THE CITY OF ROCKWALL, TEXAS

CONSTRUCTION PLANS

FOR

PAVING, DRAINAGE & WATER IMPROVEMENTS

TO SERVE

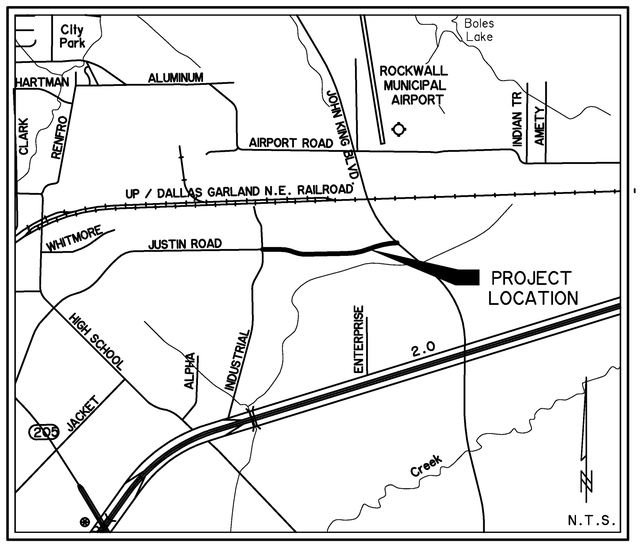
JUSTIN ROAD

(INDUSTRIAL BOULEVARD TO JOHN KING BOULEVARD)

ROCKWALL COUNTY, TEXAS

STREET CLASSIFICATION = MINOR ARTERIAL

DESIGN SPEED = 40 MPH



VICINITY MAP

DAVID SWEET - MAYOR

COUNCIL MEMBERS

DAVID WHITE - Mayor Pro Tem
JIM PRUITT
BENNIE DANIELS
DENNIS LEWIS
SCOTT MILDER
MIKE TOWNSEND

RICK CROWLEY - City Manager

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED
PROFESSIONAL ENGINEER
5/1/2015

PREPARED BY:
WIER & ASSOCIATES, INC.
ENGINEERS SURVEYORS LAND PLANNERS
701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.WierAssociates.com

SHEET INDEX

RECORD PLANS
MAY 1, 2015

NOTE:

1.) ALL REFERENCES TO 'CITY' SHALL MEAN 'CITY OF ROCKWALL'.

2.) ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE CITY OF ROCKWALL AND NORTH TEXAS COUNCIL OF GOVERNMENT STANDARD SPECIFICATIONS THIRD EDITION.

CITY OF ROCKWALL STANDARD DETAIL SHEETS INCORPORATED HEREIN BY REFERENCE.

THE STANDARD SHEETS P302 TO P305, M202, D301 TO D316, & T201 TO T212, SPECIFICALLY IDENTIFIED IN THIS INDEX OF SHEETS HAVE BEEN SELECTED BY ME OR UNDER MY RESPONSIBLE SUPERVISION AS BEING APPLICABLE TO THIS PROJECT.

W.A.# 13096 - CONSTRUCTION PLANS FOR PAVING, DRAINAGE & WATER IMPROVEMENTS TO SERVE JUSTIN ROAD, ROCKWALL, TEXAS.

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EXISTING TOPOGRAPHIC LEGEND

	ASPHALT PAVEMENT
BOL/GP	BOLLARD/GUARD POST
B/C	DIMENSION TO BACK OF CURB
CATV	CABLE TV
CM	CONTROL MONUMENT
CONC.	CONCRETE
EAP	EDGE OF ASPHALT PAVEMENT
EB	ELEC BOX (GROUND)
EM	ELEC METER
FH	FIRE HYDRANT
FO	FIBER OPTIC CABLE
GM	GAS METER
GMH	GAS MANHOLE
GTS	GAS TEST STATION
GUY	GUY WIRE
HDWL.	CONCRETE HEADWALL
ICV	IRRIGATION CONTROL VALVE
IRF	IRON ROD FOUND
IRS	IRON ROD SET
LP	LIGHT POLE
PP	POWER POLE
PP/LP	POWER POLE W/LIGHT
SDMH	STORM DRAIN MANHOLE
SHD	SPRINKLER HEAD
SN	SIGN
SSMH	SANITARY SEWER MANHOLE
SSCO	SANITARY SEWER CLEANOUT
SWBT	SOUTH WESTERN BELL TELEPHONE
TPD	TELEPHONE PEDESTAL
TSG	TELEPHONE SWITCH GEAR
TSB	TRAFFIC SIGNAL BOX
TSP	TRAFFIC SIGNAL POLE
TSC	TRAFFIC SIGNAL CONTROLLER
	TRANSFORMER PAD
WM	WATER METER
WV	WATER VALVE
OE	OVERHEAD ELECTRIC LINE
UE	UNDERGROUND ELECTRIC LINE
W	WATER LINE
SS	SANITARY SEWER LINE
FO	FIBER OPTIC LINE
UT	UNDERGROUND TELEPHONE
OT	OVERHEAD TELEPHONE
G	UNDERGROUND GAS
24" RCP	EXISTING CONCRETE STORM DRAIN LINE
24" CMP	EXISTING CORREGATED METAL STORM DRAIN LINE
	EXISTING FLOWLINE
BARBED WIRE FENCE	BARBED WIRE FENCE
CHAIN LINK FENCE	CHAIN LINK FENCE
WOOD FENCE	WOOD FENCE
	GUARD RAIL / BARRICADE
	EXISTING TREE LINE
	EXISTING TREE

PAVING PLAN LEGEND

	11" 4,200 P.S.I. REINFORCED CONCRETE STREET PAVEMENT (MIN. 7 SACK MIX)
	12" 5,000 P.S.I. REINFORCED CONCRETE STREET PAVEMENT (MIN. 7.5 SACK MIX)
	11" 4,200 P.S.I. COLORED/STAMPED REINFORCED CONCRETE STREET PAVEMENT (MIN. 7 SACK MIX)
	6" 3,600 P.S.I. REINFORCED CONCRETE DRIVE PAVEMENT (MIN. 6.5 SACK MIX)
	4" 3,000 P.S.I. REINFORCED CONCRETE SIDEWALK (MIN. 5.5 SACK MIX)
	MEDIAN CAP
	BERMUDA GRASS SOD
	HYDROMULCH SEEDING
	PROPOSED EDGE OF PAVEMENT
	FUTURE EDGE OF PAVEMENT
L2	LINE IDENTIFIED IN LINE TABLE
C2	CURVE IDENTIFIED IN CURVE TABLE
B/B	BACK OF CURB TO BACK OF CURB
	PROPOSED CHAIN LINK FENCE
	PROPOSED BARBED WIRE FENCE
	PROPOSED WOOD / STOCKADE FENCE
	PROPOSED BARRICADE / GUARD RAIL
	PROPOSED RETAINING WALL
	HANDICAP PARKING
	INDICATES CUT OR FILL SLOPE
	PROPOSED SIGN & POST
	INDICATES PROPOSED RECESSED CURB INLET
	INDICATES PROPOSED STANDARD CURB INLET
PB	PULLBOX
	PROPOSED 2" PVC STREET LIGHT CONDUIT
LPB	STREET LIGHT POLE BASE

DRAINAGE PLAN LEGEND

A-1 / 2.00	DRAINAGE AREA DESIGNATION DRAINAGE AREA (ACRES)
	WATERSHED LIMITS
	MAJOR DRAINAGE AREA DIVIDE
	MAJOR DRAINAGE AREA SUB-DIVIDE
	ZONING BOUNDARY
	FLOW DIRECTION ARROW
L2	LINE IDENTIFIED IN LINE TABLE
C2	CURVE IDENTIFIED IN CURVE TABLE
	INDICATES PROPOSED RECESSED CURB INLET
	INDICATES PROPOSED STANDARD CURB INLET
	INDICATES PROPOSED DROP INLET
	INDICATES PROPOSED JUNCTION BOX
27" RCP	PROPOSED STORM DRAIN
27" RCP	FUTURE STORM DRAIN
	PROPOSED SWALE

EROSION CONTROL LEGEND

	LIMITS OF OPERATOR DAY TO DAY OPERATIONAL CONTROL
	PROPOSED SWALE
	INDICATES STABILIZED CONSTRUCTION ENTRANCE
	INDICATES UN-REINFORCED SILT FENCE
	INDICATES REINFORCED SILT FENCE
	INDICATES ROCK BERM
	INDICATES DROP INLET PROTECTION
	INDICATES PROPOSED INLET TREATMENT
	CURLEX EROSION CONTROL BLANKET
	INDICATES SEDIMENT TRAP OUTLET CONTROL DEVICE
640	EXISTING CONTOUR LINE
640	PROPOSED CONTOUR LINE

WATER & SANITARY SEWER PLAN LEGEND

24" W	PROPOSED 16" OR LARGER WATER MAIN
8" W	PROPOSED 12" OR SMALLER WATER MAIN
24" W	FUTURE 16" OR LARGER WATER MAIN
8" W	FUTURE 12" OR SMALLER WATER MAIN
	PROPOSED GATE VALVE
	PROPOSED REDUCER
	PROPOSED WATER METER
	PROPOSED FIRE HYDRANT
	PROPOSED AIR RELEASE VALVE OR BLOW-OFF VALVE
24" SS	PROPOSED 16" OR LARGER SANITARY SEWER
8" SS	PROPOSED 12" OR SMALLER SANITARY SEWER
24" SS	FUTURE 16" OR LARGER SANITARY SEWER
8" SS	FUTURE 12" OR SMALLER SANITARY SEWER
	PROPOSED SANITARY SEWER MANHOLE
	PROPOSED SANITARY SEWER CLEANOUT

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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD TO JOHN KING BOULEVARD
TOPOGRAPHIC LEGEND

STATE OF TEXAS
PHILIP L. GRAHAM
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LICENSED PROFESSIONAL ENGINEER
5/1/2015

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LAST SHEET EDIT DATE 5/1/2015
W.A.# 13096

SHEET NO. S001

RECORD PLANS
MAY 1, 2015

PRINTED: 5/1/2015 STB FILE: WIER-PAVING.STB LAST SAVED: 4/21/2015 8:24 AM SAVED BY: CLAYTONT FILE: LEGEND-13096.DWG

PAVING, PAVEMENT MARKING, EROSION CONTROL & TRAFFIC CONTROL QUANTITIES

ITEM No.	DESCRIPTION	SHEET UNITS	TOTAL QUANTITY	P101	P102	P103	P104	P105	P106	M101	M102	G101 & G102
101	Unclassified Excavation	CY	38,869	2,133	1,281	668	1,615	81	550			32,541
102	Controlled Density Compacted Fill	CY	9,382	588	335	2,234	173	11	12			6,029
103	Right-of-way Preparation (Clearing & Grubbing)	LS	1									
104	Remove Existing Concrete Street Pavement	SY	252	119				93	40			
105	Sawcut & Remove Existing Concrete Curb	LF	636	24			162	251	199			
106	Remove Existing Pavestone Median Cap	SY	15					15				
107	Remove Existing Curb Inlet	EA	1				1					
108	Remove Existing Box Culvert Headwall	EA	1	1								
109	Remove Existing Barbed Wire Fence	LF	135				135					
110	Remove Existing Guard Rail	LF	56	56								
111	Remove Existing Street Light Base	EA	1						1			
112	8" Lime Stabilized Subgrade (48 lbs/SY)	SY	16,646	3,262	3,811	3,764	4,402		1,407			
113	Hydrated Lime	TON	399.5	78.3	91.5	90.3	105.6		33.8			
114	11" Reinforced Concrete Street Pavement	SY	13,303	2,706	2,989	2,946	3,610		1,052			
115	11" Reinforced Colored & Stamped Concrete Street Pavement	SY	248				248					
116	12" Reinforced Concrete Street Pavement on 6" Compacted Subgrade	SY	388					388				
117	6" Reinforced Concrete Drive Pavement	SY	83				83					
118	Curb Ramp (Handicap Ramp) per City Standard Detail	EA	5	2			2		1			
119	Curb Ramp (Handicap Ramp) per Detail Sheet P301	EA	2				2					
120	4" Thick Concrete Sidewalk	SY	1,535	201	536	515	283					
121	Concrete Median Cap per Detail Sheet P301	SY	412	119	81	37	116	13	46			
122	Landscape Maintenance Ramp	EA	4	1	1	1		1				
123	Place 4" Topsoil on Parkways & Slopes	SY	31,199	2,036	1,750	2,123	1,453	182	320			23,335
124	Bermuda Grass Sod Median & Parkways	SY	4,431	898	1,073	1,188	770	182	320			
125	Hydromulch Seed Slopes	SY	26,768	1,138	677	935	683					23,335
126	Metal Beam Guard Fence Low Speed Transition per Detail Sheet P304	LF	19			19						
127	Metal Beam Guard Fence per Detail Sheet P303	LF	50			50						
128	Single Guard Rail Terminal per Detail Sheet P305	EA	2			2						
129	Adjust Existing Water Valve to Finished Grade	EA	4	2					2			
130	Adjust Existing Sanitary Sewer Manhole to Finished Grade	EA	2				1	1				
131	Adjust Exist. S.S. Force Main Air Release M.H. to Finished Grade	EA	1					1				
132	2" Schedule 40 PVC Street Light Conduit	LS	1,965	450	505	505	495		10			
133	Street Light Pole Base	EA	8	2	2	2	1		1			
134	TxDOT Type "C" Pullbox	EA	10	4	1	1	4					
135	4"x4" Type I-C Reflectorized Raised Pavement Markers (2)	EA	154							154		
136	4"x4" Type II-C Reflectorized Raised Pavement Markers (2)	EA	286							246	40	
137	4" Round Non-reflectorized White Ceramic Raised Pavement Markers (2)	EA	943							883	60	
138	DELETED (2)											
139	4"x4" Type I-A Reflectorized Raised Pavement Markers (2)	EA	27								27	
140	4"x4" Type II-A Reflectorized Raised Pavement Markers (2)	EA	87								87	
141	4" Round Non-reflectorized Yellow Ceramic Raised Pavement Markers (2)	EA	102								102	
142	DELETED (2)											
143	24" Type I-White Thermoplastic Stop Bar	LF	102							68	34	
144	Type 1 White Thermoplastic Intersection Crosswalk (24" x 8' Bar)	EA	44							31	13	
145	Type I White Thermoplastic Left Turn Arrow	EA	4							3	1	
146	Type I White Thermoplastic Right Turn Arrow	EA	2							2		
147	Type I White Thermoplastic Through/Right Turn Arrow	EA	1								1	
148	Type I White Thermoplastic Through Arrow	EA	1								1	
149	Type I White Thermoplastic Word "ONLY"	EA	6							5	1	
150	Stop Sign R1-1	EA	3							2	1	
151	Speed Limit Sign R2-1	EA	2							2		
152	Left Turn Only Sign R3-7L	EA	2							2		
153	Right Turn Only Sign R3-7R	EA	2							2		
154	Keep Right Sign R4-7	EA	8							7	1	
155	Two-Way Traffic Sign W6-3	EA	1								1	
156	Lane Ends Merge Right Sign W9-2T	EA	1								1	
157	Erosion Control Measures	LS	1									
158	Traffic Control Measures	LS	1									

STORM DRAIN QUANTITIES

ITEM No.	DESCRIPTION	SHEET UNITS	TOTAL QUANTITY	D105	D106	D107	D108	D109	D201	G101 & G102	P106
201	18" R.C.P. Storm Drain Pipe Class III	LF	310	105				10	195		
202	21" R.C.P. Storm Drain Pipe Class III	LF	166						166		
203	27" R.C.P. Storm Drain Pipe Class III	LF	116				105		11		
204	30" R.C.P. Storm Drain Pipe Class III	LF	285			87	198				
205	36" R.C.P. Storm Drain Pipe Class III	LF	567			307	247		13		
206	48" R.C.P. Storm Drain Pipe Class III	LF	150			150					
207	66" R.C.P. Storm Drain Pipe Class III	LF	49		49						
208	Single 6'x4' Box Culvert	LF	85		85						
209	Single 8'x5' Box Culvert	LF	59	59							
210	5' Recessed Curb Inlet	EA	1	1							
211	10' Recessed Curb Inlet	EA	10	1		4	4	1			
212	15' Recessed Curb Inlet	EA	1								1
213	3'x3' Drop Inlet	EA	2			1	1				
214	5'x5' Drop Inlet	EA	1			1					
215	4:1 8'x5' Box Culvert SW-0 Headwall	EA	1	1							
216	4:1 66" Type SETP-PD Headwall	EA	1		1						
217	Type PW Headwall	EA	2		2						
218	Detention Pond Outlet Structure & Headwall	EA	1		1						
219	Type C221 Combination Rail	LF	129		129						
220	Type PR1 Pedestrian Handrail	LF	78		78						
221	Concrete Pilot Channel	SY	185							185	
222	Minimum 12" Diameter Grouted Rock Riprap	SY	252	85	167						
223	Trench Safety	LF	1,787	164	134	544	550	10	385		

WATER QUANTITIES

ITEM No.	DESCRIPTION	SHEET UNITS	TOTAL QUANTITY	U101	U102	U103	U104	U105
301	6" Water Main C-900 Class 200 DR 14 PVC	LF	20 (3)	5	5		10	
302	8" Water Main C-900 Class 200 DR 14 PVC	LF	189 (3)	78	5	9	97	
303	12" Water Main C-900 Class 200 DR 14 PVC	LF	1,822	400	500	500	422	
304	16" Water Main C-905 Class 200 DR 18 PVC	LF	140					140
305	6" Gate Valve	EA	4 (3)	1	1		2	
306	8" Gate Valve	EA	6 (3)	1	1	2	2	
307	12" Gate Valve	EA	6 (3)	1	1	2	2	
308	16" Butterfly Valve (2)	EA	2					2
309	Make Dry Connection to Existing 12" Water Main	EA	1	1				
310	Fire Hydrant Assembly	EA	4 (3)	1	1		2	
311	6" Blow-off Assembly	EA	1			1		
312	2" Air Release Valve	EA	1	1				
313	2" Irrigation Water Service Tap & Corporation Stop	EA	3	1	1	1		
314	Type "1" Flush Point	EA	1					1
315	4" PVC Irrigation Sleeve	LF	88	28	30	30		
316	18" Steel Casing Pipe	LF	60			60		
317	Ductile Iron Fittings	TON	5.9 (3)	1.1	1.1	0.9	2.5	0.3
318	Trench Safety	LF	2,171 (3)	483	510	509	529	140

SANITARY SEWER QUANTITIES

ITEM No.	DESCRIPTION	SHEET UNITS	TOTAL QUANTITY	U106	
401	8" SDR-26 PVC Sanitary Sewer	LF	45	45	
402	4' Diameter Sanitary Sewer Manhole to 8' Depth	EA	1	1	
403	Extra Depth Manhole	VF	5.0	5.0	
404	Connect to Existing Manhole	EA	1	1	
405	Trench Safety	LF	45	45	

TREE PLANTING QUANTITIES

ITEM No.	DESCRIPTION	SHEET UNITS	TOTAL QUANTITY	LS-2	
601	Bald Cypress Trees	EA	123	123	

RECORD PLANS
MAY 1, 2015

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	CHANGED W.L. '4' FROM 12" TO 16"	4/16/14	PLG
2	CHANGED 16"G.V. TO BUTTERFLY VALVE & REVISED PAVEMENT MARKER QUANTITIES	4/21/14	PLG
3	REVISED WATER QUANTITIES	8/13/14	PLG

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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD

SHEET QUANTITIES

STATE OF TEXAS
PHILIP L. GRAHAM
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5/1/2015

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SHEET NO.
S002

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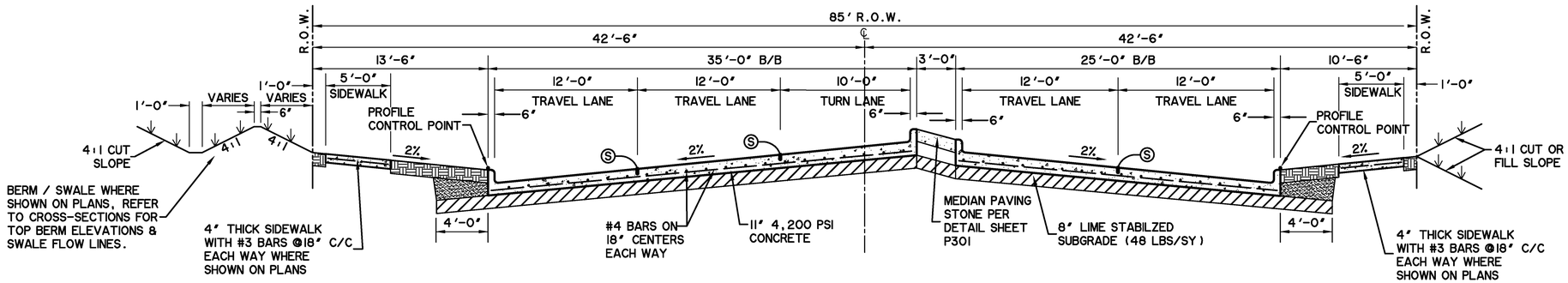
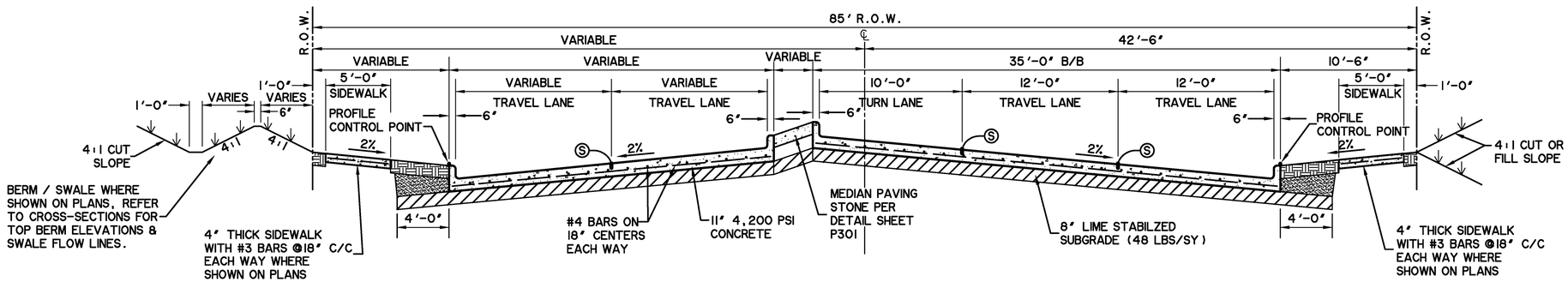


JUSTIN ROAD TYPICAL SECTION
STA 41+64 TO STA 42+23

N.T.S.



JUSTIN ROAD TYPICAL SECTION
STA 40+44 TO STA 41+03

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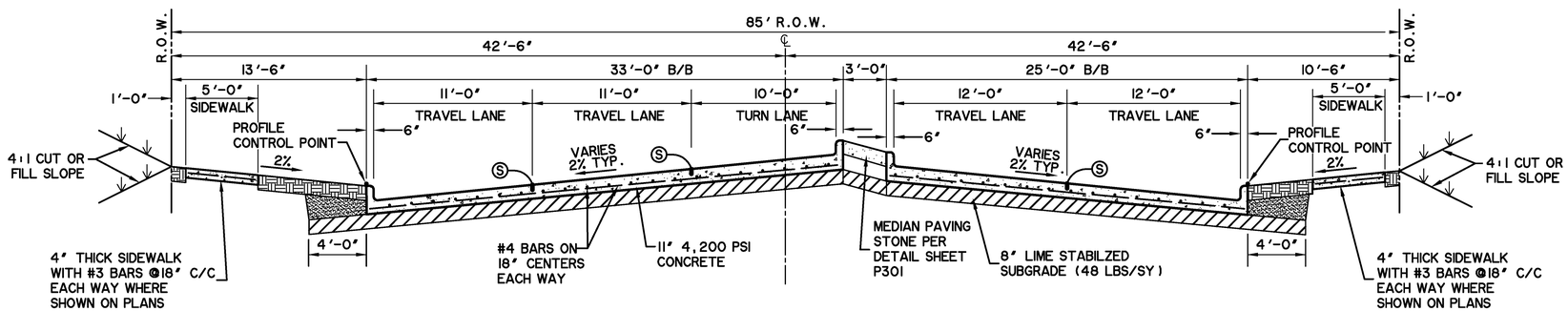

JUSTIN ROAD TYPICAL SECTION
STA 38+00 TO STA 38+83

N.T.S.

NOTES:
1. CONSTRUCT PAVEMENT IN ACCORDANCE WITH THE CITY STANDARD CONSTRUCTION DETAILS EXCEPT AS NOTED HEREON.
2. PLACE BERMUDA GRASS SOD IN PARKWAY AND MEDIANS AS PER SPECIFICATIONS.
3. IMPORT AND PLACE MINIMUM 4" TOPSOIL ON CUT AND FILL SLOPES. HYDROMULCH SEED WITH BERMUDA GRASS AS PER SPECIFICATIONS.
4. COMPACT ALL FILLS TO MINIMUM 95% OF STANDARD PROCTOR DENSITY. FILL COMPACTION SHALL BE PERFORMED WITH A SHEEPSFOOT ROLLER.
5. BACKFILL ALL CURBS WITH ON-SITE BROWN CLAY SOILS COMPACTED TO A MINIMUM 95% OF STANDARD PROCTOR DENSITY. TYPICAL ALL ROADWAY AND STREET CURBS THIS PROJECT.
6. 5'-0" CONCRETE SIDEWALK SHALL BE CONSTRUCTED WITH DEVELOPMENT OF ADJACENT PROPERTY EXCEPT WHERE SHOWN ON THE PLANS.

Ⓢ SAWED LONGITUDINAL CONTRACTION JOINT

RECORD PLANS
MAY 1, 2015

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WA# 13096
SHEET NO. P001

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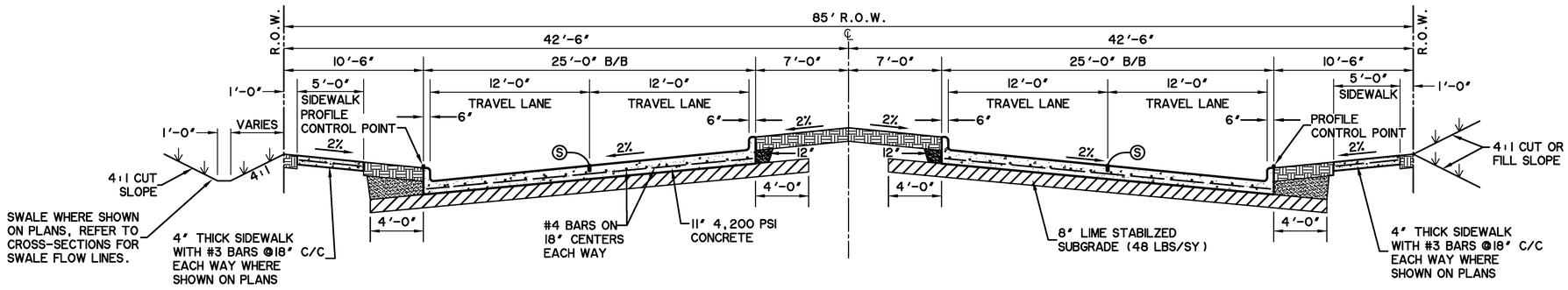

JUSTIN ROAD TYPICAL SECTION
STA 47+79 TO STA 50+50

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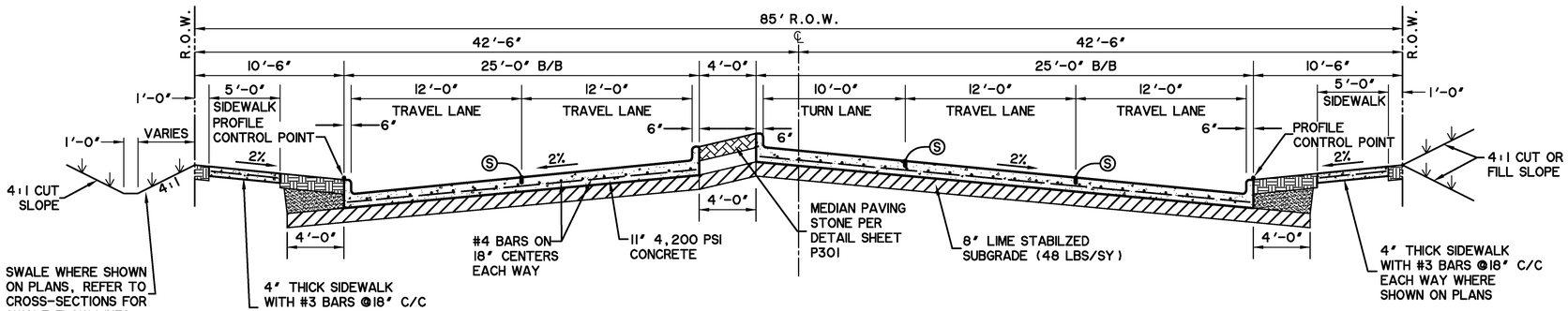

JUSTIN ROAD TYPICAL SECTION
STA 46+36 TO STA 46+94

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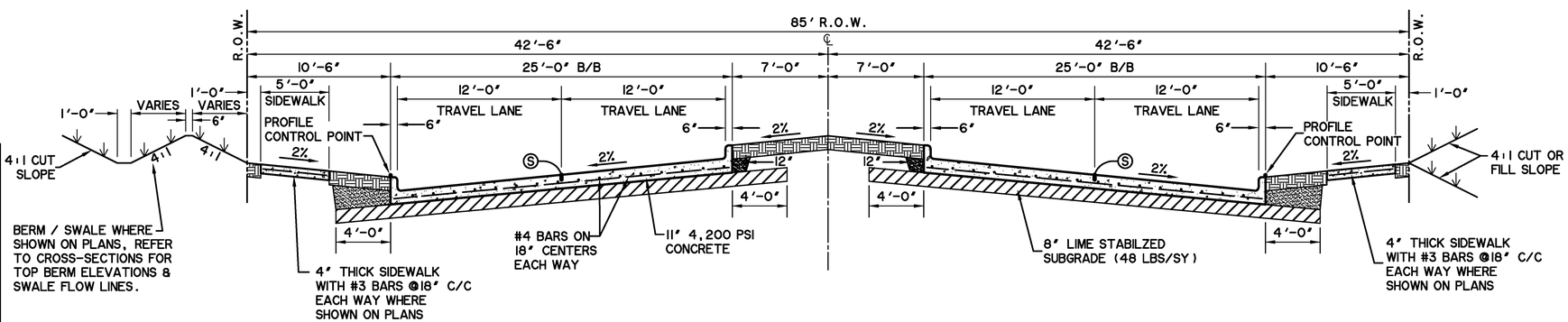

JUSTIN ROAD TYPICAL SECTION
STA 43+19 TO STA 45+27

N.T.S.

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2. PLACE BERMUDA GRASS SOD IN PARKWAY AND MEDIANS AS PER SPECIFICATIONS.
3. IMPORT AND PLACE MINIMUM 4" TOPSOIL ON CUT AND FILL SLOPES. HYDROMULCH SEED WITH BERMUDA GRASS AS PER SPECIFICATIONS.
4. COMPACT ALL FILLS TO MINIMUM 95% OF STANDARD PROCTOR DENSITY. FILL COMPACTION SHALL BE PERFORMED WITH A SHEEPSFOOT ROLLER.
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P002

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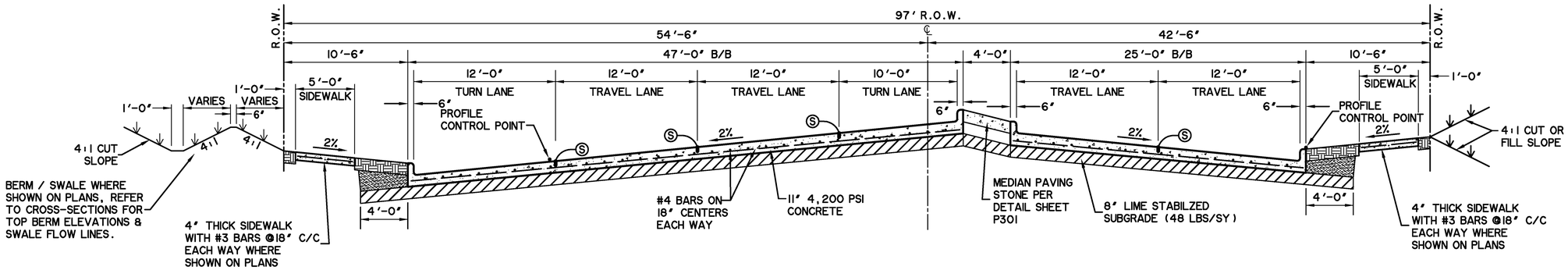
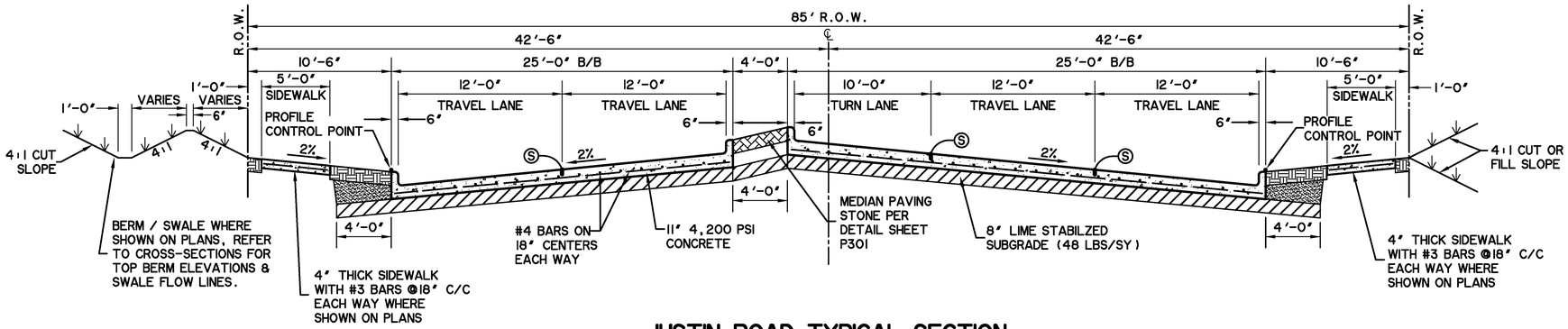


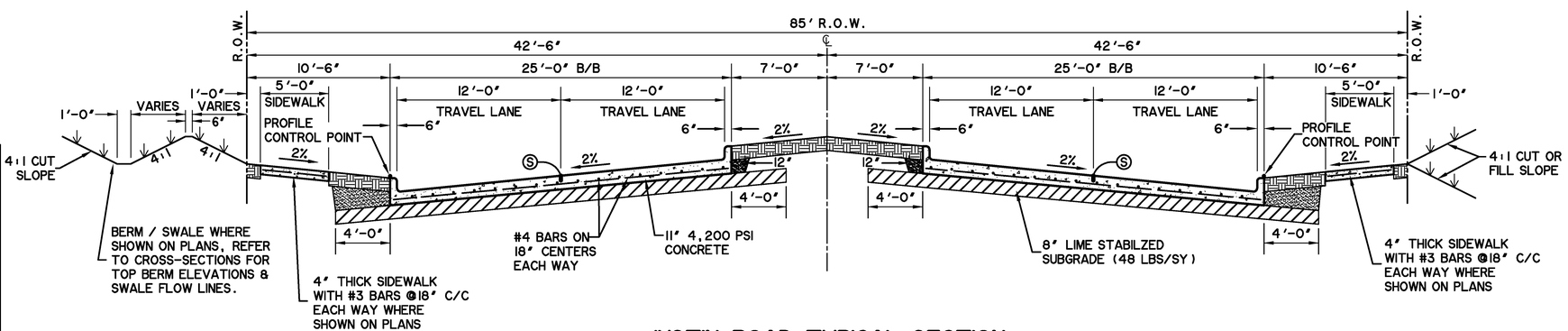
JUSTIN ROAD TYPICAL SECTION
STA 54+04 TO STA 54+50

N.T.S.



JUSTIN ROAD TYPICAL SECTION
STA 52+06 TO STA 52+46

N.T.S.



JUSTIN ROAD TYPICAL SECTION
STA 50+50 TO STA 51+07

N.T.S.

Ⓢ SAWED LONGITUDINAL CONTRACTION JOINT

RECORD PLANS
MAY 1, 2015

NOTES:

1. CONSTRUCT PAVEMENT IN ACCORDANCE WITH THE CITY STANDARD CONSTRUCTION DETAILS EXCEPT AS NOTED HEREON.
2. PLACE BERMUDA GRASS SOD IN PARKWAY AND MEDIANS AS PER SPECIFICATIONS.
3. IMPORT AND PLACE MINIMUM 4" TOPSOIL ON CUT AND FILL SLOPES. HYDROMULCH SEED WITH BERMUDA GRASS AS PER SPECIFICATIONS.
4. COMPACT ALL FILLS TO MINIMUM 95% OF STANDARD PROCTOR DENSITY. FILL COMPACTION SHALL BE PERFORMED WITH A SHEEPSFOOT ROLLER.
5. BACKFILL ALL CURBS WITH ON-SITE BROWN CLAY SOILS COMPACTED TO A MINIMUM 95% OF STANDARD PROCTOR DENSITY. TYPICAL ALL ROADWAY AND STREET CURBS THIS PROJECT.
6. 5'-0" CONCRETE SIDEWALK SHALL BE CONSTRUCTED WITH DEVELOPMENT OF ADJACENT PROPERTY EXCEPT WHERE SHOWN ON THE PLANS.

PREPARED BY:
WIER & ASSOCIATES, INC.
ENGINEERS SURVEYORS LAND PLANNERS
701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
TYPICAL SECTION

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
5/1/2015

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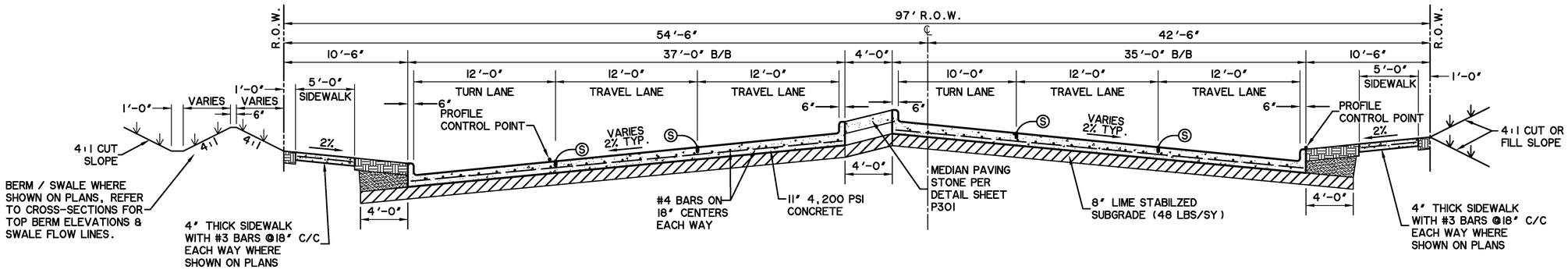

JUSTIN ROAD TYPICAL SECTION
STA 55+61 TO STA 55+92

N.T.S.

Ⓢ SAWED LONGITUDINAL CONTRACTION JOINT

RECORD PLANS
MAY 1, 2015

NOTES:

1. CONSTRUCT PAVEMENT IN ACCORDANCE WITH THE CITY STANDARD CONSTRUCTION DETAILS EXCEPT AS NOTED HEREON.
2. PLACE BERMUDA GRASS SOD IN PARKWAY AND MEDIANS AS PER SPECIFICATIONS.
3. IMPORT AND PLACE MINIMUM 4" TOPSOIL ON CUT AND FILL SLOPES. HYDROMULCH SEED WITH BERMUDA GRASS AS PER SPECIFICATIONS.
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5. BACKFILL ALL CURBS WITH ON-SITE BROWN CLAY SOILS COMPACTED TO A MINIMUM 95% OF STANDARD PROCTOR DENSITY. TYPICAL ALL ROADWAY AND STREET CURBS THIS PROJECT.
6. 5'-0" CONCRETE SIDEWALK SHALL BE CONSTRUCTED WITH DEVELOPMENT OF ADJACENT PROPERTY EXCEPT WHERE SHOWN ON THE PLANS.

PREPARED BY:
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Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
TYPICAL SECTION

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
5/1/2015

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SHEET NO.
P004

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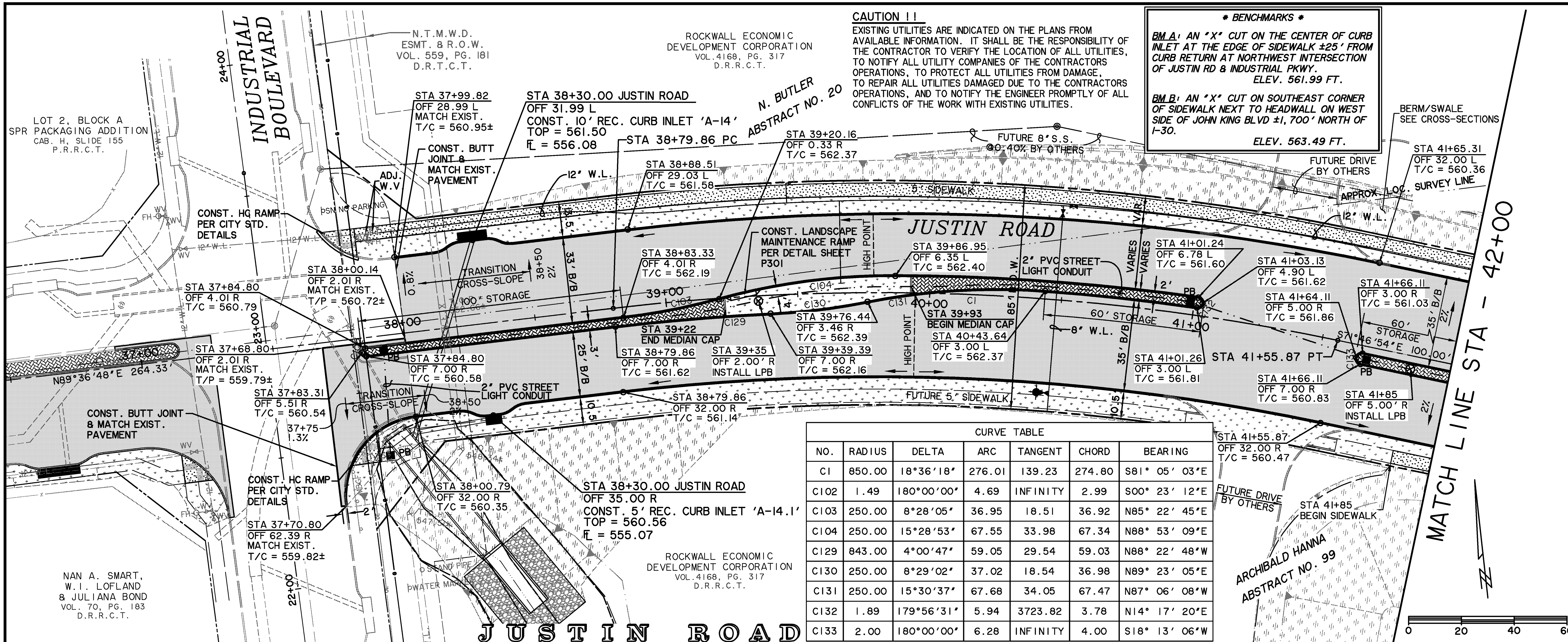
CAUTION !!

EXISTING UTILITIES ARE INDICATED ON THE PLANS FROM AVAILABLE INFORMATION. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION OF ALL UTILITIES, TO NOTIFY ALL UTILITY COMPANIES OF THE CONTRACTORS OPERATIONS, TO PROTECT ALL UTILITIES FROM DAMAGE, TO REPAIR ALL UTILITIES DAMAGED DUE TO THE CONTRACTORS OPERATIONS, AND TO NOTIFY THE ENGINEER PROMPTLY OF ALL CONFLICTS OF THE WORK WITH EXISTING UTILITIES.

* BENCHMARKS *

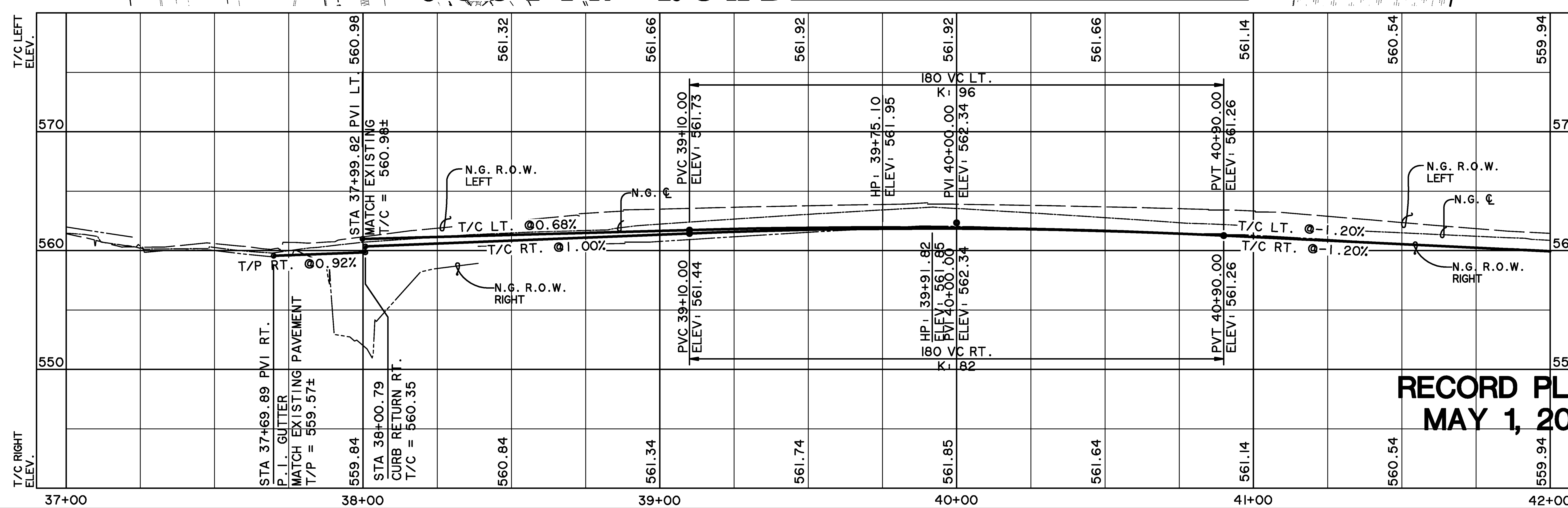
BM A: AN "X" CUT ON THE CENTER OF CURB INLET AT THE EDGE OF SIDEWALK ±25' FROM CURB RETURN AT NORTHWEST INTERSECTION OF JUSTIN RD & INDUSTRIAL PKWY.
ELEV. 561.99 FT.

BM B: AN "X" CUT ON SOUTHEAST CORNER OF SIDEWALK NEXT TO HEADWALL ON WEST SIDE OF JOHN KING BLVD ±1,700' NORTH OF I-30.
ELEV. 563.49 FT.



INDUSTRIAL BOULEVARD
N.T.M.W.D. ESMT. & R.O.W. VOL. 559, PG. 181 D.R.T.C.T.
ROCKWALL ECONOMIC DEVELOPMENT CORPORATION VOL. 4168, PG. 317 D.R.R.C.T.
LOT 2, BLOCK A SPR PACKAGING ADDITION CAB. H, SLIDE 155 P.R.R.C.T.
N. BUTLER ABSTRACT NO. 20
JUSTIN ROAD
MATCH LINE STA - 42+00
ARCHIBALD HANNA ABSTRACT NO. 99
NAN A. SMART, W.I. LOFLAND & JULIANA BOND VOL. 70, PG. 183 D.R.R.C.T.
STA 38+30.00 JUSTIN ROAD OFF 31.99 L CONST. 10' REC. CURB INLET 'A-14' TOP = 561.50 FL = 556.08
STA 38+30.00 JUSTIN ROAD OFF 35.00 R CONST. 5' REC. CURB INLET 'A-14.1' TOP = 560.56 FL = 555.07
STA 38+79.86 PC
STA 41+55.87 PT
CONST. LANDSCAPE MAINTENANCE RAMP PER DETAIL SHEET P301
CONST. HC RAMP PER CITY STD. DETAILS
CONST. BUTT JOINT & MATCH EXIST. PAVEMENT
FUTURE 8' S.S. @0.40% BY OTHERS
FUTURE 5' SIDEWALK
FUTURE DRIVE BY OTHERS
BERM/SWALE SEE CROSS-SECTIONS
2" PVC STREET LIGHT CONDUIT
STA 39+93 BEGIN MEDIAN CAP
STA 39+22 END MEDIAN CAP
STA 41+85 BEGIN SIDEWALK
JUSTIN ROAD

CURVE TABLE						
NO.	RADIUS	DELTA	ARC	TANGENT	CHORD	BEARING
C1	850.00	18°36'18"	276.01	139.23	274.80	S81° 05' 03"E
C102	1.49	180°00'00"	4.69	INFINITY	2.99	S00° 23' 12"E
C103	250.00	8°28'05"	36.95	18.51	36.92	N85° 22' 45"E
C104	250.00	15°28'53"	67.55	33.98	67.34	N88° 53' 09"E
C129	843.00	4°00'47"	59.05	29.54	59.03	N88° 22' 48"W
C130	250.00	8°29'02"	37.02	18.54	36.98	N89° 23' 05"E
C131	250.00	15°30'37"	67.68	34.05	67.47	N87° 06' 08"W
C132	1.89	179°56'31"	5.94	3723.82	3.78	N14° 17' 20"E
C133	2.00	180°00'00"	6.28	INFINITY	4.00	S18° 13' 06"W



T/C LEFT ELEV.
T/C RIGHT ELEV.
180 VC LT. K: 96
180 VC RT. K: 82
STA 37+99.82 PVI LT. MATCH EXISTING T/C = 560.98±
STA 37+69.89 PVI RT. P.I. GUTTER MATCH EXISTING PAVEMENT T/P = 559.57±
STA 38+00.79 CURB RETURN RT. T/C = 560.35
PVC 39+10.00 ELEV: 561.73
HP: 39+75.10 ELEV: 561.95
PVI 40+00.00 ELEV: 562.34
PVT 40+90.00 ELEV: 561.26
PVC 39+10.00 ELEV: 561.44
PVT 40+90.00 ELEV: 561.26
T/C LT. @0.68%
T/C RT. @1.00%
T/P RT. @0.92%
T/C LT. @-1.20%
T/C RT. @-1.20%
N.G. R.O.W. LEFT
N.G. R.O.W. RIGHT
N.G. ℄
37+00
38+00
39+00
40+00
41+00
42+00

RECORD PLANS
MAY 1, 2015

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Texas Firm Registration No. F-2776 www.WierAssociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD TO JOHN KING BOULEVARD
PAVING PLAN & PROFILE
BEGINNING TO STA 42+00

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
5/1/2015

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WA# 13096

SHEET NO. P101

RECORD PLANS
MAY 1, 2015

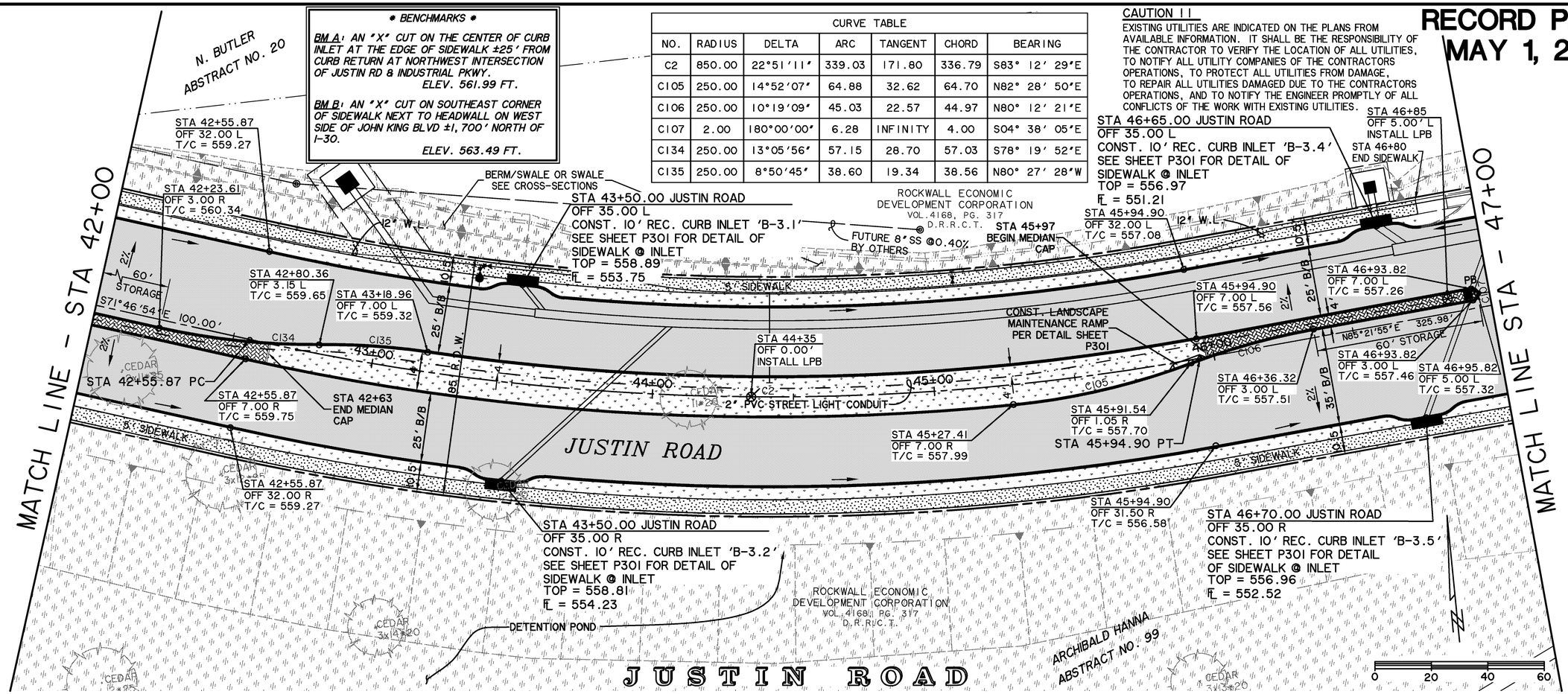
*** BENCHMARKS ***

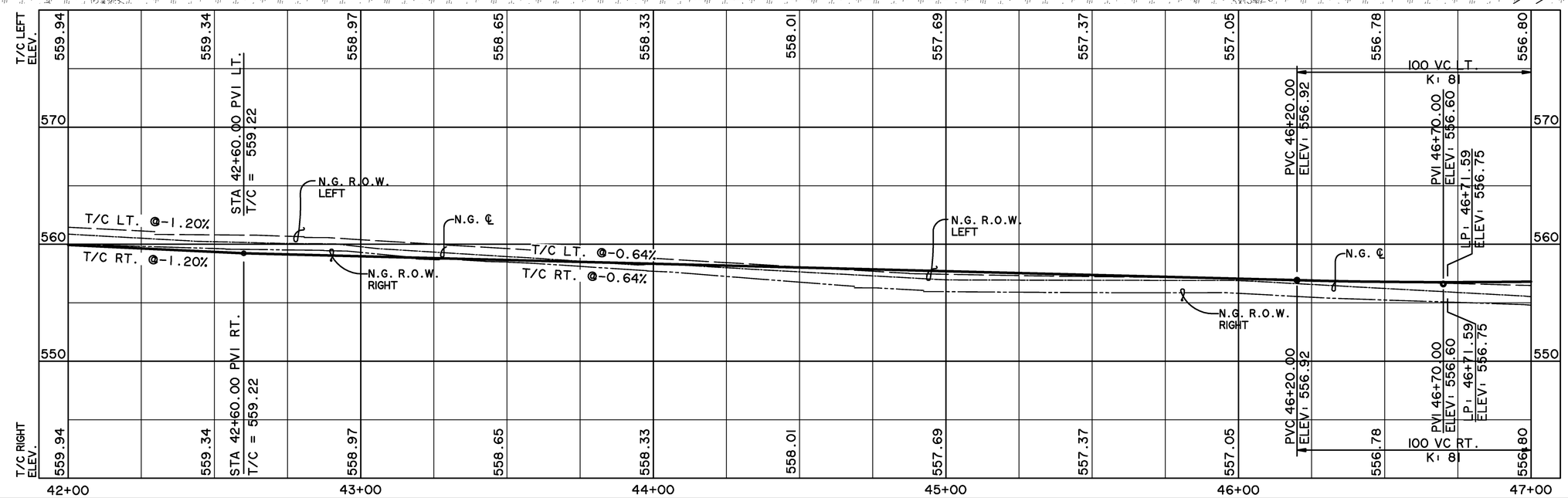
BM A: *AN "X" CUT ON THE CENTER OF CURB INLET AT THE EDGE OF SIDEWALK ±25' FROM CURB RETURN AT NORTHWEST INTERSECTION OF JUSTIN RD & INDUSTRIAL PKWY.*
ELEV. 561.99 FT.

BM B: *AN "X" CUT ON SOUTHEAST CORNER OF SIDEWALK NEXT TO HEADWALL ON WEST SIDE OF JOHN KING BLVD ±1,700' NORTH OF I-30.*
ELEV. 563.49 FT.

CURVE TABLE						
NO.	RADIUS	DELTA	ARC	TANGENT	CHORD	BEARING
C2	850.00	22°51'11"	339.03	171.80	336.79	S83° 12' 29"E
C105	250.00	14°52'07"	64.88	32.62	64.70	N82° 28' 50"E
C106	250.00	10°19'09"	45.03	22.57	44.97	N80° 12' 21"E
C107	2.00	180°00'00"	6.28	INFINITY	4.00	S04° 38' 05"E
C134	250.00	13°05'56"	57.15	28.70	57.03	S78° 19' 52"E
C135	250.00	8°50'45"	38.60	19.34	38.56	N80° 27' 28"W

CAUTION !!
EXISTING UTILITIES ARE INDICATED ON THE PLANS FROM AVAILABLE INFORMATION. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION OF ALL UTILITIES, TO NOTIFY ALL UTILITY COMPANIES OF THE CONTRACTORS OPERATIONS, TO PROTECT ALL UTILITIES FROM DAMAGE, TO REPAIR ALL UTILITIES DAMAGED DUE TO THE CONTRACTORS OPERATIONS, AND TO NOTIFY THE ENGINEER PROMPTLY OF ALL CONFLICTS OF THE WORK WITH EXISTING UTILITIES.





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701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
PAVING PLAN & PROFILE
STA 42+00 TO STA 47+00

PHILIP L. GRAHAM 94719 LICENSED PROFESSIONAL ENGINEER
5/1/2015

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SHEET NO. P102

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CURVE TABLE						
NO.	RADIUS	DELTA	ARC	TANGENT	CHORD	BEARING
C3	850.00	10°34'42"	156.93	78.69	156.71	N80° 04' 34"E
C108	50.00	25°08'29"	21.94	11.15	21.76	S82° 03' 50"E
C109	2.50	129°43'03"	5.66	5.33	4.53	S04° 38' 05"E
C110	50.00	25°08'29"	21.94	11.15	21.76	S72° 47' 41"W
C136	250.00	11°28'42"	50.08	25.13	50.00	N69° 02' 52"E
C137	250.00	11°28'42"	50.08	25.13	50.00	S69° 02' 52"W

CAUTION !!

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*** BENCHMARKS ***

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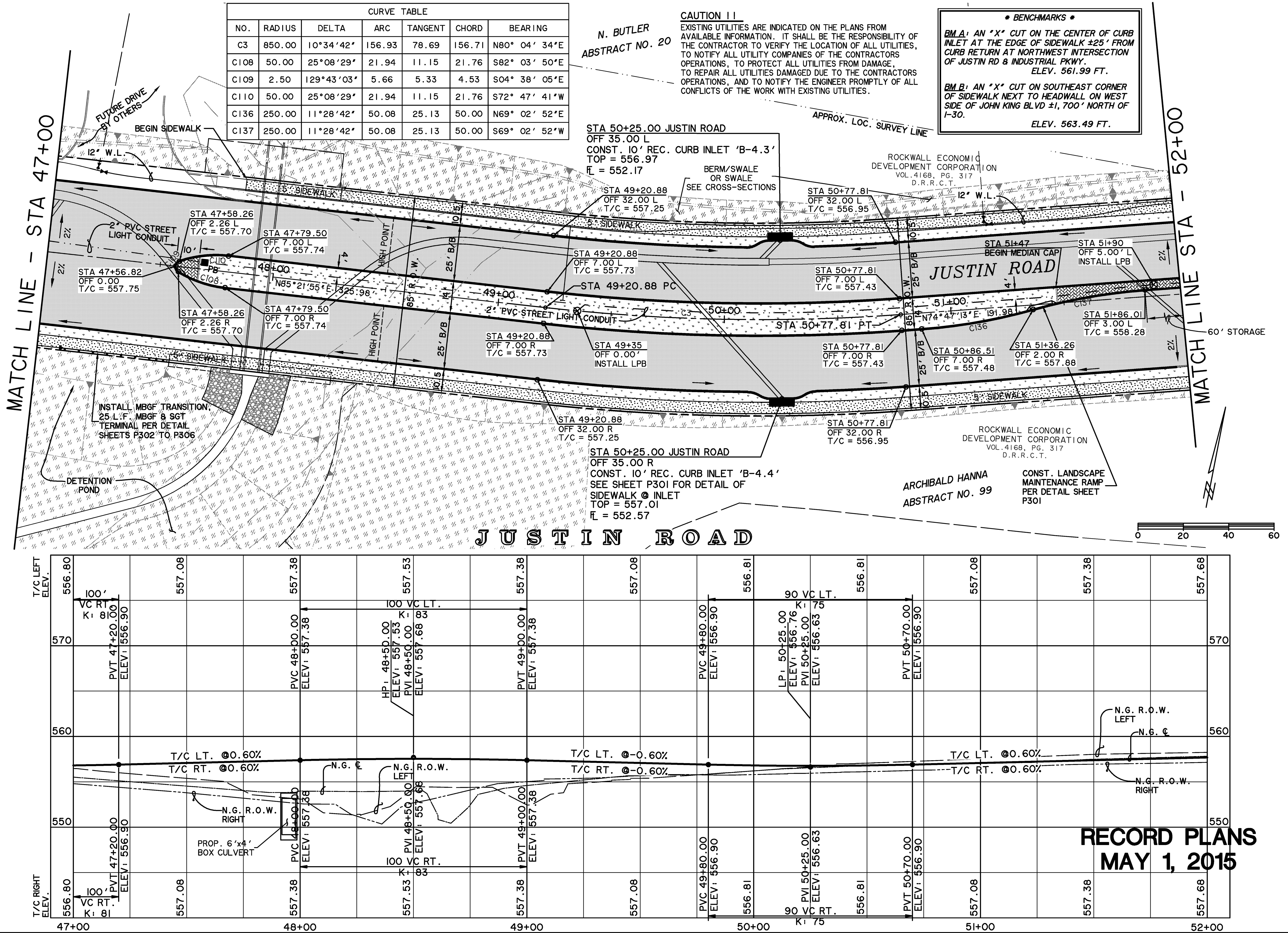
ELEV. 561.99 FT.

BM B: AN "X" CUT ON SOUTHEAST CORNER OF SIDEWALK NEXT TO HEADWALL ON WEST SIDE OF JOHN KING BLVD ±1,700' NORTH OF I-30.
ELEV. 563.49 FT.



RECORD PLANS
MAY 1, 2015

PREPARED BY:
WIER & ASSOCIATES, INC.
ENGINEERS SURVEYORS LAND PLANNERS
701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.WierAssociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD TO JOHN KING BOULEVARD
PAVING PLAN & PROFILE
STA 47+00 TO STA 52+00

STATE OF TEXAS PHILIP L. GRAHAM 94719 LICENSED PROFESSIONAL ENGINEER 5/1/2015

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SHEET NO. P103

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CAUTION !!

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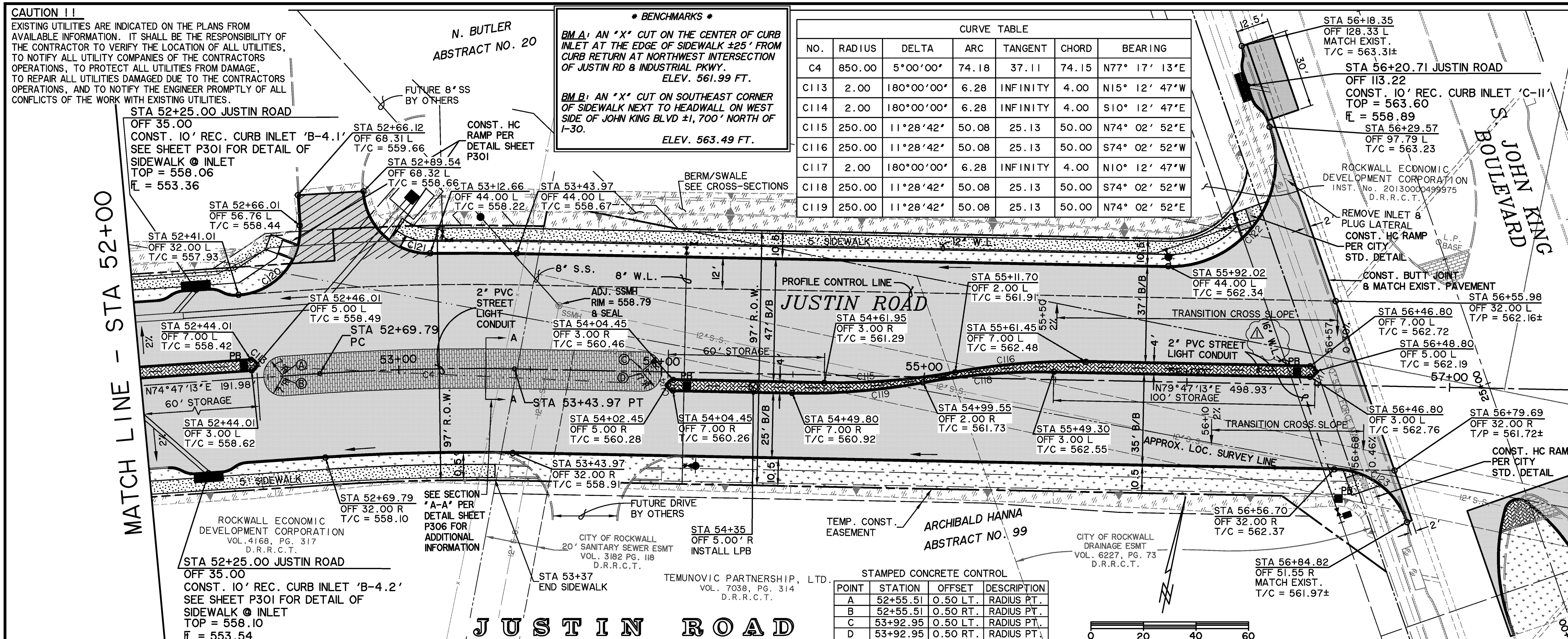
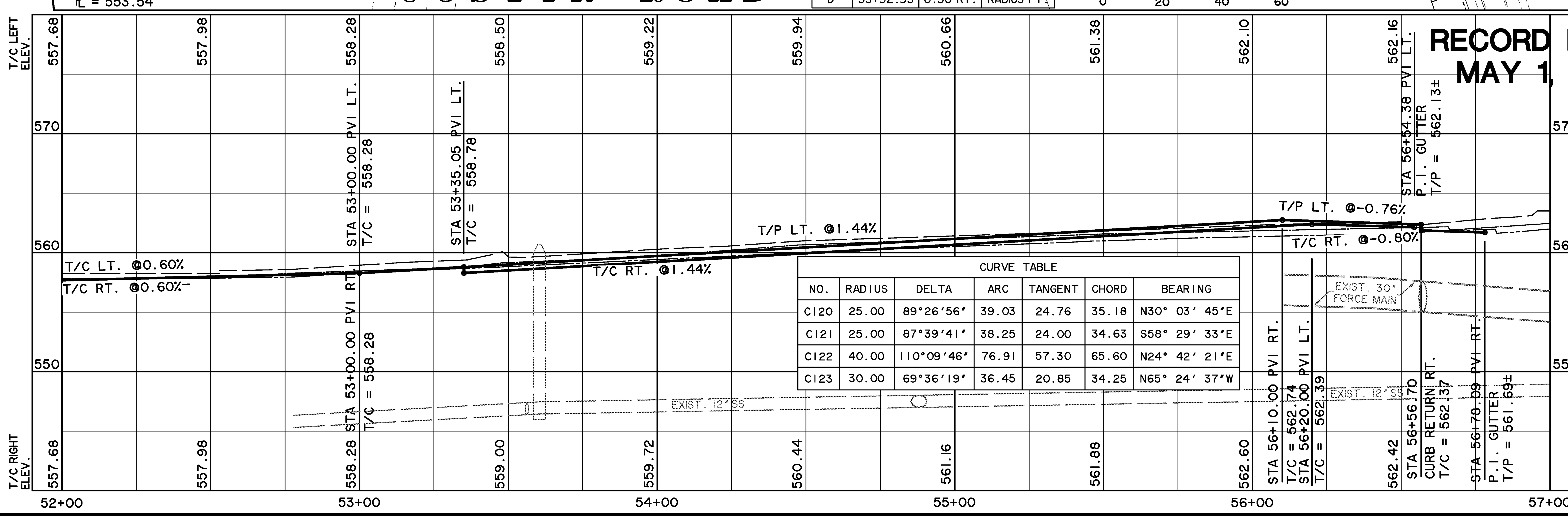
ELEV. 563.49 FT.

CURVE TABLE						
NO.	RADIUS	DELTA	ARC	TANGENT	CHORD	BEARING
C4	850.00	5°00'00"	74.18	37.11	74.15	N77° 17' 13"E
C113	2.00	180°00'00"	6.28	INFINITY	4.00	N15° 12' 47"W
C114	2.00	180°00'00"	6.28	INFINITY	4.00	S10° 12' 47"E
C115	250.00	11°28'42"	50.08	25.13	50.00	N74° 02' 52"E
C116	250.00	11°28'42"	50.08	25.13	50.00	S74° 02' 52"W
C117	2.00	180°00'00"	6.28	INFINITY	4.00	N10° 12' 47"W
C118	250.00	11°28'42"	50.08	25.13	50.00	S74° 02' 52"W
C119	250.00	11°28'42"	50.08	25.13	50.00	N74° 02' 52"E



STAMPED CONCRETE CONTROL			
POINT	STATION	OFFSET	DESCRIPTION
A	52+55.51	0.50 LT.	RADIUS PT.
B	52+55.51	0.50 RT.	RADIUS PT.
C	53+92.95	0.50 LT.	RADIUS PT.
D	53+92.95	0.50 RT.	RADIUS PT.



CURVE TABLE						
NO.	RADIUS	DELTA	ARC	TANGENT	CHORD	BEARING
C120	25.00	89°26'56"	39.03	24.76	35.18	N30° 03' 45"E
C121	25.00	87°39'41"	38.25	24.00	34.63	S58° 29' 33"E
C122	40.00	110°09'46"	76.91	57.30	65.60	N24° 42' 21"E
C123	30.00	69°36'19"	36.45	20.85	34.25	N65° 24' 37"W

RECORD PLANS
MAY 1, 2015

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	CHANGED WATER LINE FROM 12" TO 16"	4/16/14	PLG

PREPARED BY:
WIER & ASSOCIATES, INC.
ENGINEERS SURVEYORS LAND PLANNERS
701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.WierAssociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD TO JOHN KING BOULEVARD
PAVING PLAN & PROFILE
STA 52+00 TO END

STATE OF TEXAS — PHILIP L. GRAHAM 94719 LICENSED PROFESSIONAL ENGINEER 5/1/2015

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SHEET NO. P104

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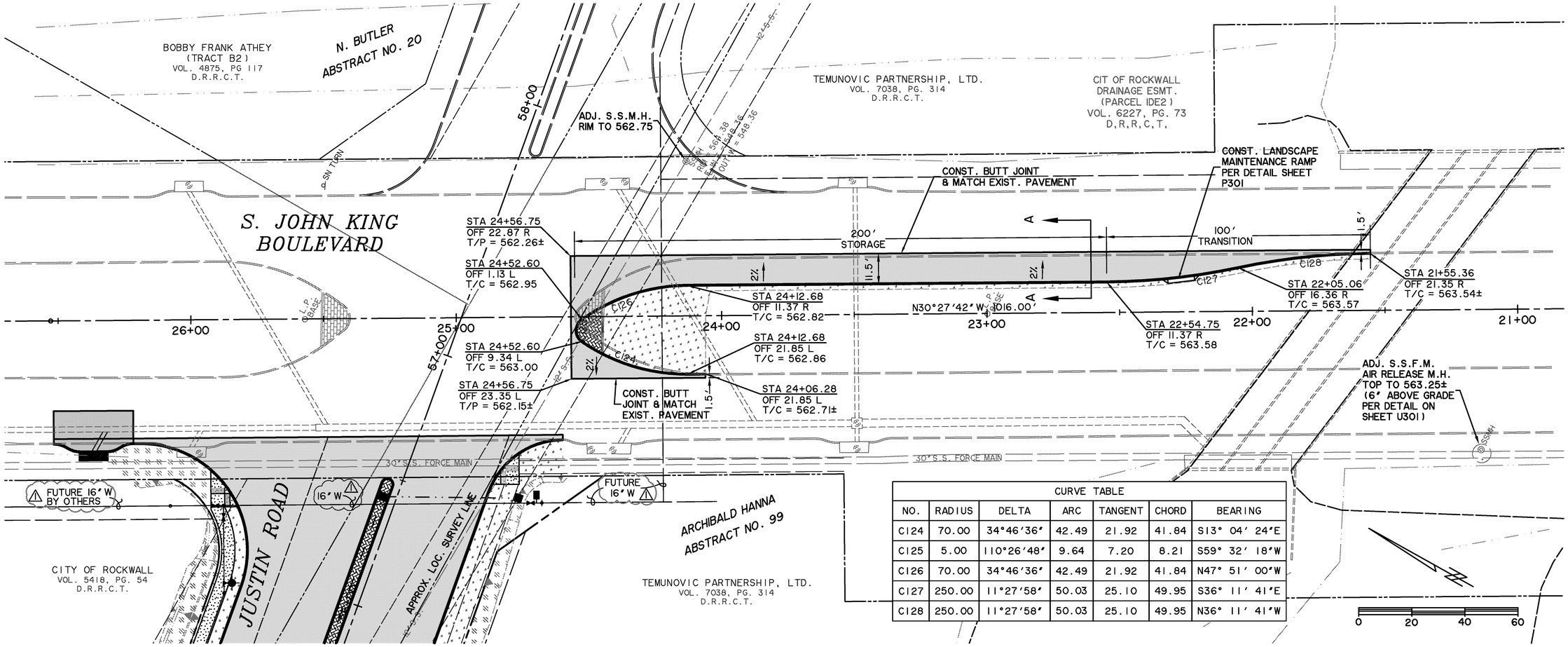

CURVE TABLE						
NO.	RADIUS	DELTA	ARC	TANGENT	CHORD	BEARING
C124	70.00	34°46'36"	42.49	21.92	41.84	S13° 04' 24"E
C125	5.00	110°26'48"	9.64	7.20	8.21	S59° 32' 18"W
C126	70.00	34°46'36"	42.49	21.92	41.84	N47° 51' 00"W
C127	250.00	11°27'58"	50.03	25.10	49.95	S36° 11' 41"E
C128	250.00	11°27'58"	50.03	25.10	49.95	N36° 11' 41"W

JOHN KING BOULEVARD

RECORD PLANS
MAY 1, 2015

CAUTION !!

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*** BENCHMARKS ***

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ELEV. 561.99 FT.

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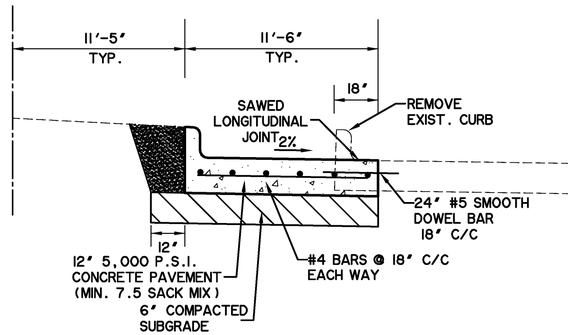
ELEV. 563.49 FT.



TYPICAL SECTION 'A-A'

N.T.S.

REVISIONS		
NO	DESCRIPTION	DATE BY
1	CHANGED WATER LINE FROM 12" TO 16"	4/16/14 PLG

PREPARED BY:
WIER & ASSOCIATES, INC.
ENGINEERS SURVEYORS LAND PLANNERS
701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
JOHN KING BOULEVARD
LEFT TURN LANE

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED
PROFESSIONAL ENGINEER
5/1/2015

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SHEET NO.
P105

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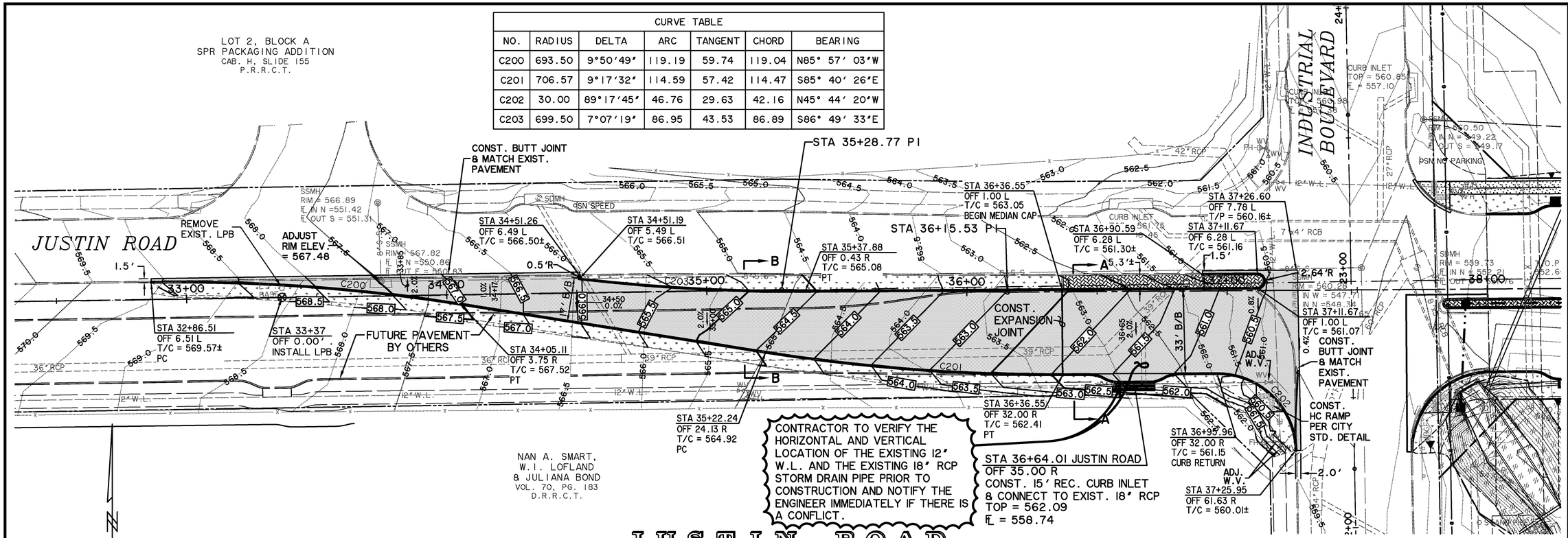
CURVE TABLE						
NO.	RADIUS	DELTA	ARC	TANGENT	CHORD	BEARING
C200	693.50	9°50'49"	119.19	59.74	119.04	N85° 57' 03"W
C201	706.57	9°17'32"	114.59	57.42	114.47	S85° 40' 26"E
C202	30.00	89°17'45"	46.76	29.63	42.16	N45° 44' 20"W
C203	699.50	7°07'19"	86.95	43.53	86.89	S86° 49' 33"E



* BENCHMARKS *

BM A: AN "X" CUT ON THE CENTER OF CURB INLET AT THE EDGE OF SIDEWALK ±25' FROM CURB RETURN AT NORTHWEST INTERSECTION OF JUSTIN RD & INDUSTRIAL PKWY.
ELEV. 561.99 FT.

BM B: AN "X" CUT ON SOUTHEAST CORNER OF SIDEWALK NEXT TO HEADWALL ON WEST SIDE OF JOHN KING BLVD ±1,700' NORTH OF I-30.
ELEV. 563.49 FT.

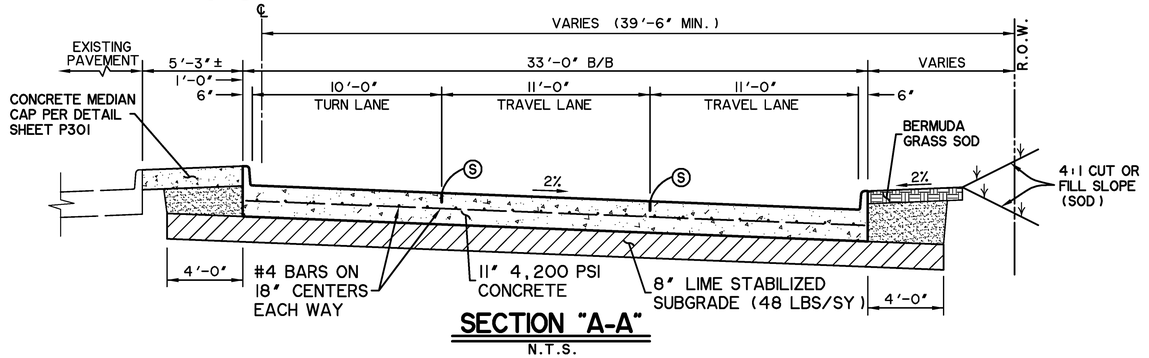
CAUTION !!

EXISTING UTILITIES ARE INDICATED ON THE PLANS FROM AVAILABLE INFORMATION. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION OF ALL UTILITIES, TO NOTIFY ALL UTILITY COMPANIES OF THE CONTRACTORS OPERATIONS, TO PROTECT ALL UTILITIES FROM DAMAGE, TO REPAIR ALL UTILITIES DAMAGED DUE TO THE CONTRACTORS OPERATIONS, AND TO NOTIFY THE ENGINEER PROMPTLY OF ALL CONFLICTS OF THE WORK WITH EXISTING UTILITIES.

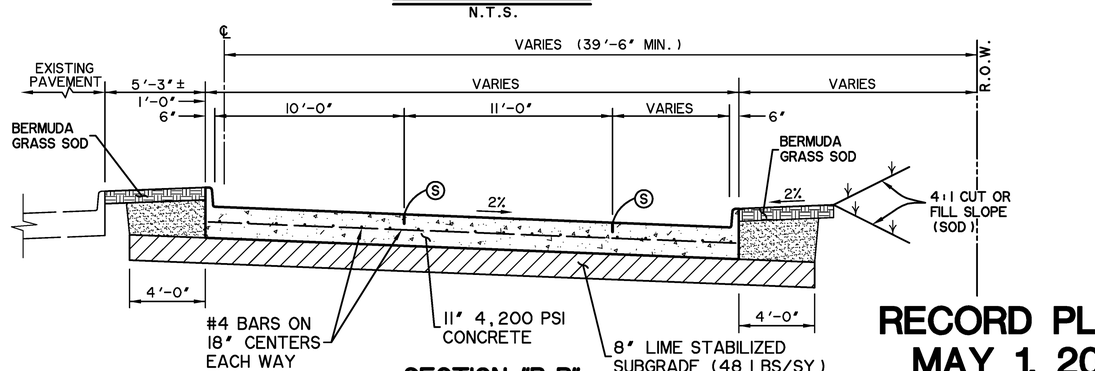
NOTES:

1. CONSTRUCT PAVEMENT IN ACCORDANCE WITH THE CITY STANDARD CONSTRUCTION DETAILS EXCEPT AS NOTED HEREON.
2. PLACE BERMUDA GRASS SOD IN PARKWAY AND MEDIANS AS PER SPECIFICATIONS.
3. IMPORT AND PLACE MINIMUM 4" TOPSOIL ON CUT AND FILL SLOPES. HYDROMULCH SEED WITH BERMUDA GRASS AS PER SPECIFICATIONS.
4. COMPACT ALL FILLS TO MINIMUM 95% OF STANDARD PROCTOR DENSITY. FILL COMPACTION SHALL BE PERFORMED WITH A SHEEPSFOOT ROLLER.
5. BACKFILL ALL CURBS WITH ON-SITE BROWN CLAY SOILS COMPACTED TO A MINIMUM 95% OF STANDARD PROCTOR DENSITY. TYPICAL ALL ROADWAY AND STREET CURBS THIS PROJECT.

JUSTIN ROAD



SECTION "A-A"
N.T.S.



SECTION "B-B"
N.T.S.

Ⓢ SAWED LONGITUDINAL CONTRACTION JOINT

RECORD PLANS
MAY 1, 2015

PREPARED BY:
WIER & ASSOCIATES, INC.
ENGINEERS SURVEYORS LAND PLANNERS
701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.WierAssociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
PAVEMENT TRANSITION PLAN

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
5/1/2015

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LAST SHEET EDIT DATE 5/1/2015
W.A.# 13096

SHEET NO. P106

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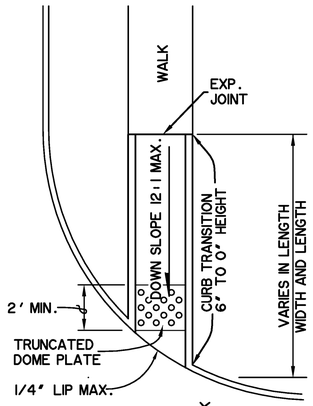
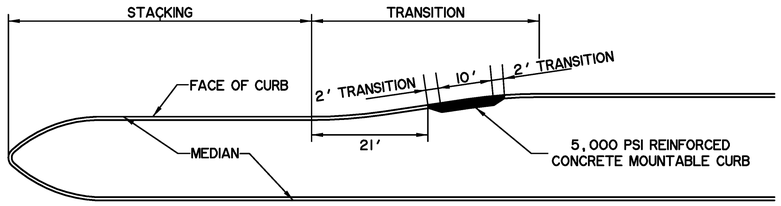


CURB RAMP FOR STRAIGHT THROUGH WALK

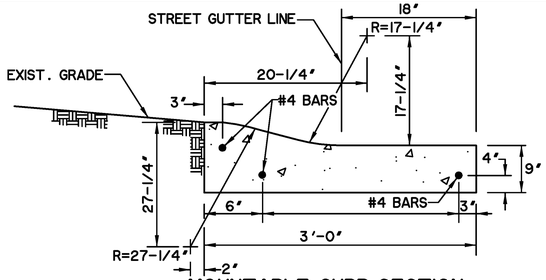
N.T.S.



NOTE: NO RAMPING SHALL BE IN FRONT OF STANDARD CURB

PLAN VIEW LANDSCAPE MAINTENANCE RAMP

N.T.S.



MOUNTABLE CURB SECTION

N.T.S.

RECORD PLANS MAY 1, 2015

PREPARED BY:
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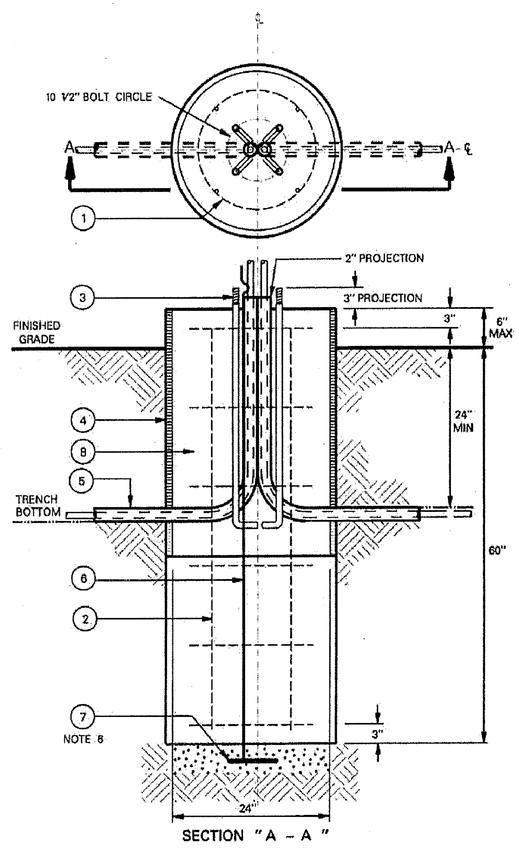
213 – 320 04 – 08

STREET LIGHT FOUNDATION 25' M.H. & 30' M.H. ROUND STEEL POLE

213 – 320 04 – 08



SECTION "A – A"

NOTES:

1. CONCRETE TO BE MINIMUM 3000 PSI AT 28 DAYS. (5 SACK) MAXIMUM AGGREGATE 3/4". TOP OF FOUNDATION TO BE TROWELED TO A FLAT AND LEVEL SURFACE. AVOID EXCESSIVE TROWELING. CONCRETE TO SET A MINIMUM OF 72 HOURS BEFORE POLE INSTALLATION.
2. REBAR HOOPS ARE TIED BEGINNING 3" BELOW TOP OF CONCRETE FORM AND ARE REPEATED AT APPROXIMATE 1 FT. INTERVALS TO BOTTOM OF FOUNDATION.
3. USE ANCHOR BOLT TEMPLATE FURNISHED BY POLE MANUFACTURER FOR ALIGNING ANCHOR BOLTS.
4. CONCRETE FORM OF SONOTUBE TO EXTEND TO BOTTOM OF TRENCH OR AS NEEDED.
5. PROVIDE 24" PIGTAIL FOR CONNECTION OF GROUND WIRE TO POLE.
6. A MINIMUM OF 12' OF BARE #6 SD CU WIRE TO BE PLACED IN BOTTOM OF HOLE AND COVERED WITH 2" OF DIRT.
7. IF SOIL HAS BEEN DISTURBED, EXTEND FOUNDATION BY DEPTH OF DISTURBED SOIL.

ITEM	QTY	DESCRIPTION	TSN/REF	CU	MU
1	6	#3 REBAR, 18 IN. DIAMETER HOOP, 3 IN. OVERLAP	314470	SLF25	
2	4	#5 REBAR, STRAIGHT, 60 IN. LONG	317821		
3	4	ANCHOR BOLT, GALVANIZED 1 IN.	318585		
4	AS REQD	CONCRETE FOUNDATION TUBE, 24 IN. DIAMETER	313841		
5	AS REQD	CONDUIT, PVC OR PEC (NOT IN FOUNDATION AUN)			
6	.5 LB	WIRE, #8 COPPER, SOLID	303244		
7	1	GROUND, POLE BUTT WIRE COIL			
8	AS REQD	CONCRETE			
	1	FND, PRECAST, 10.5" BC, 1" ANCHOR BOLTS	398699	SLFP25	

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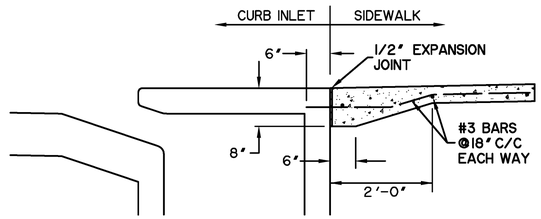
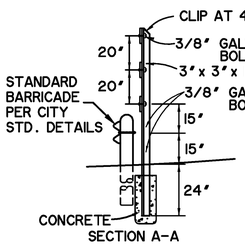


SIDEWALK / CURB INLET BUTT JOINT

N.T.S.



TYPICAL DETAIL FOR BARRICADE RAIL

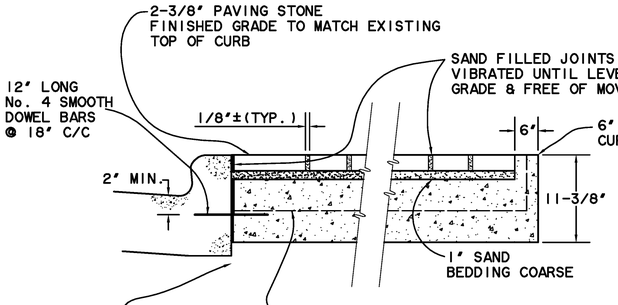
STRIPING

BARRICADES SHOULD HAVE STRIPES SLOPE DOWNWARD IN THE DIRECTION TOWARD WHICH TRAFFIC MUST TURN IN DETOURING. WHEN BOTH RIGHT AND LEFT TURNS ARE PROVIDED FOR, OR THERE IS NO TURN PROVIDED FOR, THE CHEVRON STRIPING MAY SLOPE DOWNWARD IN BOTH DIRECTIONS FROM THE CENTER OF THE BARRICADE.

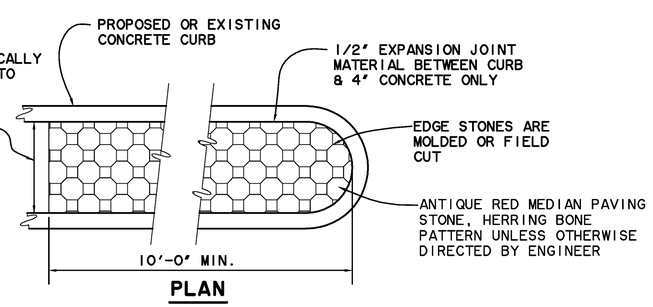
STRIPING OF RAILS, PANELS AND GATES FOR THE RIGHT SIDE OF THE ROADWAY, IS SHOWN ABOVE. FOR THE LEFT SIDE OF THE ROADWAY STRIPING SHOULD SLOPE DOWNWARD TO THE RIGHT. THE REFLECTORIZED WHITE AND REFLECTORIZED ORANGE STRIPES SHALL BE CONSTRUCTED OF RETROREFLECTIVE SHEETING MEETING THE COLOR AND REFLECTIVITY REQUIREMENTS OF TEXAS DEPARTMENT OF TRANSPORTATION MATERIAL SPECIFICATION, D-9-8300, TYPE C.

DEAD END BARRICADE

N.T.S.



TYPICAL CROSS SECTION



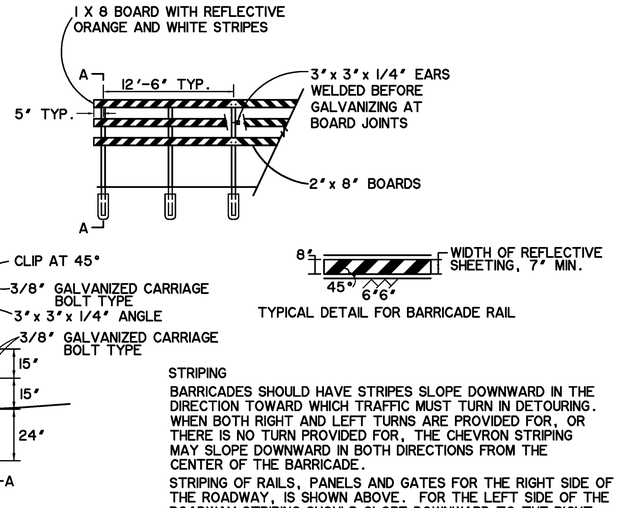
PLAN

NOTES:

1. MEDIAN PAVING SHALL EXTEND TO A POINT WHERE MEDIAN IS 7' WIDE.
2. PAVING STONE SHALL BE INTERLOCKING CONCRETE PER ITEMS 2.3.7 AND 5.8.8 OF THE SPECIAL PROVISIONS AND SHALL BE ANTIQUE RED COLOR.

MEDIAN PAVING STONE DETAIL

N.T.S.



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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
PAVING DETAILS

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
5/1/2015

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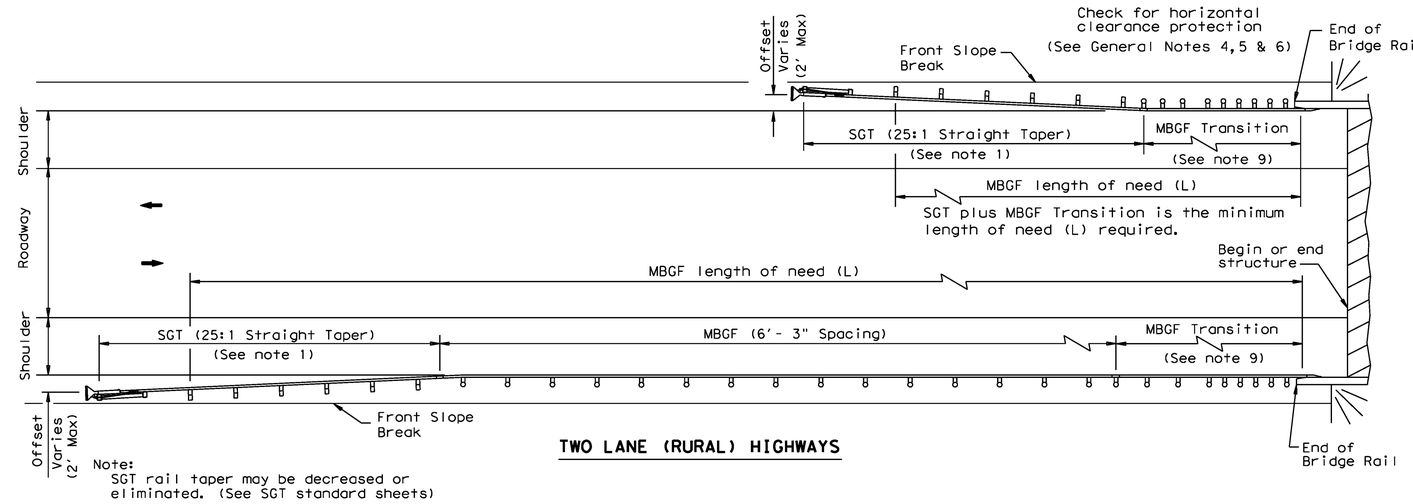
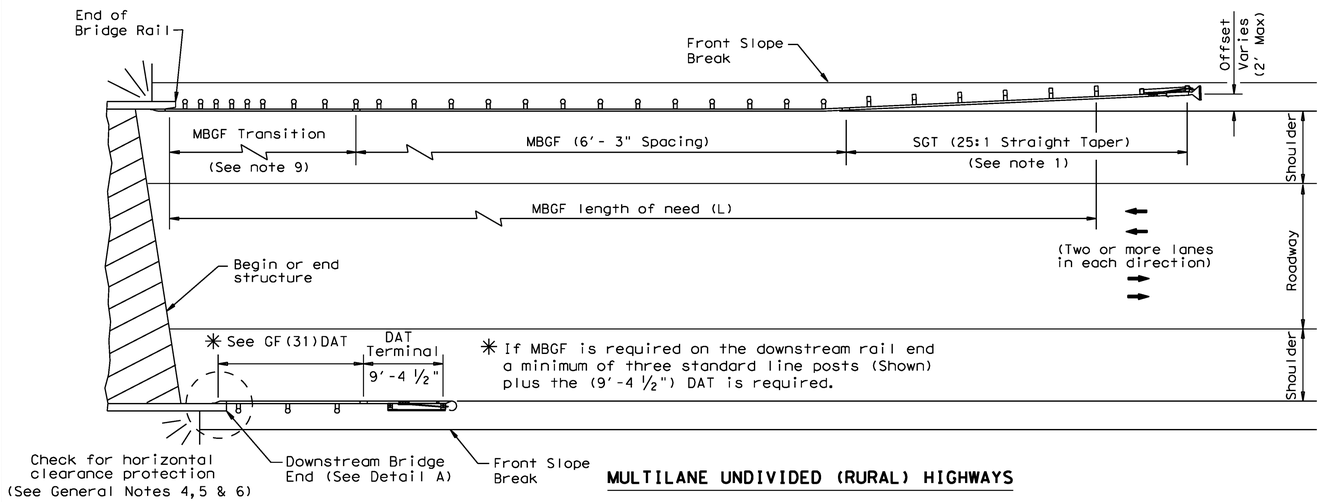
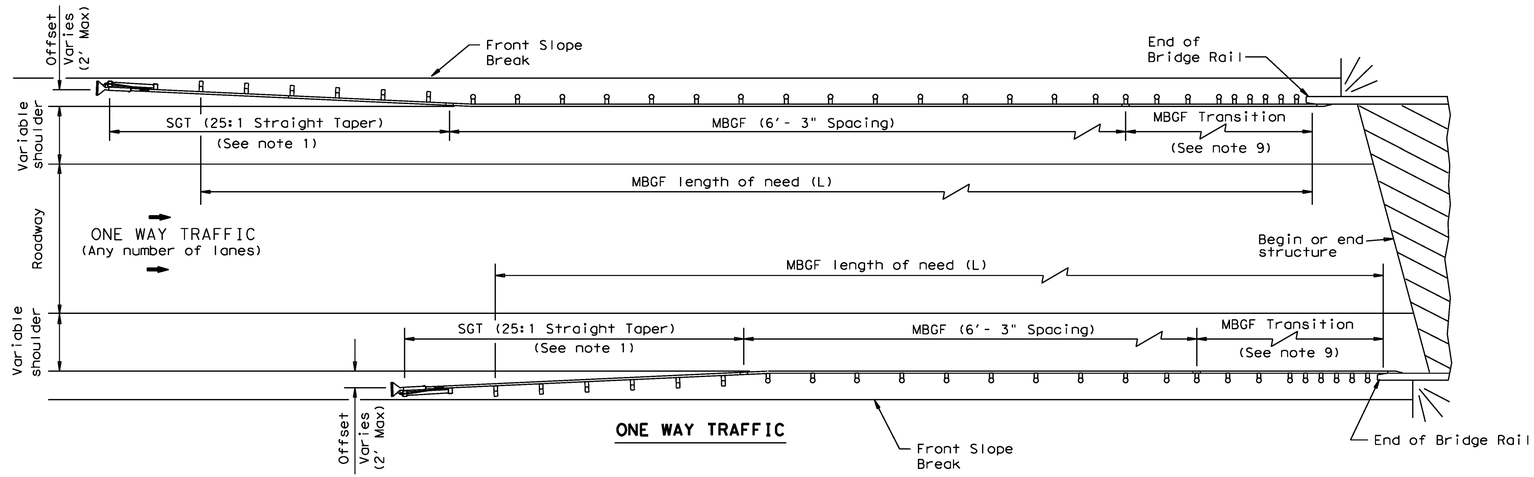


Note:
SGT rail taper may be decreased or eliminated. (See SGT standard sheets)

TWO LANE (RURAL) HIGHWAYS



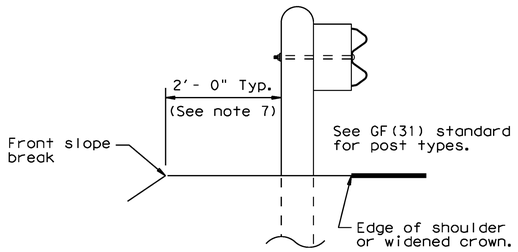
MULTILANE UNDIVIDED (RURAL) HIGHWAYS



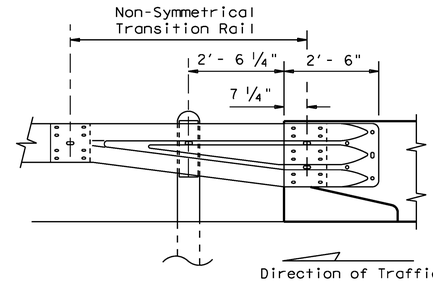
ONE WAY TRAFFIC

GENERAL NOTES

1. For more detail: See GF(31), SGT( )31, GF(31)TR, and GF(31)TL2 standard sheets.
2. Quantities of metal beam guard fence (MBGF) at individual bridge ends are as shown in the plans.
3. Use average daily traffic (ADT) for the current year to determine MBGF length of need in accordance with the Roadway Design Manual unless otherwise specified. Where significant traffic volume growth is anticipated on low volume (0-750 ADT) highways, use length determinations for the higher volume category.
4. MBGF may not be required to shield departure end of bridge unless other obstacles within the horizontal clearance limits or opposing traffic indicate a MBGF consideration.
5. Downstream anchor terminals (DAT) are only for downstream end anchorage use, outside the horizontal clearance area of opposing traffic.
6. Direct connection of MBGF to concrete rails are only for downstream rail connections outside the horizontal clearance area of opposing traffic. (This requires a minimum of three standard line posts plus the DAT terminal, See Detail A)
7. The crown shall be widened to accommodate MBGF. Typically the "front slope" break should be 2'- 0" from the back of the MBGF post. This applies to new construction on new alignment or where existing roadway cross section is to be widened to increase roadway width. This does not apply to rehabilitation work where existing roadway crown width is to be retained (See Typical Cross Section at MBGF).
8. <u>For restrictive bridge widths:</u> The MBGF should be properly transitioned from the existing bridge rail to the adjoining MBGF (See MBGF Transition Standards). Metal beam guard fence at these bridge location(s) shall be flared at the rate of 25:1 or flatter, and be of the length necessary to locate the terminal end at the 2 ft. "maximum" offset from the shoulder edge in the approach direction.
9. Transition length and post spacing will vary depending on the transition type. Transition type will be shown elsewhere in the plans.



