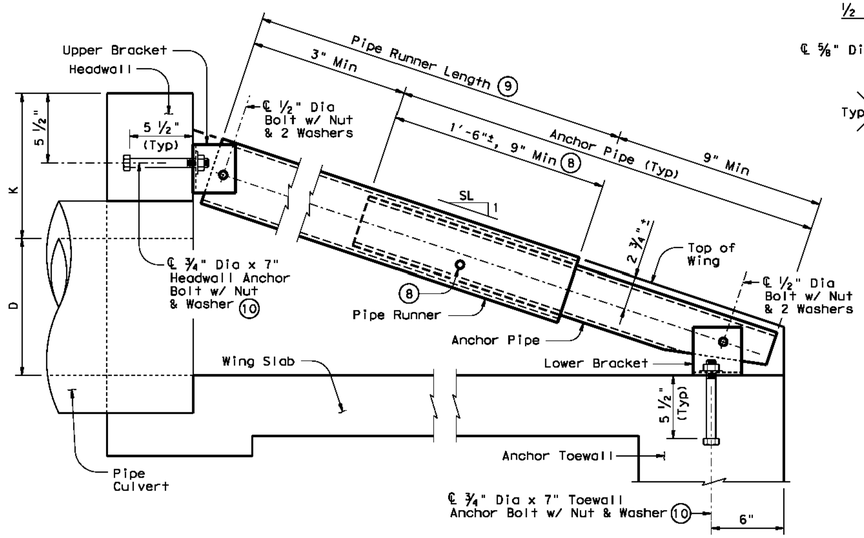
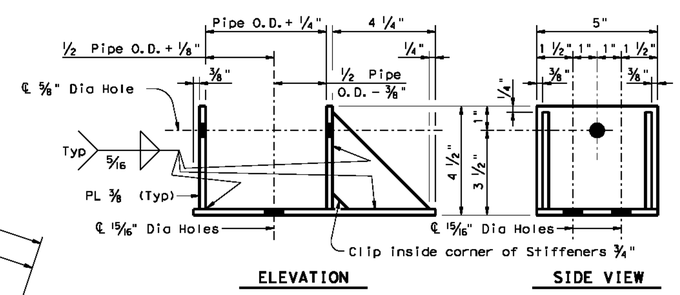
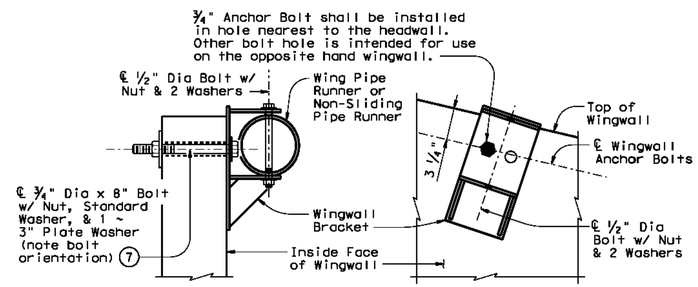


SECTION B-B

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



ELEVATION SIDE VIEW

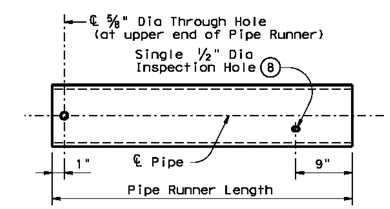


SECTION C-C (Showing installed bracket.)

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

NOTE: Wingwall Bracket shall match the Upper Bracket size.

WINGWALL BRACKET DETAILS



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

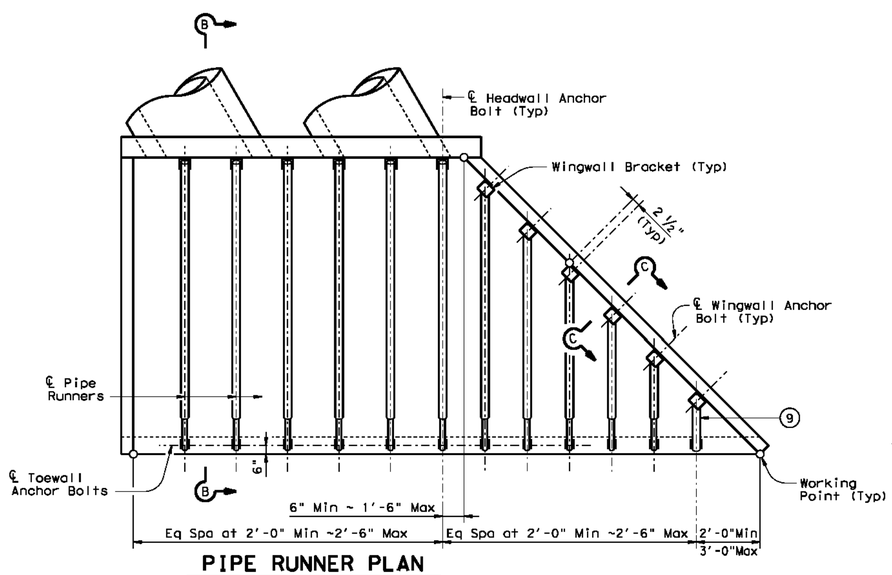
PIPE RUNNER DETAILS

(7) At Contractor's option, 7/8" diameter hole may be formed or cored drilled. Percussion drilling is not permitted. Adjust placement of reinforcing steel as necessary to avoid bolt holes.

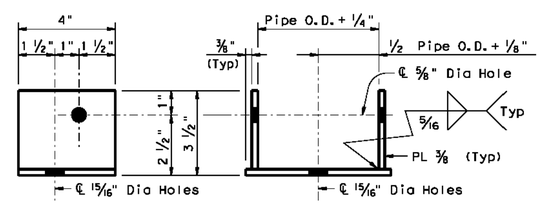
(8) After installation of the Pipe Runner, the 1/2" inspection hole shall be utilized to ensure that the lap of the Anchor Pipe with the Pipe Runner is adequate.

