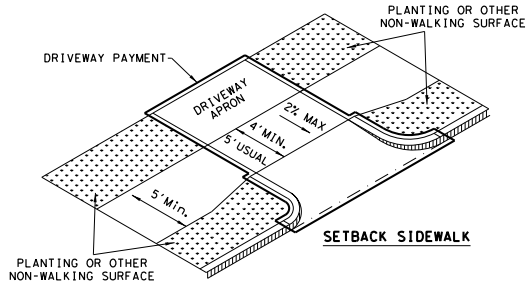
PEDESTRIAN FACILITIES CURB RAMPS

PED-18

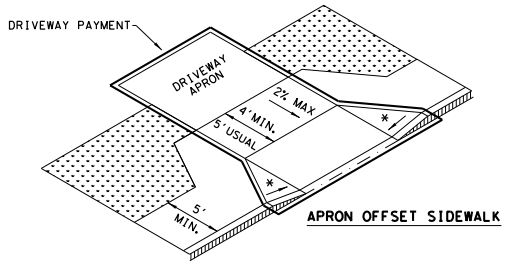
FILE: ped18	DN: TxDOT	CK: VP	CK: KM	CK: PK & JG
© TxDOT: MARCH, 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS				
REVISED 08,2005	DIST	COUNTY		SHEET NO.
REVISED 06,2012				
REVISED 01,2018				

DATE:
FILE:

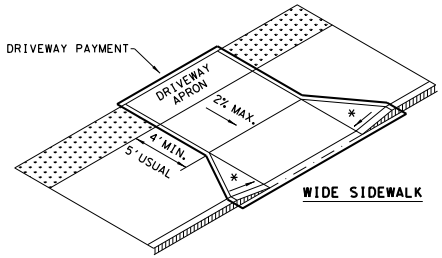
SIDEWALK TREATMENT AT DRIVEWAYS



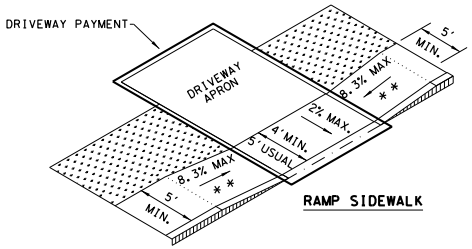
SETBACK SIDEWALK



APRON OFFSET SIDEWALK



WIDE SIDEWALK

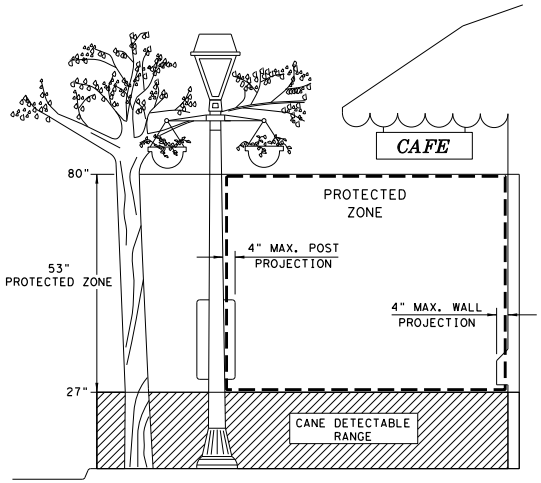


RAMP SIDEWALK

NOTES:

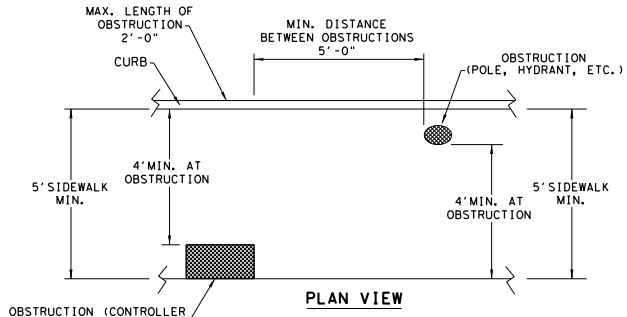
* WHERE DRIVEWAYS CROSS THE PEDESTRIAN ROUTE, SIDES SHALL BE FLARED AT 10% MAX SLOPE.

** IF CURB HEIGHT IS GREATER THAN 6 INCHES, USE GRADE LESS THAN OR EQUAL TO 5%. HANDRAIL AND DETECTABLE WARNING ARE NOT REQUIRED.