TYPICAL CROSS SECTION AT MBGF



Note:
All rail elements shall be lapped in the direction of adjacent traffic.

DETAIL A

Showing Downstream Rail Attachment

Texas Department of Transportation

Design Division Standard

BRIDGE END DETAILS

(Metal Beam Guard Fence Applications to Rigid Rails)

BED-11

FILE: bed11.dgn	DN: TxDOT	CK: AM	DW: BD	CK:
©TxDOT December 2011	CONT	SECT	JOB	HIGHWAY
REVISIONS				
	DIST	COUNTY		SHEET NO.
				P302

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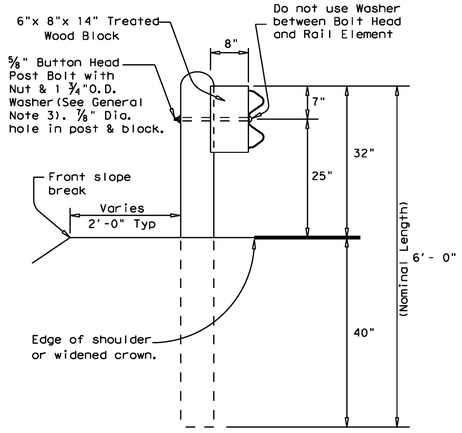
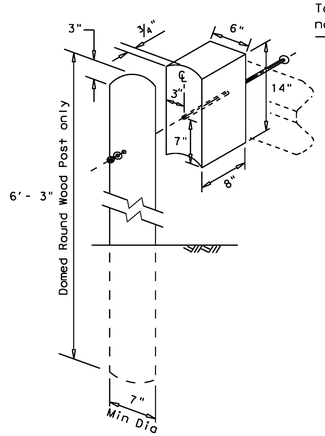
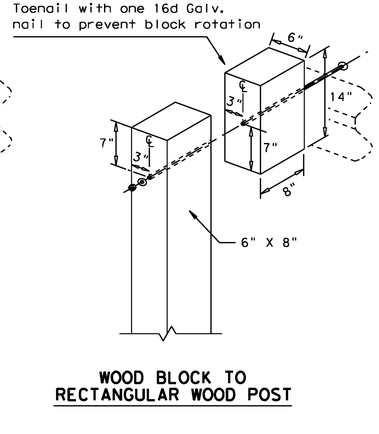


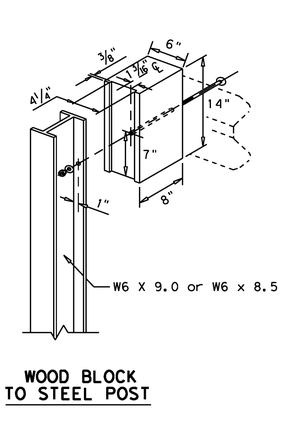
TYPICAL POST



WOOD BLOCK TO ROUND WOOD POST



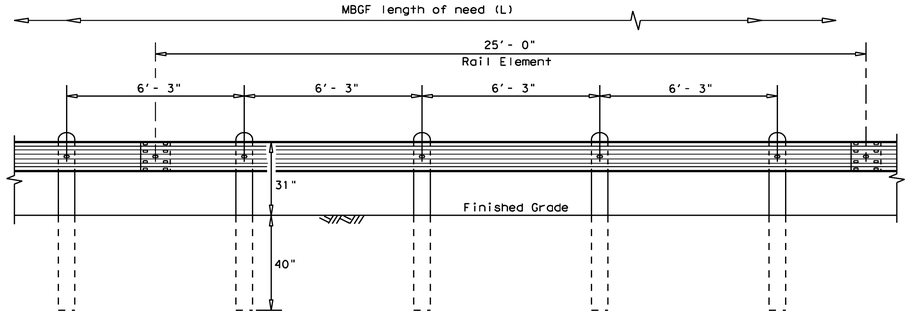
WOOD BLOCK TO RECTANGULAR WOOD POST



WOOD BLOCK TO STEEL POST

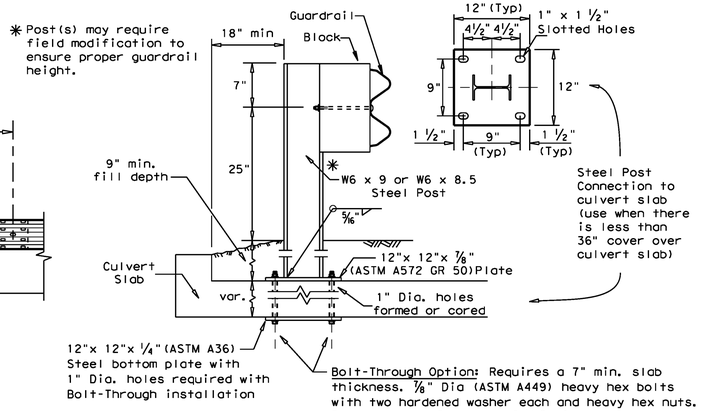
GENERAL NOTES

1. The type of post (round wood post, rectangular wood post, or steel post) will be as shown in the plans. The exact position of MBGF shall be shown in the plans or as directed by the Engineer. Steel posts to be galvanized in accordance with Item 445, "Galvanizing."
2. Rail element shall meet the requirements of Item 540, "Metal Beam Guard Fence" except as modified in the plans. The Contractor may furnish rail elements of 25'- 0", or 12'- 6" (nom.) lengths. Rail elements may have slotted holes at 3'-1½" C-C or 6'-3" C-C. A special length of rail may be manufactured to accommodate the downstream anchor terminal (DAT) and the transition sections of guardrail.
3. Button head "post" bolts (ASTM A307) shall be of sufficient length to extend through the full thickness of the nut (ASTM A563) and Type A (1 ¾" O.D.)washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) are ⅝" x 1 ¼" (or 2" long at triple rail splices) with a ⅝" double recessed nut (ASTM A563). Thrie beam "connection" ⅞" dia. (ASTM A325) hex bolts shall be of sufficient length to extend through the full thickness of the rail, washers, and nuts.
4. Fittings (bolts, nuts, and washers) shall be galvanized in accordance with Item 445, "Galvanizing." Fittings shall be subsidiary to the bid item.
5. Crown shall be widened to accommodate the Metal Beam Guard Fence.
6. The lateral approach to the guard fence, shall have a maximum slope of 1V:10H.
7. If shown elsewhere in the plans or as directed by the Engineer, the guard fence may be flared at a rate of 25:1 or flatter.
8. Unless otherwise shown in the plans, guard fence placed in the vicinity of curbs shall be positioned so that the face of curb is located directly below or behind the face of the rail. Rail placed over curbs shall be installed so that the post bolt is located approximately 25 inches above the gutter pan or edge of shoulder.
9. If solid rock is encountered within 0 to 18" of the finished grade, drill a 22" dia. hole, or drill two 12" dia. front to back overlapping holes, 24" into the rock. If solid rock is encountered below 18", drill a 12" dia. hole, 12" into the rock or to the standard embedment depth, whichever maybe less. Any excess post length, after meeting these depths, may be field cut to ensure proper guardrail mounting height. Backfill with a cohesionless material.
10. Posts shall not be set in concrete, of any depth.
11. Special fabrication will be required at installations having a curvature of less than 150 ft. radius.
12. Unless otherwise shown in the plans, a composite material post and/or block that meets the requirements of DMS-7210, "Composite Material Posts and Blocks for Metal Beam Guard Fence" may be substituted for posts and/or blocks of similar dimensions. The Construction Division, TxDOT maintains a Material Producer List (MPL) for producers of materials conforming to DMS-7210. Only producers on the MPL may furnish composite material posts and/or blocks.
13. For posts located partially or wholly between precast box culvert units, the use of a cast-in-place concrete closure between boxes is required. See Detail "A" on Bridge Standard SCP-MD.



ELEVATION MID-SPAN RAIL SPLICE

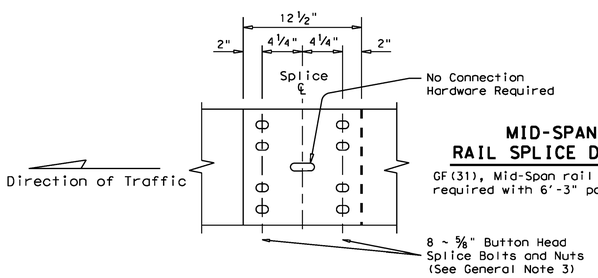
Showing a 25'- 0" section of W-Beam rail, 12'- 6" rail sections may also be supplied (See General Note 2)



LOW FILL CULVERT POST

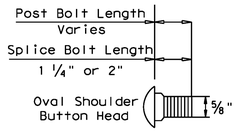
For use on culverts up to 50 ft. in length. Culverts of 25 ft. or less, See GF(31)LS standard for "Long Span" option.

Epoxy Note:
Epoxy Anchor Option: This option may only be used if the culvert slab is 8" min. thick. Threaded anchor rods must be ⅞" Dia. ASTM A449 or A193 Grade B7 with heavy hex nut, and one hardened washer each. Embed anchor rods 6" with Hilti HIT RE 500 epoxy adhesive. Other Type III Class C epoxy adhesives meeting the requirements of DMS-6100, "Epoxies and Adhesives", may be used if it can be demonstrated that they meet or exceed the strength of Hilti HIT RE 500 with the same embedment depth and threaded rod dia. Follow the manufacturer's requirements for installing epoxied threaded rods. Extend rods ¼" min. beyond nut.



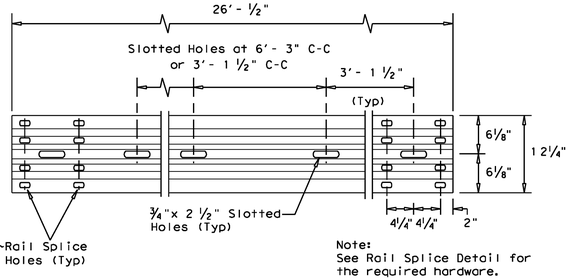
MID-SPAN RAIL SPLICE DETAIL

GF(31), Mid-Span rail splices are required with 6'-3" post spacings.



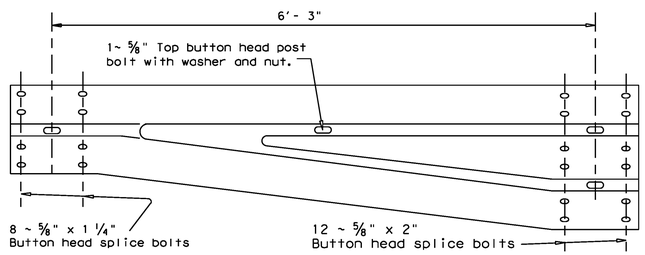
BUTTON HEAD BOLT

Post and Splice Bolts (See General Note 3)



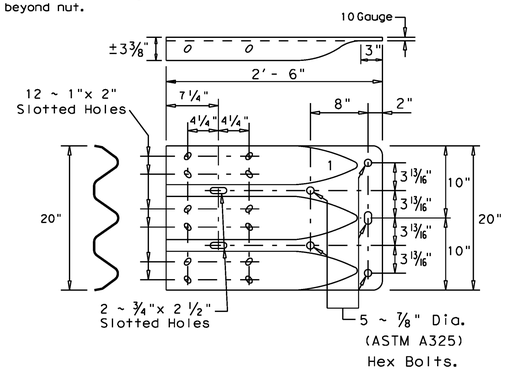
ELEVATION 25'- 0" (NOM.) W-BEAM SECTION

12'- 6" rail sections may also be supplied (See General Note 2)



NON-SYMMETRICAL TRANSITION FROM W-BEAM TO CONCRETE RAIL (10 GA.)

(See GF(31)DAT for Downstream Connection to Concrete Rail)



THRIE-BEAM TERMINAL CONNECTION (10 GA.)

(See General Note 3 for required hardware)

Texas Department of Transportation

Design Division Standard

METAL BEAM GUARD FENCE

GF(31)-11

FILE: gf3111.dgn	DN: TxDOT	CK: AM	DW: VP	CK:
©TxDOT December 2011	CONT	SECT	JOB	HIGHWAY
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	DIST	COUNTY		SHEET NO.
				P303

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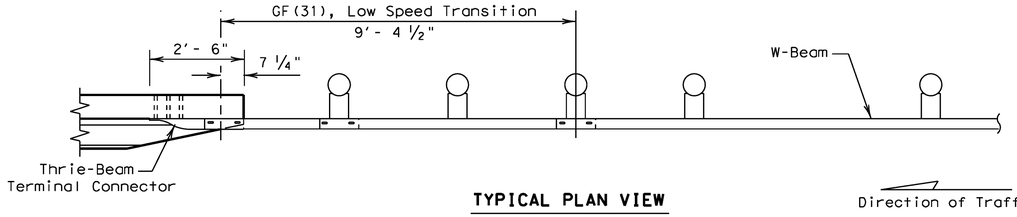
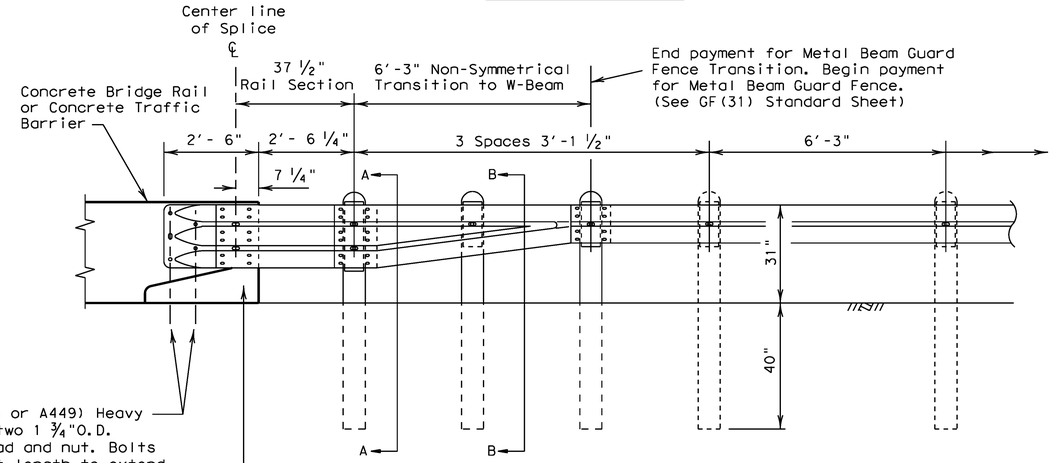


TYPICAL PLAN VIEW



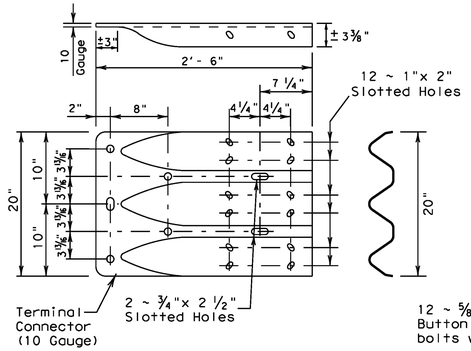
TYPICAL ELEVATION VIEW

GENERAL NOTES

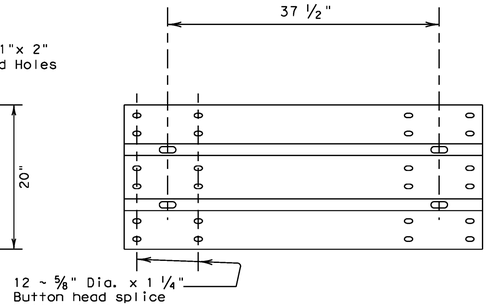
1. The type of post (round wood post, rectangular wood post, or steel post) will be as shown in the plans. The exact position of transitions shall be as shown in the plans or as directed by the Engineer.
2. Rail element shall meet the requirements of Item 540, "Metal Beam Guard Fence" except as modified in the plans.
3. Button head "post" bolts (ASTM A307) shall be of sufficient length to extend through the full thickness of the nut and Type A 1 ¾" O.D. washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) are ⅝" x 1 ¼" with ⅝" double recessed nuts (ASTM A563).
4. Fittings (bolts, nuts, and washers) shall be galvanized in accordance with Item 445, "Galvanizing." Fittings shall be subsidiary to the bid item requiring construction of the transition.
5. Crown will be widened to accommodate transitions.
6. If solid rock is encountered. See the GF(31) standard sheet for the proper installation guidance.
7. Posts shall not be set in concrete, of any depth.
8. Unless otherwise shown in the plans, a composite material post and/or block that meets the requirements of DMS-7210, "Composite Material Posts and Blocks for Metal Beam Guard Fence" may be substituted for posts and/or blocks of similar dimensions. The Construction Division, TxDOT, maintains a Material Producer List (MPL) for producers of materials conforming to DMS-7210. Only producers on the MPL can furnish composite material posts and/or blocks.
9. Refer to GF(31) standard sheet for additional details.

TERMINAL CONNECTION NOTE

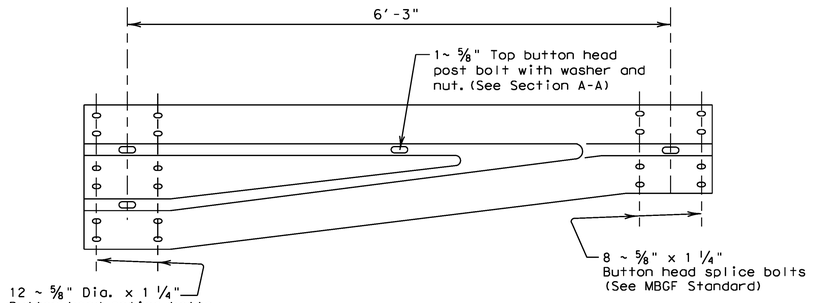
To ensure a stable connection. (12) Rectangular Washers (FWR03) are required under the recessed nuts at the Terminal Connection splice.



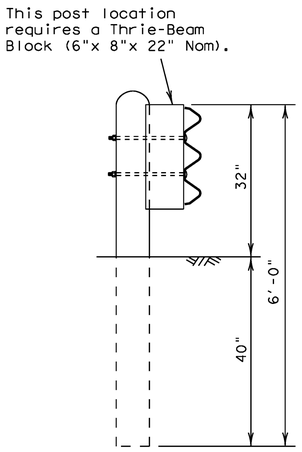
THRIE-BEAM TERMINAL CONNECTION
(See Terminal Connection Note)



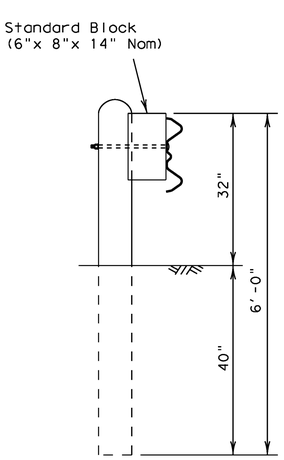
**THRIE-BEAM (3′ - 1 ½")
(10 GA.) ELEMENT SECTION**



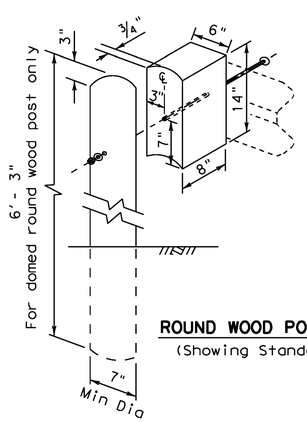
**NON-SYMMETRICAL (10 GA.)
TRANSITION SECTION**



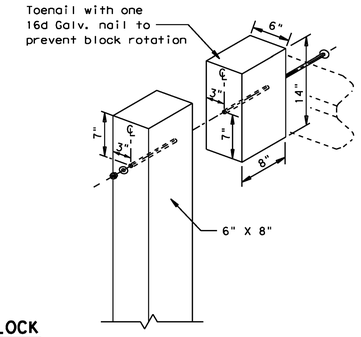
SECTION A-A



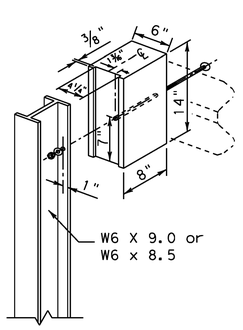
SECTION B-B



ROUND WOOD POST & BLOCK
(Showing Standard Block)



**WOOD BLOCK TO
RECTANGULAR WOOD POST**



STEEL POST & BLOCK
(Showing Standard Block)

Texas Department of Transportation

Design Division Standard

METAL BEAM GUARD FENCE TRANSITION (TL-2)
(Low Speed Transition)
GF(31)TL2-11

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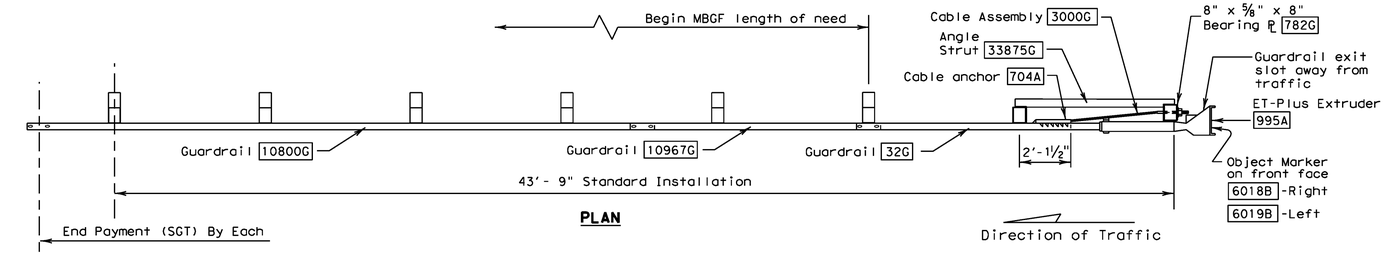
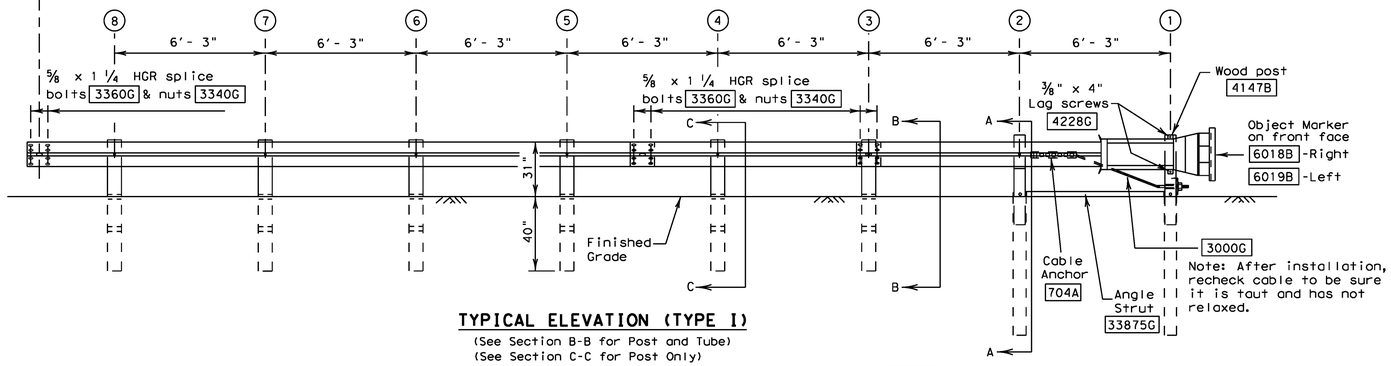
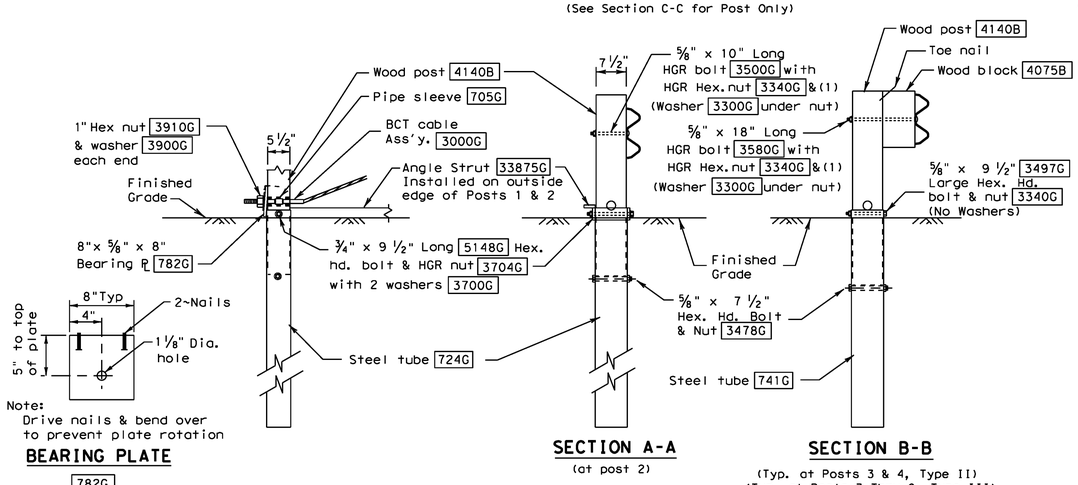


PLAN



TYPICAL ELEVATION (TYPE I)

(See Section B-B for Post and Tube)
(See Section C-C for Post Only)



BEARING PLATE

782G

SECTION A-A

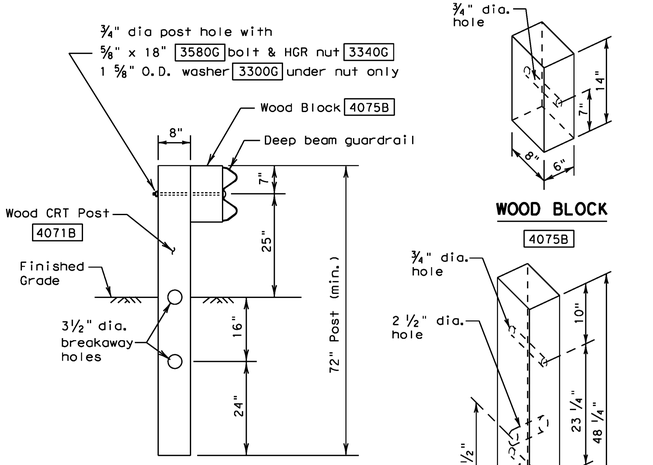
(at post 2)

SECTION B-B

(Typ. at Posts 3 & 4, Type II)
(Typ. at Posts 3 Thru 8, Type III)

PARTIAL VIEW AT POST #1

See the manufacturers installation manual for additional information.

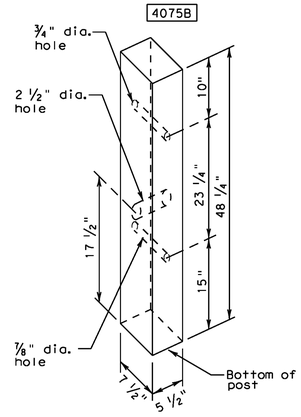


SECTION C-C

(Typ. at post only positions)

WOOD BLOCK

4075B



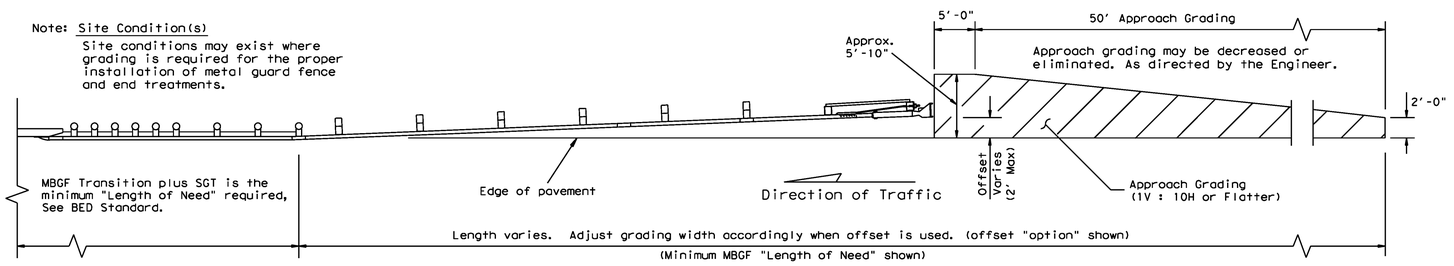
All measurements should be taken from bottom of posts.

WOOD POST

4140B

POST & TUBE OPTIONS			
Type I	Posts	① thru	②
Type II	Posts	① thru	④
Type III	Posts	① thru	⑧

Note: Site Condition(s)
Site conditions may exist where grading is required for the proper installation of metal guard fence and end treatments.



GRADING AT GUARDRAIL END TREATMENTS

GENERAL NOTES

1. For additional information contact: Trinity Highway Products, 1-800-527-6050.
2. The Type of SGT unit will be specified elsewhere in the plans. Numbers in circles indicate post position. The Type of SGT unit chosen is a maintenance consideration and does not affect the systems performance.

Post & Tube Options		Post Only
Type I	Posts ① thru ②	Posts ③ thru ⑧
Type II	Posts ① thru ④	Posts ⑤ thru ⑧
Type III	Posts ① thru ⑧	

3. SGT's placed within the "minimum" 150 ft. radius, shall be installed straight. Standard rail elements may be installed within the radius, without special fabrication.
4. All bolts, nuts, cable assemblies, cable anchors, steel tubes & bearing plates shall be galvanized.
5. A flare rate of 25:1 may be used to prevent the terminal head from encroaching on the shoulder. The flare may be decreased or eliminated for specific installations, if directed by the Engineer.
6. The steel tubes shall not protrude more than 4 inches above ground. Site grading may be necessary to meet this requirement.
7. The steel tubes may be driven with an approved driving head. They shall not be driven with the wood post in the tube. If the steel tubes are placed in drilled holes, the backfill material must be satisfactorily compacted to prevent tube settlement.
8. If solid rock is encountered. See the manufacturer's installation manual for the proper installation guidance.
9. The breakaway cable assembly must be taut. A locking device, (vice grips or channel lock pliers) should be used to prevent the cable from twisting when tightening the nuts.
10. The wood blocks shall be "toe nailed" to the rectangular wood posts to prevent them from turning when the wood shrinks.
11. For curb installations, the soil tubes and posts shall be installed at the proper ground elevation behind the curb. The posts will then require field drilling new holes to accommodate the rail to post connection bolt to maintain the proper height of the rail above the gutter pan. The excess post length above the rail will be removed as directed by the Engineer.
12. An object marker shall be installed on the front of the impact head as detailed on D&OM(VIA).
13. A special site evaluation should be considered, prior to using this end treatment where there is less than 25 feet between the extrusion side of the end treatment and any adjacent driving lane.

BILL OF MATERIAL

Code #	POST & TUBE OPTIONS Type I Qty.	Type II Qty.	Type III Qty.	DESCRIPTION
32G	1	1	1	Guardrail (12 Ga) at 12'- 6" (ANC)
10967G	1	1	1	Guardrail (12 Ga) at 9'- 4 ½"
10800G	1	1	1	Guardrail (12 Ga) at 25'- 0"
724G	2	2	2	Steel Tube - 6"x 8"x 72"x ⅛" min
741G	0	2	6	Steel Tube - 6" x 8" x 54" x ⅛" min
4140B	2	4	8	Wood Posts - 5 ½" x 7 ½" x 48 ¼"
4071B	6	4	0	Wood CRT Posts - 6"x 8"x 72"
4075B	6	6	6	Wood Block - 6"x 8"x 14"
705G	1	1	1	Pipe Sleeve - 2" std. pipe x 5 ½"
782G	1	1	1	Bearing Plate - 8"x 8"x ⅝"
704A	1	1	1	Cable Anchor Bracket
3000G	1	1	1	Cable Assembly (¾" x 78")
33875G	1	1	1	Angle Strut
995A	1	1	1	ET-Plus Extruder
5148G	2	2	2	¾" x 9 ½" Hex Hd (Top of tubes 1&2)A325
3300G	7	7	7	⅝" Washers
3478G	2	4	8	⅝" x 7 ½" Hex Bolt
3500G	1	1	1	⅝" x 10" Post Bolt (Post ②)
3580G	6	6	6	⅝" x 18" Post Bolt (Posts ③ thru ⑧)
3360G	24	24	24	⅝" x 1 ¼" Splice Bolt
3340G	33	37	45	⅝" Hex Nut
4228G	2	2	2	⅜" x 4" Lag Screw
3910G	2	2	2	1" Hex Nut
3900G	2	2	2	1" Washer
6018B	1	1	1	Right - Object Marker
6019B	1	1	1	Left - Object Marker
3700G	4	4	4	¾" Washer
3704G	2	2	2	¾" Heavy Hex Nut
3497G	0	2	6	⅝" x 9 ½" Hex Hd (Top of Tubes 3-8)A307

Texas Department of Transportation

Design Division Standard

SINGLE GUARDRAIL TERMINAL (ET-31) (WOOD POST) SGT(7)31-11

FILE: sgt73111.dgn	DN: TxDOT	CK: AM	DW: BD	CK:
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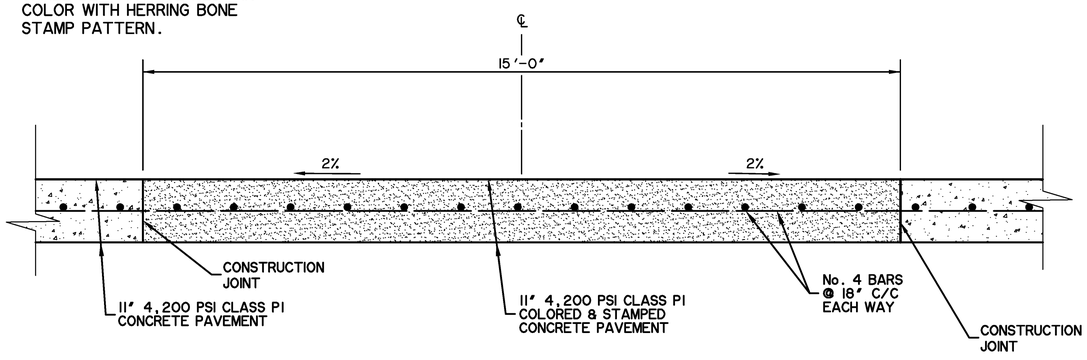
NOTE:
COLORED & STAMPED CONCRETE SHALL BE "ANTIQUE RED" IN COLOR WITH HERRING BONE STAMP PATTERN.



SECTION "A-A"

N.T.S.

PREPARED BY:
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ENGINEERS SURVEYORS LAND PLANNERS
701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD TO JOHN KING BOULEVARD
PAVING DETAILS

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
5/1/2015

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SHEET NO. P306

RECORD PLANS
MAY 1, 2015

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RECORD PLANS
MAY 1, 2015

JUSTN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
PAVEMENT MARKING PLAN
(BASE BID)

LOT 2, BLOCK A
SPR PACKAGING ADDITION
CAB. H, SLIDE 155
P.R.R.C.T.

CITY OF ROCKWALL
VOL. 4880, PG. 36
D.R.R.C.T.

NAN A. SMART,
W.I. LOFLAND
& JULIANA BOND
VOL. 70, PG. 183
D.R.R.C.T.

ROCKWALL ECONOMIC
DEVELOPMENT CORPORATION
VOL. 4168, PG. 317
D.R.R.C.T.

APPROX. LOC. SURVEY LINE

INSTALL LEFT TURN ONLY ARROW & WORD PER DETAIL SHEET M202

INSTALL DOUBLE SOLID WHITE LINE PER DETAIL SHEET M201

STOP SIGN R1-1

INSTALL THERMOPLASTIC STOP BAR PER DETAIL SHEET M201

INSTALL BROKEN WHITE LINE PER DETAIL SHEET M201

KEEP RIGHT SIGN R4-7

INSTALL THERMOPLASTIC CROSSWALK PER DETAIL SHEET M201

STA 40+20 SPEED LIMIT SIGN R2-1

INDUSTRIAL BOULEVARD

JUSTIN ROAD

MATCH LINE - THIS SHEET

ROCKWALL ECONOMIC DEVELOPMENT CORPORATION
INST. No. 20130000499975
D.R.R.C.T.

INSTALL LEFT TURN ONLY ARROW & WORD PER DETAIL SHEET M202 & LEFT TURN ONLY SIGN R3-7L

LANE DROP (WHITE) PER DETAIL SHEET M201

INSTALL RIGHT TURN ONLY ARROW & WORD PER DETAIL SHEET M202 & RIGHT TURN ONLY SIGN R3-7R

INSTALL CENTER LANE DROP PER DETAIL SHEET M201

BOBBY FRANK ATHEY
(TRACT B2)
VOL. 4875, PG. 117
D.R.R.C.T.

INSTALL THERMOPLASTIC CROSSWALK PER DETAIL SHEET M201

INSTALL THERMOPLASTIC STOP BAR PER DETAIL SHEET M201

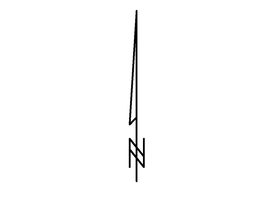
FUTURE JUSTIN ROAD EXTENSION

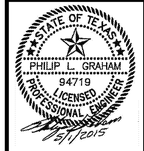
TEMUNOVIC PARTNERSHIP, LTD.
VOL. 7038, PG. 314
D.R.R.C.T.

SOUTH JOHN KING BOULEVARD

N. BUTLER
ABSTRACT NO. 20

ARCHIBALD HANNA
ABSTRACT NO. 99





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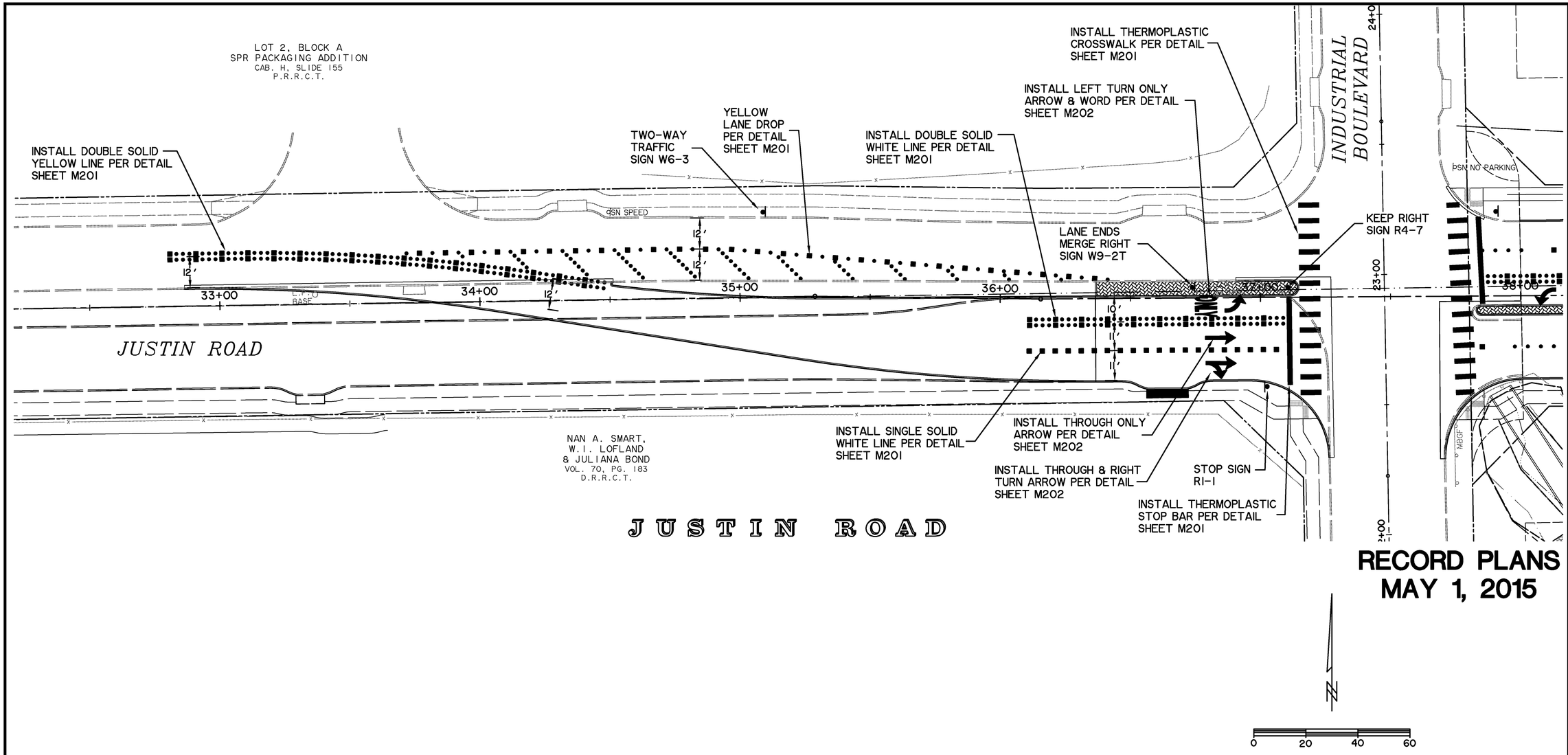

JUSTIN ROAD

RECORD PLANS
MAY 1, 2015

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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
PAVEMENT MARKING PLAN
(BASE BID)

STATE OF TEXAS
PHILIP L. GRAHAM
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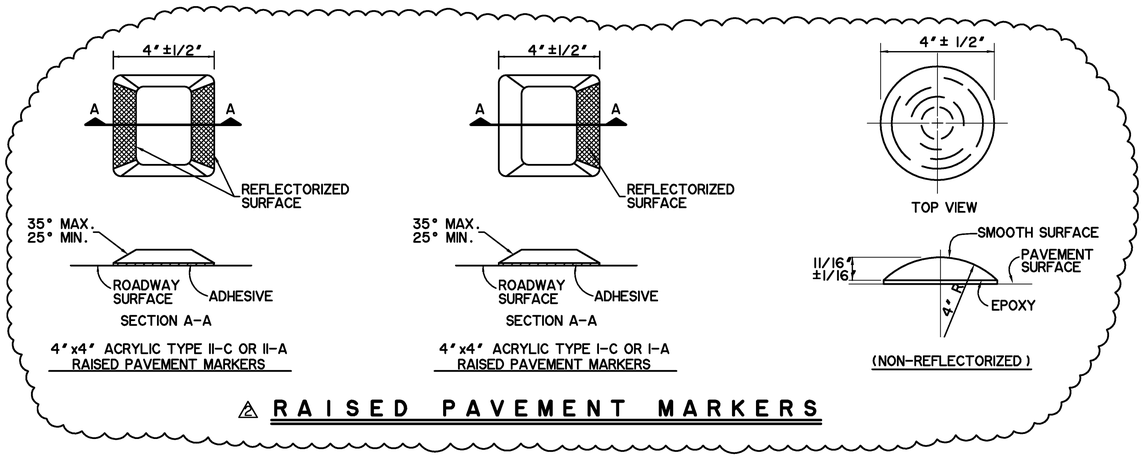
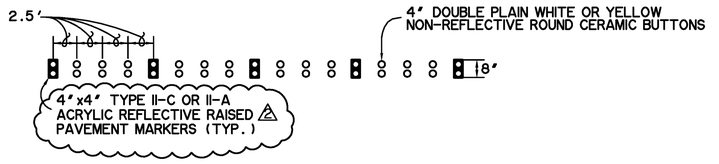
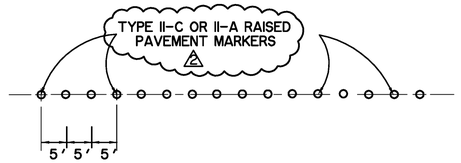


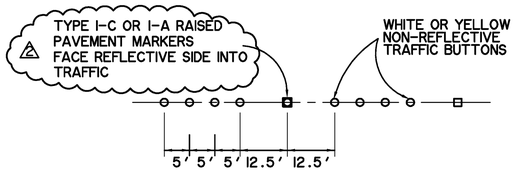
⚠2 RAISED PAVEMENT MARKERS



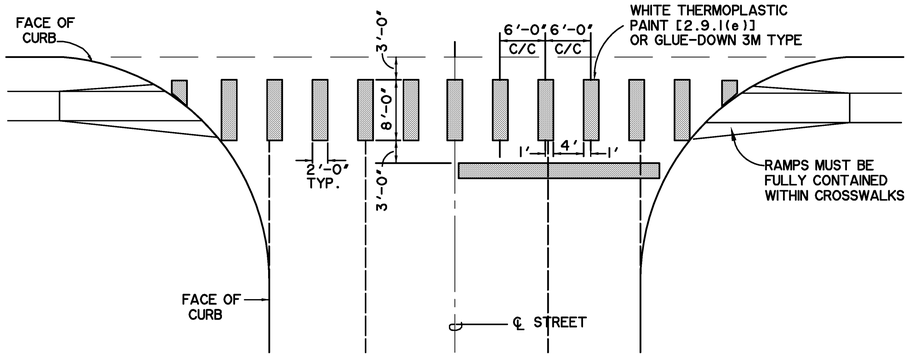
DOUBLE SOLID LINE



SOLID LINE



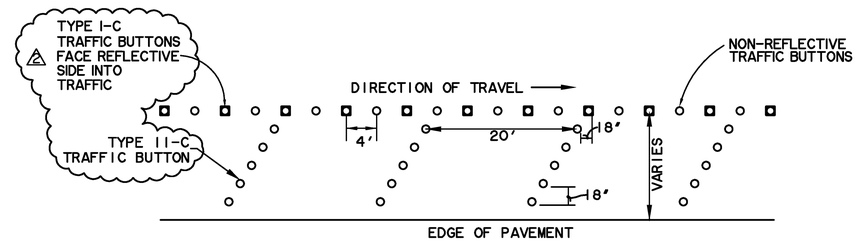
BROKEN LINE



INTERSECTION CROSSWALK

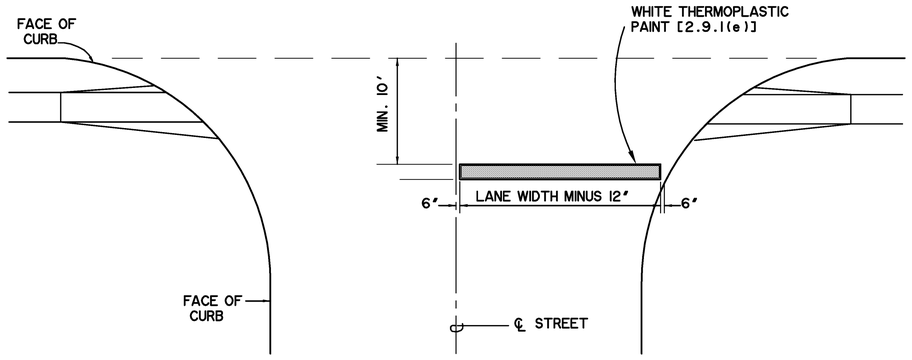
CENTER LANE DROP

N.T.S.



LANE DROP

N.T.S.



INTERSECTION STOP BAR

RECORD PLANS
MAY 1, 2015

REVISIONS			
NO.	DESCRIPTION	DATE	BY
⚠1	CHANGED W.L. "W-4" FROM 12' TO 16'	4/16/14	PLG
⚠2	REVISED PAVEMENT MARKER DETAILS	4/21/14	PLG

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701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD TO JOHN KING BOULEVARD
PAVEMENT MARKING DETAILS

STATE OF TEXAS
PHILIP L. GRAHAM
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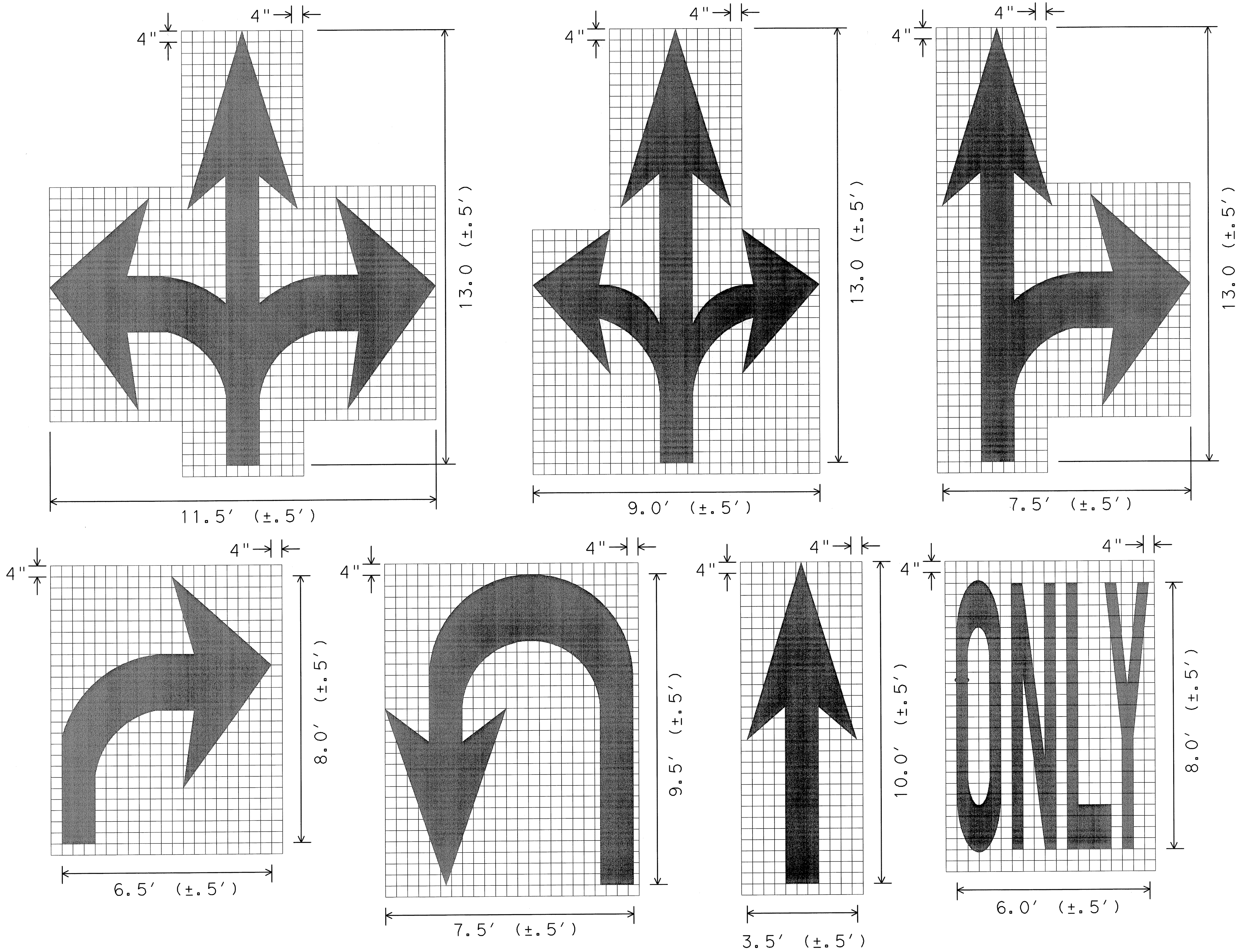


GENERAL NOTES;

1. Minimum 8 foot white markings should be used, unless otherwise noted. If message consists of more than one word, it should be placed with first word nearest the driver.
2. These details are standard size for normal installation; sizes may be reduced approximately one-third for low speed urban conditions; larger sizes may be needed for freeways, above average speed conditions or other critical locations.
3. The longitudinal space between markings should be at least four times the height of the markings, on low speed roads, but should not exceed ten times the height under any condition.
4. Markings considered appropriate for use when warranted include the following:
   A. Regulatory
      STOP
      RIGHT (LEFT) TURN ONLY
      25 MPH
      SYMBOL ARROWS
   B. Warning
      STOP AHEAD
      SIGNAL AHEAD
      SCHOOL
      SCHOOL X-ING
      PED X-ING
      R X R (see RCPM standard)
   C. Guide
      US XXX
      ROUTE XXX
      STATE XXX
      Other words or symbols may be necessary under certain conditions
5. Uncontrolled use of pavement markings can result in driver confusion. Word and symbol markings should be no more than three lines.
6. The word "STOP" shall not be used on the pavement unless accompanied by a Stop line and Stop sign. The word "STOP" shall not be placed on the pavement in advance to a stop line, unless every vehicle is required to stop at all times.
7. Pavement markings should generally be no more than one lane in width, with School messages being the exception. For details of School and School crossing pavement markings, refer to Part VII of the "Texas Manual on Uniform Traffic Control Devices".
8. Spacing between letters should be approximately 4 inches. The width of letters may vary depending on the width of the travel lanes.
9. Lane-Use arrow markings may be used to convey either guidance or mandatory messages. Arrows used to convey a mandatory movement must be accompanied by standard signs and the pavement marking word "ONLY".
10. Pavement markings are to be located as specified elsewhere in the plans.

SPACING BETWEEN LINES OF PAVEMENT MARKINGS	
MPH	SPACING
≤45	MINIMUM 4 TIMES THE LETTER HEIGHT
>45	MINIMUM - 4 TIMES THE LETTER HEIGHT MAXIMUM - 10 TIMES THE LETTER HEIGHT

Texas Department of Transportation
Traffic Operations Division

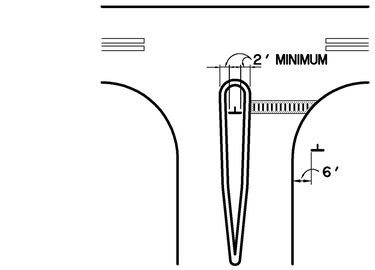
STANDARD PAVEMENT MARKINGS (ARROWS)

PM(6)-01

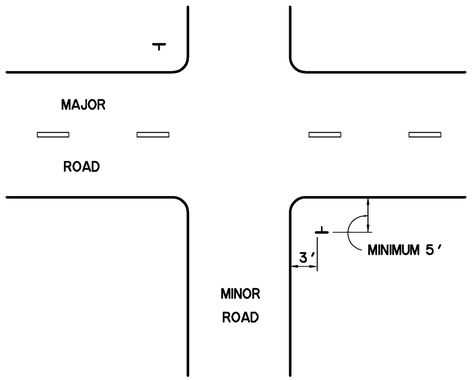
©TxDOT march 2001	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
REVISIONS	CONT	SECT	JOB	HIGHWAY
	DIST	COUNTY		SHEET NO. M202

22H

DATE:
FILE:



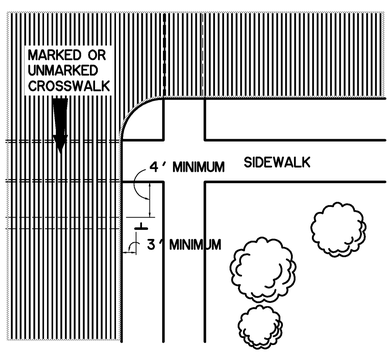
DIVISION ISLAND



URBAN CROSS ROAD

N.T.S.

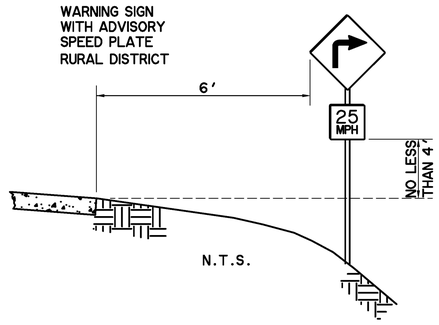
STREET SIGN PLACEMENT



URBAN INTERSECTION

N.T.S.

STREET SIGN PLACEMENT



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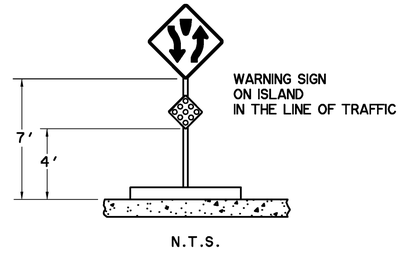

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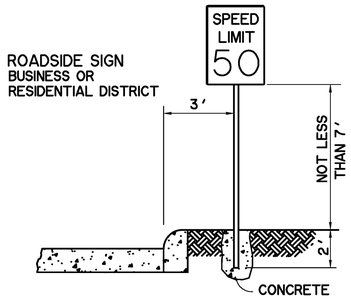

MINIMUM DIAMETER OF CONCRETE BASE 6', MAXIMUM 12'

N.T.S.

GENERAL STREET SIGN REQUIREMENTS: (INSTALLATION BY CITY)

1. THE STOCK NUMBERS LISTED FOR SIGNS ARE AVAILABLE FROM SARGENT-SOWEL INC. (SASO) IN GRAND PRAIRIE, TEXAS AND UNLESS OTHERWISE SPECIFIED, ANY SUBSTITUTIONS SHALL BE APPROVED BY THE ENGINEERING DEPARTMENT PRIOR TO INSTALLATION.

2. ALL SIGNS SHALL BE OF ALUMINUM SHEET WITH REFLECTORIZED SHEETING AND REFLECTORIZED LETTERS.

   A. STOP SIGNS: SASO #09-398 30"x30" STANDARD SIZE

   B. OTHER SIGNS: 'YIELD', SASO #09-512, 30"x30"x30"
   SPEED LIMIT 30, SASO #01-312, 24"x30"
   4 WAY STOP, SASO #09E418, 12"x6"
   3 WAY STOP, SASO #09E419, 12"x6"
   NO PARKING, SASO #01E539, 18"x24"
   DEAD END/NO OUTLET, SASO #01E070/09E121, 30" x 30"

3. BLOCK NUMBERS ARE REQUIRED ON ALL STREET NAME BLADES.

4. ALL SIGNAGE INSTALLED SHALL COMPLY WITH THE CURRENT TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

5. STREET NAME BLADES SHALL BE NINE INCHES TALL EXTRUDED ALUMINUM. THE BLADES SHALL BE 0.080 INCHES THICK.

6. HIGH INTENSITY RETROFLECTIVE SHEETING FOR STREET, REGULATORY AND WARNING SIGNS SHALL BE DIAMOND GRADE PRISMATIC TYPE III HIGH INTENSITY.

7. THE LETTERING FOR STREET NAME BLADES SHALL BE HIROAD B-FONT HIGHWAY GOTHIC-8" UPPERCASE 6" TALL LETTERS. LETTERS OF ABBREVIATED STREET DESIGNATIONS SHALL BE 3" TALL AND ALL UPPERCASE (I.E, LN, PKWY, CT, ETC.) BLOCK NUMBERS SHALL BE 3" TALL.

8. THE STREET BACKGROUND SHALL BE GREEN AND THE LEGEND SHALL BE WHITE.

9. STREET BLADE MUST INCORPORATE THE CURRENT CITY OF ROCKWALL LOGO.

10. STREET SIGN POST CENTER SHALL BE LOCATED 1.5' FROM BACK OF CURB.

    A. POSTS: ALL POSTS SHALL BE OF GALVANIZED STEEL TUBING 12' LONG x 2-3/8" DIA. WITH A WALL THICKNESS OF .080 INCHES SASO #03-099, ALSO AVAILABLE AT ANY LOCAL FENCE SUPPLY COMPANY.

    B. TEE'S: 90 DEGREE BRACKETS, SASO #45E683
    45 DEGREE BRACKETS, SASO #45E684

    C. POST CAP: SASO #45E682

    D. ALUMINUM SIGN CLAMPS: SASO #03E154

11. LOCATIONS FOR SIGNS SHALL BE ASSIGNED BY THE CITY OF ROCKWALL ENGINEERING DEPARTMENT AND SHALL BE PLACED IN THE FIELD AS DIAGRAMMED AND/OR SHALL MEET OR EXCEED THE REQUIREMENTS GIVEN IN THE TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, 1980 ED. WITH ADDENDUMS.

PREPARED BY:
WIER & ASSOCIATES, INC.
ENGINEERS SURVEYORS LAND PLANNERS
701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
STREET SIGN DETAILS

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED
PROFESSIONAL ENGINEER
5/1/2015

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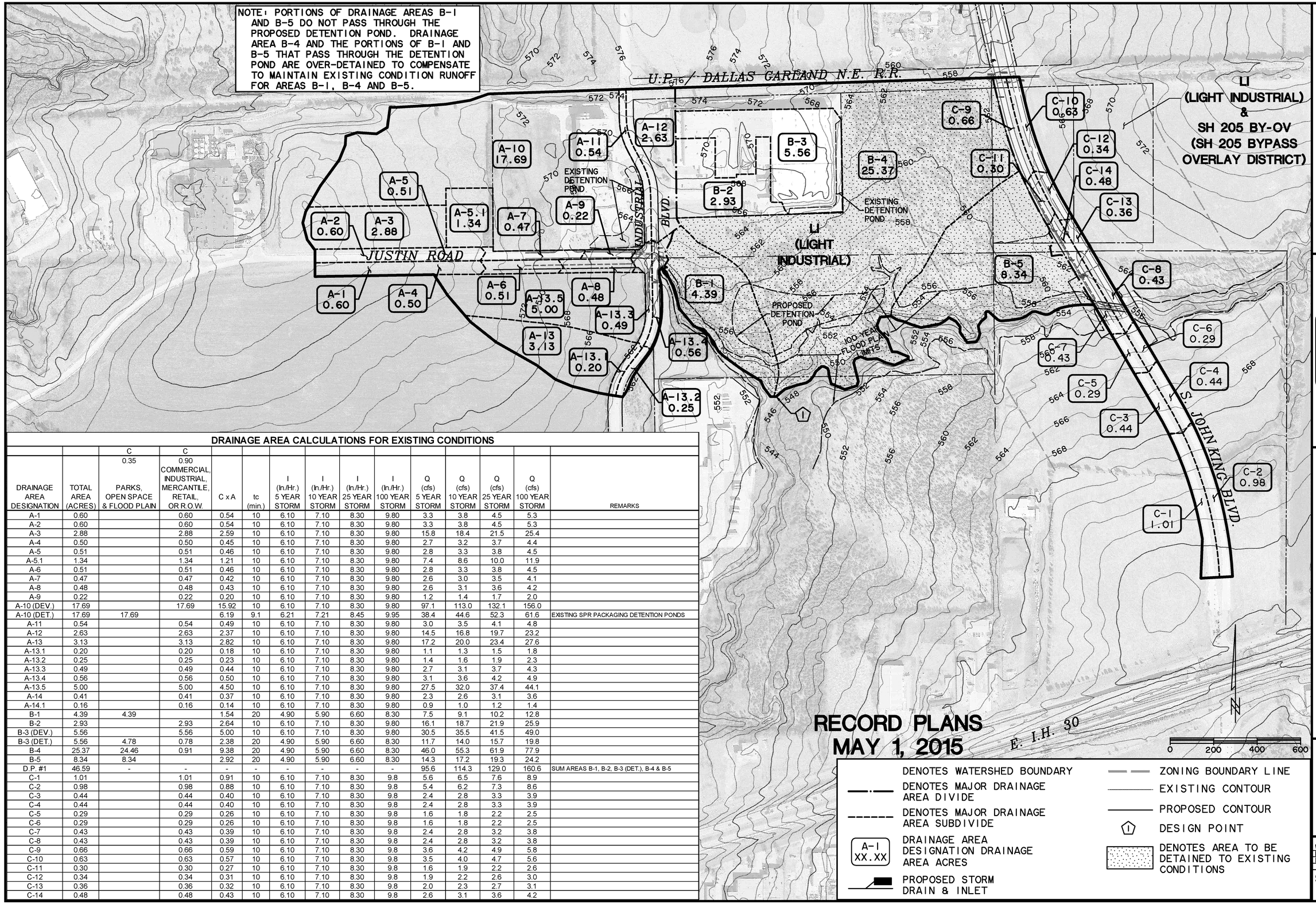
LAST SHEET EDIT DATE 5/1/2015
WA# 13096

SHEET NO. M203

RECORD PLANS
MAY 1, 2015

PRINTED: 5/1/2015 STB FILE: WIER-PAVING.STB LAST SAVED: 4/21/2015 2:14 PM SAVED BY: CLAYTONT FILE: SIGN-DETAIL-I-13096.DWG

NOTE: PORTIONS OF DRAINAGE AREAS B-1 AND B-5 DO NOT PASS THROUGH THE PROPOSED DETENTION POND. DRAINAGE AREA B-4 AND THE PORTIONS OF B-1 AND B-5 THAT PASS THROUGH THE DETENTION POND ARE OVER-DETAINED TO COMPENSATE TO MAINTAIN EXISTING CONDITION RUNOFF FOR AREAS B-1, B-4 AND B-5.



DRAINAGE AREA CALCULATIONS FOR EXISTING CONDITIONS

DRAINAGE AREA DESIGNATION	TOTAL AREA (ACRES)	C 0.35 PARKS, OPEN SPACE & FLOOD PLAIN	C 0.90 COMMERCIAL, INDUSTRIAL, MERCANTILE, RETAIL, OR R.O.W.	C x A	tc (min.)	I (In./Hr.) 5 YEAR STORM	I (In./Hr.) 10 YEAR STORM	I (In./Hr.) 25 YEAR STORM	I (In./Hr.) 100 YEAR STORM	Q (cfs) 5 YEAR STORM	Q (cfs) 10 YEAR STORM	Q (cfs) 25 YEAR STORM	Q (cfs) 100 YEAR STORM	REMARKS
A-1	0.60		0.60	0.54	10	6.10	7.10	8.30	9.80	3.3	3.8	4.5	5.3	
A-2	0.60		0.60	0.54	10	6.10	7.10	8.30	9.80	3.3	3.8	4.5	5.3	
A-3	2.88		2.88	2.59	10	6.10	7.10	8.30	9.80	15.8	18.4	21.5	25.4	
A-4	0.50		0.50	0.45	10	6.10	7.10	8.30	9.80	2.7	3.2	3.7	4.4	
A-5	0.51		0.51	0.46	10	6.10	7.10	8.30	9.80	2.8	3.3	3.8	4.5	
A-5.1	1.34		1.34	1.21	10	6.10	7.10	8.30	9.80	7.4	8.6	10.0	11.9	
A-6	0.51		0.51	0.46	10	6.10	7.10	8.30	9.80	2.8	3.3	3.8	4.5	
A-7	0.47		0.47	0.42	10	6.10	7.10	8.30	9.80	2.6	3.0	3.5	4.1	
A-8	0.48		0.48	0.43	10	6.10	7.10	8.30	9.80	2.6	3.1	3.6	4.2	
A-9	0.22		0.22	0.20	10	6.10	7.10	8.30	9.80	1.2	1.4	1.7	2.0	
A-10 (DEV.)	17.69		17.69	15.92	10	6.10	7.10	8.30	9.80	97.1	113.0	132.1	156.0	
A-10 (DET.)	17.69	17.69		6.19	9.1	6.21	7.21	8.45	9.95	38.4	44.6	52.3	61.6	EXISTING SPR PACKAGING DETENTION PONDS
A-11	0.54		0.54	0.49	10	6.10	7.10	8.30	9.80	3.0	3.5	4.1	4.8	
A-12	2.63		2.63	2.37	10	6.10	7.10	8.30	9.80	14.5	16.8	19.7	23.2	
A-13	3.13		3.13	2.82	10	6.10	7.10	8.30	9.80	17.2	20.0	23.4	27.6	
A-13.1	0.20		0.20	0.18	10	6.10	7.10	8.30	9.80	1.1	1.3	1.5	1.8	
A-13.2	0.25		0.25	0.23	10	6.10	7.10	8.30	9.80	1.4	1.6	1.9	2.3	
A-13.3	0.49		0.49	0.44	10	6.10	7.10	8.30	9.80	2.7	3.1	3.7	4.3	
A-13.4	0.56		0.56	0.50	10	6.10	7.10	8.30	9.80	3.1	3.6	4.2	4.9	
A-13.5	5.00		5.00	4.50	10	6.10	7.10	8.30	9.80	27.5	32.0	37.4	44.1	
A-14	0.41		0.41	0.37	10	6.10	7.10	8.30	9.80	2.3	2.6	3.1	3.6	
A-14.1	0.16		0.16	0.14	10	6.10	7.10	8.30	9.80	0.9	1.0	1.2	1.4	
B-1	4.39	4.39		1.54	20	4.90	5.90	6.60	8.30	7.5	9.1	10.2	12.8	
B-2	2.93		2.93	2.64	10	6.10	7.10	8.30	9.80	16.1	18.7	21.9	25.9	
B-3 (DEV.)	5.56		5.56	5.00	10	6.10	7.10	8.30	9.80	30.5	35.5	41.5	49.0	
B-3 (DET.)	5.56	4.78	0.78	2.38	20	4.90	5.90	6.60	8.30	11.7	14.0	15.7	19.8	
B-4	25.37	24.46	0.91	9.38	20	4.90	5.90	6.60	8.30	46.0	55.3	61.9	77.9	
B-5	8.34	8.34		2.92	20	4.90	5.90	6.60	8.30	14.3	17.2	19.3	24.2	
D.P. #1	46.59	-	-	-	-	-	-	-	-	95.6	114.3	129.0	160.6	SUM AREAS B-1, B-2, B-3 (DET.), B-4 & B-5
C-1	1.01		1.01	0.91	10	6.10	7.10	8.30	9.8	5.6	6.5	7.6	8.9	
C-2	0.98		0.98	0.88	10	6.10	7.10	8.30	9.8	5.4	6.2	7.3	8.6	
C-3	0.44		0.44	0.40	10	6.10	7.10	8.30	9.8	2.4	2.8	3.3	3.9	
C-4	0.44		0.44	0.40	10	6.10	7.10	8.30	9.8	2.4	2.8	3.3	3.9	
C-5	0.29		0.29	0.26	10	6.10	7.10	8.30	9.8	1.6	1.8	2.2	2.5	
C-6	0.29		0.29	0.26	10	6.10	7.10	8.30	9.8	1.6	1.8	2.2	2.5	
C-7	0.43		0.43	0.39	10	6.10	7.10	8.30	9.8	2.4	2.8	3.2	3.8	
C-8	0.43		0.43	0.39	10	6.10	7.10	8.30	9.8	2.4	2.8	3.2	3.8	
C-9	0.66		0.66	0.59	10	6.10	7.10	8.30	9.8	3.6	4.2	4.9	5.8	
C-10	0.63		0.63	0.57	10	6.10	7.10	8.30	9.8	3.5	4.0	4.7	5.6	
C-11	0.30		0.30	0.27	10	6.10	7.10	8.30	9.8	1.6	1.9	2.2	2.6	
C-12	0.34		0.34	0.31	10	6.10	7.10	8.30	9.8	1.9	2.2	2.6	3.0	
C-13	0.36		0.36	0.32	10	6.10	7.10	8.30	9.8	2.0	2.3	2.7	3.1	
C-14	0.48		0.48	0.43	10	6.10	7.10	8.30	9.8	2.6	3.1	3.6	4.2	

RECORD PLANS
MAY 1, 2015

- DENOTES WATERSHED BOUNDARY
- DENOTES MAJOR DRAINAGE AREA DIVIDE
- DENOTES MAJOR DRAINAGE AREA SUBDIVIDE
- A-1 XX.XX — DRAINAGE AREA DESIGNATION DRAINAGE AREA ACRES
- PROPOSED STORM DRAIN & INLET
- ZONING BOUNDARY LINE
- EXISTING CONTOUR
- PROPOSED CONTOUR
- (1) DESIGN POINT
- DENOTES AREA TO BE DETAINED TO EXISTING CONDITIONS

PREPARED BY:
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Texas Firm Registration No. F-2776 www.wierassociates.com

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED
PROFESSIONAL ENGINEER
5/1/2015

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
DRAINAGE AREA MAP
EXISTING CONDITIONS

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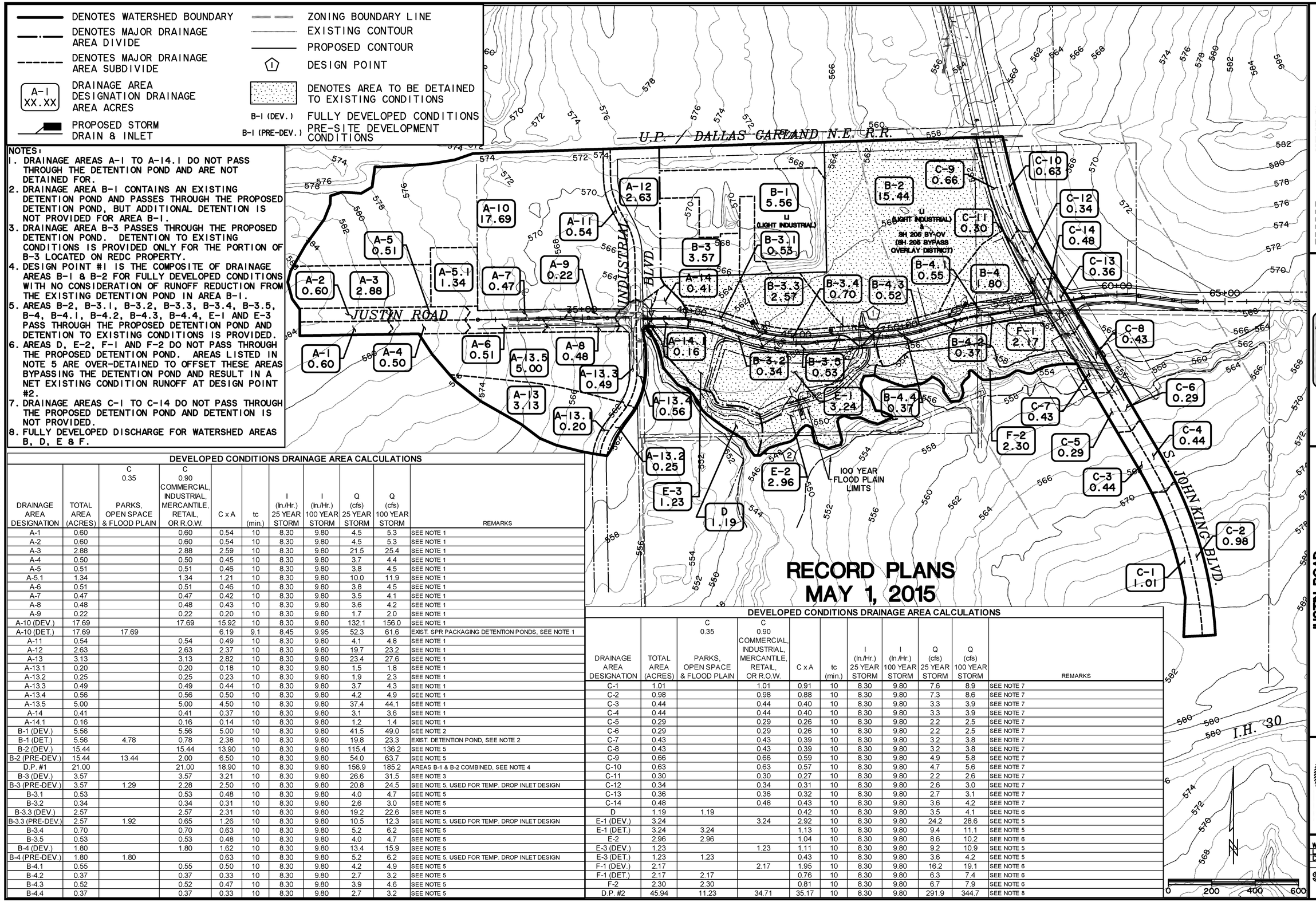
LAST SHEET EDIT DATE 5/1/2015
WA# 13096

SHEET NO. D101

PRINTED: 5/1/2015 STB FILE: WIER-DAMAP.STB LAST SAVED: 5/1/2015 6:25 AM SAVED BY: PHILIPG FILE: DRAINAGE-AREA-MAP-EXISTING-CONDITIONS-13096.DWG



NOTES:

1. DRAINAGE AREAS A-1 TO A-14.1 DO NOT PASS THROUGH THE DETENTION POND AND ARE NOT DETAINED FOR.
2. DRAINAGE AREA B-1 CONTAINS AN EXISTING DETENTION POND AND PASSES THROUGH THE PROPOSED DETENTION POND, BUT ADDITIONAL DETENTION IS NOT PROVIDED FOR AREA B-1.
3. DRAINAGE AREA B-3 PASSES THROUGH THE PROPOSED DETENTION POND. DETENTION TO EXISTING CONDITIONS IS PROVIDED ONLY FOR THE PORTION OF B-3 LOCATED ON REDC PROPERTY.
4. DESIGN POINT #1 IS THE COMPOSITE OF DRAINAGE AREAS B-1 & B-2 FOR FULLY DEVELOPED CONDITIONS WITH NO CONSIDERATION OF RUNOFF REDUCTION FROM THE EXISTING DETENTION POND IN AREA B-1.
5. AREAS B-2, B-3.1, B-3.2, B-3.3, B-3.4, B-3.5, B-4, B-4.1, B-4.2, B-4.3, B-4.4, E-1 AND E-3 PASS THROUGH THE PROPOSED DETENTION POND AND DETENTION TO EXISTING CONDITIONS IS PROVIDED.
6. AREAS D, E-2, F-1 AND F-2 DO NOT PASS THROUGH THE PROPOSED DETENTION POND. AREAS LISTED IN NOTE 5 ARE OVER-DETAINED TO OFFSET THESE AREAS BYPASSING THE DETENTION POND AND RESULT IN A NET EXISTING CONDITION RUNOFF AT DESIGN POINT #2.
7. DRAINAGE AREAS C-1 TO C-14 DO NOT PASS THROUGH THE PROPOSED DETENTION POND AND DETENTION IS NOT PROVIDED.
8. FULLY DEVELOPED DISCHARGE FOR WATERSHED AREAS B, D, E & F.

DEVELOPED CONDITIONS DRAINAGE AREA CALCULATIONS

DRAINAGE AREA DESIGNATION	TOTAL AREA (ACRES)	C 0.35 PARKS, OPEN SPACE & FLOOD PLAIN	C 0.90 COMMERCIAL, INDUSTRIAL, MERCANTILE, RETAIL, OR R.O.W.	C x A	tc (min.)	I (In./Hr.) 25 YEAR STORM	I (In./Hr.) 100 YEAR STORM	Q (cfs) 25 YEAR STORM	Q (cfs) 100 YEAR STORM	REMARKS
A-1	0.60		0.60	0.54	10	8.30	9.80	4.5	5.3	SEE NOTE 1
A-2	0.60		0.60	0.54	10	8.30	9.80	4.5	5.3	SEE NOTE 1
A-3	2.88		2.88	2.59	10	8.30	9.80	21.5	25.4	SEE NOTE 1
A-4	0.50		0.50	0.45	10	8.30	9.80	3.7	4.4	SEE NOTE 1
A-5	0.51		0.51	0.46	10	8.30	9.80	3.8	4.5	SEE NOTE 1
A-5.1	1.34		1.34	1.21	10	8.30	9.80	10.0	11.9	SEE NOTE 1
A-6	0.51		0.51	0.46	10	8.30	9.80	3.8	4.5	SEE NOTE 1
A-7	0.47		0.47	0.42	10	8.30	9.80	3.5	4.1	SEE NOTE 1
A-8	0.48		0.48	0.43	10	8.30	9.80	3.6	4.2	SEE NOTE 1
A-9	0.22		0.22	0.20	10	8.30	9.80	1.7	2.0	SEE NOTE 1
A-10 (DEV.)	17.69		17.69	15.92	10	8.30	9.80	132.1	156.0	SEE NOTE 1
A-10 (DET.)	17.69	17.69		6.19	9.1	8.45	9.95	52.3	61.6	EXIST. SPR PACKAGING DETENTION PONDS, SEE NOTE 1
A-11	0.54		0.54	0.49	10	8.30	9.80	4.1	4.8	SEE NOTE 1
A-12	2.63		2.63	2.37	10	8.30	9.80	19.7	23.2	SEE NOTE 1
A-13	3.13		3.13	2.82	10	8.30	9.80	23.4	27.6	SEE NOTE 1
A-13.1	0.20		0.20	0.18	10	8.30	9.80	1.5	1.8	SEE NOTE 1
A-13.2	0.25		0.25	0.23	10	8.30	9.80	1.9	2.3	SEE NOTE 1
A-13.3	0.49		0.49	0.44	10	8.30	9.80	3.7	4.3	SEE NOTE 1
A-13.4	0.56		0.56	0.50	10	8.30	9.80	4.2	4.9	SEE NOTE 1
A-13.5	5.00		5.00	4.50	10	8.30	9.80	37.4	44.1	SEE NOTE 1
A-14	0.41		0.41	0.37	10	8.30	9.80	3.1	3.6	SEE NOTE 1
A-14.1	0.16		0.16	0.14	10	8.30	9.80	1.2	1.4	SEE NOTE 1
B-1 (DEV.)	5.56		5.56	5.00	10	8.30	9.80	41.5	49.0	SEE NOTE 2
B-1 (DET.)	5.56	4.78	0.78	2.38	10	8.30	9.80	19.8	23.3	EXIST. DETENTION POND, SEE NOTE 2
B-2 (DEV.)	15.44		15.44	13.90	10	8.30	9.80	115.4	136.2	SEE NOTE 5
B-2 (PRE-DEV.)	15.44	13.44	2.00	6.50	10	8.30	9.80	54.0	63.7	SEE NOTE 5
D.P. #1	21.00		21.00	18.90	10	8.30	9.80	156.9	185.2	AREAS B-1 & B-2 COMBINED, SEE NOTE 4
B-3 (DEV.)	3.57		3.57	3.21	10	8.30	9.80	26.6	31.5	SEE NOTE 3
B-3 (PRE-DEV.)	3.57	1.29	2.28	2.50	10	8.30	9.80	20.8	24.5	SEE NOTE 5, USED FOR TEMP. DROP INLET DESIGN
B-3.1	0.53		0.53	0.48	10	8.30	9.80	4.0	4.7	SEE NOTE 5
B-3.2	0.34		0.34	0.31	10	8.30	9.80	2.6	3.0	SEE NOTE 5
B-3.3 (DEV.)	2.57		2.57	2.31	10	8.30	9.80	19.2	22.6	SEE NOTE 5
B-3.3 (PRE-DEV.)	2.57	1.92	0.65	1.26	10	8.30	9.80	10.5	12.3	SEE NOTE 5, USED FOR TEMP. DROP INLET DESIGN
B-3.4	0.70		0.70	0.63	10	8.30	9.80	5.2	6.2	SEE NOTE 5
B-3.5	0.53		0.53	0.48	10	8.30	9.80	4.0	4.7	SEE NOTE 5
B-4 (DEV.)	1.80		1.80	1.62	10	8.30	9.80	13.4	15.9	SEE NOTE 5
B-4 (PRE-DEV.)	1.80	1.80		0.63	10	8.30	9.80	5.2	6.2	SEE NOTE 5, USED FOR TEMP. DROP INLET DESIGN
B-4.1	0.55		0.55	0.50	10	8.30	9.80	4.2	4.9	SEE NOTE 5
B-4.2	0.37		0.37	0.33	10	8.30	9.80	2.7	3.2	SEE NOTE 5
B-4.3	0.52		0.52	0.47	10	8.30	9.80	3.9	4.6	SEE NOTE 5
B-4.4	0.37		0.37	0.33	10	8.30	9.80	2.7	3.2	SEE NOTE 5

DEVELOPED CONDITIONS DRAINAGE AREA CALCULATIONS

DRAINAGE AREA DESIGNATION	TOTAL AREA (ACRES)	C 0.35 PARKS, OPEN SPACE & FLOOD PLAIN	C 0.90 COMMERCIAL, INDUSTRIAL, MERCANTILE, RETAIL, OR R.O.W.	C x A	tc (min.)	I (In./Hr.) 25 YEAR STORM	I (In./Hr.) 100 YEAR STORM	Q (cfs) 25 YEAR STORM	Q (cfs) 100 YEAR STORM	REMARKS
C-1	1.01		1.01	0.91	10	8.30	9.80	7.6	8.9	SEE NOTE 7
C-2	0.98		0.98	0.88	10	8.30	9.80	7.3	8.6	SEE NOTE 7
C-3	0.44		0.44	0.40	10	8.30	9.80	3.3	3.9	SEE NOTE 7
C-4	0.44		0.44	0.40	10	8.30	9.80	3.3	3.9	SEE NOTE 7
C-5	0.29		0.29	0.26	10	8.30	9.80	2.2	2.5	SEE NOTE 7
C-6	0.29		0.29	0.26	10	8.30	9.80	2.2	2.5	SEE NOTE 7
C-7	0.43		0.43	0.39	10	8.30	9.80	3.2	3.8	SEE NOTE 7
C-8	0.43		0.43	0.39	10	8.30	9.80	3.2	3.8	SEE NOTE 7
C-9	0.66		0.66	0.59	10	8.30	9.80	4.9	5.8	SEE NOTE 7
C-10	0.63		0.63	0.57	10	8.30	9.80	4.7	5.6	SEE NOTE 7
C-11	0.30		0.30	0.27	10	8.30	9.80	2.2	2.6	SEE NOTE 7
C-12	0.34		0.34	0.31	10	8.30	9.80	2.6	3.0	SEE NOTE 7
C-13	0.36		0.36	0.32	10	8.30	9.80	2.7	3.1	SEE NOTE 7
C-14	0.48		0.48	0.43	10	8.30	9.80	3.6	4.2	SEE NOTE 7
D	1.19	1.19		0.42	10	8.30	9.80	3.5	4.1	SEE NOTE 6
E-1 (DEV.)	3.24		3.24	2.92	10	8.30	9.80	24.2	28.6	SEE NOTE 5
E-1 (DET.)	3.24	3.24		1.13	10	8.30	9.80	9.4	11.1	SEE NOTE 5
E-2	2.96	2.96		1.04	10	8.30	9.80	8.6	10.2	SEE NOTE 6
E-3 (DEV.)	1.23		1.23	1.11	10	8.30	9.80	9.2	10.9	SEE NOTE 5
E-3 (DET.)	1.23	1.23		0.43	10	8.30	9.80	3.6	4.2	SEE NOTE 5
F-1 (DEV.)	2.17		2.17	1.95	10	8.30	9.80	16.2	19.1	SEE NOTE 6
F-1 (DET.)	2.17	2.17		0.76	10	8.30	9.80	6.3	7.4	SEE NOTE 6
F-2	2.30	2.30		0.81	10	8.30	9.80	6.7	7.9	SEE NOTE 6
D.P. #2	45.94	11.23	34.71	35.17	10	8.30	9.80	291.9	344.7	SEE NOTE 8

RECORD PLANS
MAY 1, 2015

PREPARED BY:
WIER & ASSOCIATES, INC.
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JUSTIN ROAD FROM INDUSTRIAL BOULEVARD TO JOHN KING BOULEVARD DRAINAGE AREA MAP DEVELOPED CONDITIONS

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
5/1/2015

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SHEET NO.
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PRINTED: 5/1/2015 STB FILE: WIER-DAMAP.STB LAST SAVED: 5/1/2015 6:37 AM SAVED BY: PHILIPG FILE: DRAINAGE-AREA-MAP-PROPOSED-13096.DWG

INLET DESIGN CALCULATIONS

INLET No.	DISCHARGES TO	DESIGN STORM FREQUENCY (years)	TIME OF CONC. (min.)	RAINFALL INTENSITY (in./hr.)	DRAINAGE AREA (acres)	DRAINAGE AREA CA	FLOW FROM DRAINAGE AREA (cfs)	CARRY-OVER (cfs)	TOTAL GUTTER FLOW (cfs)	GUTTER SLOPE (%)	STREET SECTION	CROSS-SLOPE OR CROWN (ft/ft) OR (in.)	DEPTH OF FLOW (ft)	PONDED WIDTH (ft)	INLET LENGTH	FLOW COLLECTED	CARRY-OVER (cfs)	REMARKS
A-1	LINE 'A'	100	10.0	9.80	0.52	0.47	4.6	0.0	4.6	1.25	TRIANGULAR	0.0200	0.26	13.0	10	4.6	0.0	FUTURE RECESSED CURB INLET
A-2	LAT. 'A-2'	100	10.0	9.80	0.52	0.47	4.6	0.0	4.6	1.25	TRIANGULAR	0.0200	0.26	13.0	10	4.6	0.0	EXISTING RECESSED CURB INLET
A-4	LAT. 'A-4'	100	10.0	9.80	0.50	0.45	4.4	0.0	4.4	1.40	TRIANGULAR	0.0200	0.24	12.0	10	4.4	0.0	FUTURE RECESSED CURB INLET
A-5	LAT. 'A-5'	100	10.0	9.80	0.51	0.46	4.5	0.0	4.5	1.40	TRIANGULAR	0.0200	0.24	12.0	10	4.5	0.0	EXISTING RECESSED CURB INLET
A-6	LAT. 'A-6'	100	10.0	9.80	0.51	0.46	4.5	0.0	4.5	1.88	TRIANGULAR	0.0200	0.24	12.0	10	4.5	0.0	FUTURE RECESSED CURB INLET
A-7	LAT. 'A-7'	100	10.0	9.80	0.47	0.42	4.1	0.0	4.1	1.88	TRIANGULAR	0.0200	0.23	11.5	10	4.1	0.0	EXISTING RECESSED CURB INLET
A-8	LAT. 'A-8'	100	10.0	9.80	0.48	0.43	4.2	0.0	4.2	1.88	TRIANGULAR	0.0200	0.23	11.5	15	4.2	0.0	RECESSED CURB INLET (ONLY IF BASE BID ACCEPTED)
A-9	LAT. 'A-9'	100	10.0	9.80	0.22	0.20	2.0	0.0	2.0	1.88	TRIANGULAR	0.0200	0.18	9.0	15	2.0	0.0	EXISTING RECESSED CURB INLET
A-11	LAT. 'A-11'	100	10.0	9.80	0.54	0.49	4.8	0.0	4.8	1.40	TRIANGULAR	6"	0.35	13.3	10	4.8	0.0	EXISTING RECESSED CURB INLET
A-12	LAT. 'A-12'	100	10.0	9.80	2.63	2.37	23.2	0.0	23.2	1.40	TRIANGULAR	6"	0.50	22.0	10	6.4	16.8	EXISTING RECESSED CURB INLET
A-13.1	LAT. 'A-13.1'	100	10.0	9.80	0.20	0.18	1.8	0.0	1.8	0.50	TRIANGULAR	6"	0.28	7.4	20	1.8	0.0	EXISTING RECESSED CURB INLET
A-13.2	LAT. 'A-13.2'	100	10.0	9.80	0.25	0.23	2.3	0.0	2.3	0.50	TRIANGULAR	6"	0.30	8.2	10	2.3	0.0	EXISTING RECESSED CURB INLET
A-13.3	LAT. 'A-13.3'	100	10.0	9.80	0.49	0.44	4.3	0.0	4.3	SUMP	TRIANGULAR	6"	0.10	3.8	20	4.3	0.0	EXISTING RECESSED CURB INLET
A-13.4	LAT. 'A-13.4'	100	10.0	9.80	0.56	0.50	4.9	16.8	21.7	SUMP	TRIANGULAR	6"	0.46	17.4	12	21.7	0.0	EXISTING RECESSED CURB INLET
A-14	LAT. 'A-14'	100	10.0	9.80	0.41	0.37	3.6	0.0	3.6	0.68	TRIANGULAR	0.0120	0.22	18.3	10	3.6	0.0	RECESSED CURB INLET
A-14.1	LAT. 'A-14.1'	100	10.0	9.80	0.16	0.14	1.4	0.0	1.4	1.00	TRIANGULAR	0.0200	0.18	9.0	5	1.4	0.0	RECESSED CURB INLET
B-3	LINE 'B-3'	100	10.0	9.80	3.57	2.50	24.5	0.0	24.5	SUMP	SWALE	N/A	0.50	5.0	5'x5'	24.5	0.0	SEE NOTE 1
B-3.1	LAT. 'B-3.1'	100	10.0	9.80	0.53	0.48	4.7	0.0	4.7	0.64	TRIANGULAR	0.0200	0.30	15.0	10	4.7	0.0	
B-3.2	LAT. 'B-3.2'	100	10.0	9.80	0.34	0.31	3.0	0.0	3.0	0.64	TRIANGULAR	0.0200	0.25	12.5	10	3.0	0.0	
B-3.3	LAT. 'B-3.3'	100	10.0	9.80	2.57	1.26	12.3	0.0	12.3	SUMP	SWALE	N/A	0.52	5.2	3'x3'	12.3	0.0	SEE NOTE 1
B-3.4	LAT. 'B-3.3'	100	10.0	9.80	0.70	0.63	6.2	0.0	6.2	SUMP	TRIANGULAR	0.0200	0.12	6.0	10	6.2	0.0	
B-3.5	LAT. 'B-3.5'	100	10.0	9.80	0.53	0.48	4.7	0.0	4.7	SUMP	TRIANGULAR	0.0200	0.10	5.0	10	4.7	0.0	
B-4	LINE 'B-4'	100	10.0	9.80	1.80	0.63	6.2	0.0	6.2	SUMP	SWALE	N/A	0.35	3.8	3'x3'	6.2	0.0	SEE NOTE 1
B-4.1	LAT. 'B-4.1'	100	10.0	9.80	0.55	0.50	4.9	0.0	4.9	0.60	TRIANGULAR	0.0200	0.31	15.5	10	4.9	0.0	
B-4.2	LAT. 'B-4.2'	100	10.0	9.80	0.37	0.33	3.2	0.0	3.2	0.60	TRIANGULAR	0.0200	0.26	13.0	10	3.2	0.0	
B-4.3	LAT. 'B-4.3'	100	10.0	9.80	0.52	0.47	4.6	0.0	4.6	SUMP	TRIANGULAR	0.0200	0.10	5.0	10	4.6	0.0	
B-4.4	LAT. 'B-4.4'	100	10.0	9.80	0.37	0.33	3.2	0.0	3.2	SUMP	TRIANGULAR	0.0200	0.10	5.0	10	3.2	0.0	
C-1	LINE 'C'	100	10.0	9.80	1.01	0.91	8.9	0.0	8.9	1.79	TRIANGULAR	0.0200	0.32	16.0	15	8.9	0.0	EXISTING RECESSED CURB INLET
C-2	LAT. 'C-2'	100	10.0	9.80	0.98	0.88	8.6	0.0	8.6	1.79	TRIANGULAR	0.0200	0.31	15.5	15	8.6	0.0	EXISTING RECESSED CURB INLET
C-3	LAT. 'C-3'	100	10.0	9.80	0.44	0.40	3.9	0.0	3.9	0.52	TRIANGULAR	0.0200	0.29	14.5	10	3.9	0.0	EXISTING RECESSED CURB INLET
C-4	LAT. 'C-4'	100	10.0	9.80	0.44	0.40	3.9	0.0	3.9	0.52	TRIANGULAR	0.0200	0.29	14.5	10	3.9	0.0	EXISTING RECESSED CURB INLET
C-5	LAT. 'C-5'	100	10.0	9.80	0.29	0.26	2.5	0.0	2.5	0.52	TRIANGULAR	0.0200	0.24	12.0	10	2.5	0.0	EXISTING RECESSED CURB INLET
C-6	LAT. 'C-6'	100	10.0	9.80	0.29	0.26	2.5	0.0	2.5	0.52	TRIANGULAR	0.0200	0.24	12.0	10	2.5	0.0	EXISTING RECESSED CURB INLET
C-7	LAT. 'C-7'	100	10.0	9.80	0.43	0.39	3.8	0.0	3.8	0.52	TRIANGULAR	0.0200	0.29	14.5	10	3.8	0.0	EXISTING RECESSED CURB INLET
C-8	LAT. 'C-8'	100	10.0	9.80	0.43	0.39	3.8	0.0	3.8	0.52	TRIANGULAR	0.0200	0.29	14.5	10	3.8	0.0	EXISTING RECESSED CURB INLET
C-9	LINE 'C-9'	100	10.0	9.80	0.66	0.59	5.8	0.0	5.8	0.70	TRIANGULAR	0.0200	0.32	16.0	10	5.8	0.0	EXISTING RECESSED CURB INLET
C-10	LAT. 'C-10'	100	10.0	9.80	0.63	0.57	5.6	0.0	5.6	0.70	TRIANGULAR	0.0200	0.31	15.5	10	5.6	0.0	EXISTING RECESSED CURB INLET
C-11	LAT. 'C-11'	100	10.0	9.80	0.30	0.27	2.6	0.0	2.6	0.70	TRIANGULAR	0.0200	0.25	12.5	10	2.6	0.0	
C-12	LAT. 'C-12'	100	10.0	9.80	0.34	0.31	3.0	0.0	3.0	0.70	TRIANGULAR	0.0200	0.25	12.5	10	3.0	0.0	EXISTING RECESSED CURB INLET
C-13	LAT. 'C-13'	100	10.0	9.80	0.36	0.32	3.1	0.0	3.1	SUMP	TRIANGULAR	0.0200	0.10	5.0	15	3.1	0.0	EXISTING RECESSED CURB INLET
C-14	LAT. 'C-14'	100	10.0	9.80	0.48	0.43	4.2	0.0	4.2	SUMP	TRIANGULAR	0.0200	0.10	5.0	15	4.2	0.0	EXISTING RECESSED CURB INLET

NOTES:
1. INLET IS DESIGNED FOR EXISTING CONDITIONS, STORM DRAIN PIPE IS DESIGNED FOR FULLY DEVELOPED CONDITIONS.