(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 3/4". 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.



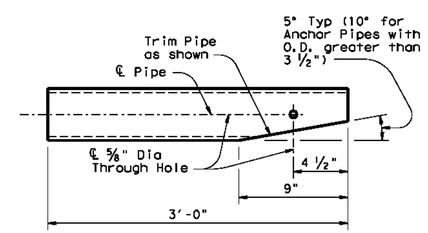
PIPE RUNNER PLAN



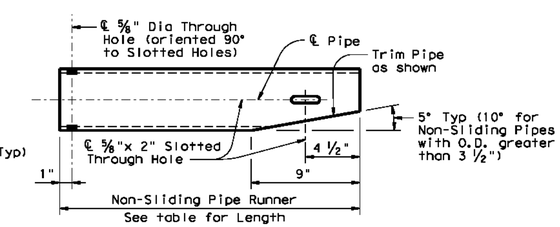
SIDE VIEW ELEVATION

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



ANCHOR PIPE 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)

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
©TxDOT February 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS	DIST		COUNTY	SHEET NO.

DISCLAIMER:
The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE:
FILE:

RS&H

RS&H, Inc.
13750 SAN PEDRO AVE, SUITE 300
SAN ANTONIO, TX 78232
(210) 224-2800 FAX (210) 545-3103
WWW.RSANDH.COM
REGISTERED FIRM NO: F-3401

SAN ANTONIO INTERNATIONAL AIRPORT
SAN ANTONIO, TEXAS

PERIMETER ROAD IMPROVEMENTS

CONSULTANTS

ATKINS
15900 La Cantera Parkway, Suite 26200
San Antonio, TX 78256
Phone: 210.828.9494

STATE OF TEXAS — STEVEN D. TEMPLER — 58656 — PROFESSIONAL ENGINEER

$DATE$

REVISIONS

NO.	DESCRIPTION	DATE

DATE ISSUED: 04-28-16
REVIEWED BY:
DRAWN BY:
DESIGNED BY:

AEP PROJECT NUMBER
000-0000-000

©2016 RS&H, INC.

SHEET TITLE

DRAINAGE DETAILS - SHEET 5

SHEET NUMBER

C505

100% BID SET

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.

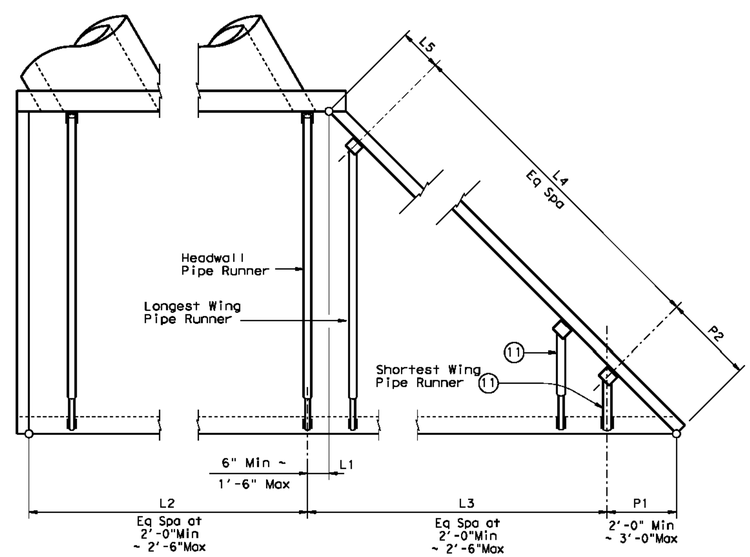
(13) Anchor Pipe size shall be the next smaller size than the Pipe Runner size.

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:

Total Length of All Pipe Runners = Total Length of Wingwall Pipe Runners + (No. of Headwall Pipe Runners) (Headwall Pipe Runner Length)

Total Length of All Anchor Pipes = (3.000') (No. of Wing Pipe Runners + No. of Headwall Pipe Runners − No. of Non-Sliding Pipe Runners)

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
©TxDOT February 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS				
	DIST		COUNTY	SHEET NO.

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE:
FILE:

RS&H

RS&H, Inc.
13750 SAN PEDRO AVE, SUITE 300
SAN ANTONIO, TX 78232
(210) 224-2800 FAX (210) 545-3103
WWW.RSANDH.COM
REGISTERED FIRM NO: F-3401

SAN ANTONIO INTERNATIONAL AIRPORT
SAN ANTONIO, TEXAS

PERIMETER ROAD IMPROVEMENTS

CONSULTANTS

ATKINS
15900 La Cantera Parkway, Suite 26200
San Antonio, TX 78256
Phone: 210.828.9494
STATE OF TEXAS — STEVEN D. TEMPLER — 86656 — PROFESSIONAL ENGINEER
$DATE$

REVISIONS

NO.	DESCRIPTION	DATE

DATE ISSUED: 04-28-16
REVIEWED BY:
DRAWN BY:
DESIGNED BY:

AEP PROJECT NUMBER
000-0000-000

© 2016 RS&H, INC.