PROTECTED ZONE

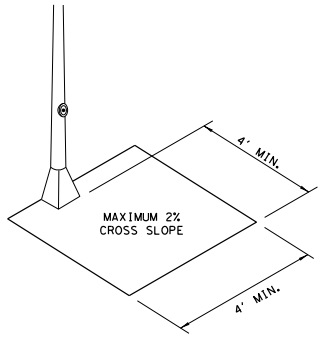
NOTE: IN PEDESTRIAN CIRCULATION AREA, MAXIMUM 4" PROJECTION FOR POST OR WALL MOUNTED OBJECTS BETWEEN 27" AND 80" ABOVE THE SURFACE.



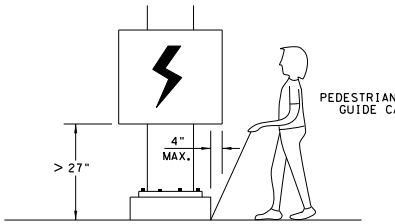
PLAN VIEW

PLACEMENT OF STREET FIXTURES

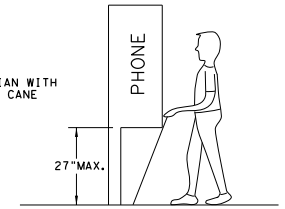
NOTE: ITEMS NOT INTENDED FOR PUBLIC USE. MINIMUM 4' X 4' CLEAR GROUND SPACE REQUIRED AT PUBLIC USE FIXTURES.



CLEAR SPACE ADJACENT TO PEDESTRIAN PUSH BUTTON



WHEN AN OBSTRUCTION OF A HEIGHT GREATER THAN 27" FROM THE SURFACE WOULD CREATE A PROTRUSION OF MORE THAN 4" INTO THE PEDESTRIAN CIRCULATION AREA, CONSTRUCT ADDITIONAL CURB OR FOUNDATION AT THE BOTTOM TO PROVIDE A MAXIMUM 4" OVERHANG.



PROTRUDING OBJECTS OF A HEIGHT ≤27" ARE DETECTABLE BY CANE AND DO NOT REQUIRE ADDITIONAL TREATMENT.

DETECTION BARRIER FOR VERTICAL CLEARANCE < 80"

SHEET 3 OF 4

Texas Department of Transportation — Design Division Standard

PEDESTRIAN FACILITIES CURB RAMPS

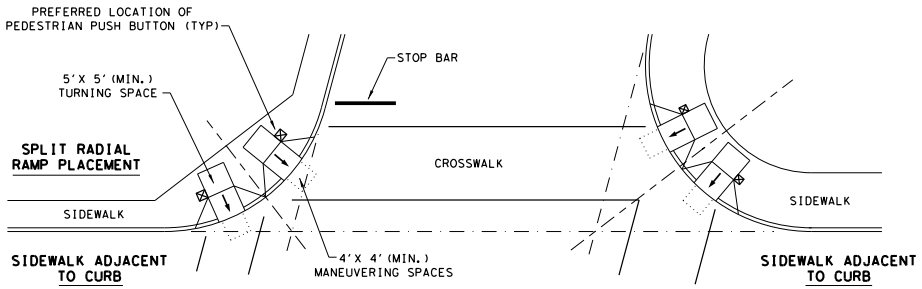
PED-18

FILE: ped18	DN: TxDOT	CK: VP	CK: KM	CK: PK & JG
© TxDOT: MARCH, 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS				
REVISED 08,2005 REVISED 06,2012 REVISED 01,2018	DIST	COUNTY		SHEET NO.

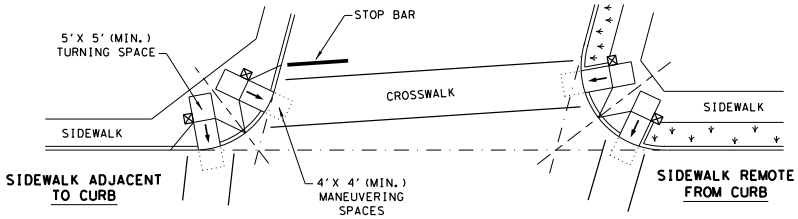
DATE:
FILE:

TYPICAL CROSSING LAYOUTS

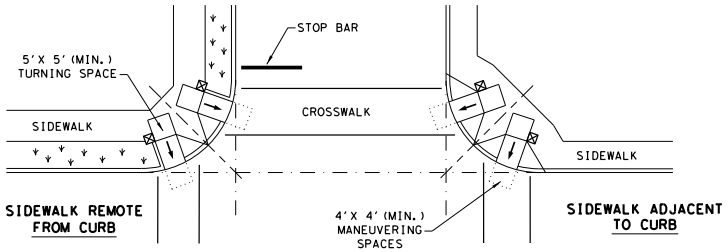
SEE SHEET 1 OF 4 FOR DETAILS AND DIMENSIONS