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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
INLET DESIGN CALCULATIONS

STATE OF TEXAS
PHILIP L. GRAHAM
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LICENSED
PROFESSIONAL ENGINEER
5/1/2015

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WA# 13096
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D103

RECORD PLANS
MAY 1, 2015

PRINTED: 5/1/2015 STB FILE: WIER-PAVING.STB LAST SAVED: 4/21/2015 2:25 PM SAVED BY: CLAYTONT FILE: INLET-DESIGN-CALCULATIONS-13096.DWG

STORM DRAIN DESIGN CALCULATIONS

FROM	REACH TO	INFLOW (INLETS & HEADWALLS) LENGTH (ft)	SOURCE	'CA'	INLET TIME (min)	TOTAL 'CA'	TIME AT UPSTREAM OF REACH (min)	DESIGN STORM FREQUENCY (yr)	RAINFALL INTENSITY 'I' (in/hr)	TOTAL FLOW 'Q' (cfs)	STORM DRAIN SIZE	VELOCITY (ft/sec)	SLOPE OF FRICTION GRADIENT (ft/ft)	STRUCTURE LOSS COEFF. 'Kj'	STRUCTURE LOSS AT UPSTREAM OF REACH (ft)	FLOW TIME IN DRAIN (min)	TIME AT DOWNSTREAM OF REACH (min)	H.G. AT UPSTREAM OF REACH (ft)	REMARKS
STORM DRAIN SYSTEM 'A'																			
INLET_A-1	13+44.37	11.56	INLET_A-1	0.47	10.0	0.47	10.0	100	9.80	4.6	18	2.6	0.0019	1.25	0.13	0.0	10.0	576.77	
13+44.37	13+15.65	28.72		0.00	0.0	0.47	10.0	100	9.80	4.6	24	1.5	0.0004	0.60	0.02	0.1	10.1	574.71	
INLET_A-2	13+15.65	69.27	INLET_A-2	0.47	10.0	0.47	10.0	100	9.80	4.6	18	2.6	0.0019	1.25	0.13	0.1	10.1	576.77	
13+15.65	11+30.24	185.41		0.00	0.0	0.94	10.1	100	9.78	9.2	24	2.9	0.0017	0.60	0.11	0.4	10.5	574.38	
0+78.54	11+30.24	78.54	AREA A-3	2.60	10.0	2.60	10.0	100	9.80	25.5	24	8.1	0.0127	0.00	0.00	0.1	10.1	574.25	
11+30.24	9+89.53	140.71		0.00	0.0	3.54	10.5	100	9.72	34.4	30	7.0	0.0070	0.60	0.68	0.3	10.8	572.96	
INLET_A-4	9+89.53	10.76	INLET_A-4	0.45	10.0	0.45	10.0	100	9.80	4.4	18	2.5	0.0018	1.25	0.12	0.0	10.0	571.98	
9+89.53	9+60.02	29.51		0.00	0.0	3.99	10.8	100	9.67	38.6	30	7.9	0.0089	0.50	0.59	0.1	10.9	571.30	
INLET_A-5	0+45.96	24.11	INLET_A-5	0.46	10.0	0.46	10.0	100	9.80	4.5	18	2.5	0.0018	1.25	0.13	0.0	10.0	571.98	
0+32.85	0+45.96	32.85	AREA A-5.1	1.21	10.0	1.21	10.0	100	9.80	11.9	18	6.7	0.0128	0.00	0.00	0.0	10.0	571.75	
0+45.96	9+60.02	45.96		0.00	0.0	1.67	10.0	100	9.80	16.4	24	5.2	0.0053	0.50	0.37	0.1	10.1	571.06	
9+60.02	6+81.75	278.27		0.00	0.0	5.66	10.9	100	9.66	54.7	30	11.1	0.0178	0.50	1.43	0.4	11.3	570.45	
6+81.75	6+29.85	51.90		0.00	0.0	5.66	11.3	100	9.59	54.3	36	7.7	0.0066	0.80	0.00	0.1	11.4	563.76	
INLET_A-6	6+29.85	10.87	INLET_A-6	0.46	10.0	0.46	10.0	100	9.80	4.5	18	2.5	0.0018	1.25	0.13	0.0	10.0	565.33	
6+29.85	4+98.96	130.89		0.00	0.0	6.12	11.4	100	9.58	58.6	36	8.3	0.0077	0.40	0.70	0.3	11.7	563.42	
INLET_A-7	4+98.96	69.98	INLET_A-7	0.42	10.0	0.42	10.0	100	9.80	4.1	18	2.3	0.0015	1.25	0.10	0.1	10.1	563.51	
4+98.96	3+14.41	184.55		0.00	0.0	6.54	11.7	100	9.53	62.3	39	7.5	0.0057	0.40	0.45	0.4	12.1	561.71	
3+14.41	2+96.98	17.43		0.00	0.0	6.54	12.1	100	9.46	61.9	42	6.4	0.0038	0.40	0.29	0.0	12.1	560.21	
INLET_A-8	2+96.98	24.75	INLET_A-8	0.43	10.0	0.43	10.0	100	9.80	4.2	18	2.4	0.0016	1.25	0.11	0.2	10.2	560.00	
2+96.98	JUNCT. BOX	45.73		0.00	0.0	6.97	12.1	100	9.46	65.9	45	6.0	0.0030	0.20	0.43	0.1	12.2	559.85	
INLET_A-9	JUNCT. BOX	50.17	INLET_A-9	0.22	10.0	0.22	10.0	100	9.80	2.2	18	1.2	0.0004	1.25	0.03	0.7	10.7	559.33	
JUNCT. BOX	2+37.13	14.06		0.00	0.0	7.19	12.2	100	9.45	67.9	7x4	2.4	0.0003	0.40	0.00	0.1	12.3	559.28	
DET. POND	2+37.13	42.37	DET. POND	6.03	10.0	6.03	10.0	100	9.80	59.1	42	6.1	0.0035	1.25	0.73	0.1	10.1	560.16	
1+87.13	1+92.37	44.76		0.00	0.0	13.22	12.3	100	9.43	124.7	7x4	4.5	0.0011	0.60	0.26	0.2	12.5	559.28	
A-11-12	1+92.37	10.00		1.14	10.0	1.14	10.0	100	9.80	11.2	27	2.8	0.0013	0.00	0.00	0.1	10.1	558.98	
1+92.37	1+84.16	8.21		0.00	0.0	14.36	12.5	100	9.40	135.0	7x4	4.8	0.0013	0.60	0.17	0.0	12.5	558.97	
1+84.16	1+69.06	15.10		0.00	0.0	14.36	12.5	100	9.40	135.0	7x4	4.8	0.0013	0.60	0.22	0.1	12.6	558.79	
A-13	1+69.06	10.00		10.38	10.0	10.38	10.0	100	9.80	101.7	60	5.2	0.0015	0.00	0.00	0.0	10.0	558.57	
1+69.06	1+20.36	48.70		0.00	0.0	24.74	12.6	100	9.38	232.1	8x5	5.8	0.0015	0.60	0.31	0.1	12.7	558.55	
1+20.36	1+13.39	6.97		0.00	0.0	24.74	12.7	100	9.37	231.8	8x5	5.8	0.0014	0.00	0.00	0.0	12.7	558.17	
INLET_A-14	0+50	33.29		0.37	10.0	0.37	10.0	100	9.80	3.6	18	2.0	0.0012	1.25	0.08	0.3	10.3	558.42	
0+50	0+07.31	42.69		0.00	0.0	0.37	10.3	100	9.75	3.6	18	2.0	0.0012	0.00	0.00	0.4	10.7	558.30	
INLET_A-14.1	0+07.31	27.46		0.14	10.0	0.14	10.0	100	9.80	1.4	18	0.8	0.0002	1.25	0.01	0.3	10.6	558.27	
0+07.31	1+13.39	2.49		0.00	0.0	0.51	10.7	100	9.69	4.9	18	2.8	0.0022	0.60	0.08	0.0	10.7	558.25	
1+13.39	0+61	52.39		0.00	0.0	25.25	12.7	100	9.37	236.6	8x5	5.9	0.0015	0.40	0.33	0.1	12.8	558.16	BEG. HG = 557.75 BUFFALO CREEK TRIB. 1.2 Q100 W.S.
STORM DRAIN LINE 'B'																			
1+55	0+70	85.00	AREAS B-1, B-2	18.90	10.0	18.90	10.0	100	9.80	185.2	6x4	7.7	0.0036	0.21	0.19	0.2	10.2	554.87	BEG. HG = 554.38, DETENTION POND Q100 W.S.
STORM DRAIN LINE 'B-3'																			
INLET_B-3	5+03.12	51.07	INLET B-3	3.21	10.0	3.21	10.0	100	9.80	31.5	30	6.4	0.0059	1.25	0.80	0.1	10.1	558.91	
5+03.12	4+62.00	41.12		0.00	0.0	3.21	10.1	100	9.78	31.4	30	6.4	0.0059	0.50	0.32	0.1	10.2	557.81	
INLET_B-3.1	4+62.00	13.36	INLET_B-3.1	0.48	10.0	0.48	10.0	100	9.80	4.7	18	2.7	0.0020	1.25	0.14	0.1	10.1	557.42	
4+62.00	4+16.66	45.34		0.00	0.0	3.69	10.2	100	9.76	36.0	36	5.1	0.0029	0.20	0.28	0.1	10.3	557.25	
INLET_B-3.2	4+16.66	82.95	INLET_B-3.2	0.31	10.0	0.31	10.0	100	9.80	3.0	18	1.7	0.0008	1.25	0.06	0.8	10.8	556.97	
4+16.66	1+54.30	262.36		0.00	0.0	4.00	10.8	100	9.64	38.6	36	5.5	0.0033	0.20	0.39	0.8	11.6	556.84	
INLET_B-3.3	0+16.19	11.01	INLET B-3.3	2.31	10.0	2.31	10.0	100	9.80	22.6	27	5.7	0.0053	1.25	0.63	0.0	10.0	556.32	
0+16.19	INLET_B-3.4	2.75		0.00	0.0	2.31	10.0	100	9.80	22.6	27	5.7	0.0053	0.00	0.00	0.0	10.0	555.63	
INLET_B-3.4	1+54.30	13.44	INLET_B-3.4	0.63	0.0	2.94	10.0	100	9.80	28.8	36	4.1	0.0019	0.50	0.01	0.1	10.1	555.62	
1+54.30	1+23.99	30.31		0.00	0.0	6.94	11.6	100	9.50	65.9	48	5.2	0.0021	0.40	0.23	0.1	11.7	555.58	
INLET_B-3.5	1+23.99	69.59	INLET_B-3.5	0.48	10.0	0.48	10.0	100	9.80	4.7	21	2.0	0.0009	1.25	0.08	0.6	10.6	555.43	
1+23.99	0+20.00	103.99		0.00	0.0	7.42	11.7	100	9.48	70.3	48	5.6	0.0024	0.20	0.40	0.3	12.0	555.29	
0+20.00	0+10.00	10.00		0.00	0.0	7.42	12.0	100	9.43	70.0	48	5.6	0.0024	0.50	0.24	0.0	12.0	554.64	BEG. HG = 554.38, DETENTION POND Q100 W.S.
STORM DRAIN LINE 'B-4'																			
INLET_B-4	5+05.36	55.30	INLET B-4	1.62	10.0	1.62	10.0	100	9.80	15.9	27	4.0	0.0026	1.25	0.31	0.1	10.1	557.26	
5+05.36	4+50.61	54.75		0.00	0.0	1.62	10.1	100	9.78	15.8	27	4.0	0.0026	0.50	0.12	0.1	10.2	556.81	
INLET_B-4.1	4+50.61	13.44	INLET_B-4.1	0.50	10.0	0.50	10.0	100	9.80	4.9	18	2.8	0.0022	1.25	0.15	0.1	10.1	556.73	
4+50.61	3+99.61	51.00		0.00	0.0	2.12	10.3	100	9.74	20.6	30	4.2	0.0025	0.30	0.20	0.2	10.5	556.55	
INLET_B-4.2	3+99.61	85.56	INLET_B-4.2	0.33	10.0	0.33	10.0	100	9.80	3.2	18	1.8	0.0009	1.25	0.06	0.8	10.8	556.36	
3+99.61	2+52.24	147.37		0.00	0.0	2.45	10.8	100	9.64	23.6	30	4.8	0.0033	0.20	0.30	0.5	11.3	556.22	
INLET_B-4.3	2+52.24	13.36	INLET_B-4.3	0.47	10.0	0.47	10.0	100	9.80	4.6	21	1.9	0.0008	1.25	0.07	0.1	10.1	555.51	
2+52.24	2+07.00	45.24		0.00	0.0	2.92	11.3	100	9.55	27.9	36	3.9	0.0017	0.20	0.16	0.2	11.5	555.43	
INLET_B-4.4	2+07.00	82.88	INLET_B-4.4	0.33	10.0	0.33	10.0	100	9.80	3.2	21	1.3	0.0004	1.25	0.03	1.1	11.1	555.25	
2+07.00	0+75.00	132.00		0.00	0.0	3.25	11.5	100	9.52	30.9	36	4.4	0.0021	0.20	0.25	0.5	12.0	555.19	
0+75.00	0+20.00	55.00		0.00	0.0	3.25	12.0	100	9.43	30.6	36	4.3	0.0021	0.00	0.00	0.2	12.2	554.66	
0+20.00	0+10.00	10.00		0.00	0.0	3.25	12.2	100	9.40	30.6	36	4.3	0.0021	0.50	0.14	0.0	12.2	554.54	BEG. HG = 554.38, DETENTION POND Q100 W.S.
STORM DRAIN LINE 'E'																			
1+37	0+88	49.00	DETENTION POND	N/A	N/A	N/A	N/A	100	N/A	119.0	6x4	5.0	0.0012	0.21	0.08	0.2	N/A	551.77	BEG. HG = 551.63, BUFFALO CREEK TRIB. 1 Q100 W.S.

RECORD PLANS
MAY 1, 2015

PREPARED BY:
WIER & ASSOCIATES, INC.
ENGINEERS SURVEYORS LAND PLANNERS
701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
STORM DRAIN DESIGN
CALCULATIONS

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED
PROFESSIONAL ENGINEER
5/1/2015

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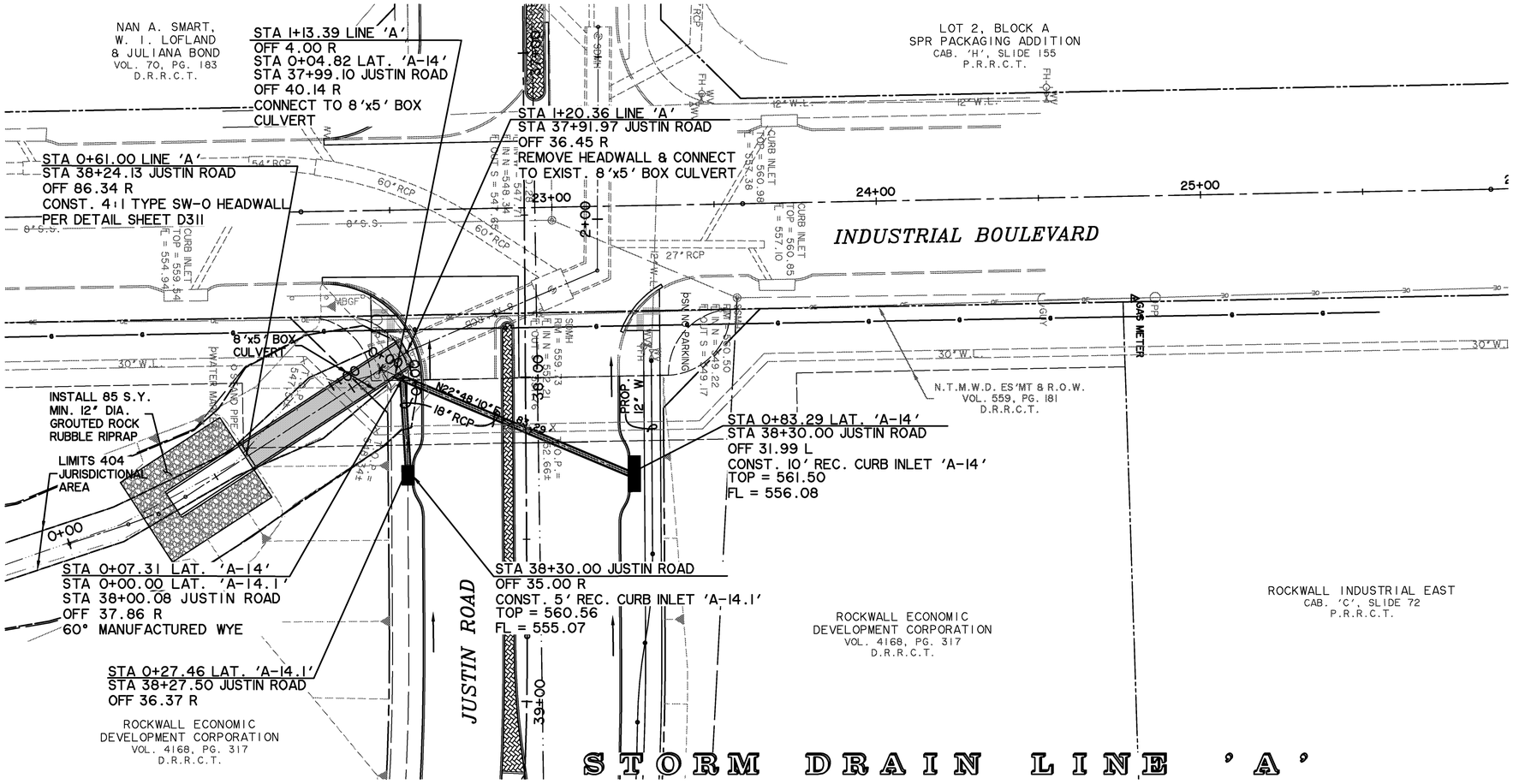
LAST SHEET EDIT DATE 5/1/2015
WA# 13096
SHEET NO. D104

PRINTED: 5/1/2015 STB FILE: WIER-PAVING.STB LAST SAVED: 4/21/2015 2:26 PM SAVED BY: CLAYTONT FILE: STORM-DRAIN-DESIGN-CALCULATIONS-13096.DWG



STA 1+13.39 LINE 'A'
OFF 4.00 R
STA 0+04.82 LAT. 'A-14'
STA 37+99.10 JUSTIN ROAD
OFF 40.14 R
CONNECT TO 8'x5' BOX
CULVERT

STA 1+20.36 LINE 'A'
STA 37+91.97 JUSTIN ROAD
OFF 36.45 R
REMOVE HEADWALL & CONNECT
TO EXIST. 8'x5' BOX CULVERT

STA 0+61.00 LINE 'A'
STA 38+24.13 JUSTIN ROAD
OFF 86.34 R
CONST. 4:1 TYPE SW-O HEADWALL
PER DETAIL SHEET D311

INSTALL 85 S.Y.
MIN. 12" DIA.
GROUTED ROCK
RUBBLE RIPRAP

LIMITS 404
JURISDICTIONAL
AREA

STA 0+83.29 LAT. 'A-14'
STA 38+30.00 JUSTIN ROAD
OFF 31.99 L
CONST. 10' REC. CURB INLET 'A-14'
TOP = 561.50
FL = 556.08

STA 0+07.31 LAT. 'A-14'
STA 0+00.00 LAT. 'A-14.1'
STA 38+00.08 JUSTIN ROAD
OFF 37.86 R
60° MANUFACTURED WYE

STA 38+30.00 JUSTIN ROAD
OFF 35.00 R
CONST. 5' REC. CURB INLET 'A-14.1'
TOP = 560.56
FL = 555.07

STA 0+27.46 LAT. 'A-14.1'
STA 38+27.50 JUSTIN ROAD
OFF 36.37 R

*** BENCHMARKS ***

BM A: AN "X" CUT ON THE CENTER OF CURB INLET AT THE EDGE OF SIDEWALK ±25' FROM CURB RETURN AT NORTHWEST INTERSECTION OF JUSTIN RD & INDUSTRIAL PKWY.
ELEV. 561.99 FT.

BM B: AN "X" CUT ON SOUTHEAST CORNER OF SIDEWALK NEXT TO HEADWALL ON WEST SIDE OF JOHN KING BLVD ±1,700' NORTH OF I-30.
ELEV. 563.49 FT.

CAUTION !!

EXISTING UTILITIES ARE INDICATED ON THE PLANS FROM AVAILABLE INFORMATION. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION OF ALL UTILITIES, TO NOTIFY ALL UTILITY COMPANIES OF THE CONTRACTORS OPERATIONS, TO PROTECT ALL UTILITIES FROM DAMAGE, TO REPAIR ALL UTILITIES DAMAGED DUE TO THE CONTRACTORS OPERATIONS, AND TO NOTIFY THE ENGINEER PROMPTLY OF ALL CONFLICTS OF THE WORK WITH EXISTING UTILITIES.

CAUTION!! NOTIFY THE NTMWD ENGINEERING DEPARTMENT (972-442-5405) A MINIMUM OF 48 HOURS PRIOR TO PERFORMING ANY WORK WITHIN THE NTMWD EASEMENT

STORM DRAIN LINE 'A'

TOP HEADWALL
= 558.03

H.G. =
557.75

H.G. = 558.16
kj = 0.40
hj = 0.33
H.G. = 557.83

H.G. = 558.55
kj = 0.60
hj = 0.31
H.G. = 558.24

H.G. = 558.79
kj = 0.60
hj = 0.22
H.G. = 558.57

H.G. = 558.97
kj = 0.60
hj = 0.17
H.G. = 558.80

59 L.F. 8'x5' BOX
CULVERT @+0.30%

Q_{100}= 236.6 cfs
Sf = 0.15%
V = 5.9 fps
$V^2/2g$ = 0.54'
Qcap = 333.7 cfs

Q_{100}= 232.1 cfs
Sf = 0.15%
V = 5.8 fps
$V^2/2g$ = 0.52'
Qcap = 828.8 cfs

Q_{100}= 135.0 cfs
Sf = 0.13%
V = 4.8 fps
$V^2/2g$ = 0.36'
Qcap = 163.8 cfs

Q_{100}= 124.7 cfs
Sf = 0.11%
V = 4.5 fps
$V^2/2g$ = 0.31'
Qcap = 168.1 cfs

STA 0+61.00 LINE 'A'
CONST. 4:1 TYPE SW-O
HEADWALL PER DETAIL
SHEET D311
FL 8'x5' BOX = 550.73

STA 1+13.39 LINE 'A'
STA 0+04.82 LAT. 'A-14'
FL 8'x5' BOX = 550.84
FL 18" = 553.34

STA 1+20.36 LINE 'A'
REMOVE EXISTING HEADWALL
& CONNECT TO EXIST. BOX CULVERT
FL 8'x5' BOX = 550.86±

STA 1+69.06± LINE 'A'
EXIST. S.D.M.H.
FL 8'x5' BOX = 551.76±
FL 7'x4' BOX = 552.21±
FL 60" = 551.76±

STA 1+92.37± LINE 'A'
FL 7'x4' BOX = 552.26±
FL 27" = 555.38±

NOTE:
CONTRACTOR SHALL INSTALL CLASS 'C' COMPACTED CRUSHED STONE EMBEDMENT TO A DEPTH OF 18" BELOW BOX CULVERT FOR A LENGTH OF 8 FEET CENTERED ON NTMWD 30" WATER LINE FOR THE FULL WIDTH OF THE BOX CULVERT TRENCH.

H.G. =
558.16

H.G. = 558.25
kj = 0.60
hj = 0.08
H.G. = 558.17

H.G. = 558.42
kj = 1.25
hj = 0.08
H.G. = 558.34

45 L.F.
18" RCP
@+6.09%

33 L.F.
18" RCP
@+0.30%

Q_{100}= 4.9 cfs
Sf = 0.22%
V = 2.8 fps
$V^2/2g$ = 0.12'
Qcap = 25.9 cfs

Q_{100}= 3.6 cfs
Sf = 0.12%
V = 2.0 fps
$V^2/2g$ = 0.06'
Qcap = 5.7 cfs

STA 0+04.82 LAT. 'A-14'
= STA 1+13.39 LINE 'A'
FL 18" = 553.34
FL 8'x5' BOX = 550.84

STA 0+07.31 LAT. 'A-14'
= STA 0+00.00 LAT. 'A-14.1'
FL 18" = 553.49

STA 0+50.00 LAT. 'A-14'
FL 18" = 556.09

STA 0+83.29 LAT. 'A-14'
10' REC. CURB INLET
FL = 556.08

H.G. =
558.25

H.G. = 558.27
kj = 1.25
hj = 0.01
H.G. = 558.26

27 L.F.
18" RCP
@+7.83%

Q_{100}= 1.4 cfs
Sf = 0.02%
V = 0.80 fps
$V^2/2g$ = 0.01'
Qcap = 42.0 cfs

STA 0+00.00 LAT. 'A-14.1'
= STA 0+07.31 LAT. 'A-14'
FL 18" = 553.49

STA 0+27.46 LAT. 'A-14.1'
5' REC. CURB INLET
FL = 555.07

RECORD PLANS
MAY 1, 2015

PREPARED BY:
WIER & ASSOCIATES, INC.
ENGINEERS SURVEYORS LAND PLANNERS
701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.WierAssociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
STORM DRAIN LINE A

PHILIP L. GRAHAM
94719
5/1/2015

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DATE 5/1/2015
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SHEET NO.
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STA 0+70.00 LINE 'B'
STA 47+95.00 LINE 'B'
OFF 42.50 R
CONST. 3:1 TYPE PW HEADWALL PER DETAIL SHEETS D309 & D317 & 71 L.F. OF TYPE C221 COMBINATION RAIL PER DETAIL SHEETS D313 TO D315

STA 0+00.29 LINE 'B'
STA 47+61.52 JUSTIN ROAD
OFF 100.30 R
PC

DETENTION POND

CONCRETE PILOT CHANNEL - SEE SHEET G102

D = 56°21'57"
R = 69.00
L = 67.88
T = 36.97
CH = N26°11'11"E
65.18

JUSTIN ROAD

LINE 'B-3' 48" RCP

8'x5' BOX CULVERT

PROP. 12" W

N4°38'05"W

BOX CULVERT BY OTHERS

LINE 'B-4' 36" RCP

INSTALL 67 S.Y. MIN. 12' DIA. GROUTED ROCK RUBBLE RIPRAP

ROCKWALL ECONOMIC DEVELOPMENT CORPORATION
VOL. 4168, PG. 317
D.R.R.C.T.

STA 0+68.17 LINE 'B'
STA 47+94.92 JUSTIN ROAD
OFF 44.33 R
PT

ROCKWALL ECONOMIC DEVELOPMENT CORPORATION
VOL. 4168, PG. 317
D.R.R.C.T.

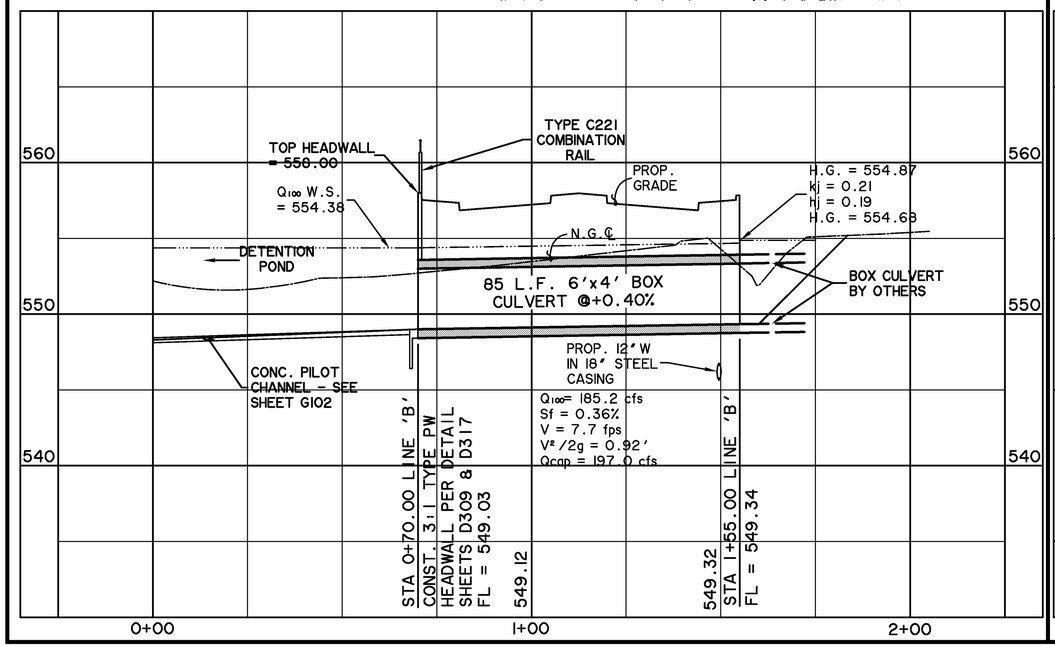
0+00 1+00 2+00 47+00 48+00 49+00

*** BENCHMARKS ***

BM A: AN "X" CUT ON THE CENTER OF CURB INLET AT THE EDGE OF SIDEWALK ±25' FROM CURB RETURN AT NORTHWEST INTERSECTION OF JUSTIN RD & INDUSTRIAL PKWY.
ELEV. 561.99 FT.

BM B: AN "X" CUT ON SOUTHEAST CORNER OF SIDEWALK NEXT TO HEADWALL ON WEST SIDE OF JOHN KING BLVD ±1,700' NORTH OF I-30.
ELEV. 563.49 FT.

STORM DRAIN 'B'



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CEDAR 5x15x20

DETENTION POND

DRAINAGE EASEMENT

ROCKWALL ECONOMIC DEVELOPMENT CORPORATION
VOL. 4168, PG. 317
D.R.R.C.T.

STA 0+78.00 LINE 'E'
STA 45+23.59 JUSTIN ROAD
OFF 311.65 R
CONST. 66' TYPE SETP-PD HEADWALL PER DETAIL SHEET D312

BUFFALO CREEK TRIBUTARY 1

N16°28'34"W

66' RCP

20' DRAINAGE EASEMENT

INSTALL 60 S.Y. MIN. 12' DIA. GROUTED ROCK RUBBLE RIPRAP

LIMITS 404 JURISDICTIONAL AREA

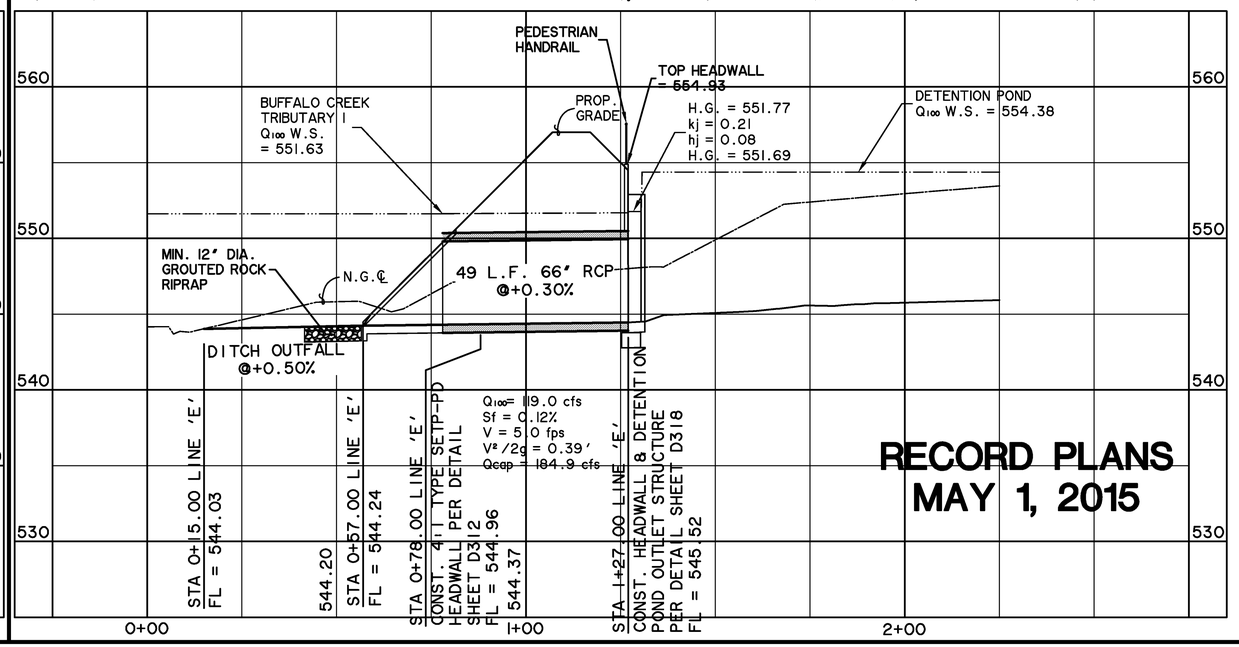
100 YEAR FLOOD PLAIN

STA 1+27.00 LINE 'E'
STA 45+12.88 JUSTIN ROAD
OFF 264.79 R
CONST. HEADWALL & DETENTION POND OUTLET STRUCTURE PER DETAIL SHEET D318 & 78 L.F. PEDESTRIAN HANDRAIL PER DETAIL SHEET D316

0+00 1+00 2+00

STORM DRAIN 'E'

0 20 40 60



RECORD PLANS
MAY 1, 2015

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Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
STORM DRAIN LINES 'B' & 'E'

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
5/1/2015

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LAST SHEET EDIT
DATE 5/1/2015
WA# 13096

SHEET NO.
D106

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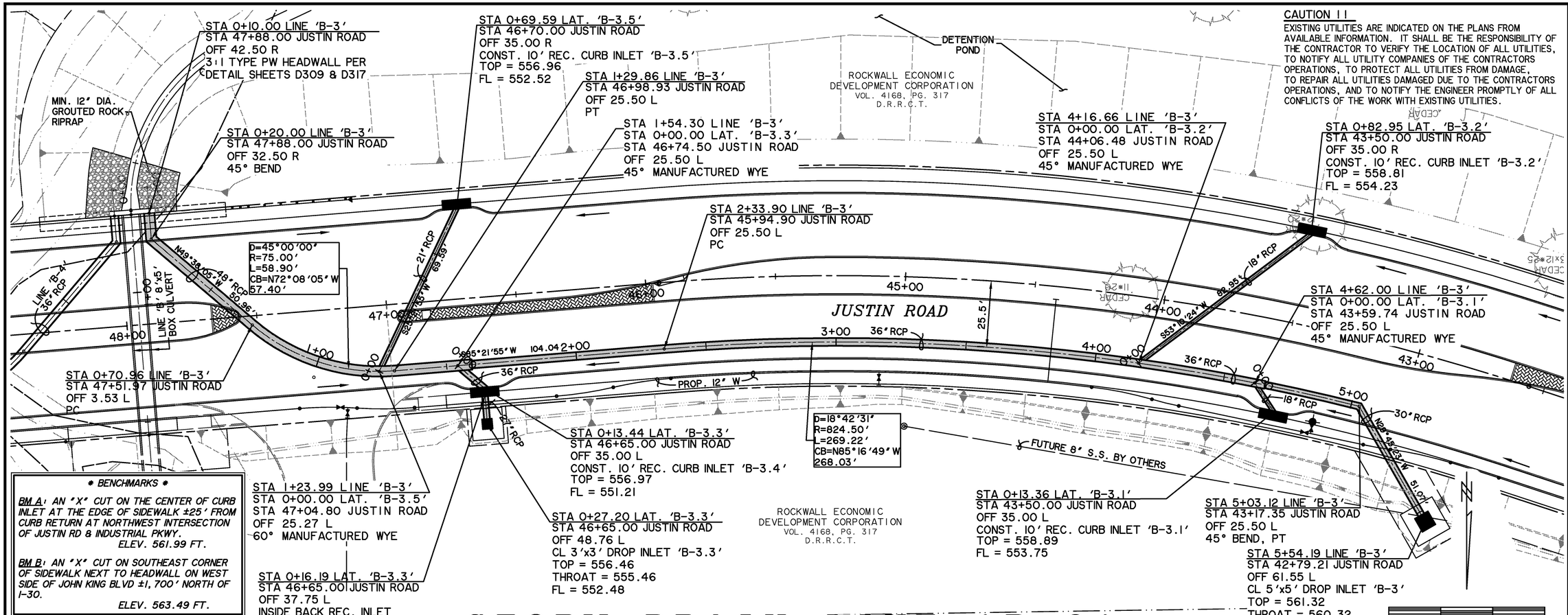

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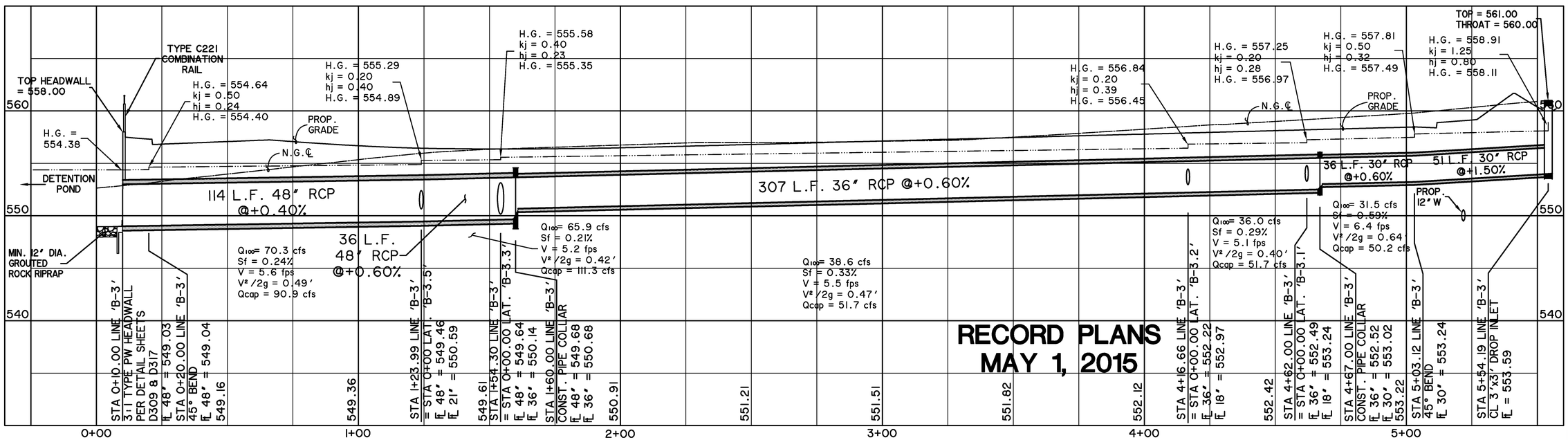
ELEV. 563.49 FT.

STORM DRAIN LINE 'B-3'



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Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
STORM DRAIN LINE 'B-3'

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED
PROFESSIONAL ENGINEER
5/1/2015

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W&A# 13096
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PRINTED: 5/1/2015 STB FILE: WIER-STORM DRAIN.STB LAST SAVED: 4/30/2015 10:42 AM SAVED BY: PHILIPG FILE: STORM-DRAIN-LINE-B3-13096.DWG

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ELEV. 561.99 FT.

BM B: AN "X" CUT ON SOUTHEAST CORNER OF SIDEWALK NEXT TO HEADWALL ON WEST SIDE OF JOHN KING BLVD ±1,700' NORTH OF I-30.
ELEV. 563.49 FT.

CAUTION !!
EXISTING UTILITIES ARE INDICATED ON THE PLANS FROM AVAILABLE INFORMATION. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION OF ALL UTILITIES, TO NOTIFY ALL UTILITY COMPANIES OF THE CONTRACTORS OPERATIONS, TO PROTECT ALL UTILITIES FROM DAMAGE, TO REPAIR ALL UTILITIES DAMAGED DUE TO THE CONTRACTORS OPERATIONS, AND TO NOTIFY THE ENGINEER PROMPTLY OF ALL CONFLICTS OF THE WORK WITH EXISTING UTILITIES.

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Texas Firm Registration No. F-2776 www.WierAssociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
STORM DRAIN LINE 'B-4'

PHILIP L. GRAHAM
94719
5/1/2015

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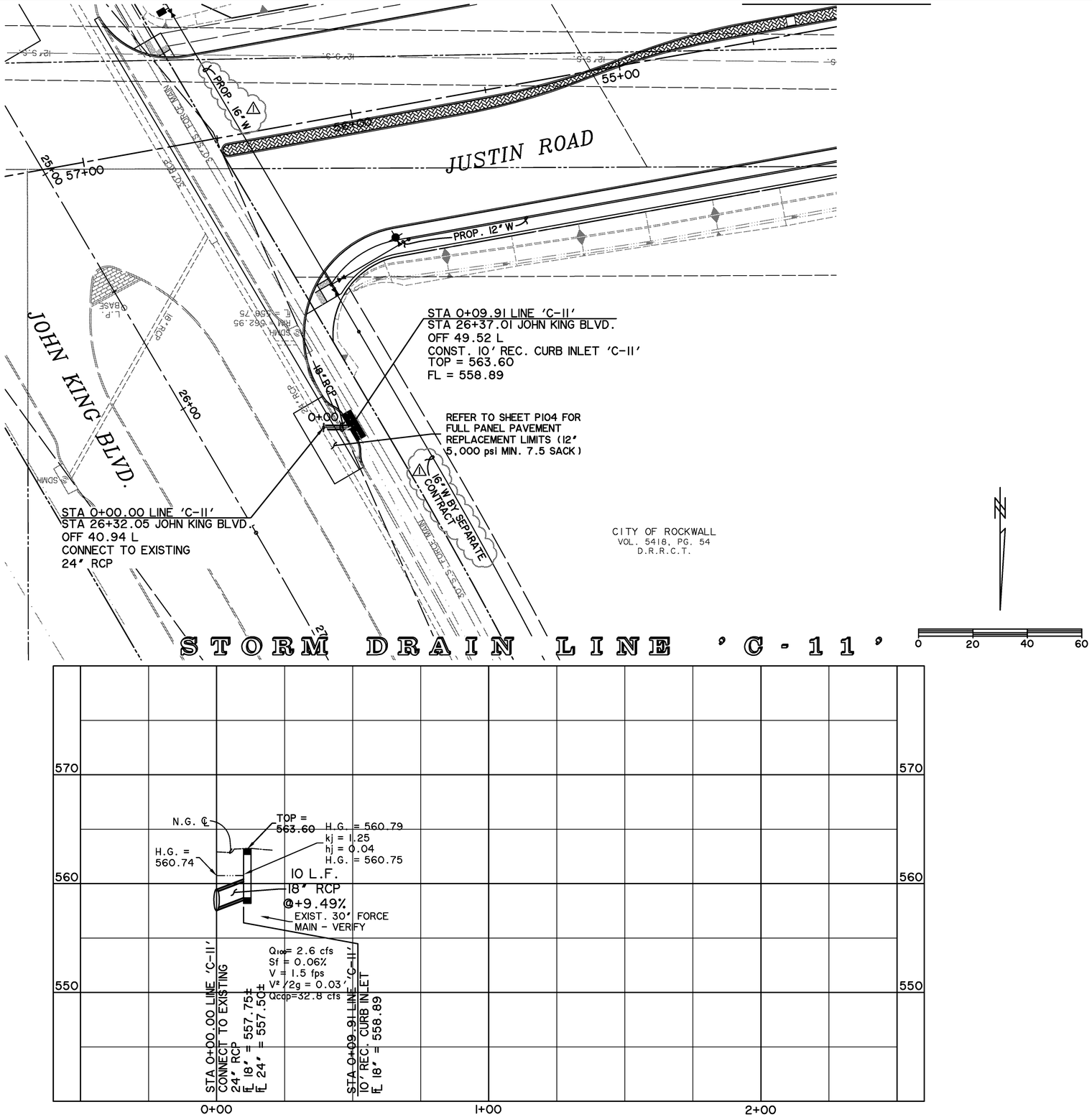

STORM DRAIN LINE 'C-11'

*** BENCHMARKS ***

BM A: AN "X" CUT ON THE CENTER OF CURB INLET AT THE EDGE OF SIDEWALK ±25' FROM CURB RETURN AT NORTHWEST INTERSECTION OF JUSTIN RD & INDUSTRIAL PKWY.
ELEV. 561.99 FT.

BM B: AN "X" CUT ON SOUTHEAST CORNER OF SIDEWALK NEXT TO HEADWALL ON WEST SIDE OF JOHN KING BLVD ±1,700' NORTH OF I-30.
ELEV. 563.49 FT.

CAUTION 11

EXISTING UTILITIES ARE INDICATED ON THE PLANS FROM AVAILABLE INFORMATION. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION OF ALL UTILITIES, TO NOTIFY ALL UTILITY COMPANIES OF THE CONTRACTORS OPERATIONS, TO PROTECT ALL UTILITIES FROM DAMAGE, TO REPAIR ALL UTILITIES DAMAGED DUE TO THE CONTRACTORS OPERATIONS, AND TO NOTIFY THE ENGINEER PROMPTLY OF ALL CONFLICTS OF THE WORK WITH EXISTING UTILITIES.

RECORD PLANS
MAY 1, 2015

REVISIONS

NO	DESCRIPTION	DATE	BY
1	CHANGED WATER LINE FROM 12" TO 16"	4/16/14	PLG

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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
STORM DRAIN LINE 'C-11'

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
5/1/2015

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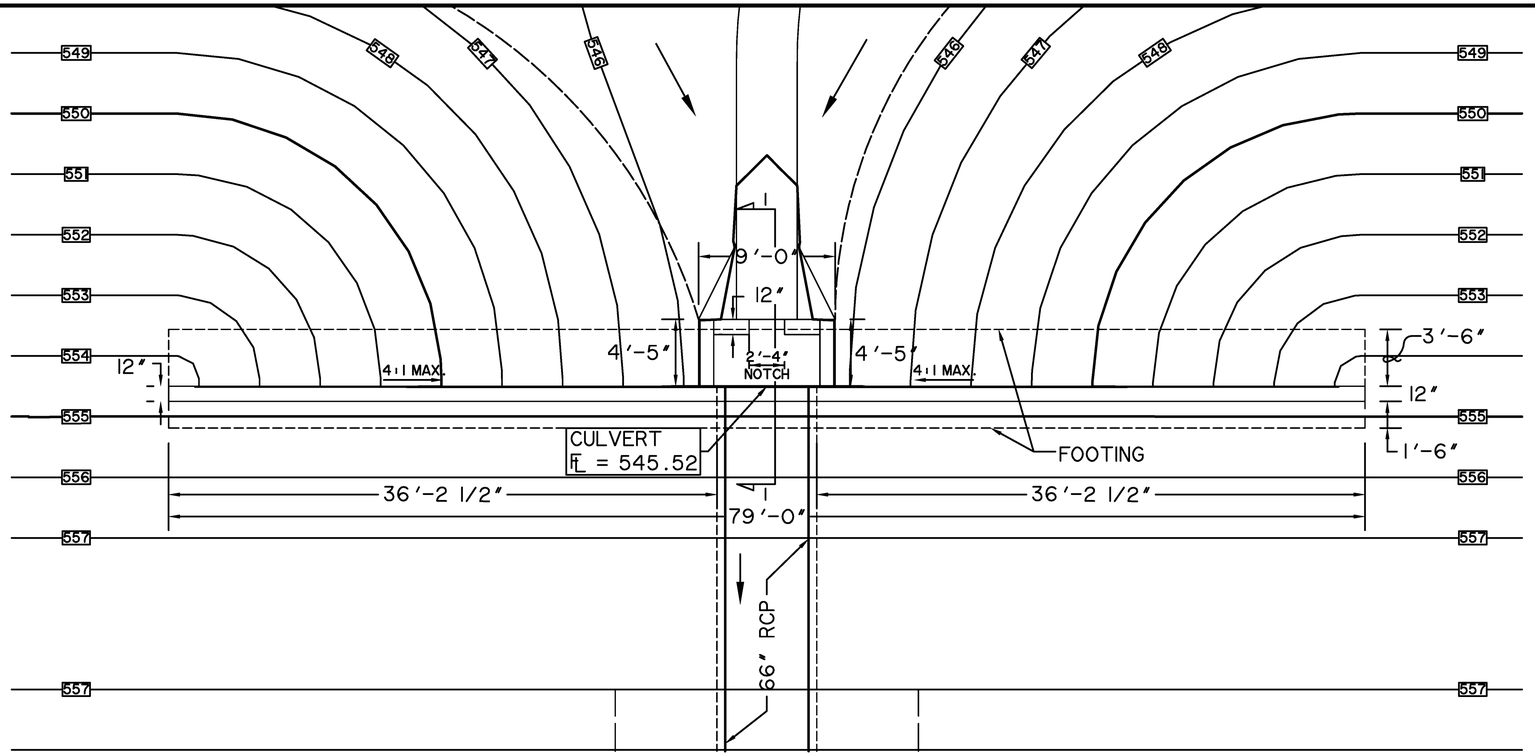


OUTLET STRUCTURE PLAN

N.T.S.

DRAINAGE STRUCTURES AND SURFACE CONCRETE NOTES

1. EXCEPT AS AMENDED HEREIN ALL CONSTRUCTION SHALL CONFORM TO THE CITY OF ROCKWALL SPECIFICATIONS AND STANDARDS WHICH INCORPORATE BY REFERENCE THE LATEST EDITION OF THE NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS (NCTCOG) STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.

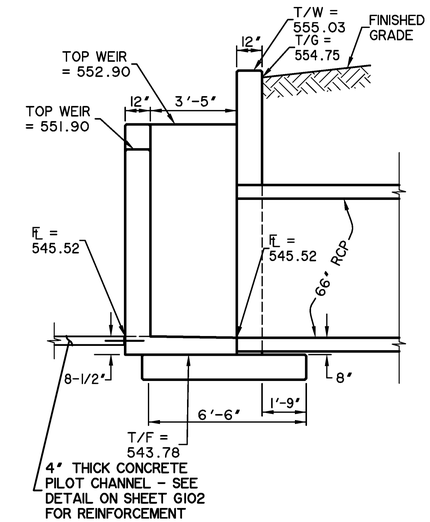
2. CONCRETE FOR DRAINAGE STRUCTURES AND WEIRS SHALL BE 4,200 PSI CLASS F ITEM 702 CONFORMING TO ALL THE APPLICABLE REQUIREMENTS OF THE NCTCOG SPECIFICATIONS. CONCRETE FOR SURFACE FLUMES OR RIPRAP SHALL BE MINIMUM 3,000 PSI CLASS A CONCRETE CONFORMING TO NCTCOG SPECIFICATIONS.

3. REINFORCING STEEL SHALL BE GRADE 60 CONFORMING TO NCTCOG SPECIFICATIONS AND BENT REBAR FOR DRAINAGE STRUCTURES SHALL BE PREFORMED.

4. FOOTINGS FOR STRUCTURES MUST ACT ADDITIONALLY AS GROUND WATER CUT OFFS TO PREVENT SURFACE RUNOFF FROM PENETRATING INTO PIPE SECTION CRUSHED STONE BEDDING AND WALL BACKFILLS. NO LEVEL UP MATERIAL SHALL BE PLACED AT THESE LOCATIONS WHICH MAY ALLOW GROUND WATER MOVEMENT UNDER THE STRUCTURE.

5. BACKFILL FOOTINGS, APRONS AND TOE WALLS WITH ONSITE BROWN CLAYS (P.I. ABOVE 30). COMPACT IN THIN LAYERS WITH HAND TAMPING EQUIPMENT TO AVOID DAMAGE TO CONCRETE WALLS. COMPACT SOILS IN MOIST CONDITION OF +2% TO +6% ABOVE OPTIMUM TO BETWEEN 92% TO 95% OF STANDARD PROCTOR DENSITY (ASTM D698).

6. PROVIDE 8" KEYWAY AT ALL WALL FOOTING JOINTS. PROVIDE 2" INCH CHAMFER AT EXPOSED WEIR VERTICAL EDGES.

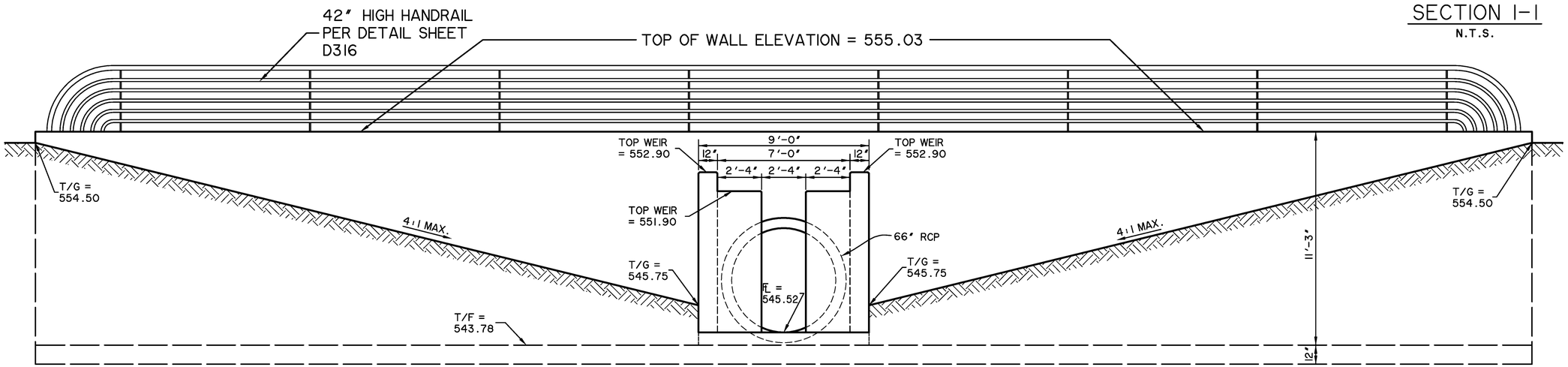


SECTION 1-1

N.T.S.

SEE SHEET D318 FOR STRUCTURAL DETAILS

RECORD PLANS
MAY 1, 2015



ELEVATION

N.T.S.

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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
DETENTION POND DETAILS

PHILIP L. GRAHAM 94719 LICENSED PROFESSIONAL ENGINEER 5/1/2015

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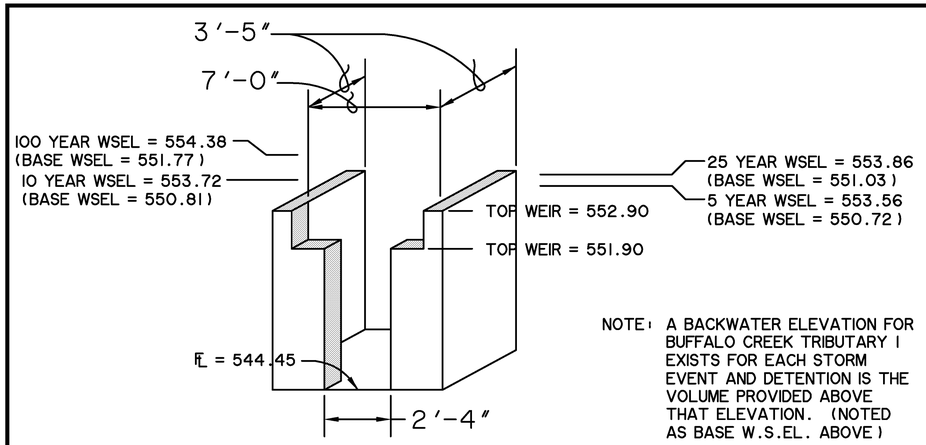


NOTE: A BACKWATER ELEVATION FOR BUFFALO CREEK TRIBUTARY 1 EXISTS FOR EACH STORM EVENT AND DETENTION IS THE VOLUME PROVIDED ABOVE THAT ELEVATION. (NOTED AS BASE W.S.EL. ABOVE)

WEIR STRUCTURE

N.T.S.

POND STORAGE CALCULATIONS

100 YEAR							
Tc (min)	Intensity (in/hr)	Q (cfs)	Inflow (Cu Ft)	Q_{OUT} (cfs)	Outflow (Cu Ft)	Storage (Cu Ft)	Acre-Ft.
10	9.8	329.3	197,574	128.2	76,920	120,654	2.77
15	9.0	302.4	272,169	128.2	96,150	176,019	4.04
20	8.3	278.9	334,667	128.2	115,380	219,287	5.03
30	6.9	231.8	417,325	128.2	153,840	263,485	6.05
40	5.8	194.9	467,727	128.2	192,300	275,427	6.32
50	5.0	168.0	504,016	128.2	230,760	273,256	6.27
60	4.5	151.2	544,337	128.2	269,220	275,117	6.32
70	4.0	134.4	564,498	128.2	307,680	256,818	5.90
80	3.7	124.3	596,755	128.2	346,140	250,615	5.75
90	3.5	117.6	635,060	128.2	384,600	250,460	5.75

25 YEAR							
Tc (min)	Intensity (in/hr)	Q (cfs)	Inflow (Cu Ft)	Q_{OUT} (cfs)	Outflow (Cu Ft)	Storage (Cu Ft)	Acre-Ft.
10	8.3	278.9	167,333	82.6	49,560	117,773	2.70
15	7.5	252.0	226,807	82.6	61,950	164,857	3.78
20	6.6	221.8	266,120	82.6	74,340	191,780	4.40
30	5.5	184.8	332,651	82.6	99,120	233,531	5.36
40	4.6	154.6	370,956	82.6	123,900	247,056	5.67
50	4.0	134.4	403,213	82.6	148,680	254,533	5.84
60	3.5	117.6	423,373	82.6	173,460	249,913	5.74
70	3.3	110.9	465,711	82.6	198,240	267,471	6.14
80	3.1	104.2	499,984	82.6	223,020	276,964	6.36
90	2.9	97.4	526,193	82.6	247,800	278,393	6.39
100	2.7	90.7	544,337	82.6	272,580	271,757	6.24
110	2.5	84.0	554,418	82.6	297,360	257,058	5.90

10 YEAR							
Tc (min)	Intensity (in/hr)	Q (cfs)	Inflow (Cu Ft)	Q_{OUT} (cfs)	Outflow (Cu Ft)	Storage (Cu Ft)	Acre-Ft.
10	7.1	238.6	143,141	74.8	44,880	98,261	2.26
15	6.5	218.4	196,566	74.8	56,100	140,466	3.22
20	5.9	198.2	237,896	74.8	67,320	170,576	3.92
30	4.8	161.3	290,313	74.8	89,760	200,553	4.60
40	4.0	134.4	322,570	74.8	112,200	210,370	4.83
50	3.5	117.6	352,811	74.8	134,640	218,171	5.01
60	3.0	100.8	362,892	74.8	157,080	205,812	4.72
70	2.8	94.1	395,149	74.8	179,520	215,629	4.95
80	2.6	87.4	419,341	74.8	201,960	217,381	4.99
90	2.5	84.0	453,614	74.8	224,400	229,214	5.26
100	2.4	80.6	483,855	74.8	246,840	237,015	5.44
110	2.3	77.3	510,064	74.8	269,280	240,784	5.53
120	2.2	73.9	532,241	74.8	291,720	240,521	5.52
130	2.1	70.6	550,385	74.8	314,160	236,225	5.42

5 YEAR							
Tc (min)	Intensity (in/hr)	Q (cfs)	Inflow (Cu Ft)	Q_{OUT} (cfs)	Outflow (Cu Ft)	Storage (Cu Ft)	Acre-Ft.
10	6.1	205.0	122,980	64.9	38,940	84,040	1.93
15	5.5	184.8	166,325	64.9	48,675	117,650	2.70
20	4.9	164.6	197,574	64.9	58,410	139,164	3.19
30	4.1	137.8	247,976	64.9	77,880	170,096	3.90
40	3.4	114.2	274,185	64.9	97,350	176,835	4.06
50	2.8	94.1	282,249	64.9	116,820	165,429	3.80
60	2.6	87.4	314,506	64.9	136,290	178,216	4.09
70	2.4	80.6	338,699	64.9	155,760	182,939	4.20
80	2.3	77.3	370,956	64.9	175,230	195,726	4.49
90	2.1	70.6	381,036	64.9	194,700	186,336	4.28

POND WEIR CALCULATIONS

100 YEAR							
Q_{OUT} (cfs)	C_B	L_1 (Ft)	L_2 (Ft)	H_1 (Ft)	H_2 (Ft)	TOTAL L (Ft)	
118.9	3	7	3.42	2.48	1.48	13.83	

25 YEAR								
Q_{OUT} (cfs)	C_B	L_1 (Ft)	L_2 (Ft)	L_3 (Ft)	H_1 (Ft)	H_2 (Ft)	H_3 (Ft)	TOTAL L (Ft)
82.6	3	2.33	7	3.42	0.87	1.96	0.96	16.17

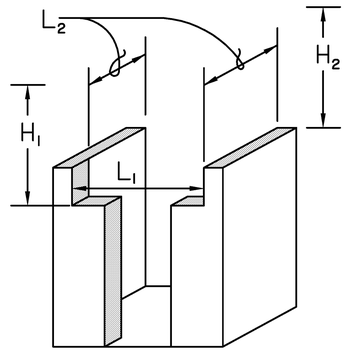
10 YEAR								
Q_{OUT} (cfs)	C_B	L_1 (Ft)	L_2 (Ft)	L_3 (Ft)	H_1 (Ft)	H_2 (Ft)	H_3 (Ft)	TOTAL L (Ft)
74.8	3	2.33	7	3.42	1.09	1.82	0.82	16.17

5 YEAR								
Q_{OUT} (cfs)	C_B	L_1 (Ft)	L_2 (Ft)	L_3 (Ft)	H_1 (Ft)	H_2 (Ft)	H_3 (Ft)	TOTAL L (Ft)
64.9	3	2.33	7	3.42	1.18	1.66	0.66	16.17

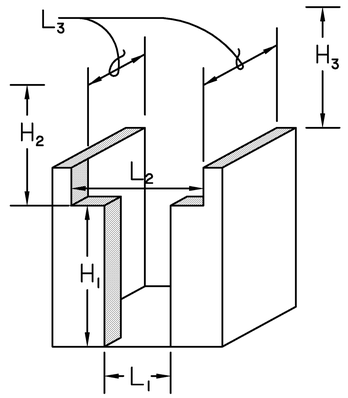
POST DEVELOPMENT Q100 DISCHARGE FROM SITE (DESIGN POINT #2 ON DEVELOPED CONDITIONS DRAINAGE AREA MAP) = DETENTION POND DISCHARGE + Q100 DISCHARGE FROM AREAS 'D', 'E-2', 'F-1' & 'F-2' IN TABLE BELOW.
Q100 DISCHARGE = 128.2 + 4.1 + 10.2 + 6.1 + 5.4 = 154.0 cfs.

DRAINAGE AREA CALCULATIONS FOR EXISTING CONDITIONS

DRAINAGE AREA DESIGNATION	TOTAL AREA (ACRES)	C 0.35 PARKS, OPEN SPACE & FLOOD PLAIN	C 0.90 COMMERCIAL, INDUSTRIAL, MERCANTILE, RETAIL, OR R.O.W.	C x A	tc (min.)	I (In./Hr.) 5 YEAR STORM	I (In./Hr.) 10 YEAR STORM	I (In./Hr.) 25 YEAR STORM	I (In./Hr.) 100 YEAR STORM	Q (cfs) 5 YEAR STORM	Q (cfs) 10 YEAR STORM	Q (cfs) 25 YEAR STORM	Q (cfs) 100 YEAR STORM
B-1	4.39	4.39		1.54	20	4.90	5.90	6.60	8.30	7.5	9.1	10.2	12.8
B-2	2.93		2.93	2.64	10	6.10	7.10	8.30	9.80	16.1	18.7	21.9	25.9
B-3 (DET.)	5.56	4.78	0.78	2.38	20	4.90	5.90	6.60	8.30	11.7	14.0	15.7	19.8
B-4	25.37	24.46	0.91	9.38	20	4.90	5.90	6.60	8.30	46.0	55.3	61.9	77.9
B-5	8.34	8.34		2.92	20	4.90	5.90	6.60	8.30	14.3	17.2	19.3	24.2
FOR DRAINAGE AREA DESIGNATIONS REFER TO EXISTING DRAINAGE AREA MAP, SHEET D101									TOTALS =	95.6	114.3	129.0	160.6



100 YEAR POND WEIR LAYOUT



5, 10, & 25 YEAR POND WEIR LAYOUT

NOTE:
THE REQUIRED STORAGE VOLUME WAS CALCULATED PER THE CITY OF ROCKWALL STANDARDS OF DESIGN. THE 100 YEAR BACKWATER ELEVATION FROM BUFFALO CREEK TRIBUTARY #1 WAS DETERMINED FOR THE SELECTED OUTFALL LOCATION. THE POND AND WEIR WERE SIZED BASED ON THE AVAILABLE HEAD ABOVE THE BACKWATER ELEVATION. FOR THE 5, 10 AND 25 YEAR STORM EVENTS, THE ASSOCIATED BACKWATER ELEVATIONS FROM BUFFALO CREEK TRIBUTARY #1 WERE DETERMINED. BASED ON THE WEIR DESIGN, 5, 10 AND 25 YEAR OUTFLOW W.S.EL.S WERE CALCULATED FOR THE POND.

DRAINAGE AREA CALCULATIONS FOR PROPOSED CONDITIONS

DRAINAGE AREA DESIGNATION	TOTAL AREA (ACRES)	C 0.35 PARKS, OPEN SPACE & FLOOD PLAIN	C 0.90 COMMERCIAL, INDUSTRIAL, MERCANTILE, RETAIL, OR R.O.W.	C x A	tc (min.)	I (In./Hr.) 5 YEAR STORM	I (In./Hr.) 10 YEAR STORM	I (In./Hr.) 25 YEAR STORM	I (In./Hr.) 100 YEAR STORM	Q (cfs) 5 YEAR STORM	Q (cfs) 10 YEAR STORM	Q (cfs) 25 YEAR STORM	Q (cfs) 100 YEAR STORM
B-1 (DET.)	5.56	4.78	0.78	2.38	10	6.10	7.10	8.30	9.80	14.5	16.9	19.8	23.3
B-2 (DEV.)	15.44		15.44	13.90	10	6.10	7.10	8.30	9.80	84.8	98.7	115.4	136.2
B-3 (DEV.)	3.57		3.57	3.21	10	6.10	7.10	8.30	9.80	19.6	22.8	26.6	31.5
B-3.1	0.53		0.53	0.48	10	6.10	7.10	8.30	9.80	2.9	3.4	4.0	4.7
B-3.2	0.34		0.34	0.31	10	6.10	7.10	8.30	9.80	1.9	2.2	2.6	3.0
B-3.3 (DEV.)	2.57		2.57	2.31	10	6.10	7.10	8.30	9.80	14.1	16.4	19.2	22.6
B-3.4	0.70		0.70	0.63	10	6.10	7.10	8.30	9.80	3.8	4.5	5.2	6.2
B-3.5	0.53		0.53	0.48	10	6.10	7.10	8.30	9.80	2.9	3.4	4.0	4.7
B-4 (DEV.)	1.80		1.80	1.62	10	6.10	7.10	8.30	9.80	9.9	11.5	13.4	15.9
B-4.1	0.55		0.55	0.50	10	6.10	7.10	8.30	9.80	3.1	3.6	4.2	4.9
B-4.2	0.37		0.37	0.33	10	6.10	7.10	8.30	9.80	2.0	2.3	2.7	3.2
B-4.3	0.52		0.52	0.47	10	6.10	7.10	8.30	9.80	2.9	3.3	3.9	4.6
B-4.4	0.37		0.37	0.33	10	6.10	7.10	8.30	9.80	2.0	2.3	2.7	3.2
D	1.19	1.19		0.42	10	6.10	7.10	8.30	9.80	2.6	3.0	3.5	4.1
E-1 (DEV.)	3.24		3.24	2.92	10	6.10	7.10	8.30	9.80	17.8	20.7	24.2	28.6
E-2	2.96	2.96		1.04	10	6.10	7.10	8.30	9.80	6.3	7.4	8.6	10.2
E-3	1.23		1.23	1.11	10	6.10	7.10	8.30	9.80	6.8	7.9	9.2	10.9
F-1 (DEV.)	2.17		2.17	1.95	10	6.10	7.10	8.30	9.80	11.9	13.8	16.2	19.1
F-2	2.30	2.30		0.81	10	6.10	7.10	8.30	9.80	4.9	5.8	6.7	7.9
									TOTALS	214.7	249.9	292.1	344.8

100 YEAR POND WEIR CALCULATIONS

H_1 (FT)	H_2 (FT)	ELEV. (FT)	Q (CFS)
0.00	0.00	551.90	0.0
0.10	0.00	552.00	0.7
0.20	0.00	552.10	1.9
0.30	0.00	552.20	3.5
0.40	0.00	552.30	5.3
0.50	0.00	552.40	7.4
0.60	0.00	552.50	9.8
0.70	0.00	552.60	12.3
0.80	0.00	552.70	15.0
0.90	0.00	552.80	17.9
1.00	0.00	552.90	21.0
1.10	0.10	553.00	24.8
1.20	0.20	553.10	29.4
1.30	0.30	553.20	34.5
1.40	0.40	553.30	40.0
1.50	0.50	553.40	45.8
1.60	0.60	553.50	52.0
1.70	0.70	553.60	58.5
1.80	0.80	553.70	65.4
1.90	0.90	553.80	72.5
2.00	1.00	553.90	79.9
2.10	1.10	554.00	87.6
2.20	1.20	554.10	95.4
2.30	1.30	554.20	103.7
2.40	1.40	554.30	112.1
2.48	1.48	554.38	118.9

RECORD PLANS
MAY 1, 2015

PREPARED BY:
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TO JOHN KING BOULEVARD
DETENTION POND DETAILS

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED
PROFESSIONAL ENGINEER
5/1/2015

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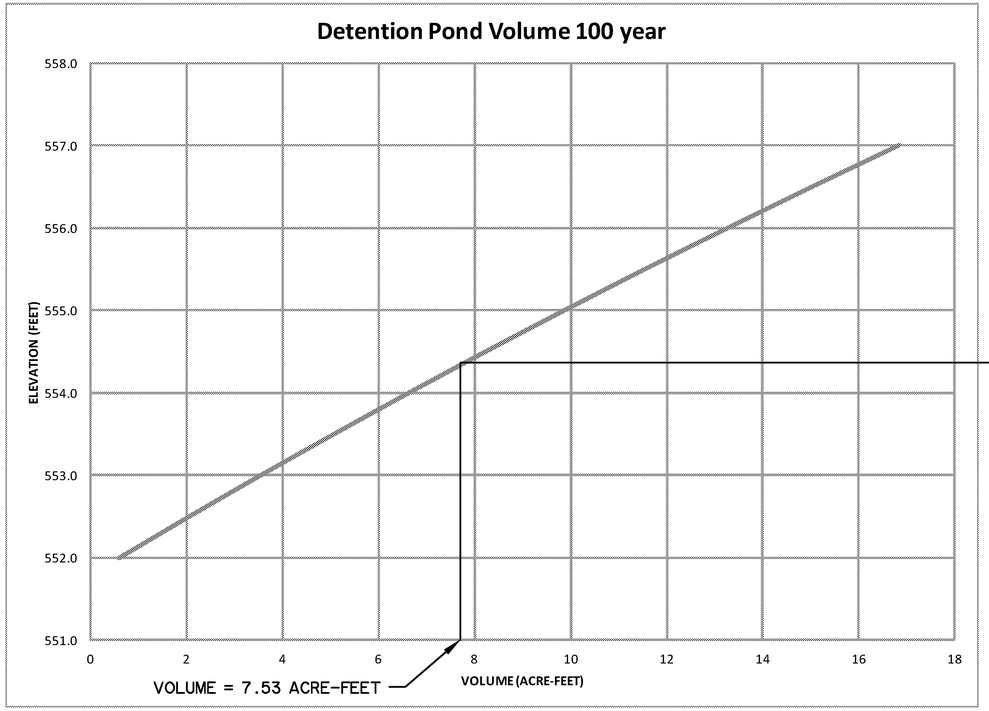

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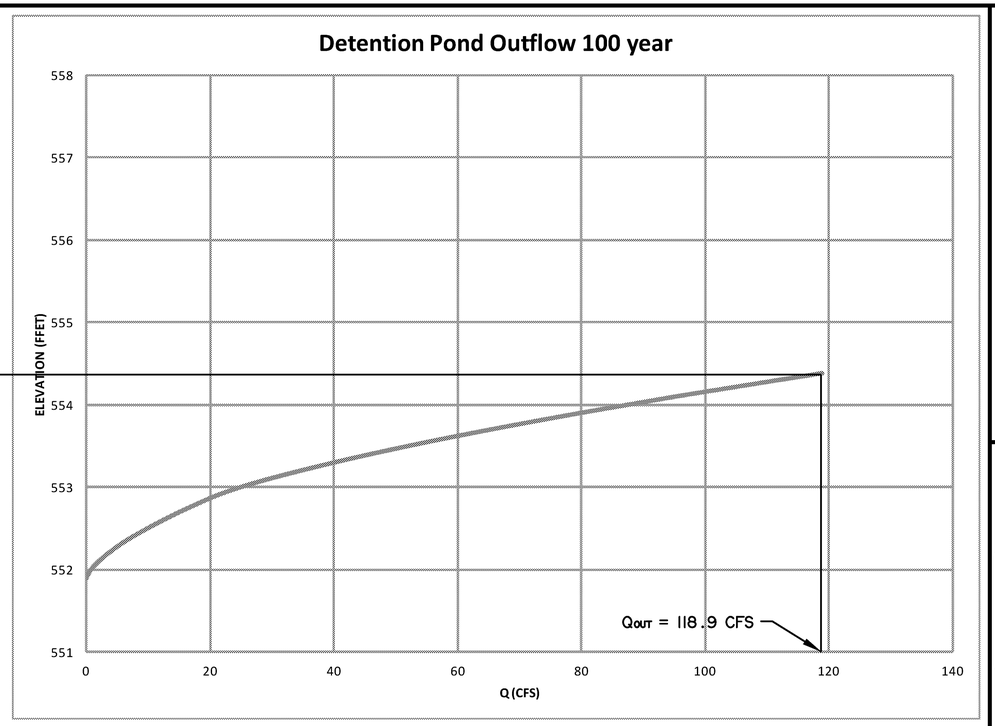

NOTE:
THE REQUIRED STORAGE VOLUME WAS CALCULATED PER THE CITY OF ROCKWALL STANDARDS OF DESIGN. THE 100 YEAR BACKWATER ELEVATION FROM BUFFALO CREEK TRIBUTARY #1 WAS DETERMINED FOR THE SELECTED OUTFALL LOCATION. THE POND AND WEIR WERE SIZED BASED ON THE AVAILABLE HEAD ABOVE THE BACKWATER ELEVATION. FOR THE 5, 10 AND 25 YEAR STORM EVENTS, THE ASSOCIATED BACKWATER ELEVATIONS FROM BUFFALO CREEK TRIBUTARY #1 WERE DETERMINED. BASED ON THE WEIR DESIGN, 5, 10 AND 25 YEAR OUTFLOW W.S.EL.S WERE CALCULATED FOR THE POND.

RECORD PLANS
MAY 1, 2015

PREPARED BY:
WIER & ASSOCIATES, INC.
ENGINEERS SURVEYORS LAND PLANNERS
701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.WierAssociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
DETENTION POND DETAILS

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED
PROFESSIONAL ENGINEER
5/1/2015

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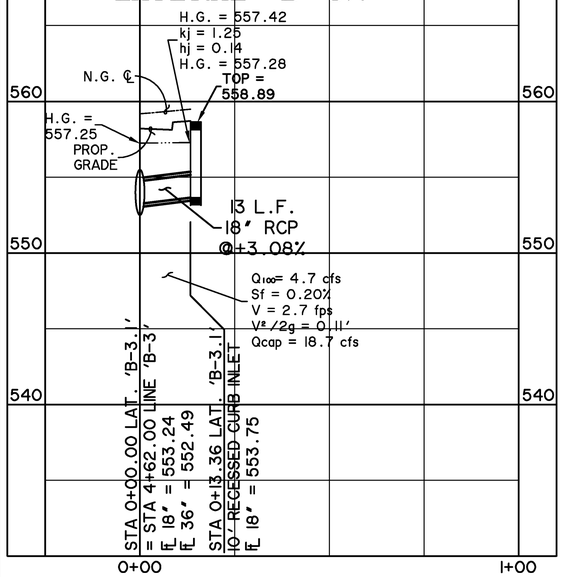
LAST SHEET EDIT
DATE 5/1/2015
WA# 13096
SHEET NO.
D203

PRINTED: 5/1/2015 STB FILE: WIER-PAVING.STB LAST SAVED: 5/1/2015 7:48 AM SAVED BY: PHILIPG FILE: DETENTION-POND-DETAILS-3-13096.DWG

PRINTED: 5/1/2015 STB FILE: WIER-STORM DRAIN.STB LAST SAVED: 4/28/2015 3:50 PM SAVED BY: CLAYTONT FILE: STORM-DRAIN-LATERALS-I3096.DWG

LATERAL 'B-3.1'



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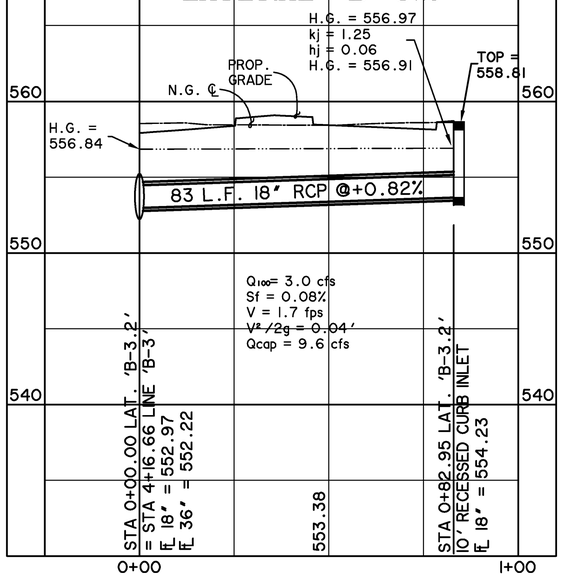

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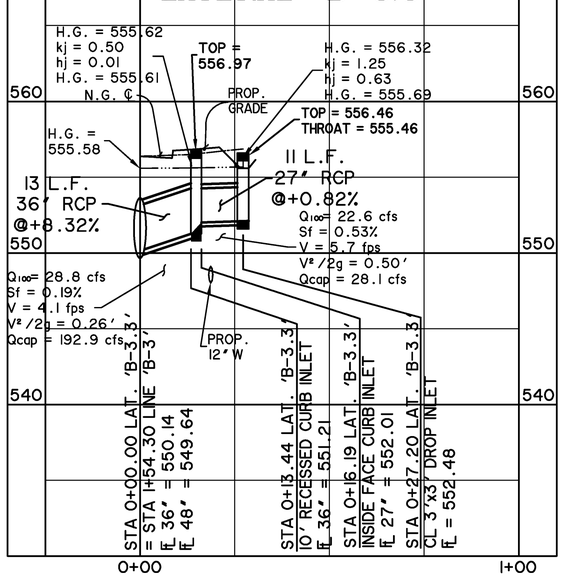

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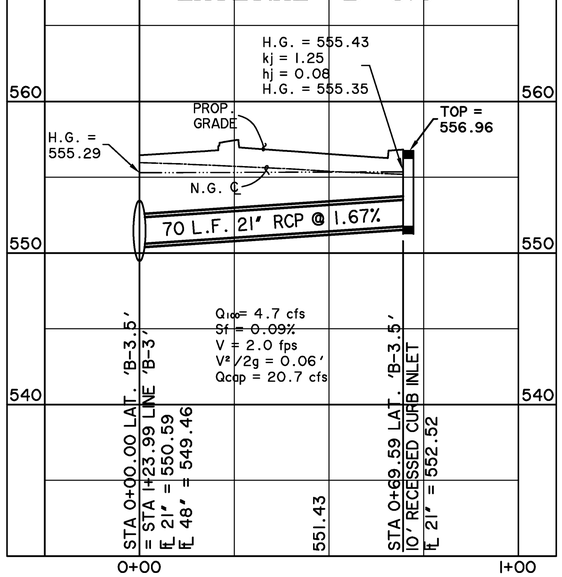

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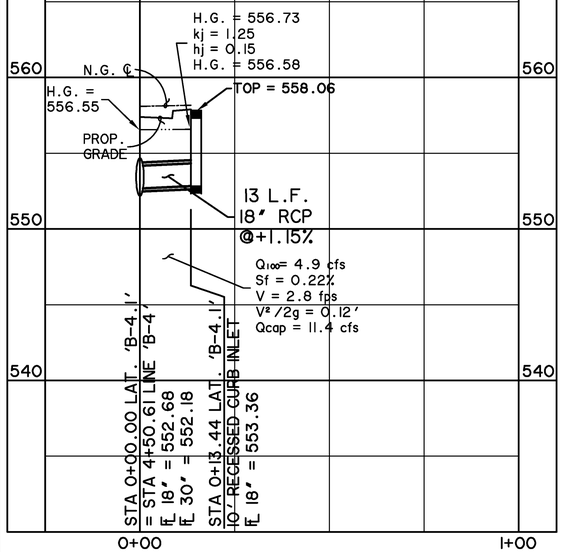

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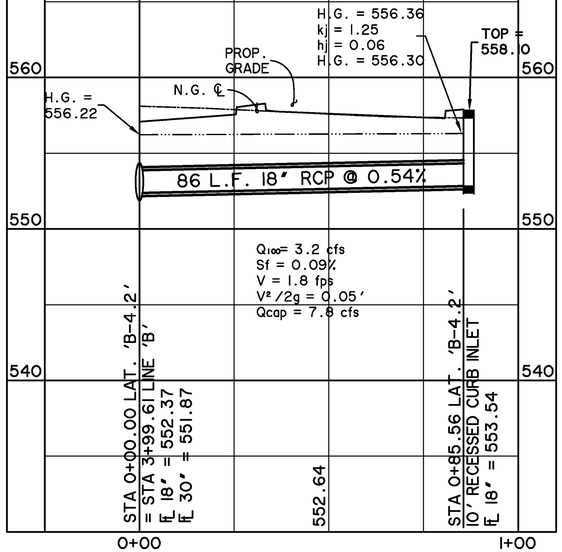

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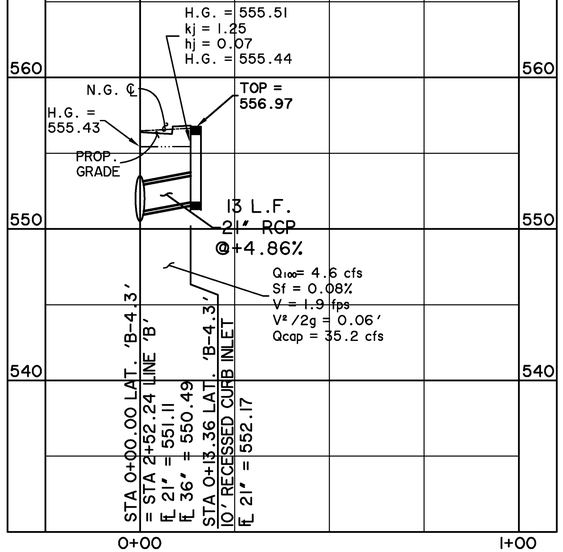

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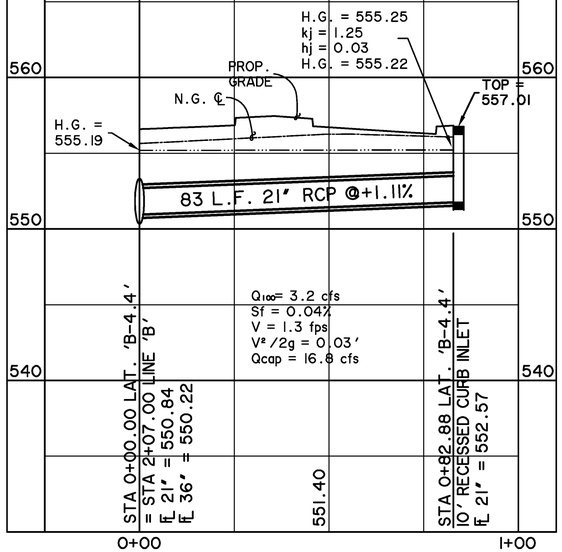

RECORD PLANS
MAY 1, 2015

CAUTION !!
EXISTING UTILITIES ARE INDICATED ON THE PLANS FROM AVAILABLE INFORMATION. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION OF ALL UTILITIES, TO NOTIFY ALL UTILITY COMPANIES OF THE CONTRACTORS OPERATIONS, TO PROTECT ALL UTILITIES FROM DAMAGE, TO REPAIR ALL UTILITIES DAMAGED DUE TO THE CONTRACTORS OPERATIONS, AND TO NOTIFY THE ENGINEER PROMPTLY OF ALL CONFLICTS OF THE WORK WITH EXISTING UTILITIES.

*** BENCHMARKS ***

BM A: AN 'X' CUT ON THE CENTER OF CURB INLET AT THE EDGE OF SIDEWALK ±25' FROM CURB RETURN AT NORTHWEST INTERSECTION OF JUSTIN RD & INDUSTRIAL PKWY.
ELEV. 561.99 FT.

BM B: AN 'X' CUT ON SOUTHEAST CORNER OF SIDEWALK NEXT TO HEADWALL ON WEST SIDE OF JOHN KING BLVD ±1,700' NORTH OF I-30.
ELEV. 563.49 FT.

PREPARED BY:
WIER & ASSOCIATES, INC.
ENGINEERS SURVEYORS LAND PLANNERS
701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
STORM DRAIN LATERAL PROFILES

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
5/1/2015

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LAST SHEET EDIT DATE 5/1/2015
WA# I3096
SHEET NO. D204

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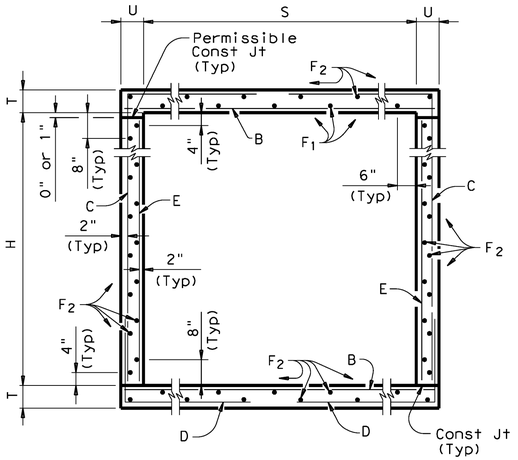
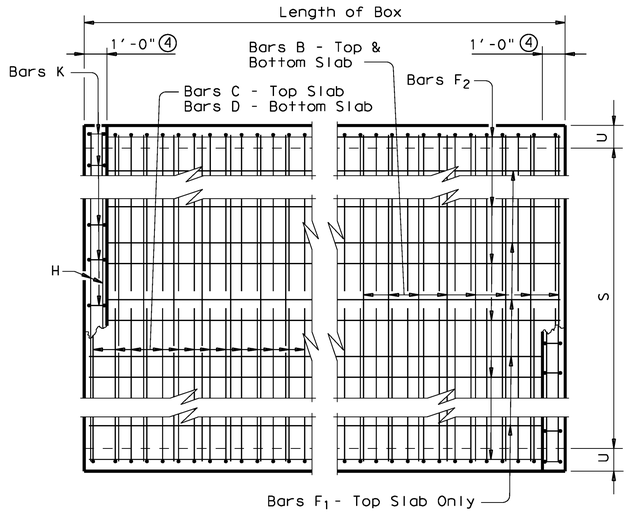
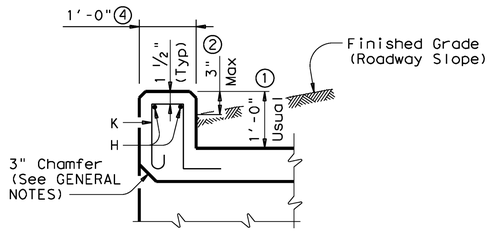
LEVELS DISPLAYED
ACC:
1



TYPICAL SECTION



PLAN OF REINF STEEL



SECTION THRU CURB

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 bridge rail, refer to T6-CM standard. For structures with traffic rail, other than T6, refer to RAC standard.

② 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.

③ 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.

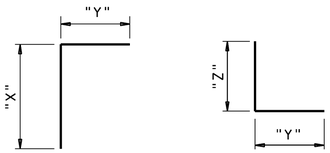
④ 1'-0" typical. 2'-0" when RAC standard is referred to elsewhere in the plans.

Deformed welded wire reinforcement (WWR) meeting the requirements of ASTM A1064 may be used to replace conventional reinforcement shown at the Contractor's option. The area of required reinforcement may be reduced by the ratio of 60 ksi / 70 ksi. Spacing of WWR is limited to 4" Min and 18" Max. When required, provide lap splices in the WWR of the same length required for the equivalent bar size, rounded up for wire sizes between conventional bar sizes.

Example Conversion: Replacement of No. 6 Gr 60 at 6" Spacing with WWR.
WWR required = (0.44 sq in/ 0.5') x (60 ksi/70 ksi) = 0.754 sq in/ft.
If D30.6 wire is used to meet the 0.754 sq in/ft requirement in this example, the required spacing = (0.306 sq in/ 0.754 sq in/ft) x 12 in/ft = 4.87" Max spacing.
Required lap length for the provided D30.6 wire is 2'-2" (Lap required for uncoated No. 5 bars, as shown in Item 440).

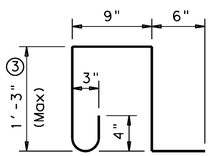
GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.
Designed to the maximum fill height shown.
All reinforcing steel shall be Grade 60.
~~All concrete shall be Class "C" with these exceptions: Use Class "S" for top slabs of culverts with overlay, with 1 to 2 course surface treatment, or with the top slab as the final riding surface. Class "C" concrete shall have a minimum compressive strength of 3,600 psi. Class "S" concrete shall have a minimum compressive strength of 4,000 psi.~~
The use of permanent forms is not allowed.
The bottom edge of the top slab shall be chamfered 3" at the entrance.
Reinforcing bars shall be adjusted to provide a minimum of 1 1/4" clear cover.
Construction joints shown at the flow line may be raised a maximum of 6" at the Contractor's option. If this option is used, Bars E may be cut off or raised, and Bars C and D may be reversed.
See standard SCC-MD for skewed ends, angle sections and lengthening details.
All concrete shall be Class "F" with a minimum compressive strength of 4,200 psi.



BARS C

BARS D



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

HL93 LOADING

Texas Department of Transportation
Bridge Division

SINGLE BOX CULVERTS CAST-IN-PLACE
0' TO 30' FILL

SCC-5 & 6

FILE: scc56ste.dgn	DN: GAF	CK: LMW	DW: BWH/TxDOT	CK: GAF		
© TxDOT February 2010	DISTRICT	FEDERAL AID PROJECT			SHEET	
REVISIONS					D301	
10-12: Added WWR	COUNTY		CONTROL	SECT	JOB	HIGHWAY

BILLS OF REINFORCING STEEL (For Box Length = 40 feet)

SECTION DIMENSIONS				⑤ FILL HEIGHT	Bars B					Bars C							Bars D							Bars E~#4 at 18" Max			Bars F_1 ~#4				Bars F_2~#4 at 18" Max			Bars H 4~#4		Bars K		QUANTITIES: Per foot of Barrel		Curb		Total	
S	H	T	U		No.	Size	Spa	Length	Weight	No.	Size	Spa	Length	Weight	"X"	"Y"	No.	Size	Spa	Length	Weight	"Y"	"Z"	No.	Length	Wt	No.	Spa	Length	Wt	No.	Length	Wt	Length	Wt	No.	Wt	Conc (CY)	Reinf (Lb)	Conc (CY)	Reinf (Lb)	Conc (CY)	Reinf (Lb)
5'-0"	2'-0"	7"	7"	26'	194	#5	5"	5'-11"	1,197	162	#5	6"	5'- 2"	873	2'- 5"	2'- 9"	162	#5	6"	5'- 4"	901	2'- 9"	2'- 7"	56	2'-0"	75	8	7"	39'-9"	212	22	39'-9"	584	5'-11"	16	14	40	0.353	96.1	0.5	56	14.6	3,898
5'-0"	2'-0"	8"	7"	30'	194	#5	5"	5'-11"	1,197	194	#4	5"	5'- 0"	648	2'- 6"	2'- 6"	194	#4	5"	4'- 9"	616	2'- 6"	2'- 3"	56	2'-0"	75	4	18"	39'-9"	106	22	39'-9"	584	5'-11"	16	14	40	0.391	80.7	0.5	56	16.1	3,282
5'-0"	3'-0"	7"	7"	26'	194	#5	5"	5'-11"	1,197	194	#4	5"	5'-11"	767	3'- 5"	2'- 6"	194	#4	5"	4'- 8"	605	2'- 6"	2'- 2"	56	3'-0"	112	8	7"	39'-9"	212	26	39'-9"	690	5'-11"	16	14	40	0.396	89.6	0.5	56	16.3	3,639
5'-0"	3'-0"	8"	7"	30'	194	#5	5"	5'-11"	1,197	194	#4	5"	6'- 0"	778	3'- 6"	2'- 6"	194	#4	5"	4'- 9"	616	2'- 6"	2'- 3"	56	3'-0"	112	4	18"	39'-9"	106	26	39'-9"	690	5'-11"	16	14	40	0.434	87.5	0.5	56	17.9	3,555
5'-0"	4'-0"	7"	7"	26'	194	#5	5"	5'-11"	1,197	194	#4	5"	6'-11"	896	4'- 5"	2'- 6"	194	#4	5"	4'- 8"	605	2'- 6"	2'- 2"	56	4'-0"	150	8	7"	39'-9"	212	26	39'-9"	690	5'-11"	16	14	40	0.439	93.8	0.5	56	18.1	3,806
5'-0"	4'-0"	8"	7"	30'	194	#5	5"	5'-11"	1,197	194	#4	5"	7'- 0"	907	4'- 6"	2'- 6"	194	#4	5"	4'- 9"	616	2'- 6"	2'- 3"	56	4'-0"	150	4	18"	39'-9"	106	26	39'-9"	690	5'-11"	16	14	40	0.477	91.7	0.5	56	19.6	3,722
5'-0"	5'-0"	7"	7"	26'	194	#5	5"	5'-11"	1,197	194	#4	5"	7'-11"	1,026	5'- 5"	2'- 6"	194	#4	5"	4'- 8"	605	2'- 6"	2'- 2"	56	5'-0"	187	8	7"	39'-9"	212	30	39'-9"	797	5'-11"	16	14	40	0.483	100.6	0.5	56	19.8	4,080
5'-0"	5'-0"	8"	7"	30'	194	#5	5"	5'-11"	1,197	194	#4	5"	8'- 0"	1,037	5'- 6"	2'- 6"	194	#4	5"	4'- 9"	616	2'- 6"	2'- 3"	56	5'-0"	187	4	18"	39'-9"	106	30	39'-9"	797	5'-11"	16	14	40	0.521	98.5	0.5	56	21.3	3,996
6'-0"	3'-0"	7"	7"	20'	194	#5	5"	6'-11"	1,400	162	#5	6"	6'- 6"	1,098	3'- 5"	3'- 1"	162	#5	6"	5'- 8"	957	3'- 1"	2'- 7"	56	3'-0"	112	10	7"	39'-9"	266	29	39'-9"	770	6'-11"	18	16	45	0.439	115.1	0.5	63	18.1	4,666
6'-0"	3'-0"	8"	7"	26'	162	#6	6"	6'-11"	1,683	162	#5	6"	6'- 7"	1,112	3'- 6"	3'- 1"	162	#5	6"	5'- 9"	972	3'- 1"	2'- 8"	56	3'-0"	112	5	18"	39'-9"	133	29	39'-9"	770	6'-11"	18	16	45	0.484	119.6	0.5	63	19.9	4,845
6'-0"	3'-0"	9"	8"	30'	162	#6	6"	7'- 1"	1,724	162	#5	6"	6'- 8"	1,126	3'- 7"	3'- 1"	162	#5	6"	5'-10"	986	3'- 1"	2'- 9"	56	3'-0"	112	5	18"	39'-9"	133	29	39'-9"	770	7'- 1"	19	18	51	0.556	121.3	0.5	70	22.7	4,921
6'-0"	4'-0"	7"	7"	20'	194	#5	5"	6'-11"	1,400	194	#4	5"	7'- 3"	940	4'- 5"	2'-10"	194	#4	5"	5'- 0"	648	2'-10"	2'- 2"	56	4'-0"	150	10	7"	39'-9"	266	29	39'-9"	770	6'-11"	18	16	45	0.483	104.4	0.5	63	19.8	4,237
6'-0"	4'-0"	8"	7"	26'	194	#6	5"	6'-11"	2,015	162	#5	6"	7'- 7"	1,281	4'- 6"	3'- 1"	162	#5	6"	5'- 9"	972	3'- 1"	2'- 8"	56	4'-0"	150	5	18"	39'-9"	133	29	39'-9"	770	6'-11"	18	16	45	0.527	133.0	0.5	63	21.6	5,384
6'-0"	4'-0"	9"	8"	30'	162	#6	6"	7'- 1"	1,724	162	#5	6"	7'- 8"	1,295	4'- 7"	3'- 1"	162	#5	6"	5'-10"	986	3'- 1"	2'- 9"	56	4'-0"	150	5	18"	39'-9"	133	29	39'-9"	770	7'- 1"	19	18	51	0.605	126.5	0.5	70	24.7	5,128
6'-0"	5'-0"	7"	7"	20'	194	#5	5"	6'-11"	1,400	194	#4	5"	8'- 3"	1,069	5'- 5"	2'-10"	194	#4	5"	5'- 0"	648	2'-10"	2'- 2"	56	5'-0"	187	10	7"	39'-9"	266	33	39'-9"	876	6'-11"	18	16	45	0.526	111.2	0.5	63	21.5	4,509
6'-0"	5'-0"	8"	7"	26'	194	#6	5"	6'-11"	2,015	162	#5	6"	8'- 7"	1,450	5'- 6"	3'- 1"	162	#5	6"	5'- 9"	972	3'- 1"	2'- 8"	56	5'-0"	187	5	18"	39'-9"	133	33	39'-9"	876	6'-11"	18	16	45	0.570	140.8	0.5	63	23.3	5,696
6'-0"	5'-0"	9"	8"	30'	194	#6	5"	7'- 1"	2,064	162	#5	6"	8'- 8"	1,464	5'- 7"	3'- 1"	162	#5	6"	5'-10"	986	3'- 1"	2'- 9"	56	5'-0"	187	5	18"	39'-9"	133	33	39'-9"	876	7'- 1"	19	18	51	0.654	142.8	0.5	70	26.7	5,780
6'-0"	6'-0"	7"	7"	20'	194	#5	5"	6'-11"	1,400	194	#4	5"	9'- 3"	1,199	6'- 5"	2'-10"	194	#4	5"	5'- 0"	648	2'-10"	2'- 2"	56	6'-0"	224	10	7"	39'-9"	266	37	39'-9"	982	6'-11"	18	16	45	0.569	118.0	0.5	63	23.3	4,782
6'-0"	6'-0"	8"	7"	26'	194	#6	5"	6'-11"	2,015	162	#5	6"	9'- 7"	1,619	6'- 6"	3'- 1"	162	#5	6"	5'- 9"	972	3'- 1"	2'- 8"	56	6'-0"	224	5	18"	39'-9"	133	37	39'-9"	982	6'-11"	18	16	45	0.613	148.6	0.5	63	25.0	6,008
6'-0"	6'-0"	9"	8"	30'	194	#6	5"	7'- 1"	2,064	162	#5	6"	9'- 8"	1,633	6'- 7"	3'- 1"	162	#5	6"	5'-10"	986	3'- 1"	2'- 9"	56	6'-0"	224	5	18"	39'-9"	133	37	39'-9"	982	7'- 1"	19	18	51	0.704	150.6	0.5	70	28.7	6,092

⑤ For each box size, minimum fill height shown shall be used for all culverts with less than 2'-0" of fill.

Deformed welded wire reinforcement (WWR) meeting the requirements of ASTM A1064 may be used to replace conventional reinforcement shown at the Contractor's option. The area of required reinforcement may be reduced by the ratio of 60 ksi / 70 ksi. Spacing of WWR is limited to 4" Min and 18" Max. When required, provide lap splices in the WWR of the same length required for the equivalent bar size, rounded up for wire sizes between conventional bar sizes.

Example Conversion: Replacement of No. 6 Gr 60 at 6" Spacing with WWR.
WWR required = (0.44 sq in/ 0.5') x (60 ksi/70 ksi) = 0.754 sq in/ft.
If D30.6 wire is used to meet the 0.754 sq in/ft requirement in this example, the required spacing = (0.306 sq in/ 0.754 sq in/ft) x 12 in/ft = 4.87" Max spacing.
Required lap length for the provided D30.6 wire is 2'-2" (Lap required for uncoated No. 5 bars, as shown in Item 440).