SHEET TITLE

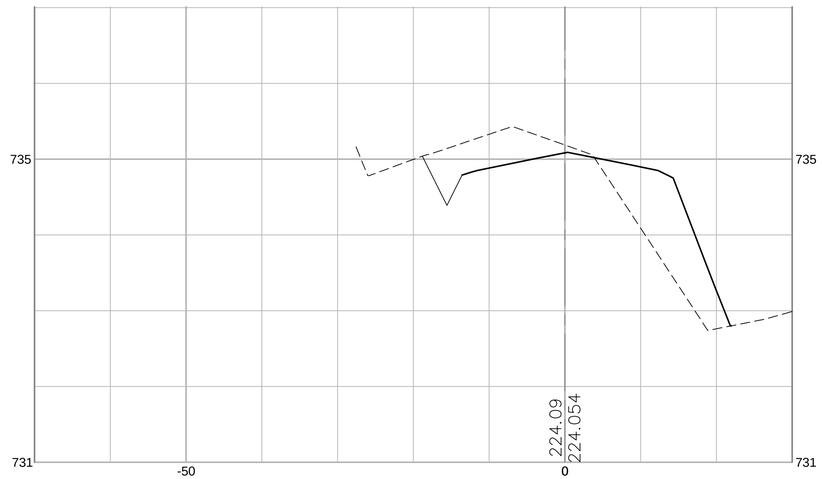
DRAINAGE DETAILS - SHEET 6

SHEET NUMBER

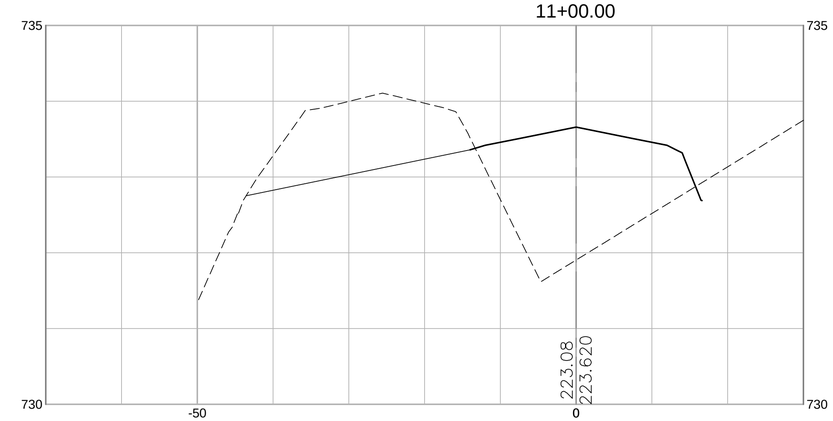
C506

100% BID SET

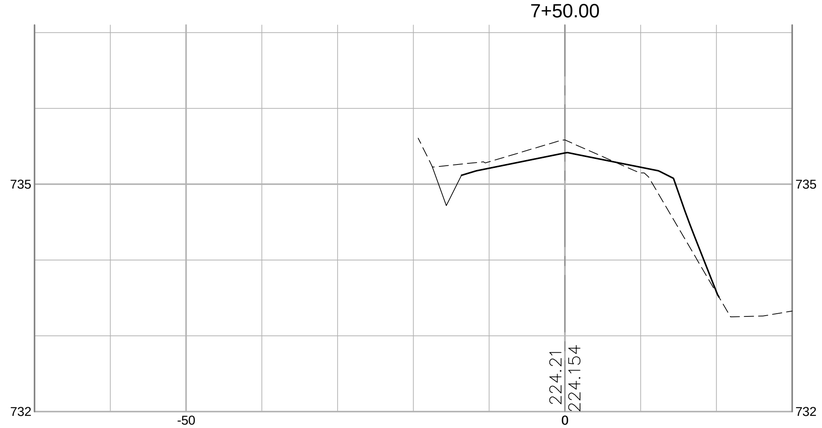
8+00.00



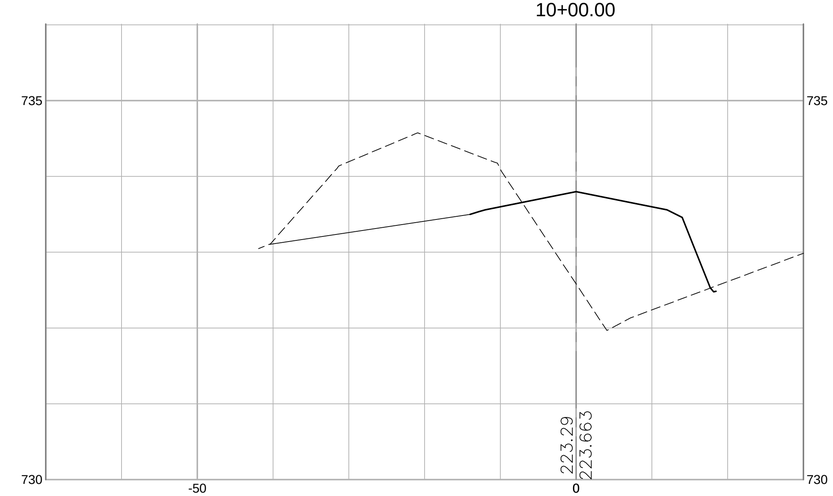
11+00.00



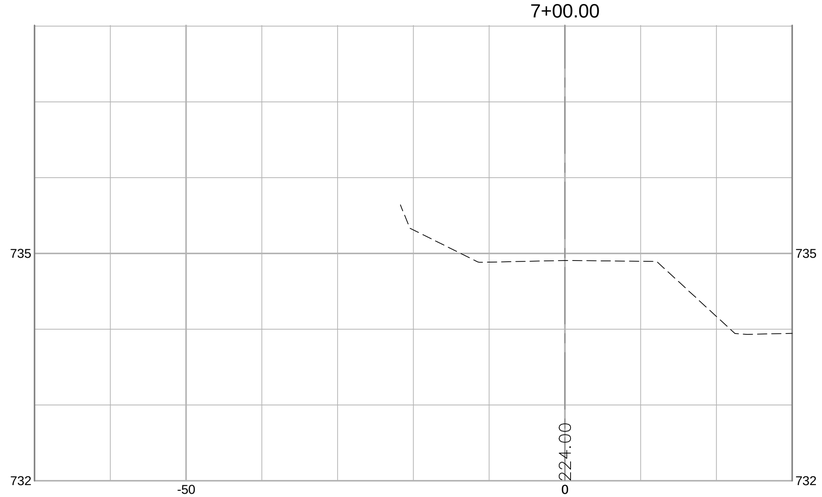
7+50.00



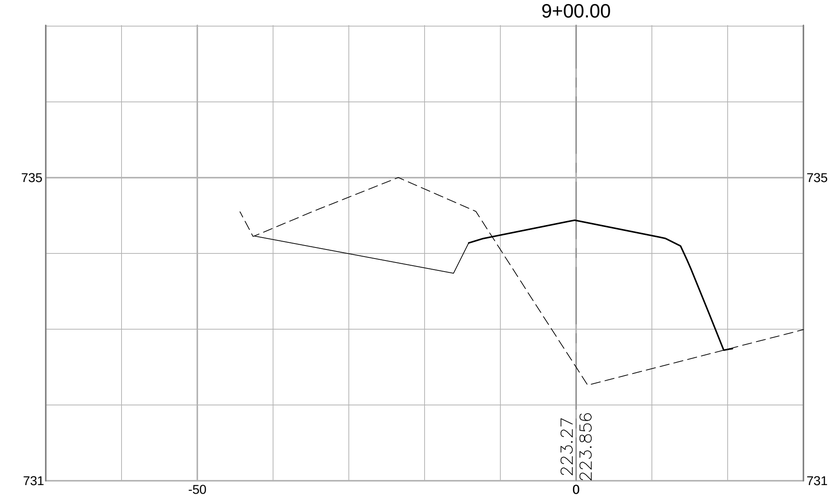
10+00.00



7+00.00



9+00.00



RS&H

RS&H, Inc.
13750 SAN PEDRO AVE, SUITE 300
SAN ANTONIO, TX 78232
(210) 224-2800 FAX (210) 545-3103
WWW.RSANDH.COM
REGISTERED FIRM NO: F-3401

SAN ANTONIO
INTERNATIONAL AIRPORT
SAN ANTONIO, TEXAS

PERIMETER ROAD IMPROVEMENTS

CONSULTANTS

ATKINS
15900 La Cantera Parkway, Suite 26200
San Antonio, TX 78256
Phone: 210.828.9494

STATE OF TEXAS
STEVEN D. TEMPLER
08656
PROFESSIONAL ENGINEER

$DATE$

REVISIONS

NO.	DESCRIPTION	DATE

DATE ISSUED: 04-28-16
REVIEWED BY:
DRAWN BY:
DESIGNED BY:

AEP PROJECT NUMBER
000-0000-000

© 2016 RS&H, INC.