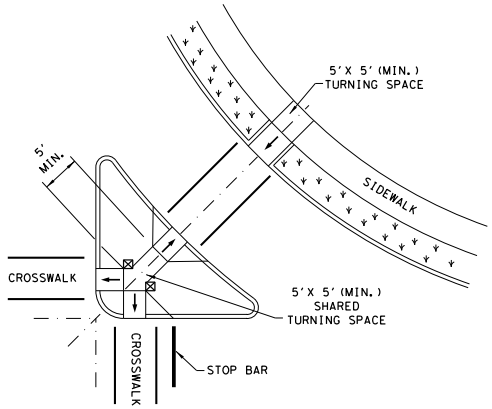
SKEWED INTERSECTION WITH "LARGE" RADIUS



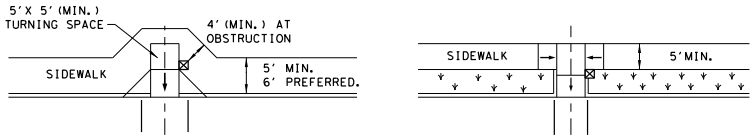
SKEWED INTERSECTION WITH "SMALL" RADIUS



NORMAL INTERSECTION WITH "SMALL" RADIUS



AT INTERSECTION
W/FREE RIGHT TURN & ISLAND



MID-BLOCK PLACEMENT
PERPENDICULAR RAMPS

LEGEND:

SHOWS DOWNWARD SLOPE. →

DENOTES PREFERRED LOCATION OF PEDESTRIAN PUSH BUTTON (IF APPLICABLE). ☒

DENOTES PLANTING OR NON-WALKING SURFACE NOT PART OF PEDESTRIAN CIRCULATION PATH.

Texas Department of Transportation — Design Division Standard

PEDESTRIAN FACILITIES CURB RAMPS

PED-18

FILE: ped18	DN: TxDOT	CK: VP	CK: KM	CK: PK & JG
© TxDOT: MARCH, 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS				
REVISED 08,2005 REVISED 06,2012 REVISED 01,2018	DIST	COUNTY		SHEET NO.

DATE:
FILE:

GENERAL ROADWAY CAST IN PLACE CONCRETE BID TABULATION							
			COMPANY:				
BID ITEM	ITEM	NO.	DESCRIPTION	EST. QTY.	UNITS	UNIT PRICE	UNIT PRICE (LABOR ONLY)
1	104	6021	REMOVING CONC (CURB)	100	LF		N/A
2	104	6022	REMOVING CONC (CURB AND GUTTER)	50	LF		N/A
3	104	6036	REMOVING CONC (SIDEWALK OR RAMP)	50	SY		N/A
4	423	6005	RETAINING WALL (SPREAD FOOTING)	100	SF		
5	432	6002	RIPRAP (CONC)(5 IN)	120	CY		
6	465	2174	INLET (COMPL)(DROP)(TY I)	2	EA		
7	465	2168	INLET (COMPL)(DROP)(TY II)	2	EA		
8	466	2001	WINGWALL (SW-0)	100	SF		
9	466	2002	WINGWALL (FW-0)	100	SF		
10	466	2003	WINGWALL (FW-S)	50	SF		
11	466	2004	WINGWALL (PW)	100	SF		
12	466	6094	HEADWALL (CH-PW-0)(DIA= 15 IN)	2	EA		
13	466	6095	HEADWALL (CH-PW-0)(DIA= 18 IN)	2	EA		
14	466	6097	HEADWALL (CH-PW-0)(DIA= 24 IN)	2	EA		
15	466	6099	HEADWALL (CH-PW-0)(DIA= 30 IN)	2	EA		
16	466	6101	HEADWALL (CH-PW-0)(DIA= 36 IN)	2	EA		
17	466	6102	HEADWALL (CH-PW-0)(DIA= 42 IN)	2	EA		
18	466	6103	HEADWALL (CH-PW-0)(DIA= 48 IN)	2	EA		
19	466	6104	HEADWALL (CH-PW-0)(DIA= 54 IN)	2	EA		
20	466	6105	HEADWALL (CH-PW-0)(DIA= 60 IN)	2	EA		
21	466	6002	HEADWALL (CH-FW-0)(DIA= 15 IN)	2	EA		
22	466	6003	HEADWALL (CH-FW-0)(DIA= 18 IN)	2	EA		
23	466	6005	HEADWALL (CH-FW-0)(DIA= 24 IN)	2	EA		
24	466	6007	HEADWALL (CH-FW-0)(DIA= 30 IN)	2	EA		
25	466	6009	HEADWALL (CH-FW-0)(DIA= 36 IN)	2	EA		
26	466	6010	HEADWALL (CH-FW-0)(DIA= 42 IN)	2	EA		
27	466	6011	HEADWALL (CH-FW-0)(DIA= 48 IN)	2	EA		
28	466	6012	HEADWALL (CH-FW-0)(DIA= 54 IN)	2	EA		
29	466	6013	HEADWALL (CH-FW-0)(DIA= 60 IN)	2	EA		
30	466	6032	HEADWALL (CH-FW-30)(DIA= 15 IN)	2	EA		