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LEVELS DISPLAYED
ACC:
1

HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation
Bridge Division

SINGLE BOX CULVERTS CAST-IN-PLACE
0' TO 30' FILL

SCC-5 & 6

FILE: scc56ste.dgn	DN: GAF	CK: LMW	DW: BWH/TxDOT	CK: GAF
©TxDOT February 2010	DISTRICT	FEDERAL AID PROJECT		SHEET
REVISIONS				D302
10-12: Added WWR	COUNTY	CONTROL	SECT	JOB	HIGHWAY

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ACC:

LEVELS DISPLAYED

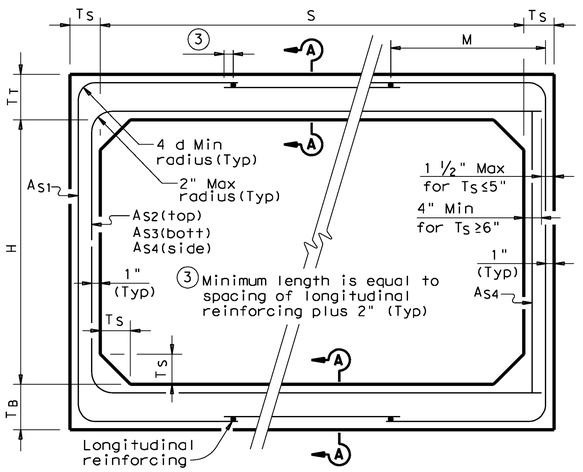
1

BOX DATA

SECTION DIMENSIONS					Fill Height	M (Min)	REINFORCING (in²/ft) ②								① Lift Weight (Tons)
S (ft)	H (ft)	T_T (in)	T_B (in)	T_S (in)	(ft)	(in)	A_{S1}	A_{S2}	A_{S3}	A_{S4}	A_{S5}	A_{S6}	A_{S7}	A_{S8}	
6	3	8	7	7	<2	-	0.20	0.31	0.22	0.17	0.19	0.19	0.19	0.17	7.9
6	3	7	7	7	2<3	43	0.21	0.24	0.19	0.17	-	-	-	-	7.5
6	3	7	7	7	3-5	39	0.17	0.18	0.17	0.17	-	-	-	-	7.5
6	3	7	7	7	10	39	0.17	0.18	0.19	0.17	-	-	-	-	7.5
6	3	7	7	7	15	38	0.22	0.24	0.24	0.17	-	-	-	-	7.5
6	3	7	7	7	20	38	0.28	0.31	0.31	0.17	-	-	-	-	7.5
6	3	7	7	7	25	38	0.35	0.38	0.39	0.17	-	-	-	-	7.5
6	3	7	7	7	30	38	0.42	0.46	0.46	0.17	-	-	-	-	7.5
6	4	8	7	7	<2	-	0.19	0.34	0.25	0.17	0.19	0.19	0.19	0.17	8.6
6	4	7	7	7	2<3	43	0.19	0.27	0.21	0.17	-	-	-	-	8.2
6	4	7	7	7	3-5	39	0.17	0.21	0.19	0.17	-	-	-	-	8.2
6	4	7	7	7	10	39	0.17	0.20	0.21	0.17	-	-	-	-	8.2
6	4	7	7	7	15	38	0.18	0.27	0.27	0.17	-	-	-	-	8.2
6	4	7	7	7	20	38	0.24	0.34	0.35	0.17	-	-	-	-	8.2
6	4	7	7	7	25	38	0.29	0.43	0.42	0.17	-	-	-	-	8.2
6	4	7	7	7	30	38	0.35	0.51	0.52	0.17	-	-	-	-	8.2
6	5	8	7	7	<2	-	0.19	0.37	0.28	0.17	0.19	0.19	0.19	0.17	9.3
6	5	7	7	7	2<3	43	0.17	0.30	0.24	0.17	-	-	-	-	8.9
6	5	7	7	7	3-5	43	0.17	0.23	0.21	0.17	-	-	-	-	8.9
6	5	7	7	7	10	39	0.17	0.22	0.23	0.17	-	-	-	-	8.9
6	5	7	7	7	15	38	0.17	0.28	0.29	0.17	-	-	-	-	8.9
6	5	7	7	7	20	38	0.20	0.37	0.38	0.17	-	-	-	-	8.9
6	5	7	7	7	25	38	0.25	0.45	0.46	0.17	-	-	-	-	8.9
6	5	7	7	7	30	38	0.30	0.54	0.55	0.17	-	-	-	-	8.9
6	6	8	7	7	<2	-	0.19	0.38	0.30	0.17	0.19	0.19	0.19	0.17	10.0
6	6	7	7	7	2<3	52	0.17	0.32	0.26	0.17	-	-	-	-	9.6
6	6	7	7	7	3-5	52	0.17	0.24	0.22	0.17	-	-	-	-	9.6
6	6	7	7	7	10	43	0.17	0.23	0.24	0.17	-	-	-	-	9.6
6	6	7	7	7	15	39	0.17	0.29	0.31	0.17	-	-	-	-	9.6
6	6	7	7	7	20	39	0.18	0.38	0.39	0.17	-	-	-	-	9.6
6	6	7	7	7	25	38	0.23	0.46	0.48	0.17	-	-	-	-	9.6
6	6	7	7	7	30	38	0.27	0.55	0.57	0.17	-	-	-	-	9.6

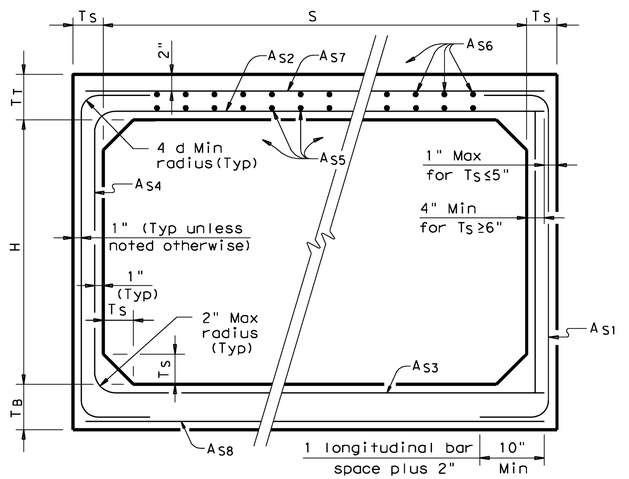
① For Box Length = 8'-0"

② A_{S1} thru A_{S4}, A_{S7} and A_{S8} are minimum required areas of reinforcement per linear foot of box length. A_{S6} and A_{S5} are minimum required areas of reinforcement per linear foot of box width.



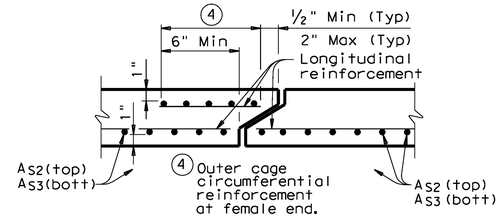
CORNER OPTION "A" CORNER OPTION "B"

FILL HEIGHT 2 FT AND GREATER



CORNER OPTION "A" CORNER OPTION "B"

FILL HEIGHT LESS THAN 2 FT



SECTION A-A

(TOP AND BOTTOM SLAB JOINT REINFORCEMENT)

GENERAL NOTES:

Designs shown conform to ASTM C1577.

Refer to ASTM C1577 for information or details not shown.

All concrete shall be Class "H" Concrete with a minimum compressive strength of 5,000 psi.

See SCP-MD standard sheet for miscellaneous details and notes not shown.

In lieu of furnishing the designs shown on this sheet, the contractor may furnish an alternate design that is equal to or exceeds the box design for the design fill height in the table. Shop plans for alternate designs shall be submitted in accordance with Item "Precast Concrete Structures".

HL93 LOADING

Texas Department of Transportation
Bridge Division

SINGLE BOX CULVERTS PRECAST
6'-0" SPAN

SCP-6

FILE: scp06ste.dgn	DN: GAF	CK: LMW	DW: BWH/TxDOT	CK: GAF
©TxDOT February 2010	DISTRICT	FEDERAL AID PROJECT		SHEET
REVISIONS				D303
	COUNTY	CONTROL	SECT	JOB	HIGHWAY

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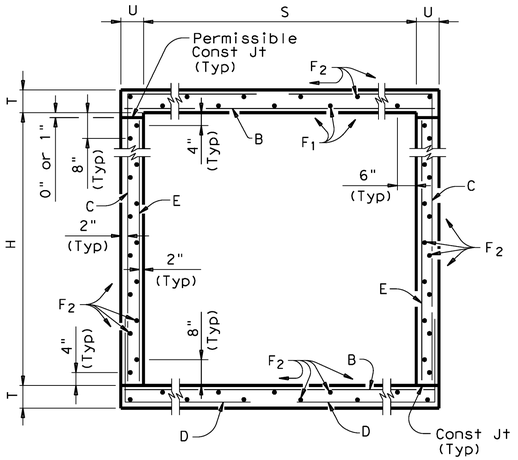
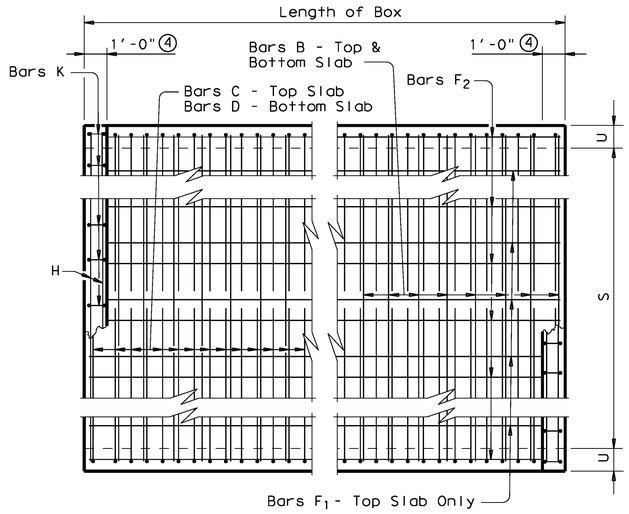
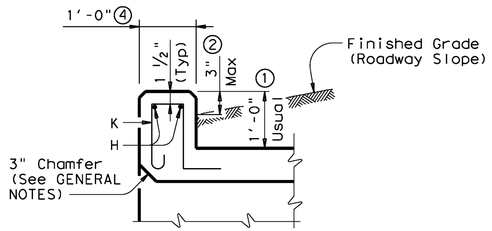
LEVELS DISPLAYED
ACC:
1



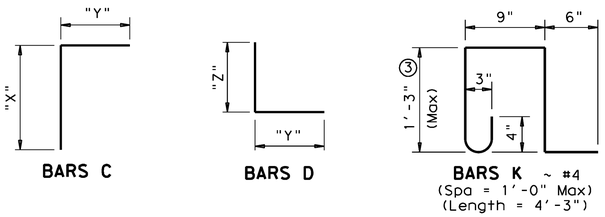
TYPICAL SECTION



PLAN OF REINF STEEL



SECTION THRU CURB



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 bridge rail, refer to T6-CM standard. For structures with traffic rail, other than T6, refer to RAC standard.

② 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.

③ 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.

④ 1'-0" typical. 2'-0" when RAC standard is referred to elsewhere in the plans.

Deformed welded wire reinforcement (WWR) meeting the requirements of ASTM A1064 may be used to replace conventional reinforcement shown at the Contractor's option. The area of required reinforcement may be reduced by the ratio of 60 ksi / 70 ksi. Spacing of WWR is limited to 4" Min and 18" Max. When required, provide lap splices in the WWR of the same length required for the equivalent bar size, rounded up for wire sizes between conventional bar sizes.

Example Conversion: Replacement of No. 6 Gr 60 at 6" Spacing with WWR.
WWR required = (0.44 sq in/ 0.5') x (60 ksi/70 ksi) = 0.754 sq in/ft.
If D30.6 wire is used to meet the 0.754 sq in/ft requirement in this example, the required spacing = (0.306 sq in/ 0.754 sq in/ft) x 12 in/ft = 4.87" Max spacing.
Required lap length for the provided D30.6 wire is 2'-2" (Lap required for uncoated No. 5 bars, as shown in Item 440).

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.
Designed to the maximum fill height shown.
All reinforcing steel shall be Grade 60.
~~All concrete shall be Class "C" with these exceptions: use Class "S" for top slabs of culverts with overlay, with 1-to-2 course surface treatment, or with the top slab as the final riding surface. Class "C" concrete shall have a minimum compressive strength of 3,600 psi. Class "S" concrete shall have a minimum compressive strength of 4,000 psi.~~
The use of permanent forms is not allowed.
The bottom edge of the top slab shall be chamfered 3" at the entrance.
Reinforcing bars shall be adjusted to provide a minimum of 1 1/4" clear cover.
Construction joints shown at the flow line may be raised a maximum of 6" at the Contractor's option. If this option is used, Bars E may be cut off or raised, and Bars C and D may be reversed.
See standard SCC-MD for skewed ends, angle sections and lengthening details.
All concrete shall be Class "F" with a minimum compressive strength of 4,200 psi.

HL93 LOADING

Texas Department of Transportation
Bridge Division

SINGLE BOX CULVERTS CAST-IN-PLACE
0' TO 30' FILL

SCC-8

FILE: scc08ste.dgn	DN: GAF	CK: LMW	DW: BWH/TxDOT	CK: GAF		
©TxDOT February 2010	DISTRICT	FEDERAL AID PROJECT			SHEET	
REVISIONS					D304	
10-12: Added WWR	COUNTY		CONTROL	SECT	JOB	HIGHWAY

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LEVELS DISPLAYED
ACC:
1

BILLS OF REINFORCING STEEL (For Box Length = 40 feet)

SECTION DIMENSIONS				FILL HEIGHT ⑤	Bars B					Bars C							Bars D							Bars E~#4 at 18" Max			Bars F_1 ~#4				Bars F_2~#4 at 18" Max			Bars H 4~#4		Bars K		QUANTITIES: Per foot of Barrel		Curb		Total	
S	H	T	U		No.	Size	Spa	Length	Weight	No.	Size	Spa	Length	Weight	"X"	"Y"	No.	Size	Spa	Length	Weight	"Y"	"Z"	No.	Length	Wt	No.	Spa	Length	Wt	No.	Length	Wt	Length	Wt	No.	Wt	Conc (CY)	Reinf (Lb)	Conc (CY)	Reinf (Lb)	Conc (CY)	Reinf (Lb)
8'-0"	4'-0"	7"	7"	13'	162	#6	6"	8'-11"	2,170	194	#5	5"	8'- 8"	1,754	4'- 5"	4'- 3"	194	#5	5"	6'-10"	1,383	4'- 3"	2'- 7"	56	4'-0"	150	13	7"	39'-9"	345	32	39'-9"	850	8'-11"	24	20	57	0.569	166.3	0.7	81	23.5	6,733
8'-0"	4'-0"	8"	7"	16'	194	#6	5"	8'-11"	2,598	194	#5	5"	8'- 9"	1,770	4'- 6"	4'- 3"	194	#5	5"	6'-11"	1,400	4'- 3"	2'- 8"	56	4'-0"	150	6	18"	39'-9"	159	32	39'-9"	850	8'-11"	24	20	57	0.626	173.2	0.7	81	25.7	7,008
8'-0"	4'-0"	9"	8"	20'	194	#6	5"	9'- 1"	2,647	194	#5	5"	8'-10"	1,787	4'- 7"	4'- 3"	194	#5	5"	7'- 0"	1,416	4'- 3"	2'- 9"	56	4'-0"	150	6	18"	39'-9"	159	32	39'-9"	850	9'- 1"	24	22	62	0.716	175.2	0.7	86	29.3	7,095
8'-0"	4'-0"	10"	8"	23'	194	#6	5"	9'- 1"	2,647	138	#6	7"	8'-11"	1,848	4'- 8"	4'- 3"	138	#6	7"	7'- 6"	1,555	4'- 3"	3'- 3"	56	4'-0"	150	6	18"	39'-9"	159	32	39'-9"	850	9'- 1"	24	22	62	0.774	180.2	0.7	86	31.7	7,295
8'-0"	4'-0"	11"	9"	30'	162	#7	6"	9'- 3"	3,063	194	#5	5"	9'- 0"	1,821	4'- 9"	4'- 3"	194	#5	5"	7'- 2"	1,450	4'- 3"	2'-11"	56	4'-0"	150	6	18"	39'-9"	159	34	39'-9"	903	9'- 3"	25	22	62	0.867	188.7	0.7	87	35.4	7,633
8'-0"	5'-0"	7"	7"	13'	162	#6	6"	8'-11"	2,170	194	#5	5"	9'- 8"	1,956	5'- 5"	4'- 3"	194	#5	5"	6'-10"	1,383	4'- 3"	2'- 7"	56	5'-0"	187	13	7"	39'-9"	345	36	39'-9"	956	8'-11"	24	20	57	0.612	174.9	0.7	81	25.2	7,078
8'-0"	5'-0"	8"	7"	16'	194	#6	5"	8'-11"	2,598	194	#5	5"	9'- 9"	1,973	5'- 6"	4'- 3"	194	#5	5"	6'-11"	1,400	4'- 3"	2'- 8"	56	5'-0"	187	6	18"	39'-9"	159	36	39'-9"	956	8'-11"	24	20	57	0.669	181.8	0.7	81	27.5	7,354
8'-0"	5'-0"	9"	8"	20'	194	#6	5"	9'- 1"	2,647	194	#5	5"	9'-10"	1,990	5'- 7"	4'- 3"	194	#5	5"	7'- 0"	1,416	4'- 3"	2'- 9"	56	5'-0"	187	6	18"	39'-9"	159	36	39'-9"	956	9'- 1"	24	22	62	0.765	183.9	0.7	86	31.3	7,441
8'-0"	5'-0"	10"	8"	23'	194	#6	5"	9'- 1"	2,647	194	#5	5"	9'-11"	2,007	5'- 8"	4'- 3"	194	#5	5"	7'- 1"	1,433	4'- 3"	2'-10"	56	5'-0"	187	6	18"	39'-9"	159	36	39'-9"	956	9'- 1"	24	22	62	0.823	184.7	0.7	86	33.6	7,475
8'-0"	5'-0"	11"	9"	30'	194	#7	5"	9'- 3"	3,668	194	#5	5"	10'- 0"	2,023	5'- 9"	4'- 3"	194	#5	5"	7'- 2"	1,450	4'- 3"	2'-11"	56	5'-0"	187	6	18"	39'-9"	159	38	39'-9"	1,009	9'- 3"	25	22	62	0.923	212.4	0.7	87	37.6	8,583
8'-0"	6'-0"	7"	7"	13'	194	#6	5"	8'-11"	2,598	162	#5	6"	10'- 8"	1,802	6'- 5"	4'- 3"	162	#5	6"	6'-10"	1,155	4'- 3"	2'- 7"	56	6'-0"	224	13	7"	39'-9"	345	40	39'-9"	1,062	8'-11"	24	20	57	0.655	179.7	0.7	81	26.9	7,267
8'-0"	6'-0"	8"	7"	16'	194	#6	5"	8'-11"	2,598	194	#5	5"	10'- 9"	2,175	6'- 6"	4'- 3"	194	#5	5"	6'-11"	1,400	4'- 3"	2'- 8"	56	6'-0"	224	6	18"	39'-9"	159	40	39'-9"	1,062	8'-11"	24	20	57	0.712	190.5	0.7	81	29.2	7,699
8'-0"	6'-0"	9"	8"	20'	194	#6	5"	9'- 1"	2,647	194	#5	5"	10'-10"	2,192	6'- 7"	4'- 3"	194	#5	5"	7'- 0"	1,416	4'- 3"	2'- 9"	56	6'-0"	224	6	18"	39'-9"	159	40	39'-9"	1,062	9'- 1"	24	22	62	0.815	192.5	0.7	86	33.3	7,786
8'-0"	6'-0"	10"	8"	23'	194	#6	5"	9'- 1"	2,647	194	#5	5"	10'-11"	2,209	6'- 8"	4'- 3"	194	#5	5"	7'- 1"	1,433	4'- 3"	2'-10"	56	6'-0"	224	6	18"	39'-9"	159	40	39'-9"	1,062	9'- 1"	24	22	62	0.872	193.4	0.7	86	35.6	7,820
8'-0"	6'-0"	11"	9"	30'	194	#7	5"	9'- 3"	3,668	194	#5	5"	11'- 0"	2,226	6'- 9"	4'- 3"	194	#5	5"	7'- 2"	1,450	4'- 3"	2'-11"	56	6'-0"	224	6	18"	39'-9"	159	42	39'-9"	1,115	9'- 3"	25	22	62	0.978	221.1	0.7	87	39.8	8,929
8'-0"	7'-0"	7"	7"	13'	194	#6	5"	8'-11"	2,598	194	#5	5"	11'- 8"	2,361	7'- 5"	4'- 3"	194	#5	5"	6'-10"	1,383	4'- 3"	2'- 7"	56	7'-0"	262	13	7"	39'-9"	345	40	39'-9"	1,062	8'-11"	24	20	57	0.699	200.3	0.7	81	28.7	8,092
8'-0"	7'-0"	8"	7"	16'	194	#6	5"	8'-11"	2,598	194	#5	5"	11'- 9"	2,378	7'- 6"	4'- 3"	194	#5	5"	6'-11"	1,400	4'- 3"	2'- 8"	56	7'-0"	262	6	18"	39'-9"	159	40	39'-9"	1,062	8'-11"	24	20	57	0.755	196.5	0.7	81	30.9	7,940
8'-0"	7'-0"	9"	8"	20'	194	#6	5"	9'- 1"	2,647	194	#5	5"	11'-10"	2,394	7'- 7"	4'- 3"	194	#5	5"	7'- 0"	1,416	4'- 3"	2'- 9"	56	7'-0"	262	6	18"	39'-9"	159	40	39'-9"	1,062	9'- 1"	24	22	62	0.864	198.5	0.7	86	35.3	8,026
8'-0"	7'-0"	10"	8"	23'	162	#7	6"	9'- 1"	3,008	194	#5	5"	11'-11"	2,411	7'- 8"	4'- 3"	194	#5	5"	7'- 1"	1,433	4'- 3"	2'-10"	56	7'-0"	262	6	18"	39'-9"	159	40	39'-9"	1,062	9'- 1"	24	22	62	0.922	208.4	0.7	86	37.6	8,421
8'-0"	7'-0"	11"	9"	30'	194	#7	5"	9'- 3"	3,668	194	#5	5"	12'- 0"	2,428	7'- 9"	4'- 3"	194	#5	5"	7'- 2"	1,450	4'- 3"	2'-11"	56	7'-0"	262	6	18"	39'-9"	159	42	39'-9"	1,115	9'- 3"	25	22	62	1.034	227.1	0.7	87	42.1	9,169
8'-0"	8'-0"	7"	7"	13'	194	#6	5"	8'-11"	2,598	194	#5	5"	12'- 8"	2,563	8'- 5"	4'- 3"	194	#5	5"	6'-10"	1,383	4'- 3"	2'- 7"	56	8'-0"	299	13	7"	39'-9"	345	44	39'-9"	1,168	8'-11"	24	20	57	0.742	208.9	0.7	81	30.4	8,437
8'-0"	8'-0"	8"	7"	16'	194	#6	5"	8'-11"	2,598	194	#5	5"	12'- 9"	2,580	8'- 6"	4'- 3"	194	#5	5"	6'-11"	1,400	4'- 3"	2'- 8"	56	8'-0"	299	6	18"	39'-9"	159	44	39'-9"	1,168	8'-11"	24	20	57	0.798	205.1	0.7	81	32.6	8,285
8'-0"	8'-0"	9"	8"	20'	194	#6	5"	9'- 1"	2,647	194	#5	5"	12'-10"	2,597	8'- 7"	4'- 3"	194	#5	5"	7'- 0"	1,416	4'- 3"	2'- 9"	56	8'-0"	299	6	18"	39'-9"	159	44	39'-9"	1,168	9'- 1"	24	22	62	0.914	207.2	0.7	86	37.3	8,372
8'-0"	8'-0"	10"	8"	23'	162	#7	6"	9'- 1"	3,008	194	#5	5"	12'-11"	2,614	8'- 8"	4'- 3"	194	#5	5"	7'- 1"	1,433	4'- 3"	2'-10"	56	8'-0"	299	6	18"	39'-9"	159	44	39'-9"	1,168	9'- 1"	24	22	62	0.971	217.0	0.7	86	39.5	8,767
8'-0"	8'-0"	11"	9"	30'	194	#7	5"	9'- 3"	3,668	194	#5	5"	13'- 0"	2,630	8'- 9"	4'- 3"	194	#5	5"	7'- 2"	1,450	4'- 3"	2'-11"	56	8'-0"	299	6	18"	39'-9"	159	46	39'-9"	1,221	9'- 3"	25	22	62	1.090	235.7	0.7	87	44.3	9,514

⑤ For each box size, minimum fill height shown shall be used for all culverts with less than 2'-0" of fill.

Deformed welded wire reinforcement (WWR) meeting the requirements of ASTM A1064 may be used to replace conventional reinforcement shown at the Contractor's option. The area of required reinforcement may be reduced by the ratio of 60 ksi / 70 ksi. Spacing of WWR is limited to 4" Min and 18" Max. When required, provide lap splices in the WWR of the same length required for the equivalent bar size, rounded up for wire sizes between conventional bar sizes.

Example Conversion: Replacement of No. 6 Gr 60 at 6" Spacing with WWR.
WWR required = (0.44 sq in/ 0.5') x (60 ksi/70 ksi) = 0.754 sq in/ft.
If D30.6 wire is used to meet the 0.754 sq in/ft requirement in this example, the required spacing = (0.306 sq in/ 0.754 sq in/ft) x 12 in/ft = 4.87" Max spacing.
Required lap length for the provided D30.6 wire is 2'-2" (Lap required for uncoated No. 5 bars, as shown in Item 440).

HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation
Bridge Division

SINGLE BOX CULVERTS CAST-IN-PLACE
0' TO 30' FILL

SCC-8

FILE: scc08ste.dgn	DN: GAF	CK: LMW	DW: BWH/TxDOT	CK: GAF
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REVISIONS				D305
10-12: Added WWR	COUNTY	CONTROL	SECT	JOB	HIGHWAY

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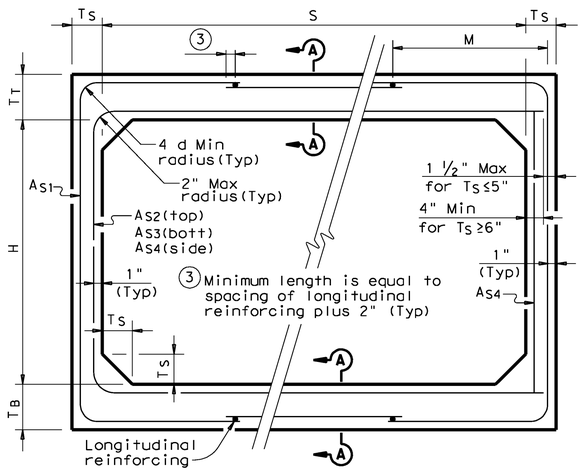
BOX DATA

SECTION DIMENSIONS					Fill Height	M (Min)	REINFORCING (in²/ft) ②								① Lift Weight (Tons)
S (ft)	H (ft)	T_T (in)	T_B (in)	T_S (in)	(ft)	(in)	A_{S1}	A_{S2}	A_{S3}	A_{S4}	A_{S5}	A_{S6}	A_{S7}	A_{S8}	
8	4	8	8	8	<2	-	0.27	0.38	0.29	0.19	0.19	0.19	0.19	0.19	11.2
8	4	8	8	8	2<3	50	0.31	0.34	0.32	0.19	-	-	-	-	11.2
8	4	8	8	8	3-5	50	0.25	0.27	0.27	0.19	-	-	-	-	11.2
8	4	8	8	8	10	45	0.26	0.28	0.29	0.19	-	-	-	-	11.2
8	4	8	8	8	15	41	0.34	0.37	0.38	0.19	-	-	-	-	11.2
8	4	8	8	8	20	41	0.44	0.48	0.49	0.19	-	-	-	-	11.2
8	5	8	8	8	<2	-	0.24	0.40	0.32	0.19	0.19	0.19	0.19	0.19	12.0
8	5	8	8	8	2<3	50	0.28	0.37	0.35	0.19	-	-	-	-	12.0
8	5	8	8	8	3-5	45	0.23	0.29	0.30	0.19	-	-	-	-	12.0
8	5	8	8	8	10	45	0.23	0.31	0.32	0.19	-	-	-	-	12.0
8	5	8	8	8	15	41	0.30	0.41	0.42	0.19	-	-	-	-	12.0
8	5	8	8	8	20	41	0.39	0.52	0.54	0.19	-	-	-	-	12.0
8	6	8	8	8	<2	-	0.22	0.42	0.35	0.19	0.19	0.19	0.19	0.19	12.8
8	6	8	8	8	2<3	50	0.25	0.40	0.38	0.19	-	-	-	-	12.8
8	6	8	8	8	3-5	50	0.21	0.32	0.33	0.19	-	-	-	-	12.8
8	6	8	8	8	10	45	0.22	0.33	0.34	0.19	-	-	-	-	12.8
8	6	8	8	8	15	41	0.28	0.43	0.45	0.19	-	-	-	-	12.8
8	6	8	8	8	20	41	0.36	0.55	0.57	0.19	-	-	-	-	12.8
8	7	8	8	8	<2	-	0.20	0.44	0.37	0.19	0.19	0.19	0.19	0.19	13.6
8	7	8	8	8	2<3	55	0.23	0.43	0.41	0.19	-	-	-	-	13.6
8	7	8	8	8	3-5	55	0.19	0.34	0.35	0.19	-	-	-	-	13.6
8	7	8	8	8	10	50	0.20	0.34	0.36	0.19	-	-	-	-	13.6
8	7	8	8	8	15	41	0.26	0.45	0.47	0.19	-	-	-	-	13.6
8	7	8	8	8	20	41	0.33	0.57	0.60	0.19	-	-	-	-	13.6
8	8	8	8	8	<2	-	0.20	0.45	0.40	0.19	0.19	0.19	0.19	0.19	14.4
8	8	8	8	8	2<3	65	0.21	0.45	0.44	0.19	-	-	-	-	14.4
8	8	8	8	8	3-5	65	0.19	0.36	0.38	0.19	-	-	-	-	14.4
8	8	8	8	8	10	55	0.19	0.35	0.38	0.19	-	-	-	-	14.4
8	8	8	8	8	15	45	0.24	0.46	0.49	0.19	-	-	-	-	14.4
8	8	8	8	8	20	45	0.31	0.59	0.62	0.19	-	-	-	-	14.4

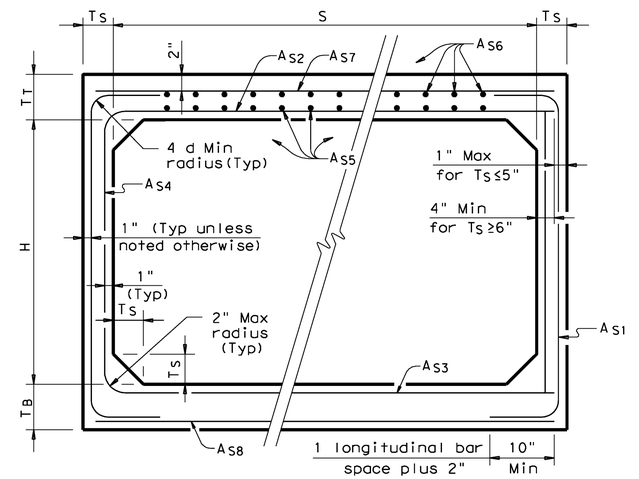
① For Box Length = 8'-0"

② A_{S1} thru A_{S4}, A_{S7} and A_{S8} are minimum required areas of reinforcement per linear foot of box length. A_{S6} and A_{S5} are minimum required areas of reinforcement per linear foot of box width.



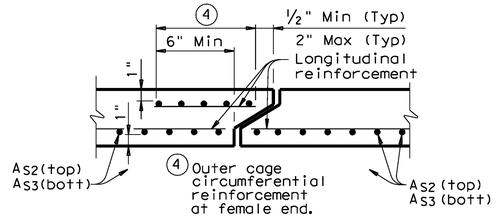
CORNER OPTION "A" CORNER OPTION "B"

FILL HEIGHT 2 FT AND GREATER



CORNER OPTION "A" CORNER OPTION "B"

FILL HEIGHT LESS THAN 2 FT



SECTION A-A

(TOP AND BOTTOM SLAB JOINT REINFORCEMENT)

GENERAL NOTES:

Designs shown conform to ASTM C1577.

Refer to ASTM C1577 for information or details not shown.

All concrete shall be Class "H" Concrete with a minimum compressive strength of 5,000 psi.

See SCP-MD standard sheet for miscellaneous details and notes not shown.

In lieu of furnishing the designs shown on this sheet, the contractor may furnish an alternate design that is equal to or exceeds the box design for the design fill height in the table. Shop plans for alternate designs shall be submitted in accordance with Item "Precast Concrete Structures".

HL93 LOADING

Texas Department of Transportation
Bridge Division

SINGLE BOX CULVERTS PRECAST
8'-0" SPAN

SCP-8

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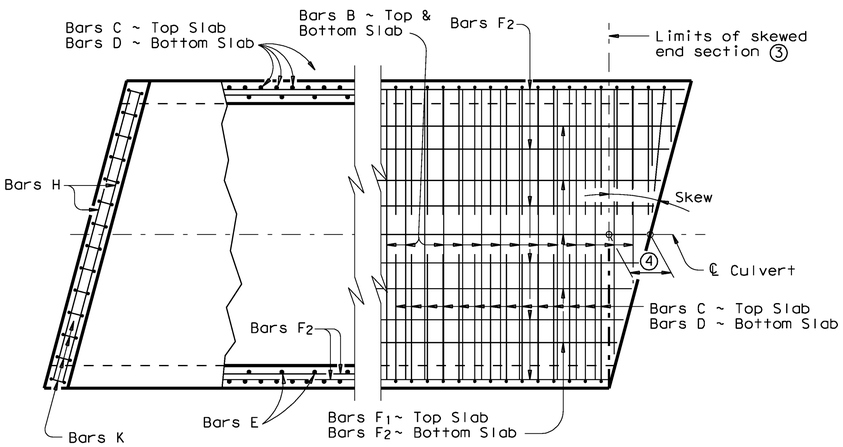


PLAN OF SKEWED ENDS ~ FROM 0° TO 15° ⑦

② When the spacing between Bars B becomes less than half of the normal spacing, bars shall be cut to avoid fouling

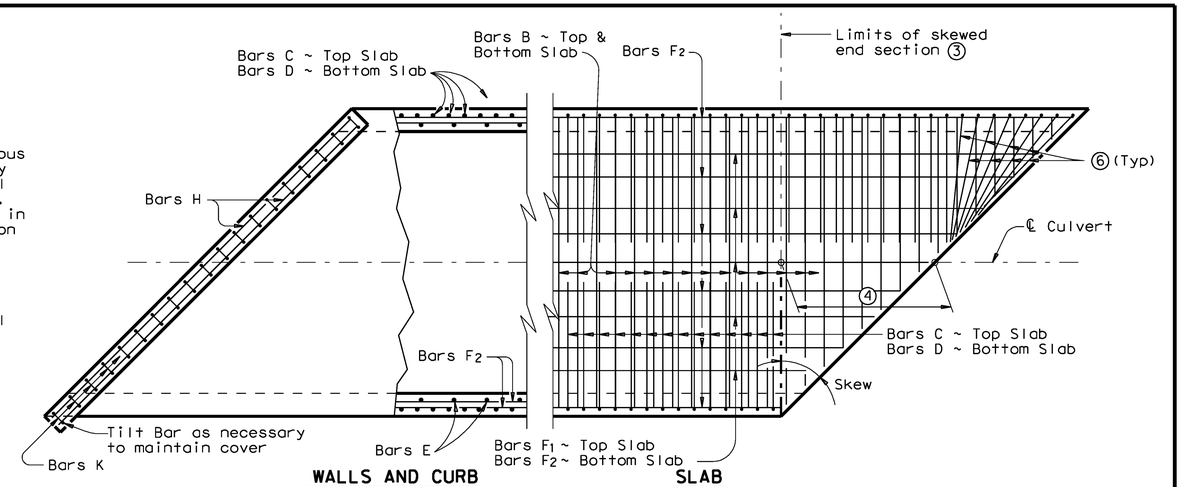
③ The length of Bars B and E will vary in the skewed end sections

④ [One half of overall width] x [Tan of the skew angle]

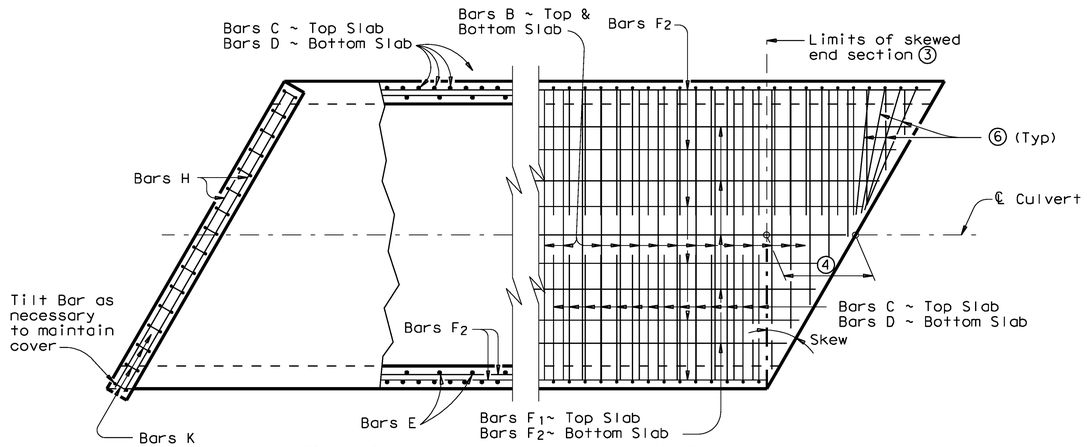
⑤ Bars F_1 and F_2 shall be continuous through the angle section. They shall be bent to remain parallel to the walls of the Box Culvert.

⑥ When necessary to avoid fouling in acute corners, the slab extension leg of Bars C and Bars D may be shortened to a minimum of 1'-6" for skews of 30° and 45°.

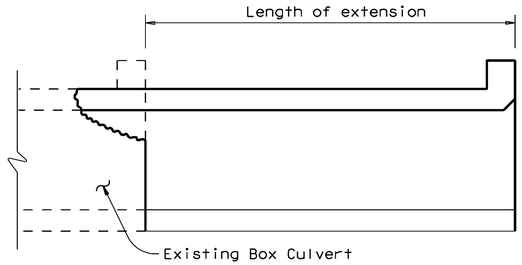
⑦ For skews of 15° or less, the contractor has the option of placing Bars B, C and D parallel to the skewed end while maintaining spacing along centerline box. Lengths of Bars B shown on the standards shall be increased to accommodate the skew.



PLAN OF SKEWED ENDS ~ OVER 30° TO 45°

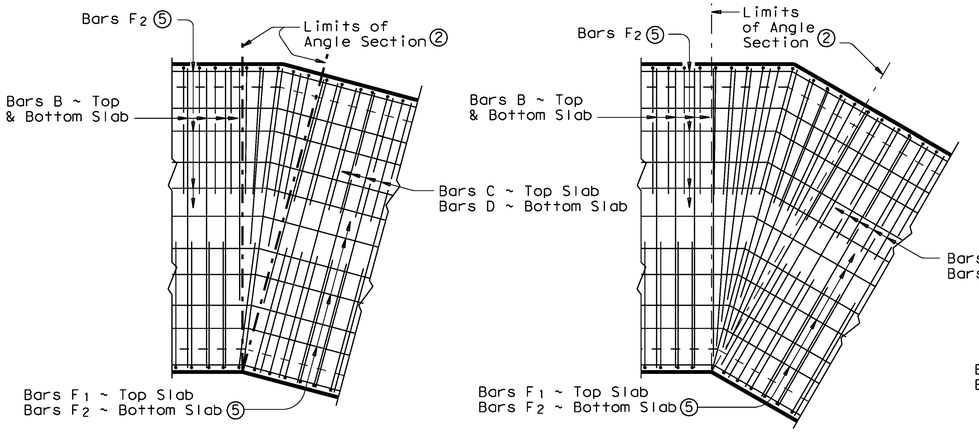


PLAN OF SKEWED ENDS ~ OVER 15° TO 30°



LENGTHENING DETAIL ①

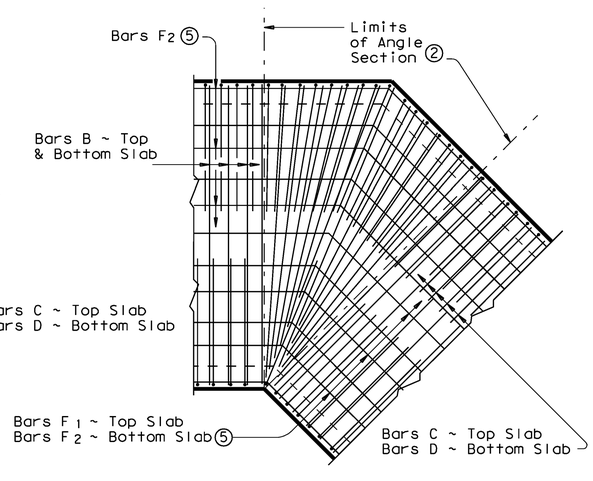
① For box culverts with less than 2'-0" of fill, the top slab shall be broken back to provide a minimum 1'-10" lap of the existing longitudinal bars with the longitudinal bars in the extension. If the depth of fill is 2'-0" or greater, the top slab shall be broken back to provide a 1'-0" minimum embedment of existing longitudinal reinforcing into the extension. Alternatively, if the fill height is greater than 2'-0", the existing curb may be left in place and 2'-0" long #6 bars shall be drilled and grouted 1'-0" into the existing top slab at 1'-6" center to center spacing. Wings and apron shall be broken back as necessary to install the extension. Exposed wingwall and apron reinforcing may be removed or cleaned and included in the extension. When lengthening existing box culverts with dimensions different than current standard dimensions, horizontal and vertical transitions shall be formed as directed by the Engineer. Bottom slabs shall match to maintain an uninterrupted flow line. Existing and new reinforcing shall be field bent into transition maintaining specified cover requirements.



PLAN OF SKEWED ENDS ~ OVER 15° TO 30°

PLAN OF ANGLE SECTION ~ FROM 0° TO 15°

PLAN OF ANGLE SECTION ~ OVER 15° TO 30°



PLAN OF ANGLE SECTION ~ OVER 30° TO 45°

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

All reinforcing steel shall be Grade 60.

~~All concrete shall be Class "C" with these exceptions: use Class "S" for top slabs of culverts with overlay, with 1 to 2 course surface treatment, or with the top slab as the final riding surface.~~

~~Class "C" concrete shall have a minimum compressive strength of 3,600 psi. Class "S" concrete shall have a minimum compressive strength of 4,000 psi.~~

The use of permanent forms is not allowed.

Refer to Single Box Culverts Cast-in-Place standard for details of straight sections of culvert. For skewed sections and angle sections refer to Single Box Culverts Cast-in-Place standard for slab and wall dimensions, bar sizes, maximum bar spacing, and any other details not shown. For Skewed ends with curbs, adjust length of Bars H, number of Bars K, curb concrete volume and reinforcing steel weight by dividing the values shown on the culvert standards by the cosine of the skew angle.

Laps for Bars H, when required, shall be 1'-9" for uncoated bars and 2'-7" for epoxy coated.

All concrete shall be Class "F" with a minimum compressive strength of 4,200 psi.

HL93 LOADING

Texas Department of Transportation
Bridge Division

SINGLE BOX CULVERTS CAST-IN-PLACE MISCELLANEOUS DETAILS

SCC-MD

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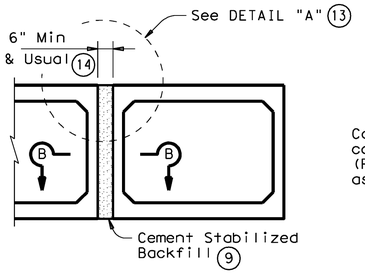
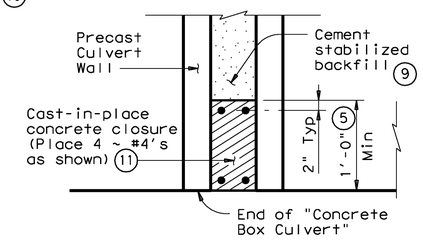
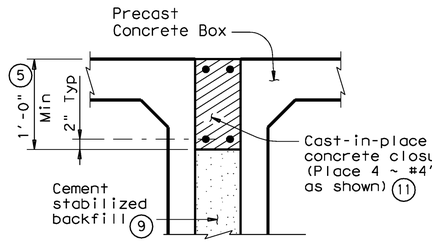


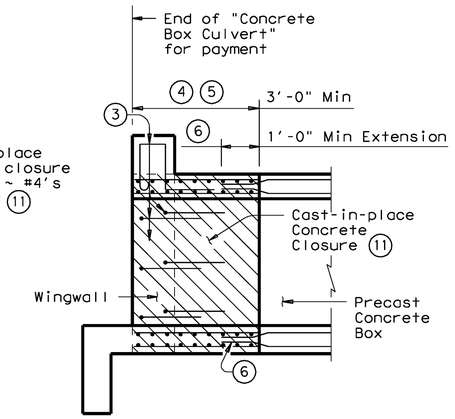
MULTIPLE UNIT PLACEMENT



SECTION B-B

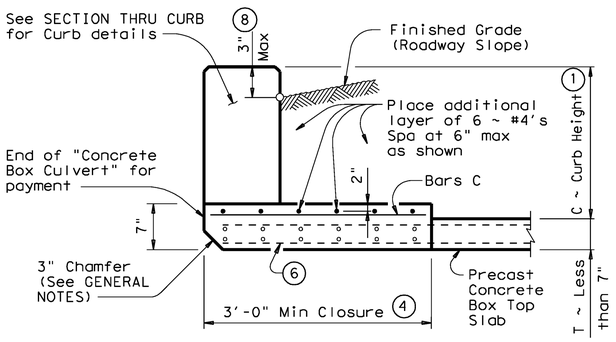


DETAIL "A" (13)

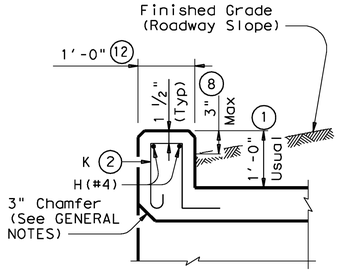


WINGWALL CONNECTION

(Also applies to Safety End Treatment)

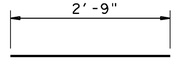


SECTION THRU TOP SLABS LESS THAN 7"

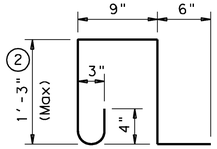


SECTION THRU CURB

(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".~~

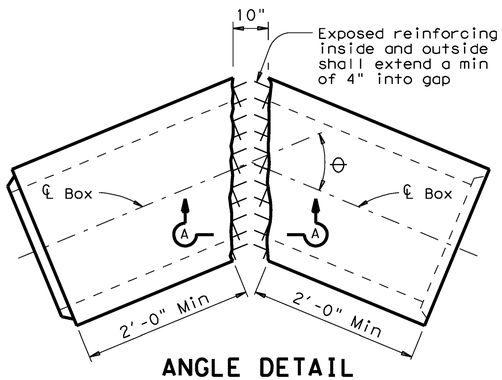
Any additional concrete required for the closures shall be considered as subsidiary to the Concrete Box Culvert.

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

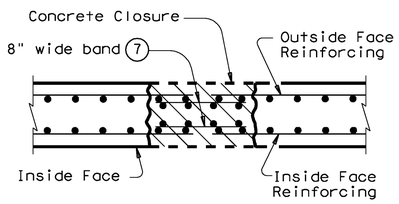
The bottom edge of the top slab closure shall be chamfered 3 inches at the entrance.

All closure concrete shall be Class "F" with a minimum compressive strength of 4,200 psi.

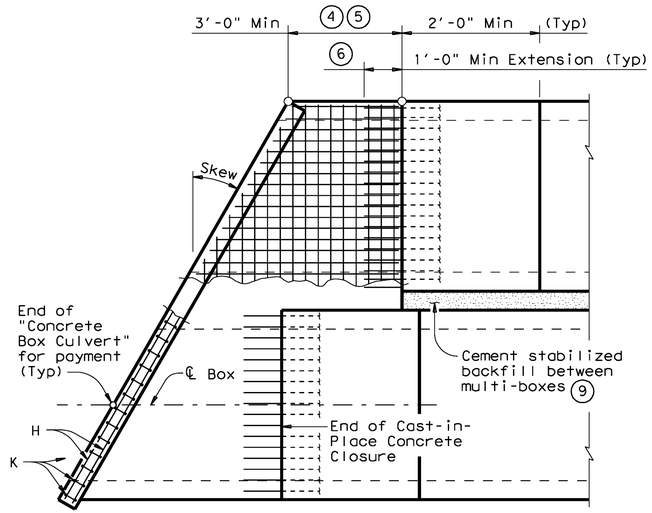
HL93 LOADING



ANGLE DETAIL



SECTION A-A



PLAN OF SKEWED ENDS

(Showing multi-box placement)

Texas Department of Transportation
Bridge Division

BOX CULVERTS PRECAST MISCELLANEOUS DETAILS

SCP-MD

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REVISIONS				D308
	COUNTY	CONTROL	SECT	JOB	HIGHWAY

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

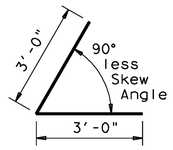
Dimensions					Variable Reinforcing				Estimated ④ Quantities per ft of wing (2~Wings)		Estimated Quantities per ft of Toewall (1~Toewall)	
					Bars J1		Bars J2					
Maximum Wingwall Height Hw	W	X	Y	Z	Size	Spa	Size	Spa	Reinf (Lb/Ft)	Conc (CY/Ft)	Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'-10"	10"	1'- 0"	7"	#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)

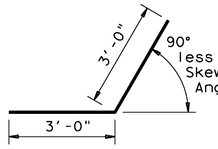
Bar	Size	No.	Spa
D1	#6	~	1'-0"
D2	#6	~	1'-0"
E1	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	~	8"
M1	#4	4	~
P	#4	~	1'-0"
V	#4	~	1'-0"

TABLE OF TOEWALL REINFORCING

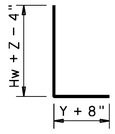
Bar	Size	No	Spa
J3	#4	~	1'-0"
M2	#4	2	~
E2	#4	~	1'-0"



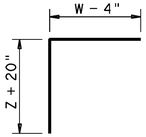
BARS D1



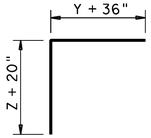
BARS D2



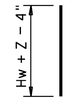
BARS J1



BARS J2



BARS J3



BARS V

WING DIMENSION CALCULATIONS:

Formulas: (All values are in Feet)

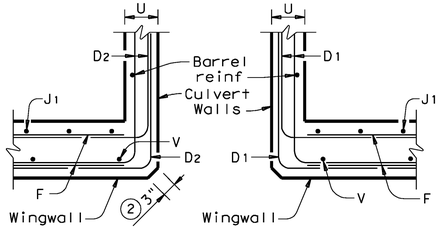
Hw = H + T + C
Lw = (Hw) (SL) ÷ Cosine θ for Ty PW-1
= (Hw - 1') (SL) ÷ Cosine θ for Ty PW-2 and Hw ≥ 4'
= (Hw - 0.5') (SL) ÷ Cosine θ for Ty PW-2 and Hw < 4'

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

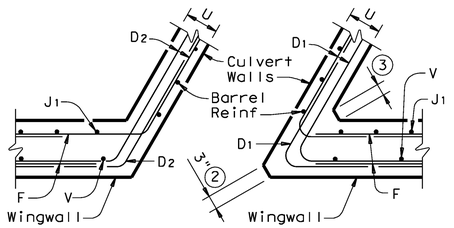
For Precast culverts:
Ltw = [(N) (2 U + S) + (N - 1) (0.5')] ÷ Cosine θ
Total Wingwall Area (Two Wings ~ SF)
= (2)(Hw)(Lw) for Ty PW-1
= (2)(Hw)(Lw) - 6 SF for Ty PW-2 and Hw ≥ 4'
= (2)(Hw)(Lw) - 1.5 SF for Ty PW-2 and Hw < 4'

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

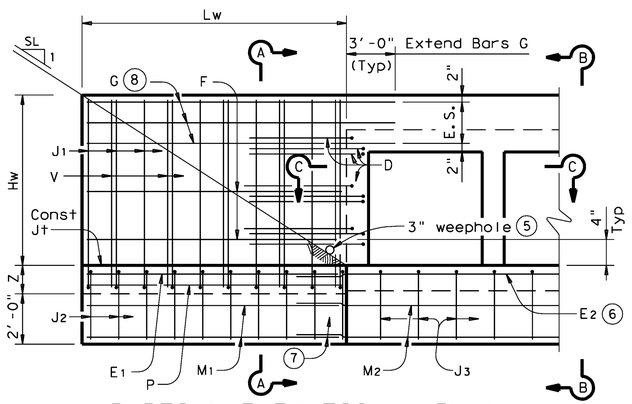
See applicable box culvert standard for S, H, T and U values.



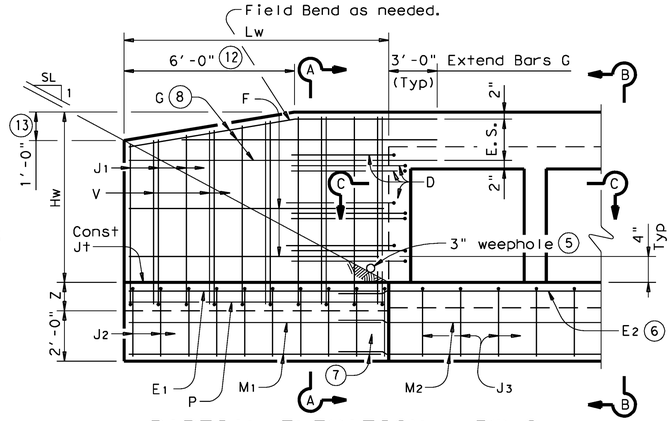
SECTION C-C



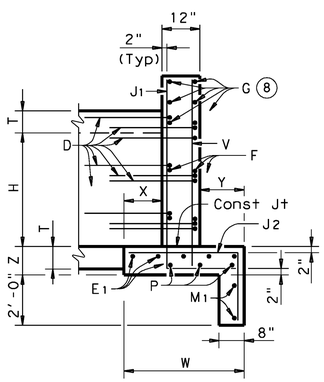
SECTION C-C



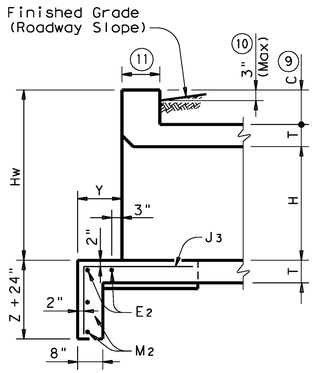
PARTIAL ELEVATION - PW-1



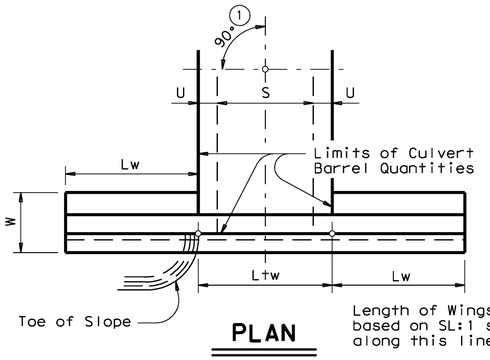
PARTIAL ELEVATION - PW-2



SECTION A-A
(Showing Wing Reinf)

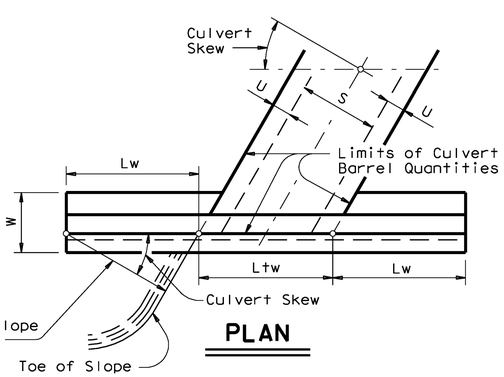


SECTION B-B
(Showing Wing Reinf)



PLAN

DETAILS FOR NON-SKEWED BOX CULVERTS



PLAN

DETAILS FOR SKEWED BOX CULVERTS
(Showing 30° Skew)

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'.

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 1 ¼" 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.

All concrete shall be Class "F" with a minimum compressive strength of 4,200 psi and Grade 60 reinforcing steel.

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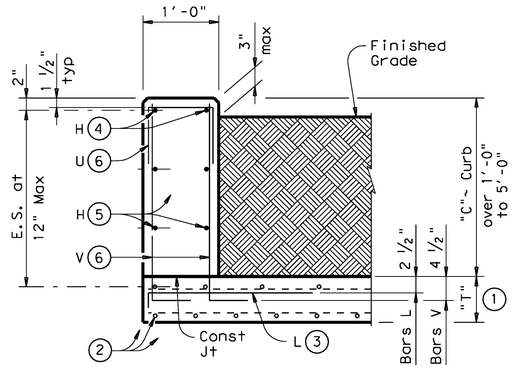
LEVELS DISPLAYED
ACC:
1

Texas Department of Transportation
Bridge Division

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

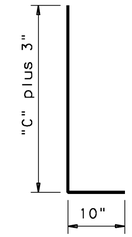
PW

FILE: pwstde01.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: GAF
©TxDOT February 2010	DISTRICT	FEDERAL AID PROJECT		SHEET
REVISIONS				D309
11-10: Reinforcing Quantities. 01-12: PW-1 & PW-2.	COUNTY	CONTROL	SECT	JOB	HIGHWAY



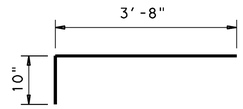
TYPICAL SECTION

Used for Curbs over 1'-0" to 5'-0"



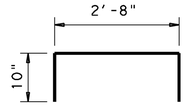
BARS V (#5) (6)

Spaced at 12" max



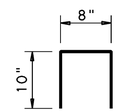
BARS L (#5) (3)

Spaced at 12" max



OPTIONAL BARS L (#5) (3)(7)

Spaced at 12" max



BARS U (#4) (6)

Spaced at 12" max

(1) "T" is equal to the culvert top slab thickness. For Precast Boxes with slabs less than 7", see SCP-MD Standard for additional details.

(2) Normal culvert slab bars adjusted as necessary to clear obstructions.

(3) Place bars L as shown. Tilt hook as necessary to maintain cover.

(4) Place normal culvert curb bars H (#4) as shown. Adjust as necessary to clear obstructions.

(5) Additional bars H (#4) as required to maintain 12" max spa.

(6) Replace normal culvert curb bars K with one bar U and two bars V as shown spaced at 12" max. Adjust length of bars V as necessary to maintain clear cover.

(7) Optional bars L are to be used only for precast box culverts with 3'-0" closure pour.

(8) Quantities shown are for contractor's information only. Quantities are per linear foot of curb length. The values for each section type in table can be interpolated for intermediate values of curb height, "C". Quantity includes bars K (when applicable).

TABLE OF ESTIMATED CURB QUANTITIES (8)

Curb Height "C"	Conc (CY/LF)	Reinf Steel (Lb/LF)
1'-0"	0.037	8.9
1'-6"	0.056	14.3
2'-0"	0.074	15.4
2'-6"	0.093	17.7
3'-0"	0.111	18.8
3'-6"	0.130	21.2
4'-0"	0.148	22.2
4'-6"	0.167	24.6
5'-0"	0.185	25.6

GENERAL NOTES:

Designed according to current AASHTO LRFD Specifications.

These extended curb details have sufficient strength to allow for future retrofit of Type T6 railing. These details are suitable for use with PR1, PR2 and PR3 type rails. These details are not suitable for the mounting of other rail types. For new construction using T6 railing, use the T6-CM standards.

All reinforcing shall be Grade 60. Adjust reinforcing as necessary to provide 1 ¼" cover.

~~All concrete for curbs shall be Class "C" with a minimum compressive strength of 3600 psi.~~

This Curb shall be considered as part of the Box Culvert for payment.

For vehicle safety, the top of the curb shall project no more than 3" above the finished grade.

All concrete for curbs shall be Class "F" with a minimum compressive strength of 4,200 psi.

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LEVELS DISPLAYED

PATH:

1

Texas Department of Transportation
Bridge Division

EXTENDED CURB DETAILS

FOR BOX CULVERTS WITH CURBS OVER 1'-0" TO 5'-0" TALL

ECD

FILE: ecdstde1.dgn	DN: GAF	CK:	DW: TxDOT	CK: GAF
©TxDOT February 2010	DISTRICT	FEDERAL AID PROJECT		SHEET
REVISIONS				D310
	COUNTY	CONTROL	SECT	JOB	HIGHWAY

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COMMENTS:

LEVELS DISPLAYED

1

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

Dimensions					Variable Reinforcing				Estimated ③ Quantities per ft of wing length (2~Wings)	
					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)

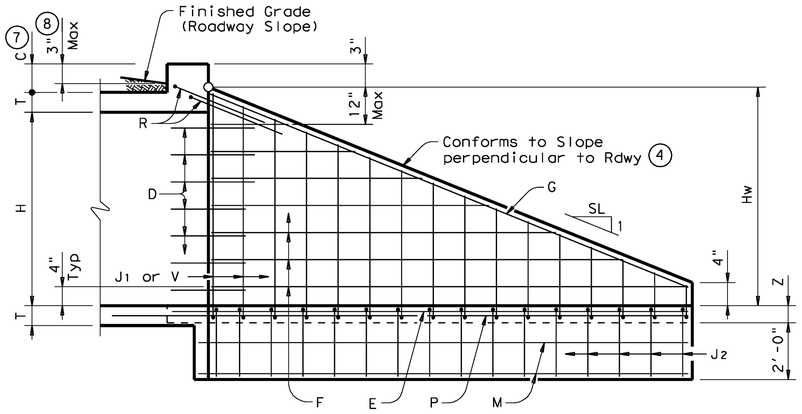
For Precast culverts:

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

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

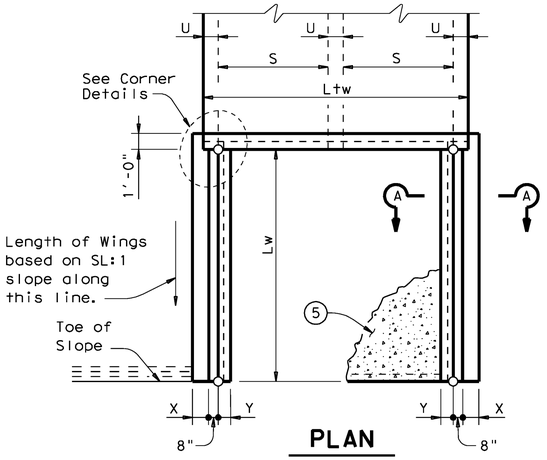
Hw = Height of Wingwall
SL:1 = Side Slope Ratio (Horizontal:1 Vertical)
Lw = Length of Wingwall
Ltw = Culvert Toewall Length
N = Number of Culvert Spans

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



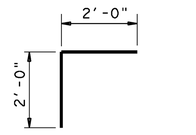
INSIDE ELEVATION

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

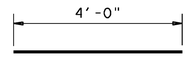


PLAN

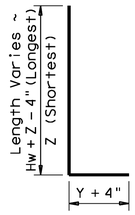
(Showing Dimensions)



BARS R

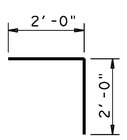


BARS D

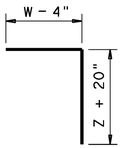


BARS J1

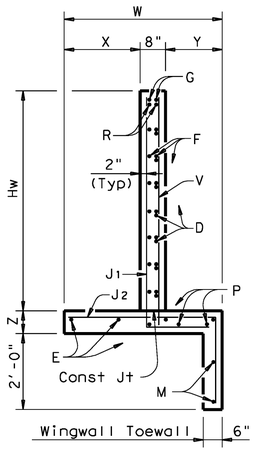
BARS V



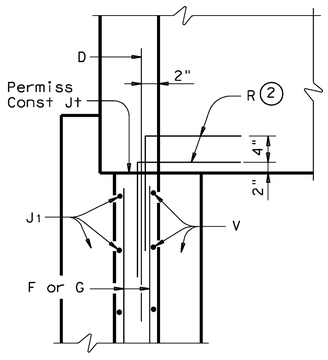
BARS L



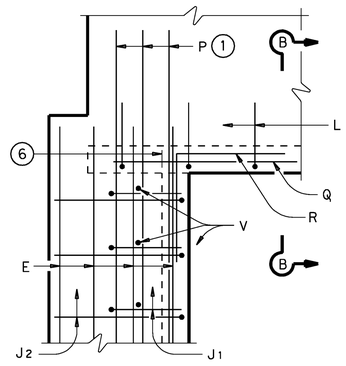
BARS J2



SECTION A-A



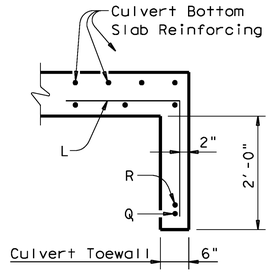
WINGWALL



FOOTING AND TOEWALL

CORNER DETAILS

(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.

All concrete shall be Class "F" with a minimum compressive strength of 4,200 psi.

Texas Department of Transportation
Bridge Division

CONCRETE WINGWALLS WITH STRAIGHT WINGS FOR 0° SKEW BOX CULVERTS

SW-0

FILE: sw-0stde.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: GAF
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REVISIONS				D311
11-10: Add note for synthetic fibers.	COUNTY	CONTROL	SECT	JOB	HIGHWAY

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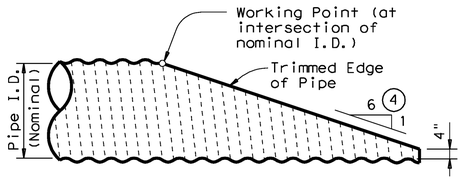
ACC:

LEVELS DISPLAYED

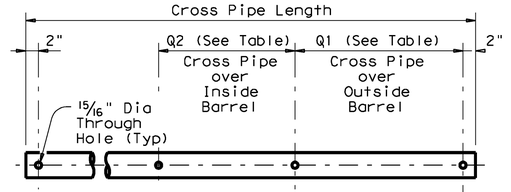
1



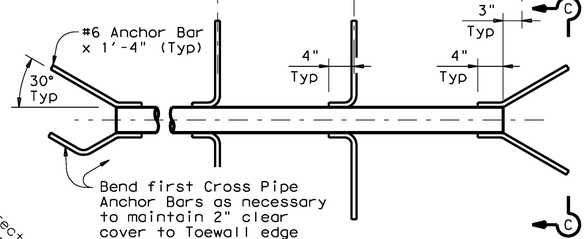
NOTE: All Cross Pipes, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

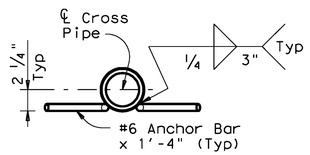
(Showing Corrugated Metal Pipe Culvert.)
(Details at Concrete Pipe Culvert are similar.)



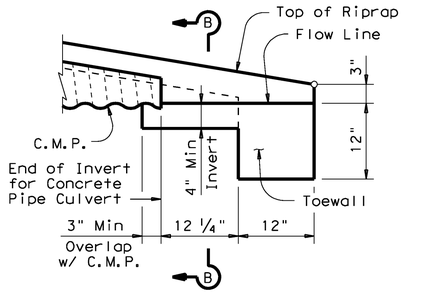
PIPE W/ BOLTED ANCHOR



PIPE W/ ANCHOR BARS

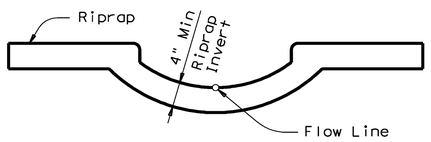


SECTION C-C



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.)

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.

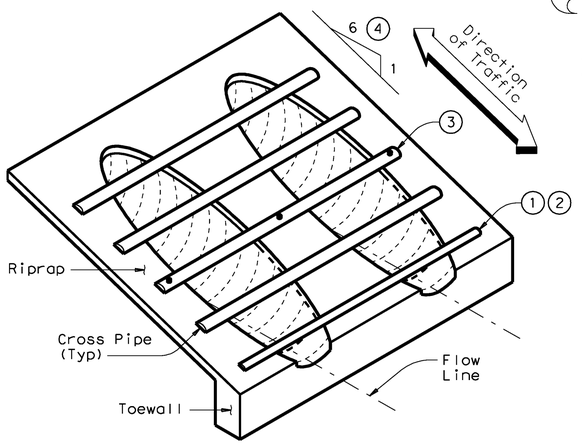
(2) Size of Cross Pipes, except the first bottom pipe, shall be as shown in the PIPE SIZE table. The first bottom pipe shall be 3 1/2" Standard Pipe (4" O.D.).

(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.

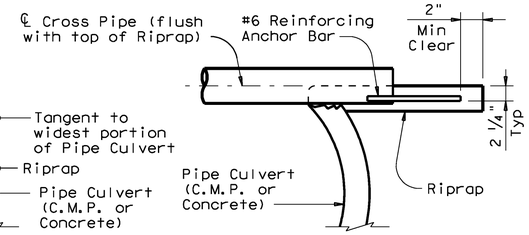
(5) Riprap placed beyond the limits shown will be paid as Concrete Riprap in accordance with Item 432, "Riprap".

(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.



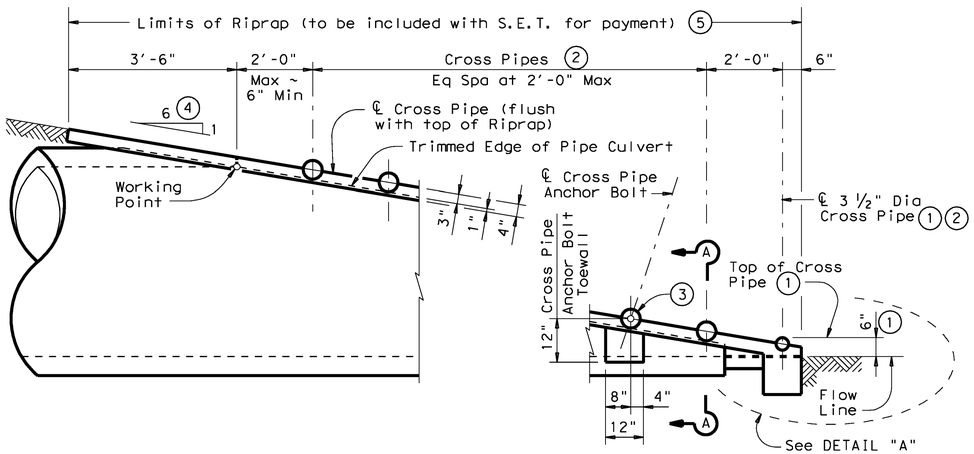
ISOMETRIC VIEW OF TYPICAL INSTALLATION

CROSS PIPE DETAILS



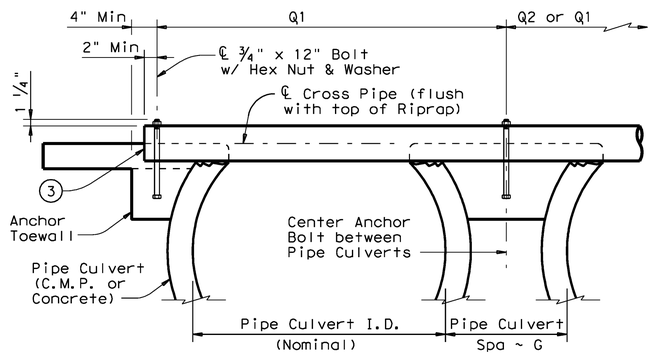
SHOWING TYPICAL PIPE CULVERT & RIPRAP

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

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

SETP-PD

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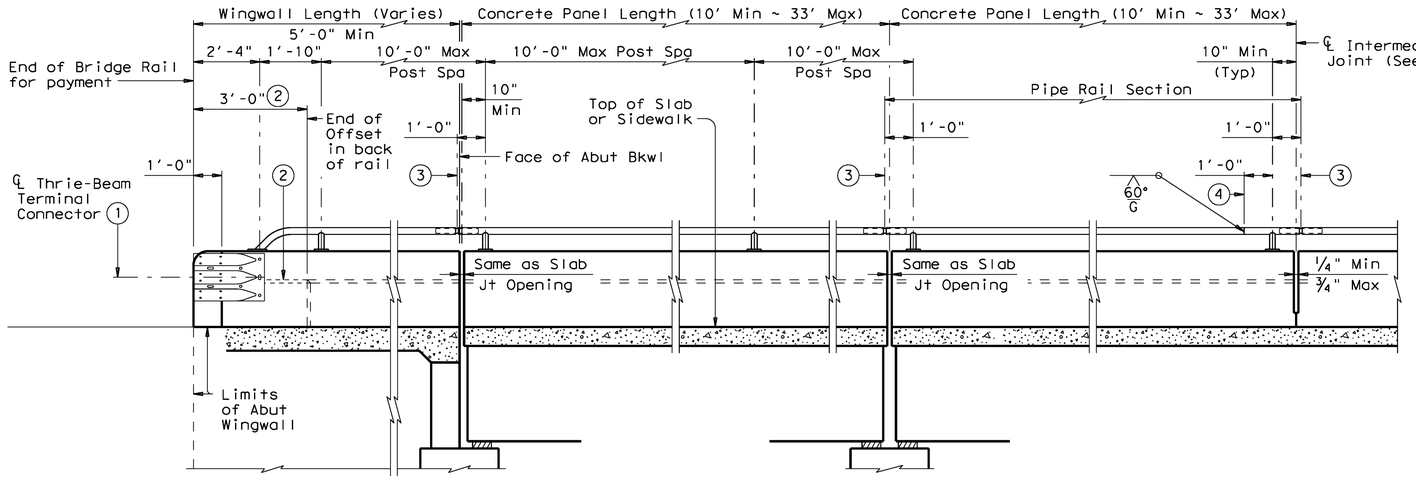
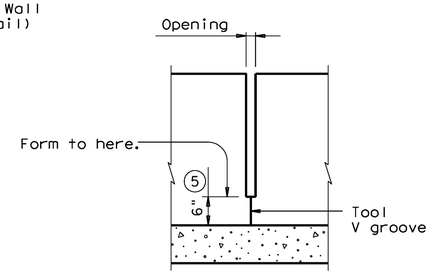


AT ABUTMENT BENTS AT SLAB EXP JOINTS AT INTERMEDIATE WALL JOINTS

ROADWAY ELEVATION OF RAIL



INTERMEDIATE WALL JOINT DETAIL

Provide at all interior bents without slab expansion joints. Space equally in between at 33' Max, 10' Min. Location independent of pipe rail splices.

(1) Terminal Connectors and associated hardware are to be paid for under the Item "Metal Beam Guard Fence". Metal Beam Guard Fence Transitions must be attached to the bridge rail and extended along the embankment unless otherwise shown in the plans.

(2) Back of rail offset may, with Engineer's approval be continued to the end of the railing.

(3) ℄ Exp Joint or Splice Joint as required.

(4) One shop splice per pipe rail section is permitted with minimum 85 percent penetration. The weld may be square groove, or single vee groove. Grind smooth.

(5) Increase 2" for structures with overlay.

(6) Bolts must be of sufficient length to extend 1/2" to 3/4" beyond nut.

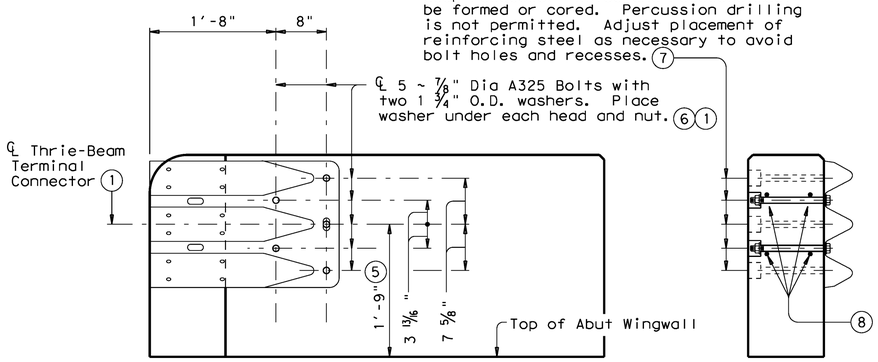
(7) Bolt recesses are only required when pedestrian sidewalks are adjacent to back of rail.

(8) 4 additional Bars R(#4) 3'-8" in length must be placed inside Bars S(#4) and centered 2'-0" from end of rail when Terminal Connections are required. Field bend as needed.

(9) 2 1/2" Std Pipe (2.875" O.D. 0.203" wall thickness)

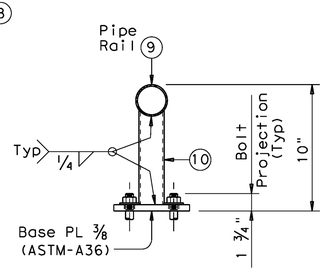
(10) 2" Std Pipe (2.375" O.D., 0.154" wall thickness)

(11) 3/8" Dia Hole in bottom of pipe or tube (Minimum 1 hole between posts ~ Typ)

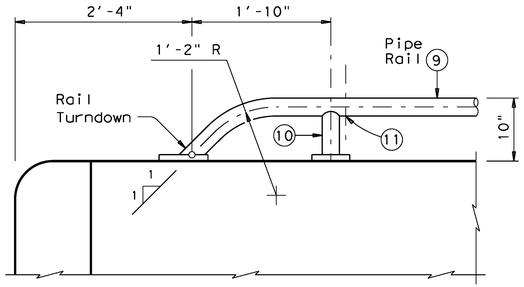


ELEVATION SECTION

TERMINAL CONNECTION DETAILS

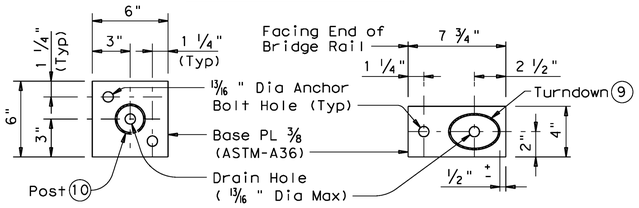


TRANSVERSE SECTION



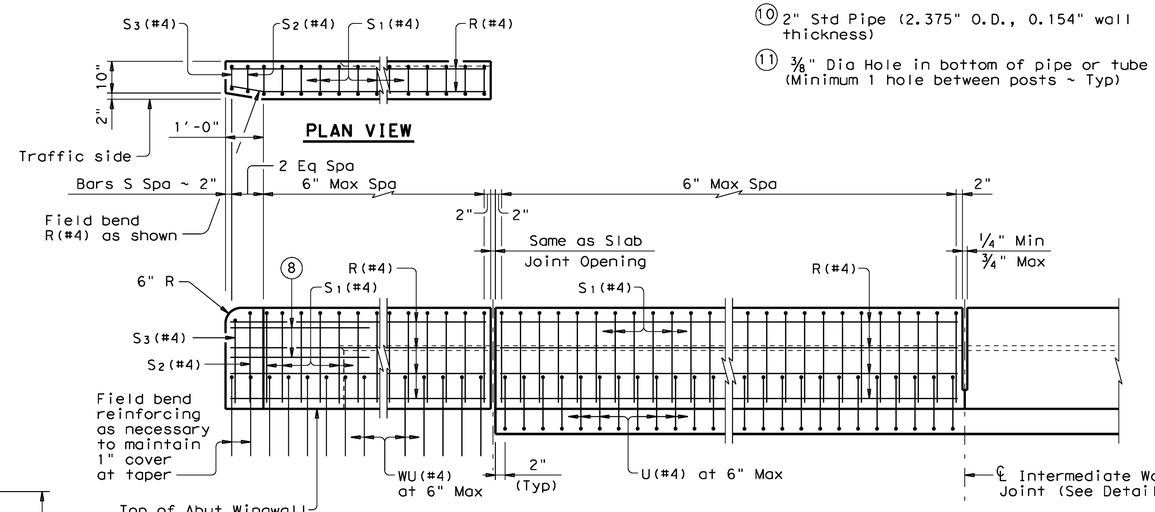
Note that at least two anchor points (as shown) are required for the Bridge Rail on the Abutment Wingwall. Longer Wingwalls may require more than two Rail anchorages.

PIPE RAIL TERMINAL DETAIL



POST BASE PLATE PLAN RAIL TURNDOWN BASE PLATE PLAN

PIPE RAIL DETAILS



ELEVATION SHOWING TYPICAL REINFORCING PLACEMENT

(Showing without raised sidewalk)

The use of this railing is restricted to design speeds of 45 mph or less.

SHEET 1 OF 3

Texas Department of Transportation
Bridge Division

COMBINATION RAIL

TYPE C221

FILE: rlstd018.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: JMH
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REVISIONS				D313
05-11: Wall Joint Note. 07-12: Guardrail Transition.	COUNTY	CONTROL	SECT	JOB	HIGHWAY

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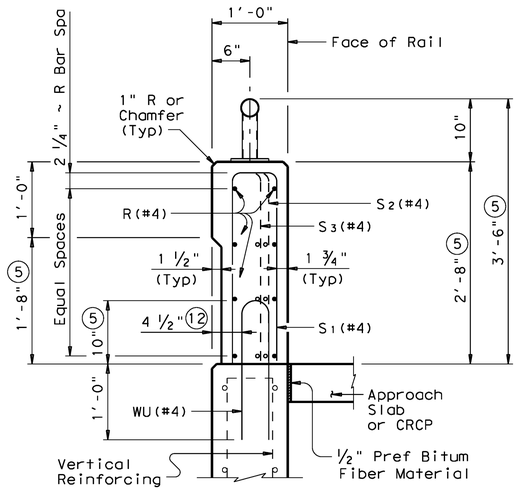
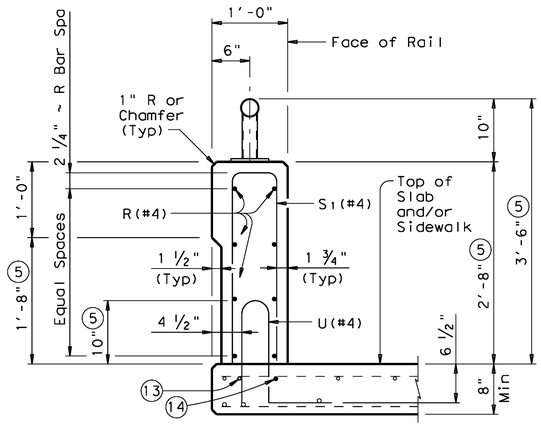
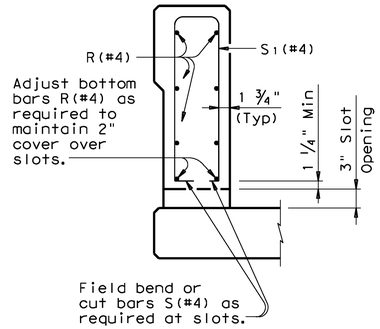


ON ABUTMENT WINGWALLS OR CIP RETAINING WALLS

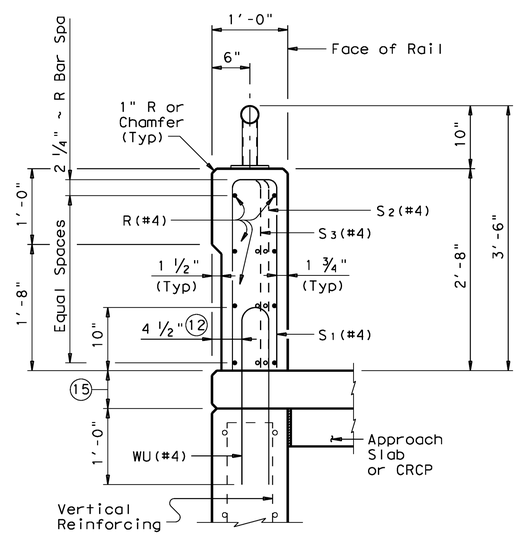


ON BRIDGE SLAB

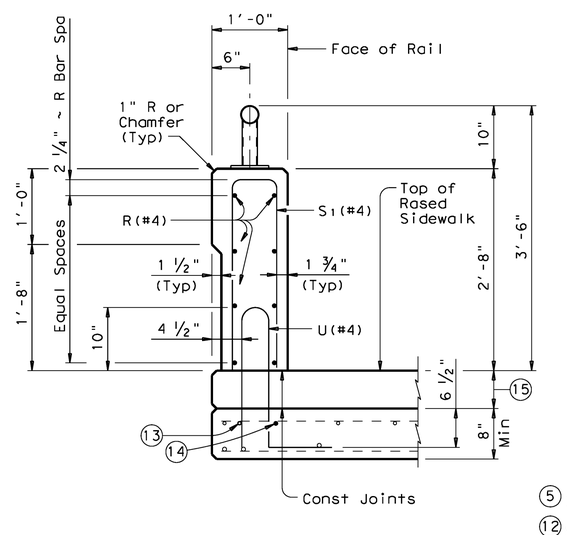
SECTIONS THRU RAIL WITHOUT RAISED SIDEWALK



SECTION THRU OPTIONAL SIDE SLOT DRAIN

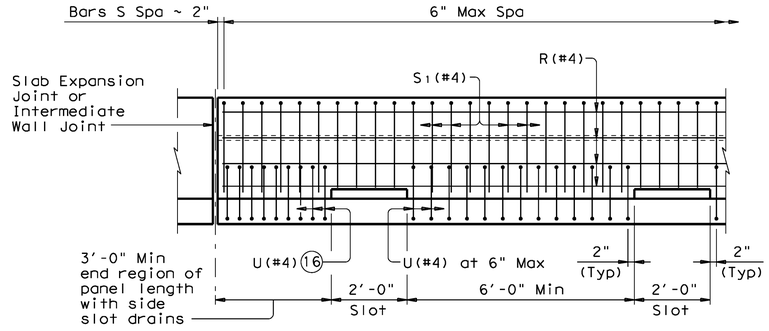


ON ABUTMENT WINGWALLS OR CIP RETAINING WALLS



ON BRIDGE SLAB

SECTIONS THRU RAIL WITH RAISED SIDEWALK



OPTIONAL SIDE SLOT DRAIN DETAIL

Note: Side Slot Drains may be used where shown elsewhere on the plans or as directed by the Engineer. Drains should not be placed over railroad tracks, lower roadways, or sidewalks. When this rail is used as a separator between a roadway surface and a sidewalk surface, side drain slots will not be permitted.

(5) Increase 2" for structures with overlay.

(12) 5 1/2" when vertical reinforcing has closer clear cover over horizontal reinforcing in abutment wingwalls or retaining walls on traffic side of wall.

(13) As an aid in supporting reinforcement, additional longitudinal bars may be used in the slab with the approval of the Engineer. Such bars must be furnished at the Contractors expense.

(14) Top longitudinal slab bar may be adjusted laterally 3" plus or minus to tie reinforcing.

(15) Raised Sidewalk

(16) Space U(#4) bars at 4" Max when end region of panel length is less than 6'-0" to side slot drain. Space U(#4) bars at 6" Max when end region of panel length is 6'-0" and greator to side slot drain.

Texas Department of Transportation
Bridge Division

COMBINATION RAIL

TYPE C221

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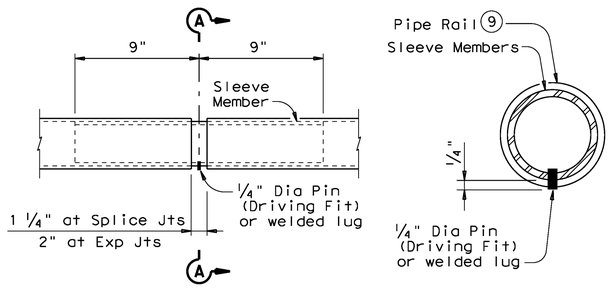
RAIL DATA FOR HORIZONTAL CURVES

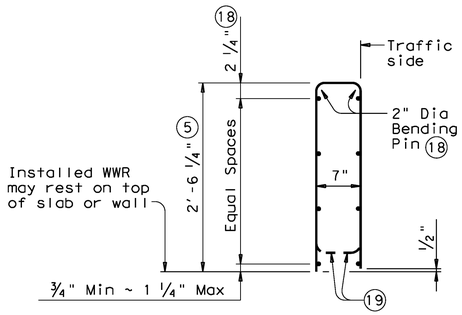
	RADIUS TO FACE OF RAIL	MAX CHORD LENGTH	CONSTRUCT OR FABRICATE
Pipe Rail	Over 2800'	29'-0"	Straight rail panels
	Over 1400' thru 2800'	14'-6"	To required radius or to chords shown (17)
	Over 700' thru 1400'	7'-3"	
	Thru 700'	Zero	To required radius (17)



AT SPLICE OR EXP JTS **SECTION A-A**

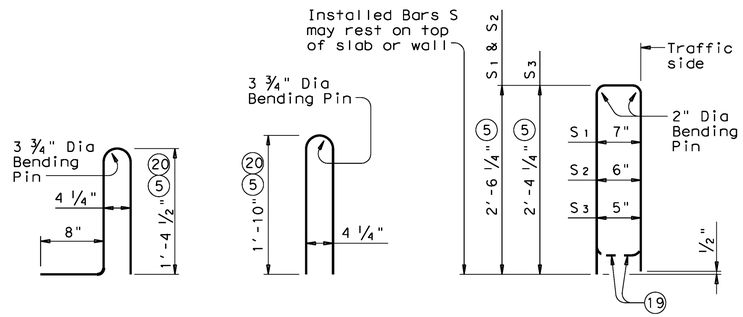
The difference between the outside dimension of sleeve and inside dimension of pipe rail must not exceed 0.167" before galvanizing. Minimum wall thickness of sleeve is 0.120".

PIPE SPLICE DETAILS

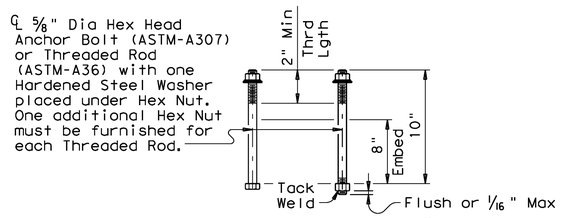


OPTIONAL WELDED WIRE REINFORCEMENT (WWR)

DESCRIPTION	LONGITUDINAL WIRES	VERTICAL WIRES
Minimum (Cumulative Total) Wire Area	1.067 Sq In.	0.267 Sq In. per Ft
	No. of Wires	Spacing
Minimum	8	4"
Maximum	10	8"
Maximum Wire Size Differential	The smaller wire must have an area of 40% or more of the larger wire.	



BARS U (#4) **BARS WU (#4)** **BARS S (#4)**



CAST-IN-PLACE (21) ANCHOR BOLT OPTIONS

(5) Increase 2" for structures with overlay.

(9) 2 1/2" Std Pipe (2.875" O.D. 0.203" wall thickness)

(17) Shop drawings for approval required for tubular steel sections.

(18) No longitudinal wires may be in top center of cage.

(19) Bend or cut as required to clear drain slots.

(20) For raised sidewalks, add sidewalk height to total bar height. Use sidewalk height at rail's location.

(21) See "Material Notes" for anchor bolt information.

CONSTRUCTION NOTES:

This railing may be constructed with slip-forms when approved by the Engineer, with equipment approved by the Engineer and when epoxy adhesive anchor bolts are used. Slip-forming parapet is not allowed if anchor bolts are cast with parapet wall. Sensor control for both line and grade must be provided. Tack welding to provide bracing for slip-form operations is acceptable. Welding can be performed at a minimum spacing of 3 ft between the cage and the anchorage. It is permissible to weld to U, WU and S bars at any location on the cage. If increased bracing is needed, additional anchorage devices must be added and welding must be performed in the upper two thirds of the cage.

Face of rail, parapet must be plumb unless otherwise approved by the Engineer. Pipe rail posts must be square to the top of parapet. Use epoxy mortar under post base plates if gaps larger than 1/16" exist.

Exposed edges of pipe rail and pipe rail posts must be rounded or chamfered to approximately 1/16" by grinding.

At the contractor's option anchor bolts may be cast with the parapet (See Cast-in-Place Anchor Bolt Options).

Pipe rail sections must not include less than two posts, and no more than four (except at Abutment

Chamfer all parapet exposed corners.

MATERIAL NOTES:

All steel components except reinforcing must be galvanized unless otherwise shown on plans.

Use Class "C" concrete. Use Class "C" (HPC) if required elsewhere.

All reinforcing must be Grade 60.

Epoxy coat all rail reinforcement if slab bars are epoxy coated.

Deformed welded wire reinforcement (WWR) may be used as an option to conventional reinforcement and must be made in accordance with ASTM A497 (Deformed Wire). Combinations of Reinforcing Steel and WWR or configurations of WWR other than shown will be permitted when the conditions in the table are satisfied.

Pipe for pipe rail must conform to ASTM A53 Grade B or A500 Grade B.

Anchor bolts must be 5/8" Dia ASTM A36 fully threaded rods with one hex nut and one hardened steel washer at each bolt. Embed threaded rods into parapet wall with a Type III Class C epoxy anchorage system. Minimum embedment depth is 3". Anchorage system chosen must be able to achieve an ultimate tensile resistance of 8.4 kips per bolt. 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 instructions.

Optional cast-in-place anchor bolts must be 5/8" Dia ASTM A307 Grade A bolts (or A36 threaded rods with one tack welded hex nut each) with one hex nut and one hardened steel washer at each bolt.

GENERAL NOTES:

This rail, without the pipe rail, has been evaluated and accepted to be of equal strength to railings with like geometry, which have been crash tested to meet NCHRP Report 350 TL-4 criteria. However, its use is limited to design speeds of 45 mph or less due to the presence of the pipe rail.

This railing cannot be used on bridges with expansion joints providing more than 5" movement.

Rail anchorage details shown on this standard may require modification for select structure types. See appropriate details elsewhere in plans for these modifications.

Erection drawings showing panel lengths, rail post spacing, and anchor bolt setting must be submitted to the Engineer for approval.

Average weight of railing with no overlay: 370 plf (Conc)
10 plf (Steel)

Texas Department of Transportation
Bridge Division

COMBINATION RAIL

TYPE C221

FILE: rlstd018.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: JMH
©TxDOT April 2009	DISTRICT	FEDERAL AID PROJECT		SHEET
REVISIONS				D315
05-11: Wall Joint Note. 07-12: Guardrail Transition.	COUNTY	CONTROL	SECT	JOB HIGHWAY

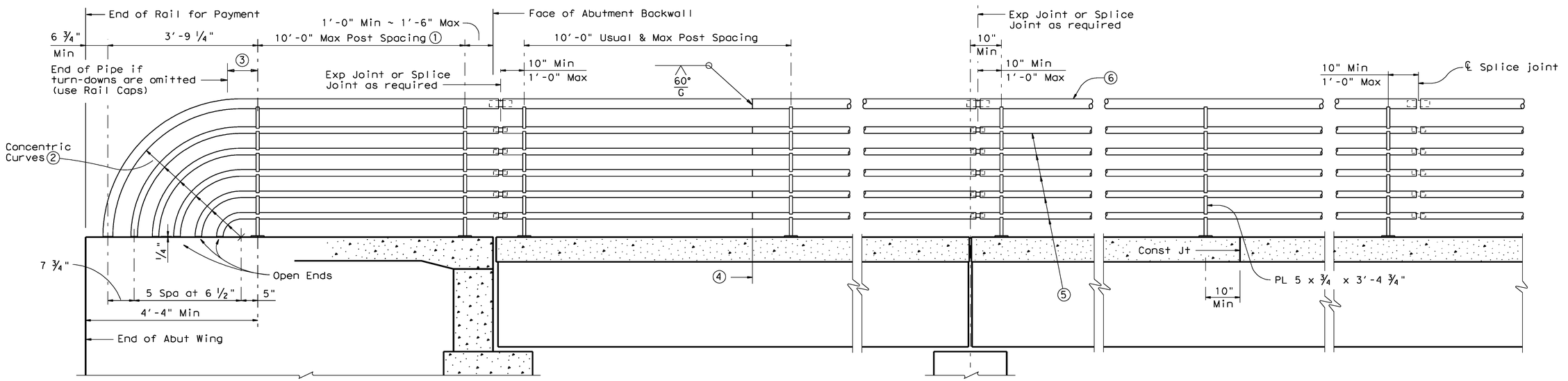
ACC:
LEVELS DISPLAYED
1

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.

ACC:

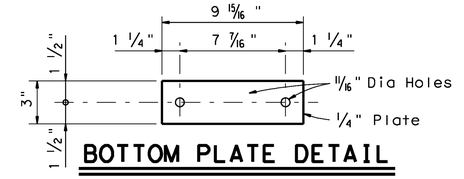
LEVELS DISPLAYED

1

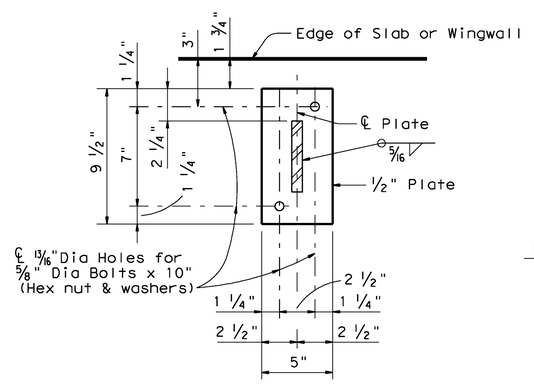


AT ABUTMENT BENTS | AT SHOP SPLICE | AT ENDS OF UNIT | AT SLAB CONST JOINT | AT SPLICE JOINT

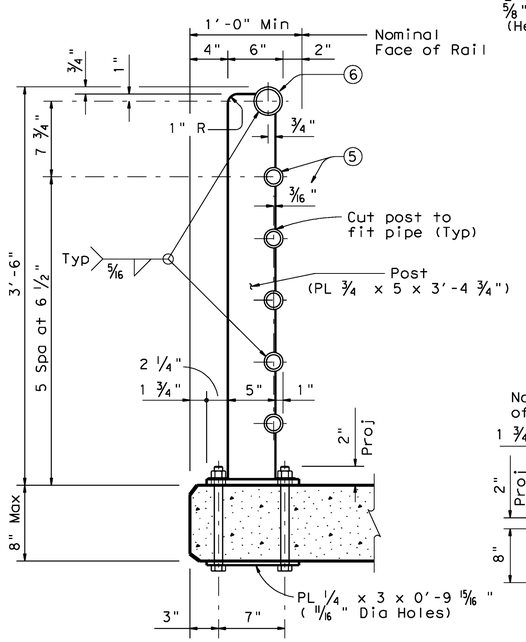
ROADWAY ELEVATION OF RAIL



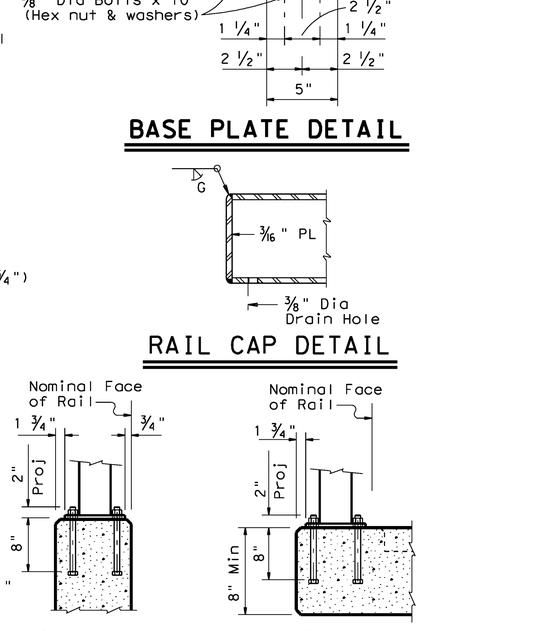
BOTTOM PLATE DETAIL



BASE PLATE DETAIL



BASIC CONDITION

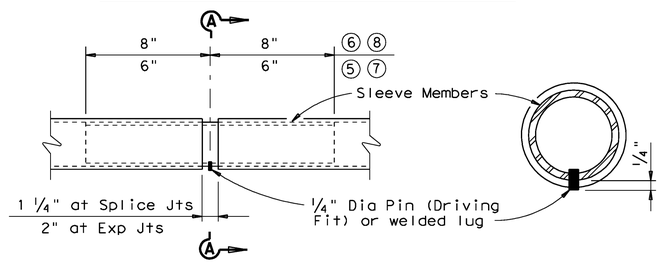


ON ABUT WING OR CIP RETAINING WALL

ON CULVERTS OR SLABS OVER 8" THICK

POST MOUNTING DETAILS

RAIL CAP DETAIL



AT SPLICE OR EXP JTS | SECTION A-A

PIPE SPLICE DETAIL

(1) Min of 2 posts required on wingwall

(2) Portion of railing with turn-downs to be used or omitted as indicated on Bridge Layout.

(3) 10" Min ~ 1'-6" Max if turn-downs are omitted.

(4) One shop splice per panel is permitted (with minimum 85 percent penetration). The weld may be square groove or single vee groove. Grind smooth.

(5) 2" Std Pipe (2.375" O.D., 0.154" wall thickness)

(6) 3" Std Pipe (3.500" O.D., 0.216" wall thickness)

(7) 1 1/2" Std Pipe Sleeve (1.900" O.D., 0.145" wall thickness)

(8) 2 1/2" Std Pipe Sleeve (2.875" O.D., 0.203" wall thickness)

CONSTRUCTION NOTES:

Panel lengths of railing must be attached to a minimum of three posts except at abutment wingwalls.

Face of rail and posts must be vertical transversely unless otherwise approved by the Engineer. Posts must be perpendicular to adjacent roadway grade. Use epoxy mortar under post base plates if gaps larger than 1/16" exist.

For curved railing applications, fabricate the pipe rails to the radius when the radius is 600' or less. Submit shop drawings for approval when tubes are required to be fabricated to a radius. Shop drawings must be submitted to the Engineer for approval.

Exposed edges of pipe rail and pipe rail posts must be rounded or chamfered to approximately 1/16" by grinding.

MATERIAL NOTES:

Pipe for pipe rail must conform to ASTM A53 Gr B, or A500 Gr B. Posts and Plates must be ASTM A36.

All steel components to be galvanized unless otherwise shown in plans.

Anchor bolts must be 5/8" Dia ASTM A307 Grade A bolts (or A36 threaded rods with one tack welded hex nut each) with one hex nut and one hardened steel washer at each bolt. Threaded rods may be 0.557" minimum diameter with rolled threads. Nuts must conform to A563 requirements.

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

Rail anchorage details shown on this standard may require modification for select structure types. See appropriate details elsewhere in plans for these modifications.

This railing cannot be used on bridges with expansion joints providing more than 5" movement.

For all rails, erection drawings showing section lengths, splice locations, rail post spacing and anchor bolt setting must be submitted to the Engineer for approval.