SHEET TITLE

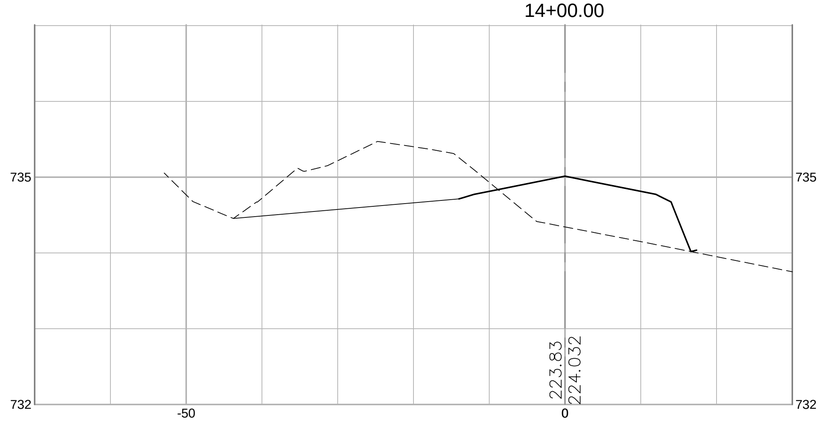
PERIMETER ROAD CROSS SECTIONS - SHEET 1

SHEET NUMBER

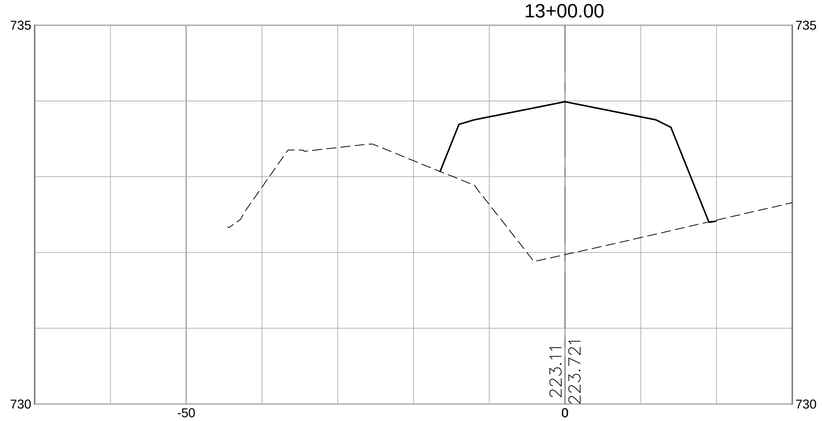
CX101

100% BID SET

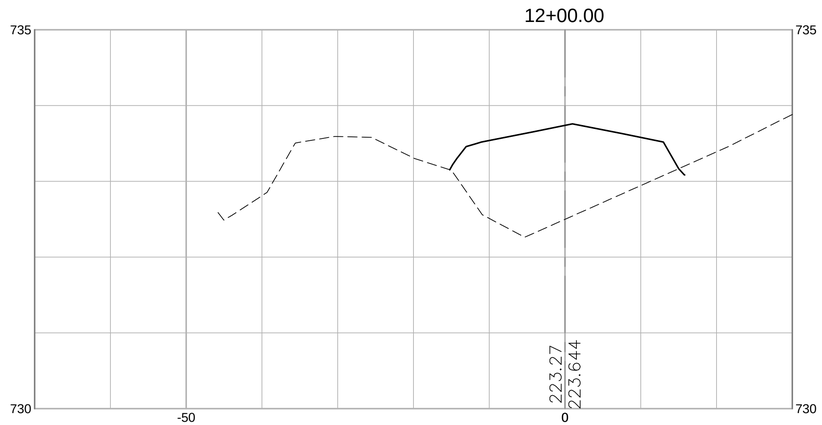
14+00.00



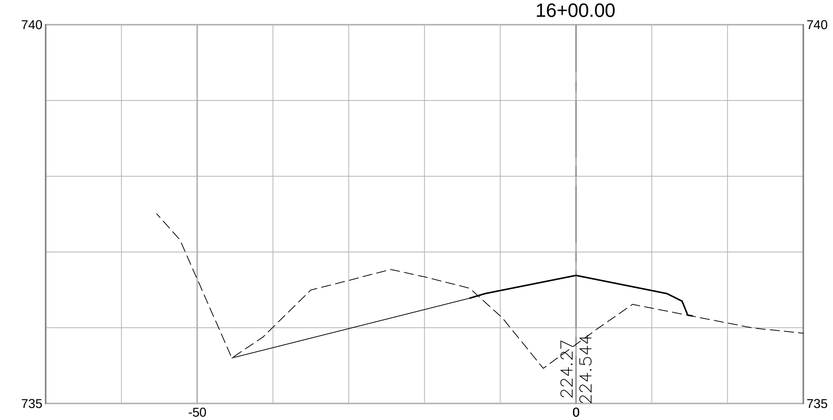
13+00.00



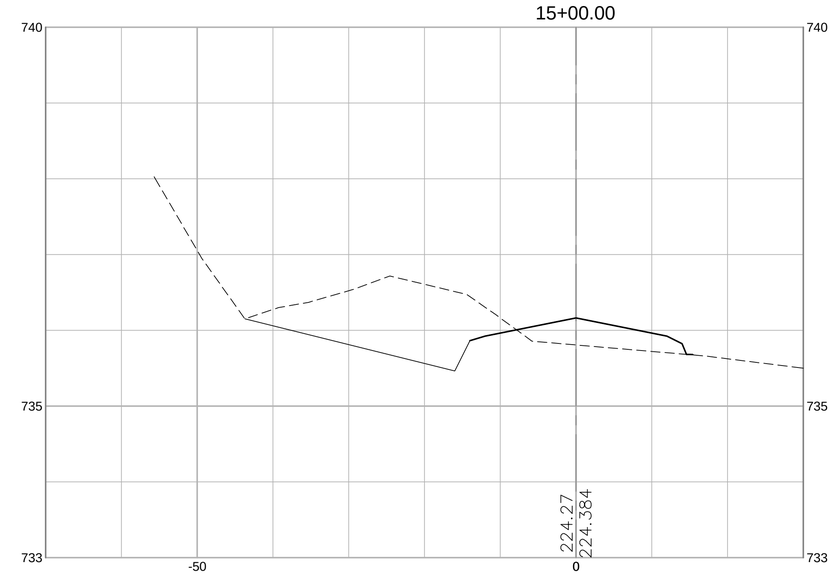
12+00.00



16+00.00



15+00.00



RS&H

RS&H, Inc.
13750 SAN PEDRO AVE, SUITE 300
SAN ANTONIO, TX 78232
(210) 224-2800 FAX (210) 545-3103
WWW.RSANDH.COM
REGISTERED FIRM NO: F-3401

SAN ANTONIO
INTERNATIONAL AIRPORT
SAN ANTONIO, TEXAS

PERIMETER ROAD IMPROVEMENTS

CONSULTANTS

ATKINS
15900 La Cantera Parkway, Suite 26200
San Antonio, TX 78256
Phone: 210.828.9494

STATE OF TEXAS
STEVEN D. TEMPLER
86656
PROFESSIONAL ENGINEER

$DATE$

REVISIONS

NO.	DESCRIPTION	DATE

DATE ISSUED: 04-28-16
REVIEWED BY:
DRAWN BY:
DESIGNED BY:

AEP PROJECT NUMBER
000-0000-000

© 2016 RS&H, INC.