31	466	6033	HEADWALL (CH-FW-30)(DIA= 18 IN)	2	EA		
32	466	6035	HEADWALL (CH-FW-30)(DIA= 24 IN)	2	EA		
33	466	6037	HEADWALL (CH-FW-30)(DIA= 30 IN)	2	EA		
34	466	6039	HEADWALL (CH-FW-30)(DIA= 36 IN)	2	EA		
35	466	6040	HEADWALL (CH-FW-30)(DIA= 42 IN)	2	EA		
36	466	6041	HEADWALL (CH-FW-30)(DIA= 48 IN)	2	EA		
37	466	6042	HEADWALL (CH-FW-30)(DIA= 54 IN)	2	EA		
38	466	6043	HEADWALL (CH-FW-30)(DIA= 60 IN)	2	EA		
39	467	6329	SET (TY II)(15 IN)(CMP)(3:1)(C)	2	EA		
40	467	6343	SET (TY II)(18 IN)(CMP)(3:1)(C)	2	EA		
41	467	6375	SET (TY II)(24 IN)(CMP)(3:1)(C)	2	EA		
42	467	6406	SET (TY II)(30 IN)(CMP)(3:1)(C)	2	EA		
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44	467	6456	SET (TY II)(42 IN)(CMP)(3:1)(C)	2	EA		
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46	467	6481	SET (TY II)(54 IN)(CMP)(3:1)(C)	2	EA		
47	467	6491	SET (TY II)(60 IN)(CMP)(3:1)(C)	2	EA		
48	467	6330	SET (TY II)(15 IN)(CMP)(4:1)(C)	2	EA		
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64	467	6333	SET (TY II)(15 IN)(CMP)(6:1)(P)	2	EA		
65	467	6348	SET (TY II)(18 IN)(CMP)(6:1)(P)	2	EA		
66	467	6380	SET (TY II)(24 IN)(CMP)(6:1)(P)	2	EA		
67	467	6410	SET (TY II)(30 IN)(CMP)(6:1)(P)	2	EA		

68	467	6444	SET (TY II)(36 IN)(CMP)(6:1)(P)	2	EA		
69	467	6460	SET (TY II)(42 IN)(CMP)(6:1)(P)	2	EA		
70	467	6471	SET (TY II)(48 IN)(CMP)(6:1)(P)	2	EA		
71	496	6002	REMOV STR (INLET)	2	EA		N/A
72	496	6042	REMOV STR (SMALL)	2	EA		N/A
73	496	6041	REMOV STR (LARGE)	1	EA		N/A
74	500	6001	MOBILIZATION	1	LS		N/A
75	529	6001	CONC CURB (TY I)	150	LF		
76	529	6002	CONC CURB (TY II)	150	LF		
77	529	6007	CONC CURB & GUTTER (TY I)	100	LF		
78	529	6008	CONC CURB & GUTTER (TY II)	100	LF		
79	531	6002	CONC SIDEWALKS (5")	100	SY		

BID AFFIDAVIT

This form must be completed, signed, notarized and returned with Bid package

The undersigned attests that the company named below, under the provisions of Subtitle F, Title 10, Texas Government Code Chapter 2270:

1. Does not boycott Israel currently; and
2. Will not boycott Israel during the term of the contract.

Pursuant to Section 2270.001, Texas Government Code:

1. "Boycott Israel" means refusing to deal with, terminating business activities with, or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations specifically with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory, but does not include an action made for ordinary business purposes; and
2. "Company" means a for-profit sole proprietorship, organization, association, corporation, partnership, joint venture, limited partnership, or any limited liability company, including a wholly owned subsidiary, majority-owned subsidiary, parent company or affiliate of those entities or business associations that exist to make a profit.

The undersigned certifies that the IFB and the Bidder's Bid have been carefully reviewed and are submitted as correct and final. Bidder further certifies and agrees to furnish any and/or all goods and/or services upon which prices are extended at the price Bid, and upon the conditions contained in the IFB.