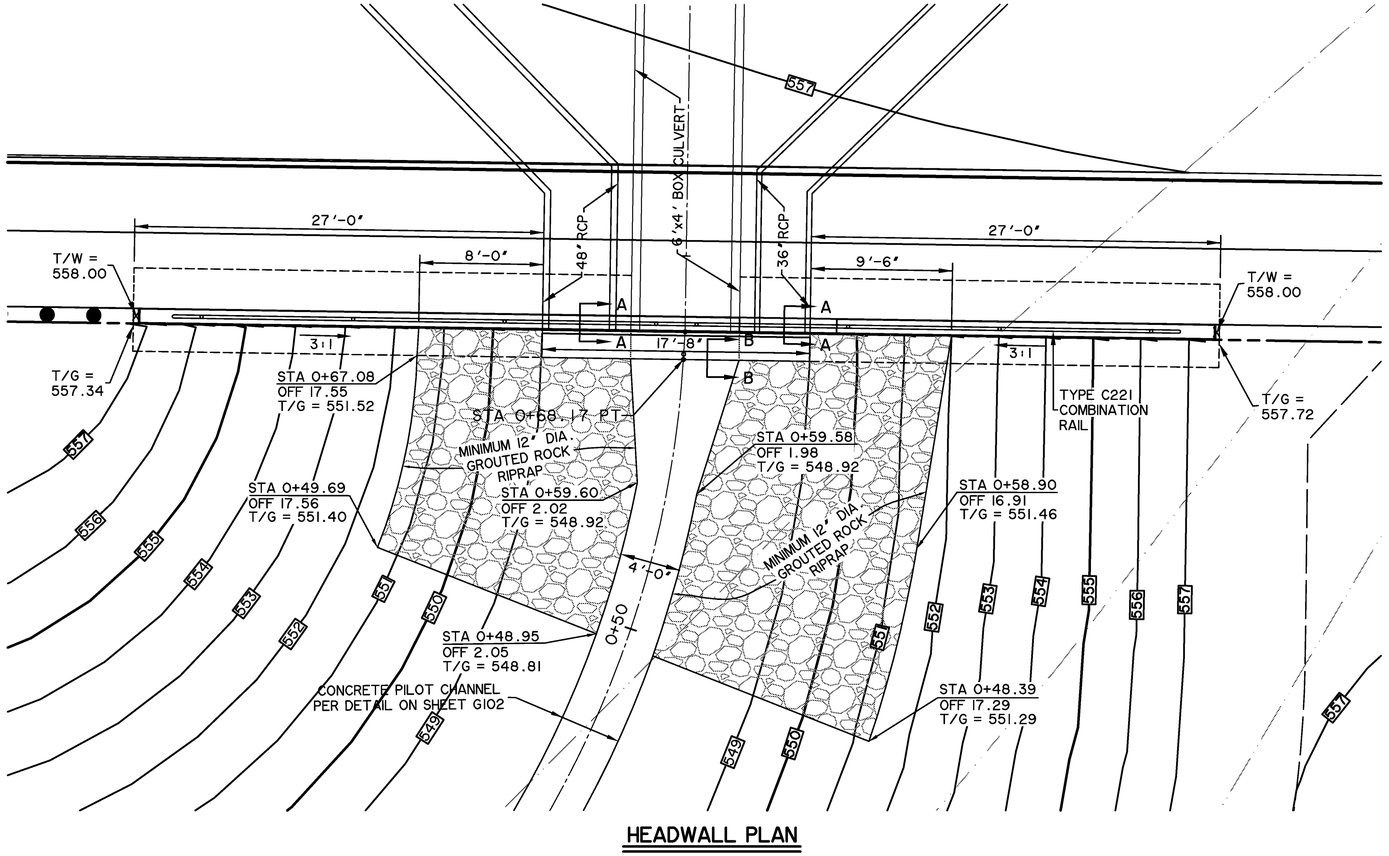
Average weight of railing is 30 plf.

Texas Department of Transportation
Bridge Division

PEDESTRIAN RAIL

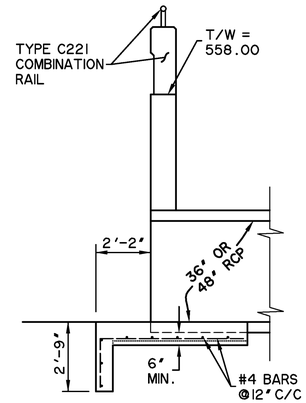
TYPE PR1

FILE: rlstd028.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: TxDOT
©TxDOT April 2009	DISTRICT	FEDERAL AID PROJECT		SHEET
REVISIONS				D316
	COUNTY	CONTROL	SECT	JOB	HIGHWAY



HEADWALL PLAN

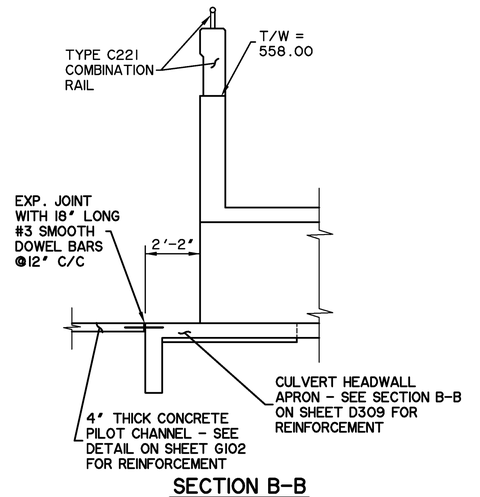
N.T.S.



SEE SECTION A-A ON SHEET D309 FOR HEADWALL REINFORCEMENT

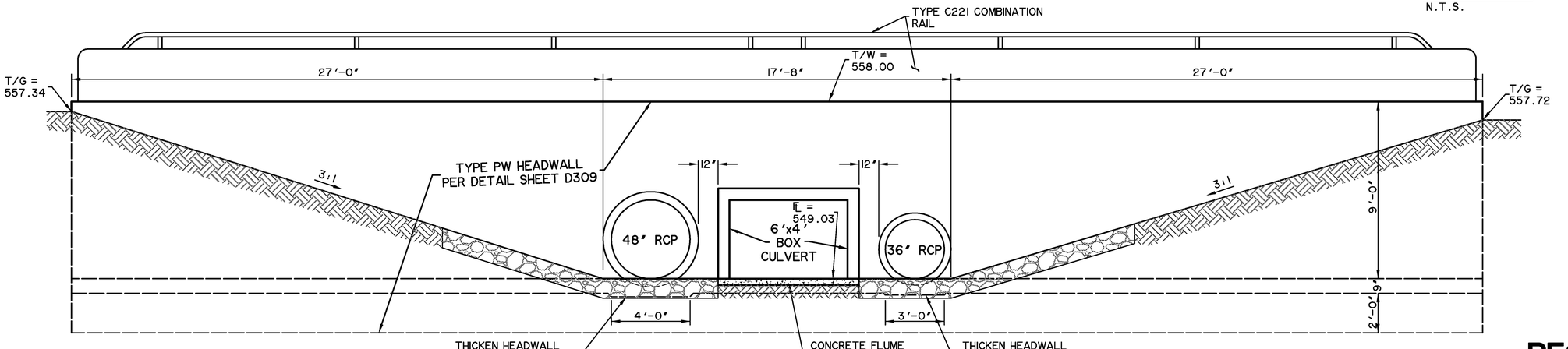
SECTION A-A

N.T.S.



SECTION B-B

N.T.S.



HEADWALL ELEVATION

N.T.S.

PREPARED BY:
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701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
STORM DRAIN LINE 'B'
DOWNSTREAM HEADWALL DETAILS

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
5/1/2015

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WA# 13096

SHEET NO. D317

RECORD PLANS
MAY 1, 2015

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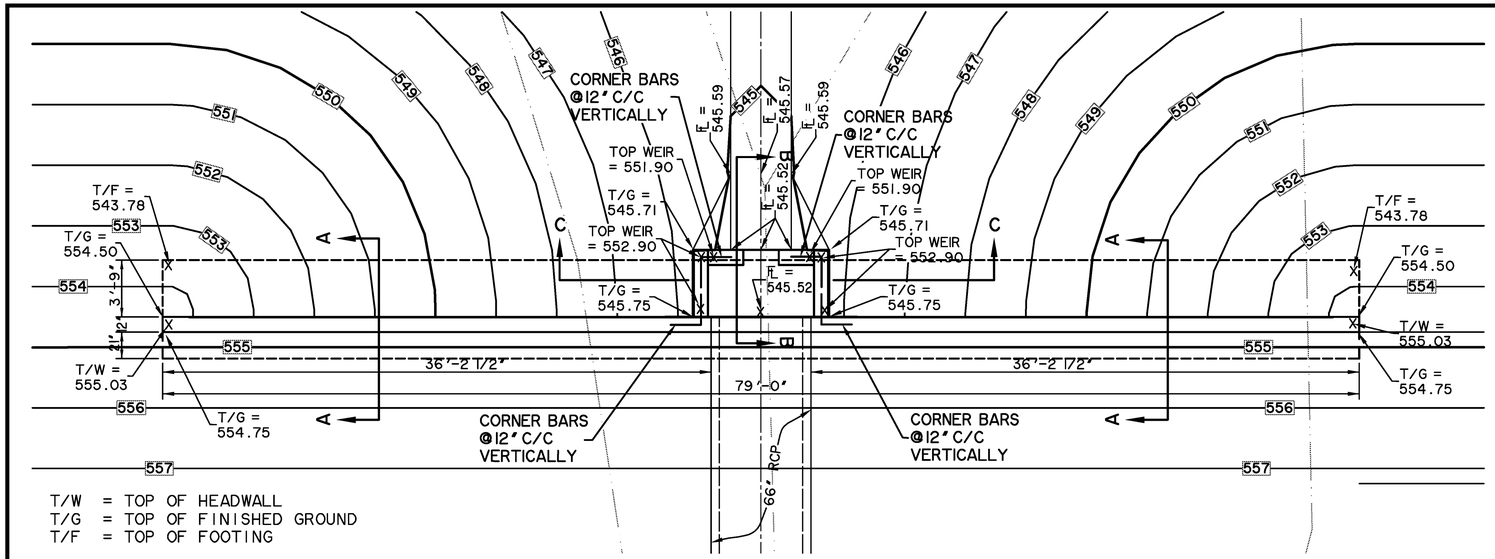
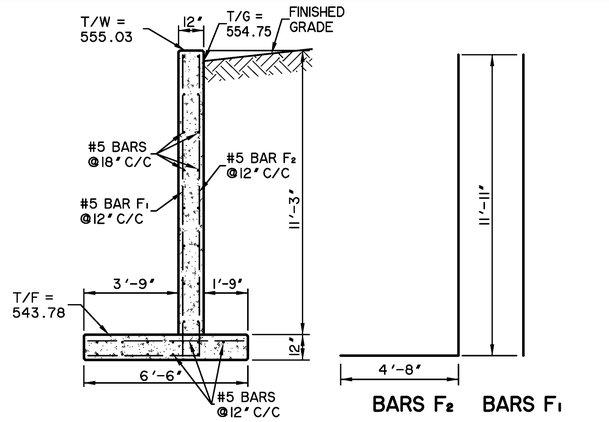


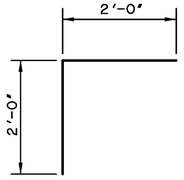
T/W = TOP OF HEADWALL
T/G = TOP OF FINISHED GROUND
T/F = TOP OF FOOTING

HEADWALL PLAN
N.T.S.

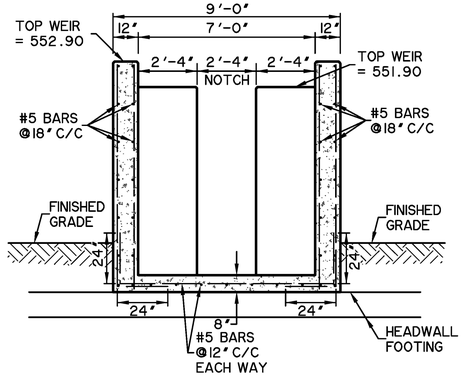


SECTION A-A
N.T.S.

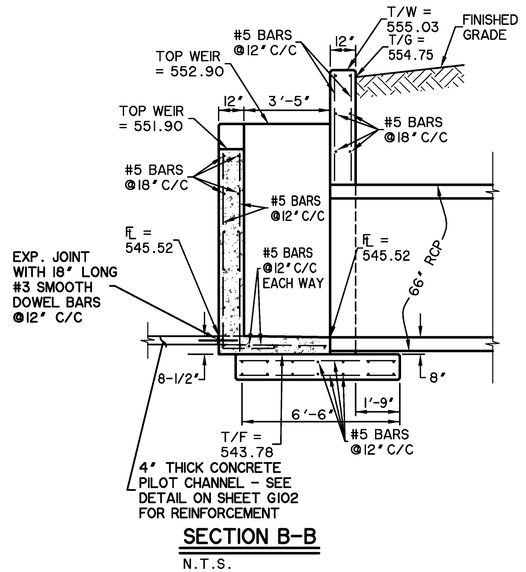
GENERAL NOTES:
1. ALL CONCRETE SHALL BE CLASS "F" WITH A MINIMUM COMPRESSIVE STRENGTH OF 4,200 psi.
2. REINFORCING STEEL SHALL BE GRADE 60.
3. PROVIDE MINIMUM 1-1/4" CLEAR COVER TO REINFORCING STEEL.



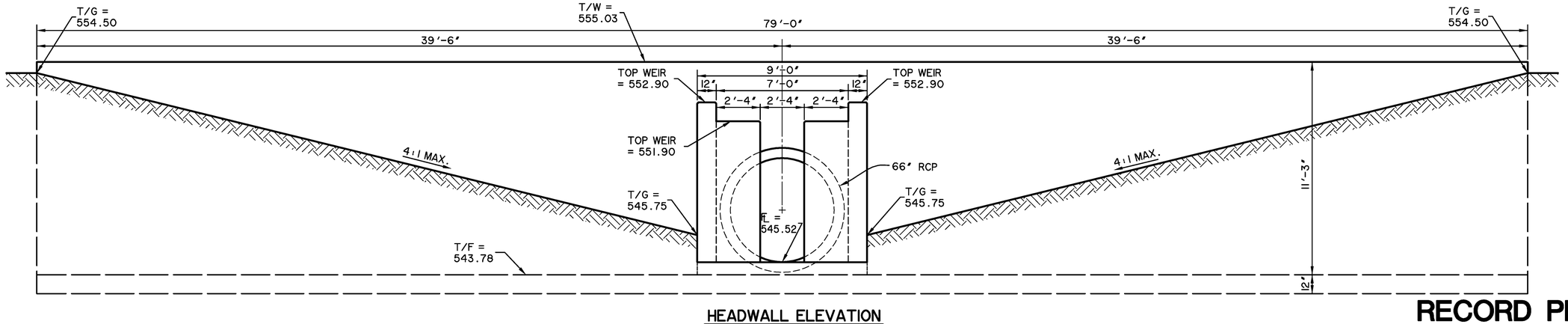
CORNER BARS



SECTION C-C
N.T.S.



SECTION B-B
N.T.S.



HEADWALL ELEVATION
N.T.S.

RECORD PLANS
MAY 1, 2015

PREPARED BY:
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Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
STORM DRAIN LINE 'E'
DETENTION POND OUTLET DETAILS

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
5/1/2015

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D318

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ROCKWALL ECONOMIC DEVELOPMENT CORPORATION
VOL. 4168, PG. 317
D.R.R.C.T.

JUSTIN ROAD

5' CONC. SIDEWALK

ROCKWALL ECONOMIC DEVELOPMENT CORPORATION
VOL. 4168, PG. 317
D.R.R.C.T.

SEE SHEET G102 FOR DETENTION POND BOTTOM & INTERIOR SIDE PREPARATION DETAIL

SEE SHEET G102 FOR PILOT CHANNEL DETAIL

SEE SHEET D201 & D202 FOR DETENTION POND WEIR AND OUTLET DETAILS
SEE SHEET D318 FOR STRUCTURAL DETAILS

SEE SHEET D106 FOR STORM DRAIN PLAN AND PROFILE

100 YEAR FLOOD PLAIN

ROCKWALL ECONOMIC DEVELOPMENT CORPORATION
VOL. 4168, PG. 317
D.R.R.C.T.

BUFFALO TRIBUTARY I

548 CREEK

546.98
546.48
545.98
545.90
545.62
545.57
545.52

MATCH LINE – SEE SHEET G102

NOTES:
1. REVEGETATE ALL DISTURBED AREAS AROUND DETENTION POND BY HYDRO-MULCH SEEDING WITH BERMUDA GRASS. PLACE 6" TOPSOIL PRIOR TO RE-VEGETATION.
2. SEE SHEET D202 FOR CALCULATIONS.
3. DETENTION POND SUBGRADE SHALL BE SCARIFIED TO A MINIMUM DEPTH OF 8" AND RECOMPACTED (RE-PROCESSED) TO A MINIMUM 95% ASTM D698 AT A MOISTURE CONTENT BETWEEN +2% TO +5% OF OPTIMUM. LINER MATERIALS SHALL BE PROCESSED SUCH THAT THE LARGEST PARTICLE OR CLOD IS LESS THAN 3 INCHES PRIOR TO COMPACTION.
4. DETENTION POND TO BE INSTALLED AND SHALL HAVE SIDES AND BOTTOM EITHER SODDED OR HAVE ANCHORED SEEDED CURLEX BLANKET PRIOR TO ANY PAVING.

RECORD PLANS
MAY 1, 2015

0 20 40 60

PREPARED BY:
WIER & ASSOCIATES, INC.
ENGINEERS SURVEYORS LAND PLANNERS
701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
DETENTION POND GRADING PLAN

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
5/1/2015

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SHEET NO.
G101

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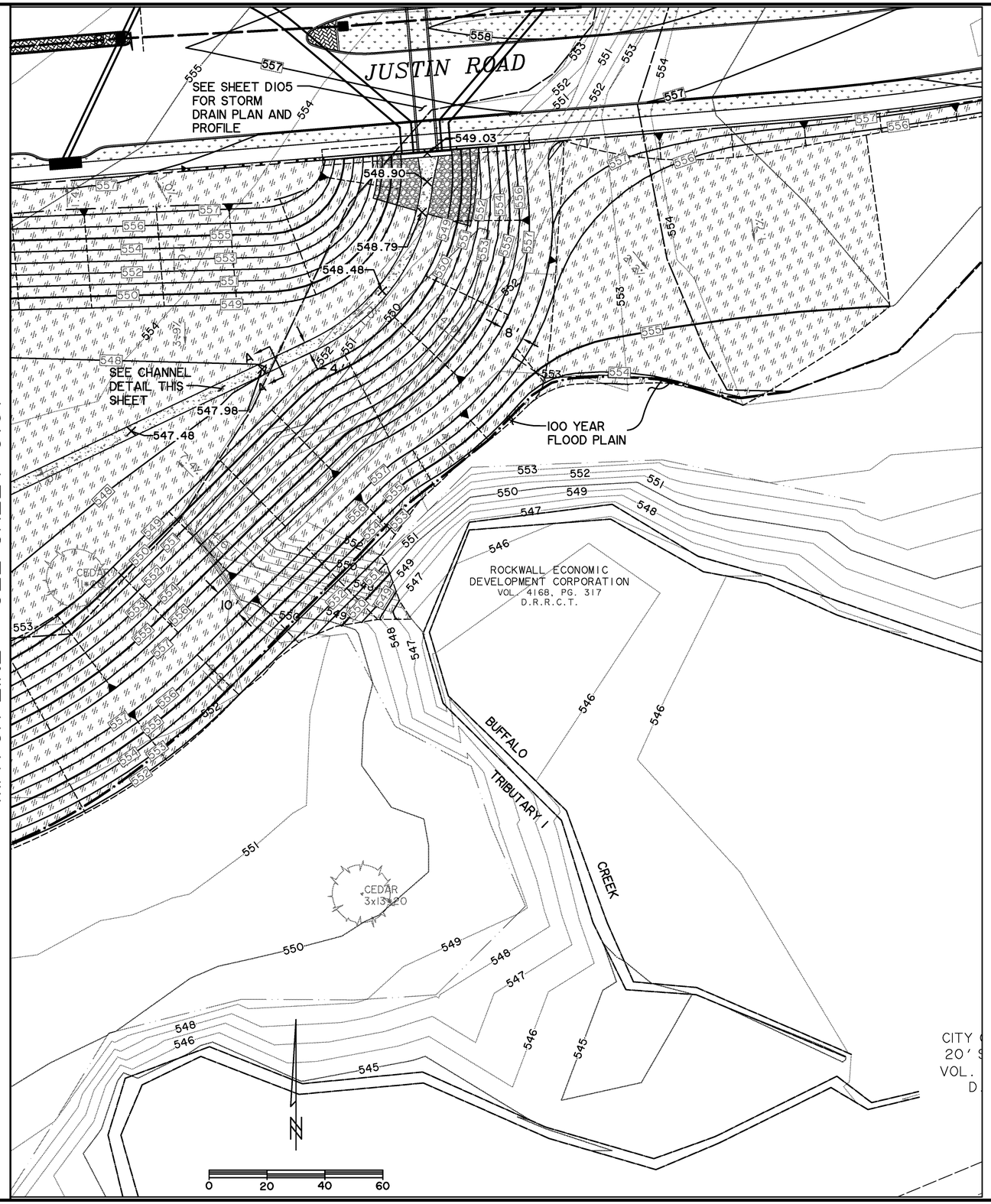
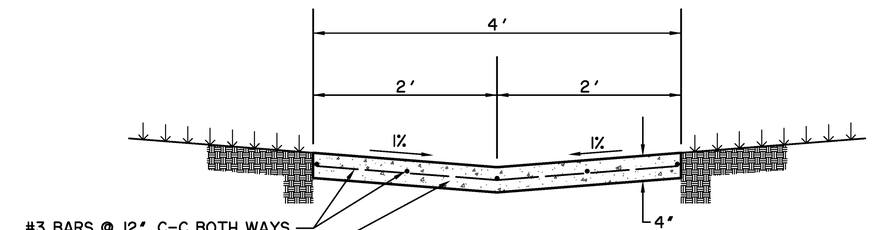
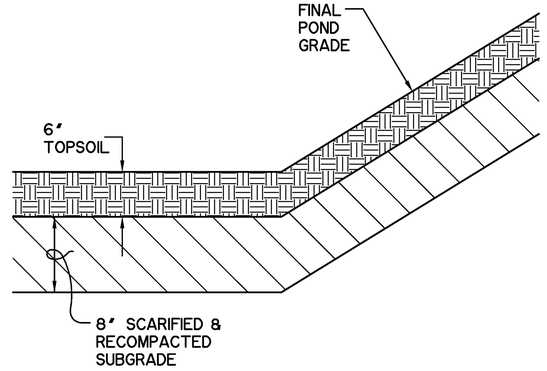
MATCH LINE - SEE SHEET G101





PILOT CHANNEL SECTION 'A-A'

N.T.S.



DETENTION POND BOTTOM & INTERIOR SIDE PREPARATION

N.T.S.

RECORD PLANS
MAY 1, 2015

NOTES:
1. REVEGETATE ALL DISTURBED AREAS AROUND DETENTION POND BY HYDRO-MULCH SEEDING WITH BERMUDA GRASS. PLACE 6" TOPSOIL PRIOR TO RE-VEGETATION.
2. SEE SHEET D202 FOR CALCULATIONS.
3. DETENTION POND SUBGRADE SHALL BE SCARIFIED TO A MINIMUM DEPTH OF 8" AND RECOMPACTED (RE-PROCESSED) TO A MINIMUM 95% ASTM D698 AT A MOISTURE CONTENT BETWEEN +2% TO +5% OF OPTIMUM. LINER MATERIALS SHALL BE PROCESSED SUCH THAT THE LARGEST PARTICLE OR CLOD IS LESS THAN 3 INCHES PRIOR TO COMPACTION.
4. DETENTION POND TO BE INSTALLED AND SHALL HAVE SIDES AND BOTTOM EITHER SODDED OR HAVE ANCHORED SEEDED CURLEX BLANKET PRIOR TO ANY PAVING.

PREPARED BY:
WIER & ASSOCIATES, INC.
ENGINEERS SURVEYORS LAND PLANNERS
701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD TO JOHN KING BOULEVARD
DETENTION POND GRADING PLAN

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
5/1/2015

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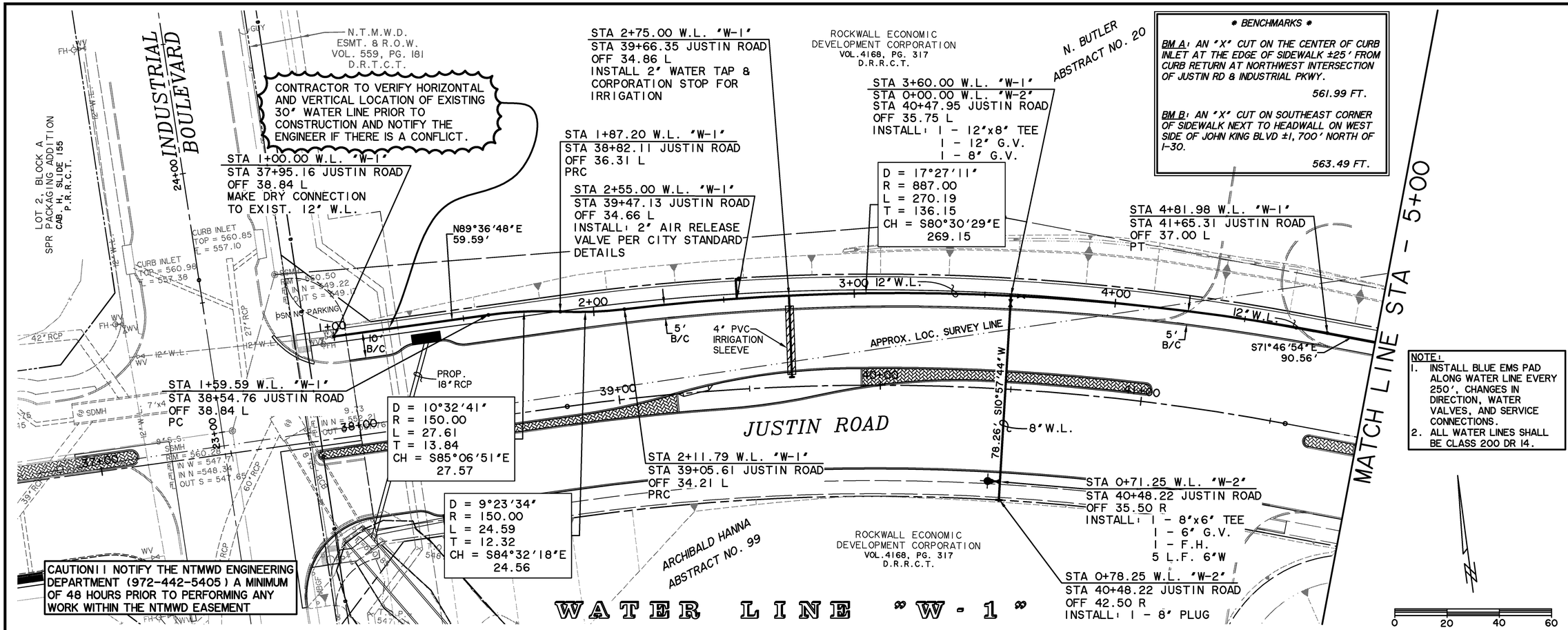
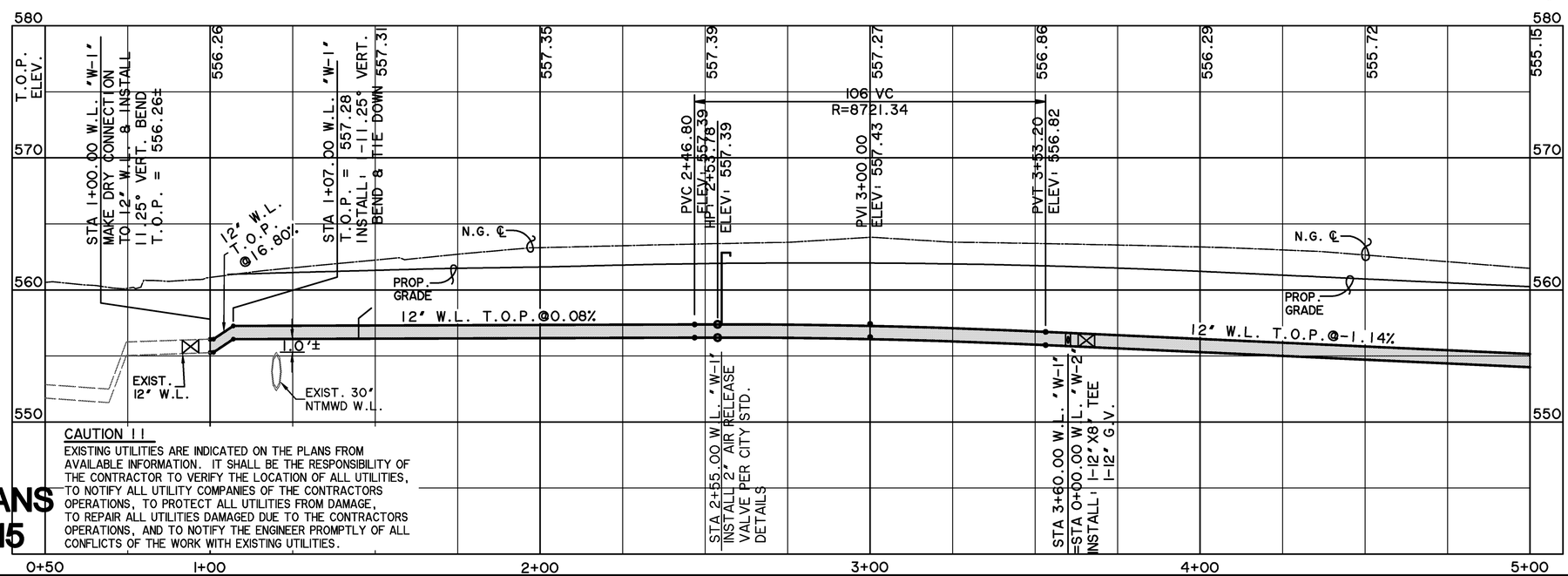
SHEET NO.
G102

WATER LINE "W-1"





CAUTION!! EXISTING UTILITIES ARE INDICATED ON THE PLANS FROM AVAILABLE INFORMATION. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION OF ALL UTILITIES, TO NOTIFY ALL UTILITY COMPANIES OF THE CONTRACTORS OPERATIONS, TO PROTECT ALL UTILITIES FROM DAMAGE, TO REPAIR ALL UTILITIES DAMAGED DUE TO THE CONTRACTORS OPERATIONS, AND TO NOTIFY THE ENGINEER PROMPTLY OF ALL CONFLICTS OF THE WORK WITH EXISTING UTILITIES.

RECORD PLANS
MAY 1, 2015

PREPARED BY:
WIER & ASSOCIATES, INC.
ENGINEERS SURVEYORS LAND PLANNERS
701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
WATER LINE PLAN & PROFILE
BEGINNING TO STA 5+00

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
5/1/2015

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SHEET NO.
U101

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RECORD PLANS
MAY 1, 2015

NOTE:
1. INSTALL BLUE EMS PAD ALONG WATER LINE EVERY 250', CHANGES IN DIRECTION, WATER VALVES, AND SERVICE CONNECTIONS.
2. ALL WATER LINES SHALL BE CLASS 200 DR 14.

*** BENCHMARKS ***

BM A: AN 'X' CUT ON THE CENTER OF CURB INLET AT THE EDGE OF SIDEWALK ±25' FROM CURB RETURN AT NORTHWEST INTERSECTION OF JUSTIN RD & INDUSTRIAL PKWY.
561.99 FT.

BM B: AN 'X' CUT ON SOUTHEAST CORNER OF SIDEWALK NEXT TO HEADWALL ON WEST SIDE OF JOHN KING BLVD ±1,700' NORTH OF I-30.
563.49 FT.

N. BUTLER
ABSTRACT NO. 20

ROCKWALL ECONOMIC DEVELOPMENT CORPORATION
VOL. 4168, PG. 317
D.R.R.C.T.

APPROX. LOC. SURVEY LINE

MATCH LINE - STA 5+00

MATCH LINE STA - 10+00

D = 4°03'45"
R = 150.00
L = 10.64
T = 5.32
CH = S80°09'29"E
10.63

D = 9°02'09"
R = 150.00
L = 23.66
T = 11.85
CH = S77°40'16"E
23.63

D = 1°22'18"
R = 813.00
L = 19.46
T = 9.73
CH = S72°28'03"E
19.46

D = 9°02'09"
R = 150.00
L = 23.66
T = 11.85
CH = S78°34'56"E
23.63

D = 8°26'29"
R = 150.00
L = 22.10
T = 11.07
CH = N89°35'10"E
22.08

D = 8°33'09"
R = 150.00
L = 22.39
T = 11.22
CH = N81°12'07"E
22.37

D = 8°26'23"
R = 150.00
L = 22.10
T = 11.07
CH = N81°08'44"E
22.08

N85°21'55"E
54.75'

PROP. 27" RCP

12" W.L.
S71°46'54"E 90.56'

5' B/C

6+00

S78°07'36"E
72.45'

7+00

8+00

9+00

10+00

STA 5+72.54 W.L. "W-1"
STA 42+55.87 JUSTIN ROAD
OFF 37.00 L
PCC

STA 5+92.00 W.L. "W-1"
STA 42+76.22 JUSTIN ROAD
OFF 37.00 L
PCC

STA 6+15.66 W.L. "W-1"
STA 43+00.90 JUSTIN ROAD
OFF 38.52 L
PRC

STA 6+26.29 W.L. "W-1"
STA 43+12.00 JUSTIN ROAD
OFF 39.44 L
PT

STA 6+98.74 W.L. "W-1"
STA 43+88.00 JUSTIN ROAD
OFF 39.44 L
PC

STA 6+47.00 W.L. "W-1"
STA 43+33.71 JUSTIN ROAD
OFF 40.10 L
INSTALL: 1 - 12"X6" TEE
1 - 12" G.V.
1 - 6" G.V.
1 - F.H.
5 L.F. 6" W

STA 7+33.03 W.L. "W-1"
STA 44+23.78 JUSTIN ROAD
OFF 37.00 L
PCC

STA 7+50.00 W.L. "W-1"
STA 44+41.52 JUSTIN ROAD
OFF 37.00 L
INSTALL 2" WATER TAP & CORPORATION STOP FOR IRRIGATION

STA 7+09.38 W.L. "W-1"
STA 43+99.10 JUSTIN ROAD
OFF 38.52 L
PRC

STA 8+95.10 W.L. "W-1"
STA 45+93.23 JUSTIN ROAD
OFF 37.00 L
PCC

STA 8+15.00 W.L. "W-1"
STA 45+09.48 JUSTIN ROAD
OFF 37.00 L
INSTALL: 1-12"x8" TEE
1-8" G.V.

STA 9+17.49 W.L. "W-1"
STA 46+15.61 JUSTIN ROAD
OFF 38.63 L
PRC

STA 9+39.59 W.L. "W-1"
STA 46+37.63 JUSTIN ROAD
OFF 40.25 L
PT

STA 9+94.34 W.L. "W-1"
STA 46+92.38 JUSTIN ROAD
OFF 40.25 L
PC

PROP. 30" RCP

4" PVC IRRIGATION SLEEVE

PROP. 36" RCP

PROP. 18" RCP

PROP. 21" RCP

CEDAR 11"±

CEDAR 12"±

3x12"±

2x11"±

JUSTIN ROAD

D = 4°03'45"
R = 150.00
L = 10.64
T = 5.32
CH = S76°05'44"E
10.63

D = 11°25'18"
R = 813.00
L = 162.07
T = 81.30
CH = S88°48'40"E
161.80

ROCKWALL ECONOMIC DEVELOPMENT CORPORATION
VOL. 4168, PG. 317
D.R.R.C.T.

ARCHIBALD HANNA
ABSTRACT NO. 99

0 20 40 60

WATER LINE "W-1"

T.O.P. ELEV.

580 / 570 / 560 / 550

555.15 — STA 5+90.00 PVI LT. — 11.25° VERTICAL BEND — T.O.P. = 554.12

554.58

552.33 — STA 6+10.00 PVI LT. — 11.25° VERTICAL BEND — T.O.P. = 550.54

STA 6+25.00 PVI LT. — 11.25° VERTICAL BEND — T.O.P. = 550.54

553.89 — STA 6+45.00 PVI LT. — 11.25° VERTICAL BEND — T.O.P. = 553.93

STA 6+47.00 W.L. "W-1" INSTALL 1-12"X6" TEE 1-12" G.V.

553.49

553.09

552.69 — STA 8+15.00 W.L. "W-1" INSTALL 1-12"x8" TEE

552.29

551.52

549.69

548.01

PROP. GRADE

12" W.L. T.O.P.@-1.14%

PROP. 30" RCP

2.5'±

PROP. GRADE

N.G. ℄

12" W.L. T.O.P.@-0.80%

PVC 8+64.99 ELEV: 552.17

50 VC R=1668.18

PVI 8+90.00 ELEV: 551.97

PVT 9+14.99 ELEV: 551.02

PVC 9+55.00 ELEV: 549.50

40 VC R=4523.81

PVI 9+75.00 ELEV: 548.74

PVT 9+95.00 ELEV: 548.15

12" W.L. T.O.P. @-3.80%

PROP. 27" RCP

2.7'±

12" W.L. T.O.P. @-2.91%

5+00 6+00 7+00 8+00 9+00 10+00

CAUTION !!
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NO	REVISIONS DESCRIPTION	DATE	BY
2	DELETED F.H., L.F.H. LEAD & 12" G.V. ADDED TEE & G.V.	8/13/14	PLG

PREPARED BY:
WIER & ASSOCIATES, INC.
ENGINEERS SURVEYORS LAND PLANNERS
701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD TO JOHN KING BOULEVARD
WATER LINE PLAN & PROFILE
STA 5+00 TO STA 10+00

STATE OF TEXAS
PHILIP L. GRIMM
94719
LICENSED PROFESSIONAL ENGINEER
ILLINOIS

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LAST SHEET EDIT DATE 5/1/2015
WA# 13096

SHEET NO.
U102

PRINTED: 5/1/2015 LAST SAVED: 4/21/2015 3:07 PM SAVED BY: CLAYTONT FILE: WATER-PLAN-PROFILE-2-13096.DWG

NOTE:
1. INSTALL BLUE EMS PAD ALONG WATER LINE EVERY 250', CHANGES IN DIRECTION, WATER VALVES, AND SERVICE CONNECTIONS.
2. ALL WATER LINES SHALL BE CLASS 200 DR 14.

* BENCHMARKS *

BM A: AN 'X' CUT ON THE CENTER OF CURB INLET AT THE EDGE OF SIDEWALK ±25' FROM CURB RETURN AT NORTHWEST INTERSECTION OF JUSTIN RD & INDUSTRIAL PKWY.
561.99 FT.

BM B: AN 'X' CUT ON SOUTHEAST CORNER OF SIDEWALK NEXT TO HEADWALL ON WEST SIDE OF JOHN KING BLVD ±1,700' NORTH OF I-30.
563.49 FT.

MATCH LINE - STA 10+00

MATCH LINE STA - 15+00

N. BUTLER
ABSTRACT NO. 20

APPROX. LOC. SURVEY LINE

JUSTIN ROAD

D = 8°26'29"
R = 150.00
L = 22.10
T = 11.07
CH = N89°35'10"E
22.08

D = 9°02'09"
R = 150.00
L = 23.66
T = 11.85
CH = N78°48'09"E
23.63

D = 2°02'42"
R = 813.00
L = 29.02
T = 14.51
CH = N84°20'35"E
29.01

D = 4°03'45"
R = 150.00
L = 10.64
T = 5.32
CH = N76°18'57"E
10.63

D = 7°59'10"
R = 150.00
L = 20.91
T = 10.47
CH = N78°46'49"E
20.89

D = 4°25'34"
R = 150.00
L = 11.59
T = 5.80
CH = N80°33'36"E
11.58

D = 8°26'29"
R = 150.00
L = 22.10
T = 11.07
CH = N70°33'59"E
22.08

STA 10+16.44 W.L. 'W-1'
STA 47+14.40 JUSTIN ROAD
OFF 38.62 L
PRC

STA 10+20.00 W.L. 'W-1'
STA 47+17.93 JUSTIN ROAD
OFF 38.14 L
INSTALL: 1 - 12"x8" TEE
1 - 12" G.V.
1 - 8" G.V.
1 - 8" PLUG
4 L.F. 8" W.L.

STA 10+38.54 W.L. 'W-1'
STA 47+36.42 JUSTIN ROAD
OFF 37.00 L
PT

STA 11+28.00 W.L. 'W-1'
STA 48+25.88 JUSTIN ROAD
OFF 37.00 L
INSTALL: 6" BLOW-OFF
PER DETAIL
SHEET U301

STA 12+30.00 W.L. 'W-1'
STA 49+28.20 JUSTIN ROAD
OFF 37.00 L
INSTALL 2" WATER TAP & CORPORATION STOP FOR IRRIGATION

STA 12+23.00 W.L. 'W-1'
STA 49+20.88 JUSTIN ROAD
OFF 37.00 L
PC

STA 12+52.02 W.L. 'W-1'
STA 49+51.22 JUSTIN ROAD
OFF 37.00 L
PCC

STA 12+75.67 W.L. 'W-1'
STA 49+75.90 JUSTIN ROAD
OFF 38.52 L
PRC

STA 12+86.31 W.L. 'W-1'
STA 49+87.00 JUSTIN ROAD
OFF 39.44 L
PT

STA 13+57.84 W.L. 'W-1'
STA 50+62.04 JUSTIN ROAD
OFF 39.48 L
PC

STA 13+69.43 W.L. 'W-1'
STA 50+74.13 JUSTIN ROAD
OFF 38.45 L
PRC

STA 13+90.34 W.L. 'W-1'
STA 50+95.14 JUSTIN ROAD
OFF 37.00 L
PT

STA 14+12.53 W.L. 'W-1'
STA 51+17.33 JUSTIN ROAD
OFF 37.00 L
PT
INSTALL: 1 - 12"x8" TEE
1 - 12" G.V.
1 - 8" G.V.
1 - 8" PLUG
5 L.F. 8" W

STA 14+48.78 W.L. 'W-1'
STA 51+53.58 JUSTIN ROAD
OFF 37.00 L
PC

STA 14+70.88 W.L. 'W-1'
STA 51+75.60 JUSTIN ROAD
OFF 38.62 L
PRC

PROP. 48" RCP
PROP. 6'X4' BOX CULVERT
PROP. 36" RCP
PROP. 30" RCP
4" PVC IRRIGATION SLEEVE
8" W.L. BY OTHERS
12" W.L.
5' B/C

ROCKWALL ECONOMIC DEVELOPMENT CORPORATION
VOL. 4168, PG. 317
D.R.R.C.T.

ARCHIBALD HANNA
ABSTRACT NO. 99

N85°21'55"E 184.46'
N78°20'49"E 71.53'
N74°47'13"E 58.44'

0 20 40 60

WATER LINE "W-1"

T.O.P. ELEV.

PVC 10+25.00 ELEV: 547.28
40 VC R=1373.13
PVI 10+45.00 ELEV: 546.70
PVT 10+65.00 ELEV: 546.70

STA 11+28.00 W.L. 'W-1' INSTALL: 6" BLOW-OFF VALVE

STA 11+30.00 PVI LT. 22.5° VERTICAL BEND T.O.P. = 546.70

STA 11+60.00 PVI LT. 22.5° VERTICAL BEND T.O.P. = 552.66

PVC 13+15.00 ELEV: 551.73
50 VC R=3847.41
PVI 13+40.00 ELEV: 551.58
PVT 13+65.00 ELEV: 551.76

STA 14+12.53 W.L. 'W-1' INSTALL: 1-12"x8" TEE 1-12" G.V.

PROP. GRADE
N.G. ℄
PROP. 6'X4' BOX CULVERT

12" W.L. T.O.P. @-2.91%
12" W.L. T.O.P. 2.0'± @0.00%
12" W.L. T.O.P. @-0.60%
12" W.L. T.O.P. @0.70%

STA 10+65 TO 11+25
60 L.F. OF 18" STEEL ENCASEMENT PIPE

LP: 13+38.08 ELEV: 551.66

CAUTION !!
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RECORD PLANS
MAY 1, 2015

10+00 11+00 12+00 13+00 14+00 15+00

REVISIONS			
NO	DESCRIPTION	DATE	BY
2	ADDED TEE, G.V.'S, & PLUG, DELETED P.H., P.H. LEAD & G.V.	8/13/14	PLG
1	RELOCATED TEE, G.V., & PLUG	8/29/14	PLG

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Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
WATER LINE PLAN & PROFILE
STA 10+00 TO STA 15+00

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
5/1/2015

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LAST SHEET EDIT
DATE 5/1/2015
WA# 13096

SHEET NO.
U103

PRINTED: 5/1/2015 LAST SAVED: 4/30/2015 4:40 PM SAVED BY: PHILIPG FILE: WATER-PLAN-PROFILE-3-13096.DWG

NOTE:
1. INSTALL BLUE EMS PAD ALONG WATER LINE EVERY 250', CHANGES IN DIRECTION, WATER VALVES, AND SERVICE CONNECTIONS.
2. ALL WATER LINES SHALL BE CLASS 200 DR 14.

* BENCHMARKS *

BM A: AN 'X' CUT ON THE CENTER OF CURB INLET AT THE EDGE OF SIDEWALK ±25' FROM CURB RETURN AT NORTHWEST INTERSECTION OF JUSTIN RD & INDUSTRIAL PKWY.
561.99 FT.

BM B: AN 'X' CUT ON SOUTHEAST CORNER OF SIDEWALK NEXT TO HEADWALL ON WEST SIDE OF JOHN KING BLVD ±1,700' NORTH OF I-30.
563.49 FT.

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED W.L. 'W-1' PROFILE & W.L. 'W-4' SIZE	4/16/14	PLG
2	CHANGED 16"G.V. TO BUTTERFLY VALVE	4/21/14	PLG
3	ADDED TEE, G.V.'S & PLUG	8/13/14	PLG

PREPARED BY:
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Texas Firm Registration No. F-2776 www.wierassociates.com

ROCKWALL ECONOMIC DEVELOPMENT CORPORATION VOL.4168, PG. 317 D.R.R.C.T.

ROCKWALL ECONOMIC DEVELOPMENT CORPORATION INST. No. 20130000499975 D.R.R.C.T.

N. BUTLER ABSTRACT NO. 20

ARCHIBALD HANNA ABSTRACT NO. 99

CITY OF ROCKWALL 20' SANITARY SEWER ESMT VOL. 3182 PG. 118 D.R.R.C.T.

ROCKWALL ECONOMIC DEVELOPMENT CORPORATION VOL.4168, PG. 317 D.R.R.C.T.

TEMUNOVIC PARTNERSHIP, LTD. VOL. 7038, PG. 314 D.R.R.C.T.

MATCH LINE - STA 15+00

STA 15+28.32 W.L. 'W-1'
STA 52+32.97 JUSTIN ROAD
OFF 40.25 L
INSTALL: 1 - 12" 22.5° HORIZONTAL BEND

STA 15+51.19 W.L. 'W-1'
STA 52+54.09 JUSTIN ROAD
OFF 49.00 L
INSTALL: 1 - 12" 22.5° HORIZONTAL BEND

STA 15+66.89 W.L. 'W-1'
STA 52+69.79 JUSTIN ROAD
OFF 49.00 L
PC

PROP. 27" RCP

FUTURE 8"S.S. BY OTHERS

8" W.L. BY OTHERS

D = 5°00'00"
R = 899.00
L = 78.45
T = 39.25
CH = N77°17'13"E 78.43

STA 16+17.00 W.L. 'W-1'
STA 53+17.17 JUSTIN ROAD
OFF 49.00 L
INSTALL: 1 - 12"x8" TEE
1 - 8" G.V.
1 - 12" G.V.
1 - 8" PLUG
5 L.F. 8" W

STA 16+45.34 W.L. 'W-1'
STA 53+43.97 JUSTIN ROAD
OFF 49.00 L
PT

STA 0+84.50 W.L. 'W-3'
STA 54+08.63 JUSTIN ROAD
OFF 35.50 R
INSTALL: 1 - 8"X6" TEE
1 - 6" G.V.
1 - F.H.
5 L.F. 6" W

STA 0+91.50 W.L. 'W-3'
STA 54+08.63 JUSTIN ROAD
OFF 42.50 R
INSTALL: 1 - 8" PLUG

STA 17+10.00 W.L. 'W-1'
STA 0+00.00 W.L. 'W-3'
STA 54+08.63 JUSTIN ROAD
OFF 49.00 L
INSTALL: 1 - 12"x8" TEE
1 - 12" G.V.
1 - 8" G.V.

STA 18+92.59 W.L. 'W-1'
STA 55+90.99 JUSTIN ROAD
OFF 50.31 L
INSTALL: 1 - 12"x6" TEE
1 - 6" G.V.
1 - F.H.
5 L.F. 6" W

STA 18+88.80 W.L. 'W-1'
STA 55+87.43 JUSTIN ROAD
OFF 49.00 L
INSTALL: 1 - 12" 22.5° HORIZONTAL BEND

STA 19+21.78 W.L. 'W-1'
STA 16+93.76 W.L. 'W-4'
STA 56+18.36 JUSTIN ROAD
OFF 60.41 L
INSTALL: 1 - 16"x12" TEE
1 - 16" BUTTERFLY VALVE
1 - 12" G.V.

FUTURE 16" W.L. BY OTHERS

PROPOSED WATER EASEMENT

30" S.S. FORCE MAIN

JUSTIN ROAD

JOHN KING BOULEVARD

N79°47'13"E 243.46'

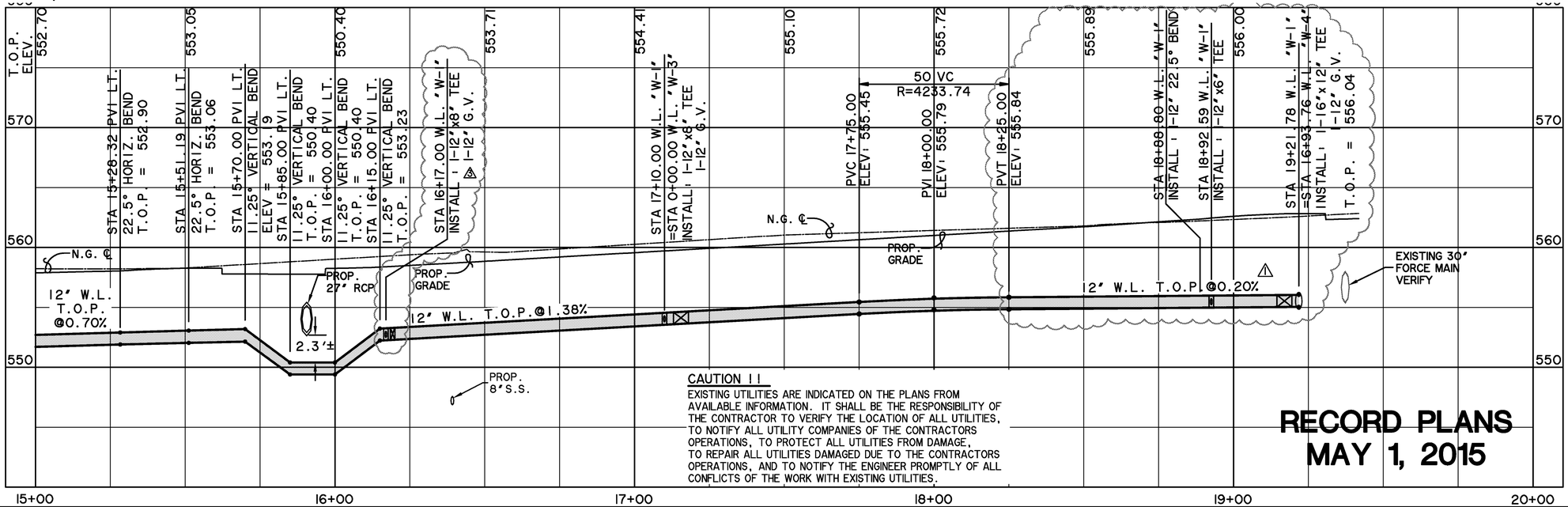
S10°12'47"E 91.50'

N59°32'18"E 32.97'

APPROX. LOC. SURVEY LINE

0 20 40 60

WATER LINE "W-1"



CAUTION !!
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RECORD PLANS
MAY 1, 2015

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
WATER LINE PLAN & PROFILE
STA 15+00 TO END

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
5/1/2015

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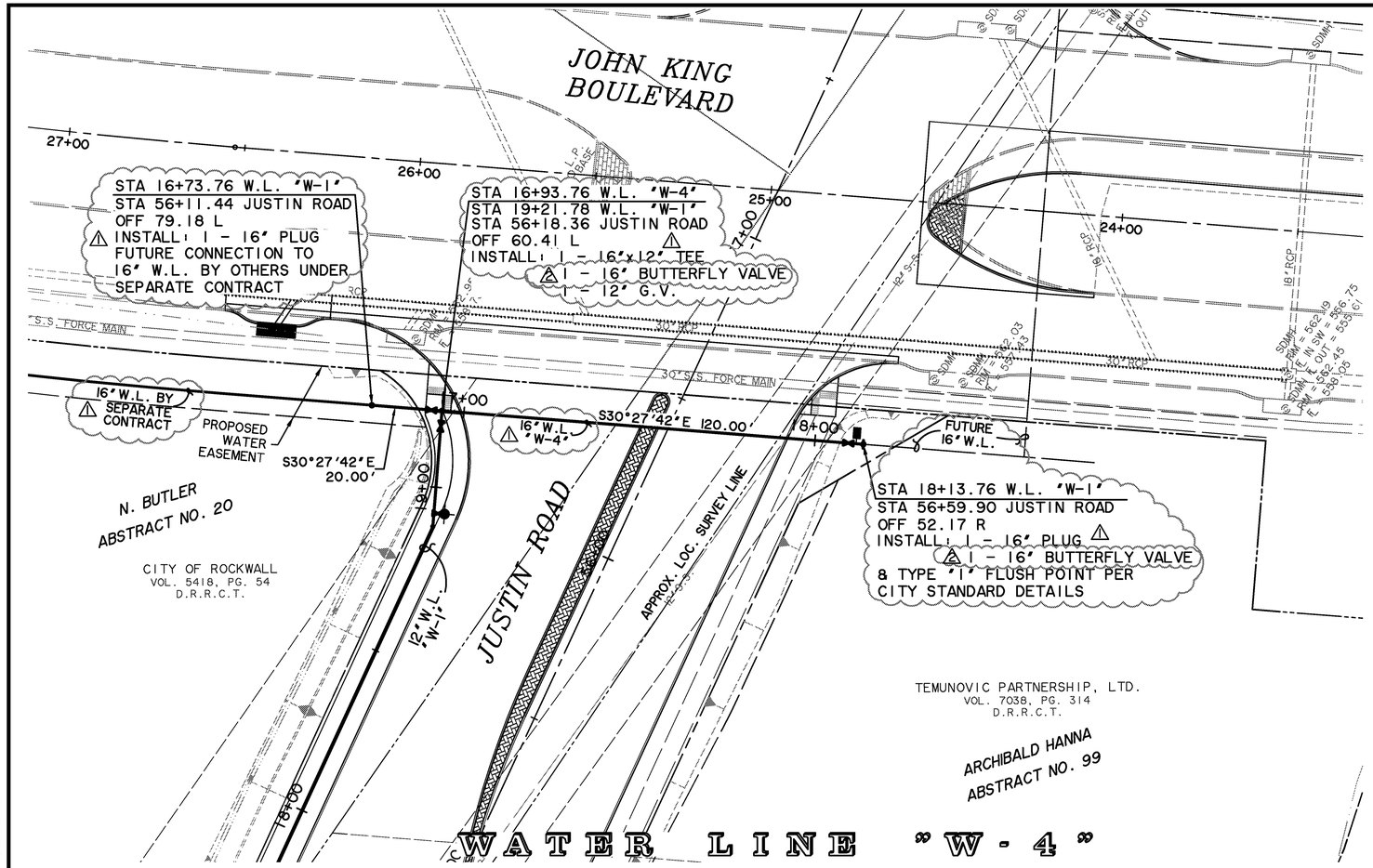
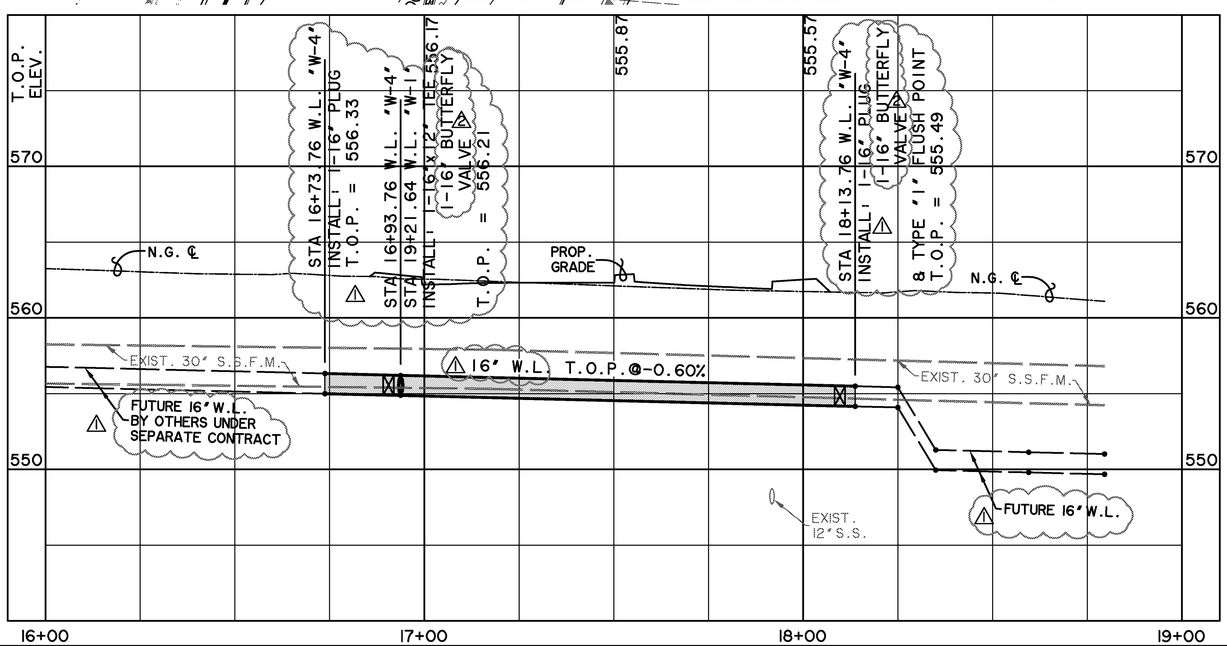
LAST SHEET EDIT DATE 5/1/2015
WA# 13096

SHEET NO.
U104

PRINTED: 5/1/2015 LAST SAVED: 4/30/2015 4:41 PM SAVED BY: PHILIPG FILE: WATER-PLAN-PROFILE-4-13096.DWG



WATER LINE "W-4"



*** BENCHMARKS ***

BM A: AN 'X' CUT ON THE CENTER OF CURB INLET AT THE EDGE OF SIDEWALK ±25' FROM CURB RETURN AT NORTHWEST INTERSECTION OF JUSTIN RD & INDUSTRIAL PKWY.

561.99 FT.

BM B: AN 'X' CUT ON SOUTHEAST CORNER OF SIDEWALK NEXT TO HEADWALL ON WEST SIDE OF JOHN KING BLVD ±1,700' NORTH OF I-30.

563.49 FT.

CAUTION !!

EXISTING UTILITIES ARE INDICATED ON THE PLANS FROM AVAILABLE INFORMATION. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION OF ALL UTILITIES, TO NOTIFY ALL UTILITY COMPANIES OF THE CONTRACTORS OPERATIONS, TO PROTECT ALL UTILITIES FROM DAMAGE, TO REPAIR ALL UTILITIES DAMAGED DUE TO THE CONTRACTORS OPERATIONS, AND TO NOTIFY THE ENGINEER PROMPTLY OF ALL CONFLICTS OF THE WORK WITH EXISTING UTILITIES.

NOTE:
1. INSTALL BLUE EMS PAD ALONG WATER LINE EVERY 250', CHANGES IN DIRECTION, WATER VALVES, AND SERVICE CONNECTIONS.
2. 6" TO 12" WATER LINES SHALL BE CLASS 200 DR 14. 16" WATER LINE SHALL BE CLASS 200 DR 18.

0 20 40 60

RECORD PLANS
MAY 1, 2015

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	CHANGED W.L. 'W-4' FROM 12" TO 16"	4/16/14	PLG
2	CHANGED 16" G.V. TO BUTTERFLY VALVE	4/21/14	PLG

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701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
WATER LINE PLAN & PROFILE
WATER LINE "W-4"

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
5/1/2015

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LAST SHEET EDIT
DATE 5/1/2015
WA# 13096

SHEET NO.
U105

PRINTED: 5/1/2015 LAST SAVED: 4/30/2015 4:42 PM SAVED BY: PHILIPG FILE: WATER-PLAN-PROFILE-5-13096.DWG

CITY OF ROCKWALL
20' SANITARY SEWER ESMT
VOL. 3182 PG. 118
D.R.R.C.T.

ARCHIBALD HANNA
ABSTRACT NO. 99

TEMUNOVIC PARTNERSHIP, LTD.
VOL. 7038, PG. 314
D.R.R.C.T.

CITY OF ROCKWALL
DRAINAGE ESMT
VOL. 6227, PG. 73
D.R.R.C.T.

N. BUTLER
ABSTRACT NO. 20

STA 1+00.00 S.S. LINE 'A'
STA 53+60.45 JUSTIN ROAD
OFF -24.47 L
CONNECT TO EXIST. S.S.M.H.
& REWORK INVERT
ADJ. RIM = 558.79

STA 1+45.00 S.S. LINE 'A'
STA 53+30.82 JUSTIN ROAD
OFF -57.64 L
CONSTRUCT 4' DIA. S.S.M.H.
RIM = 560.00

APPROX. LOCATION SURVEY LINE

8" W.L.

12" W.L.

N52°55'04"W 45.00'

1+00

53+00

54+00

55+00

JUSTIN ROAD

FUTURE SANITARY SEWER
BY OTHERS

15' SANITARY SEWER
EASEMENT

ROCKWALL ECONOMIC
DEVELOPMENT CORPORATION
VOL.4168, PG. 317
D.R.R.C.T.

ROCKWALL ECONOMIC
DEVELOPMENT CORPORATION
INST. No. 20130000499975
D.R.R.C.T.

INGRESS/EGRESS ESMT
VOL. 4875 PG. 125
D.R.R.C.T.

S. S. LINE "A"

0 20 40 60

CAUTION !!

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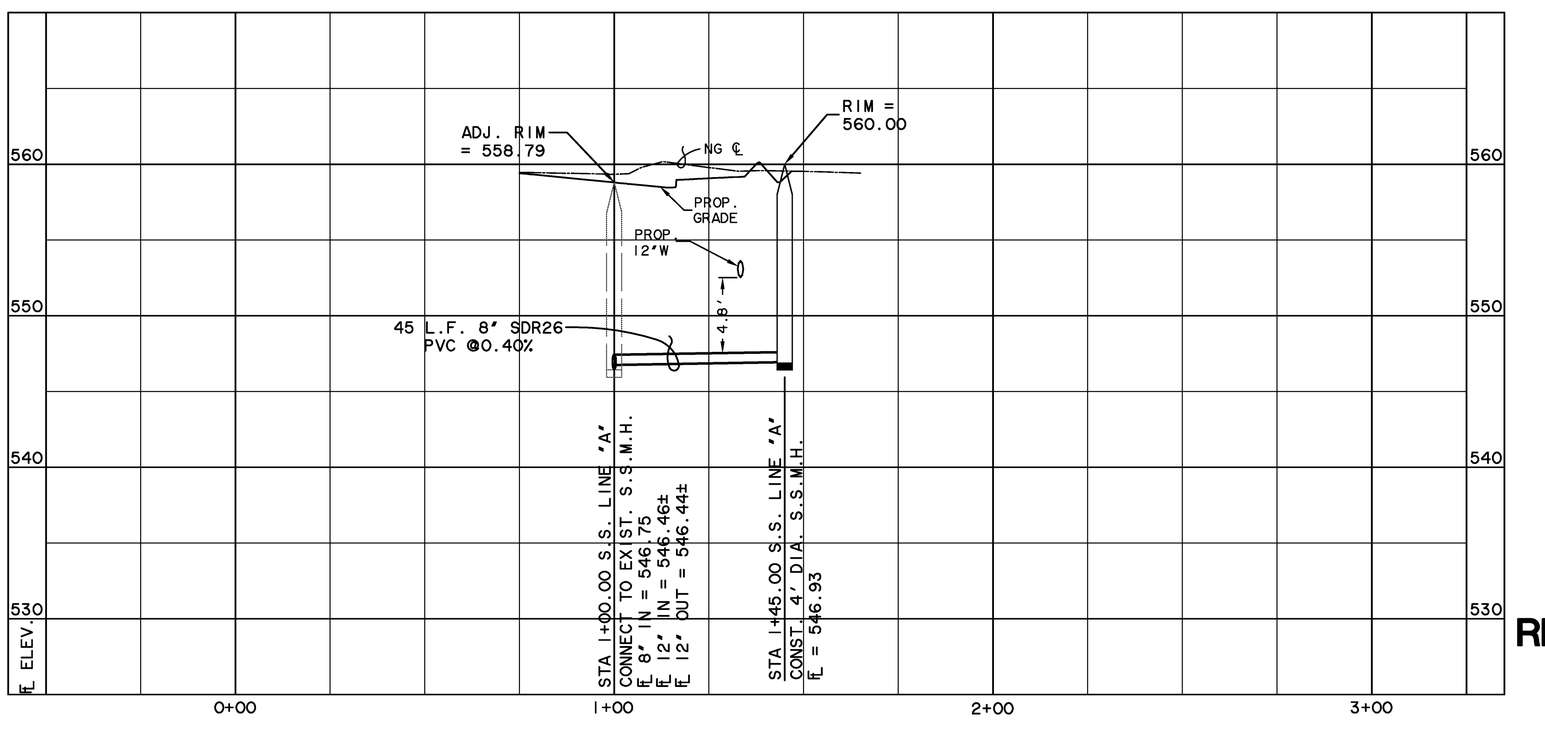
ELEV. 561.99 FT.

BM B: AN "X" CUT ON SOUTHEAST CORNER OF SIDEWALK NEXT TO HEADWALL ON WEST SIDE OF JOHN KING BLVD ±1,700' NORTH OF I-30.
ELEV. 563.49 FT.

NOTE:
ALL MANHOLES SHALL BE RAVEN LINED OR APPROVED EQUAL.



RECORD PLANS
MAY 1, 2015

PREPARED BY:
WIER & ASSOCIATES, INC.
ENGINEERS SURVEYORS LAND PLANNERS
701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.WierAssociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
SANITARY SEWER PLAN & PROFILE

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED
PROFESSIONAL ENGINEER
5/1/2015

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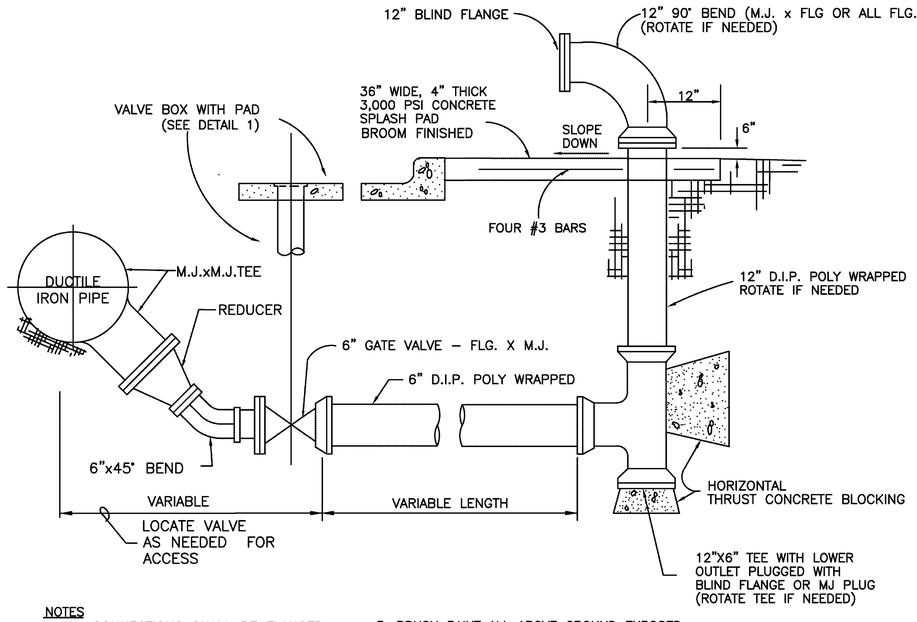
LAST SHEET EDIT
DATE 5/1/2015
WA# 13096
SHEET NO.
U106

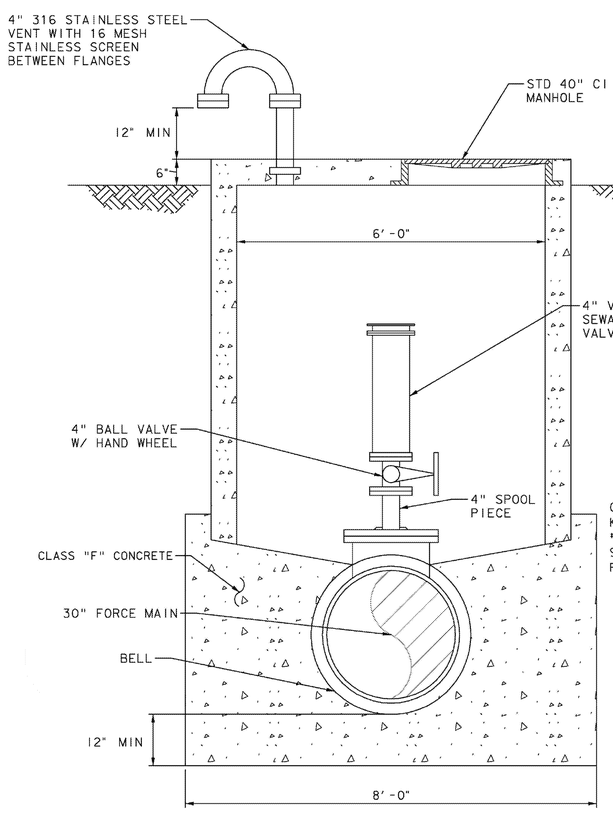
PRINTED: 5/1/2015 STB FILE: WIER-SEWER.STB LAST SAVED: 4/30/2015 4:43 PM SAVED BY: PHILIPG FILE: SANITARY-SEWER-PLAN & PROFILE-13096.DWG



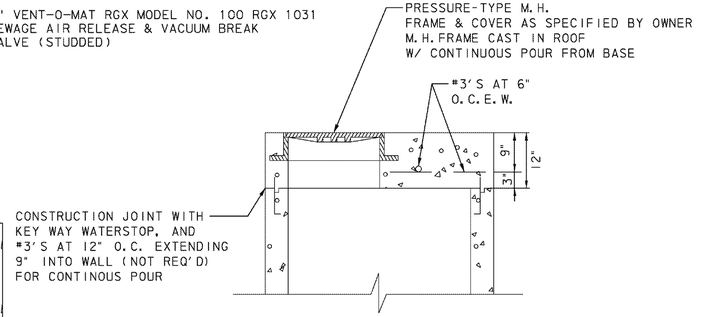
NOTES

1. ALL CONNECTIONS SHALL BE FLANGED OR MJ RESTRAINED WITH APPROVED RETAINER GLANDS OR THRUST RESTRAINT DEVICES.
2. ALL PIPING TO BE DUCTILE IRON WITH ALL BURIED VALVE, PIPE & FITTINGS TO BE POLY–WRAPPED.
3. BRUSH PAINT ALL ABOVE GROUND EXPOSED FITTINGS AND PIPE WITH TWO COATS OF FLYNT READY MIXED ALUMINUM PAINT OF GREENVILLE, TEXAS 1–800–473–5698. SILVER COLOR ONLY.
4. APPLY TO PVC MAIN BY TURNING DOWN TEE AND INSTALLING A 45 DEGREE BEND. MUST BE APPROVED BY ENGINEER OR INSPECTOR.
5. INSTALL RISER AT RIGHT-OF-WAY.

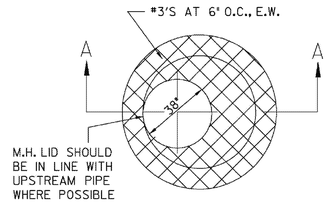
BLOW OFF DETAIL
N.T.S.



COMBINATION AIR & VACUMM RELEASE VALVE
NOT TO SCALE



SECTION A–A
NOT TO SCALE



ROOF STEEL LAYOUT
NOT TO SCALE

RECORD PLANS
MAY 1, 2015

PREPARED BY:
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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
WATER SYSTEM
DETAILS

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED
PROFESSIONAL ENGINEER
5/1/2015

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LAST SHEET EDIT DATE 5/1/2015
WA# 13096

SHEET NO.
U301

PRINTED: 5/1/2015 STB FILE: WIER-PAVING.STB LAST SAVED: 4/21/2015 3:15 PM SAVED BY: CLAYTONT FILE: WATER-SYSTEM-DETAILS-13096.DWG

SWP3 NOTES

1. THE CONTRACTOR AND SUB-CONTRACTORS WORKING ON THIS SITE SHALL THOROUGHLY REVIEW AND UNDERSTAND THE APPLICABLE REGULATIONS UNDER SECTION 402 OF THE CLEAN WATER ACT AND CHAPTER 26 OF THE TEXAS WATER CODE REGARDING GENERAL PERMIT PROVISIONS TO DISCHARGE WASTE UNDER TPDES CONSTRUCTION GENERAL PERMIT NO. TXR150000 ISSUED FEBRUARY 19, 2013 AND EFFECTIVE MARCH 5, 2013 BY THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY. REGULATIONS, PERMIT FORMS AND SUPPORT INFORMATION CAN BE OBTAINED BY CONTACTING THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ) STORM WATER PROGRAM AT (512)239-4671 OR ON THE TCEQ WEB SITE AT www.tceq.texas.gov/permitting/stormwater/sw_permits.html.

2. SITE OPERATORS:

   BY DEFINITION A **PRIMARY OPERATOR** IS THE PERSON OR PERSONS ASSOCIATED WITH A LARGE OR SMALL CONSTRUCTION ACTIVITY THAT MEETS EITHER OF THE FOLLOWING CRITERIA:

   A. THE PERSON OR PERSONS HAVE ON-SITE OPERATIONAL CONTROL OVER CONSTRUCTION PLANS AND SPECIFICATIONS, INCLUDING THE ABILITY TO MAKE MODIFICATIONS TO THOSE PLANS AND SPECIFICATIONS; OR
   B. THE PERSON OR PERSONS HAVE DAY-TO-DAY OPERATIONAL CONTROL OF THOSE ACTIVITIES AT A CONSTRUCTION SITE THAT ARE NECESSARY TO ENSURE COMPLIANCE WITH A STORM WATER POLLUTION PREVENTION PLAN (SWP3) FOR THE SITE OR OTHER PERMIT CONDITIONS (FOR EXAMPLE, THEY ARE AUTHORIZED TO DIRECT WORKERS AT A SITE TO CARRY OUT ACTIVITIES REQUIRED BY THE SWP3 OR COMPLY WITH OTHER PERMIT CONDITIONS).

   BY DEFINITION A **SECONDARY OPERATOR** IS THE PERSON OR ENTITY, OFTEN THE PROPERTY OWNER, WHOSE OPERATIONAL CONTROL IS LIMITED TO:

   A. THE EMPLOYMENT OF OTHER OPERATORS, SUCH AS A GENERAL CONTRACTOR, TO PERFORM OR SUPERVISE CONSTRUCTION ACTIVITIES; OR

   B. THE ABILITY TO APPROVE OR DISAPPROVE CHANGES TO CONSTRUCTION PLANS AND SPECIFICATIONS, BUT WHO DOES NOT HAVE DAY-TO-DAY ON-SITE OPERATIONAL CONTROL OVER CONSTRUCTION ACTIVITIES AT THE SITE.

   SECONDARY OPERATORS MUST EITHER PREPARE THEIR OWN SWP3 OR PARTICIPATE IN A SHARED SWP3 THAT COVERS THE AREAS OF THE CONSTRUCTION SITE WHERE THEY HAVE CONTROL OVER THE PLANS AND SPECIFICATIONS.

   IF THERE IS NOT A PRIMARY OPERATOR AT THE CONSTRUCTION SITE, THEN THE SECONDARY OPERATOR IS DEFINED AS THE PRIMARY OPERATOR AND MUST COMPLY WITH THE REQUIREMENTS FOR PRIMARY OPERATORS.

(SIGNATURE)	(SIGNATURE)
OWNER	CONTRACTOR
OPERATOR IN CONTROL OF	OPERATOR IN CONTROL OF
PLANS & SITE SPECIFICATIONS	DAY-TO-DAY ACTIVITIES
NAME & TITLE	NAME & TITLE
R.E.D.C.	COMPANY NAME
2610 I-30 FRONTAGE ROAD #104	
ROCKWALL, TX 75032	ADDRESS
972-772-0025	PHONE

THE SWP3 SHALL BE SIGNED BY ALL SITE OPERATORS IN COMPLIANCE WITH TXR150000 PART III.A.1.

3. RESPONSIBILITIES OF ALL SITE OPERATORS:

   EACH OPERATOR MUST:

   A. SIGN THE SWP3 PLAN SHEETS IN THE LOCATIONS PROVIDED. SIGNATORIES MUST MEET THE REQUIREMENTS AS SET FORTH IN 30 TEXAS ADMINISTRATIVE CODE §305.44.
   B. FOR SMALL CONSTRUCTION SITES WITH ONE TO LESS THAN FIVE ACRES OF DISTURBANCE, COMPLETE AND CERTIFY A CONSTRUCTION SITE NOTICE FOR SMALL CONSTRUCTION SITES. A COPY OF THE CONSTRUCTION SITE NOTICE MAY BE FOUND IN THE CONTRACT DOCUMENTS. A COPY OF THE SIGNED AND CERTIFIED CONSTRUCTION SITE NOTICE MUST BE POSTED AT THE CONSTRUCTION SITE IN A LOCATION WHERE IT IS SAFELY AND READILY AVAILABLE FOR VIEWING BY THE GENERAL PUBLIC, LOCAL, STATE, AND FEDERAL AUTHORITIES PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES, AND MAINTAINED IN THAT LOCATION UNTIL COMPLETION OF THE CONSTRUCTION ACTIVITY (SEE ITEM 8 BELOW REGARDING LINEAR PROJECTS). A COPY OF THE SIGNED AND CERTIFIED CONSTRUCTION SITE NOTICE MUST ALSO BE PROVIDED TO THE OPERATOR OF ANY MS4 RECEIVING THE DISCHARGE PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITIES.
   C. FOR LARGE CONSTRUCTION SITES WITH FIVE OR MORE ACRES OF DISTURBANCE, ALL OPERATORS SHALL COMPLETE AND CERTIFY A CONSTRUCTION SITE NOTICE FOR LARGE CONSTRUCTION SITES. A COPY OF THE CONSTRUCTION SITE NOTICE MAY BE FOUND IN THE CONTRACT DOCUMENTS. EACH PRIMARY OPERATOR MUST SUBMIT A NOTICE OF INTENT (N.O.I.) TO THE TCEQ USING THE FORM PROVIDED BY THE EXECUTIVE DIRECTOR, AT LEAST SEVEN (7) DAYS PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES, OR IF UTILIZING ELECTRONIC SUBMITTAL, PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES. A COPY CONSTRUCTION SITE NOTICE MUST BE POSTED NEAR THE MAIN ENTRANCE TO THE CONSTRUCTION SITE IN A LOCATION WHERE IT IS SAFELY AND READILY AVAILABLE FOR VIEWING BY THE GENERAL PUBLIC, LOCAL, STATE, AND FEDERAL AUTHORITIES PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES, AND MAINTAIN THE NOTICE IN THAT LOCATION UNTIL COMPLETION OF THE CONSTRUCTION ACTIVITY (SEE ITEM 8 BELOW REGARDING LINEAR PROJECTS). ALL PRIMARY OPERATORS MUST PROVIDE A COPY OF THE SIGNED N.O.I. TO THE OPERATOR OF ANY MS4 RECEIVING THE DISCHARGE AND TO ANY SECONDARY OPERATOR PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITIES. ALL PRIMARY OPERATORS MUST LIST IN THE SWP3 THE NAMES AND ADDRESSES OF ALL MS4 OPERATORS RECEIVING A COPY. IF AN ADDITIONAL PRIMARY OPERATOR IS ADDED AFTER THE INITIAL N.O.I. IS SUBMITTED, THE NEW PRIMARY OPERATOR MUST SUBMIT AN N.O.I. AT LEAST SEVEN (7) DAYS PRIOR TO ASSUMING OPERATIONAL CONTROL, OR IF UTILIZING ELECTRONIC SUBMITTAL, PRIOR TO ASSUMING OPERATIONAL CONTROL. IF THE PRIMARY OPERATOR CHANGES AFTER THE INITIAL N.O.I. IS SUBMITTED, THE NEW PRIMARY OPERATOR MUST SUBMIT A PAPER N.O.I. OR AND ELECTRONIC N.O.I. AT LEAST TEN (10) DAYS PRIOR TO ASSUMING OPERATIONAL CONTROL. ALL SECONDARY OPERATORS ARE REGULATED UNDER THE GENERAL PERMIT, BUT ARE NOT REQUIRED TO SUBMIT AN N.O.I., PROVIDED THAT ANOTHER OPERATOR(S) AT THE SITE HAS SUBMITTED AN N.O.I., OR IS REQUIRED TO SUBMIT AND N.O.I. AND THE SECONDARY OPERATOR HAS PROVIDED NOTIFICATION TO THE OPERATOR(S) OF THE NEED TO OBTAIN COVERAGE (WITH RECORDS OF NOTIFICATION AVAILABLE UPON REQUEST). ALL SECONDARY OPERATORS MUST PROVIDE A COPY OF THE SIGNED AND CERTIFIED CONSTRUCTION SITE NOTICE TO THE OPERATOR OF ANY MS4 RECEIVING THE DISCHARGE PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITIES.
   D. DELEGATE AUTHORITY TO THE SPECIFICALLY DESCRIBED POSITION OR PERSON PERFORMING INSPECTIONS, AS PROVIDED BY 30 TAC §305.128, AS AN AUTHORIZED PERSON FOR SIGNING REPORTS AND PERFORMING CERTAIN ACTIVITIES REQUESTED BY THE DIRECTOR OR REQUIRED BY THE TPDES GENERAL PERMIT. THIS DELEGATION OF AUTHORITY MUST BE PROVIDED TO THE DIRECTOR OF TCEQ IN WRITING AND A COPY SHALL BE KEPT ALONG WITH THE SIGNED EFFECTIVE COPY OF THE SWP3. AN EXAMPLE DELEGATION LETTER IS PROVIDED IN THE CONTRACT DOCUMENTS.
   E. RETAIN THE FOLLOWING RECORDS FOR A MINIMUM OF THREE YEARS FROM THE DATE THAT AN N.O.T. IS SUBMITTED. ON SMALL PROJECT SITES WHERE AN N.O.T. IS NOT REQUIRED, RECORDS SHALL BE KEPT FOR A PERIOD OF LEAST THREE YEARS FROM THE DATE OF FINAL STABILIZATION OR CHANGE OF OPERATOR.
      1) A COPY OF THE SWP3 PLAN.
      2) ALL REPORTS AND ACTIONS REQUIRED BY THE TPDES GENERAL PERMIT, INCLUDING A COPY OF THE CONSTRUCTION SITE NOTICE.
      3) ALL DATA USED TO COMPLETE THE N.O.I., IF AN N.O.I. IS REQUIRED.
      4) ALL RECORDS OF SUBMITTAL OF FORMS SUBMITTED TO THE OPERATOR OF ANY MS4 RECEIVING THE DISCHARGE AND TO THE SECONDARY OPERATOR OF A LARGE CONSTRUCTION SITE, IF APPLICABLE.

5. RESPONSIBILITIES OF THE CONTRACTOR (OPERATOR IN CONTROL OF DAY-TO-DAY ACTIVITIES):

   A. PREPARE A STANDARD THREE RING NOTEBOOK ENTITLED "SWP3 PLAN FOR PAVING, DRAINAGE AND WATER IMPROVEMENTS TO SERVE JUSTIN ROAD, ROCKWALL, TEXAS" TO KEEP TOGETHER THE EFFECTIVE SIGNED COPY OF THE SWP3 AND ALL RELATED DOCUMENTS. THE NOTEBOOK SHALL CONTAIN THE FOLLOWING:
      1. PLAN SHEETS INCLUDING, BUT NOT LIMITED TO, SIGNED COPY OF SWP3 NOTES (E001-E003), SIGNED COPY SWP3 LAYOUT PLAN (E101), EROSION CONTROL PLANS (E102-E103), SWP3 DETAILS (E201-E206), AND GRADING PLANS (G101-G102).
      2. COPY OF TPDES GENERAL PERMIT TXR150000.
      3. COPY OF DIVISION 3 OF WIER & ASSOCIATES, INC. CONTRACT DOCUMENTS.
      4. COPY OF A SIGNED N.O.I. FOR EACH PRIMARY OPERATOR, IF AN N.O.I. IS REQUIRED.
      5. COPY OF A SIGNED CONSTRUCTION SITE NOTICE FOR EACH PRIMARY AND SECONDARY OPERATOR.
      6. INSPECTION REPORTS.
      7. COPY OF A SIGNED DELEGATION LETTER FROM EACH OPERATOR.
      8. VERIFICATION THAT THE PROJECT SITE DISCHARGES DO NOT ADVERSELY AFFECT LISTED ENDANGERED OR THREATENED AQUATIC OR AQUATIC-DEPENDENT SPECIES OR THE PROJECT SATISFIES THE REQUIREMENTS OF THE ENDANGERED SPECIES ACT.
      9. ALL UPDATES REQUIRED IN ITEM F. BELOW.
      10. ALL WORKSHEETS COMPLETED AND UPDATED AS REQUIRED IN ITEMS K THROUGH O BELOW.
   B. AFTER AN N.O.T. IS SUBMITTED, OR ON SMALL PROJECT SITES WHERE AN N.O.T. IS NOT REQUIRED, THE SITE NOTICE IS REMOVED AND APPLICABLE PORTION OF THE SITE NOTICE RELATED TO REMOVAL COMPLETED, AFTER FINAL STABILIZATION OR CHANGE OF OPERATOR, THE CONTRACTOR SHALL FORWARD ALL ORIGINALS TO THE OWNER, BUT SHALL MAINTAIN A COPY FOR THEIR RECORDS AS STIPULATED IN 3.D. ABOVE.
   C. IMPLEMENT THE SWP3 MEASURES PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES THAT RESULT IN SOIL DISTURBANCE AT ANY TIME DURING THE PROJECT DURATION UNTIL RE-VEGETATION HAS OCCURRED.
   D. RETAIN THE SWP3 NOTEBOOK ON-SITE AT THE CONSTRUCTION SITE OR, IF THE SITE IS INACTIVE OR DOES NOT HAVE AN ON-SITE LOCATION TO STORE THE PLAN, A NOTICE MUST BE POSTED DESCRIBING THE LOCATION OF THE SWP3.
   E. MAKE THE SWP3 NOTEBOOK READILY AVAILABLE AT THE TIME OF AN ON-SITE INSPECTION TO: THE EXECUTIVE DIRECTOR; A FEDERAL, STATE, OR LOCAL AGENCY APPROVING SEDIMENT AND EROSION PLANS, GRADING PLANS, OR STORM WATER MANAGEMENT PLANS; LOCAL GOVERNMENT OFFICIALS; AND THE OPERATOR OF A MS4 RECEIVING DISCHARGES FROM THE SITE. IF THE SWP3 IS RETAINED OFF-SITE, IT SHALL BE MADE AVAILABLE WITHIN 24 HOURS OF A REQUEST FOR INSPECTION.
   F. KEEP CURRENT AND UPDATE THE SWP3 AS NECESSARY FOR THE FOLLOWING CONDITIONS:
      1. NEW OPERATORS OR AREAS OF RESPONSIBILITY.
      2. CHANGES IN SITE CONDITIONS BASED ON UPDATED PLANS AND SPECIFICATIONS OR BEST MANAGEMENT PRACTICES.
      3. CHANGES IN THE DESIGN, CONSTRUCTION, OPERATION, OR MAINTENANCE THAT HAS A SIGNIFICANT EFFECT ON THE DISCHARGE OF POLLUTANTS AND THAT HAS NOT BEEN PREVIOUSLY ADDRESSED BY THE SWP3.
      4. RESULTS OF INSPECTIONS OR INVESTIGATIONS BY SITE OPERATORS, OPERATORS OF A MS4 RECEIVING THE DISCHARGE, AUTHORIZED TCEQ PERSONNEL, OR A FEDERAL, STATE, OR LOCAL AGENCY APPROVING SEDIMENT AND EROSION PLANS INDICATE THE SWP3 IS PROVING INEFFECTIVE IN ELIMINATING OR SIGNIFICANTLY MINIMIZING POLLUTANTS IN DISCHARGES AUTHORIZED UNDER THE TPDES GENERAL PERMIT.
      5. CHANGES APPLICABLE TO PROTECTING SURFACE WATER RESOURCES IN SEDIMENT EROSION SITE PLANS OR SITE PERMITS, OR STORM WATER MANAGEMENT SITE PLANS OR SITE PERMITS APPROVED BY STATE OR LOCAL OFFICIAL FOR WHICH THE PERMITTEE RECEIVES WRITTEN NOTICE.
   G. ENSURE THAT THE SWP3 FOR PORTIONS OF THE PROJECT WHERE THEY ARE OPERATORS MEETS THE REQUIREMENTS OF THE TPDES GENERAL PERMIT AND ARE CONSISTENT WITH REQUIREMENTS SPECIFIED IN APPLICABLE SEDIMENT AND EROSION SITE PLANS OR SITE PERMITS, OR STORM WATER MANAGEMENT SITE PLANS OR SITE PERMITS APPROVED BY FEDERAL, STATE, OR LOCAL OFFICIALS.
   H. ENSURE THAT THE SWP3 IDENTIFIES THE PARTIES RESPONSIBLE FOR IMPLEMENTATION OF BMPs DESCRIBED IN THE PLAN.
   I. ENSURE THAT THE SWP3 INDICATES THE AREAS OF THE PROJECT WHERE THEY HAVE OPERATIONAL CONTROL.
   J. ENSURE THAT THE SWP3 FOR PORTIONS OF THE PROJECT WHERE THEY ARE OPERATORS INDICATES THE NAME AND TPDES PERMIT NUMBERS FOR PERMITTEES WITH THE DAY-TO-DAY OPERATIONAL CONTROL OVER THOSE ACTIVITIES NECESSARY TO ENSURE COMPLIANCE WITH THE SWP3 AND OTHER PERMIT CONDITIONS.
   K. MAINTAIN ALONG WITH THE EFFECTIVE COPY OF SWP3 DRAWINGS AN UPDATEABLE LIST OF ALL CONSTRUCTION AND WASTE MATERIALS TO BE STORED ON-SITE, AND A DESCRIPTION OF THE LOCATION. A WORKSHEET IS PROVIDED IN THE CONTRACT DOCUMENTS.
   L. MAINTAIN ALONG WITH THE SIGNED EFFECTIVE COPY OF SWP3 DRAWINGS AN UPDATEABLE LIST IDENTIFYING ALL POTENTIAL SOURCES OF POLLUTION OTHER THAN CONSTRUCTION INCLUDING PORTA-POTTYS, FUEL TANKS, STAGING AREAS, WASTE CONTAINERS, CHEMICAL STORAGE AREAS (LOCATION TO BE SHOWN ON SWP3), CONCRETE CURE, PAINTS SOLVENTS, ETC., AND A DESCRIPTION OF THE LOCATION. A WORKSHEET IS PROVIDED IN THE CONTRACT DOCUMENTS.
   M. MAINTAIN ALONG WITH THE SIGNED EFFECTIVE COPY OF SWP3 DRAWINGS AN UPDATEABLE LIST IDENTIFYING GOOD HOUSEKEEPING PRACTICES IMPLEMENTED TO LIMIT THE OFF-SITE TRANSPORT OF LITTER, CONSTRUCTION DEBRIS, AND CONSTRUCTION MATERIALS; AND A DESCRIPTION OF THE LOCATION. A WORKSHEET IS PROVIDED IN THE CONTRACT DOCUMENTS.
   N. MAINTAIN ALONG WITH THE SIGNED EFFECTIVE COPY OF SWP3 DRAWINGS AN UPDATEABLE LIST IDENTIFYING ALL ELIGIBLE NON-STORM WATER DISCHARGES AND ENSURE THE IMPLEMENTATION OF APPROPRIATE POLLUTION PREVENTION MEASURES. A WORKSHEET IS PROVIDED IN THE CONTRACT DOCUMENTS.
   O. MAINTAIN ALONG WITH THE SIGNED EFFECTIVE COPY OF THE SWP3 A RECORD OF THE DATES OF MAJOR GRADING ACTIVITIES, THE DATES CONSTRUCTION IS TEMPORARILY OR PERMANENTLY CEASED, AND THE DATES STABILIZATION MEASURES ARE INITIATED. A WORKSHEET IS PROVIDED IN THE CONTRACT DOCUMENTS.

6. BATCH PLANT PERMITS:

   THIS SWP3 DOES NOT ADDRESS PERMITTING OF ON-SITE OR OFF-SITE BATCH PLANTS. THE SWP3 MAY INDICATE LOCATIONS WHERE BATCH PLANTS CAN BE SET UP ON THE SITE APPROVED BY THE OWNER, BUT THE CONTRACTOR SHALL OBTAIN HIS OWN SEPARATE PERMITS THROUGH THE TCEQ. CONSTRUCTION SITE OPERATORS SHOULD ALSO BE AWARE OF TEXAS 401 CERTIFICATION SPECIAL PERMIT CONDITIONS CONTAINED IN THE EPA REGION 6 CGP. THESE SPECIAL PERMIT CONDITIONS ADDRESS SPECIAL NUMERIC LIMITATIONS FOR DISCHARGES FROM READY-MIXED CONCRETE PLANTS (ALSO FOUND IN VOLUME 63 OF THE FEDERAL REGISTER ON PAGE 36511). THE CONTRACTOR SHALL FORWARD A COPY OF THE PERMIT, SWP3 PLANS, AND ANY REVISIONS OF SAME TO THE OWNER'S ENGINEER OR PROJECT MANAGER WITHIN 48 HOURS OF RECEIPT OF PERMITS OR REVISIONS TO SWP3 PLANS. PERMITTING FOR BATCH PLANT SITES SHALL BE INCIDENTAL WORK AT NO EXTRA COST TO THE OWNER. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO ACT AS OPERATOR AND ASSURE FULL COMPLIANCE WITH THE BATCH PLANT SITE.

7. RELATED OFF-SITE ACTIVITIES:

   IF THE CONTRACTOR ELECTS TO CREATE NEW OFF-SITE MATERIAL STORAGE AREAS, STOCKPILES OF DIRT/TOPSOIL, BORROW AREAS, VEHICLE REPAIR AREAS, FUELING AREAS, ETC. CREATED SOLELY FOR OR BY THE PERMITTED PROJECT, THESE SITES SHALL COMPLY WITH TCEQ REGULATIONS FOR STORM WATER POLLUTION PREVENTION. THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER SHALL PROVIDE DOCUMENTATION TO THE OWNER OR THE OWNER'S PROJECT REPRESENTATIVE THAT THE OFF-SITE ACTIVITIES ARE PERMITTED IF REQUIRED BY TCEQ REGULATIONS. VERIFICATION OF PROPER OFF-SITE PERMITTING BY THE CONTRACTOR MUST BE PROVIDED AT LEAST 48 HOURS IN ADVANCE OF THE CONTRACTOR INCORPORATING THE SITE INTO SERVICE FOR THE SUBJECT PROJECT.

8. SIGN & NOTICE POSTINGS:

   ALL SITE OPERATORS SHALL CERTIFY AND POST A CONSTRUCTION SITE NOTICE IN COMPLIANCE WITH PART II.D.2 AND PART II.D.3 OF THE TPDES GENERAL PERMIT NUMBER TXR150000.

   ON SMALL PROJECT SITES WITH ONE TO LESS THAN FIVE ACRES OF DISTURBANCE, THE CONTRACTOR MUST POST CERTIFIED CONSTRUCTION SITE NOTICE(S) IN A LOCATION WHERE IT IS SAFELY AND READILY AVAILABLE FOR VIEWING BY THE GENERAL PUBLIC, LOCAL, STATE, AND FEDERAL AUTHORITIES, PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES, AND MAINTAIN THE NOTICE IN THAT LOCATION UNTIL COMPLETION OF THE CONSTRUCTION ACTIVITY. IF THERE IS NO LOCATION TO STORE THE SWP3 AT THE SITE, THE CONSTRUCTION SITE NOTICE MUST IDENTIFY THE LOCATION WHERE A SWP3 CAN BE READILY OBTAINED FOR VIEWING ALONG WITH CONTACT INFORMATION.

   ON LARGE PROJECT SITES WITH 5 OR MORE ACRES OF DISTURBANCE, THE CONSTRUCTION SITE NOTICE(S) MUST BE POSTED NEAR THE MAIN ENTRANCE OF THE CONSTRUCTION SITE IN A LOCATION WHERE IT IS SAFELY AND READILY AVAILABLE FOR VIEWING PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES, AND MAINTAIN THE NOTICE IN THAT LOCATION UNTIL COMPLETION OF THE CONSTRUCTION ACTIVITY. THE CONSTRUCTION SITE NOTICE SHALL CONTAIN THE INFORMATION BELOW:

RECORD PLANS
MAY 1, 2015

PREPARED BY:
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701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
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FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
SWP3
NOTES

STATE OF TEXAS
PHILIP L. GRAHAM
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9. EROSION AND SEDIMENT CONTROLS:

REFER TO THE SWP3 LAYOUT PLAN AND DETAILS FOR A DESCRIPTION OF THE BMPs THAT WILL BE USED TO RETAIN SEDIMENT ON-SITE. REFER TO THE SITE AND OR PROJECT DESCRIPTION DATA IN THESE NOTES FOR A GENERAL TIMING OR SEQUENCE FOR IMPLEMENTATION. ALL EROSION AND SEDIMENT CONTROLS IMPLEMENTED SHALL COMPLY WITH THE REQUIREMENTS AND EFFLUENT GUIDELINES PROVIDED IN PART III.G OF THE TPDES GENERAL PERMIT TXR150000.

EROSION CONTROL FACILITIES SHALL BE INSTALLED AND MAINTAINED ON THE SITE DURING ALL PHASES OF CONSTRUCTION UNTIL PAVING IS COMPLETE AND VEGETATION ESTABLISHED ON OPEN AREAS. THE METHODS AND SEQUENCE OF IMPROVEMENTS AS DESCRIBED HEREIN SHALL BE CONSIDERED MINIMUM IMPROVEMENTS. THE CONTRACTORS SEQUENCE OF CONSTRUCTION AND WEATHER CONDITIONS MAY DICTATE CONSTRUCTION OF DIFFERENT STORM WATER MANAGEMENT FACILITIES. COORDINATE WITH THE ENGINEER IF SUBSTANTIALLY DIFFERENT METHODS AND FACILITIES ARE ANTICIPATED AT ANY TIME DURING CONSTRUCTION.

TECHNIQUES TO BE USED: TECHNIQUES TO BE USED SHALL BE AS INDICATED BY THE STORM WATER POLLUTION PREVENTION PLAN AND DETAILS. THE GOALS FOR CONTROLLING EROSION SHALL COMPLY WITH THIS PLAN AND SPECIFICATIONS AND SHALL INCLUDE THE FOLLOWING:

A. WHERE FEASIBLE AND COST EFFECTIVE DIVERT UPSLOPE WATER AROUND DISTURBED AREAS.
B. CONTROL STORMWATER VOLUME AND VELOCITY WITHIN THE SITE TO MINIMIZE SOIL EROSION.
C. WHERE STORMWATER WILL BE CHANNELIZED ON THE SITE, STORMWATER CONTROLS MUST CONTROL BOTH PEAK FLOW RATES AND TOTAL STORMWATER VOLUME TO MINIMIZE EROSION AT OUTLETS AND DOWNSTREAM CHANNEL / STREAM BANK EROSION.
D. MINIMIZE THE AMOUNT OF DISTURBED AREAS EXPOSED TO THE SHORTEST DURATION POSSIBLE.
E. MINIMIZE THE DISTURBANCE OF STEEP SLOPES.
F. MINIMIZE THE SEDIMENT DISCHARGES FROM THE SITE BY STABILIZATION OR STRUCTURAL METHODS TO ADDRESS FACTORS SUCH AS THE AMOUNT, FREQUENCY, INTENSITY AND DURATION OF PRECIPITATION, THE NATURE OF RESULTING STORMWATER RUNOFF, AND SOIL CHARACTERISTICS.
G. IF EARTH DISTURBANCE ACTIVITIES ARE LOCATED IN CLOSE PROXIMITY TO A SURFACE WATER, WHERE FEASIBLE, PROVIDE AND MAINTAIN APPROPRIATE NATURAL BUFFERS AROUND THE SURFACE WATERS. IF NATURAL BUFFERS ARE NOT FEASIBLE, PERMITTEE SHALL DOCUMENT THE REASON IN THE SWP3 AND SHALL IMPLEMENT ADDITIONAL EROSION AND SEDIMENT CONTROLS TO REDUCE SEDIMENT LOAD. STORMWATER CONTROL FEATURES (i.e. STORMWATER CONVEYANCE CHANNELS, STORM DRAIN INLETS, SEDIMENT BASINS) DO NOT CONSTITUTE "SURFACE WATERS" REQUIRING A BUFFER.
H. PRESERVE NATIVE TOPSOIL AT THE SITE.
I. MINIMIZE SOIL COMPACTION IN POST-CONSTRUCTION PERVIOUS AREAS. IN AREAS OF THE CONSTRUCTION SITE WHERE FINAL VEGETATIVE STABILIZATION WILL OCCUR OR WHERE INFILTRATION PRACTICES WILL BE INSTALLED, EITHER:
   1) RESTRICT VEHICLE AND EQUIPMENT USE TO AVOID SOIL COMPACTION; OR
   2) PRIOR TO SEEDING OR PLANTING AREAS OF EXPOSED SOIL THAT HAVE BEEN COMPACTED, USE TECHNIQUES THAT CONDITION THE SOILS TO SUPPORT VEGETATIVE GROWTH.