SHEET TITLE

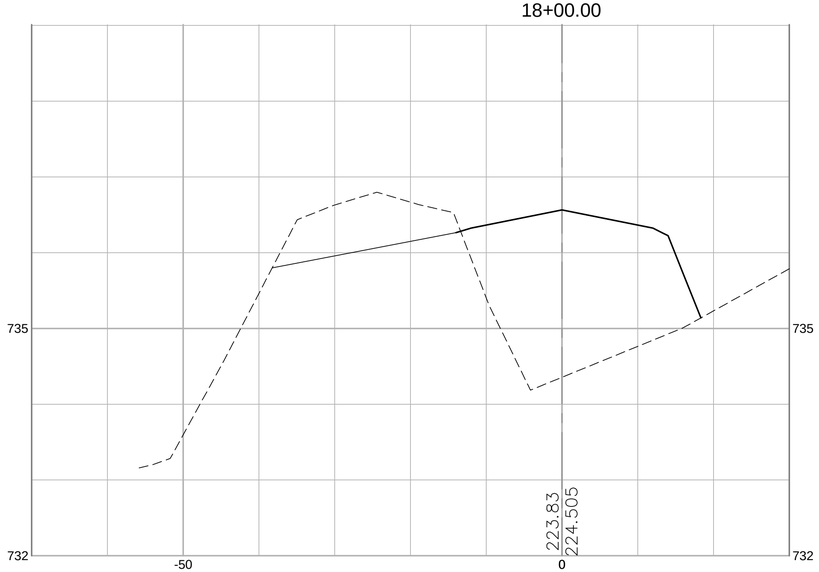
PERIMETER ROAD CROSS SECTIONS - SHEET 2

SHEET NUMBER

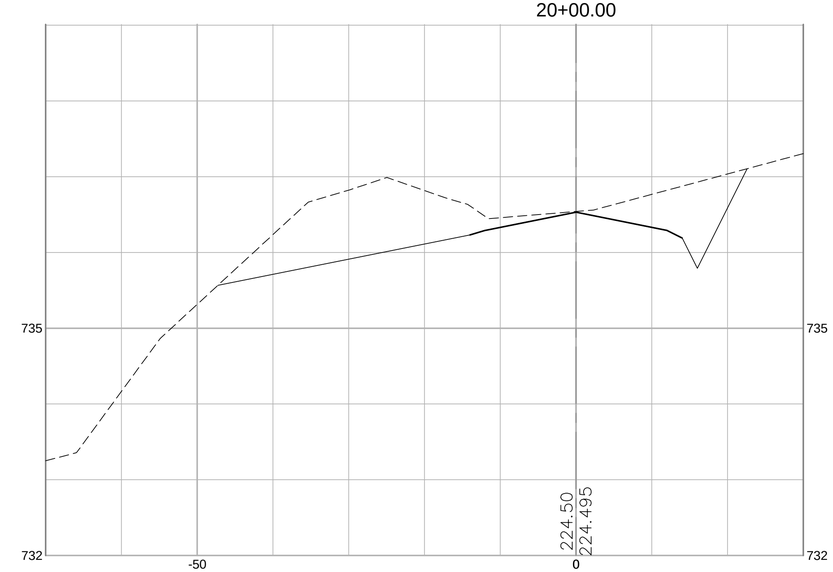
CX102

100% BID SET

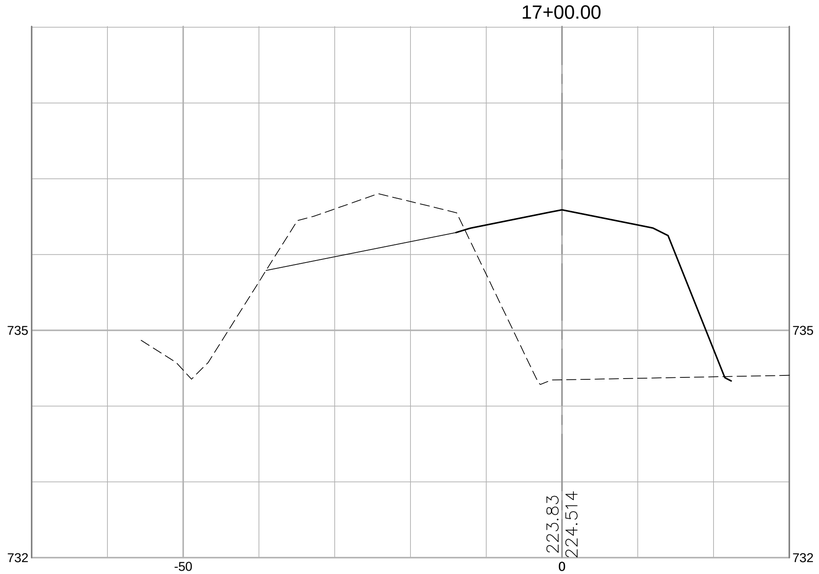
18+00.00



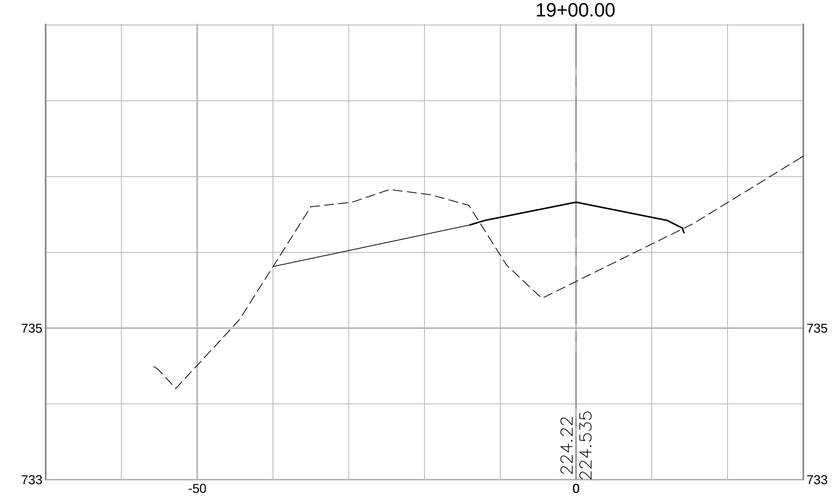
20+00.00



17+00.00



19+00.00



RS&H

RS&H, Inc.
13750 SAN PEDRO AVE, SUITE 300
SAN ANTONIO, TX 78232
(210) 224-2800 FAX (210) 545-3103
WWW.RSANDH.COM
REGISTERED FIRM NO: F-3401

SAN ANTONIO
INTERNATIONAL AIRPORT
SAN ANTONIO, TEXAS

PERIMETER ROAD IMPROVEMENTS

CONSULTANTS

ATKINS
15900 La Cantera Parkway, Suite 26200
San Antonio, TX 78256
Phone: 210.828.9494

STATE OF TEXAS
STEVEN D. TEMPLER
86656
PROFESSIONAL ENGINEER

$DATE$

REVISIONS

NO.	DESCRIPTION	DATE

DATE ISSUED: 04-28-16
REVIEWED BY:
DRAWN BY:
DESIGNED BY:

AEP PROJECT NUMBER
000-0000-000

© 2016 RS&H, INC.