I hereby certify that the foregoing Bid has not been prepared in collusion with any other Bidder or other person or persons engaged in the same line of business prior to the official opening of this Bid. Further, I certify that the Bidder is not now, nor has been for the past six (6) months, directly or indirectly concerned in any pool or agreement or combination, to control the price of services/commodities Bid on, or to influence any person or persons to submit a Bid or not to submit a Bid thereon."

Name of Bidder:	
Address of Bidder:	
Email:	
Telephone:	
Printed Name of Person Submitting Affidavit:	
Signature of Person Submitting Affidavit:	

Cooperative Purchasing Program

Check one of the following options below. A non-affirmative Bid will in no way have a negative impact on the County's evaluation of the Bid.

☐	I will offer the quoted prices to all authorized entities during the term of the County's Contract.
☐	I will not offer the quoted prices to all authorized entities.

If no box is checked, the Bidder agrees to make best efforts in good faith to offer the quoted prices to all authorized entities.

BEFORE ME, the undersigned authority, a Notary Public, personally appeared _____ (*Name of Signer*), who after being by me duly sworn, did depose and say: "I, _____, (*Name of Signer*) am a duly authorized officer of/agent for _____ (*Name of Bidder*) and have been duly authorized to execute the foregoing on behalf of the said _____ (*Name of Bidder*).

SUBSCRIBED AND SWORN to before me by the above-named _____

on this the _____ day of _____, 20_____.

_____

Notary Public in and for

The State of _____

The County of _____

SIGNATURE AND NOTARY NOT REQUIRED IF COMPLETING IN BIDSYNC ELECTRONICALLY.

CONFLICT OF INTEREST QUESTIONNAIRE

For vendor or other person doing business with local governmental entity

Form CIQ

This questionnaire is being filed in accordance with chapter 176 of the Local Government Code by a person doing business with the governmental entity.

By law this questionnaire must be filed with the records administrator of the local government not later than the 7th business day after the date the person becomes aware of facts that require the statement to be filed. See Section 176.006, Local Government Code.

A person commits an offense if the person violates Section 176.006, Local Government Code. An offense under this section is a Class C misdemeanor.

OFFICE USE ONLY

Date Received

1 **Name of person doing business with local governmental entity.**

2 ☐ **Check this box if you are filing an update to a previously filed questionnaire.**

(The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than September 1 of the year for which an activity described in Section 176.006(a), Local Government Code, is pending and not later than the 7th business day after the date the originally filed questionnaire becomes incomplete or inaccurate.)

3 **Describe each affiliation or business relationship with an employee or contractor of the local governmental entity who makes recommendations to a local government officer of the local governmental entity with respect to expenditure of money.**

4 **Describe each affiliation or business relationship with a person who is a local government officer and who appoints or employs a local government officer of the local governmental entity that is the subject of this questionnaire.**

CONFLICT OF INTEREST QUESTIONNAIRE

For vendor or other person doing business with local governmental entity

Form CIQ
Page 2

5 **Name of local government officer with whom filer has affiliation or business relationship.**
(Complete this section only if the answer to A, B, or C is YES.)

This section, item 5 including subparts A, B, C & D, must be completed for each officer with whom the filer has affiliation or other relationship. Attach additional pages to this Form CIQ as necessary.

A. Is the local government officer named in this section receiving or likely to receive taxable income from the filer of the questionnaire?

☐ Yes ☐ No

B. Is the filer of the questionnaire receiving or likely to receive taxable income from or at the direction of the local government officer named in this section AND the taxable income is not from the local governmental entity?

☐ Yes ☐ No

C. Is the filer of this questionnaire affiliated with a corporation or other business entity that the local government officer serves as an officer or director, or holds an ownership of 10 percent or more?

☐ Yes ☐ No

D. Describe each affiliation or business relationship.

6. Describe any other affiliation or business relationship that might cause conflict of interest:

7

Signature of person doing business with the governmental entity	Date

Signature not required if completing in BIDSYNC electronically.

Bidder References

List the last (3) companies or governmental agencies, where the same or similar goods and/or services as contained in this IFB package, were recently provided by Bidder.

Reference 1

Client Name: Location:

Contact Name: Title:

Phone: E-mail

Contract Date To: Contract Date From: Contract Value: $

Scope of Work:

Reference 2

Client Name: Location:

Contact Name: Title:

Phone: E-mail

Contract Date To: Contract Date From: Contract Value: $

Scope of Work:

Reference 3

Client Name: Location:

Contact Name: Title:

Phone: E-mail

Contract Date To: Contract Date From: Contract Value: $

Scope of Work:

Question and Answers for Bid #1802-216 - Cast in Place Concrete Materials and Labor

Overall Bid Questions
There are no questions associated with this bid.