THE CONTRACTOR SHALL MAINTAIN ALONG WITH THE SIGNED EFFECTIVE COPY OF SWP3 DRAWINGS AN UPDATEABLE LIST IDENTIFYING GOOD HOUSEKEEPING PRACTICES IMPLEMENTED TO LIMIT THE OFF-SITE TRANSPORT OF LITTER, CONSTRUCTION DEBRIS, AND CONSTRUCTION MATERIALS.

10. STABILIZATION PRACTICES:

REFER TO THE SWP3 LAYOUT PLAN FOR A DESCRIPTION OF INTERIM AND PERMANENT STABILIZATION PRACTICES FOR THE SITE, INCLUDING A SCHEDULE OF WHEN THE PRACTICES WILL BE IMPLEMENTED.

STABILIZATION PRACTICES SHALL INCLUDE THE FOLLOWING:

A. PRESERVE EXISTING VEGETATION WHERE POSSIBLE.
B. STABILIZATION OF DISTURBED AREAS MUST BE INITIATED IMMEDIATELY ON PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITIES HAVE TEMPORARILY CEASED AND WILL NOT RESUME FOR A PERIOD EXCEEDING 14 CALENDAR DAYS. STABILIZATION MEASURES THAT PROVIDE PROTECTIVE COVER MUST BE INITIATED IMMEDIATELY ON PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITIES HAVE PERMANENTLY CEASED. THE TERM IMMEDIATELY AS DEFINED HEREIN MEANS NO LATER THAN THE END OF THE NEXT WORK DAY FOLLOWING THE DAY WHEN EARTH-DISTURBING ACTIVITIES HAVE TEMPORARILY OR PERMANENTLY CEASED EXCEPT AS PROVIDED IN PART III.F.2(b)(iii)(A) TO III.F.2(b)(iii)(D) OF THE TPDES GENERAL PERMIT TXR150000.
C. PERMANENT STABILIZATION TECHNIQUES SHALL BE AS IDENTIFIED ON THE PLANS. INTERIM STABILIZATION METHODS MAY INCLUDE TEMPORARY SEEDING, PERMANENT SEEDING, MULCHING, GEOTEXTILES, SOD STABILIZATION, VEGETATION BUFFER STRIPS, PRESERVATION OF MATURE VEGETATIVE BUFFER STRIPS, AND OTHER APPROPRIATE MEASURES. IF CLEARING OF TREES OCCURS ON THE SITE AND MULCHING IS TO BE USED, THE CONTRACTOR MUST CONTACT THE PROJECT ENGINEER TO CONSIDER FEASIBLE AREAS WHERE MULCH CAN BE USED FOR TEMPORARY EROSION CONTROL.

THE CONTRACTOR SHALL MAINTAIN ALONG WITH THE SIGNED EFFECTIVE COPY OF THE SWP3 A RECORD OF THE DATES OF MAJOR GRADING ACTIVITIES, THE DATES CONSTRUCTION IS TEMPORARILY OR PERMANENTLY CEASED, AND THE DATES STABILIZATION MEASURES ARE INITIATED.

11. STRUCTURAL CONTROL PRACTICES:

REFER TO THE SWP3 LAYOUT PLAN AND DETAILS FOR A DESCRIPTION, ENGINEERING CALCULATIONS AND SPECIFIC LOCATION OF ANY STRUCTURAL CONTROL PRACTICES USED TO DIVERT FLOWS AWAY FROM EXPOSED SOILS, TO LIMIT THE CONTACT OF RUNOFF WITH DISTURBED AREAS, OR TO LESSEN THE OFF-SITE TRANSPORT OF ERODED SOILS.

12. PERMANENT STORM WATER CONTROLS:

REFER TO THE SWP3 LAYOUT PLAN AND DETAILS FOR A DESCRIPTION AND SPECIFIC LOCATION OF ANY MEASURES THAT WILL BE INSTALLED DURING THE CONSTRUCTION PROCESS TO CONTROL POLLUTANTS IN STORM WATER DISCHARGES THAT WILL OCCUR AFTER CONSTRUCTION OPERATIONS HAVE BEEN COMPLETED.

13. OTHER CONTROLS:

A. MATERIAL STORAGE: STORE ONLY ENOUGH OF A MATERIAL TO DO THE JOB. KEEP MATERIALS IN ORIGINAL CONTAINER IF POSSIBLE. WHEN NOT POSSIBLE, ORIGINAL LABEL SHALL BE KEPT WITH THE PRODUCT. CONTRACTOR SHALL MAINTAIN ALONG WITH THE EFFECTIVE COPY OF SWP3 DRAWINGS AN UPDATEABLE LIST OF ALL MATERIALS TO BE STORED ON-SITE, AND A DESCRIPTION OF THE LOCATION.
B. FUEL & EQUIPMENT MAINTENANCE AND STORAGE: WHERE FUELS ARE STORED, MAINTENANCE OF EQUIPMENT AND LUBRICATING MAINTENANCE ARE PROVIDED ON THE SITE, THE AREA (FUELING OR LUBRICATING) SHALL CONTAIN A MINIMUM 18" BERM AND PLASTIC COVER TO PREVENT STORM WATER FROM CARRYING PETRO CHEMICAL PRODUCTS INTO STORM WATER OR SOILS. VEHICLES ARE TO RECEIVE REGULAR PREVENTIVE MAINTENANCE. IF LOCATION IS PAVEMENT, A 6" HIGH TEMPORARY CONCRETE CURB MAY BE PLACED AROUND THE FUEL SITE IN LIEU OF EARTHEN BERM.
C. PROVIDE COVERED PROTECTED AREAS FOR STORAGE OF CHEMICALS, PAINTS, SOLVENTS, FERTILIZERS, AND OTHER POTENTIALLY TOXIC MATERIALS SUCH THAT MATERIALS ARE NOT IN CONTACT WITH STORM WATER. MATERIALS SHALL BE APPLIED ONLY IN THE MINIMUM AMOUNTS RECOMMENDED BY MANUFACTURER.
D. IF PUBLIC SANITARY FACILITIES ARE NOT AVAILABLE, PROVIDE SELF CONTAINED SANITARY FACILITIES AT THE CONSTRUCTION SITE FOR COLLECTION OF HUMAN WASTE. MAINTAIN FACILITIES AT REGULAR INTERVAL TO PREVENT OVERFLOW.
E. VEHICLE TRACKING: CONSTRUCTION WILL BE ACCESSED FROM INDUSTRIAL BOULEVARD AND JOHN KING BOULEVARD ADJACENT TO THE SITE. THE EXACT LOCATION SHALL BE CONFIRMED BY THE OWNER. THE MAJORITY OF THIS PROJECT IS LINEAR CONSTRUCTION. CONSTRUCTION AND ACCESS WILL BE IN CONFORMANCE WITH THE SWP3 PLAN AND EROSION CONTROL SHEETS.
F. DUST CONTROL: THE DISTURBED AREAS ON SITE SHALL BE REGULARLY WATERED DURING DRY PERIODS TO PREVENT DUST LEAVING THE SITE.
G. DISCHARGES FROM DEWATERING ACTIVITIES, INCLUDING DISCHARGES FROM DEWATERING TRENCHES AND EXCAVATIONS ARE PROHIBITED, UNLESS MANAGED BY APPROPRIATE CONTROLS.

14. THE CONTRACTOR SHALL PERFORM CONSTRUCTION OPERATIONS IN ACCORDANCE WITH BEST MANAGEMENT PRACTICES TO CONTROL POLLUTANTS IN STORM WATER DISCHARGES DURING CONSTRUCTION. THE CONTRACTOR SHALL CONFORM TO THE APPLICABLE LOCAL, STATE AND FEDERAL REGULATIONS TO CONTROL STORM WATER POLLUTANTS, AND TO CONTROL EROSION AND SEDIMENT FROM LEAVING THE SITE, INCLUDING DUST AND LITTER CONTROL. TRASH RECEPTACLES SHALL BE PROVIDED ON-SITE AND EMPTIED AT REGULAR INTERVALS.

15. THE CONTRACTOR SHALL LIMIT THE AREAS DISTURBED ON THE PROJECT SITE TO THE AREA NECESSARY FOR CONSTRUCTION OF THE PROPOSED IMPROVEMENTS. THE CONTRACTOR SHALL PREVENT PERSONNEL, SUPPLIERS, AND SUBCONTRACTORS FROM DISTURBING AREAS OUTSIDE OF DESIGNATED CONSTRUCTION AREAS.

16. TECHNICAL BASIS USED:

THE CONTRACTOR SHALL UTILIZE THE LATEST COPY OF THE NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENT'S STORM WATER MANAGEMENT HANDBOOK AS A GUIDE FOR THE PROPOSED STORM WATER MANAGEMENT FACILITIES AND TECHNIQUES. THE CONTRACTOR SHALL USE THE DETAILS PROVIDED FOR BUILDING THE SPECIFIED EROSION & SEDIMENTATION CONTROL STRUCTURES. THE CONTRACTOR SHALL ALSO REFER TO CONTRACT DOCUMENTS FOR TECHNICAL EVALUATION OF THESE STRUCTURES. IF SUCH STRUCTURES DO NOT MEET STANDARDS, THE ENGINEER SHALL BE CONTACTED IMMEDIATELY AND THE SITUATION REMEDIED. CALL (817) 640-3300 FOR MORE INFORMATION PERTAINING TO THE ABOVE REFERENCED HANDBOOK.

17. MAINTENANCE:

MAINTENANCE OF EROSION CONTROL FACILITIES SHALL CONSIST OF THE MINIMUM REQUIREMENTS AS FOLLOWS:

A. IN ONGOING CONSTRUCTION AREAS INSPECT EROSION CONTROL IMPROVEMENTS TO CONFIRM FACILITIES ARE IN PLACE AND OPERABLE. WHERE FACILITIES HAVE BEEN TEMPORARILY SET ASIDE OR DAMAGED DUE TO CONSTRUCTION ACTIVITY, PLACE FACILITIES IN SERVICE BEFORE LEAVING JOB SITE.
B. IF WEATHER FORECAST PREDICTS POSSIBILITY OF RAIN, CHECK ENTIRE FACILITIES THROUGHOUT SITE TO ASSURE FACILITIES ARE IN PLACE AND OPERABLE. IF JOB SITE WEATHER CONDITIONS INDICATE HIGH PROBABILITY OF RAIN, MAKE SPECIAL INSPECTION OF EROSION CONTROL FACILITIES.
C. AFTER RAINFALL EVENTS REVIEW EROSION CONTROL FACILITIES AS SOON AS SITE IS ACCESSIBLE. CLEAN INLET PROTECTION, SILT PONDS, ROCK BERMS, BERM/SWALES AND OTHER STRUCTURAL FACILITIES. DETERMINE WHERE ADDITIONAL FACILITIES OR ALTERNATIVE TECHNIQUES ARE NEEDED TO CONTROL SEDIMENT LEAVING SITE.
D. AFTER PORTIONS OF SITE HAVE BEEN SEEDED, REVIEW THESE AREAS ON REGULAR BASIS IN ACCORDANCE WITH PROJECT SPECIFICATIONS TO ASSURE PROPER WATERING UNTIL GRASS IS ESTABLISHED. RESEED AREAS WHERE GRASS IS NOT WELL ESTABLISHED.
E. SPILLS ARE TO BE HANDLED AS SPECIFIED BY THE MANUFACTURER OF THE PRODUCT IN A TIMELY SAFE MANNER BY PERSONNEL. THE SITE SUPERINTENDENT WILL BE RESPONSIBLE FOR COORDINATING SPILL PREVENTION AND CLEANUP OPERATIONS.
F. CONCRETE TRUCKS WILL DISCHARGE EXTRA CONCRETE OR WASH OUT DRUM ONLY AT AN APPROVED LOCATION ON SITE WHERE STRUCTURAL CONTROLS HAVE BEEN ESTABLISHED TO PREVENT DIRECT DISCHARGE TO SURFACE WATERS. DIRECT DISCHARGE OF CONCRETE TRUCK WASH OUT WATER TO SURFACE WATER IN THE STATE, INCLUDING DISCHARGE TO STORM SEWERS, IS PROHIBITED. RESIDUAL PRODUCT SHALL BE PROPERLY DISPOSED OF.
G. INSPECT VEHICLE ENTRANCE AND EXITS FOR EVIDENCE OF OFF-SITE TRACKING AND CORRECT AS NEEDED.
H. VEHICLE WASH AREAS WILL BE INSPECTED TO INSURE PROPER DRAINAGE AND MAINTENANCE.
I. REMOVE SEDIMENT FROM TRAPS/PONDS NO LATER THAN WHEN THE DESIGN CAPACITY HAS BEEN REDUCED BY 50%.
J. IF SEDIMENT ESCAPES THE SITE, THE CONTRACTOR WHERE FEASIBLE AND WHERE ACCESS IS AVAILABLE SHALL COLLECT AND REMOVE SEDIMENTATION MATERIAL BY APPROPRIATE NON-DAMAGING METHODS. ADDITIONALLY, THE CONTRACTOR SHALL CORRECT THE CONDITION CAUSING DISCHARGES.
K. IF INSPECTIONS OR OTHER INFORMATION SOURCES REVEAL A CONTROL HAS BEEN USED INCORRECTLY, OR THAT A CONTROL IS PERFORMING INADEQUATELY, THE CONTRACTOR MUST REPLACE, CORRECT OR MODIFY THE CONTROL AS SOON AS PRACTICAL AFTER DISCOVERY OF THE DEFICIENCY.

18. INSPECTION:

INSPECTIONS SHALL BE CONDUCTED BY QUALIFIED REPRESENTATIVES OF THE CONTRACTOR ACTING ON BEHALF OF THE OWNER OR A DESIGNATED PARTY IF HIRED SEPARATELY BY THE OWNER. EACH OPERATOR MUST DELEGATE AUTHORITY TO THE SPECIFICALLY DESCRIBED POSITION OR PERSON PERFORMING INSPECTIONS, AS PROVIDED BY 30 TAC §305.128, AS AN AUTHORIZED PERSON FOR SIGNING REPORTS AND PERFORMING CERTAIN ACTIVITIES REQUESTED BY THE DIRECTOR OR REQUIRED BY THE TPDES GENERAL PERMIT. THIS DELEGATION OF AUTHORITY MUST BE PROVIDED TO THE DIRECTOR OF TCEQ IN WRITING AND A COPY SHALL BE KEPT ALONG WITH THE SIGNED EFFECTIVE COPY OF THE SWP3. AN EXAMPLE DELEGATION LETTER IS PROVIDED IN THE CONTRACT DOCUMENTS.

INSPECTIONS MUST COMPLY WITH ONE OF THE TWO OPTIONS AS FOLLOWS:

OPTION A: AN INSPECTION SHALL OCCUR AT LEAST ONCE EVERY FOURTEEN (14) CALENDAR DAYS AND WITHIN 24 HOURS AFTER ANY STORM EVENT OF GREATER THAN 0.5 INCHES.

OPTION B: AN INSPECTION SHALL OCCUR AT LEAST ONCE EVERY SEVEN (7) CALENDAR DAYS. THE INSPECTION MUST OCCUR REGARDLESS OF WHETHER OR NOT THERE HAS BEEN A RAINFALL EVENT SINCE THE PREVIOUS INSPECTION.

THE AUTHORIZED PARTY SHALL INSPECT ALL DISTURBED AREAS OF THE SITE THAT HAVE NOT BEEN FINALLY STABILIZED, AREAS USED FOR STORAGE OF MATERIALS THAT ARE EXPOSED TO PRECIPITATION, DISCHARGE LOCATIONS, STRUCTURAL CONTROL MEASURES, AND LOCATIONS WHERE VEHICLES ENTER OR EXIT THE SITE.

DISTURBED AREAS AND AREAS USED FOR STORAGE OF MATERIALS THAT ARE EXPOSED TO PRECIPITATION MUST BE INSPECTED FOR EVIDENCE OF, OR THE POTENTIAL FOR, POLLUTANTS ENTERING THE RUNOFF FROM THE SITE. EROSION AND SEDIMENT CONTROL MEASURES IDENTIFIED IN THE PLAN MUST BE OBSERVED TO ENSURE THAT THEY ARE OPERATING CORRECTLY. OBSERVATIONS CAN BE MADE DURING WET OR DRY WEATHER CONDITIONS. WHERE DISCHARGE LOCATIONS OR POINTS ARE ACCESSIBLE, THEY MUST BE INSPECTED TO ASCERTAIN WHETHER EROSION CONTROL MEASURES ARE EFFECTIVE IN PREVENTING SIGNIFICANT IMPACTS TO RECEIVING WATERS. THIS CAN BE DONE BY INSPECTING RECEIVING WATERS TO SEE WHETHER ANY SIGNS OR EROSION OR SEDIMENT ARE ASSOCIATED WITH THE DISCHARGE LOCATION. LOCATIONS WHERE VEHICLES ENTER OR EXIT THE SITE MUST BE INSPECTED FOR EVIDENCE OF OFF-SITE SEDIMENT TRACKING.

BASED ON THE RESULTS OF THE INSPECTION, THE SITE DESCRIPTION AND THE POLLUTION PREVENTION MEASURES IDENTIFIED IN THE PLAN MUST BE REVISED AS SOON AS POSSIBLE AFTER AN INSPECTION THAT REVEALS INADEQUACIES. THE INSPECTION AND PLAN REVIEW PROCESS MUST PROVIDE FOR TIMELY IMPLEMENTATION OF ANY CHANGES TO THE PLAN WITH SEVEN (7) CALENDAR DAYS FOLLOWING THE INSPECTION.

AN INSPECTION REPORT THAT SUMMARIZES THE SCOPE OF THE INSPECTION, NAME(S) AND QUALIFICATIONS OF PERSONNEL CONDUCTING THE INSPECTION, THE DATES OF THE INSPECTION, MAJOR OBSERVATIONS RELATING TO THE IMPLEMENTATION OF THE SWP3. MAJOR OBSERVATIONS SHALL INCLUDE AS A MINIMUM LOCATION OF DISCHARGES OF SEDIMENT OR OTHER POLLUTANTS FROM THE SITE, LOCATION OF BMPs THAT NEED TO BE MAINTAINED, LOCATION OF BMPs THAT FAILED TO OPERATE AS DESIGNED OR PROVED INADEQUATE FOR A PARTICULAR LOCATION, AND LOCATIONS WHERE BMPs ARE NEEDED. ACTIONS TAKEN AS A RESULT OF THE INSPECTIONS MUST BE DESCRIBED WITHIN, AND RETAINED AS A PART OF, THE SWP3. REPORTS MUST IDENTIFY ANY INCIDENTS OF NON-COMPLIANCE. REPORTS MUST CONTAIN A RECORD OF THE TOTAL RAINFALL MEASURED, AS WELL AS THE APPROXIMATE BEGINNING AND ENDING DATES OF WINTER OR DROUGHT CONDITIONS RESULTING IN MONTHLY FREQUENCY OF INSPECTIONS. WHERE A REPORT DOES NOT IDENTIFY ANY INCIDENTS OF NON-COMPLIANCE, THE REPORT MUST CONTAIN A CERTIFICATION THAT THE FACILITY OR SITE IS IN COMPLIANCE WITH THE SWP3 AND THE TPDES GENERAL PERMIT. THE REPORT MUST BE SIGNED BY THE AUTHORIZED REPRESENTATIVE DELEGATED BY THE OPERATORS IN ACCORDANCE WITH TAC 305.128.

19. PROHIBITED DISCHARGES:

A. WASTEWATER FROM WASH OUT OF CONCRETE TRUCKS, UNLESS MANAGED BY AN APPROPRIATE CONTROL.
B. WASTEWATER FROM WASH OUT AND CLEANOUT OF STUCCO, PAINT, FORM RELEASE OILS, CURING COMPOUNDS AND OTHER CONSTRUCTION MATERIALS.
C. FUELS, OILS, OR OTHER POLLUTANTS USED IN VEHICLE AND EQUIPMENT OPERATION AND MAINTENANCE.
D. SOAPS OR SOLVENTS USED IN VEHICLE AND EQUIPMENT WASHING.

20. ELIGIBLE NON-STORM WATER DISCHARGE:

THE CONTRACTOR SHALL MAINTAIN ALONG WITH THE SIGNED EFFECTIVE COPY OF SWP3 DRAWINGS AN UPDATEABLE LIST IDENTIFYING ALL ELIGIBLE NON-STORM WATER DISCHARGES AND ENSURE THE IMPLEMENTATION OF APPROPRIATE POLLUTION PREVENTION MEASURES. A LISTING OF ELIGIBLE NON-STORM WATER DISCHARGE IS PROVIDED IN THE CONTRACT DOCUMENTS.

21. RETENTION OF RECORDS:

THE CONTRACTOR MUST RETAIN THE FOLLOWING RECORDS FOR A MINIMUM OF THREE YEARS FROM THE DATE THAT AN N.O.T. IS SUBMITTED. ON SMALL PROJECT SITES WHERE AN N.O.T. IS NOT REQUIRED, RECORDS SHALL BE KEPT FOR A PERIOD OF LEAST THREE YEARS FROM THE DATE OF FINAL STABILIZATION OR CHANGE OF OPERATOR. THE ORIGINALS SHALL BE FORWARDED TO THE OWNER.

A. A COPY OF THE SWP3 PLAN.
B. ALL REPORTS AND ACTIONS REQUIRED BY THE TPDES GENERAL PERMIT, INCLUDING A COPY OF THE CONSTRUCTION SITE NOTICE.
C. ALL DATA USED TO COMPLETE THE N.O.I., IF AN N.O.I. IS REQUIRED.
D. ALL RECORDS OF SUBMITTAL OF FORMS SUBMITTED TO THE OPERATOR OF ANY MS4 RECEIVING THE DISCHARGE AND TO THE SECONDARY OPERATOR OF A LARGE CONSTRUCTION SITE, IF APPLICABLE.

RECORD PLANS
MAY 1, 2015

PREPARED BY:
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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
SWP3
NOTES

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED
PROFESSIONAL ENGINEER
5/1/2015

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DATE 5/1/2015
WA# 13096

SHEET NO.
E002

PRINTED: 5/1/2015 STB FILE: WIER-PAVING.STB LAST SAVED: 4/21/2015 3:16 PM SAVED BY: CLAYTONT FILE: SWP3-NOTES-2-13096.DWG

SITE AND OR PROJECT DESCRIPTION DATA

1. NATURE OF THE CONSTRUCTION ACTIVITY:

   THE CONSTRUCTION ACTIVITY CONSISTS OF PAVING, DRAINAGE AND WATER LINE CONSTRUCTION TO CONVERT UNDEVELOPED PROPERTY TO A FOUR LANE DEVIDED ROADWAY.

2. POTENTIAL POLLUTANTS AND SOURCES:

   THE POTENTIAL SOURCES OF POLLUTION IDENTIFIED CONSIST OF STORM WATER RUNOFF FROM CONSTRUCTION ACTIVITIES. THERE ARE NO NON-STORM WATER DISCHARGES THAT ARE KNOWN TO EXIST AT THIS SITE. A SELF CONTAINED PORTABLE FACILITY WILL BE KEPT ON-SITE DURING CONSTRUCTION FOR HUMAN WASTE. CONSTRUCTION FUEL STORAGE IS NOT ANTICIPATED TO BE PROVIDED AT THE SITE. IF FUEL IS STORED AT THE SITE A BERM WILL BE PLACED AROUND THE FUEL TANK.

   CONTRACTOR SHALL MAINTAIN ALONG WITH THE SIGNED EFFECTIVE COPY OF SWP3 DRAWINGS AN UPDATEABLE LIST IDENTIFYING ALL POTENTIAL SOURCES OF POLLUTION INCLUDING PORTA-POTTYS, FUEL TANKS, STAGING AREAS, WASTE CONTAINERS, CHEMICAL STORAGE AREAS, CONCRETE CURE, PAINTS SOLVENTS, ETC., AND A DESCRIPTION OF THE LOCATION.

3. SEQUENCE OF MAJOR CONSTRUCTION ACTIVITIES:

   THE PROJECT SEQUENCE SHALL GENERALLY CONFORM TO THE FOLLOWING:

   PHASE I ESTIMATED START DATE: _____ ESTIMATED DURATION: _____

   A. INSTALL TEMPORARY CONSTRUCTION ENTRANCE, SACK GABIONS, AND SILT FENCE ACCORDING TO THE APPROXIMATE LOCATION AND DETAIL SHOWN ON EROSION CONTROL PLAN SHEETS AND SWP3 PLAN AND DETAILS.
   B. CLEAR AND GRADE CONSTRUCTION AREA AND DETENTION POND.
   C. SEED AND RE-VEGETATE SLOPES WHERE SHOWN.

   PHASE II ESTIMATED START DATE: _____ ESTIMATED DURATION: _____

   A. KEEP ALL STORM WATER POLLUTION PREVENTION MEASURES IN PLACE.
   B. INSTALL WATER AND STORM DRAIN AS SPECIFIED ON PLAN SHEETS.
   C. CONSTRUCT TEMPORARY SILT FENCE INLET TREATMENT AROUND OPEN STORM DRAIN INLETS ACCORDING TO THE DETAIL SHOWN ON SHEET E201 AND WHERE INDICATED ON SWP3 PLAN SHEET E102 AND E103.
   D. CONSTRUCT ALL STORM WATER POLLUTION PREVENTION DEVICES SHOWN ON PLAN SHEET E102 & E103 FOR PHASE TWO CONSTRUCTION.

   PHASE III ESTIMATED START DATE: _____ ESTIMATED DURATION: _____

   A. KEEP ALL STORM WATER POLLUTION PREVENTION MEASURES IN PLACE.
   B. STABILIZE SUBGRADE.
   C. PAVE STREETS AND SIDEWALKS AS SPECIFIED ON PLAN SHEETS.
   E. CONSTRUCT STORM DRAIN INLET TREATMENT AS SPECIFIED ON SWP3 PLAN SHEET E102 & E103 FOR PHASE THREE CONSTRUCTION.
   F. RE-VEGETATE PARKWAYS AND ALL DISTURBED AREAS.

4. AREA ESTIMATES:

   TOTAL AREA ONSITE: 7.9 ACRES
   ESTIMATED DISTURBED AREA ON-SITE: 7.9 ACRES
   ESTIMATED DISTURBED AREA OFF-SITE: 0.1 ACRES

5. ESTIMATED RUNOFF COEFFICIENT AFTER CONSTRUCTION IS COMPLETED:

   UNDEVELOPED C = 0.35
   DEVELOPED C = 0.90

6. SOIL AND OR QUALITY OF STORM WATER DISCHARGE DATA:

   REFER TO EFFICIENCY ESTIMATES FOR STRUCTURAL METHODS ON STANDARD MEASURES.

7. SOIL TYPE AT SITE:

   THE MAJORITY OF THE PROJECT CONSITS GENERALLY OF BROWN CLAY AND TAN AND GRAY SHALY CLAY. REFER TO GEOTECHNICAL REPORT BY ALPHA TESTING PROVIDED IN THE SPECIFICATIONS.

8. GENERAL LOCATION MAP AND DETAILED SITE MAP:

   REFER TO SWP3 LAYOUT SHEET AND GRADING PLAN SHEETS FOR DRAINAGE PATTERNS AND APPROXIMATE SLOPES ANTICIPATED AFTER MAJOR GRADING ACTIVITIES, AREAS WHERE SOIL DISTURBANCE WILL OCCUR, SOILS DISTURBANCE AREAS, STRUCTURAL CONTROL MEASURES, NATURAL VEGETATIVE FILTERING, RE-VEGETATION, IMPROVED STABILIZATION METHODS, SURFACE WATERS INCLUDING WETLANDS, DIRECT DISCHARGE POINTS TO SURFACE WATER BODIES.

9. LOCATION AND DESCRIPTION OF OFF-SITE MATERIAL, WASTE, BORROW OR EQUIPMENT STORAGE AREAS:

   _____
   _____
   _____
   _____
   _____
   _____

10. LOCATION AND DESCRIPTION OF SUPPORT ASPHALT PLANTS AND CONCRETE PLANTS:

    _____
    _____

11. RECEIVING WATER BODY DESCRIPTION: BUFFALO CREEK TRIBUTARY 1 AND THENCE TO LAKE RAY HUBBARD

12. WETLANDS ACREAGE:

    0.02 ACRES OF KNOWN WETLAND AREA IS BEING DISTURBED.

13. TPDES GENERAL PERMIT NUMBERS:

    OWNER _____
    CONTRACTOR _____

    N.O.I. SUBMITTAL DATES:

    OWNER _____
    CONTRACTOR _____

STABILIZATION PRACTICES

STABILIZATION PRACTICES	LOCATION ON-SITE	IMPLEMENTATION DATE	TEMPORARY OR PERMANENT
BERMUDA GRASS SODDING	PARKWAYS AND MEDIAN EDGES		PERMANENT
HYDROMULCH SEEDING	MEDIANS, CUT AND FILL SLOPES		PERMANENT
CURLEX EROSION CONTROL BLANKET	SLOPES OVER 2 FT. IN HEIGHT		TEMPORARY

STABILIZATION PRACTICES MAY INCLUDE, BUT ARE NOT LIMITED TO: ESTABLISHING TEMPORARY OR PERMANENT VEGETATION, MULCHING, GEOTEXTILES, SOD STABILIZATION, VEGETATIVE BUFFER STRIPS, AND PROTECTING EXISTING TREES AND VEGETATION.

STRUCTURAL CONTROL PRACTICES

WILL THE PROJECT DISTURB 10 ACRES OR MORE AT ONE TIME? NO
IF YES, IS IT FEASIBLE TO INSTALL A SEDIMENT BASIN? N/A

PERMANENT STORM WATER CONTROLS

THERE WILL BE NO MEASURES CONSTRUCTED TO CONTROL POST CONSTRUCTION RUNOFF.

VELOCITY DISSIPATION DEVICES

THE FOLLOWING VELOCITY DISSIPATION DEVICES WILL BE PLACED AT DISCHARGE LOCATIONS AND ALONG THE LENGTH OF ANY OUTFALL CHANNEL:

VELOCITY DISSIPATION DEVICE	OUTFALL DISCHARGING TO (MS4, BAR DITCH, CREEK/STREAM)	AT OUTFALL OR CHANNEL (DISTANCE INTERVAL FOR CHANNEL)
CONCRETE PILOT CHANNEL	DETENTION POND	BOX CULVERT DISCHARGE POINT INTO CONCRETE PILOT CHANNEL IN DETENTION POND
ROCK RUBBLE RIPRAP	EARTHEN CHANNEL	DISCHARGE POINT IN CHANNEL

EROSION AND SEDIMENT CONTROLS

BMP NO. OR LOCATION	CONDITION	BMP SELECTED	EXPLANATION
1	ENTRANCE / EXIT LOCATION	STABILIZED CONSTRUCTION ENTRANCE	PREVENTS SILT AND DEBRIS FROM LEAVING VIA CONSTRUCTON EQUIPMENT
2	CURB INLET	SUBGRADE PRE-TOPPED PHASE - FILTER BARRIER INLET PROTECTION PAVEMENT INLET TOPPED PHASE - BLOCK AND GRAVEL CURB INLET	PREVENTS SILT FROM UPSTREAM GRADING FROM ENTERING STORM DRAIN SYSTEM
3	SHEET FLOW	18" ORGANIC FILTER TUBE	DRAINAGE AREA TO SILT FENCE < 0.25 ac. / 100 L.F. MAX. DISTANCE OF FLOW < 200 ft. PREVENTS DEBRIS AND SILT FROM LEAVING SITE VIA NON-CONCENTRATED FLOW
4	CONCENTRATED SWALE FLOW	SACK GABION CHECK DAM	REDUCES VELOCITY OF CONCENTRATED FLOW AND TRAPS SEDIMENT
5	SHEET FLOW	CURLEX EROSION CONTROL BLANKET	PREVENTS GULLYING OF HIGH SLOPES AND SEDIMENT TRANSPORT
6	CONCENTRATED FLOW AT PAVEMENT	TRIANGULAR SEDIMENT FILTER DIKE	REDUCES VELOCITY AND TRAPS SEDIMENT BEFORE ENTERING PAVEMENT
7	OPEN CUT STREET	PAVEMENT REPLACEMENT SEDIMENT TRAP	FILTERS SEDIMENT TO PREVENT FROM LEAVING OPEN CUT STREET
8	DROP INLET	BLOCK AND GRAVEL DROP INLET PROTECTION	PREVENTS SILT FROM UPSTREAM GRADING FROM ENTERING STORM DRAIN SYSTEM

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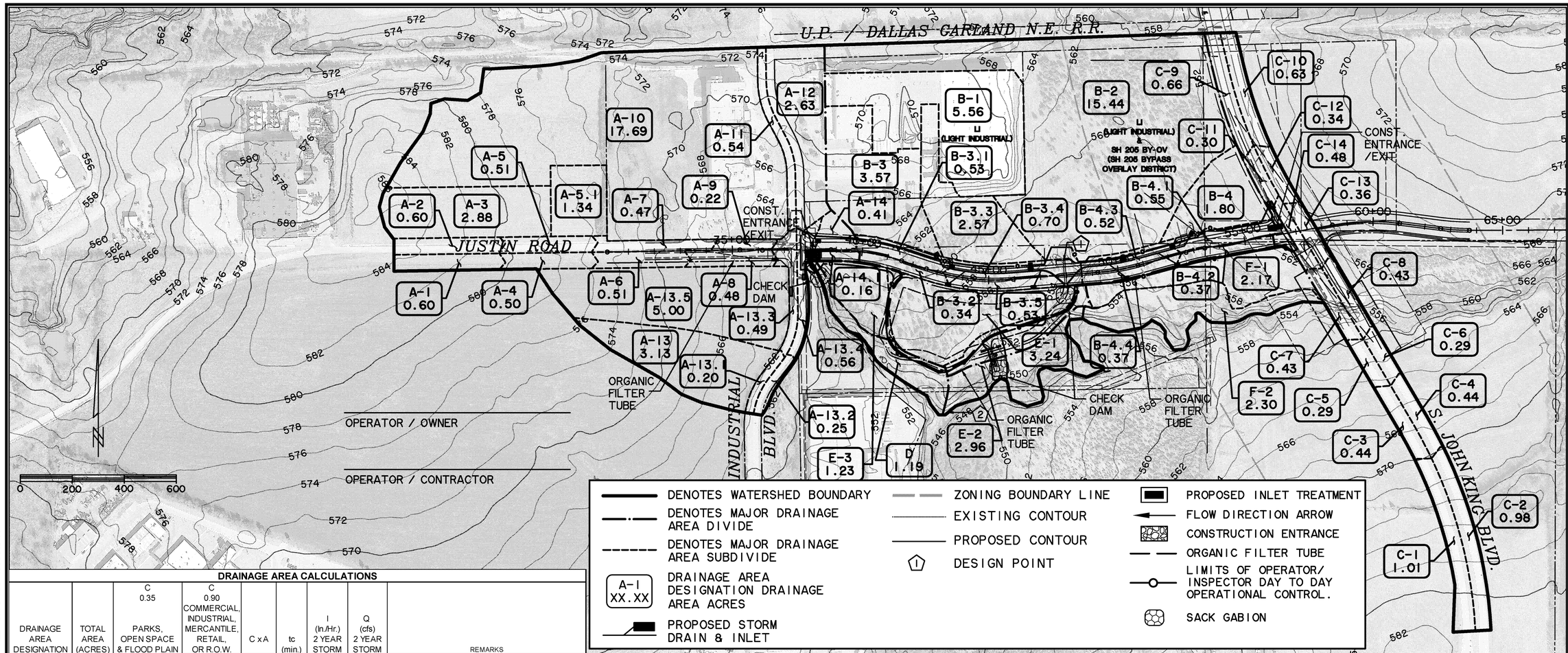
LAST SHEET EDIT DATE 5/1/2015
WA# 13096
SHEET NO. E003

RECORD PLANS
MAY 1, 2015

PRINTED: 5/1/2015 STB FILE: WIER-PAVING.STB LAST SAVED: 4/21/2015 3:17 PM SAVED BY: CLAYTONT FILE: SWP3-NOTES-3-13096.DWG



DENOTES WATERSHED BOUNDARY
DENOTES MAJOR DRAINAGE AREA DIVIDE
DENOTES MAJOR DRAINAGE AREA SUBDIVIDE
A-1 XX.XX — DRAINAGE AREA DESIGNATION DRAINAGE AREA ACRES
PROPOSED STORM DRAIN & INLET
ZONING BOUNDARY LINE
EXISTING CONTOUR
PROPOSED CONTOUR
DESIGN POINT
PROPOSED INLET TREATMENT
FLOW DIRECTION ARROW
CONSTRUCTION ENTRANCE
ORGANIC FILTER TUBE
LIMITS OF OPERATOR/ INSPECTOR DAY TO DAY OPERATIONAL CONTROL.
SACK GABION

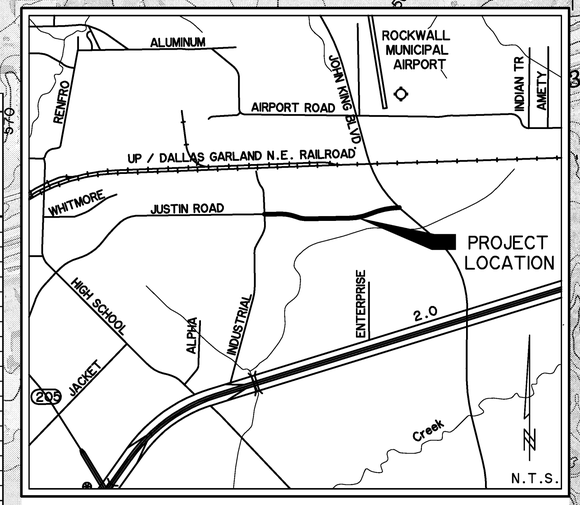
DRAINAGE AREA CALCULATIONS

DRAINAGE AREA DESIGNATION	TOTAL AREA (ACRES)	C 0.35 PARKS, OPEN SPACE & FLOOD PLAIN	C 0.90 COMMERCIAL, INDUSTRIAL, MERCANTILE, RETAIL, OR R.O.W.	C x A	tc (min.)	I (In./Hr.) 2 YEAR STORM	Q (cfs) 2 YEAR STORM	REMARKS
A-1	0.60		0.60	0.54	10	5.30	2.9	
A-2	0.60		0.60	0.54	10	5.30	2.9	
A-3	2.88		2.88	2.59	10	5.30	13.7	
A-4	0.50		0.50	0.45	10	5.30	2.4	
A-5	0.51		0.51	0.46	10	5.30	2.4	
A-5.1	1.34		1.34	1.21	10	5.30	6.4	
A-6	0.51		0.51	0.46	10	5.30	2.4	
A-7	0.47		0.47	0.42	10	5.30	2.2	
A-8	0.48		0.48	0.43	10	5.30	2.3	
A-9	0.22		0.22	0.20	10	5.30	1.1	
A-10 (DEV.)	17.69		17.69	15.92	10	5.30	84.4	
A-10 (DET.)	17.69	17.69		6.19	9.1	5.45	33.7	EXIST. SPR PACKAGING DETENTION PONDS
A-11	0.54		0.54	0.49	10	5.30	2.6	
A-12	2.63		2.63	2.37	10	5.30	12.6	
A-13	3.13		3.13	2.82	10	5.30	14.9	
A-13.1	0.20		0.20	0.18	10	5.30	1.0	
A-13.2	0.25		0.25	0.23	10	5.30	1.2	
A-13.3	0.49		0.49	0.44	10	5.30	2.3	
A-13.4	0.56		0.56	0.50	10	5.30	2.7	
A-13.5	5.00		5.00	4.50	10	5.30	23.9	
A-14	0.41		0.41	0.37	10	5.30	2.0	
A-14.1	0.16		0.16	0.14	10	5.30	0.7	
B-1 (DEV.)	5.56		5.56	5.00	10	5.30	26.5	
B-1 (DET.)	5.56	4.78	0.78	2.38	10	5.30	12.6	EXIST. DETENTION POND
B-2 (DEV.)	15.44		15.44	13.90	10	5.30	73.7	
B-2 (PRE-DEV.)	15.44	13.44	2.00	6.50	10	5.30	34.5	
D.P. #1	21.00		21.00	18.90	10	5.30	100.2	AREAS B-1 & B-2 COMBINED
B-3 (DEV.)	3.57		3.57	3.21	10	5.30	17.0	SEE NOTE 3
B-3 (PRE-DEV.)	3.57	1.29	2.28	2.50	10	5.30	13.3	USED FOR TEMP. DROP INLET DESIGN
B-3.1	0.53		0.53	0.48	10	5.30	2.5	
B-3.2	0.34		0.34	0.31	10	5.30	1.6	
B-3.3 (DEV.)	2.57		2.57	2.31	10	5.30	12.2	
B-3.3 (PRE-DEV)	2.57	1.92	0.65	1.26	10	5.30	6.7	USED FOR TEMP. DROP INLET DESIGN
B-3.4	0.70		0.70	0.63	10	5.30	3.3	
B-3.5	0.53		0.53	0.48	10	5.30	2.5	
B-4 (DEV.)	1.80		1.80	1.62	10	5.30	8.6	
B-4 (PRE-DEV.)	1.80	1.80		0.63	10	5.30	3.3	USED FOR TEMP. DROP INLET DESIGN
B-4.1	0.55		0.55	0.50	10	5.30	2.7	
B-4.2	0.37		0.37	0.33	10	5.30	1.7	
B-4.3	0.52		0.52	0.47	10	5.30	2.5	
B-4.4	0.37		0.37	0.33	10	5.30	1.7	

RECORD PLANS
MAY 1, 2015

DRAINAGE AREA CALCULATIONS

DRAINAGE AREA DESIGNATION	TOTAL AREA (ACRES)	C 0.35 PARKS, OPEN SPACE & FLOOD PLAIN	C 0.90 COMMERCIAL, INDUSTRIAL, MERCANTILE, RETAIL, OR R.O.W.	C x A	tc (min.)	I (In./Hr.) 2 YEAR STORM	Q (cfs) 2 YEAR STORM	REMARKS
C-1	1.01		1.01	0.91	10	5.30	4.8	
C-2	0.98		0.98	0.88	10	5.30	4.7	
C-3	0.44		0.44	0.40	10	5.30	2.1	
C-4	0.44		0.44	0.40	10	5.30	2.1	
C-5	0.29		0.29	0.26	10	5.30	1.4	
C-6	0.29		0.29	0.26	10	5.30	1.4	
C-7	0.43		0.43	0.39	10	5.30	2.1	
C-8	0.43		0.43	0.39	10	5.30	2.1	
C-9	0.66		0.66	0.59	10	5.30	3.1	
C-10	0.63		0.63	0.57	10	5.30	3.0	
C-11	0.30		0.30	0.27	10	5.30	1.4	
C-12	0.34		0.34	0.31	10	5.30	1.6	
C-13	0.36		0.36	0.32	10	5.30	1.7	
C-14	0.48		0.48	0.43	10	5.30	2.3	
D	1.19	1.19		0.42	10	5.30	2.2	
E-1 (DEV.)	3.24		3.24	2.92	10	5.30	15.5	
E-1 (DET.)	3.24	3.24		1.13	10	5.30	6.0	
E-2	2.96	2.96		1.04	10	5.30	5.5	
E-3 (DEV.)	1.23		1.23	1.11	10	5.30	5.9	
E-3 (DET.)	1.23	1.23		0.43	10	5.30	2.3	
F-1 (DEV.)	2.17		2.17	1.95	10	5.30	10.3	
F-1 (DET.)	2.17	2.17		0.76	10	5.30	4.0	
F-2	2.30	2.30		0.81	10	5.30	4.3	
D.P. #2	45.94	11.23	34.71	35.17	10	5.30	186.4	



VICINITY MAP

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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
SWP3
MAP

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED
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5/1/2015

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SHEET NO.
E101

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BMP No. 6
PHASE I
INSTALL TRIANGULAR
SEDIMENT FILTER DIKE

BMP No. 2
PHASE I
INSTALL INLET
PROTECTION

BMP No. 1
PHASE I
CONSTRUCTION
ENTRANCE/EXIT

BMP No. 3
PHASE I
INSTALL & MAINTAIN 18" DIAMETER
ORGANIC FILTER TUBE (360 L.F.)

BMP No. 8
PHASE I
INSTALL DROP
INLET PROTECTION

BMP No. 2
PHASE I
INSTALL INLET
PROTECTION

BMP No. 4
PHASE I
INSTALL SACK GABION
CHECK DAM (12 L.F.)

BMP No. 3
PHASE I
INSTALL & MAINTAIN 18" DIAMETER
ORGANIC FILTER TUBE (140 L.F.)

BMP No. 4
PHASE I
INSTALL SACK GABION
CHECK DAM (8 L.F.)

BMP No. 3
PHASE I
INSTALL & MAINTAIN 18" DIAMETER
ORGANIC FILTER TUBE (55 L.F.)

LOT 2, BLOCK A
SPR PACKAGING ADDITION
CAB. H, SLIDE 155
P.R.R.C.T.

INDUSTRIAL BOULEVARD

N.T.M.W.D.
ESMT. & R.O.W.
VOL. 559, PG. 181
D.R.R.C.T.

ROCKWALL ECONOMIC
DEVELOPMENT CORPORATION
VOL.4168, PG. 317
D.R.R.C.T.

NAN A. SMART,
W.I. LOFLAND
& JULIANA BOND
VOL. 70, PG. 183
D.R.R.C.T.

JUSTIN ROAD

SEE SHEET E103 FOR
DETENTION POND
EROSION CONTROL
MEASURES.

MATCH LINE STA - 50+00

0 50 100 150

BMP No. 4
PHASE I
INSTALL SACK GABION
CHECK DAM (8 L.F.)

BMP No. 1
PHASE I
CONSTRUCTION
ENTRANCE/EXIT

BMP No. 2
PHASE I
INSTALL INLET
PROTECTION

BMP No. 8
PHASE I
INSTALL DROP
INLET PROTECTION

BMP No. 2
PHASE I
INSTALL INLET
PROTECTION

BMP No. 4
PHASE I
INSTALL SACK GABION
CHECK DAM (4 L.F.)

BMP No. 2
PHASE I
INSTALL INLET
PROTECTION

BMP No. 7
PAVEMENT REPLACEMENT
SEDIMENT TRAP

BMP No. 3
PHASE I
INSTALL & MAINTAIN 18" DIAMETER
ORGANIC FILTER TUBE (680 L.F.)

JOHN KING BOULEVARD

BOBBY FRANK ATHEY
(TRACT B2)
VOL. 4875, PG. 117
D.R.R.C.T.

TEMUNOVIC PARTNERSHIP, LTD.
VOL. 7038, PG. 314
D.R.R.C.T.

MATCH LINE STA - 50+00

0 50 100 150

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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
EROSION CONTROL PLAN

RECORD PLANS
MAY 1, 2015

STATE OF TEXAS
PHILIP L. GRAHAM
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SHEET NO.
E102

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RECORD PLANS
MAY 1, 2015

N. BUTLER
ABSTRACT NO. 20

ARCHIBALD HANNA
ABSTRACT NO. 99

APPROX. LOC. SURVEY LINE

ROCKWALL ECONOMIC
DEVELOPMENT CORPORATION
VOL. 4168, PG. 317
D.R.R.C.T.

JUSTIN ROAD

42+00
43+00
44+00
45+00
46+00

BMP No. 4
PHASE I
INSTALL SACK GABION
CHECK DAM (8 L.F.)

BMP No. 4
PHASE I
INSTALL SACK GABION
CHECK DAM (20 L.F.)

BMP No. 5
PHASE I
INSTALL CURLEX EROSION
CONTROL BLANKET
(18,250 S.Y.)

BMP No. 4
PHASE I
INSTALL SACK GABION
CHECK DAM (8 L.F.)

BMP No. 4
PHASE I
INSTALL SACK GABION
CHECK DAM (8 L.F.)

BMP No. 3
PHASE I
INSTALL & MAINTAIN 9' DIAMETER
ORGANIC FILTER TUBE (575 L.F.)

BMP No. 4
PHASE I
INSTALL SACK GABION
CHECK DAM (16 L.F.)

BMP No. 3
PHASE I
INSTALL & MAINTAIN 9' DIAMETER
ORGANIC FILTER TUBE (745 L.F.)

BMP No. 5
PHASE I
INSTALL CURLEX
EROSION CONTROL
BLANKET (210 S.Y.)

0 30 60 90

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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
DETENTION POND
EROSION CONTROL PLAN

STATE OF TEXAS
PHILIP L. GRAHAM
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SHEET NO.
E103

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LOT 2, BLOCK A
SPR PACKAGING ADDITION
CAB. H, SLIDE 155
P.R.R.C.T.

JUSTIN ROAD

INDUSTRIAL BOULEVARD

BMP No. 7
PAVEMENT REPLACEMENT
SEDIMENT TRAP

FUTURE PAVEMENT
BY OTHERS

BMP No. 3
PHASE I
INSTALL & MAINTAIN 18" DIAMETER
ORGANIC FILTER TUBE (320 L.F.)

BMP No. 2
PHASE I
INSTALL INLET
PROTECTION

BMP No. 6
PHASE I
INSTALL TRIANGULAR
SEDIMENT FILTER DIKE

NAN A. SMART,
W.I. LOFLAND
& JULIANA BOND
VOL. 70, PG. 183
D.R.R.C.T.

JUSTIN ROAD

0 20 40 60

ROCKWALL ECONOMIC
DEVELOPMENT CORPORATION
INST. No. 20130000499975
D.R.R.C.T.

BMP No. 9
PHASE I
INSTALL & MAINTAIN
REINFORCED SILT FENCE

ROCKWALL ECONOMIC
DEVELOPMENT CORPORATION
VOL. 4168, PG. 317
D.R.R.C.T.

APPROXIMATE TEMPORARY
EXCESS EXCAVATION
STOCKPILE LOCATION &
LIMITS

JOHN KING BLVD.

JUSTIN ROAD

0 50 100 150

TEMPORARY EXCESS EXCAVATION STOCK PILE

RECORD PLANS
MAY 1, 2015

REVISIONS		
NO	DESCRIPTION	DATE BY
1	ADDED TEMPORARY EXCESS EXCAVATION STOCKPILE LOCATION	8/13/14 PLG

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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
EROSION CONTROL PLAN
BASE BID

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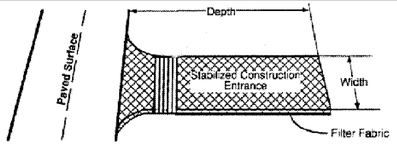
Stabilized Construction Entrance



DESCRIPTION
A stabilized construction entrance consists of a pad consisting of crushed stone, recycled concrete or other rock like material on top of geotextile filter cloth to facilitate the removal of sediment and other debris from construction equipment prior to exiting the construction site. This directly addresses the problem of silt and mud deposition in roadways used for construction site access. For added effectiveness, a wash rack area can be incorporated into the design to further reduce sediment tracking (See Wheel Wash, Fact Sheet S-10).

PRIMARY USE
Stabilized construction entrances are used primarily for sites in which significant truck traffic occurs on a daily basis. It reduces the need to remove sediment from streets. If used properly, it also directs the majority of traffic to a single location, reducing the number and quantity of disturbed areas on the site and providing protection for other structural controls through traffic control.

APPLICATIONS
Stabilized construction entrances are a required part of the erosion control plan for all site developments larger than one acre and a recommended practice for all construction sites. If possible, controlled entrances should be incorporated into small lot construction due to the large percentage of disturbed area on the site and the high potential for offsite tracking of silt and mud.

DESIGN CRITERIA
- ❑ Stabilized construction entrances are to be constructed such that drainage across the entrance is directed to a controlled, stabilized outlet on site with provisions for storage, proper filtration, and removal of wash water.
- ❑ The entrance must be sloped away from the paved surface so that storm water is not allowed to leave the site onto roadways.
- ❑ Minimum width of entrance shall be 15 feet.
- ❑ Stone shall be placed in a layer of at least 12-inches thickness. The stone shall be a minimum of **4 to 6** inch coarse aggregate.
- ❑ Prevent shortcutting of the full length of the construction entrance by installing barriers as necessary.

Applications
Perimeter Control
Slope Protection
Sediment Trapping
Channel Protection
Temporary Stabilization
Permanent Stabilization
Waste Management
Housekeeping Practices

Targeted Constituents
- ◒ Sediment
- ○ Nutrients Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Wastes

Implementation Requirements
- ● Capital Costs
- ◒ Maintenance
- ○ Training
- ○ Suitability for Slopes > 5%

Legend
- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

Fe = N/A

S-9

North Central Texas Council of Governments

Stabilized Construction Entrance

- ❑ The geotextile fabric must meet the following minimum criteria:
  - ❍ Tensile Strength, ASTM D4632 Test Method for Grab Breaking Load and Elongation of Geotextiles, 300-lbs.
  - ❍ Puncture Strength, ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Prodeucts, 120-lbs.
  - ❍ Mullen Burst Rating, ASTM D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method, 600-psi.
  - ❍ Apparent Opening Size, ASTM D4751 Test Method for Determining Apparent Opening Size of a Geotextile, U.S. Sieve No. 40 (max).
- ❑ When necessary, vehicles must be cleaned to remove sediment prior to entrance onto paved roads, streets, or parking lots. When washing is required, it shall be done on a constructed wheel wash facility that drains into an approved sediment trap or sediment basin or other sedimentation/filtration device.
- ❑ Minimum dimensions for the entrance shall be as follows:

Tract Area	Avg. Tract Depth	Min. Width of Entrance	Min. Depth of Entrance
< 1 Acre	100 feet	15 feet	20 feet
< 5 Acres	200 feet	20 feet	50 feet
> 5 Acres	> 200 feet	25 feet	75-100 feet

LIMITATIONS
Selection of the construction entrance location is critical. To be effective, it must be used exclusively.

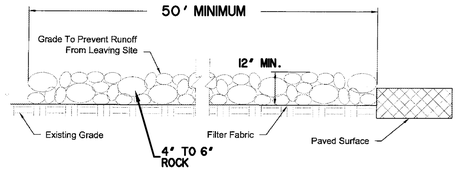
Stabilized entrances are rather expensive considering that it must be installed in combination with one or more other sediment control techniques, but it may be cost effective compared to labor-intensive street cleaning.

MAINTENANCE REQUIREMENTS
Construction entrances should be inspected regularly (at least as often as required by the TPDES Construction General Permit, Appendix A). When sediment has substantially clogged the void area between the rocks, the aggregate mat must be washed down or replaced. Periodic re-grading and top dressing with additional stone must be done to keep the efficiency of the entrance from diminishing.

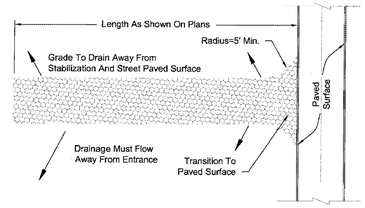
If the stabilized construction entrance is not effectively removing sediment from wheels then a wheel wash should be considered.

SPECIFICATION
Specifications for construction of this item may be found in the Standard Specifications for Public Works Construction – North Central Texas Council of Governments, Section 201.10 Stabilized Construction Entrance.

Stabilized Construction Entrance



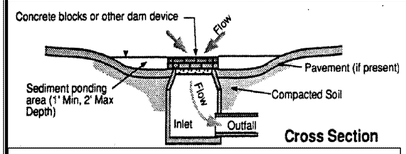
Profile View



Entrance Must Be Sloped So That Storm Water Is Not Allowed To Leave The Site And Enter Roadways.

Plan View

Inlet Protection



Cross Section

DESCRIPTION
Inlet protection consists of a variety of methods of intercepting sediment at low point inlets through the use of stone, filter fabric, inlet inserts, and other materials. This is normally located at the inlet, providing either detention or filtration to reduce sediment and floatable materials in storm water.

PRIMARY USE
Inlet protection should be considered a secondary defense in site erosion control due to the limited effectiveness and applicability of the technique. It is normally used in new developments that include new inlets or roads with new curb inlets or during major repairs to existing roadways.

Inlet protection has limited use in developed areas due to the potential for flooding, traffic safety, pedestrian safety, and maintenance problems. Inlet protection can reduce sediment in storm sewer systems by serving as a back up system to onsite controls or by reducing sediment loads from controls with limited effectiveness.

APPLICATIONS
Different inlet protection variations are used for different conditions as follows:

- ❑ Filter barrier protection (similar to a silt fence barrier around the inlet) is appropriate when the drainage area is less than one acre and the basin slope is less than five (5) percent. This type of protection is not applicable in paved areas.
- ❑ Block and gravel (crushed stone, recycled concrete is also appropriate) protection is used when flows exceed 0.5 c.f.s. and it is necessary to allow for overtopping to prevent flooding.
- ❑ Excavated impoundment protection around a drop inlet may be used for protection against sediment entering a storm drain system. With this method, it is necessary to install weep holes to allow the impoundment to drain completely. The impoundment shall be sized such that the volume of excavation shall be equal to 1800 to 3600 cubic feet per acre of disturbed area entering the inlet for full effectiveness.

Applications
Perimeter Control
Slope Protection
Sediment Trapping
Channel Protection
Temporary Stabilization
Permanent Stabilization
Waste Management
Housekeeping Practices

Targeted Constituents
- ◒ Sediment
- ○ Nutrients Toxic Materials
- ○ Oil & Grease
- ◒ Floatable Materials
- ○ Other Construction Wastes

Implementation Requirements
- ● Capital Costs
- ● Maintenance
- ○ Training
- ○ Suitability for Slopes > 5%

Legend
- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

Varies

S-4

North Central Texas Council of Governments

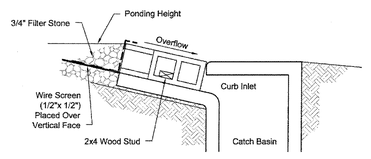
Inlet Protection

DESIGN CRITERIA
- ❑ Special caution must be exercised when installing inlet protection on publicly traveled streets or in developed areas. Ensure that inlet protection is properly designed, installed and maintained to avoid flooding of the roadway or adjacent properties and structures.
- ❑ Filter fabric protection shall be designed and maintained in a manner similar to silt fence.
- ❑ Where applicable, filter fabric, posts, and wire backing shall meet the material requirements specified in BMP Fact Sheet S-1, Silt Fence.
- ❑ Filter gravel shall be ¾ inch (Block and Gravel Protection) or 1-1/2 to 2 inch (Excavated Impoundment Protection) washed stone containing no fines. Angular shaped stone is preferable to rounded shapes.
- ❑ Concrete blocks shall be standard 8" x 8" x 16" concrete masonry units.
- ❑ Maximum depth of flow shall be eight (8) inches or less.
- ❑ Positive drainage is critical in the design of inlet protection. If overflow is not provided for at the inlet, excess flows shall be routed through established swales, streets, or other watercourses to minimize damage due to flooding.
- ❑ Filter Barrier Protection
  Silt Fence shall consist of nylon geotextile supported by wire mesh, W1.4 X W1.4, and galvanized steel posts set a minimum of 1 foot depth and spaced not more than 6 feet on center. A 6 inch wide trench is to be cut 6 inches deep at the toe of the fence to allow the fabric to be laid below the surface and backfilled with compacted earth or gravel. This entrenchment prevents any bypass of runoff under the fence.
- ❑ Block and Gravel Protection (Curb and Drop Inlets)
  Concrete blocks are to be placed on their sides in a single row around the perimeter of the inlet, with ends abutting. Openings in the blocks should face outward, not upward. ½" x ½" wire mesh shall then be placed over the outside face of the blocks covering the holes. Filter stone shall then be piled against the wire mesh to the top of the blocks with the base of the stone being a minimum of 18 inches from the blocks. Alternatively, where loose stone is a concern (streets, etc.), the filter stone mayb be placed in appropriately sized geotextile fabric bags. Periodically, when the stone filter becomes clogged, the stone must be removed and cleaned in a proper manner or replaced with new stone and piled back against the wire mesh.
- ❑ Excavated Impoundment Protection
  An excavated impoundment shall be sized to provide a storage volume of between 1800 and 3600 cubic feet per acre of disturbed area. The trap shall have a minimum depth of one foot and a maximum depth of 2 feet as measured from the top of the inlet and shall have sideslopes of 2:1 or flatter. Weep holes are to be installed in the inlet walls to allow for the complete dewatering of the the trap. When the storage capacity of the impoundment has been reduced by one-half, the silt shall be removed and disposed in a proper manner.
- ❑ Inlet inserts are commercially available to remove sediment, constituents (pollutants) adsorbed to sediment, and oil and grease. Maintenance is required to removesediment and debris that could clog the filters. Inlet inserts must have a bypass function to prevent flooding from clogging or high flows.

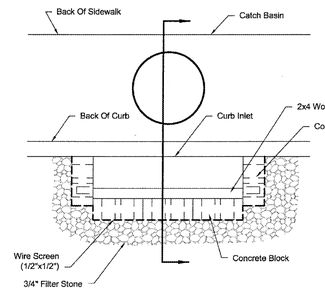
LIMITATIONS
Special caution must be exercised when installing inlet protection on publicly traveled streets or in developed areas. Ensure that inlet protection is properly designed, installed and maintained to avoid flooding of the roadway or adjacent properties and structures.

Inlet protection is only viable at low point inlets. Inlets that are on a slope cannot be effectively protected because storm water will bypass the inlet and continue downstream, causing an overload condition at inlets downstream.

Inlet Protection - Curb



Cross Section



Plan View

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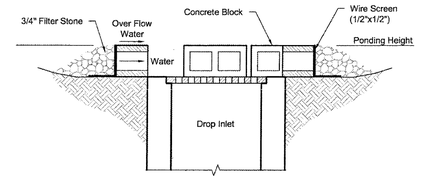
Inlet Protection – Drop Inlet



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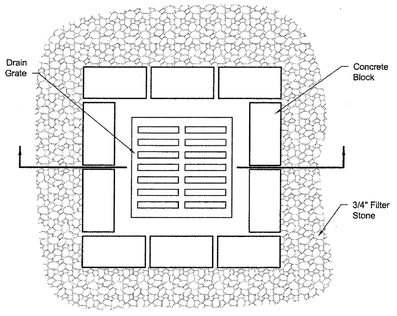

Plan View

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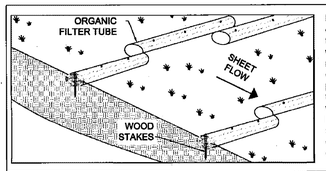
LAST SHEET EDIT
DATE 5/1/2015
WA# 13096

SHEET NO.
E201

PRINTED: 5/1/2015 STB FILE: WIER-PAVING.STB LAST SAVED: 4/21/2015 3:29 PM SAVED BY: CLAYTONT FILE: SWP3-DETAILS-I-13096.DWG

3.6 Organic Filter Tubes

Sediment Control



Description: Organic filter tubes are comprised of an open weave, mesh tube that is filled with a filter material (compost, wood chips, straw, coir, aspen fiber, or a mixture of materials). The tube may be constructed of geosynthetic material, plastic, or natural materials. Organic filter tubes are also called fiber rolls, fiber logs, wattles, mulch socks, and/or coir rolls. Filter tubes detain flow and capture sediment as linear controls along the contours of a slope or as a perimeter control down-slope of a disturbed area.

KEY CONSIDERATIONS

DESIGN CRITERIA:

- 9 inch minimum tube diameter when filled
- 3 inch minimum embedment in soil
- 18 inch minimum overlap at ends of tubes
- Spacing based on drainage area and slope
- Must be staked on soil and secured with rockbags on pavement
- Turn ends of tube lines upslope a minimum of 10 feet

ADVANTAGES / BENEFITS:

- Effective means to treat sheet flow over a short distance
- Relatively easy to install
- May be used on steep slopes
- Can provide perimeter control on paved surfaces or where soil type prevents embedment of other controls

DISADVANTAGES / LIMITATIONS:

- Difficult to remove when wet and/or filled with sediment
- Relatively small effective areas for sediment capture

MAINTENANCE REQUIREMENTS:

- Inspect regularly
- Repair eroded areas underneath the organic filter tubes
- Re-align and stake tubes that are dislodged by flow
- Remove sediment before it reaches half the height of the exposed tube

TARGETED POLLUTANTS

- ● Sediment
- ○ Nutrients & Toxic Materials
- ◒ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Wastes

APPLICATIONS

Perimeter Control
Slope Protection
Sediment Barrier

Channel Protection
Temporary Stabilization
Final Stabilization
Waste Management
Housekeeping Practices

Fe=0.50-0.75
(*Depends on soil type*)

IMPLEMENTATION CONSIDERATIONS

- ◒ Capital Costs
- ◒ Maintenance
- ○ Training
- ◒ Suitability for Slopes > 5%

Other Considerations:

- *None*

3.6.1 Primary Use

Organic filter tubes are long, flexible controls that are used along a line of constant elevation (along a contour) on slopes. They are used as perimeter controls down slope of disturbed areas and on side slopes where stormwater may runoff the area. The tubes maintain sheet flow, slow velocities, and capture sediment. When used on slopes, they also shorten the slope length and protect the slope from erosion.

3.6.2 Applications

Organic filter tubes include a wide variety of tube and filter materials. Organic filter tubes are used as a perimeter sediment barrier, similar to silt fence, for development projects and linear projects, such as roadways and utilities. They work well on individual residential lots and on lots being re-developed, where space may be limited. Organic filter tubes are most effective with coarse to silty soil types. Additional controls may be needed to remove fine silts and clay soils suspended in stormwater.

Organic filter tubes can be used on paved surfaces where it's not possible to stake a silt fence. Applications on paved surfaces include perimeter controls for soil stockpiles, pavement repair areas, utility trenching, and building demolition. When compost filter material is used in tubes on pavement, the material has the added benefit removing some oil and grease from stormwater runoff.

Applications on slopes include temporary sediment control during construction and erosion control of the disturbed soil on the slope. Organic filter tubes may be used to control sheet flow on slopes when final stabilization measures are being applied and established.

Organic filter tubes may also be used for inlet protection and, in limited cases, as check dams in small drainage swales. Refer to *Section 3.4 Inlet Protection* and *Section 2.1 Check Dam* for the design criteria to use organic filter tubes in these applications.

3.6.3 Design Criteria

General Criteria

- Filter tubes should be installed along the contour.
- Tubes shall be staked with 2 inch by 2 inch wooden stakes at a maximum spacing of 4 feet. Rebar or similar metal stakes may be used instead of wooden stakes.
- When placed on pavement, sand or rock bags shall be placed abutting the down-slope side of the tubes to prevent runoff from dislodging the tubes. At a minimum, bags shall be placed one foot from each end of the tube and at the middle of the tube.
- Filter tubes shall be embedded a minimum of three inches when placed on soil. Placement on rock shall be designed as placement on pavement.
- The end of tubes shall overlap a minimum of 18 inches when multiple tubes are connected to form a linear control along a contour or a perimeter.
- The last 10 feet (or more) at the ends of a line of tubes shall be turned upslope to prevent bypass by stormwater. Additional upslope lengths of tubes may be needed every 200 to 400 linear feet, depending on the traverse slope along the line of tubes.
- The most common sizes of tubes are 9 and 12 inch diameter; however, tubes are available in sizes up to 24 inch diameter. The designer shall specify a diameter based on the site application. Tubes less than 9 inches in diameter when filled shall not be used.
- Manufactured organic filter tube products shall have documentation of a minimum 75 percent soil retention using ASTM D7351 Standard Test Method for Determination of Sediment Retention Device Effectiveness in Sheet Flow Applications.

- When using manufactured tubes, the manufacturer's recommendations for diameter and spacing based on slope, flow velocities, and other site conditions shall be followed when they are more stringent than the design criteria in this section.
- When used as a perimeter control on grades of 10:1 or less, criteria in the following table shall be used as a guide for the size and installation rate of the organic filter tube.

Table 3.1 Perimeter Control Applications*

Drainage Area (Max)	*Max Flow Length to the Tube*	*Tube Diameter (Min)*
1/3 Acre per 100 feet	145 feet	18 inches
1/4 Acre per 100 feet	110 feet	15 inches
1/5 Acre per 100 feet	85 feet	12 inches
1/8 Acre per 100 feet	55 feet	9 inches

(Source: Modified and expanded from City of Plano Fact Sheet SP-13)
*Applicable on grades of 10:1 or flatter.

- When installing organic filter tubes along contours on slopes, criteria in the following table shall be used as a general guide for size and spacing of the tubes. Actual tube diameter and spacing shall be specified by the designer. The designer shall consider the tube manufacturers recommendations, the soil type, flow volume on the slope, required performance life, and erosion control measures that may be used in conjunction with the tubes.

Table 3.2 Maximum Spacing for Slope Protection

	Tube Diameter (Min)			
Slope (H:V)	*9 Inches*	*12 Inches*	*18 Inches*	*24 Inches*
5:1 to 10:1	35 feet	40 feet	55 feet	60 feet
4:1	30 feet	40 feet	50 feet	50 feet
3:1	25 feet	35 feet	40 feet	40 feet
2:1	20 feet	25 feet	30 feet	30 feet
1:1	10 feet	15 feet	20 feet	20 feet

(Source: Modified and expanded from Iowa Statewide Urban Design and Specifications Standards for Filter Socks)

Tube Material

- The designer shall specify the type of mesh based on the required life of the tube. At a minimum, the mesh shall have a rated life of one year under field conditions.
- If the tubes will be left onsite as part of the final stabilization, they must be constructed of 100 percent biodegradable jute, coir, sisal or similar natural fiber or 100 percent UV photodegradable plastic, polyester or geosynthetic material.
- Mesh tubes may be oval or round in cross-section.
- Mesh for the tubes shall be open and evenly woven. Size of weave openings shall be specified based on filter material. Openings may range from ½ inch for Erosion Control Compost to 2 inches for straw and coir.
- Mesh should not exceed ½ inch in diameter.

Filter Material

- Different filter materials have different properties and will affect sheet flow differently. The designer shall specify the type of material to be used (or excluded) on a particular site.
- Straw filter material shall be Certified Weed Free Forage. The straw must be in good condition, air-dried, and not rotten or moldy.

- Compost shall conform to the requirements for Erosion Control Compost in TxDOT Special Specification 1001 Compost (2004). Compost may provide some oil and grease removal; however, the large percentage of fines in compost will result in less filtering and more ponding of stormwater.
- Wood chips shall be 100 percent untreated chips and free of inorganic debris, such as plastic, glass, metal, etc. Wood chip size shall not be smaller than 1 inch and shall not exceed 3 inches in diameter. Shavings shall not be more than 5% of the total mass.

3.6.4 Design Guidance and Specifications

Specifications for Erosion Control Compost to be used as filter material may be found in Item 161 of the Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (TxDOT 2004) and TxDOT Special Specification 1001 Compost (2004).

3.6.5 Inspection and Maintenance Requirements

Organic filter tubes should be inspected regularly (at least as often as required by the TPDES Construction General Permit). The filter tube should be checked to ensure that it is in continuous contact with the soil at the bottom of the embedment trench. Closely check for rill erosion that may develop under the filter tubes. Eroded spots must be repaired and monitored to prevent reoccurrence. If erosion under the tube continues, additional controls are needed.

Staking shall be checked to ensure that the filter tubes are not moving due to stormwater runoff. Repair and re-stake slumping filter tubes. Tubes that are split, torn or unraveling shall be repaired or replaced.

Check the filter tube material to make sure that it has not become clogged with sediment or debris. Clogged filter tubes usually lead to standing water behind the filter tube after the rain event. Sediment shall be removed from behind the filter tube before it reaches half the height of the exposed portion of the tube.

When sediment control is no longer needed on the site, the tubes may be split open and the filter material may be used for mulching during establishment of vegetation for final stabilization if it meets the criteria in *Section 2.5 Mulching*.

3.6.6 Example Schematics

The following schematics are example applications of the construction control. They are intended to assist in understanding the control's design and function.

The schematics are **not for construction**. They may serve as a starting point for creating a construction detail, but they must be site adapted by the designer. In addition, dimensions and notes appropriate for the application must be added by the designer.

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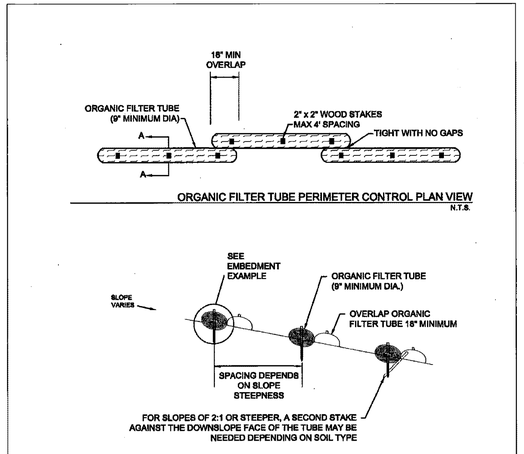


NOTES:
1. TYPE OF NETTING, FILTER MATERIAL, DIAMETER OF TUBE, AND SPACING OF TUBES SHALL BE SPECIFIED BY THE DESIGNER BASED ON THE FOLLOWING SITE PARAMETERS.
   - SIZE OF CONTRIBUTING DRAINAGE AREA
   - STEEPNESS OF SLOPE
   - GROUND CONDITIONS (SOIL OR PAVEMENT)
2. DESIGNER SHALL SHOW ON THE DRAWINGS THE LOCATIONS WHERE TUBES ARE TO BE TURNED UPSLOPE. UPSLOPE LENGTHS SHALL BE MINIMUM OF 10 FEET.

Figure 3.15 Schematics of Organic Filter Tubes

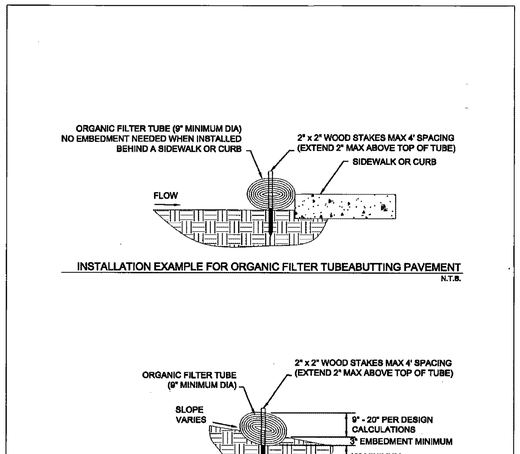
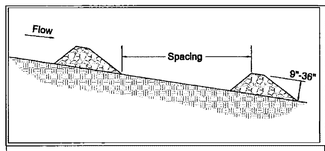


Figure 3.16 Examples of Organic Filter Tube Installation Methods

2.1 Check Dam

Erosion Control



Description: Check dams are small barriers consisting of loose rock, rock bags, or organic filter tubes placed across a drainage swale or ditch. They reduce the velocity of small concentrated flows, provide a limited barrier for sediment and reduce the potential for erosion of the swale or ditch.

KEY CONSIDERATIONS

DESIGN CRITERIA:

- Heights between 9 inches and 36 inches
- Top of the downstream dam should be at the same elevation as the toe of the upstream dam

ADVANTAGES / BENEFITS:

- Reduced velocities in long drainage swales or ditches
- May be used with other channel protection measures
- Provides some sediment removal

DISADVANTAGES / LIMITATIONS:

- Cannot be used in live stream channels
- Minor ponding upstream of the check dams
- Extensive maintenance or replacement of the dams required after heavy flows or high velocity flows
- Mowing hazard from loose rocks if all rock is not removed at end of construction

MAINTENANCE REQUIREMENTS:

- Inspect regularly
- Remove silt when it reaches approximately ⅓ the height of the dam or 12 inches, whichever is less

TARGETED POLLUTANTS

- ◒ Sediment
- ○ Nutrients & Toxic Materials
- ○ Oil & Grease
- ◒ Floatable Materials
- ○ Other Construction Wastes

APPLICATIONS

Perimeter Control
Slope Protection
Sediment Barrier
Channel Protection

Temporary Stabilization
Final Stabilization
Waste Management
Housekeeping Practices

Fe=0.30-0.50
(*Depends on soil type*)

IMPLEMENTATION CONSIDERATIONS

- ◒ Capital Costs
- ● Maintenance
- ○ Training
- ◒ Suitability for Slopes > 5%

Other Considerations:

- *None*

2.1.1 Primary Use

Check dams are used in long drainage swales or ditches to reduce erosive velocities. They are typically used in conjunction with other channel protection techniques such as vegetation lining and turf reinforcement mats. Check dams provide limited treatment to sediment-laden flows. They are more useful in reducing flow velocities to acceptable levels for stabilization methods. Check dams may be used in combination with stone outlet sediment traps, where the check dams prevent erosion of the swale while the sediment trap captures sediment at the downstream end of the swale.

2.1.2 Applications

Check dams are typically used in swales and drainage ditches along linear projects such as roadways. They can also be used in short swales down a steep slope, such as swales down a highway embankment, to reduce velocities. Check dams shall not be used in live stream channels.

Check dams should be installed before the contributing drainage area is disturbed, so as to mitigate the effects on the swale from the increase in runoff. If the swale itself is graded as part of the construction activities, check dams are installed immediately upon completion of grading to control velocities in the swale until stabilization is completed.

2.1.3 Design Criteria

General Criteria

- Typically, the dam height should be between 9 inches and 36 inches, depending on the material of which they are made. The height of the check dam shall always be less than one-third the depth of the channel.
- Dams should be spaced such that the top of the downstream dam is at the same elevation as the toe of the upstream dam. On channel grades flatter than 0.4 percent, check dams should be placed at a distance that allows small pools to form between each check dam.
- The top of the side of the check dam shall be a minimum of 12 inches higher than the middle of the dam. In addition, the side of the dams shall be embedded a minimum of 18 inches into the side of the drainage ditch, swale or channel to minimize the potential for flows to erode around the side of the dam.
- Larger flows (greater than 2-year, 24-hour design storm) must pass the check dam without causing excessive upstream flooding.
- Check dams should be used in conjunction with other sediment reduction techniques prior to releasing flow offsite.
- Use geotextile filter fabric under check dams of 12 inches in height or greater. The fabric shall meet the following minimum criteria:
  - Tensile Strength, ASTM D4632 Test Method for Grab Breaking Load and Elongation of Geotextiles, 250-lbs.
  - Puncture Rating, ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products, 135-lbs.
  - Mullen Burst Rating, ASTM D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method, 420-psi.
  - Apparent Opening Size, ASTM D4751 Test Method for Determining Apparent Opening Size of a Geotextile, U.S. Sieve No. 20 (max).
- Loose, unconfined soil, wood chips, compost, and other material that can float or be transported by runoff shall not be used to construct check dams.

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Rock Check Dams

- Stone shall be well graded with stone size ranging from 3 to 6 inches in diameter for a check dam height of 24 inches or less. The stone size range for check dams greater than 24 inches is 4 to 8 inches in diameter.
- Rock check dams shall have a minimum top width of 2 feet with side slopes of 2:1 or flatter.

Rock Bag Check Dams

- Rock bag check dams should have a minimum top width of 16 inches.
- Bag length shall be 24 inches to 30 inches, width shall be 16 inches to 18 inches and thickness shall be 6 inches to 8 inches and having a minimum weight of 40 pounds.
- Minimum rock bag dam height of 12 inches would consist of one row of bags stacked on top of two rows of bag. The dam shall always be one more row wide than it is high, stacked pyramid fashion.
- Bags should be filled with pea gravel, filter stone, or aggregate that is clean and free of deleterious material.
- Sand bags shall not be used for check dams, due to their propensity to break and release sand that is transported by the concentrated flow in the drainage swale or ditch.
- Bag material shall be polypropylene, polyethylene, polyamide or cotton burlap woven fabric, minimum unit weight 4-ounces-per-square-yard, Mullen burst strength exceeding 300-psi as determined by ASTM D3786, Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method, and ultraviolet stability exceeding 70 percent.
- PVC pipes may be installed through the dam to allow for controlled flow through the dam. Pipe should be schedule 40 or heavier polyvinyl chloride (PVC) having a nominal internal diameter of 2 inches.

Sack Gabion Check Dams

- Sack gabion check dams may be used in channels with a contributing drainage area of 5 acres or less.
- Sack gabions shall be wrapped in galvanized steel, woven wire mesh. The wire shall be 20 gauge with 1 inch diameter, hexagonal openings.
- Wire mesh shall be one piece, wrapped around the rock, and secured to itself on the downstream side using wire ties or hog rings.
- Sack gabions shall be staked with ¾ inch rebar at a maximum spacing of three feet. Each wire sack shall have a minimum of two stakes.
- Stone shall be well graded with a minimum size range from 3 to 6 inches in diameter.

Organic Filter Tube Check Dams

- Organic filter tubes may be used as check dams in channels with a contributing drainage area of 5 acres or less.
- Organic filter tubes shall be a minimum of 12 inches in diameter.
- Filter material used within tubes to construct check dams shall be limited to coir, straw, aspen fiber and other organic material with high cellulose content. The material should be slow to decay or leach nutrients in standing water.
- Staking of filter tubes shall be at a maximum of 4 foot spacing and shall alternate through the tube and on the downstream face of the tube.
- Unless superseded by requirements in this section, filter tubes and filter material shall comply with the

2.3.1 Primary Use

Erosion control blankets (ECBs) are used to hold seed and soil in place until vegetation is established on disturbed areas. They can be used on many types of disturbed areas, but are particularly effective for slopes and embankments and in small drainage swales.

ECBs seeded for vegetation may be used as a perimeter control. When used in combination with other sediment barriers, such as silt fence or organic filter tubes, blankets may be used as a perimeter control with or without vegetation.

2.3.2 Applications

ECBs may be used on many types of disturbed areas but are most applicable on gradual to steep (2:1) cut/fill slopes and in swales and channels with low to moderate flow velocities. In these applications they may provide temporary stabilization by themselves or may be used with seeding to provide final stabilization. ECBs are also used to establish vegetation in channels where velocities are less than 6.0 feet per second.

When seeded for establishment of vegetation, ECBs can be an effective perimeter along the down slope side of linear construction projects (roads and utilities). ECBs with vegetation are also used as perimeter controls for new development, particularly at the front on residential lots in new subdivisions. ECBs are an effective aid in establishing vegetated filter strips.

2.3.3 Design Criteria

- The designer shall specify the manufacturer, type of erosion control blanket to be used, and dimensioned limits of installation based on the site topography and drainage.
- The type and class of erosion control blanket must be specified in accordance with the manufacturer's guidance for the slope of the area to be protected, the flow rate (sheet flow on cut/fill slopes) or velocity (concentrated flow in swales) of stormwater runoff in contact in with the ECB, and the anticipated length of service.
- ECBs should meet the applicable "Minimum Performance Standards for TxDOT" as published by TxDOT in its "Erosion Control Report" and/or be listed on the most current annual "Approved Products List for TxDOT" applicable to TxDOT Item 169 Soil Retention Blanket and its Special Provisions.
- ECBs shall be installed vertically down slope (across contours) on cut/fill slopes and embankments and along the contours (parallel to flow) in swales and drainage ditches.
- ECBs designed to remain onsite as part of final stabilization shall have netting or mesh only on one side (the exposed side) of the ECB. The ECB shall be installed with the side that does not have netting or mesh in contact with the soil surface. All materials in the ECB, including anchors, should be 100 percent biodegradable within three years.
- On cut/fill slopes and drainage ditches or swales designed to receive erosion control blankets for temporary or final stabilization, installation of the ECBs shall be initiated immediately after completing grading of the slope or drainage way, and in no case later than 14 days after completion of grading these features. Do not delay installation of ECBs on these highly-erodible areas until completion of construction activities and stabilization of the remainder of the site.
- Unless the ECB is seeded to establish vegetation, perimeter control applications shall be limited to thirty foot wide drainage areas (i.e. linear construction projects) for an 8 foot width of ECB. When seeded for vegetation, use of ECBs for perimeter control shall follow the criteria in the *Section 3.15 Vegetated Filter Strips and Buffers*.
- Prior to the installation of the ECB, all rocks, dirt clods, stumps, roots, trash and any other obstructions that would prevent the ECB from lying in direct contact with the soil shall be removed.

- Anchor trenching shall be located along the top of slope of the installation area, except for small areas with less than 2 percent slope.
- Installation and anchoring shall conform to the recommendations shown within the manufacturer's published literature for the erosion control blanket. Anchors (staples) shall be a minimum of 6 inches in length and 1 inch wide. They shall be made of 11-gauge wire, or equivalent, unless the ECB is intended to remain in place with final stabilization and biodegrade.
- Particular attention must be paid to joints and overlapping material. Overlap along the sides and at the ends of ECBs should be per the manufacturer's recommendations for site conditions and the type of ECB being installed. At a minimum, the end of each roll of ECB shall overlap the next roll by 3 feet and the sides of rolls shall overlap 4 inches.
- After installation, the blankets should be checked for uniform contact with the soil, security of the lap joints, and flushness of the staples with the ground.
- When ECBs are installed to assist with establishing vegetation, seeding shall be completed before installation of the ECB. Criteria for seeding are provided in *Section 2.9 Vegetation*.
- Turf Reinforcement Mats should be used instead of ECBs for permanent erosion control and for stabilizing slopes greater than 2:1.
- ECBs are limited to use in swales and channels that have shear stresses of less than 2.0 pounds per square foot. Turf reinforcement mats shall be used in open channels with higher shear stresses.

2.3.4 Design Guidance and Specifications

Specifications for construction of this item may be found in the Standard Specifications for Public Works Construction – North Central Texas Council of Governments, Section 201.15 Erosion Control Blankets and in Item 169 of the Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (TxDOT, 2004).

2.3.5 Inspection and Maintenance Requirements

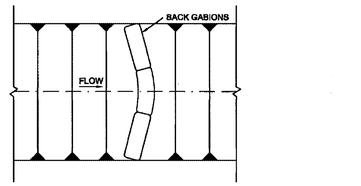
Erosion control blankets should be inspected regularly (at least as often as required by the TPDES Construction General Permit) for bare spots caused by weather or other events. Missing or loosened blankets must be replaced or re-anchored.

Check for excess sediment deposited from runoff. Remove sediment and/or replace blanket as necessary. In addition, determine the source of excess sediment and implement appropriate measures to control the erosion. Also check for rill erosion developing under the blankets. If found, repair the eroded area. Determine the source of water causing the erosion and add controls to prevent its reoccurrence.

2.3.6 Example Schematics

The following schematics are example applications of the construction control. They are intended to assist in understanding the control's design and function.

The schematics are **not for construction**. The designer is responsible for working with ECB manufacturers to ensure the proper ECB is specified based on the site topography and drainage. Installation measures should be dictated by the ECB manufacturer and are dependent on the type of ECB installed. Manufacturer's recommendations for overlap, anchoring, and stapling shall always be followed. Criteria shown here are applicable only when they are more stringent than those provided by the manufacturer.



NOTES: ACTUAL DIMENSIONS OF THE CHECK DAMS SHALL BE DESIGNED BASED ON FLOW CONDITIONS IN THE DRAINAGE SWALE OR DITCH. PROVIDE CALCULATIONS THAT DOCUMENT THE FOLLOWING PARAMETERS USED TO DESIGN THE CHECK DAMS.

- **HEIGHT OF CHECK DAMS BASED ON SWALE OR DITCH DIMENSIONS AND FLOW CONDITIONS.**
- **SPACING OF CHECK DAMS BASED ON GRADE OF THE SWALE OR DITCH. TOP OF DOWNSTREAM DAM SHALL BE AT SAME ELEVATION AS TOE OF UPSTREAM DAM.**

Figure 2.3 Schematics of Sack Gabion Check Dams
(Source: Modified from Texas Department of Transportation Detail Sheet EC (2)-93)

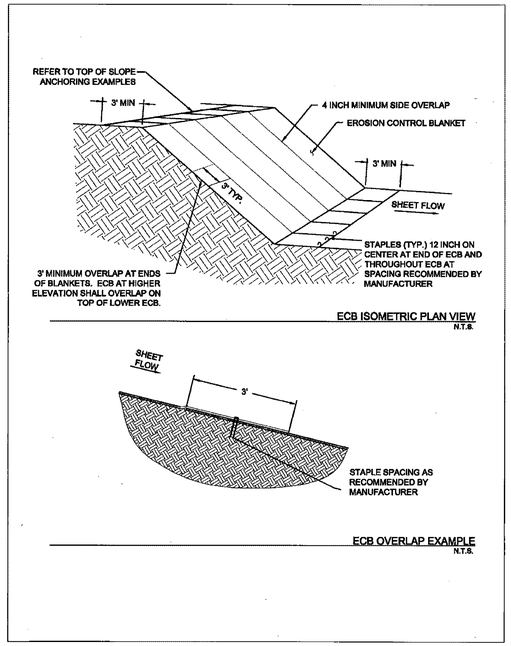
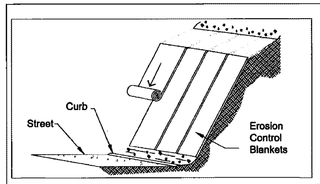


Figure 2.7 Schematics of Erosion Control Blankets

2.3 Erosion Control Blankets

Erosion Control



Description: An erosion control blanket (ECB) is a temporary, degradable, rolled erosion control product that reduces soil erosion and assists in the establishment and growth of vegetation. ECBs, also known as soil retention blankets, are manufactured by many companies and are composed primarily of processed, natural, organic materials that are woven, glued, or structurally bound together with natural fiber netting or mesh on one or both sides.

KEY CONSIDERATIONS

DESIGN CRITERIA:

- ECB selected based on slope, flow rate and length of service
- Specify preparation of soil surface to ensure uniform contact with blanket
- Installation and anchoring according to manufacturer's recommendations

ADVANTAGES / BENEFITS:

- Holds seed and soil in place until vegetation is established
- Effective for slopes, embankments and small channels

DISADVANTAGES / LIMITATIONS:

- Not for use on slopes greater than 2:1 or in channels with shear stresses greater than 2.0 pounds per square foot

MAINTENANCE REQUIREMENTS:

- Replace or re-anchor loosened blankets
- Remove sediment deposited on blankets

TARGETED POLLUTANTS

- ● Sediment
- ○ Nutrients & Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Waste

APPLICATIONS

Perimeter Control
Slope Protection
Sediment Barrier
Channel Protection
Temporary Stabilization
Final Stabilization

Waste Management

Housekeeping Practices

Fe=0.90 *(Ground cover)*
Fe=0.65
(Perimeter w/o vegetation)

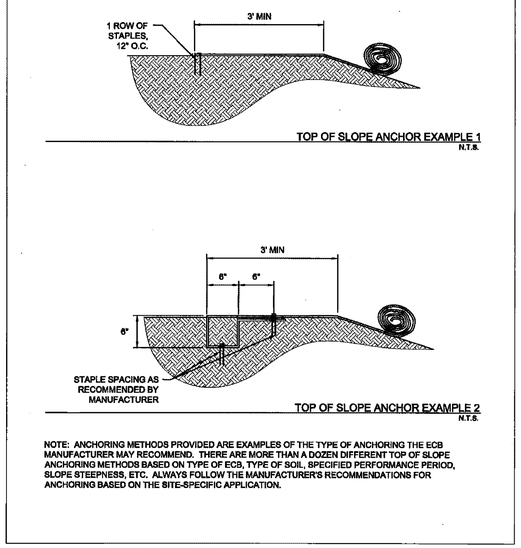
IMPLEMENTATION CONSIDERATIONS

- ● Capital Costs
- ◒ Maintenance
- ◒ Training
- ● Suitability for Slopes > 5%

Other Considerations:

- *Life expectancy, partial degradation, and mowing/ maintenance issues for ECBs left in place as part of final stabilization*

RECORD PLANS
MAY 1, 2015



NOTE: ANCHORING METHODS PROVIDED ARE EXAMPLES OF THE TYPE OF ANCHORING THE ECB MANUFACTURER MAY RECOMMEND. THERE ARE MORE THAN A DOZEN DIFFERENT TOP OF SLOPE ANCHORING METHODS BASED ON TYPE OF ECB, TYPE OF SOIL, SPECIFIED PERFORMANCE PERIOD, SLOPE STEEPNESS, ETC. ALWAYS FOLLOW THE MANUFACTURER'S RECOMMENDATIONS FOR ANCHORING BASED ON THE SITE-SPECIFIC APPLICATION.

Figure 2.8 Anchor Examples for Erosion Control Blankets
(Sources: American Excelsior Company and Western Excelsior Corporation)

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TO JOHN KING BOULEVARD
SWP3
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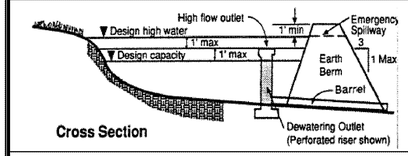
Sediment Basin



Cross Section

Applications

Perimeter Control
Slope Protection
Sediment Trapping
Channel Protection
Temporary Stabilization
Permanent Stabilization
Waste Management
Housekeeping Practices

DESCRIPTION
A sediment basin is a pond area with a controlled outlet in which sediment-laden runoff is directed to allow settling of suspended sediment from the runoff. It provides treatment for the runoff as well as detention and controlled release of runoff, minimizing flood impacts downstream.

PRIMARY USE
Sediment basins should be used for all sites with adequate open space to locate the basin and where the site topography directs a majority of the site drainage into the basin. For sites with disturbed areas of 10 acres and larger that are part of a common drainage area, sediment basins are necessary as either temporary or permanent controls, unless specific site conditions limit their use.

APPLICATIONS
Sediment basins serve as treatment devices which can be used on a variety of project types. They are normally used in site development projects in which large areas of land are available for the basin, a minor stream or off-line drainage way crosses the site, or a specific water feature is planned for the site. Sediment basins are highly effective at reducing sediment and other pollutants for design storm conditions. Sediment basins are typically easier to maintain than other structural controls (e.g. silt fences, etc).

DESIGN CRITERIA
- ❑ Refer to Appendix D of this manual for specific design guidance on temporary sediment basins.
- ❑ The iSWM Design Manual for Development/ Redevelopment should be used for guidance on the design of permanent sediment basins
- ❑ Minimum capacity of the basin shall be the calculated volume of runoff from a 2-year, 24-hour duration storm event.
- ❑ Deposited sediment shall be removed when the storage capacity of the basin has been reduced by 20%.
- ❑ Minimum width of the embankment at the top shall be 8 feet.
- ❑ Embankment slope shall be 3:1 or flatter.
- ❑ Maximum embankment height shall be 6 feet as measured from the toe of slope on the downstream side. Sediment basins with embankments exceeding 6 feet are regulated by the Texas Commission on Environmental Quality and must meet specific requirements for dam safety.

Targeted Constituents
- ● Sediment
- ◒ Nutrients Toxic Materials
- ○ Oil & Grease
- ◒ Floatable Materials
- ○ Other Construction Wastes

Implementation Requirements
- ● Capital Costs
- ◒ Maintenance
- ◒ Training
- ● Suitability for Slopes > 5%

Legend
- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

Fe=0.90

S-6

North Central Texas Council of Governments

Sediment Basin

- ❑ The basin outlet shall be designed to accommodate a 25-year design storm without causing damage to the containment structure.
- ❑ The sediment basin shall have minimum design dewatering time of 36 hours.
- ❑ The basin must be laid out such that the effective flow length of the basin should be at least twice the effective flow width.
- ❑ The outlet of the outfall pipe (barrel) shall be stabilized with riprap or other form of stabilization with design flows and velocities based on 25-year design storm peak flows. For velocities in excess of 5 feet per second, velocity dissipation measures should be used to reduce outfall velocities.
- ❑ The effectiveness of sediment basins may be increased by using baffles to prevent short-circuiting of flow through the basin.

SPECIAL CONSIDERATION
Sediment basins must be designed, constructed, and maintained to minimize mosquito breeding habitats by minimizing the creation of standing water. Whenever possible, water should be held less than 72 hours.

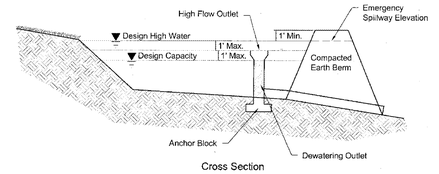
LIMITATIONS
Sediment basins can be rather large depending on site conditions, requiring the use of expensive development area and comprehensive planning for construction phasing prior to implementation.

Storm events which exceed the design storm event can cause damage to the spillway structure of the basin and may impact downstream concerns.

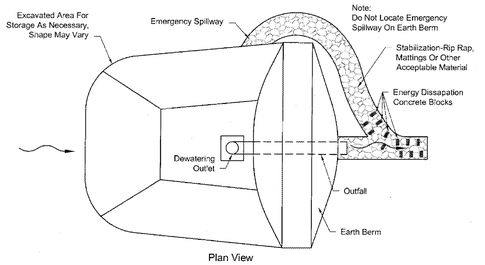
MAINTENANCE REQUIREMENTS
Sediment basins should be inspected regularly (at least as often as required by the TPDES Construction General Permit, Appendix A) to check for damage and to insure that obstructions are not diminishing the effectiveness of the structure. Sediment shall be removed and the basin shall be regraded to its original dimensions at such point that the capacity of the impoundment has been reduced to 20% of its original storage capacity. The removed sediment shall be stockpiled or redistributed in areas that are protected by erosion and sediment controls.

SPECIFICATION
No specification for construction of this item is currently available in the Standard Specifications for Public Works Construction – North Central Texas Council of Governments.

Sediment Basin

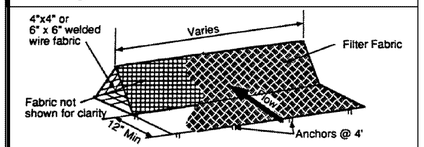


Cross Section



Plan View

Triangular Sediment Filter Dike



Applications

Perimeter Control
Slope Protection
Sediment Trapping
Channel Protection
Temporary Stabilization
Permanent Stabilization
Waste Management
Housekeeping Practices

DESCRIPTION
A Triangular Sediment Filter Dike is a self-contained silt fence consisting of filter fabric wrapped around welded wire fabric shaped into a triangular cross section. While similar in use to a silt fence, the dike is reusable, sturdier, transportable, and can be used on paved areas or in situations where it is impractical to install embedded posts for support.

PRIMARY USE
Triangular filter dikes are used in place of silt fence, treating sediment flow at the perimeter of construction areas and at the perimeter of the site. Also, the dikes can serve as stream protection devices by preventing sediment from entering the streams or as check dams in small swales.

Triangular sediment filter dikes are especially useful for construction areas surrounded by pavement, where silt fence, filter berm, or other BMP installation is impractical.

APPLICATIONS
Triangular dikes are used to provide perimeter control by detaining sediment on a disturbed site with drainage that would otherwise flow onto adjacent properties. Triangular dikes also serve as sediment trapping devices when used in areas of sheet flow across disturbed areas or are placed along stream banks to prevent sediment-laden sheet flow from entering the stream. The dikes can be subjected to more concentrated flows and a higher flow rate than silt fence.

DESIGN CRITERIA
- ❑ Dikes can be used on a variety of surfaces ranging from disturbed earth to pavement.
- ❑ Dikes are to be installed along a line of constant elevation (along a contour line).
- ❑ Maximum drainage area shall be 0.25 acre per 100 linear feet of dike.
- ❑ Maximum flow to any 20 foot section of dike shall be 1 CFS.
- ❑ Maximum distance of flow to dike shall be 200 feet or less. If the slope exceeds 10 percent the flow distance shall be less than 50 feet.
- ❑ Maximum slope adjacent to the dike shall be 2:1.

Targeted Constituents
- ● Sediment
- ○ Nutrients Toxic Materials
- ○ Oil & Grease
- ◒ Floatable Materials
- ○ Other Construction Wastes

Implementation Requirements
- ◒ Capital Costs
- ◒ Maintenance
- ○ Training
- ◒ Suitability for Slopes > 5%

Legend
- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

Fe=0.75

S-3

North Central Texas Council of Governments

Triangular Sediment Filter Dike

- ❑ If 50% or less of soil, by weight, passes the U.S. Standard sieve No. 200, select the apparent opening size (A.O.S.) to retain 85% of the soil.
- ❑ If 85% or more of soil, by weight, passes the U.S. Standard Sieve No. 200, triangular sediment dike shall not be used due to clogging.
- ❑ The filter fabric shall meet the material requirements specified in BMP Fact Sheet S-1, Silt Fence.
- ❑ The internal support for the dike structure shall be 6 gauge 6" x 6" wire mesh folded into triangular form eighteen (18) inches on each side.
- ❑ Filter material shall lap over ends six (6) inches to cover dike-to-dike junction; each junction shall be secured by shoat rings.
- ❑ Tie-in to the existing grade should be accomplished by (i) embedding the fabric six-inches below the top of ground on the upslope side, (ii) extending the fabric to form a 12-inch skirt on the upstream slope and covering it with 3 to 5 inches of crushed rock, or (iii) entrenching the base of the triangular dike four-inches below ground. For (ii) above, the skirt and the upslope portion of the triangular dike skeleton should be anchored by metal staples on two-foot centers, driven a minimum of six inches into the ground (except where crossing pavement or exposed limestone).
- ❑ Sand bags or large rock should be used as ballast inside the triangular dike section to stabilize the dike against the effects of high flows.
- ❑ Sufficient room for the operation of sediment removal equipment shall be provided between the dike and other obstructions in order to properly remove sediment.
- ❑ The ends of the dike shall be turned upgrade to prevent bypass of storm water.