SHEET TITLE

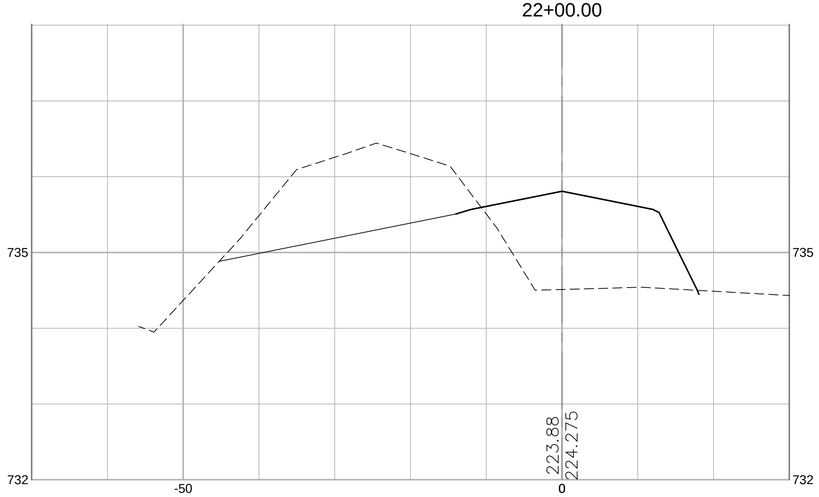
PERIMETER ROAD CROSS SECTIONS - SHEET 3

SHEET NUMBER

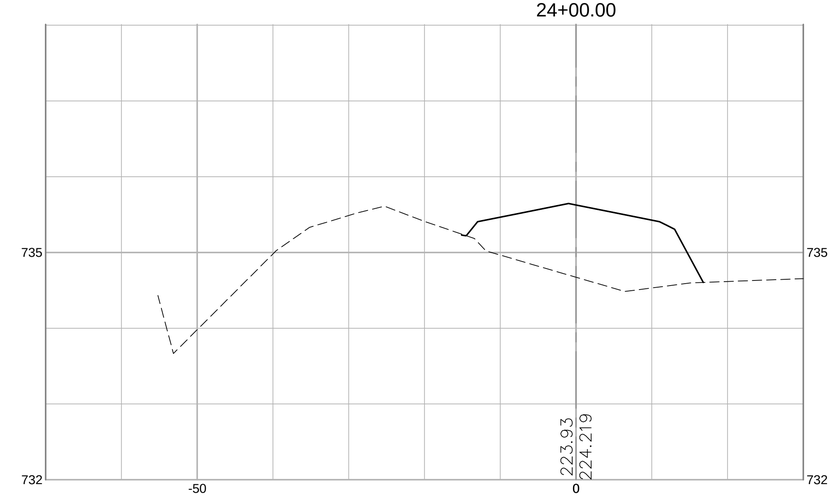
CX103

100% BID SET

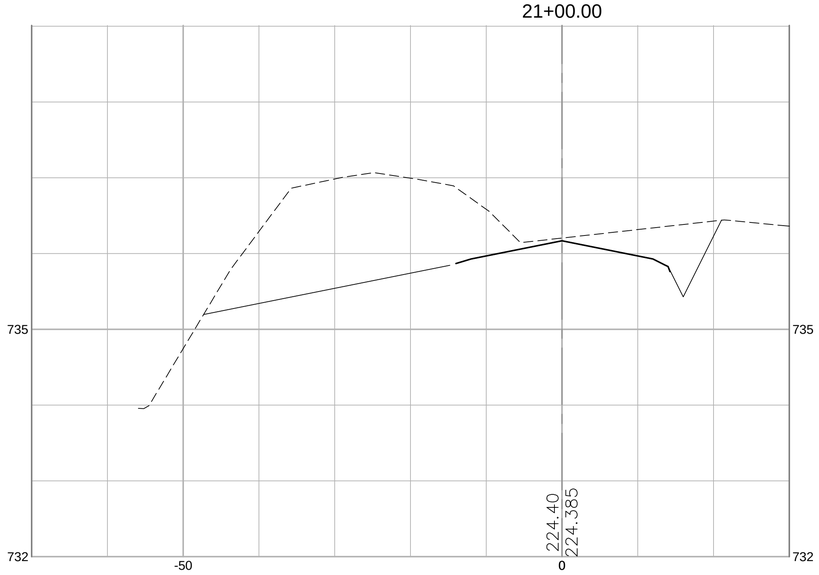
22+00.00



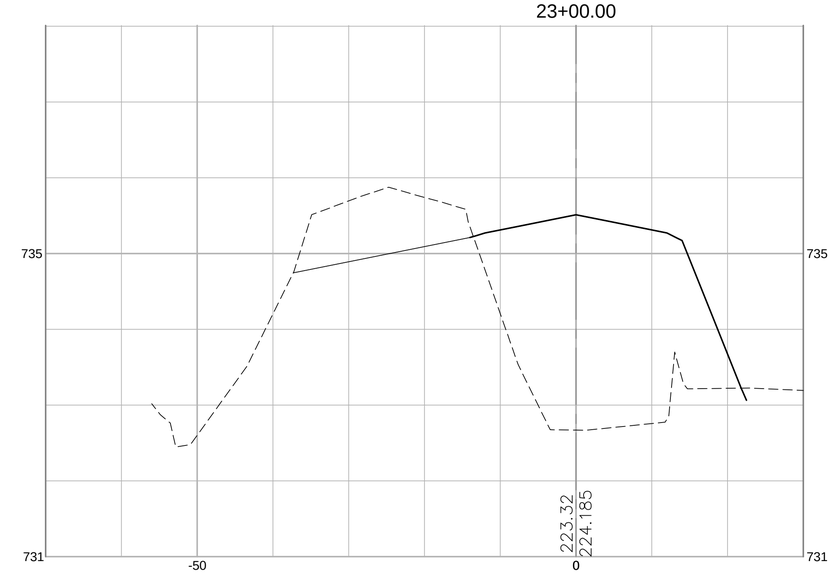
24+00.00



21+00.00



23+00.00



RS&H

RS&H, Inc.
13750 SAN PEDRO AVE, SUITE 300
SAN ANTONIO, TX 78232
(210) 224-2800 FAX (210) 545-3103
WWW.RSANDH.COM
REGISTERED FIRM NO: F-3401

SAN ANTONIO
INTERNATIONAL AIRPORT
SAN ANTONIO, TEXAS

PERIMETER ROAD IMPROVEMENTS

CONSULTANTS

ATKINS
15900 La Cantera Parkway, Suite 26200
San Antonio, TX 78256
Phone: 210.828.9494

STATE OF TEXAS
STEVEN D. TEMPLER
86656
PROFESSIONAL ENGINEER

$DATE$

REVISIONS

NO.	DESCRIPTION	DATE

DATE ISSUED: 04-28-16
REVIEWED BY:
DRAWN BY:
DESIGNED BY:

AEP PROJECT NUMBER
000-0000-000