LIMITATIONS
Effects of ponding caused by the dikes should be evaluated for effects on adjacent areas.
Triangular sediment filter dikes are not effective for conditions where there are substantial concentrated flows or when they are not constructed along a contour line due to the potential for flow concentration and overtopping.

MAINTENTANCE REQUIREMENTS
Triangular sediment filter dikes should be inspected regularly (at least as often as required by the TPDES Construction General Permit, Appendix A). Sediment should be removed when it reaches approximately 6 inches in depth. If the fabric becomes clogged, it should be cleaned or, if necessary, replaced. If structural deficiencies are found, the dike should be immediately repaired or replaced.

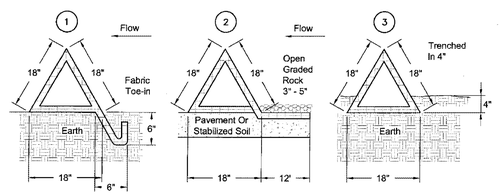
As with silt fence, integrity of the filter fabric is important to the effectiveness of the dike. Overlap between dike sections must be checked on a regular basis and repaired if deficient.

SPECIFICATION

Specifications for construction of this item may be found in the Standard Specifications for Public Works Construction – North Central Texas Council of Governments, Section 201.8 Triangular Sediment Filter Dike.

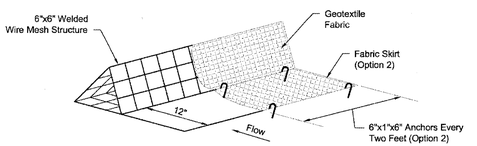
RECORD PLANS
MAY 1, 2015

Triangular Sediment Filter Dike



Cross Section Of Installation Options

1. Toe-in 6" Min.
2. Fabric Skirt Weighted With Rock
3. Trenched In 4"



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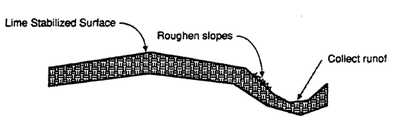
Lime Stabilization Management



DESCRIPTION
Lime stabilization is used extensively in the North Central Texas region to stabilize pavement subbases for roadways, parking lots, and other paved surfaces, and as a subgrade amendment for building pad sites. Hydrated lime is applied to the soil and mixed through disking and other techniques, then allowed to cure. This practice will reduce the potential for runoff to carry lime offsite, where it may impact aquatic life by changing the pH balance of streams, ponds, and other water bodies.

PRIMARY USE
This BMP should be implemented when lime is required for soil stabilization.

APPLICATIONS
Lime stabilization can be used under a variety of conditions. The engineer should determine the applicability of lime stabilization based on site conditions such as available open space, quantity of area to be stabilized, proximity of nearby water courses and other BMPs employed at the site. The use of diversion dikes and interceptor swales (see appropriate fact sheets) to divert runoff away from areas to be stabilized can be used in conjunction with these techniques to reduce the impact of the lime.

DESIGN CRITERIA
- ❑ The contractor shall limit lime operations to that which can be thoroughly mixed and compacted by the end of each workday.
- ❑ No traffic other than water trucks and mixing equipment shall be allowed to pass over the spread lime until after completion of mixing.
- ❑ Areas adjacent and downstream of stabilized areas shall be roughened to intercept lime from runoff and reduce runoff velocity.
- ❑ Geotextile fabrics such as those used for silt fence should not be used to address lime since the grain size of lime is significantly smaller than the apparent opening size of the fabric.
- ❑ For areas for which phasing of lime operations is impractical, use of a curing seal such as Liquid Asphalt, Grade MC-250 or MC-800 applied at a rate of 0.15 gallons per sq. yd. of surface can be used to protect the base.
- ❑ Use of sediment basins with a significant (>36 hour) drawdown time is encouraged for large areas to be stabilized (see S-6, Sediment Basin).
- ❑ Provide containment around lime storage, loading, and dispensing areas.

LIMITATIONS
Lime stabilization can be part of an overall plan to reduce pollutants from an active construction site. In the case of pollution due to lime, prevention of contamination is the only effective method to address this pollutant. Proper application and mixing along with avoiding applications when there is a significant probability of rain will reduce lime runoff.

Applications
Perimeter Control
Slope Protection
Sediment Trapping
Channel Protection
Temporary Stabilization
Permanent Stabilization
Waste Management
Housekeeping Practices

Targeted Constituents
- ○ Sediment
- ◒ Nutrients Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Wastes

Implementation Requirements
- ○ Capital Costs
- ◒ Maintenance
- ○ Training
- ○ Suitability for Slopes > 5%

Legend
- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

M-6

North Central Texas Council of Governments

Dust Control

DESCRIPTION
Dust control includes those measures necessary to prevent wind transport of dust from disturbed soil surfaces onto roadways, drainage ways, and surface waters.

PRIMARY USE
Dust control is applied in areas (including roadways) subject to surface and air movement to dust where on-site and off-site impacts to roadways, drainage ways, or surface waters are likely.

DESIGN CRITERIA
- ❑ Vegetate or mulch areas that will not receive vehicle traffic. In areas where planting, mulching, or paving is impractical, apply gravel or landscaping rock.
- ❑ Limit dust generation by clearing only those areas where immediate activity will take place, leaving the remaining area(s) in the original condition, if stable. Maintain the original cover as long as practicable.
- ❑ Construct natural or artificial windbreaks or windscreens. These may be designed as enclosures for small dust sources.
- ❑ Sprinkle the site with water until dampened sufficiently to prevent dust and repeat as needed. Do not apply water in quantities to cause runoff.
- ❑ Irrigation water can be used for dust control. Irrigation systems should be installed as a first step on sites where dust control is a concern.

SPECIFICATIONS
No specification for construction of this item is currently available in the Standard Specifications for Public Works Construction – North Central Texas Council of Governments.

Applications
Perimeter Control
Slope Protection
Sediment Trapping
Channel Protection
Temporary Stabilization
Permanent Stabilization
Waste Management
Housekeeping Practices

Targeted Constituents
- ● Sediment
- ○ Nutrients/Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Wastes

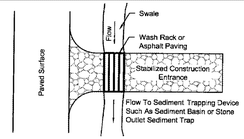
Implementation Requirements
- ○ Capital Costs
- ○ Maintenance
- ● Training
- ○ Suitability for Slopes > 5%

Legend
- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

E-8

North Central Texas Council of Governments

Wheel Wash



DESCRIPTION
The wheel wash is used in conjunction with a stabilized construction entrance to provide an area where truck wheels and undercarriages can be cleaned prior to traversing the stabilized construction entrance and entering the public road system. A wheel wash may consist of an impervious area or a grate over a swale. Wash water from hand held pressure washers or fixed nozzles is collected and drained to a sediment-trapping device such as a stone outlet sediment trap or sediment basin to provide for removal of sediment prior to discharge.

PRIMARY USE
Wheel washes should be used on large jobs where there is significant truck traffic, on those sites where site conditions cause the stabilized construction entrance to be overloaded with sediment and become ineffective, and in those instances where contaminated solids might be present on site. They provide added protection and reduce the need to remove sediment from streets.

APPLICATIONS
Wheel washes should be considered an ancillary component to the stabilized construction entrance.

DESIGN CRITERIA
- ❑ The location should be within the stabilized construction entrance so that the vehicle does not pick up additional sediment load by traversing disturbed areas.
- ❑ The size of the wheel wash facility should be sufficient so that all wash water and sediment is collected and drained to a sediment trapping device such as a sediment basin or stone outlet sediment trap.
- ❑ Suggested designs:
  - 4-inch thick asphalt pavement on an 8-inch base of crushed rock graded so that wash water drains to a swale; or
  - grate suitably designed to support construction vehicles installed over a swale.
- ❑ The facility should be designed so that it can be cleaned between uses.

LIMITATIONS
Sediment trapping BMPs used in conjunction with wheel wash facilities must be carefully designed for the anticipated amount of wash water to be treated.

Applications
Perimeter Control
Slope Protection
Sediment Trapping
Channel Protection
Temporary Stabilization
Permanent Stabilization
Waste Management
Housekeeping Practices

Targeted Constituents
- ◒ Sediment
- ○ Nutrients Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Wastes

Implementation Requirements
- ◒ Capital Costs
- ◒ Maintenance
- ◒ Training
- ○ Suitability for Slopes > 5%

Legend
- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

Fe = N/A

S-10

North Central Texas Council of Governments

Wheel Wash

MAINTENANCE REQUIREMENTS
Wheel wash facilities should be inspected regularly (at least as often as required by the TPDES Construction General Permit, Appendix A). The surface of the wheel wash should be cleaned between vehicles as necessary. Sediment that has accumulated in the wash water sedimentation BMP (sediment trap, sediment basin, etc.) must be removed when it reaches a depth of approximately 1/3 the design depth of the device or 12", whichever is less. The removed sediment shall be stockpiled or redistributed in areas that are protected from erosion.

SPECIFICATION
No specification for construction of this item is currently available in the Standard Specifications for Public Works Construction – North Central Texas Council of Governments.

Concrete Waste Management

DESCRIPTION
Concrete waste at construction sites comes in two forms: 1) excess fresh concrete mix including truck and equipment washing, and 2) concrete dust and concrete debris resulting from demolition. Both forms have the potential to impact water quality through storm water runoff contact with the waste.

PRIMARY USE
Concrete waste is present at most construction sites. This BMP should be utilized at sites in which concrete waste is present.

APPLICATIONS
A number of water quality parameters can be affected by introduction of concrete - especially fresh concrete. Concrete affects the pH of runoff, causing significant chemical changes in water bodies and harming aquatic life. Suspended solids in the form of both cement and aggregate dust are also generated from both fresh and demolished concrete waste.

Unacceptable Waste Concrete Disposal Practices
- ❑ Dumping in vacant areas on the job-site.
- ❑ Illicit dumping off-jobsite.
- ❑ Dumping into ditches or drainage facilities.

Recommended Disposal Practices
- ❑ Avoid unacceptable disposal practices listed above.
- ❑ Develop pre-determined, safe concrete disposal areas.
- ❑ Provide a washout area with a minimum of 6 cubic feet of containment area volume for every 10 cubic yards of concrete poured.
- ❑ Never dump waste concrete illicitly or without property owner's knowledge and consent.
- ❑ Overflow of washdown water shall be discharged in an area protected by one or more sediment removal BMPs and shall be done in a manner that does not result in a violation of groundwater or surface water quality standards.

Education
- ❑ Drivers and equipment operators should be instructed on proper disposal and equipment washing practices (see above).
- ❑ Supervisors must be made aware of the potential environmental consequences of improperly handled concrete waste.

Enforcement
- ❑ The construction site manager or foreman must ensure that employees and pre-mix companies follow proper procedures for concrete disposal and equipment washing.
- ❑ Employees violating disposal or equipment cleaning directives must be re-educated or disciplined if necessary.

Demolition Practices
- ❑ Monitor weather and wind direction to ensure concrete dust is not entering drainage structures and surface waters.
- ❑ Where appropriate, construct sediment traps or other types of sediment detention devices downstream of demolition activities.

Applications
Perimeter Control
Slope Protection
Sediment Trapping
Channel Protection
Temporary Stabilization
Permanent Stabilization
Waste Management
Housekeeping Practices

Targeted Constituents
- ○ Sediment
- ○ Nutrients Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ● Other Construction Wastes

Implementation Requirements
- ◒ Capital Costs
- ◒ Maintenance
- ◒ Training
- ○ Suitability for Slopes > 5%

Legend
- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

M-3

North Central Texas Council of Governments

Concrete Waste Management

Requirements
- ❑ Use pre-determined disposal sites for waste concrete.
- ❑ Prohibit dumping waste concrete anywhere but pre-determined areas.
- ❑ Assign pre-determined truck and equipment washing areas.
- ❑ Educate drivers and operators on proper disposal and equipment cleaning procedures.

Costs
- ❑ Minimal cost impact for training and monitoring.
- ❑ Concrete disposal cost depends on availability and distance to suitable disposal areas
- ❑ Additional costs involved in equipment washing could be significant.

LIMITATIONS
Concrete waste management is one part of a comprehensive construction site waste management program.

RECORD PLANS
MAY 1, 2015

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Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
SWP3
DETAILS

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
5/1/2015

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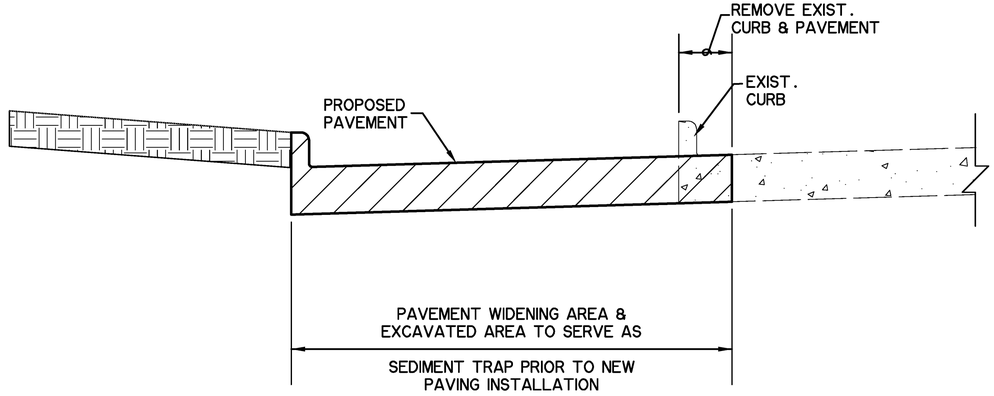

PAVEMENT REPLACEMENT SEDIMENT TRAP

N.T.S.

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MAY 1, 2015

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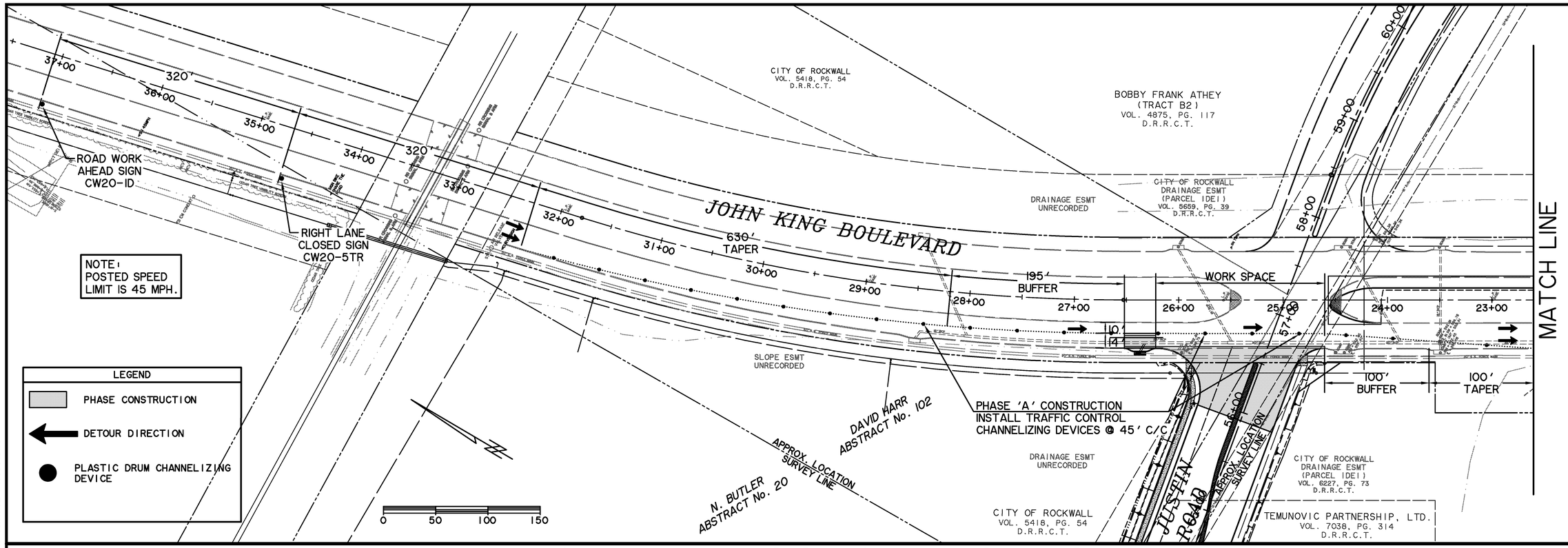
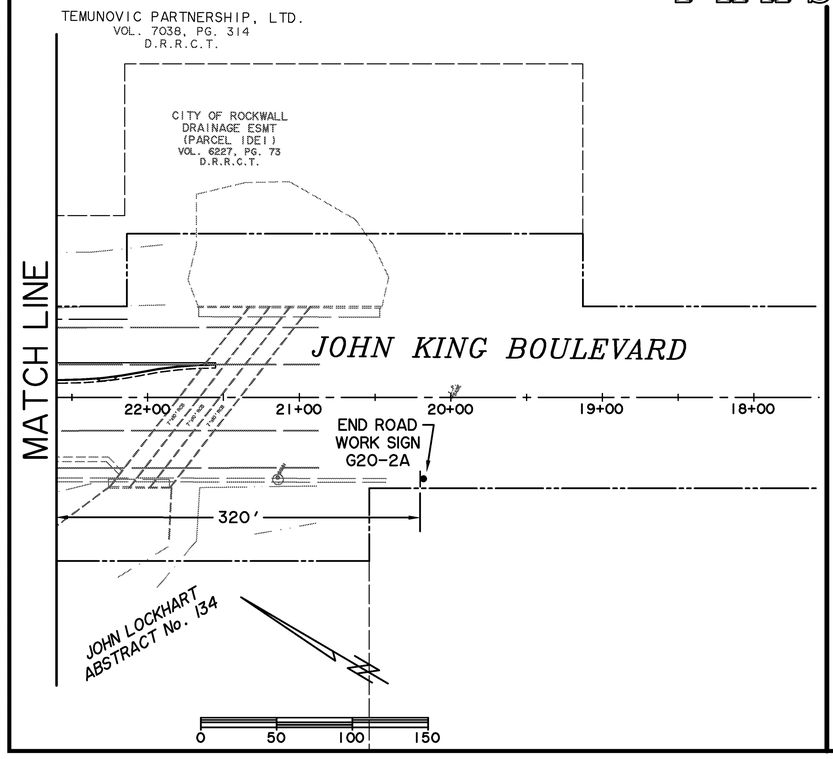
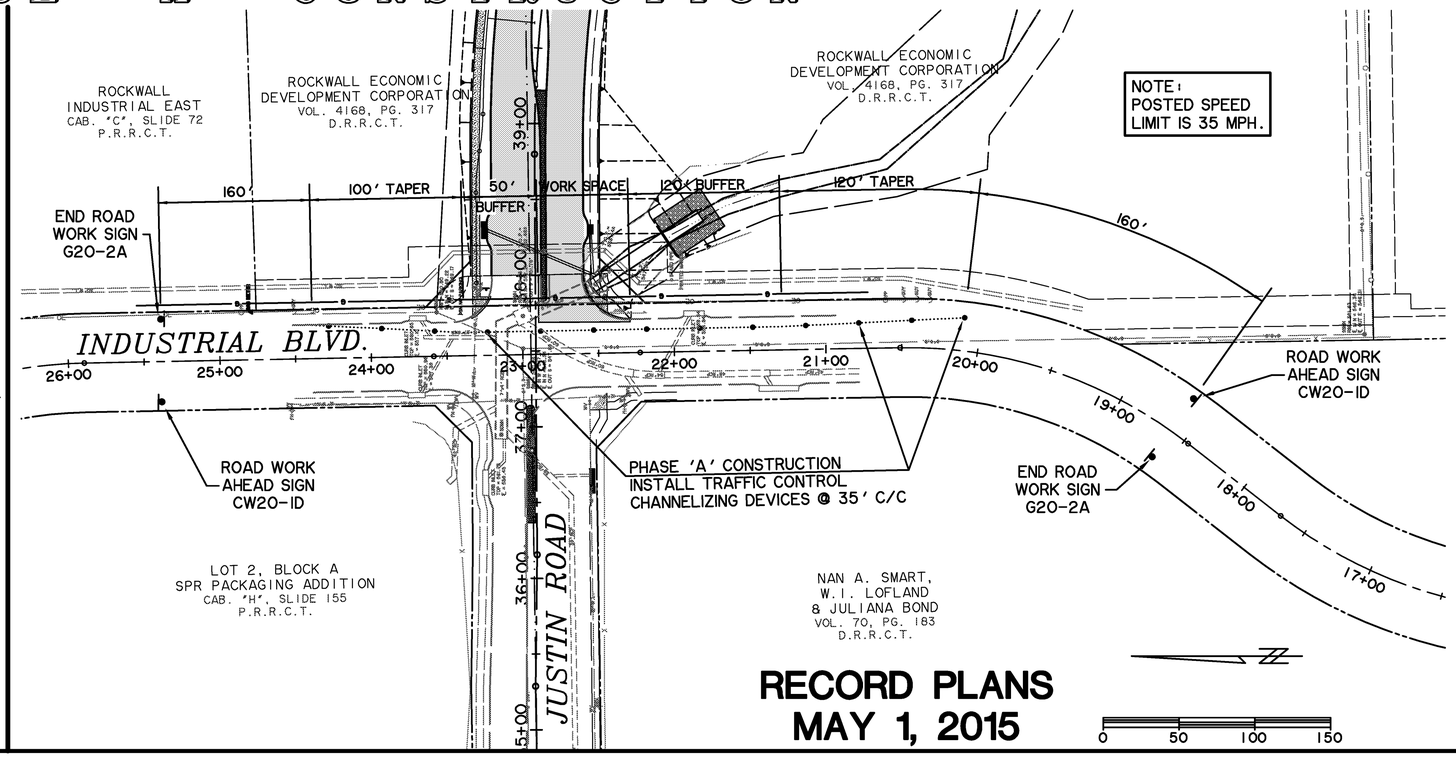
PHASE 'A' CONSTRUCTION







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Texas Firm Registration No. F-2776 www.wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
TRAFFIC CONTROL
PLAN PHASE "A"

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED PROFESSIONAL ENGINEER
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NOTE:
POSTED SPEED
LIMIT IS 45 MPH.

CITY OF ROCKWALL
VOL. 5418, PG. 54
D.R.R.C.T.

BOBBY FRANK ATHEY
(TRACT B2)
VOL. 4875, PG. 117
D.R.R.C.T.

TEMUNOVIC PARTNERSHIP, LTD.
VOL. 7038, PG. 314
D.R.R.C.T.

CITY OF ROCKWALL
DRAINAGE ESMT
(PARCEL IDE1)
VOL. 5659, PG. 39
D.R.R.C.T.

CITY OF ROCKWALL
DRAINAGE ESMT
(PARCEL IDE1)
VOL. 6227, PG. 73
D.R.R.C.T.

DRAINAGE ESMT
UNRECORDED

PHASE 'B' CONSTRUCTION
INSTALL TRAFFIC CONTROL
CHANNELIZING DEVICES @ 45' C/C

END ROAD
WORK SIGN
G20-2A

320'

100'
TAPER

100'
BUFFER

WORK SPACE

100'
BUFFER

100'
TAPER

320'

ROAD WORK
AHEAD SIGN
CW20-ID

30+00 29+00 28+00 27+00 26+00 25+00 24+00 23+00 22+00 21+00 20+00 19+00 18+00 17+00

60+00 59+00 57+00

JOHN KING BOULEVARD

END ROAD
WORK SIGN
G20-2A

SLOPE ESMT
UNRECORDED

DAVID HARR
ABSTRACT No. 102

APPROX. LOCATION
SURVEY LINE

N. BUTLER
ABSTRACT No. 20

JUSTIN ROAD

55+00

JOHN LOCKHART
ABSTRACT No. 134

PHASE 'B' CONSTRUCTION

RECORD PLANS
MAY 1, 2015

0 50 100 150

LEGEND

- PHASE CONSTRUCTION
- DETOUR DIRECTION
- PLASTIC DRUM CHANNELIZING DEVICE

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LOT 2, BLOCK A
SPR PACKAGING ADDITION
CAB. 'H', PG. 155
P.R.R.C.T.

160' | 100' TAPER | 50' BUFFER

END ROAD
WORK SIGN
G20-2A

PHASE 'B' CONSTRUCTION
INSTALL TRAFFIC CONTROL
CHANNELIZING DEVICES @ 35' C/C

31+00 32+00 33+00 34+00 35+00 36+00 37+00

25+00 24+00 23+00 22+00 21+00

JUSTIN ROAD

INDUSTRIAL BLVD

ROAD WORK
AHEAD SIGN
CW20-ID

NAN A. SMART,
W.I. LOFLAND
& JULIANA BOND
VOL. 70, PG. 183
D.R.R.C.T.

ROCKWALL ECONOMIC
DEVELOPMENT CORPORATION
VOL. 4168, PG. 317
D.R.R.C.T.

NOTE:
POSTED SPEED
LIMIT IS 35 MPH.

ROCKWALL ECONOMIC
DEVELOPMENT CORPORATION
VOL. 4168, PG. 317
D.R.R.C.T.

END ROAD
WORK SIGN
G20-2A

PHASE 'B' CONSTRUCTION
INSTALL TRAFFIC CONTROL
CHANNELIZING DEVICES @ 35' C/C

ROAD WORK
AHEAD SIGN
CW20-ID

39+00 38+00 37+00 36+00

INDUSTRIAL BLVD.

25+00 24+00 23+00 22+00 21+00 20+00

ROAD WORK
AHEAD SIGN
CW20-ID

160' | 120' TAPER | 50' BUFFER | 50' BUFFER | 100' TAPER | 160'

END ROAD
WORK SIGN
G20-2A

WORK
SPACE

JUSTIN ROAD

LOT 2, BLOCK A
SPR PACKAGING ADDITION
CAB. 'H', PG. 155
P.R.R.C.T.

NAN A. SMART,
W.I. LOFLAND
& JULIANA BOND
VOL. 70, PG. 183
D.R.R.C.T.

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
TRAFFIC CONTROL
PLAN PHASE "B"

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED
PROFESSIONAL ENGINEER
9/1/2015

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Barricade and Construction (BC) Standard Sheets General Notes:

1. The Barricade and Construction Standard Sheets (BC sheets) are intended to show typical examples for placement of temporary traffic control devices, construction pavement markings, and typical work zone signs. The information contained in these sheets meet or exceed the requirements shown in the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD).
2. The development and design of the Traffic Control Plan (TCP) is the responsibility of the Engineer.
3. The Contractor may propose changes to the TCP that are signed and sealed by a licensed professional engineer for approval. The Engineer may develop, sign and seal Contractor proposed changes.
4. The Contractor is responsible for installing and maintaining the traffic control devices as shown in the plans. The Contractor may not move or change the approximate location of any device without the approval of the Engineer.
5. Geometric design of lane shifts and detours should, when possible, meet the applicable design criteria contained in manuals such as the American Association of State Highway and Transportation Officials (AASHTO), "A Policy on Geometric Design of Highways and Streets", the TxDOT "Roadway Design Manual" or engineering judgment.
6. When projects abut, the Engineer(s) may omit the END ROAD WORK, TRAFFIC FINES DOUBLE, and other advance warning signs if the signing would be redundant and the work areas appear continuous to the motorists. If the adjacent project is completed first, the Contractor shall erect the necessary warning signs as shown on these sheets, the TCP sheets or as directed by the Engineer. The BEGIN ROAD WORK NEXT X MILES sign shall be revised to show appropriate work zone distance.
7. The Engineer may require duplicate warning signs on the median side of divided highways where median width will permit and traffic volumes justify the signing.
8. All signs shall be constructed in accordance with the details found in the "Standard Highway Sign Designs for Texas," latest edition. Sign details not shown in this manual shall be shown in the plans or the Engineer shall provide a detail to the Contractor before the sign is manufactured.
9. The temporary traffic control devices shown in the illustrations of the BC sheets are examples. As necessary, the Engineer will determine the most appropriate traffic control devices to be used.
10. As shown on BC(2), the OBEY WARNING SIGNS STATE LAW sign and the WORK ZONE TRAFFIC FINES DOUBLE sign with plaque shall be erected in advance of the CSJ limits. The BEGIN ROAD WORK NEXT X MILES, CONTRACTOR and END ROAD WORK signs shall be erected at or near the CSJ limits.
11. Except for devices required by Note 10, traffic control devices should be in place only while work is actually in progress or a definite need exists.
12. The Engineer has the final decision on the location of all traffic control devices.
13. Inactive equipment and work vehicles, including workers' private vehicles must be parked away from travel lanes. They should be as close to the right-of-way line as possible, or located behind a barrier or guardrail, or as approved by the Engineer.

Worker Safety Apparel Notes:

1. Workers on foot who are exposed to traffic or to construction equipment within the right-of-way shall wear high-visibility safety apparel meeting the requirements of ISEA "American National Standard for High-Visibility Apparel" labeled as ANSI 107-2004 standard performance for Class 2 or 3 risk exposure. Class 3 garments should be considered for high traffic volume work areas or night time work.

Only pre-qualified products shall be used. The "Compliant Work Zone Traffic Control Devices List" (CWZTCD) describes prequalified products and their sources and may be found on-line at the web address given below or by contacting:

Texas Department of Transportation
Traffic Operations Division - TE
Phone (512) 416-3134

WEB ADDRESSES FOR REFERENCED DOCUMENTS

Compliant Work Zone Traffic Control Devices List (CWZTCD)
http://www.txdot.gov/publications/traffic.htm

Texas Manual on Uniform Traffic Control Devices (TMUTCD)
http://www.txdot.gov/publications/traffic.htm

Standard Highway Sign Designs for Texas (SHSD)
http://www.txdot.gov/publications/traffic.htm

Traffic Engineering Standard Sheets
http://www.txdot.gov/business/disclaim.htm

Material Producer List
http://www.txdot.gov/business/producer*list.htm

Departmental Material Specifications (DMS)
http://www.txdot.gov/services/construction/material*specifications/

Roadway Design Manual
http://www.txdot.gov/services/general*services/manuals.htm

Texas Department of Transportation
Traffic Operations Division

BARRICADE AND CONSTRUCTION GENERAL NOTES AND REQUIREMENTS

1 of 12 BC(1)-07

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REVISIONS
4-03
9-07

CONT	SECT	JOB	HIGHWAY

DIST	COUNTY	SHEET NO.
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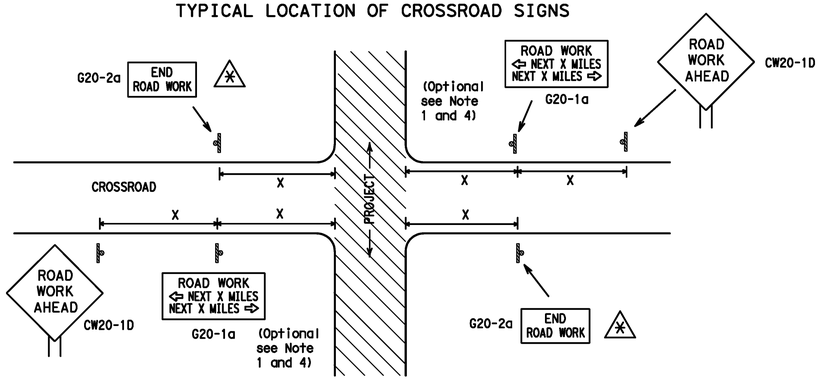
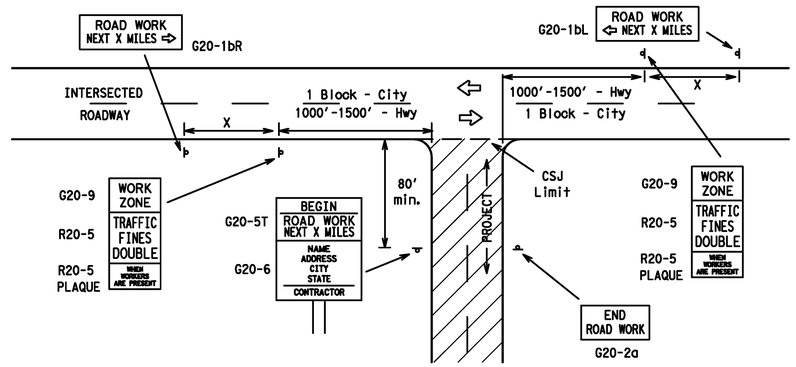
TYPICAL LOCATION OF CROSSROAD SIGNS



✱ May be mounted on back of CW20-1D sign with approval of engineer. (See note 2 below)

1. The typical minimum signing on a crossroad approach should be a CW20-1D ROAD WORK AHEAD sign and a G20-2a END ROAD WORK sign, unless noted otherwise in plans.
2. The Engineer may use the reduced size 36" x 36" ROAD WORK AHEAD (CW20-1D) sign mounted back to back with the reduced size 36" x 18" END ROAD WORK (G20-2a) sign on low volume crossroads (see Note 4 under "Typical Construction Warning Sign Size and Spacing"). See the "Standard Highway Sign Designs for Texas" manual for sign details. The Engineer may omit the advance warning signs on low volume crossroads. The Engineer will determine whether a road is low volume. This information shall be shown in the plans.
3. Based on existing field conditions, the Engineer/Inspector may require additional signs such as FLAGGER AHEAD, LOOSE GRAVEL, or other appropriate signs. When additional signs are required, these signs will be considered part of the minimum requirements. The Engineer/Inspector will determine the proper location and spacing of any sign not shown on the BC sheets, Traffic Control Plan sheets or the Work Zone Standard Sheets.
4. The G20-1a sign shall be required at high volume crossroads to advise motorists of the length of construction in either direction from the intersection. The Engineer will determine whether a roadway is considered high volume.
5. Additional traffic control devices may be shown elsewhere in the plans for higher volume crossroads.
6. When work occurs in the intersection area, appropriate traffic control devices, as shown elsewhere in the plans or as determined by the Engineer/Inspector, shall be in place.

T-INTERSECTION



CSJ LIMITS AT T-INTERSECTION

1. The Engineer will determine the types and location of any additional traffic control devices, such as a flagger and accompanying signs, or other signs, that should be used when work is being performed at or near an intersection.
2. If construction closes the road at a T-intersection the Contractor shall place the G20-6 "Contractor Name" sign behind the Type III Barricades for the road closure (see BC(10) also). The G20-1bL and G20-1bR signs shall be replaced by the detour signing called for in the plans.

TYPICAL CONSTRUCTION WARNING SIGN SIZE AND SPACING [1,5,6]

SIZE			SPACING	
Sign Number or Series	Conventional Road	Expressway/ Freeway	Posted Speed	Sign Spacing "X" Δ
			MPH	Feet (Apprx.)
CW20 [4], CW21, CW22, CW23, CW25	48" x 48"	48" x 48"	30	120
			35	160
			40	240
			45	320
CW1, CW2, CW7, CW8, CW9, CW11, CW14	36" x 36"	48" x 48"	50	400
			55	500 [2]
			60	600 [2]
CW3, CW4, CW5, CW6, CW8-3, CW10, CW12	48" x 48"	48" x 48"	65	700 [2]
			70	800 [2]
			75	900 [2]
			80	1000 [2]
			✱	✱ [3]

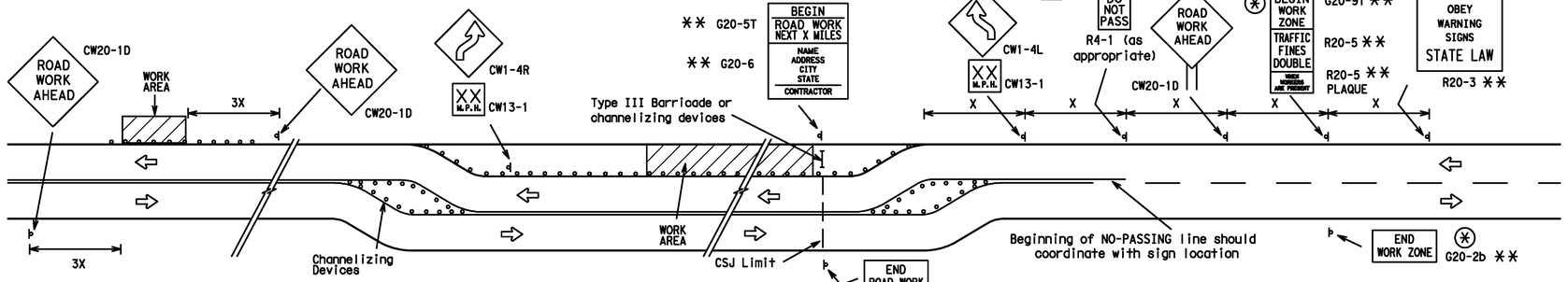
✱ For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

Δ Minimum distance from work area to first Advance Warning sign nearest the work area and/or distance between each additional sign.

General Notes:

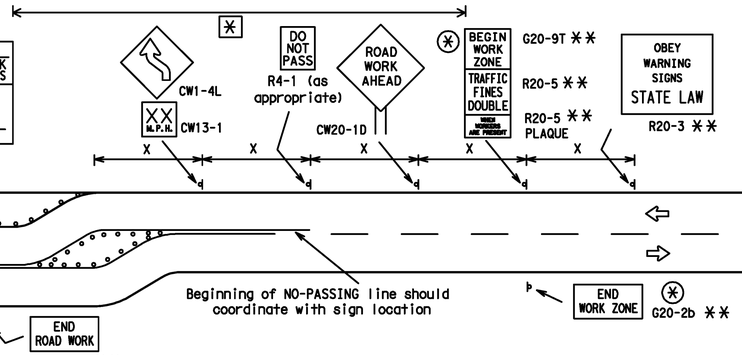
1. Special or larger size signs may be used as necessary.
2. Distance between signs should be increased as required to have 1500 feet advance warning.
3. Distance between signs should be increased as required to have ½ mile or more advance warning.
4. 36" x 36" ROAD WORK AHEAD (CW20-1D) signs may be used on low volume crossroads at the discretion of the Engineer. See Note 2 under "Typical Location of Crossroad Signs".
5. Only diamond shaped warning sign sizes are indicated.
6. See sign size listing in "TMUTCD", Sign Appendix or the "Standard Highway Sign Designs for Texas" manual for complete list of available sign design sizes.

WORK AREAS IN MULTIPLE LOCATIONS WITHIN CSJ LIMITS

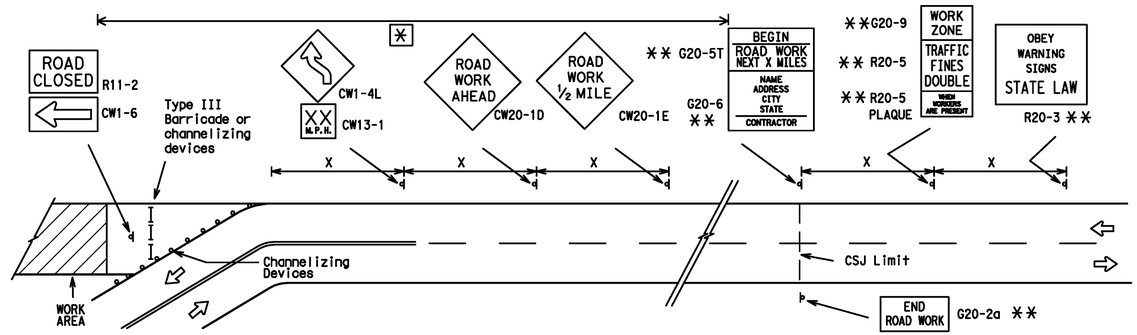


When extended distances occur between minimal work areas, the Engineer/Inspector should ensure additional Road Work Ahead (CW20-1D) signs are placed in advance of these work areas to remind drivers they are still within the project limits. See the applicable TCP sheets for exact location and spacing of signs and channelizing devices.

SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING AT THE CSJ LIMITS



SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING DOWNSTREAM OF THE CSJ LIMITS



NOTES

The Contractor shall determine the appropriate distance to be placed on the G20-1 series signs and G20-5T sign for each specific project. This distance shall replace the "X" and shall be rounded to the nearest whole mile with the approval of the Engineer. No decimals shall be used.

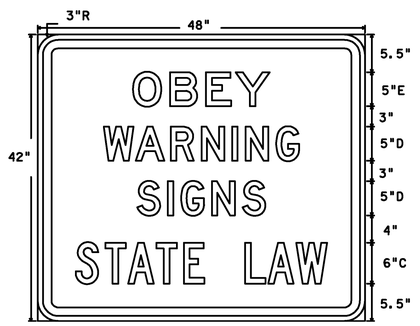
✱ The G20-9T and G20-2b shall be used when advance signs are required outside the CSJ Limits. They inform the motorist of entering or leaving a work zone where traffic fines may double if workers are present.

✱✱ Required CSJ Limit signing. See Note 10 on BC(1).

✱ Area for placement of "ROAD WORK AHEAD" sign and other signs or devices as called for on the Traffic Control Plan.

LEGEND

- Sign
- Channelizing Devices
- Type III Barricade
- X — See Typical Construction Warning Sign Size and Spacing chart or the TMUTCD for sign spacing requirements.



R20-3
Legend/Border - Black
Background - White

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Traffic Operations Division

BARRICADE AND CONSTRUCTION PROJECT LIMIT STANDARD

2 of 12 BC(2)-07

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9-07 REVISIONS	COUNT	SECT	JOB	HIGHWAY
	DIST	COUNTY		SHEET NO.
				T202

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FILE:

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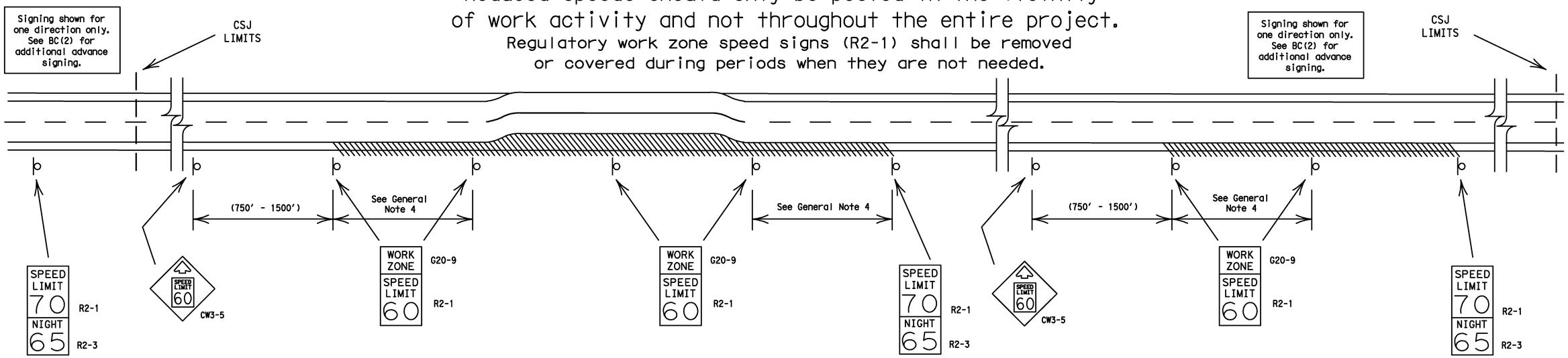
TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

Work zone speed limits shall be regulatory, established in accordance with the "Procedures for Establishing Speed Zones," and approved by the Texas Transportation Commission, or by City Ordinance when within Incorporated City Limits.

Reduced speeds should only be posted in the vicinity of work activity and not throughout the entire project.

Regulatory work zone speed signs (R2-1) shall be removed or covered during periods when they are not needed.



GUIDANCE FOR USE:

LONG/INTERMEDIATE TERM WORK ZONE SPEED LIMITS

This type of work zone speed limit should be included on the design of the traffic control plans when restricted geometrics with a lower design speed are present in the work zone and modification of the geometrics to a higher design speed is not feasible.

Long/Intermediate Term Work Zone Speed Limit signs, when approved as described above, should be posted and visible to the motorist when work activity is present. Work activity may also be defined as a change in the roadway that requires a reduced speed for motorists to safely negotiate the work area, including:

a) rough road or damaged pavement surface
b) substantial alteration of roadway geometrics (diversions)
c) construction detours
d) grade
e) width
f) other conditions readily apparent to the driver

As long as any of these conditions exist, the work zone speed limit signs should remain in place.

SHORT TERM WORK ZONE SPEED LIMITS

This type of work zone speed limit should be included on the design of the traffic control plans when workers or equipment are not behind concrete barrier, when work activity is within 15 feet of pavement edge or actually on the pavement.

Short Term Work Zone Speed Limit signs should be posted and visible to the motorists only when work activity is present. When work activity is not present, signs shall be removed or covered.
(See Removing or Covering on BC(4)).

GENERAL NOTES:

1. Regulatory work zone speed limits should be used only for sections of construction projects where speed control is of major importance.
2. Regulatory work zone speed limit signs shall be placed on supports at a 7 foot minimum mounting height.
3. Speed zone signs are illustrated for one direction of travel and are normally posted for each direction of travel.
4. Frequency of work zone speed limit signs should be:
   40 mph and greater 0.2 to 2 miles
   35 mph and less 0.2 to 1 mile
5. Regulatory speed limit signs shall have black legend and border on a white reflective background (See "Reflective Sheeting" on BC(4)).
6. Fabrication, errection and maintenance of the CW3-5 sign, G20-9 plaque and the R2-1 and R2-3 signs shall not be paid for directly, but shall be considered subsidiary to Item 502.
7. Turning signs from view, laying signs over or down will not be allowed, unless otherwise noted.
8. Techniques that may help reduce traffic speeds include but are not limited to:
   A. Law enforcement.
   B. Flagger stationed next to sign.
   C. Portable changeable message sign (PCMS).
   D. Low-power (drone) radar transmitter.
   E. Speed monitor trailers or signs.
9. Speeds shown on details above are for illustration only.
   Work Zone Speed Limits should only be posted as approved for each project.

Texas Department of Transportation
Traffic Operations Division

BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT STANDARD

3 of 12 BC(3)-07

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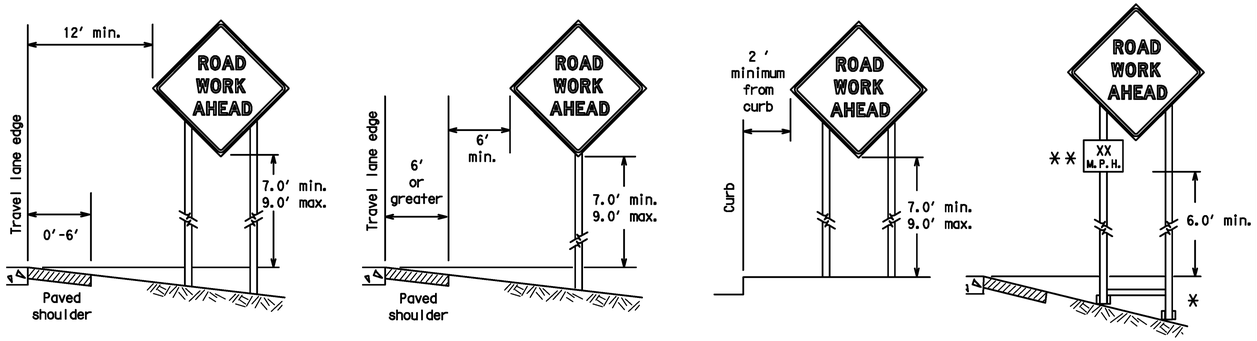
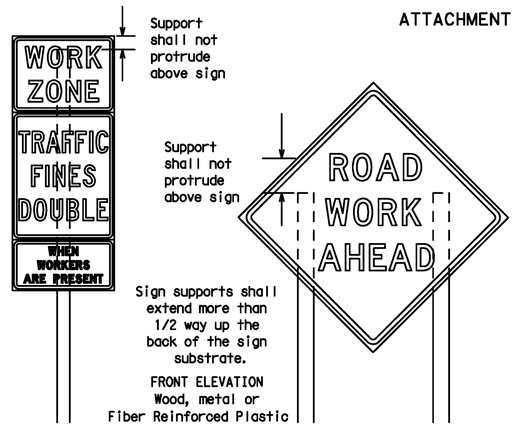
TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS

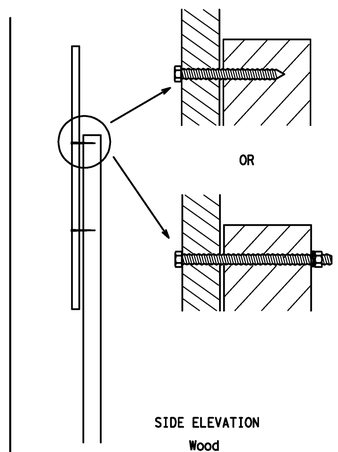


* When placing skid supports on unlevel ground, the leg post lengths must be adjusted so the sign appears straight and plumb. Objects shall NOT be placed under skids as a means of leveling.

** When plaques are placed on dual-leg supports, they should be attached to the upright nearest the travel lane. Supplemental plaques (advisory or distance) should not cover the surface of the parent sign.

ATTACHMENT FOR SIGN SUPPORTS





Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

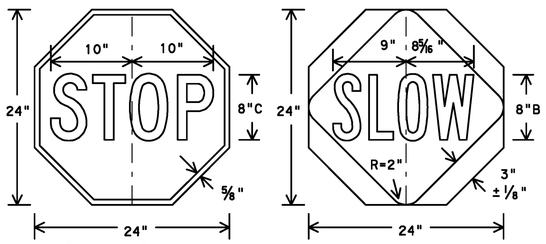
Nails will NOT be allowed.

Each sign shall be attached directly to the sign support. Multiple signs shall not be joined or spliced by any means. Wood supports shall not be extended or repaired by splicing or other means.

Splicing embedded perforated square metal tubing in order to extend post height will only be allowed when the splice is made using four bolts, two above and two below the spice point. Splice must be located entirely behind the sign substrate, not near the base of the support. Splice insert lengths should be at least 5 times nominal post size, centered on the splice and of at least the same guage material.

STOP/SLOW PADDLES

1. STOP/SLOW paddles are the primary method to control traffic by flaggers. The STOP/SLOW paddle size should be 24" x 24" as detailed below.
2. When used at night, the STOP/SLOW paddle shall be retroreflectorized.
3. STOP/SLOW paddles may be attached to a staff with a minimum length of 6' to the bottom of the sign.
4. Any lights incorporated into the STOP or SLOW paddle faces shall only be as specifically described in Section 6E.03 Hand Signaling Devices in the TMUTCD.



CONTRACTOR REQUIREMENTS FOR MAINTAINING PERMANENT SIGNS WITHIN THE PROJECT LIMITS

1. Permanent signs are used to give notice of traffic laws or regulations, call attention to conditions that are potentially hazardous to traffic operations, show route designations, destinations, directions, distances, services, points of interest, and other geographical, recreational, or cultural information. Drivers proceeding through a work zone need the same, if not better route guidance as normally installed on a roadway without construction.
2. When permanent regulatory or warning signs conflict with work zone conditions, remove or cover the permanent signs until the permanent sign message matches the roadway condition.
3. When existing permanent signs are moved and relocated due to construction purposes, they shall be visible to motorists at all times.
4. If existing signs are to be relocated on their original supports, they shall be installed on crashworthy bases as shown on the SMD Standard sheets. The signs shall meet the required mounting heights shown on the BC Sheets or the SMD Standards. This work should be paid for under the appropriate pay item for relocating existing signs.
5. If permanent signs are to be removed and relocated using temporary supports, the Contractor shall use crashworthy supports as shown on the BC sheets or the CWZTCD. The signs shall meet the required mounting heights shown on the BC Sheets or the SMD Standards during construction. This work should be paid for under the appropriate pay item for relocating existing signs.
6. Any sign or traffic control device that is struck or damaged by the Contractor or his/her construction equipment shall be replaced as soon as possible by the Contractor to ensure proper guidance for the motorists. This will be subsidiary to Item 502.

GENERAL NOTES FOR WORK ZONE SIGNS

1. Contractor shall install and maintain signs in a straight and plumb condition and/or as directed by the Engineer.
2. Wooden sign posts shall be painted white.
3. Barricades shall NOT be used as sign supports.
4. Nails shall NOT be used to attach signs to any support.
5. All signs shall be installed in accordance with the plans or as directed by the Engineer. Signs shall be used to regulate, warn, and guide the traveling public safely through the work zone.
6. The Contractor may furnish either the sign design shown in the plans or in the "Standard Highway Sign Designs for Texas" (SHSD). The Engineer/Inspector may require the Contractor to furnish other work zone signs that are shown in the TMUTCD but may have been omitted from the plans. Any variation in the plans shall be documented by written agreement between the Engineer and the Contractor's Responsible Person. All changes must be documented in writing before being implemented. This can include documenting the changes in the Inspector's TxDOT diary and having both the Inspector and Contractor initial and date the agreed upon changes.
7. The Contractor shall furnish sign supports listed in the "Compliant Work Zone Traffic Control Device List" (CWZTCD). The Contractor shall install the sign support in accordance with the manufacturer's recommendations. If there is a question regarding installation procedures, the Contractor shall furnish the Engineer a copy of the manufacturer's installation recommendations so the Engineer can verify the correct procedures are being followed.
8. The Contractor is responsible for installing signs on approved supports and replacing signs with damaged or cracked substrates and/or damaged or marred reflective sheeting as directed by the Engineer/Inspector.
9. Identification markings may be shown only on the back of the sign substrate. The maximum height of letters and/or company logos used for identification shall be 1 inch.
10. The Contractor shall replace damaged wood posts. New or damaged wood sign posts shall not be spliced.

DURATION OF WORK (as defined by the "Texas Manual on Uniform Traffic Control Devices" Part 6)

1. The types of sign supports, sign mounting height, the size of signs, and the type of sign substrates can vary based on the type of work being performed. The Engineer is responsible for selecting the appropriate size sign for the type of work being performed. The Contractor is responsible for ensuring the sign support, sign mounting height and substrate meets manufacturer's recommendations in regard to crashworthiness and duration of work requirements.
   a. Long-term stationary - work that occupies a location more than 3 days.
   b. Intermediate-term stationary - work that occupies a location more than one daylight period up to 3 days, or nighttime work lasting more than one hour.
   c. Short-term stationary - daytime work that occupies a location for more than 1 hour in a single daylight period.
   d. Short, duration - work that occupies a location up to 1 hour.
   e. Mobile - work that moves continuously or intermittently (stopping for up to approximately 15 minutes.)

SIGN MOUNTING HEIGHT

1. The bottom of Long-term/Intermediate-term signs shall be at least 7 feet, but not more than 9 feet, above the paved surface, except as shown for supplemental plaques mounted below other signs.
2. The bottom of Short-term/Short Duration signs shall be a minimum of 1 foot above the pavement surface but no more than 2 feet above the ground.
3. Long-term/Intermediate-term Signs may be used in lieu of Short-term/Short Duration signing.
4. Short-term/Short Duration signs shall be used only during daylight and shall be removed at the end of the workday. or raised to appropriate Long-term/Intermediate sign height.
5. Regulatory signs shall be mounted at least 7 feet, but not more than 9 feet, above the paved surface regardless of work duration.

SIZE OF SIGNS

1. The Engineer may allow the use of smaller size construction warning signs on secondary roads or city streets where speeds are low if the sign size is listed as an option on the "Typical Construction Warning Sign Size and Spacing" chart shown on BC(2).
2. The Contractor shall furnish the sign sizes shown in plans, the BC Sheets, the TCP sheets or as directed by the Engineer.

SIGN SUBSTRATES

1. The Contractor shall ensure the sign substrate is installed in accordance with the manufacturer's recommendations for the type of sign support that is being used. The CWZTCD lists each substrate that can be used on the different types and models of sign supports.
2. "Mesh" type materials are NOT an approved sign substrate, regardless of the tightness of the weave.
3. All wooden individual sign panels fabricated from 2 or more pieces shall have one or more plywood cleat, 1/2" thick by 6" wide, fastened to the back of the sign and extending fully across the sign. The cleat shall be attached to the back of the sign using wood screws that do not penetrate the face of the sign panel. The screws shall be placed on both sides of the splice and spaced at 6" centers. The Engineer may approve other methods of splicing the sign face.

REFLECTIVE SHEETING

1. All signs shall be retroreflective and constructed of sheeting meeting the color and retro-reflectivity requirements of DMS-8300 for rigid signs or DMS-8310 for roll-up signs. The web address for DMS specifications is shown on BC(1).
2. White sheeting, meeting the requirements of DMS-8300 Type C (High Specific Intensity), shall be used for signs with a white background.
3. Orange sheeting, meeting the requirements of DMS-8300 Type E (Fluorescent Prismatic), shall be used for rigid signs with orange backgrounds.

SIGN LETTERS

1. All sign letters and numbers shall be clear, and open rounded type uppercase alphabet letters as approved by the Federal Highway Administration (FHWA) and as published in the "Standard Highway Sign Design for Texas" manual. Signs, letters and numbers shall be of first class workmanship in accordance with Department Standards and Specifications.

REMOVING OR COVERING

1. When sign messages may be confusing or do not apply, the signs shall be removed or completely covered.
2. Long-term stationary or intermediate stationary signs installed on square metal tubing may be turned away from traffic 90 degrees when the sign message is not applicable. This type of sign support meets the crashworthiness standards regardless of the direction of impact. This technique may not be used for signs installed in the median of divided highways or near any intersections where the sign may be seen from approaching traffic.
3. Signs installed on wooden skids shall not be turned at 90 degree angles to the roadway. These signs should be removed or completely covered when not required.
4. When signs are covered, the material used shall be opaque, such as heavy mil black plastic, or other materials which will cover the entire sign face and maintain their opaque properties under automobile headlights at night, without damaging the sign sheeting.
5. Burlap shall NOT be used to cover signs.
6. Duct tape or other adhesive material shall NOT be affixed to a sign face. These materials can damage the retroreflectivity of sheeting.
7. Signs and anchor stubs shall be removed and holes backfilled upon completion of work.

SIGN SUPPORT WEIGHTS

1. Where sign supports require the use of weights to keep from turning over, the use of sandbags with dry, cohesionless sand is recommended.
2. The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight.
3. Rock, concrete, iron, steel or other solid objects shall not be permitted for use as sign support weights.
4. Sandbags should weigh a minimum of 35 lbs and a maximum of 50 lbs.
5. Sandbags shall be made of a durable material that tears upon vehicular impact.
6. Rubber (such as tire inner tubes) shall NOT be used for sandbags.
7. Rubber ballasts designed for channelizing devices should not be used for ballast on portable sign supports. Sign supports designed and manufactured with rubber bases may be used when shown on the CWZTCD list.
8. Sandbags shall only be placed along or laid over the base supports of the traffic control device and shall not be suspended above ground level or hung with rope, wire, chains or other fasteners. Sandbags shall be placed along the length of the skids to weigh down the sign support.
9. Sandbags shall NOT be placed under the skid and shall not be used to level sign supports placed on slopes.

Texas Department of Transportation
Traffic Operations Division

BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES STANDARD

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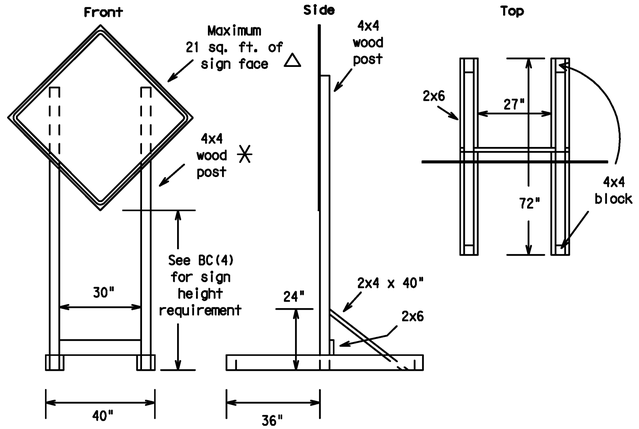
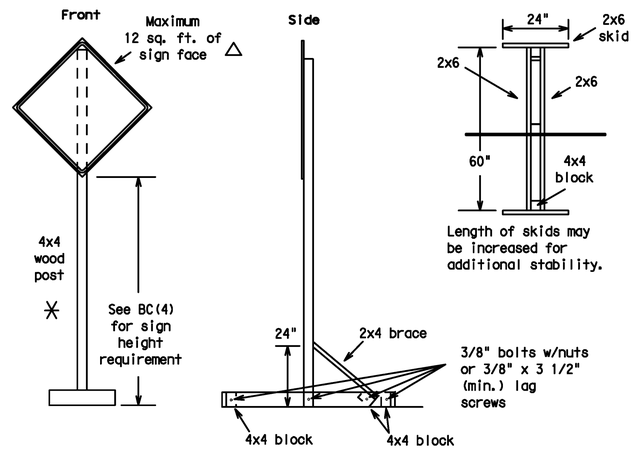
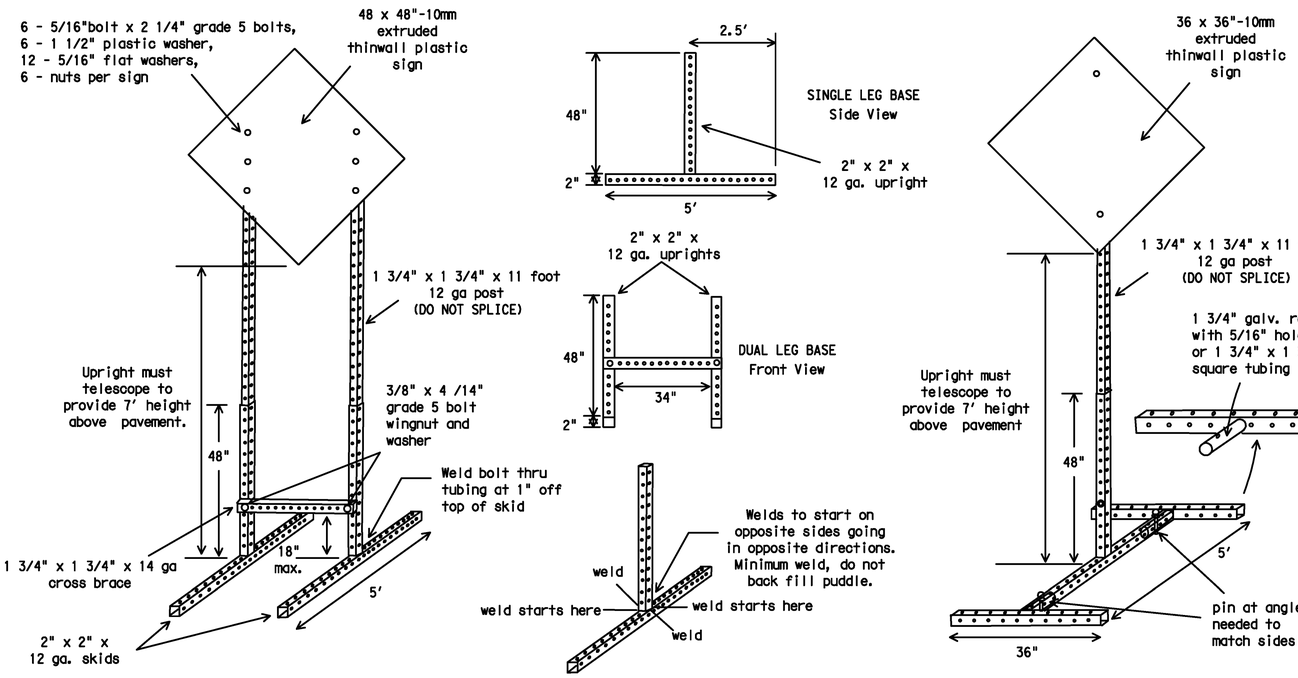
SKID MOUNTED WOOD SIGN SUPPORTS

LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS □





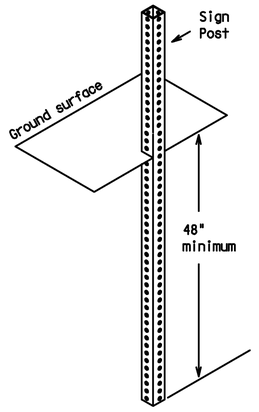
SKID MOUNTED PERFORATED SQUARE STEEL TUBING SIGN SUPPORTS



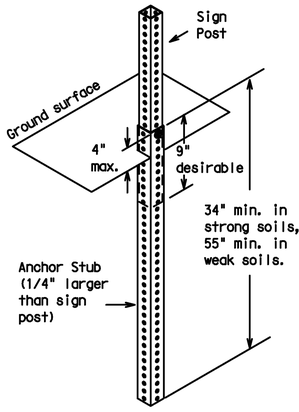
GROUND MOUNTED SIGN SUPPORTS

Refer to the CWZTCD and the manufacturer's installation procedure for each type sign support.
The maximum sign square footage shall adhere to the manufacturer's recommendation.
Two post installations can be used for larger signs.

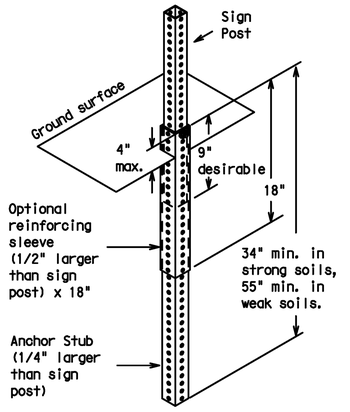
PERFORATED SQUARE METAL TUBING



OPTION 1
(Direct Embedment)



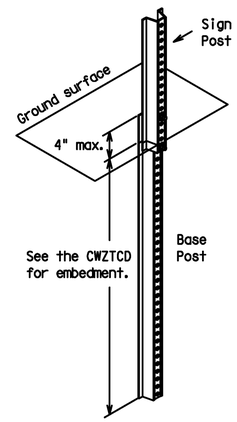
OPTION 2
(Anchor Stub)



OPTION 3
(Anchor Stub and Reinforcing Sleeve))

WING CHANNEL

Lap-splice/base bolted anchor



GENERAL NOTES

1. Nails may be used in the assembly of wooden sign supports, but 3/8" bolts with nuts or 3/8" x 3 1/2" lag screws must be used on every joint for final connection.
2. More details of approved Long/Intermediate and Short Term supports can be found on the CWZTCD list. See BC(1) for website location.
3. No more than 2 sign posts shall be placed within a 7 ft. circle, except for specific materials noted on the CWZTCD List.
4. When project is completed, all sign supports and foundations shall be removed from the project site. This will be considered subsidiary to Item 502.

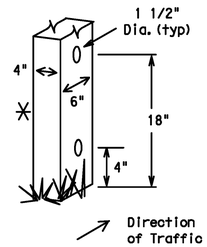
□ See BC(4) for definition of "Work Duration."

✳ Wood sign posts MUST be one piece. Splicing will NOT be allowed. Posts shall be painted white.

△ See the CWZTCD for the type of sign substrate that can be used for each approved sign support.

WEDGE ANCHORS

Both steel and plastic Wedge Anchor Systems as shown on the SMD Standard Sheets may be used as temporary sign supports for signs up to 10 square feet of sign face. They may be set in concrete or in sturdy soils if approved by the Engineer. (See web address for "Traffic Engineering Standard Sheets" on BC(1)).



WOOD POST SYSTEM FOR GROUND MOUNTED SIGN SUPPORTS

Nominal Post Size	No. of Posts	Maximum Sq. feet of Sign Face	Minimum Soil Embedment	Drilled Hole(s) Required
4 x 4	1	12	36"	NO
4 x 4	2	21	36"	NO
4 x 6	1	21	36"	YES
4 x 6	2	36	36"	YES

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Traffic Operations Division

BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT STANDARD

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PORTABLE CHANGEABLE MESSAGE SIGNS

1. The Engineer/Inspector shall approve all messages used on portable changeable message signs (PCMS).
2. Messages on PCMS should contain no more than 8 words (about four to eight characters per word), not including simple words such as "TO," "FOR," "AT," etc.
3. Messages should consist of a single phase, or two phases that alternate. Three-phase messages are not allowed. Each phase of the message should convey a single thought, and must be understood by itself.
4. Use the word "EXIT" to refer to an exit ramp on a freeway; i.e., "EXIT CLOSED." Do not use the term "RAMP."
5. Always use the route or interstate designation (IH, US, SH, FM) along with the number when referring to a roadway.
6. When in use the bottom of a stationary PCMS message panel should be a minimum 7 feet above the roadway, where possible.
7. The message term "WEEKEND" should be used only if the work is to start on Saturday morning and end by Sunday evening at midnight. Actual days and hours of work should be displayed on the PCMS if work is to begin on Friday evening and/or continue into Monday morning.
8. The Engineer/Inspector may select one of two options which are available for displaying a two-phase message on a PCMS. Each phase may be displayed for either four seconds each or for three seconds each.
9. Do not "flash" messages or words included in a message. The message should be steady burn or continuous while displayed.
10. Do not present redundant information on a two-phase message; i.e., keeping two lines of the message the same and changing the third line.
11. Do not use the word "Danger" in message.
12. Do not display the message "LANES SHIFT LEFT" or "LANES SHIFT RIGHT" on a PCMS. Drivers do not understand the message.
13. Do not display messages that scroll horizontally or vertically across the face of the sign.
14. The following table lists abbreviated words and two-word phrases that are acceptable for use on a PCMS. Both words in a phrase must be displayed together. Words or phrases not on this list should not be abbreviated.
15. PCMS character height should be at least 18 inches for trailer mounted units. They should be visible from at least 1/2 (.5) mile and the text should be legible from at least 720 feet. Truck mounted units must have a character height of 10 inches and must be legible from at least 400 feet.
16. Each line of text should be centered on the message board rather than left or right justified.
17. If disabled, the PCMS should default to an illegible display that will not alarm motorists and will only be used to alert workers that the PCMS has malfunctioned. A pattern such as a series of horizontal solid bars is appropriate.

Word or Phrase	Abb.	Word or Phrase	Abb.
Access Road	ACCS RD	Major	MAJ
Air Quality	AIR QLTY	Miles	MI
Alternate	ALT	Miles Per Hour	MPH
Avenue	AVE	Minor	MNR
Best Route	BEST RTE	Monday	MON
Boulevard	BLVD	Normal	NORM
Bridge	BRDG	North	N
Cannot	CANT	Northbound	(route) N
Center	CNTR	Parking	PKING
Construction Ahead	CONST AHEAD	Parking Lot	PRK LOT
Detour Route	DETOUR RTE	Road	RD
Do Not	DONT	Right Lane	RGT LN
East	E	Saturday	SAT
Eastbound	(route) E	Service Road	SERV RD
Emergency	EMER	Shoulder	SHLDR
Emergency Vehicle	EMER VEH	Slippery	SLIP
Entrance, Enter	ENT	South	S
Express Lanes	EXP LANE	Southbound	(route) S
Expressway	EXPWY	Speed	SPD
XXXX Feet	XXXX FT	Street	ST
Fog Ahead	FOG AHD	Sunday	SUN
Freeway	FRWY, FWY	Telephone	PHONE
Freeway Blocked	FWY BLKD	Temporary	TEMP
Friday	FRI	Thursday	THURS
Hazardous Driving	HAZ DRIVING	To Downtown	TO DWNTN
Hazardous Material	HAZMAT	Traffic	TRAF
High-Occupancy Vehicle	HOV	Travelers	TRVLRS
Highway	HWY	Tuesday	TUES
Hours	HR	Time Minutes	TIME MIN
Information	INFO	Upper Level	UPPR LVL
It Is	ITS	Vehicle	VEH
Junction	JCT	Warning	WARN
Left	LFT	Wednesday	WED
Left Lane	LFT LN	Weight Limit	WT LIMIT
Lane Closed	LN CLSD	West	W
Lower Level	LOWR LVL	Westbound	(route) W
Maintenance	MAINT	Wet Pavement	WET PVMT
		Will Not	WONT

Roadway designation # IH-number, US-number, SH-number, FM-number

WHEN NOT IN USE, REMOVE THE PCMS FROM THE RIGHT-OF-WAY OR PLACE THE PCMS BEHIND BARRIER OR GUARDRAIL WITH SIGN PANEL TURNED PARALLEL TO TRAFFIC

RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

(The Engineer may approve other messages not specifically covered here.)

Phase 1: Condition Lists

Road/Lane/Ramp Closure List

FREEWAY CLOSED X MILE	FRONTAGE ROAD CLOSED
ROAD CLOSED AT SH XXX	SHOULDER CLOSED XXX FT
ROAD CLSD AT FM XXXX	RIGHT LN CLOSED XXX FT
RIGHT X LANES CLOSED	RIGHT X LANES OPEN
CENTER LANE CLOSED	DAYTIME LANE CLOSURES
NIGHT LANE CLOSURES	I-XX SOUTH EXIT CLOSED
VARIOUS LANES CLOSED	EXIT XXX CLOSED X MILE
EXIT CLOSED	RIGHT LN TO BE CLOSED
MALL DRIVEWAY CLOSED	X LANES CLOSED TUE - FRI
XXXXXXXX BLVD CLOSED	

Other Condition List

ROADWORK XXX FT	ROAD REPAIRS XXXX FT
FLAGGER XXXX FT	LANE NARROWS XXXX FT
RIGHT LN NARROWS XXXX FT	TWO-WAY TRAFFIC XX MILE
MERGING TRAFFIC XXXX FT	CONST TRAFFIC XXX FT
LOOSE GRAVEL XXXX FT	UNEVEN LANES XXXX FT
DETOUR X MILE	ROUGH ROAD XXXX FT
ROADWORK PAST SH XXXX	ROADWORK NEXT FRI-SUN
BUMP XXXX FT	US XXX EXIT X MILES
TRAFFIC SIGNAL XXXX FT	LANES SHIFT *

* LANES SHIFT in Phase 1 must be used with STAY IN LANE in Phase 2.

Phase 2: Possible Component Lists

Action to Take/Effect on Travel List		Location List	Warning List	** Advance Notice List
MERGE RIGHT	FORM X LINES RIGHT	AT FM XXXX	SPEED LIMIT XX MPH	TUE-FRI XX AM- X PM
DETOUR NEXT X EXITS	USE XXXXX RD EXIT	BEFORE RAILROAD CROSSING	MAXIMUM SPEED XX MPH	APR XX-XX X PM-X AM
USE EXIT XXX	USE EXIT I-XX NORTH	NEXT X MILES	MINIMUM SPEED XX MPH	BEGINS MONDAY
STAY ON US XXX SOUTH	USE I-XX E TO I-XX N	PAST US XXX EXIT	ADVISORY SPEED XX MPH	BEGINS MAY XX
TRUCKS USE US XXX N	WATCH FOR TRUCKS	XXXXXXX TO XXXXXXX	RIGHT LANE EXIT	MAY X-X XX PM - XX AM
WATCH FOR TRUCKS	EXPECT DELAYS	US XXX TO FM XXXX	USE CAUTION	NEXT FRI-SUN
EXPECT DELAYS	PREPARE TO STOP		DRIVE SAFELY	XX AM TO XX PM
REDUCE SPEED XXX FT	END SHOULDER USE		DRIVE WITH CARE	NEXT TUE AUG XX
USE OTHER ROUTES	WATCH FOR WORKERS			TONIGHT XX PM- XX AM
STAY IN LANE *				

** See Application Guidelines Note 6.

Application Guidelines

1. Only 1 or 2 phases are to be used on a PCMS.
2. The 1st phase (or both) should be selected from the "Road/Lane/Ramp Closure List" and the "Other Condition List".
3. A 2nd phase can be selected from the "Action to Take/Effect on Travel, Location, General Warning, or Advance Notice Phase Lists".
4. A Location Phase is necessary only if a distance or location is not included in the first phase selected.
5. If two PCMS are used in sequence, they must be separated by a minimum of 1000 ft. Each PCMS shall be limted to two phases, and should be understandable by themselves.
6. For advance notice, when the current date is within seven days of the actual work date, calendar days should be replaced with days of the week. Advance notification should typically be for no more than one week prior to the work

Wording Alternatives

1. The words RIGHT, LEFT and ALL can be interchanged as appropriate.
2. Roadway designations IH, US, SH, FM and LP can be interchanged as appropriate.
3. EAST, WEST, NORTH and SOUTH (or abbreviations E, W, N and S) can be interchanged as appropriate.
4. Highway names and numbers replaced as appropriate.
5. ROAD, HIGHWAY and FREEWAY can be interchanged as needed.
6. AHEAD may be used instead of distances if necessary.
7. FT and MI, MILE and MILES interchanged as appropriate.
8. AT, BEFORE and PAST interchanged as needed.
9. Distances or AHEAD can be eliminated from the message if a location phase is used.

PCMS SIGNS WITHIN THE R.O.W. SHALL BE BEHIND GUARDRAIL OR CONCRETE BARRIER OR SHALL HAVE A MINIMUM OF FOUR (4) PLASTIC DRUMS PLACED PERPENDICULAR TO TRAFFIC ON THE UPSTREAM SIDE OF THE PCMS.

FULL MATRIX PCMS SIGNS

1. When Full Matrix PCMS signs are used, the character height and legibility/visibility requirements shall be maintained as listed in Note 15 under "PORTABLE CHANGEABLE MESSAGE SIGNS" above.
2. When symbol signs, such as the CW20-7a Flagger Symbol, are represented graphically on the Full Matrix PCMS sign and, with the approval of the Engineer, it shall maintain the legibility/visibility requirement listed above.
3. When symbol signs are represented graphically on the Full Matrix PCMS, they shall only supplement the use of the static sign represented, and shall not substitute for, or replace that sign.
4. A full matrix PCMS may be used to simulate a flashing arrow panel provided it meets the visibility, flash rate and dimming requirements on BC(7), for the same size arrow.

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BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS) STANDARD

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		T206

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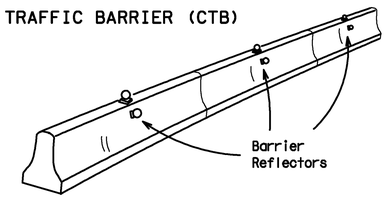
BARRIER REFLECTORS FOR CONCRETE TRAFFIC BARRIER AND ATTENUATORS

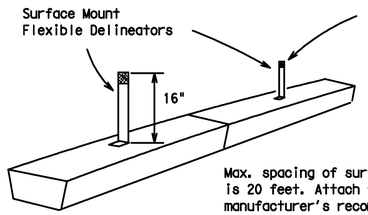
1. Barrier Reflectors shall be prequalified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors (Type C Delineators) can be found at the Material Producer List web address shown on BC(1).
2. Color of Barrier Reflectors shall be as specified in the TMUTCD. The cost of the reflectors shall be considered subsidiary to Item 502.

CONCRETE TRAFFIC BARRIER (CTB)



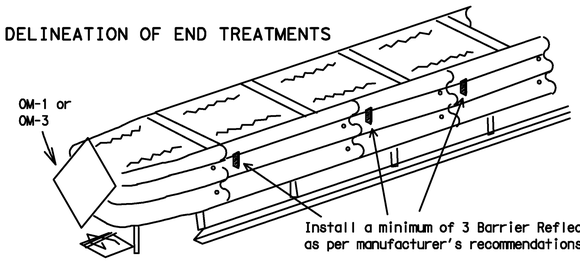
3. Where traffic is on one side of the CTB, two (2) Barrier Reflectors shall be mounted in approximately the midsection of each section of CTB. An alternate mounting location is uniformly spaced at one end of each CTB. This will allow for attachment of a barrier grapple without damaging the reflector. The Barrier Reflector mounted on the side of the CTB shall be located directly below the reflector mounted on top of the barrier, as shown in the detail above.
4. Where CTB separates two-way traffic, three barrier reflectors shall be mounted on each section of CTB. The reflector unit on top shall have two yellow reflective faces (Bi-Directional)while the reflectors on each side of the barrier shall have one yellow reflective face, as shown in the detail above.
5. When CTB separates traffic traveling in the same direction, no barrier reflectors will be required on top of the CTB.
6. Barrier Reflector units shall be yellow or white in color to match the edgeline being supplemented. Yellow Barrier Reflectors shall be made with Type E Fluorescent Prismatic Yellow Retroreflective Sheeting. White reflectors shall be made with Type D White Prismatic sheeting.
7. Maximum spacing of Barrier Reflectors is forty (40) feet.
8. Pavement markers or temporary flexible-reflective roadway marker tabs shall NOT be used as CTB delineation.
9. Attachment of Barrier Reflectors to CTB shall be per manufacturer's recommendations.
10. Missing or damaged Barrier Reflectors shall be replaced as directed by the Engineer.
11. Single slope barriers shall be delineated as shown on the above detail.

LOW PROFILE CONCRETE BARRIER (LPCB)



Max. spacing of surface mount flexible delineators is 20 feet. Attach the delineators as per manufacturer's recommendations.

DELINEATION OF END TREATMENTS



	APPROACHING TRAFFIC	
	BOTH SIDES	ONE SIDE
DELINEATION	OM-1	OM-3 or Vertical Panel

END TREATMENTS FOR CTB'S USED IN WORK ZONES

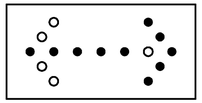
End treatments used on CTB's in work zones shall meet crashworthy standards as defined in the National Cooperative Highway Research Report 350. Refer to the CWZTCD List for approved end treatments and manufacturers.

TYPICAL FLASHING ARROW PANEL

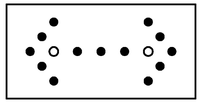
Arrow Panels may be located behind channelizing devices in place for a shoulder taper or merging taper, otherwise they shall be delineated with four (4) channelizing devices placed perpendicular to traffic on the upstream side of traffic.

1. The Flashing Arrow Panel should be used for all lane closures on multi-lane roadways, or slow moving maintenance or construction activities on the travel lanes.
2. Flashing Arrow Panels should not be used on two-lane, two-way roadways, detours, diversions or work on shoulders unless the "CAUTION" display (see detail below) is used.
3. The Engineer/Inspector shall choose all appropriate signs, barricades and/or other traffic control devices that should be used in conjunction with the Flashing Arrow Panel.
4. The Flashing Arrow Panel should be able to display the following symbols:

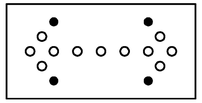
Flashing RIGHT (LEFT) ARROW



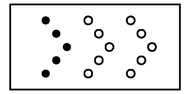
Flashing DOUBLE ARROW



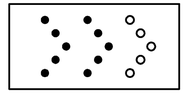
Flashing CAUTION

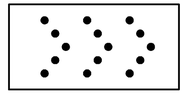


5. The "CAUTION" display consists of four corner lamps flashing simultaneously.
6. The straight line caution display is NOT ALLOWED.
7. The Flashing Arrow Panel shall be capable of minimum 50 percent dimming from rated lamp voltage. The flashing rate of the lamps shall not be less than 25 nor more than 40 flashes per minute.
8. Minimum lamp "on time" shall be approximately 50 percent for the flashing arrow and equal intervals of 25 percent for each sequential phase of the flashing chevron.
9. The sequential arrow display is NOT ALLOWED.
10. The flashing arrow display is the TxDOT standard; however, the sequential Chevron display may be used during daylight operations.



Sequential Chevron





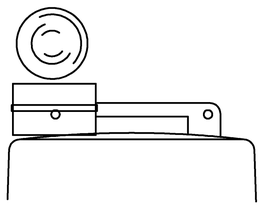
REQUIREMENTS

TYPE	MINIMUM SIZE	MINIMUM NUMBER OF PANEL LAMPS	MINIMUM VISIBILITY DISTANCE
B	30 x 60	13	3/4 mile
C	48 x 96	15	1 mile

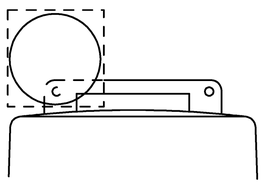
ATTENTION: Flashing Arrow Panels shall be equipped with automatic dimming devices.

WHEN NOT IN USE, REMOVE THE ARROW PANEL FROM THE RIGHT-OF-WAY OR PLACE THE ARROW PANEL BEHIND CONCRETE TRAFFIC BARRIER OR GUARDRAIL.

11. The Flashing Arrow Panel shall be mounted on a vehicle, trailer or other suitable support.
12. A Flashing Arrow Panel SHALL NOT BE USED to laterally shift traffic.
13. A full matrix PCMS may be used to simulate a Flashing Arrow Panel provided it meets visibility, flash rate and dimming requirements on this sheet for the same size arrow.
14. Minimum mounting height of trailer mounted arrow panels should be 7 feet from roadway to bottom of panel.



Type C Warning Light or approved substitute mounted adjacent to the travel way.



Warning reflector may be round or square. Must have a reflective surface area of at least 30 square inches

WARNING LIGHTS

1. Warning lights shall meet the requirements of the TMUTCD.
2. Warning lights shall NOT be installed on barricades.
3. Type A-Low Intensity Flashing Warning Lights are commonly used with drums. They are intended to warn of or mark a potentially hazardous area. Their use shall be as indicated on this sheet and/or other sheets of the plans by the designation "FL". The Type A Warning Lights shall not be used with signs manufactured with Type E Sheeting (Fluorescent Prismatic) meeting the requirements of Departmental Material Specification DMS-8300.
4. Type-C and Type D 360 degree Steady Burn Lights are intended to be used in a series for delineation to supplement other traffic control devices. Their use shall be as indicated on this sheet and/or other sheets of the plans by the designation "SB".
5. The Engineer/Inspector or the plans shall specify the location and type of warning lights to be installed on the traffic control devices.
6. When required by the Engineer, the Contractor shall furnish a copy of the warning lights certification. The warning light manufacturer will certify the warning lights meet the requirements of the latest ITE Purchase Specifications for Flashing and Steady-Burn Warning Lights.
7. When used to delineate curves, Type-C and Type D Steady Burn Lights should only be placed on the outside of the curve, not the inside.

WARNING LIGHTS MOUNTED ON PLASTIC DRUMS

1. Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
2. Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
3. A series of sequential flashing warning lights placed on channelizing devices to form a merging taper may be used for delineation. If used, the successive flashing of the sequential warning lights should occur from the beginning of the taper to the end of the merging taper in order to identify the desired vehicle path. The rate of flashing for each light shall be 65 flashes per minute, plus or minus 10 flashes.
4. Type C and D steady-burn warning lights are intended to be used in a series to delineate the edge of the travel lane on detours, on lane changes, on lane closures, and on other similar conditions.
5. Type A, Type C and Type D warning lights shall be installed at locations as detailed on other sheets in the plans.
6. Warning lights shall not be installed on a drum that has a sign, chevron or vertical panel.
7. The maximum spacing for warning lights on drums should be identical to the channelizing device spacing.

WARNING REFLECTORS MOUNTED ON PLASTIC DRUMS AS A SUBSTITUTE FOR TYPE C (STEADY BURN) WARNING LIGHTS

1. A warning reflector or approved substitute may be mounted on a plastic drum as a substitute for a Type C, steady burn warning light at the discretion of the Contractor unless otherwise noted in the plans.
2. The warning reflector shall be yellow in color and shall be manufactured using a sign substrate approved for use with plastic drums listed on the CWZTCD.
3. The warning reflector shall have a minimum retroreflective surface area (one-side) of 30 square inches.
4. Round reflectors shall be fully reflectorized, including the area where attached to the drum.
5. Square substrates must have a minimum of 30 square inches of reflectorized sheeting. They do not have to be reflectorized where it attaches to the drum.
6. The side of the warning reflector facing approaching traffic shall have sheeting meeting the color and retroreflectivity requirements for DMS 8300-Type D (Non-fluorescent Prismatic).
7. When used near two-way traffic, both sides of the warning reflector shall be reflectorized.
8. The warning reflector should be mounted on the side of the handle nearest approaching traffic.
9. The maximum spacing for warning reflectors should be identical to the channelizing device spacing requirements.

TRUCK-MOUNTED ATTENUATORS

1. Truck-mounted attenuators (TMA) used on TxDOT facilities must meet the requirements outlined in the National Cooperative Highway Research Report No. 350 (NCHRP 350).
2. Refer to the CWZTCD for the requirements of Level 2 or Level 3 TMAs.
3. Refer to the dates shown in the CWZTCD to ensure that the TMA meets the age requirements and the crashworthiness criteria established by the Federal Highway Administration (FHWA) for TMAs.
4. Refer to the CWZTCD for a list of approved TMAs.
5. TMAs are required on freeways unless otherwise noted in the plans.
6. A TMA should be used anytime that it can be positioned approximately 30 to 100 feet in advance of the area of crew exposure without adversely affecting the work performance.
7. The only reason a TMA should not be required is when a work area is spread down the roadway and the work crew is an extended distance from the TMA.

Texas Department of Transportation
Traffic Operations Division

BARRICADE AND CONSTRUCTION ARROW PANEL, REFLECTORS, WARNING LIGHTS & ATTENUATOR STANDARD

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BC(7)-07

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DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
9-07 REVISIONS	COUNT	SECT	JOB	HIGHWAY
	DIST	COUNTY		SHEET NO.
				T207

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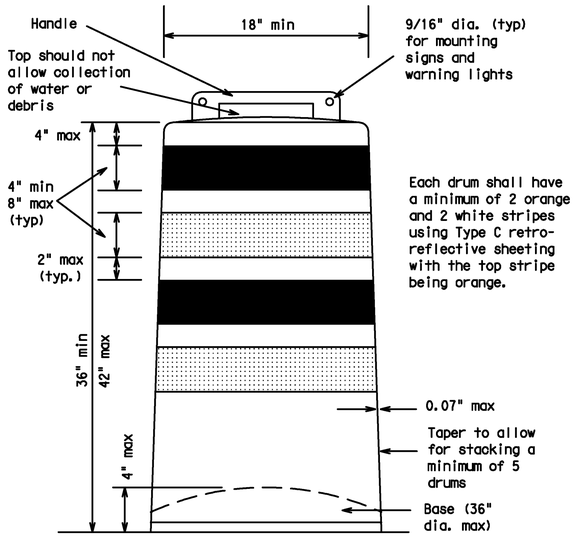


GENERAL NOTES

1. For long term stationary work zones on freeways, drums shall be used as the primary channelizing device.
2. For intermediate term stationary work zones on freeways, drums should be used as the primary channelizing device but may be replaced in tangent sections by vertical panels, or 42" two-piece cones. In tangent sections one-piece cones may be used with the approval of the Engineer but only if personnel are present on the project at all times to maintain the cones in proper position and location.
3. For short term stationary work zones on freeways, drums are the preferred channelizing device but may be replaced in tapers, transitions and tangent sections by vertical panels, two-piece cones ar one-piece cones as approved by the Engineer.
4. Drums and all related items shall comply with the requirements of the current version of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) and the "Compliant Work Zone Traffic Control Devices List" (CWZTCD).
5. Drums, bases, and related materials shall exhibit good workmanship and shall be free from objectionable marks or defects that would adversely affect their appearance or serviceability.
6. The Contractor shall have a maximum of 24 hours to replace any plastic drums identified for replacement by the Engineer/Inspector. The replacement device must be an approved device.

GENERAL DESIGN REQUIREMENTS

Prequalified plastic drums shall meet the following requirements:

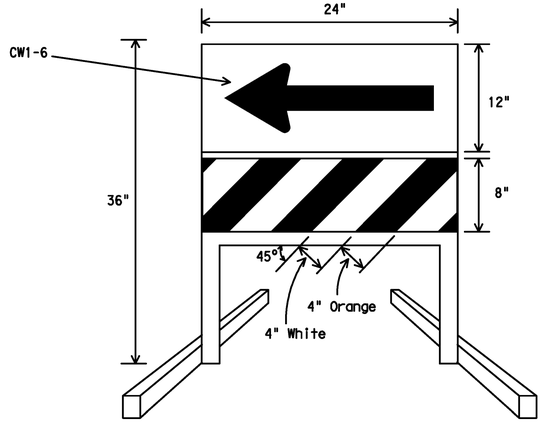
1. Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
2. The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents accidental separation due to normal handling and/or air turbulence created by passing vehicles.
3. Plastic drums shall be constructed of lightweight flexible, and deformable materials. The Contractor shall NOT use metal drums or single piece plastic drums as channelization devices or sign supports.
4. Drums shall present a profile that is a minimum of 18 inches in width at the 36 inch height when viewed from any direction. The height of drum unit (body installed on base) shall be a minimum of 36 inches and a maximum of 42 inches.
5. The top of the drum shall have a built-in handle for easy pickup and shall be designed to drain water and not collect debris. The handle shall have a minimum of two widely spaced 9/16 inch diameter holes to allow attachment of a warning light, warning reflector unit or approved compliant sign.
6. The exterior of the drum body shall have a minimum of four alternating orange and white retroreflective circumferential stripes not less than 4 inches nor greater than 8 inches in width. Any non-reflectorized space between any two adjacent stripes shall not exceed 2 inches in width.
7. Bases shall have a maximum width of 36 inches, a maximum height of 4 inches, and a minimum of two footholds of sufficient size to allow base to be held down while separating the drum body from the base.
8. Plastic drums shall be constructed of ultra-violet stabilized, orange, high-density polyethylene (HDPE) or other approved material.
9. Drum body shall have a minimum unballasted weight of 7.7 lbs. and maximum unballasted weight of 11 lbs. The wall of the drum body shall be a minimum of 0.07 inch in thickness. Weight of any drum supplied shall not vary more than 0.5 lb. from that of the prequalified sample.
10. Drum and base shall be marked with manufacturer's name and model number.

RETROREFLECTIVE SHEETING

1. The stripes used on drums shall be constructed of sheeting meeting the color and retroreflectivity requirements of Departmental Materials Specification DMS-8300, "Flat Surface Reflective Sheeting." High Specific Intensity (Type C) retroreflective sheeting shall be supplied unless otherwise specified in the plans.
2. The sheeting shall be suitable for use on and shall adhere to the drum surface such that, upon vehicular impact, the sheeting shall remain adhered in-place and exhibit no delaminating, cracking, or loss of retroreflectivity other than that loss due to abrasion of the sheeting surface.

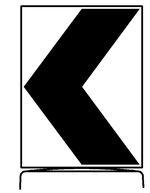
BALLAST

1. Unballasted bases shall be large enough to hold up to 50 lbs. of sand. This base, when filled with the ballast material, should weigh between 35 lbs (minimum) and 50 lbs (maximum). The ballast may be sand in one to three sandbags separate from the base, sand in a sand-filled plastic base, or other ballasting devices as approved by the Engineer. Stacking of sandbags will be allowed, however height of sandbags above pavement surface may not exceed 12 inches.
2. Bases with built-in ballast shall weigh between 40 lbs. and 50 lbs. Built-in ballast can be constructed of an integral crumb rubber base or a solid rubber base.
3. The ballast shall not be heavy objects, water, or any material that would become hazardous to motorists, pedestrians, or workers when the drum is struck by a vehicle.
4. When used in regions susceptible to freezing, drums shall have drainage holes in the bottoms so that water will not collect and freeze becoming a hazard when struck by a vehicle.
5. Ballast shall not be placed on top of drums.
6. Adhesives may be used to secure base of drums to pavement.

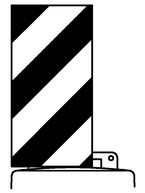


DIRECTION INDICATOR BARRICADE

1. The Direction Indicator Barricade may be used in tapers, transitions, and other areas where specific directional guidance to drivers is necessary.
2. If used, the Direction Indicator Barricade should be used in series to direct the driver through the transition and into the intended travel lane.
3. The Direction Indicator Barricade shall consist of One-Direction Large Arrow (CW1-6) sign in the size shown with a black arrow on a background of Type E Fluoprescent Prismatic Orange above a rail with Type C High Specific Intensity retroreflective sheeting in alternation 4" white and orange stripes sloping downward at an angle of 45 degrees in the direction road users are to pass.
4. Double arrows on the Direction Indicator Barricade will not be allowed.
5. Approved manufacturers are shown on the CWZTCD List. Ballast shall be as approved by the manufacturers instructions.



18" x 24" Sign
(Maximum Sign Dimension)
Chevron CW1-8, Opposing Traffic Lane Divider, Driveway sign D70a, Keep Right R4 series or other signs as approved by Engineer



12" x 24"
Vertical Panel
mount with diagonals sloping down towards travel way

Plywood, Aluminum or Metal sign substrates shall NOT be used on plastic drums

SIGNS, CHEVRONS, AND VERTICAL PANELS MOUNTED ON PLASTIC DRUMS

1. Signs used on plastic drums shall be manufactured using substrates listed on the CWZTCD.
2. Chevrons and other work zone signs with an orange background shall be manufactured with Type E (Fluorescent Prismatic) sheeting meeting the color and retroreflectivity requirements of DMS-8300, "Sign Face Material," unless otherwise specified in the plans.
3. Vertical Panels shall be manufactured with orange and white sheeting meeting the requirements of DMS-8300 Type C (High Specific Intensity). Diagonal stripes on Vertical Panels shall slope down toward the intended traveled lane.
4. Other sign messages (text or symbolic) may be used as approved by the Engineer. Sign dimensions shall not exceed 18 inches in width or 24 inches in height.
5. Signs shall be installed using a 1/2 inch bolt (nominal) and nut, two washers, and one locking washer for each connection.
6. Mounting bolts and nuts shall be fully engaged and adequately torqued. Bolts should not extend more than 1/2 inch beyond nuts.
7. Chevrons may be placed on drums on the outside of curves, on merging tapers or on shifting tapers. When used in these locations they may be placed on every drum or spaced not more than on every third drum. A minimum of three (3) should be used at each location called for in the plans.
8. R9-9, R9-10, R9-11 and R9-11a Sidewalk Closed signs which are 24 inches wide may be mounted on plastic drums, with approval of the Engineer.

Texas Department of Transportation
Traffic Operations Division

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES STANDARD

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4-03 REVISIONS	CONT	SECT	JOB	HIGHWAY
9-07				
	DIST	COUNTY		SHEET NO.
				T208

DATE:
FILE:

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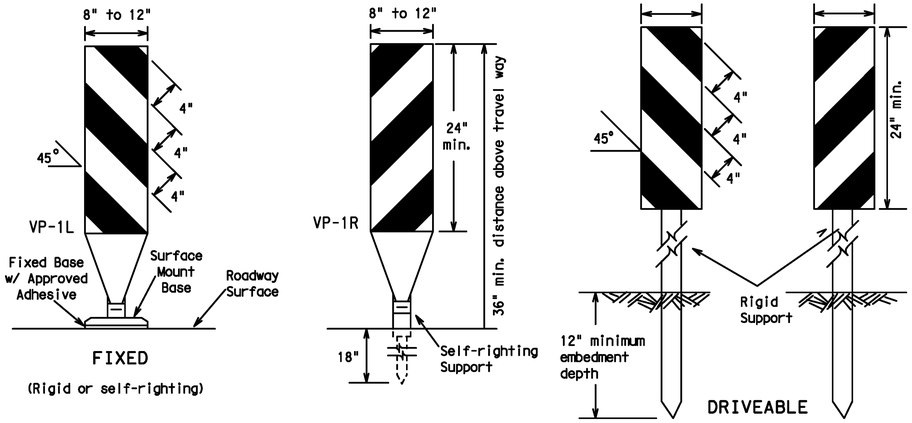
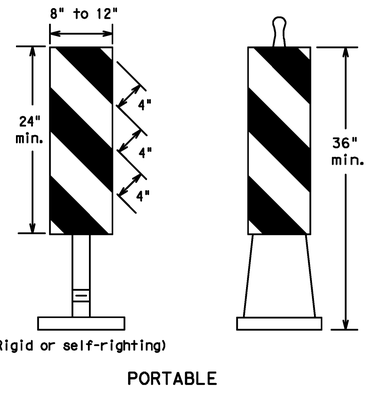
CHANNELIZING DEVICES

VERTICAL PANELS (VPs)

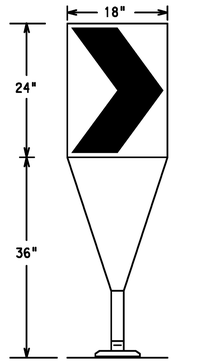


1. Vertical Panels (VP's) are normally used to channelize traffic or divide opposing lanes of traffic.
2. VP's may be used in daytime or nighttime situations. They may be used at the edge of shoulder drop-offs and other areas such as lane transitions where positive daytime and nighttime delineation is required. The Engineer/Inspector shall refer to the Roadway Design Manual Appendix B "Treatment of Pavement Drop-offs in Work Zones" for additional guidelines on the use of VP's for drop-offs.
3. VP's should be mounted back to back if used at the edge of cuts adjacent to two-way two lane roadways. Stripes are to be reflective orange and reflective white and should always slope downward toward the travel lane.
4. VP's used on expressways and freeways or other high speed roadways, shall have a minimum of 270 square inches of retroreflective area facing traffic.
5. Self-righting supports are available with portable base. See "Compliant Work Zone Traffic Control Devices List" (CWZTCD).
6. Sheeting for the VP's shall be retroreflective Type C (High Specific Intensity) conforming to Departmental Material Specification DMS-8300, unless noted otherwise.
7. Where the height of reflective material on the vertical panel is greater than 36 inches, a panel stripe of 6 inches shall be used.



PORTABLE

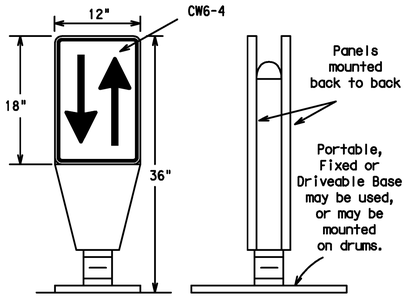
CHEVRONS



Fixed Base w/ Approved Adhesive (Driveable Base, or Flexible Support can be used)

1. The chevron shall be a vertical rectangle with a minimum size of 12 by 18 inches.
2. Chevrons are intended to give notice of a sharp change of alignment with the direction of travel and provide additional emphasis and guidance for vehicle operators with regard to changes in horizontal alignment of the roadway.
3. Chevrons, when used, shall be erected on the outside of a sharp curve or turn, or on the far side of an intersection. They shall be in line with and at right angles to approaching traffic. Spacing should be such that the motorist always has three in view, until the change in alignment eliminates its need.
4. To be effective, the chevron should be visible for at least 500 feet.
5. Chevrons shall be orange with a black nonreflective legend. Sheeting for the chevron shall be retroreflective Type E (Fluorescent Prismatic) conforming to Departmental Material Specification DMS-8300, unless noted otherwise. The legend shall be black vinyl non-reflective decal sheeting meeting the requirements of DMS-8300.
6. For Long Term Stationary use on tapers or transitions on freeways and divided highways self-righting chevrons may be used to supplement plastic drums but not to replace plastic drums.