© 2016 RS&H, INC.

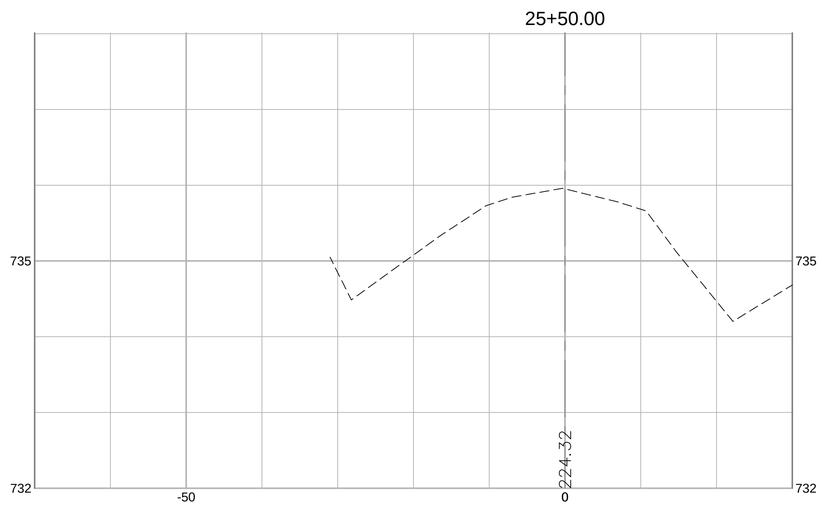
SHEET TITLE

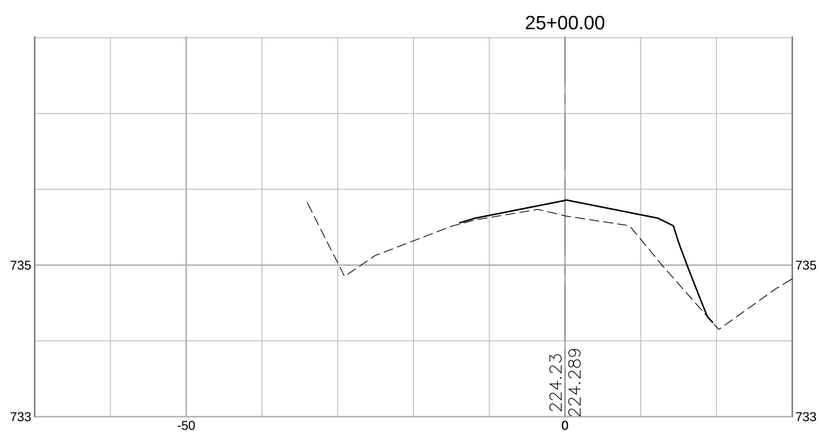
PERIMETER ROAD CROSS SECTIONS - SHEET 4

SHEET NUMBER

CX104

100% BID SET





RS&H

RS&H, Inc.
13750 SAN PEDRO AVE, SUITE 300
SAN ANTONIO, TX 78232
(210) 224-2800 FAX (210) 545-3103
WWW.RSANDH.COM
REGISTERED FIRM NO: F-3401

SAN ANTONIO
INTERNATIONAL AIRPORT
SAN ANTONIO, TEXAS

PERIMETER ROAD IMPROVEMENTS

CONSULTANTS

ATKINS
15900 La Cantera Parkway, Suite 26200
San Antonio, TX 78256
Phone: 210.828.9494

STATE OF TEXAS
STEVEN D. TEMPLER
86656
PROFESSIONAL ENGINEER

$DATE$

REVISIONS

NO.	DESCRIPTION	DATE

DATE ISSUED: 04-28-16
REVIEWED BY:
DRAWN BY:
DESIGNED BY:

AEP PROJECT NUMBER
000-0000-000

© 2016 RS&H, INC.

SHEET TITLE

PERIMETER ROAD CROSS SECTIONS - SHEET 5

SHEET NUMBER

CX105

100% BID SET