OPPOSING TRAFFIC LANE DIVIDERS (OTLD)



1. Opposing Traffic Lane Dividers (OTLD) are delineation devices designed to convert a normal one-way roadway section to two-way operation. OTLD's are used on temporary centerlines. The upward and downward arrows on the sign's face indicate the direction of traffic on either side of the divider. The base is secured to the pavement with an adhesive or rubber weight to minimize movement caused by a vehicle impact or wind gust.
2. The OTLD may be used in combination with simple tubular markers or VPs.
3. Spacing between the OTLD shall not exceed 500 feet. Tubular markers or VPs placed between the OTLD's should not exceed 100 foot spacing.
4. The OTLD shall be orange with a black non-reflective legend. Sheeting for the OTLD shall be retroreflective Type E (Fluorescent Prismatic) conforming to Departmental Material Specification DMS-8300, unless noted otherwise. The legend shall be black vinyl non-reflective decal sheeting meeting the requirements of DMS-8300.

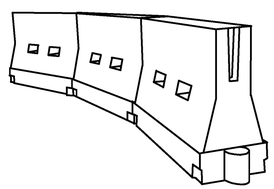
GENERAL NOTES:

1. Work Zone channelizing devices illustrated on this sheet may be installed in close proximity to traffic and are suitable for use on high or low speed roadways. The Engineer/Inspector shall ensure that spacing and placement is uniform and in accordance with the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD).
2. Channelizing devices shown on this sheet may have a driveable, fixed or portable base. The requirement for self-righting channelizing devices must be specified in the General Notes or other plan sheets.
3. Channelizing devices on self-righting supports should be used in work zone areas where channelizing devices are frequently impacted by errant vehicles or vehicle related wind gusts making alignment of the channelizing devices difficult to maintain. Locations of these devices shall be detailed elsewhere in the plans. These devices shall conform to the TMUTCD and the "Compliant Work Zone Traffic Control Devices List" (CWZTCD).
4. The Contractor shall maintain devices in a clean condition and replace damaged, nonreflective, faded, or broken devices and bases as required by the Engineer/Inspector. The Contractor shall be required to maintain proper device spacing and alignment.
5. Portable bases shall be fabricated from virgin and/or recycled rubber. The portable bases shall weigh approximately 35 lbs.
6. Pavement surfaces shall be prepared in a manner that ensures proper bonding between the adhesives, the fixed mount bases and the pavement surface. Adhesives shall be prepared and applied according to the manufacturer's recommendations.
7. The installation and removal of channelizing devices shall not cause detrimental effects to the final pavement surfaces, including pavement surface discoloration or surface integrity. Driveable bases shall not be permitted on final pavement surfaces. The Engineer/Inspector shall approve all application and removal procedures of fixed bases.
8. Examples on this sheet are commonly used channelizing devices in work zones. For other devices, refer to the CWZTCD.

Posted Speed	Formula	Minimum Desirable Taper Lengths ** 10' Offset	11' Offset	12' Offset	Suggested Maximum Spacing of Channelizing Devices On a Taper	On a Tangent
30	$L=\frac{WS^2}{60}$	150'	165'	180'	30'	60'-75'
35		205'	225'	245'	35'	70'-90'
40		265'	295'	320'	40'	80'-100'
45	L=WS	450'	495'	540'	45'	90'-110'
50		500'	550'	600'	50'	100'-125'
55		550'	605'	660'	55'	110'-140'
60		600'	660'	720'	60'	120'-150'
65		650'	715'	780'	65'	130'-165'
70		700'	770'	840'	70'	140'-175'
75		750'	825'	900'	75'	150'-185'
80		800'	880'	960'	80'	160'-195'

**Taper lengths have been rounded off.
L=Length of Taper (FT.) W=Width of Offset (FT.)
S=Posted Speed (MPH)

HOLLOW OR WATER BALLASTED SYSTEMS USED AS LONGITUDINAL CHANNELIZING DEVICES OR BARRIERS



LONGITUDINAL CHANNELIZING DEVICES

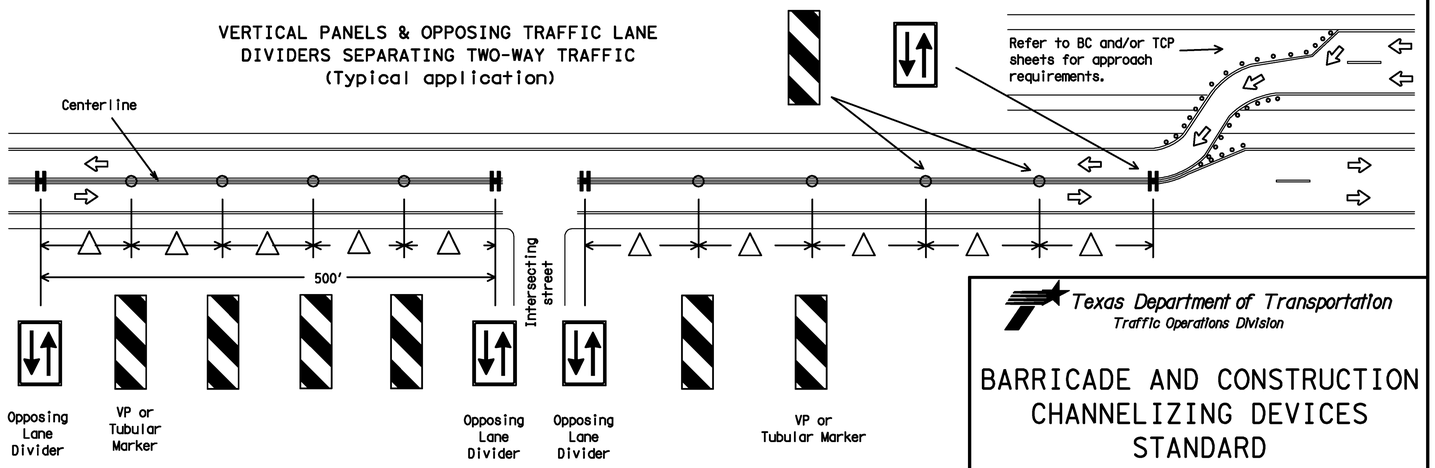
1. Longitudinal channelizing devices are crashworthy, lightweight, deformable devices that are highly visible, have good target value and can be connected together. **They are not designed to contain or redirect a vehicle on impact.**
2. Longitudinal channelizing devices may be used instead of a line of cones or drums.
3. Longitudinal channelizing devices shall be placed in accordance to application and installation requirements specific to the device, and used only when shown on the CWZTCD list.
4. Longitudinal channelizing devices should not be used to provide positive protection for obstacles, pedestrians or workers.
5. Longitudinal channelizing devices shall be retroreflective, or supplemented with retroreflective delineation as required for temporary barriers on BC(7)-07.

WATER BALLASTED SYSTEMS USED AS BARRIERS

1. Water ballasted systems used as barriers shall not be used solely to channelize road users, but also to protect the work space per the appropriate NCHRP 350 crashworthiness requirements based on roadway speed and barrier application.
2. Water ballasted systems used to channelize vehicular traffic shall be supplemented with retroreflective delineation or channelizing devices to improve daytime/nighttime visibility. They may also be supplemented with pavement markings.
3. Water ballasted systems used as barriers shall be placed in accordance to application and installation requirements specific to the device, and used only when shown on the CWZTCD list.
4. Water ballasted systems used as barriers should not be used for a merging taper except in low speed (less than 45 MPH) urban areas. When used on a taper in a low speed urban area, the taper shall be delineated and the taper length should be designed to optimize road user operations considering the available geometric conditions.
5. When water ballasted systems used as barriers have blunt ends exposed to traffic, they should be attenuated as per manufacturer recommendations or flared to point outside the clear zone.

If used to channelize pedestrians, longitudinal channelizing devices or water ballasted systems must have a continuous detectable bottom for users of long canes and the top of the unit shall be not less than 32 inches in height.

VERTICAL PANELS & OPPOSING TRAFFIC LANE DIVIDERS SEPARATING TWO-WAY TRAFFIC (Typical application)



△ Spacing between the VP's or tubular markers shall not exceed 100 feet. On roadways with speeds less than 45 MPH, spacing between the tubular markers or VP's shall be as shown on the channelizing spacing table shown on this page. If the table shows spacing greater than 100 feet based on the roadway speed, then use a maximum of 100 feet spacing between the tubular markers or VP's. Every fifth channelizing device shall be an OTLD, except when the OLTD must be spaced closer to accomodate an intersection. Spacing between the OTLD shall not exceed 500 feet.

Texas Department of Transportation
Traffic Operations Division

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES STANDARD

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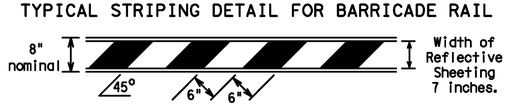
TYPE III BARRICADES

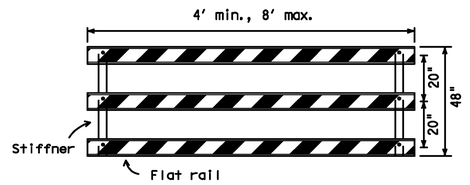
1. Refer to the Compliant Work Zone Traffic Control Devices List (CWZTCD) for details of the Type III Barricades and a list of all materials used in the construction of Type III Barricades.
2. Type III Barricades shall be used at each end of construction projects closed to all traffic.
3. Barricades extending across a roadway should have stripes that slope downward in the direction toward which traffic must turn in detouring. When both right and left turns are provided, the chevron striping may slope downward in both directions from the center of the barricade. Where no turns are provided at a closed road striping should slope downward in both directions toward the center of roadway.
4. Striping of rails, for the right side of the roadway, should slope downward to the left. For the left side of the roadway, striping should slope downward to the right.
5. Identification markings may be shown only on the back of the barricade rails. The maximum height of letters and/or company logos used for identification shall be 1".
6. Barricades shall not be placed parallel to traffic unless an adequate clear zone is provided.
7. Warning lights shall NOT be installed on barricades.
8. Where barricades require the use of weights to keep from turning over, the use of sandbags with dry, cohesionless sand is recommended. The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight. Sand bags shall not be stacked in a manner that covers any portion of a barricade rails reflective sheeting. Rock, concrete, iron, steel or other solid objects will NOT be permitted. Sandbags should weigh a minimum of 35 lbs and a maximum of 50 lbs. Sandbags shall be made of a durable material that tears upon vehicular impact. Rubber (such as tire inner tubes) shall not be used for sandbags. Sandbags shall only be placed along or upon the base supports of the device and shall not be suspended above ground level or hung with rope, wire, chains or other fasteners.
9. Sheeting for barricades shall be retroreflective Type C (High Specific Intensity) conforming to Departmental Material Specification DMS-8300 unless otherwise noted.

Barricades shall NOT be used as a sign support.

TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



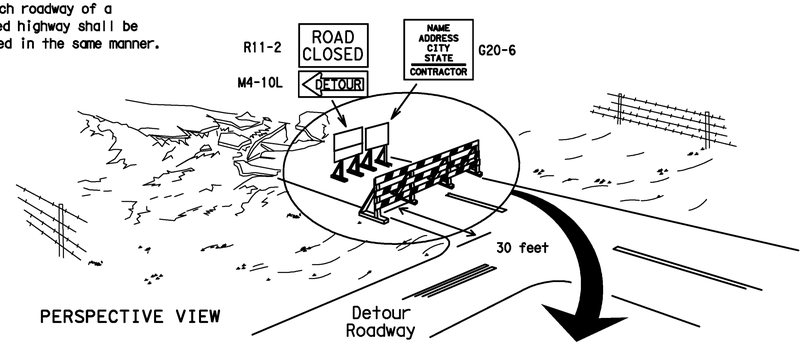
TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES



Stiffner may be inside or outside of support, but no more than 2 stiffeners shall be allowed on one barricade.

TYPE III BARRICADE (POST AND SKID) TYPICAL APPLICATION

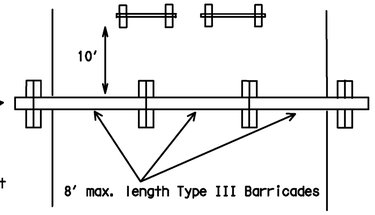
Each roadway of a divided highway shall be barricaded in the same manner.



PERSPECTIVE VIEW

The three rails on Type III barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic.

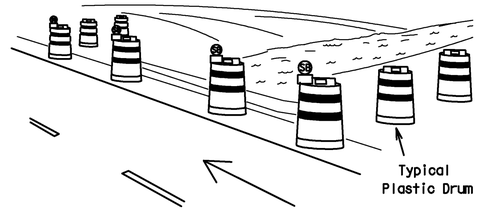
Barricade striping should slant downward in the direction of detour.



PLAN VIEW

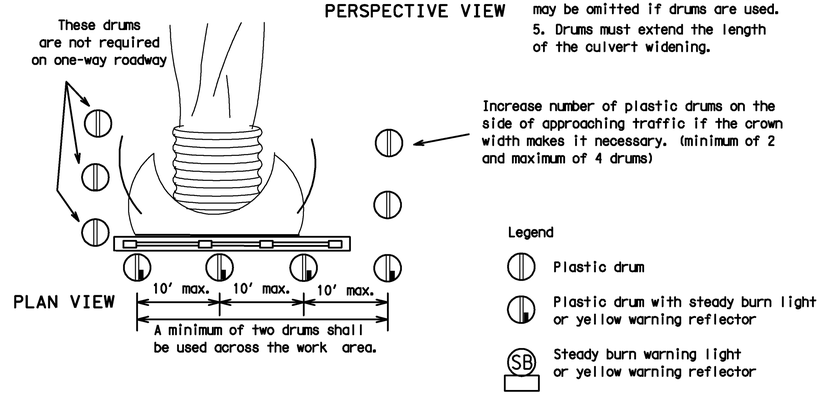
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type III Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS



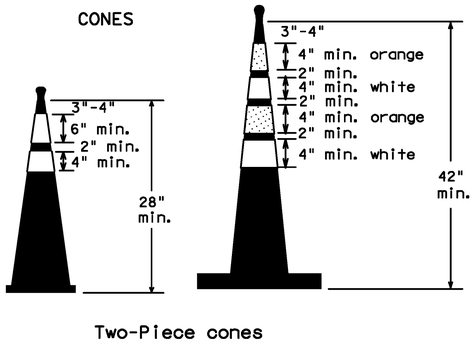
PERSPECTIVE VIEW

1. Where positive redirectional capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder width is greater than 12 feet, steady-burn lights may be omitted if drums are used.
5. Drums must extend the length of the culvert widening.

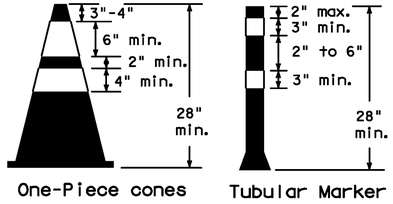


PLAN VIEW

CONES



Two-Piece cones

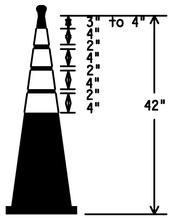


One-Piece cones Tubular Marker

28" Cones shall have a minimum weight of 9 1/2 lbs.

42" 2-piece cones shall have a minimum weight of 30 lbs. including base.

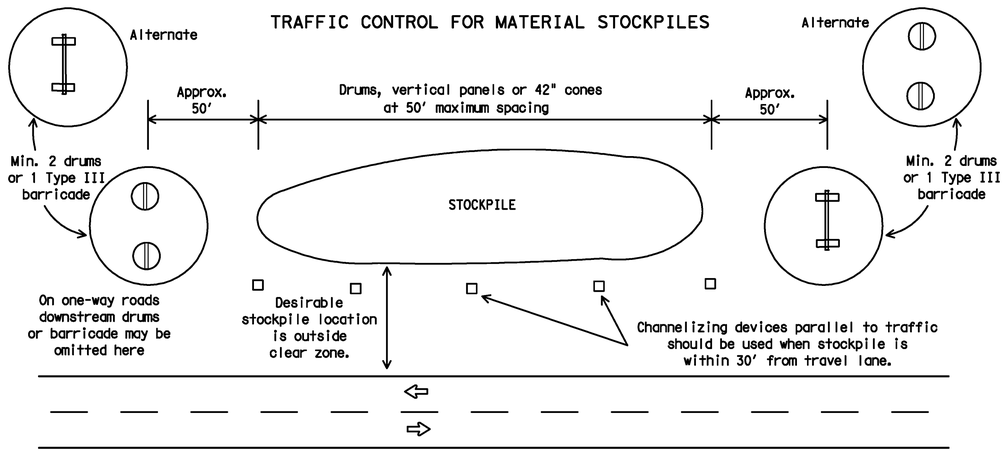
1. Traffic cones and tubular markers shall be a minimum of 28 inches in height when used either on freeways or at nighttime.
2. Cones or tubular markers shall be predominantly orange, fluorescent red-orange, or fluorescent yellow-orange. They should be kept clean and bright for maximum visibility.
3. Cones used only for daytime operations do not require the reflectorized bands.
4. Cones and tubular markers used for nighttime operations shall be reflectorized. Reflectorized material shall have a smooth, sealed outer surface that displays the same approximate color during the day and night. The reflectorized bands shall be retroreflective Type C (High Specific Intensity) conforming to Departmental Material Specification DMS-8300, unless otherwise noted.
5. When used at night, appropriate personnel shall ensure that cones and tubular markers remain in their proper location and in an upright position.
6. Reflectorization of 28"cones shall consist of a minimum 6 inch band placed at least 3 inches but not more than 4 inches from the top, supplemented by a minimum 4 inch band spaced a minimum of 2 inches below the 6 inch band.
7. Reflectorization of 42" cones shall be provided by alternating 4 to 6" orange and white stripes with orange on top.
8. Reflectorization of tubular markers shall be a minimum of two 3 inch bands placed a maximum of 2 inches from the top with a maximum of 6 inches between bands.
9. One-piece cones or tubular markers are generally suitable for temporary usage (up to 8 hours) with other channelization devices such as vertical panels, drums or two-piece cones for long term usage. Care should be taken to ensure they remain in their proper location and in an upright position.
10. Cones or tubular markers used on each project shall be of the same size and shape.
11. The handle may be designed as a hook or other shape, fabricated from non-rigid materials similar to the cone material, and may extend up to a maximum of 8 inches above the top of cone. Length of the handle shall not be considered with regard to the overall height of the cone.



EDGELINE CHANNELIZER

1. This device is intended only for use in place of a vertical panel to channelize traffic by indicating the edge of the travel lane. It is not intended to be used in transitions or tapers.
2. This device shall not be used to separate lanes of traffic (opposing or otherwise) or warn of objects.
3. This device is based on a 42 inch, two-piece cone with an alternate striping pattern: four 4 inch retroreflective bands, with an approximate 2 inch gap between bands. The color of the band should correspond to the color of the edgeline (yellow for left edgeline, white for right edgeline) for which the device is substituted or for which it supplements. The reflectorized bands shall be retroreflective Type C encapsulated bead (High Specific Intensity) conforming to Departmental Material Specification DMS-8300, unless otherwise noted.
4. The base must weigh a minimum of 30 lbs.

TRAFFIC CONTROL FOR MATERIAL STOCKPILES



Texas Department of Transportation
Traffic Operations Division

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES STANDARD

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WORK ZONE PAVEMENT MARKINGS

GENERAL

1. The Contractor shall be responsible for maintaining work zone and existing pavement markings, in accordance with the standard specifications and special provisions, on all roadways open to traffic within the CSJ limits unless otherwise stated in the plans.
2. Color, patterns and dimensions shall be in conformance with the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD).
3. Additional supplemental pavement marking details may be found in the plans or specifications.
4. Pavement markings shall be installed in accordance with the TMUTCD and as shown on the plans.
5. When short term markings are required on the plans, short term markings shall conform with the TMUTCD, the plans and details as shown on the Standard Plan Sheet WZ(STPM).
6. When standard pavement markings are not in place and the roadway is opened to traffic, DO NOT PASS signs shall be erected to mark the beginning of the sections where passing is prohibited and PASS WITH CARE signs at the beginning of sections where passing is permitted.
7. All work zone pavement markings shall be installed in accordance with Item 662, "Work Zone Pavement Markings."

RAISED PAVEMENT MARKERS

1. Raised pavement markers are to be placed according to the patterns on BC(12).
2. All raised pavement markers used for work zone markings shall meet the requirements of Item 672, "RAISED PAVEMENT MARKERS" and Departmental Material Specification DMS-4200 or DMS-4300.

PREFABRICATED PAVEMENT MARKINGS

1. Removable prefabricated pavement markings shall meet the requirements of DMS-8241.
2. Non-removable prefabricated pavement markings (foil back) shall meet the requirements of DMS-8240.

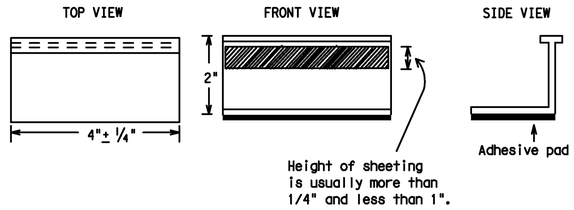
MAINTAINING WORK ZONE PAVEMENT MARKINGS

1. The Contractor will be responsible for maintaining work zone pavement markings within the work limits.
2. Work zone pavement markings shall be inspected in accordance with the frequency and reporting requirements of work zone traffic control device inspections as required by Form 599.
3. The markings should provide a visible reference for a minimum distance of 300 feet during normal daylight hours and 160 feet when illuminated by automobile low-beam headlights at night, unless sight distance is restricted by roadway geometrics.
4. Markings failing to meet this criteria within the first 30 days after placement shall be replaced at the expense of the Contractor as per Specification Item 662.

REMOVAL OF PAVEMENT MARKINGS

1. Pavement markings that are no longer applicable, could create confusion or direct a motorist toward or into the closed portion of the roadway, shall be removed or obliterated before the roadway is opened to traffic.
2. The above shall not apply to detours in place for less than two weeks, where flaggers and/or sufficient channelizing devices are used in lieu of markings to outline the detour route.
3. Pavement markings shall be removed to the fullest extent possible, so as not to leave a discernable marking. This shall be by any method approved by TxDOT Specification Item 677 for "Eliminating Existing Pavement Markings and Markers".
4. The removal of pavement markings may require resurfacing or seal coating portions of the roadway.
5. Subject to the approval of the Engineer, any method that proves to be successful on a particular type pavement may be used.
6. Blast cleaning may be used but will not be required unless specifically shown in the plans.
7. Over-painting of the markings SHALL NOT BE permitted.
8. Removal of raised pavement markers shall be as directed by the Engineer.
9. Removal of existing pavement markings and markers will be paid for directly in accordance with Item 677, "ELIMINATING EXISTING PAVEMENT MARKINGS AND MARKERS," unless otherwise stated in the plans.
10. Black-out marking tape may be used to cover conflicting existing markings for periods less than two weeks when approved by the Engineer.

Temporary Flexible-Reflective Roadway Marker Tabs



STAPLES OR NAILS SHALL NOT BE USED TO SECURE TEMPORARY FLEXIBLE-REFLECTIVE ROADWAY MARKER TABS TO THE PAVEMENT SURFACE

1. Temporary flexible-reflective roadway marker tabs used as guidemarks shall meet the requirements of DMS-8242.
2. Tabs detailed on this sheet are to be inspected and accepted by the Engineer or designated representative. Sampling and testing is not normally required, however at the option of the Engineer, either "A" or "B" below may be imposed to assure quality before placement on the roadway.
   A. Select five (5) or more tabs at random from each lot or shipment and submit to the Construction Division, Materials and Pavement Section to determine specification compliance.
   B. Select five (5) tabs and perform the following test. Affix five (5) tabs at 24 inch intervals on an asphaltic pavement in a straight line. Using a medium size passenger vehicle or pickup, run over the markers with the front and rear tires at a speed of 35 to 40 miles per hour, four (4) times in each direction. No more than one (1) out of the five (5) reflective surfaces shall be lost or displaced as a result of this test.
3. Small design variances may be noted between tab manufacturers.
4. See Standard Sheet WZ(STPM) for tab placement on new pavements. See Standard Sheet TCP(7-1) for tab placement on seal coat work.

Raised Pavement Markers used as Guidemarks

1. Raised pavement markers used as guidemarks shall be from the approved product list, and meet the requirements of DMS-4200.
2. All temporary construction raised pavement markers provided on a project shall be of the same manufacturer.
3. Adhesive for guidemarks shall be bituminous material hot applied or butyl rubber pad for all surfaces, or thermoplastic for concrete surfaces.

Guidemarks shall be designated as:
YELLOW - (two amber reflective surfaces with yellow body).
WHITE - (one silver reflective surface with white body).

DEPARTMENTAL MATERIAL SPECIFICATIONS

PAVEMENT MARKERS (REFLECTORIZED)	DMS-4200
TRAFFIC BUTTONS	DMS-4300
EPOXY AND ADHESIVES	DMS-6100
BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS	DMS-6130
PREFABRICATED PAVEMENT MARKINGS-PERMANENT	DMS-8240
PREFABRICATED PAVEMENT MARKINGS-REMOVABLE	DMS-8241
TEMPORARY FLEXIBLE-REFLECTIVE ROADWAY MARKER TABS	DMS-8242

A list of prequalified reflective raised pavement markers, non-reflective traffic buttons, roadway marker tabs and other pavement markings can be found at the Material Producer List web address shown on BC(1).

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BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS STANDARD

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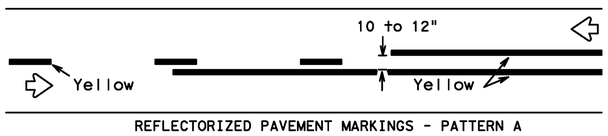
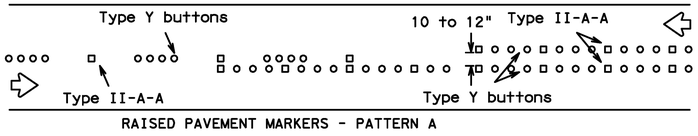
PAVEMENT MARKING PATTERNS

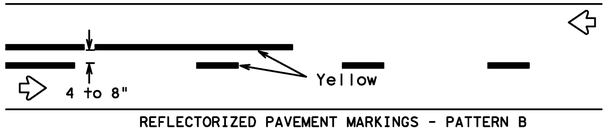
CENTER LINE & NO-PASSING ZONE BARRIER LINES FOR TWO-LANE, TWO-WAY HIGHWAYS



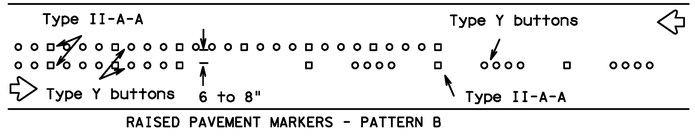
REFLECTORIZED PAVEMENT MARKINGS - PATTERN A



RAISED PAVEMENT MARKERS - PATTERN A



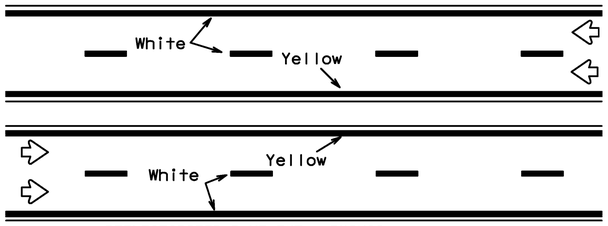
REFLECTORIZED PAVEMENT MARKINGS - PATTERN B



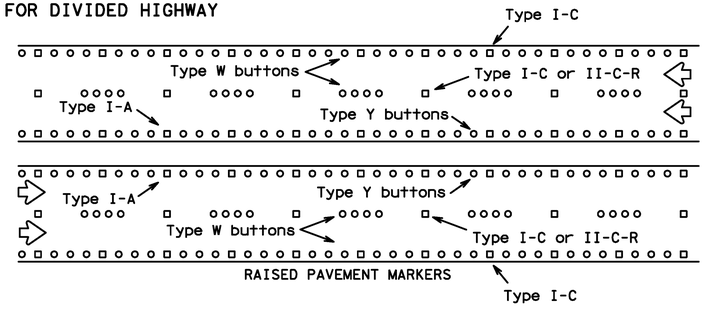
RAISED PAVEMENT MARKERS - PATTERN B

Pattern A is the TXDOT Standard, however Pattern B may be used if approved by the Engineer.
Prefabricated markings may be substituted for reflectorized pavement markings.

EDGE & LANE LINES FOR DIVIDED HIGHWAY



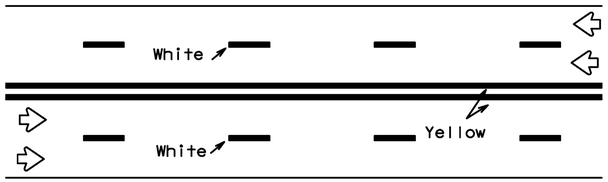
REFLECTORIZED PAVEMENT MARKINGS



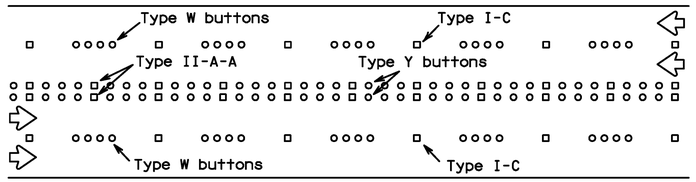
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



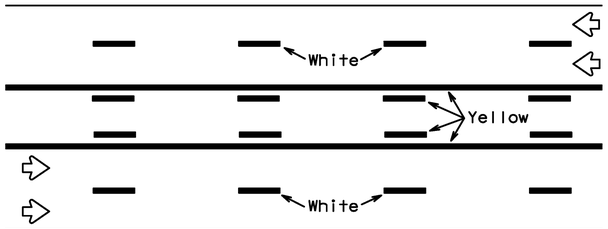
REFLECTORIZED PAVEMENT MARKINGS



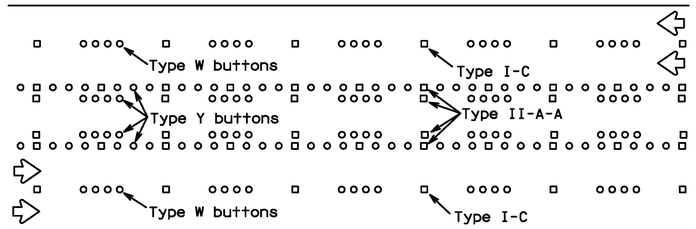
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

TWO-WAY LEFT TURN LANE



REFLECTORIZED PAVEMENT MARKINGS



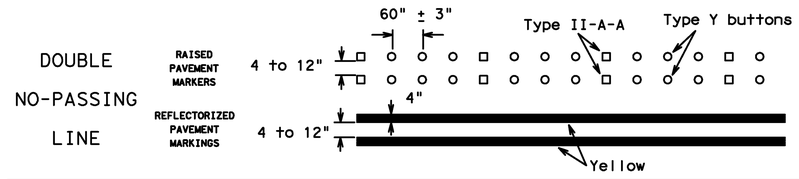
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

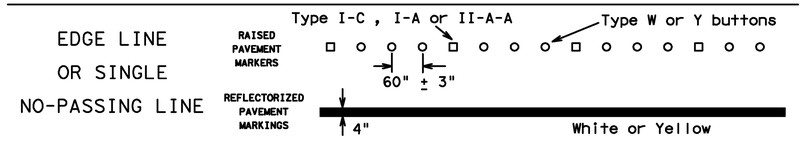
STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS

SOLID LINES

DOUBLE NO-PASSING LINE

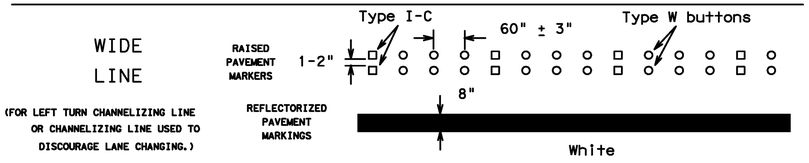


EDGE LINE OR SINGLE NO-PASSING LINE



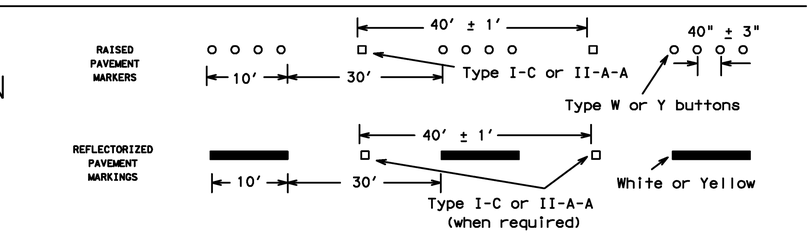
WIDE LINE

(FOR LEFT TURN CHANNELIZING LINE OR CHANNELIZING LINE USED TO DISCOURAGE LANE CHANGING.)



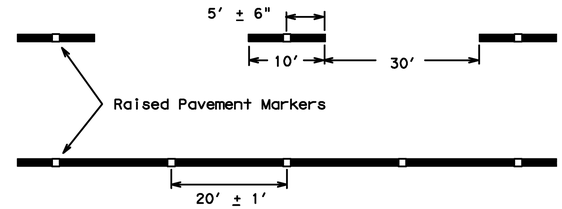
BROKEN LINE

(FOR CENTER LINE OR LANE LINE.)



REMOVABLE MARKINGS WITH RAISED PAVEMENT MARKERS

If raised pavement markers are used to supplement REMOVABLE markings, the markers shall be applied to the top of the tape at the approximate mid length of tape used for broken lines or at 20 foot spacing for solid lines. This allows an easier removal of raised pavement markers and tape.



Centerline only - not to be used on edge lines

Raised pavement markers used as standard pavement markings shall be from the approved products list and meet the requirements of Item 672 "RAISED PAVEMENT MARKERS."

Texas Department of Transportation
Traffic Operations Division

BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS STANDARD

12 of 12 BC(12)-07

© TxDOT February 1998

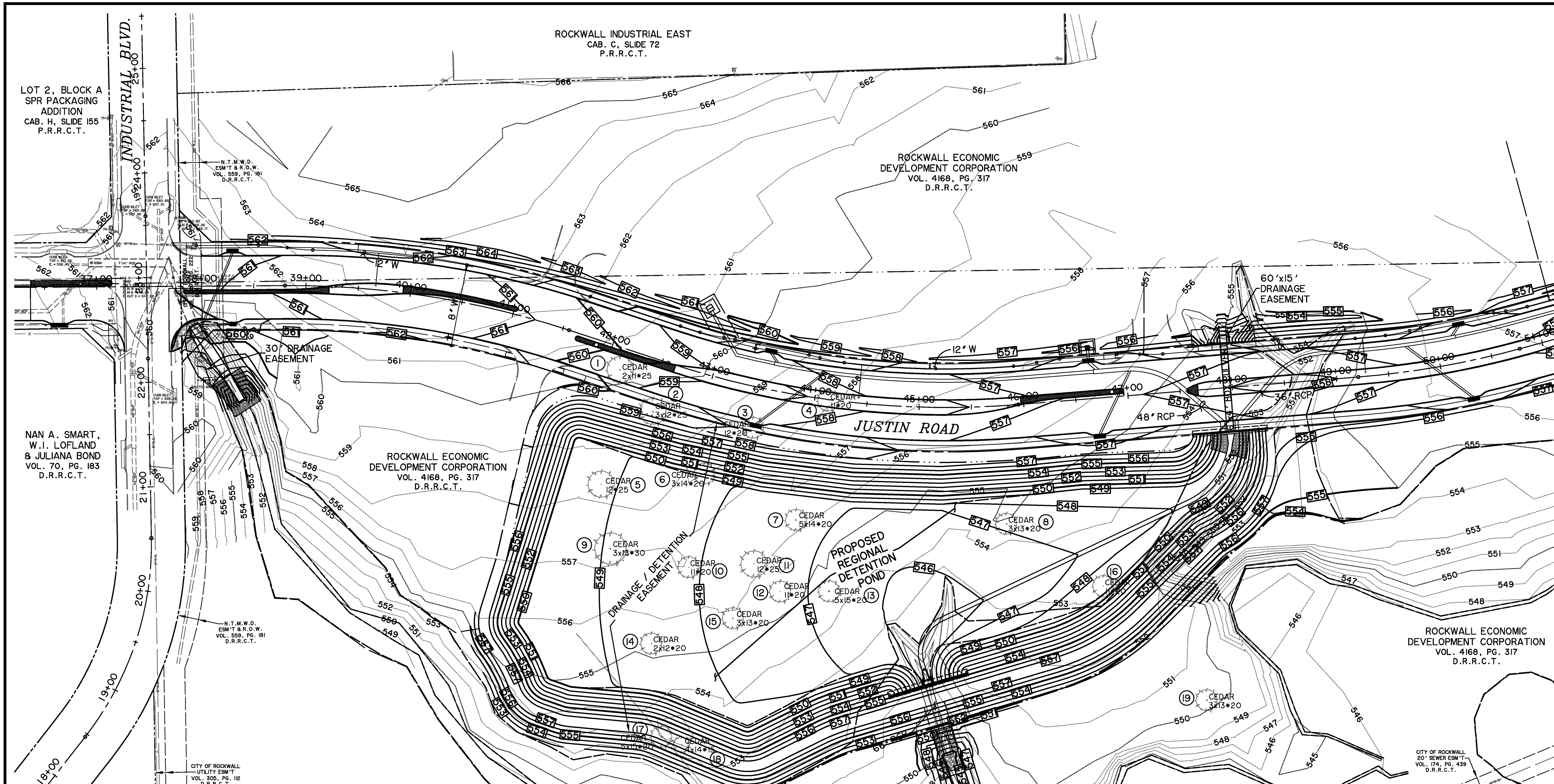
DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
CONT	SECT	JOB	HIGHWAY
DIST	COUNTY		SHEET NO.

REVISIONS
1-97
2-98
11-02
9-07

T212

109C

DATE:
FILE:



TREE TABLE						
No.	TYPE	TRUNKS	CALIPER (in.)	TOTAL CALIPER (in.)	STATUS	MITIGATION (in.)
1	CEDAR	2	11	22	EXEMPT	0
2	CEDAR	3	12	36	REMOVE	18
3	CEDAR	1	12	12	EXEMPT	0
4	CEDAR	1	11	11	EXEMPT	0
5	CEDAR	1	12	12	REMOVE	6
6	CEDAR	3	14	42	REMOVE	21
7	CEDAR	5	14	70	REMOVE	35
8	CEDAR	3	13	39	REMOVE	19.5
9	CEDAR	3	13	39	REMOVE	19.5
10	CEDAR	1	11	11	REMOVE	5.5
11	CEDAR	1	12	12	REMOVE	6
12	CEDAR	1	11	11	REMOVE	5.5
13	CEDAR	5	15	75	REMOVE	37.5
14	CEDAR	2	12	24	REMOVE	12
15	CEDAR	3	13	39	REMOVE	19.5
16	CEDAR	1	11	11	REMOVE	5.5
17	CEDAR	5	15	75	REMOVE	37.5
18	CEDAR	4	14	56	REMOVE	28
19	CEDAR	3	13	39	SAVE	0
			TOTAL CALIPER INCHES:	636	TOTAL:	276
			SAVED:	39		
			REMOVED:	552		
			EXEMPT:	45		

RECORD PLANS
MAY 1, 2015

OWNER:
ROCKWALL ECONOMIC
DEVELOPMENT CORPORATION
2610 OBSERVATION TRAIL
ROCKWALL, TEXAS 75032
PHONE: 972-772-0025

PRINTED: 5/1/2015 STB FILE: WIER-PAVEMENT-MARKING.STB LAST SAVED: 4/21/2015 3:39 PM SAVED BY: CLAYTONT FILE: DETENTION-POND-TREE-SURVEY-13096.DWG

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701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.WierAssociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
REGIONAL DETENTION POND
TREE REMOVAL PERMIT PLAN

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WA# 13096

SHEET NO.
LS-1

DETENTION POND TREES SHALL BE MINIMUM 3' CALIPER BALD CYPRESS TREES PLANTED AT APPROXIMATE 30' C/C SPACING.

DETENTION POND BOTTOM AREA = 92,035 SQ. FT.
NUMBER OF TREES REQUIRED: 1 TREE / 750 SQ. FT. = 123 TREES

TOTAL CALIPER INCHES TO BE PLANTED = 3 IN. X 123 = 369 INCHES

INDICATES BALD CYPRESS TREE TO BE PLANTED

ROCKWALL INDUSTRIAL EAST
CAB. C, SLIDE 72
P.R.R.C.T.

INDUSTRIAL BLVD.

LOT 2, BLOCK A
SPR PACKAGING ADDITION
CAB. H, SLIDE 155
P.R.R.C.T.

ROCKWALL ECONOMIC DEVELOPMENT CORPORATION
VOL. 4168, PG. 317
D.R.R.C.T.

N.T.M.W.D. ESM'T & R.O.W.
VOL. 559, PG. 181
D.R.R.C.T.

30' DRAINAGE EASEMENT

60'x15' DRAINAGE EASEMENT

JUSTIN ROAD

36" RCP

48" RCP

NAN A. SMART, W.I. LOFLAND & JULIANA BOND
VOL. 70, PG. 183
D.R.R.C.T.

ROCKWALL ECONOMIC DEVELOPMENT CORPORATION
VOL. 4168, PG. 317
D.R.R.C.T.

DRAINAGE / DETENTION EASEMENT

PROPOSED REGIONAL DETENTION POND

CITY OF ROCKWALL UTILITY ESM'T
VOL. 305, PG. 112
D.R.R.C.T.

15' UTILITY ESM'T
CAB. C, SLIDE 186
P.R.R.C.T.

20' N.T.M.W.D ESM'T
VOL. 566, PG. 87
D.R.R.C.T.

LOT 2
RESUBDIVISION OF
INDUSTRIAL ADDITION
CAB. C, SLIDE 186
P.R.R.C.T.

ROCKWALL STEEL Co., INC.
VOL. 752, PG. 28
D.R.R.C.T.

CITY OF ROCKWALL 20' SEWER ESM'T
VOL. 174, PG. 439
D.R.R.C.T.

RECORD PLANS
MAY 1, 2015

0 50 100 150

OWNER:
ROCKWALL ECONOMIC DEVELOPMENT CORPORATION
2610 OBSERVATION TRAIL
ROCKWALL, TEXAS 75032
PHONE: 972-772-0025

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701 HIGHLANDER BLVD., SUITE 300 ARLINGTON, TEXAS 76015 METRO (817)467-7700
Texas Firm Registration No. F-2776 www.WierAssociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
REGIONAL DETENTION POND
TREE PLANTING PLAN

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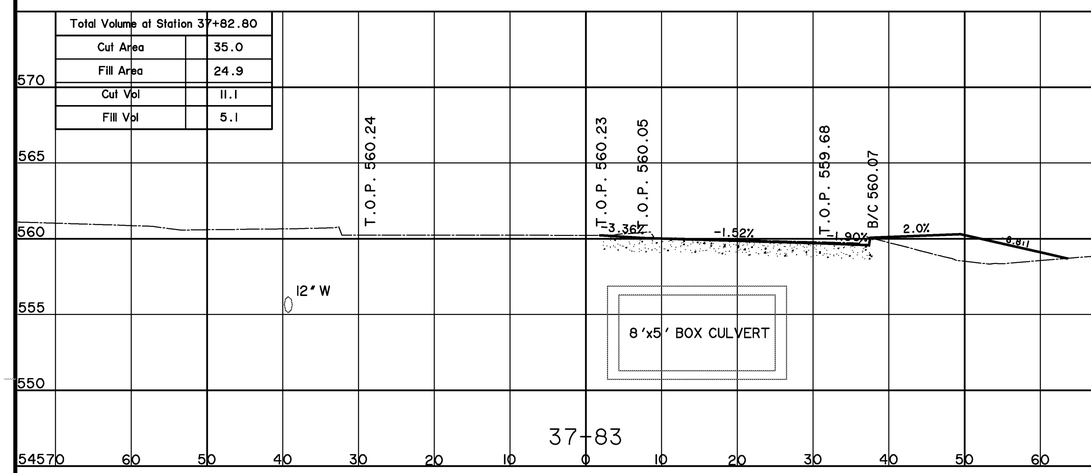
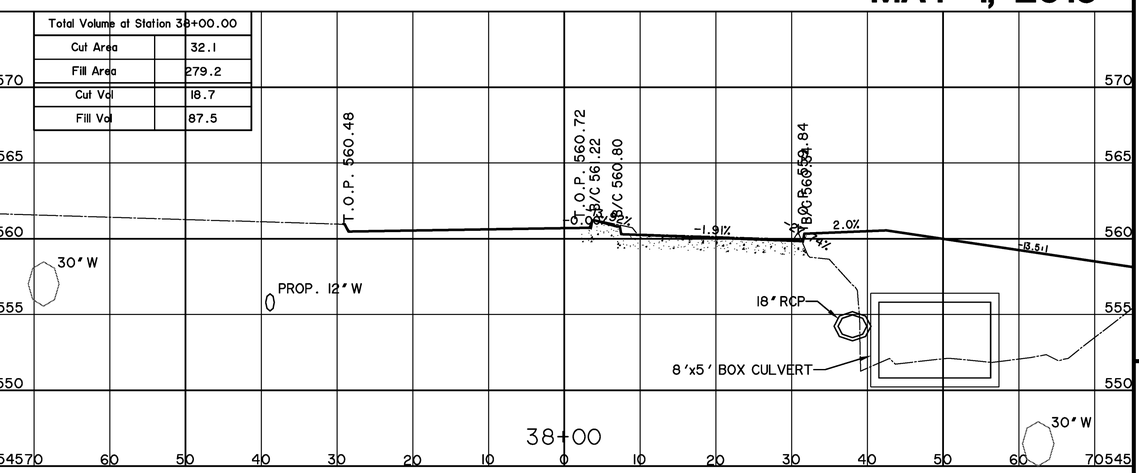
RECORD PLANS
MAY 1, 2015

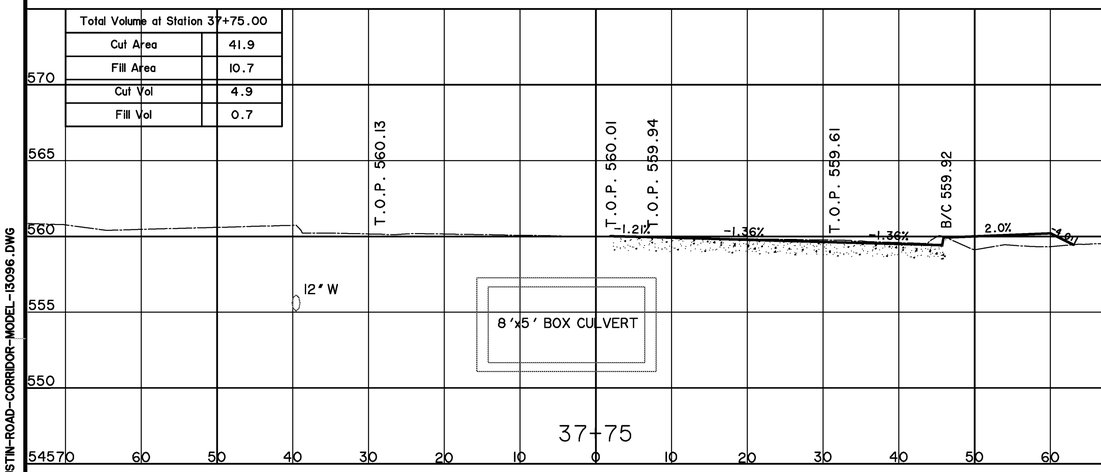
Total Volume at Station 37+82.80	
Cut Area	35.0
Fill Area	24.9
Cut Vol	11.1
Fill Vol	5.1



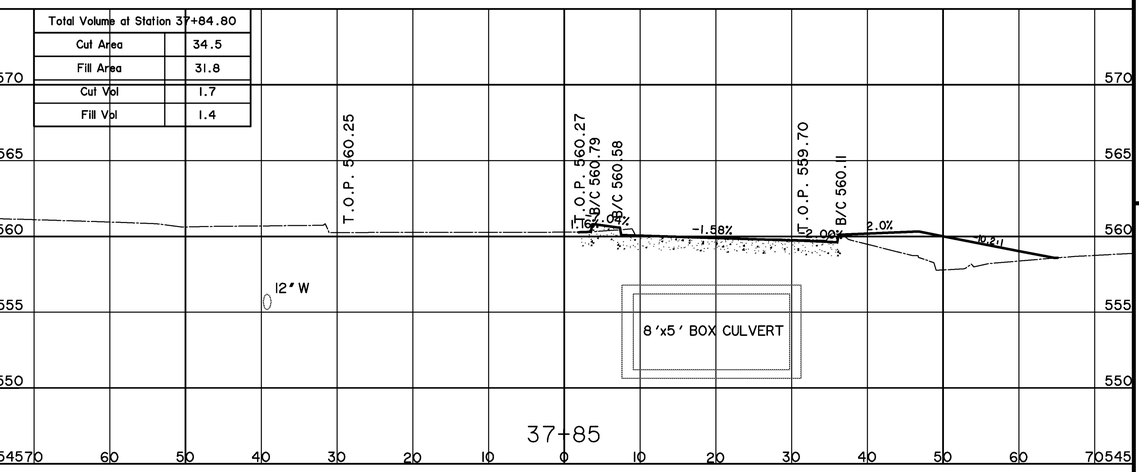
Total Volume at Station 38+00.00	
Cut Area	32.1
Fill Area	279.2
Cut Vol	18.7
Fill Vol	87.5



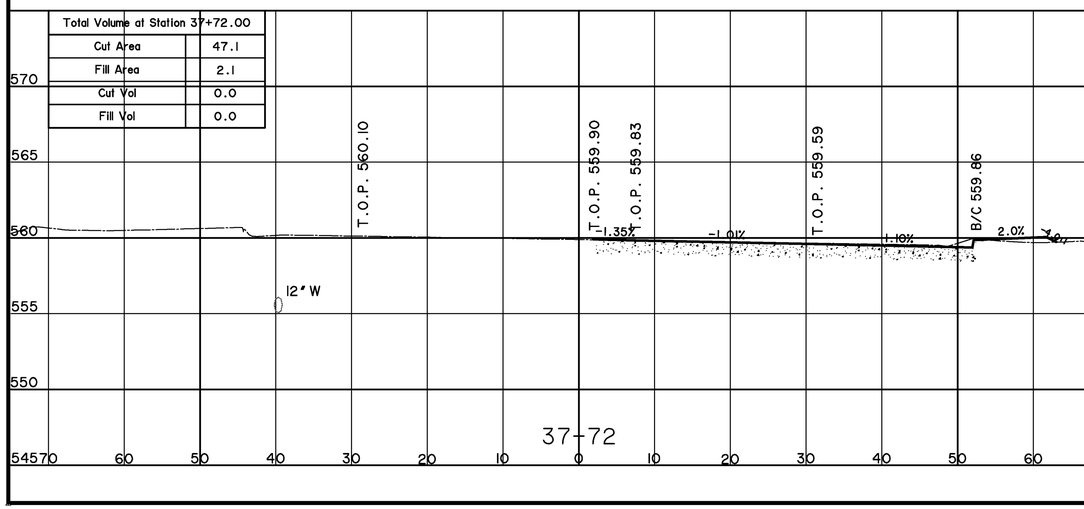
Total Volume at Station 37+75.00	
Cut Area	41.9
Fill Area	10.7
Cut Vol	4.9
Fill Vol	0.7



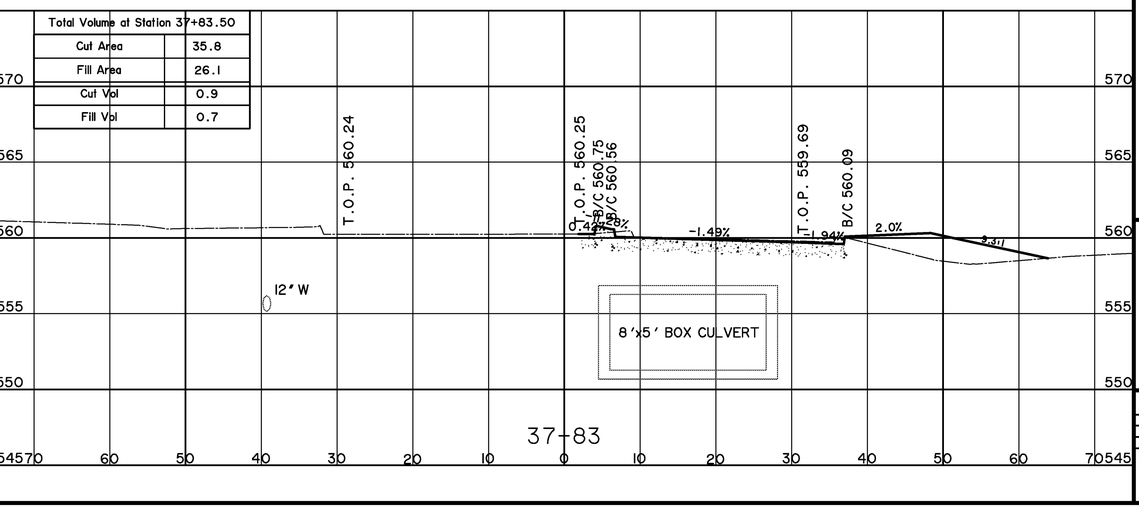
Total Volume at Station 37+84.80	
Cut Area	34.5
Fill Area	31.8
Cut Vol	1.7
Fill Vol	1.4



Total Volume at Station 37+72.00	
Cut Area	47.1
Fill Area	2.1
Cut Vol	0.0
Fill Vol	0.0



Total Volume at Station 37+83.50	
Cut Area	35.8
Fill Area	26.1
Cut Vol	0.9
Fill Vol	0.7



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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
CROSS-SECTIONS

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED
PROFESSIONAL ENGINEER
5/1/2015

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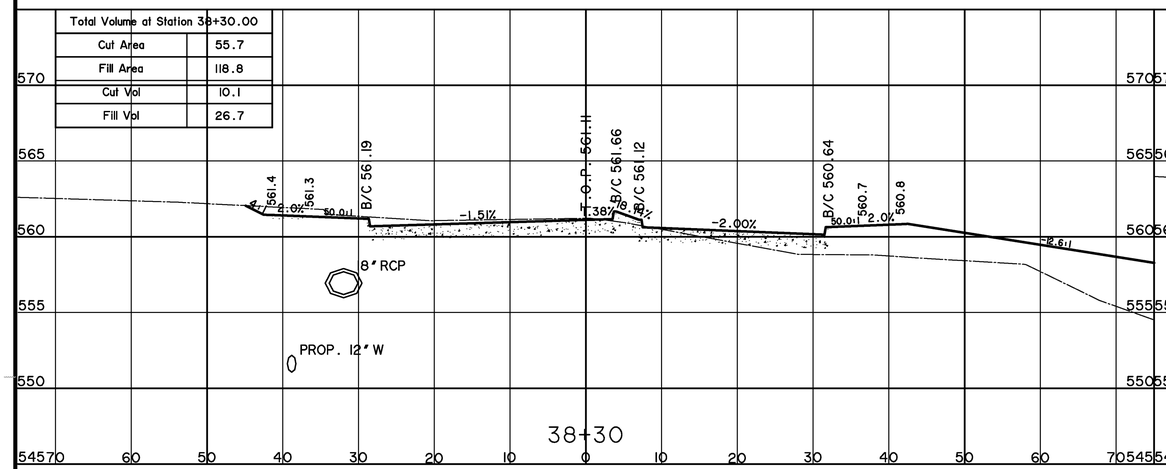
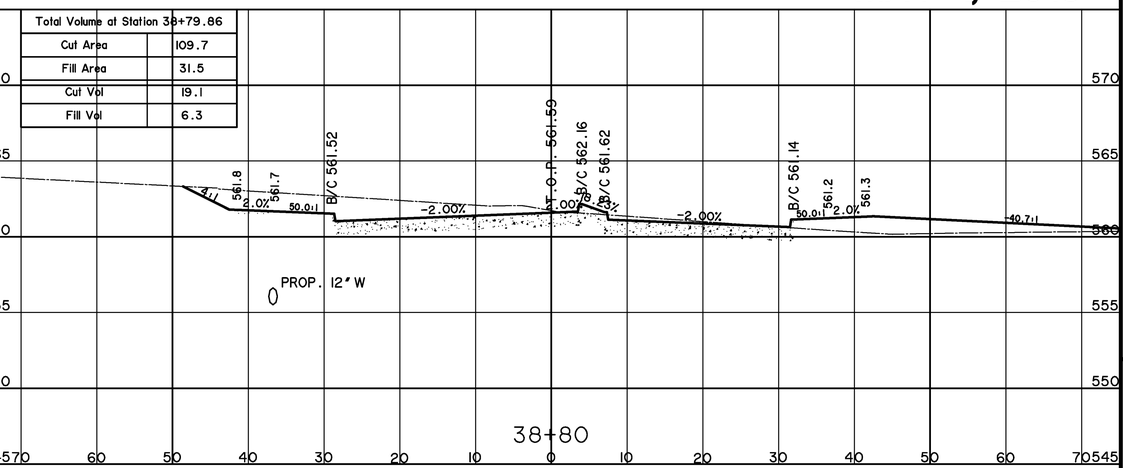
RECORD PLANS
MAY 1, 2015

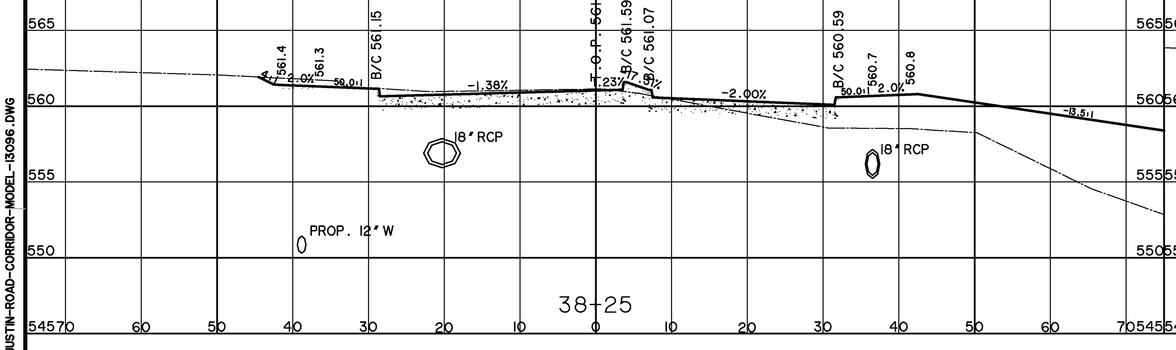
Total Volume at Station 38+30.00	
Cut Area	55.7
Fill Area	118.8
Cut Vol	10.1
Fill Vol	26.7



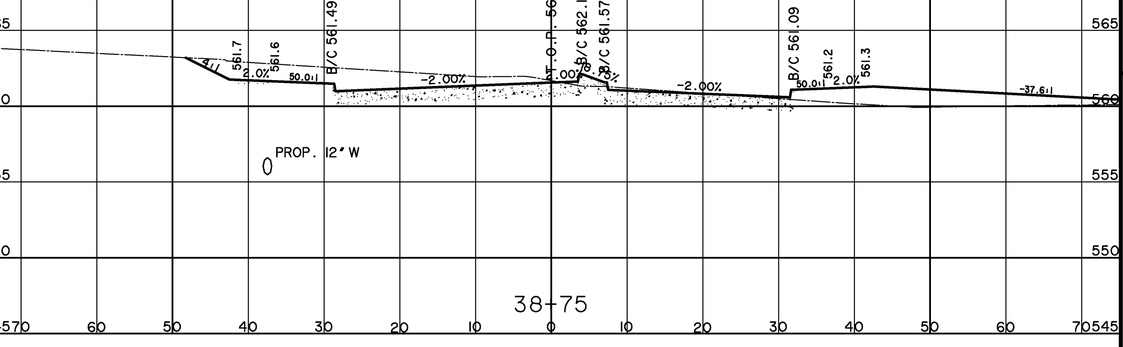
Total Volume at Station 38+79.86	
Cut Area	109.7
Fill Area	31.5
Cut Vol	19.1
Fill Vol	6.3



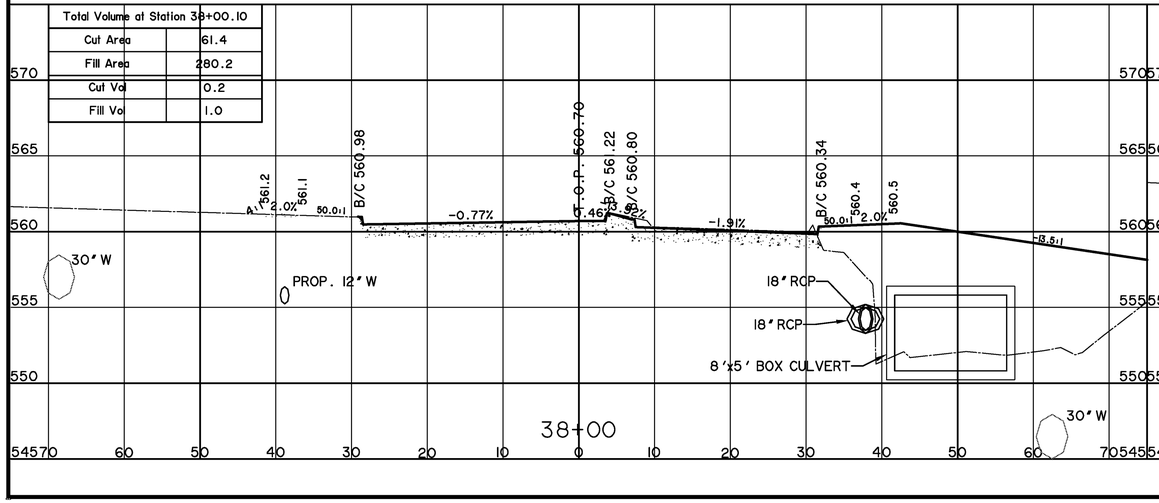
Total Volume at Station 38+25.00	
Cut Area	53.6
Fill Area	169.4
Cut Vol	53.0
Fill Vol	207.3



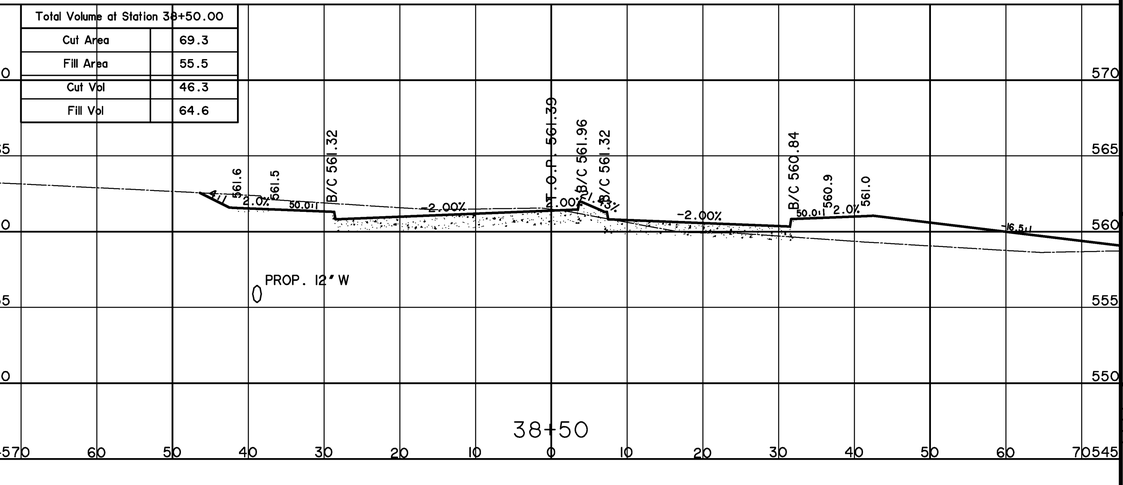
Total Volume at Station 38+75.00	
Cut Area	102.3
Fill Area	38.8
Cut Vol	79.4
Fill Vol	43.7



Total Volume at Station 38+00.10	
Cut Area	61.4
Fill Area	280.2
Cut Vol	0.2
Fill Vol	1.0



Total Volume at Station 38+50.00	
Cut Area	69.3
Fill Area	55.5
Cut Vol	46.3
Fill Vol	64.6



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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
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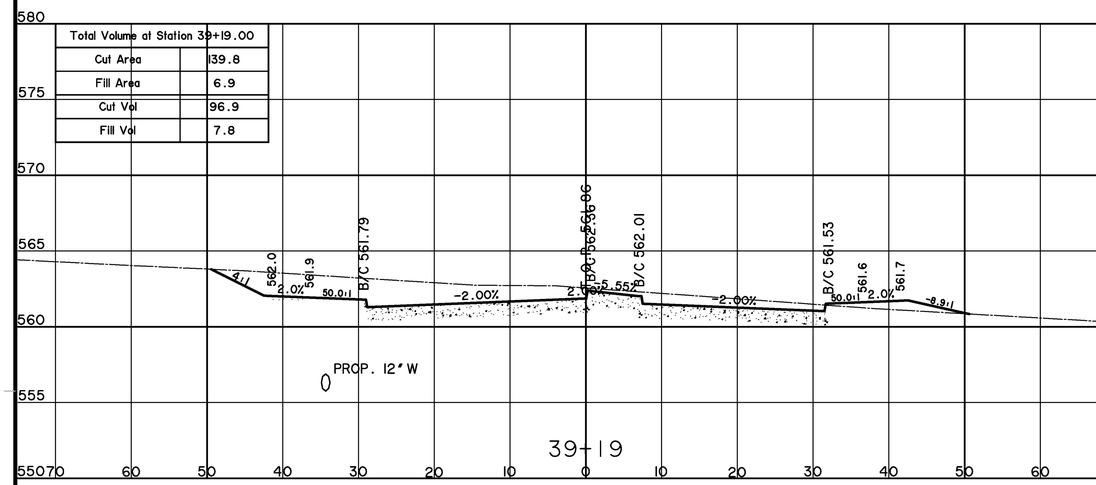
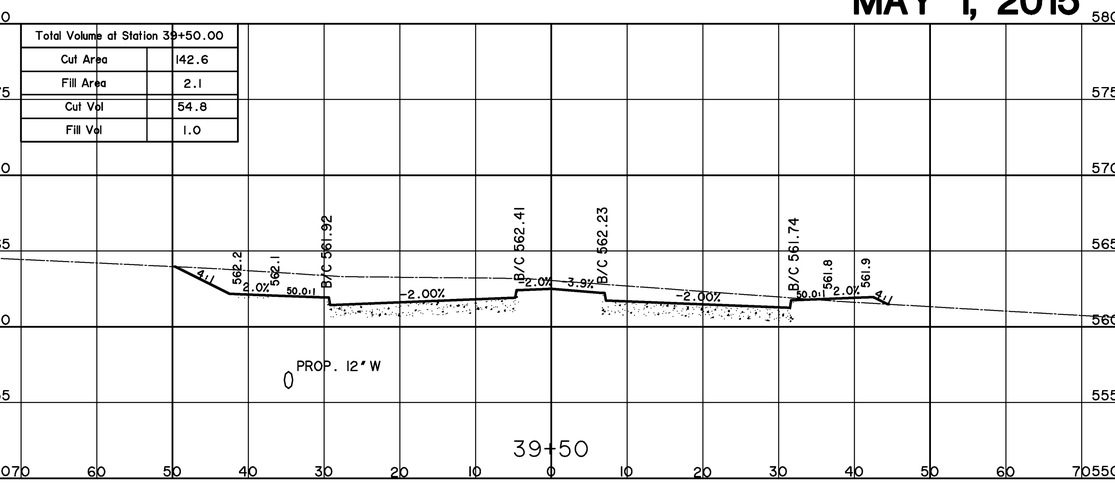
RECORD PLANS
MAY 1, 2015

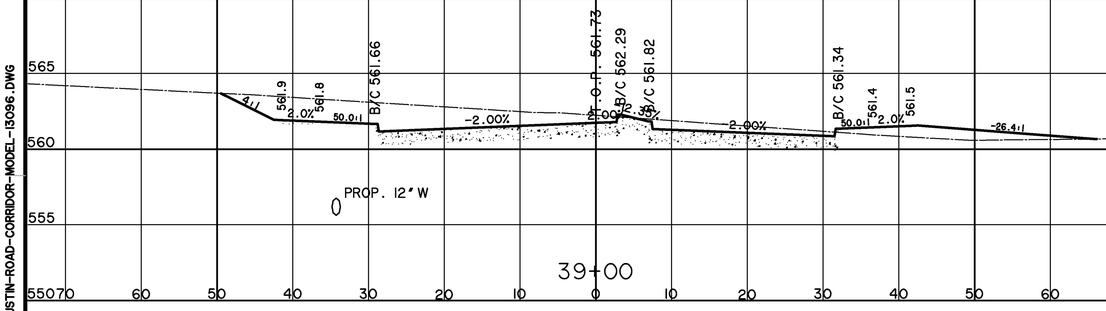
Total Volume at Station 39+19.00	
Cut Area	139.8
Fill Area	6.9
Cut Vol	96.9
Fill Vol	7.8



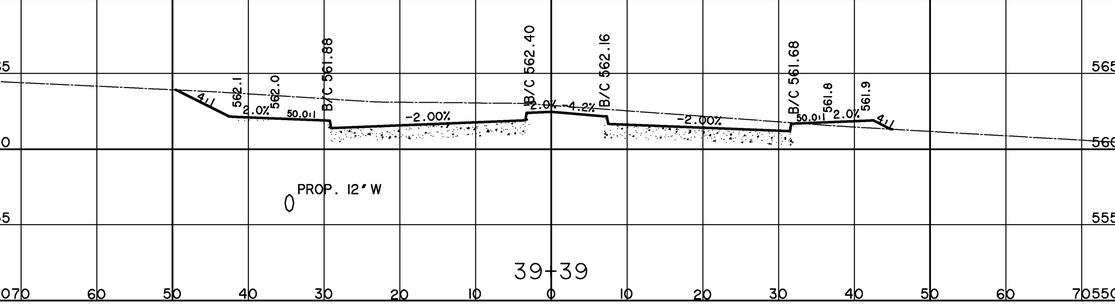
Total Volume at Station 39+50.00	
Cut Area	142.6
Fill Area	2.1
Cut Vol	54.8
Fill Vol	1.0



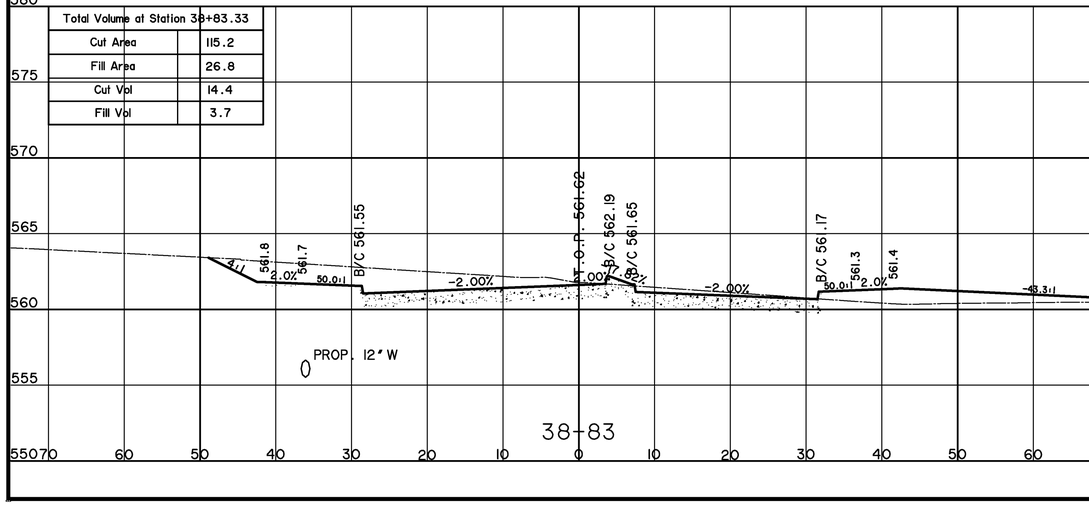
Total Volume at Station 39+00.00	
Cut Area	132.5
Fill Area	16.6
Cut Vol	77.4
Fill Vol	12.6



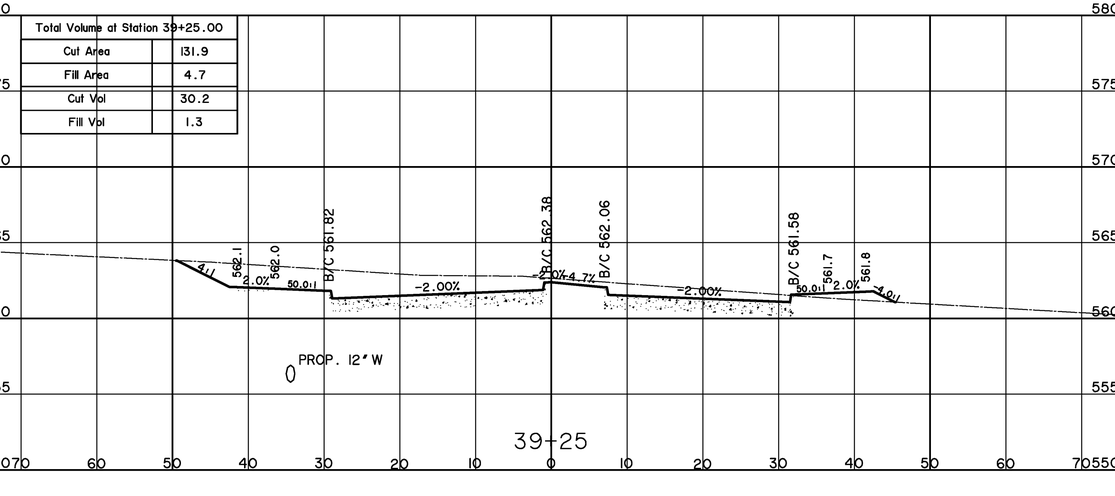
Total Volume at Station 39+39	
Cut Area	136.5
Fill Area	3.2
Cut Vol	71.6
Fill Vol	2.1



Total Volume at Station 38+83.33	
Cut Area	115.2
Fill Area	26.8
Cut Vol	14.4
Fill Vol	3.7



Total Volume at Station 39+25.00	
Cut Area	131.9
Fill Area	4.7
Cut Vol	30.2
Fill Vol	1.3



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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
CROSS-SECTIONS

STATE OF TEXAS
PHILIP L. GRAHAM
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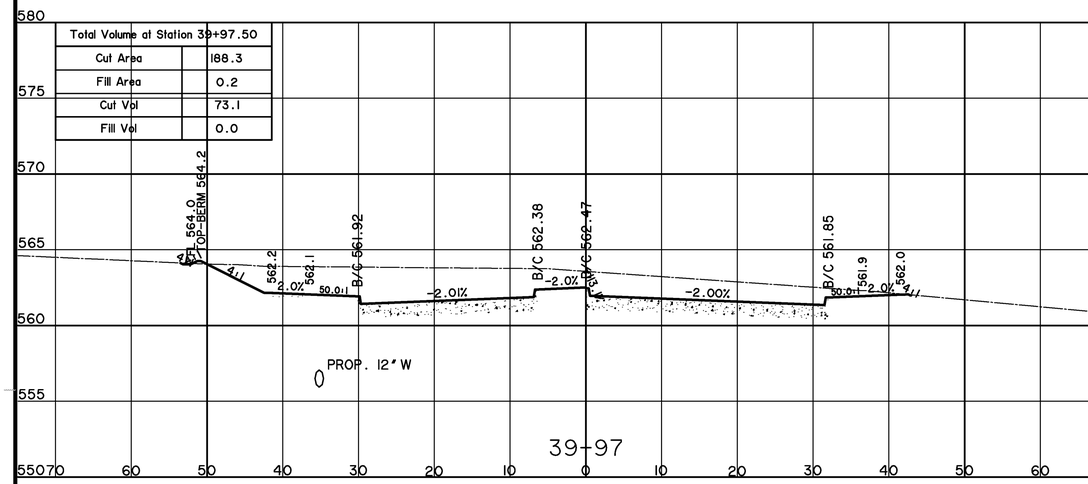
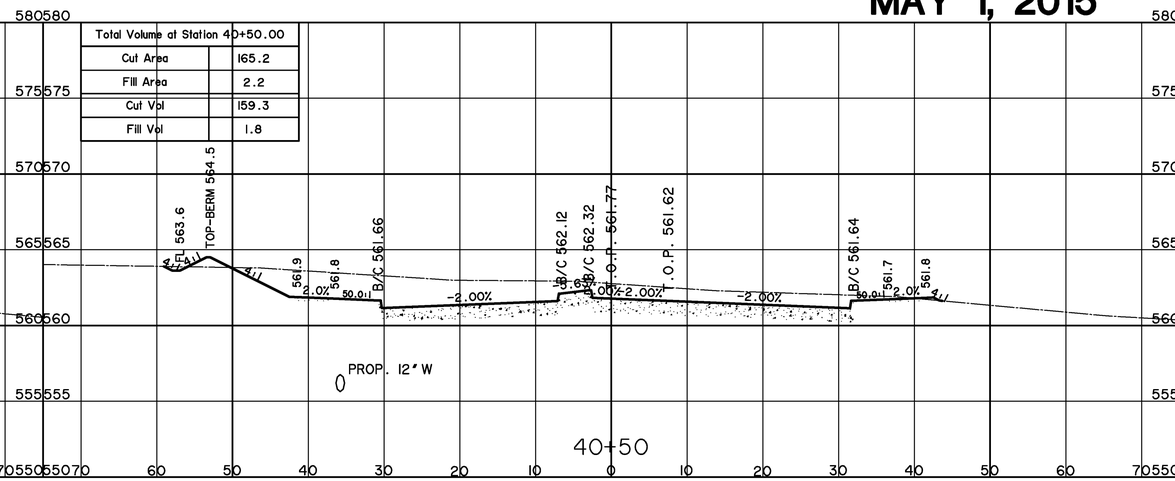
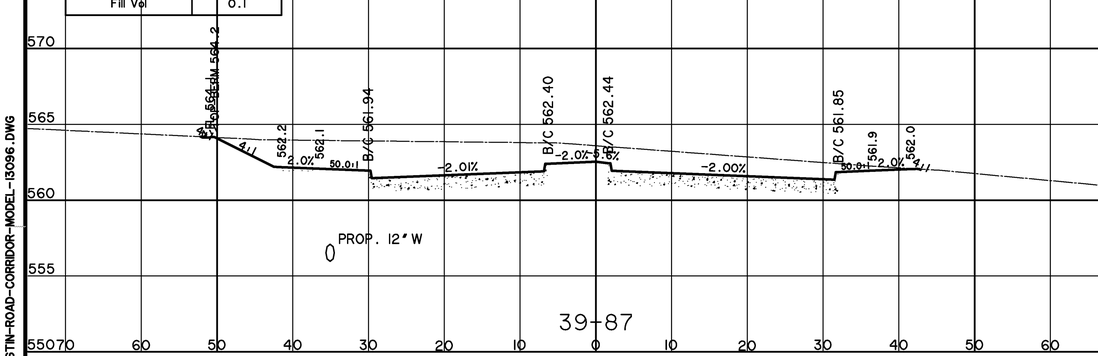
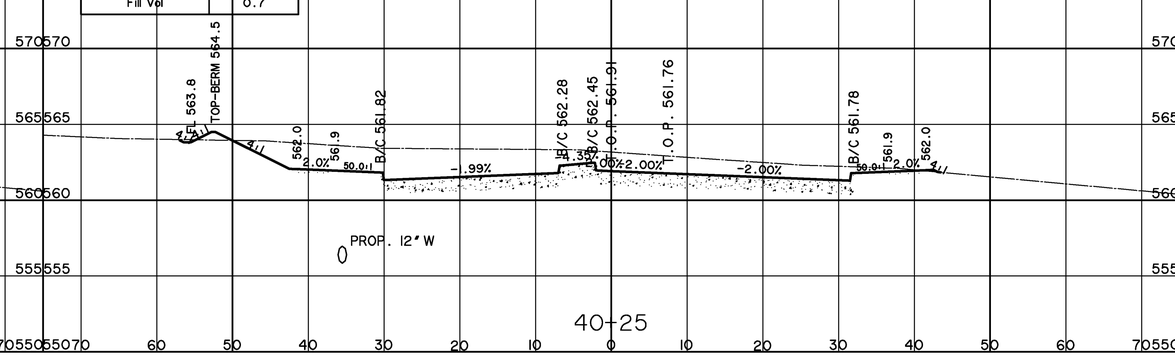
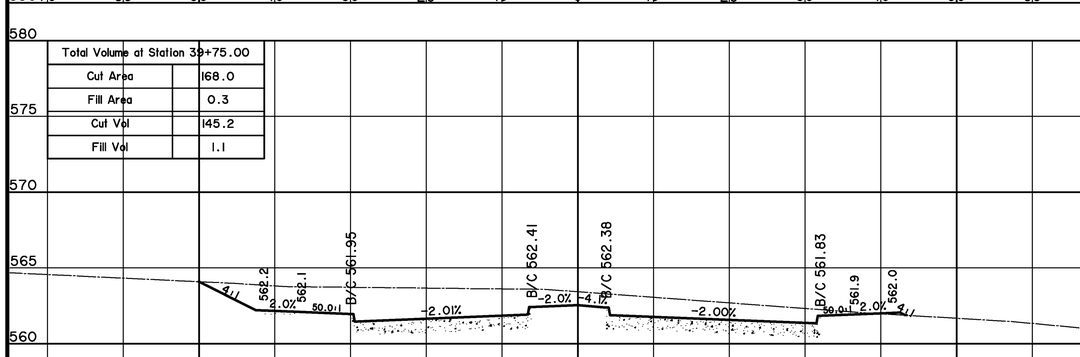
RECORD PLANS
MAY 1, 2015

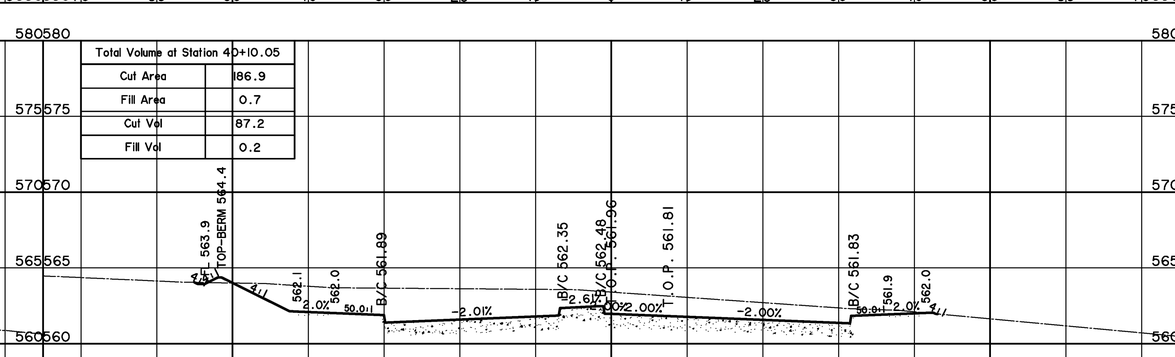












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ENGINEERS SURVEYORS LAND PLANNERS
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Texas Firm Registration No. F-2776 www.Wierassociates.com

JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
CROSS-SECTIONS

STATE OF TEXAS
PHILIP L. GRAHAM
94719
LICENSED
PROFESSIONAL ENGINEER
5/1/2015

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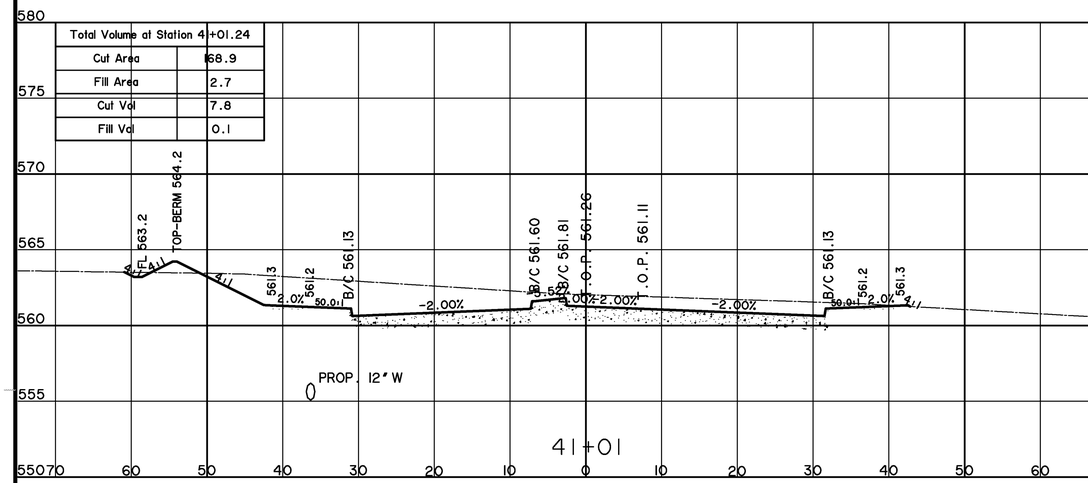
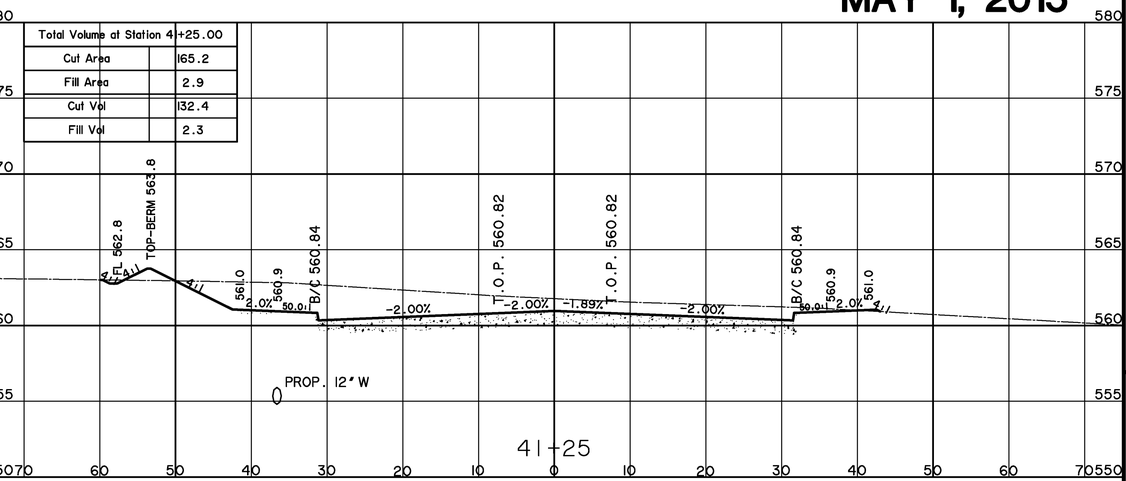
RECORD PLANS
MAY 1, 2015

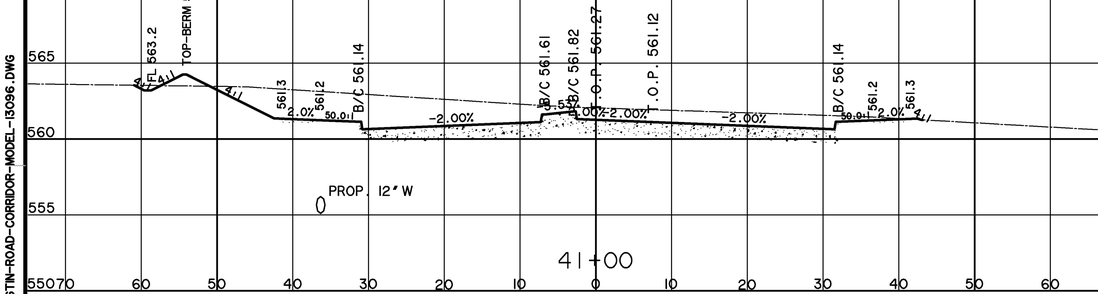
Total Volume at Station 41+01.24	
Cut Area	168.9
Fill Area	2.7
Cut Vol	7.8
Fill Vol	0.1



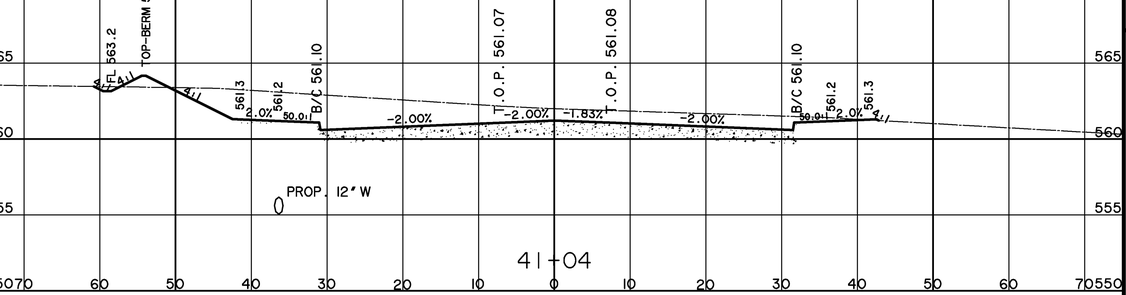
Total Volume at Station 41+25.00	
Cut Area	165.2
Fill Area	2.9
Cut Vol	132.4
Fill Vol	2.3



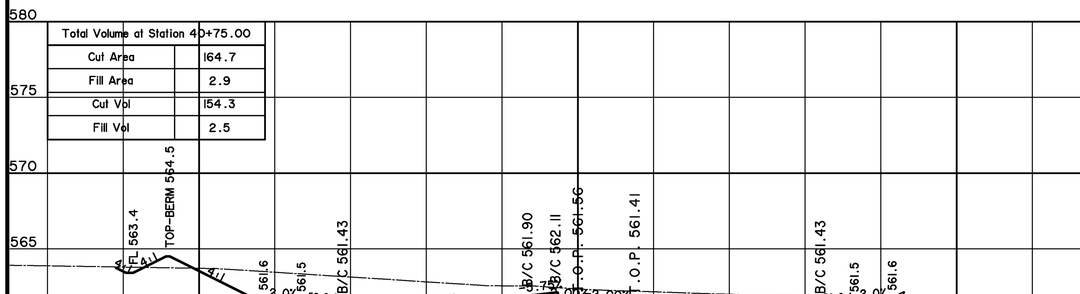
Total Volume at Station 41+00.00	
Cut Area	169.0
Fill Area	2.6
Cut Vol	156.1
Fill Vol	2.7



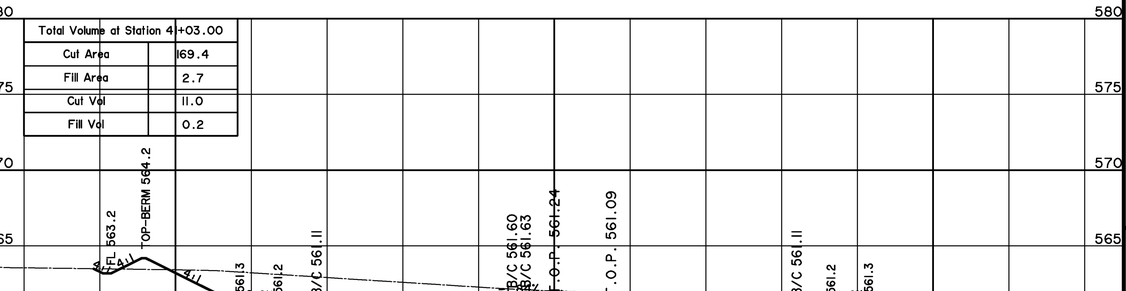
Total Volume at Station 41+03.75	
Cut Area	167.6
Fill Area	2.7
Cut Vol	4.7
Fill Vol	0.1



Total Volume at Station 40+75.00	
Cut Area	164.7
Fill Area	2.9
Cut Vol	154.3
Fill Vol	2.5



Total Volume at Station 41+03.00	
Cut Area	169.4
Fill Area	2.7
Cut Vol	11.0
Fill Vol	0.2



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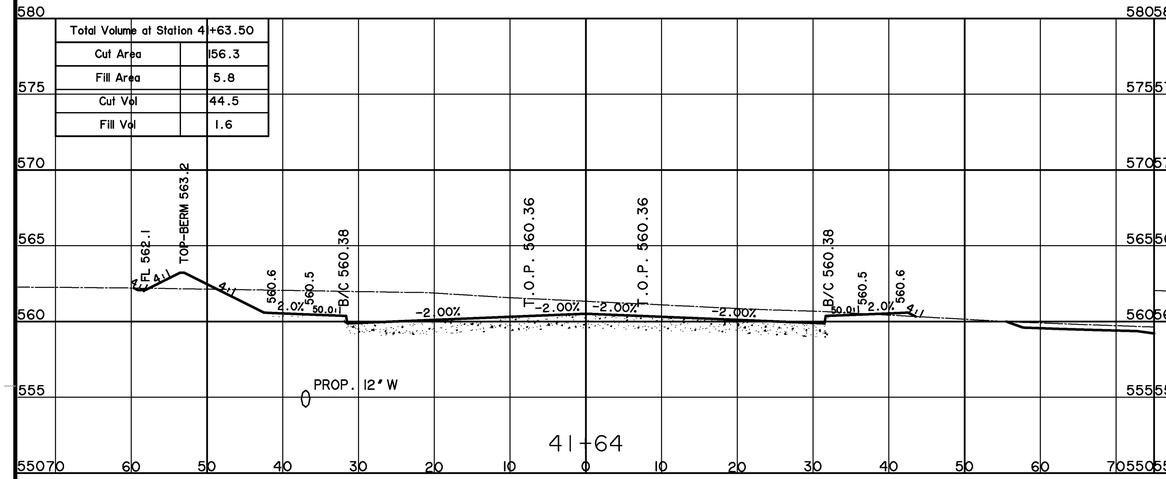
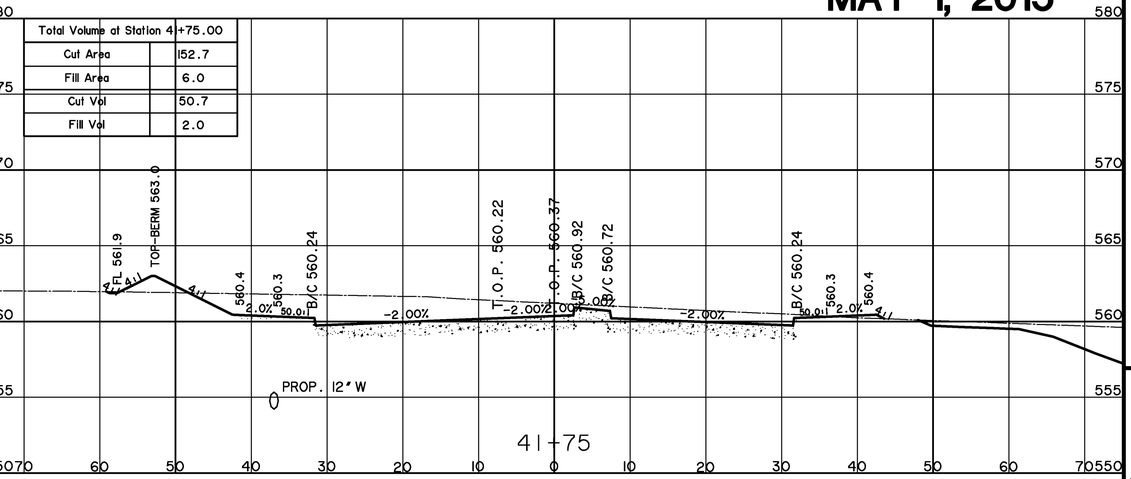
RECORD PLANS
MAY 1, 2015

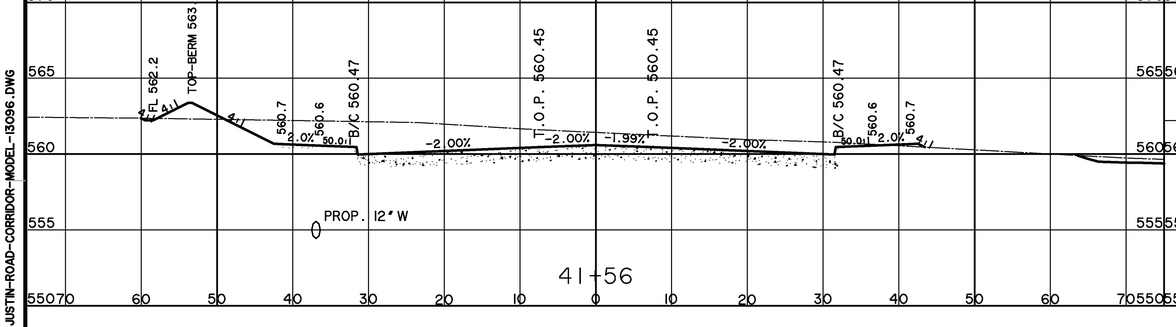
Total Volume at Station 41+63.50	
Cut Area	156.3
Fill Area	5.8
Cut Vol	44.5
Fill Vol	1.6



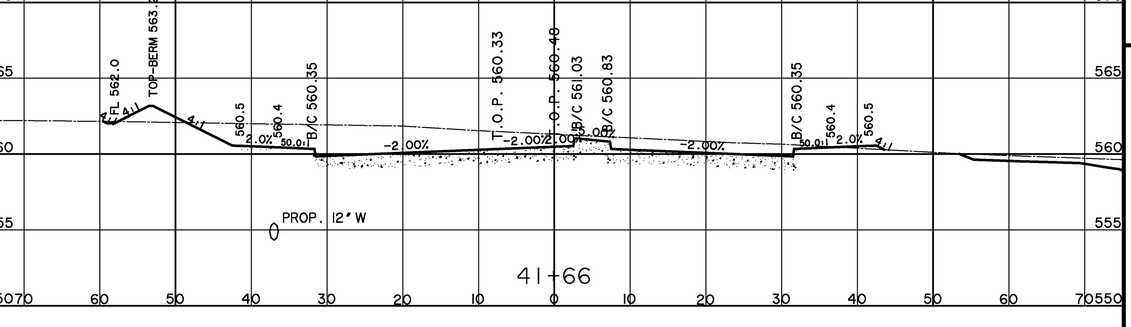
Total Volume at Station 41+75.00	
Cut Area	152.7
Fill Area	6.0
Cut Vol	50.7
Fill Vol	2.0



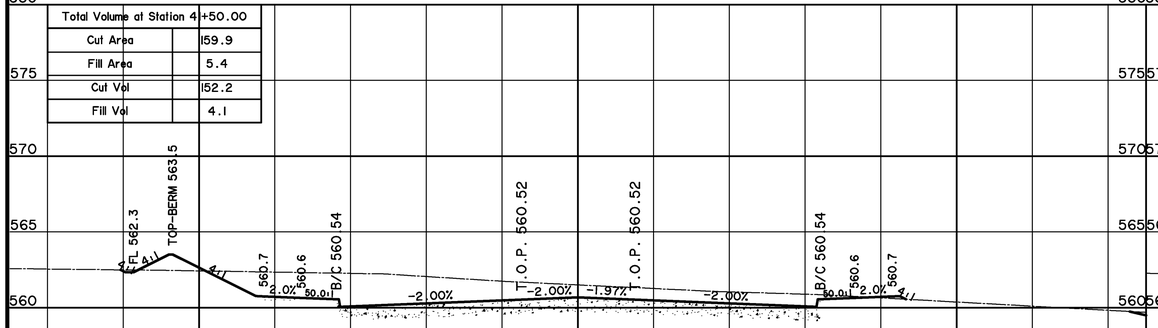
Total Volume at Station 41+55.87	
Cut Area	158.4
Fill Area	5.6
Cut Vol	34.6
Fill Vol	1.2



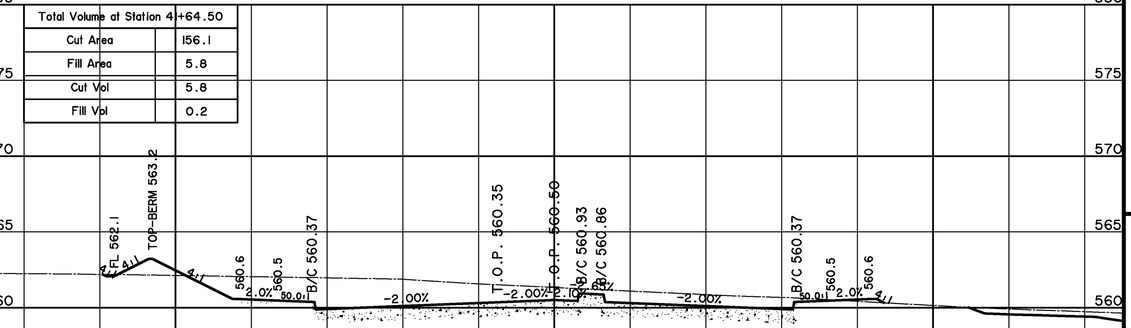
Total Volume at Station 41+66.11	
Cut Area	155.2
Fill Area	5.9
Cut Vol	9.3
Fill Vol	0.3



Total Volume at Station 41+50.00	
Cut Area	159.9
Fill Area	5.4
Cut Vol	152.2
Fill Vol	4.1



Total Volume at Station 41+64.50	
Cut Area	156.1
Fill Area	5.8
Cut Vol	5.8
Fill Vol	0.2



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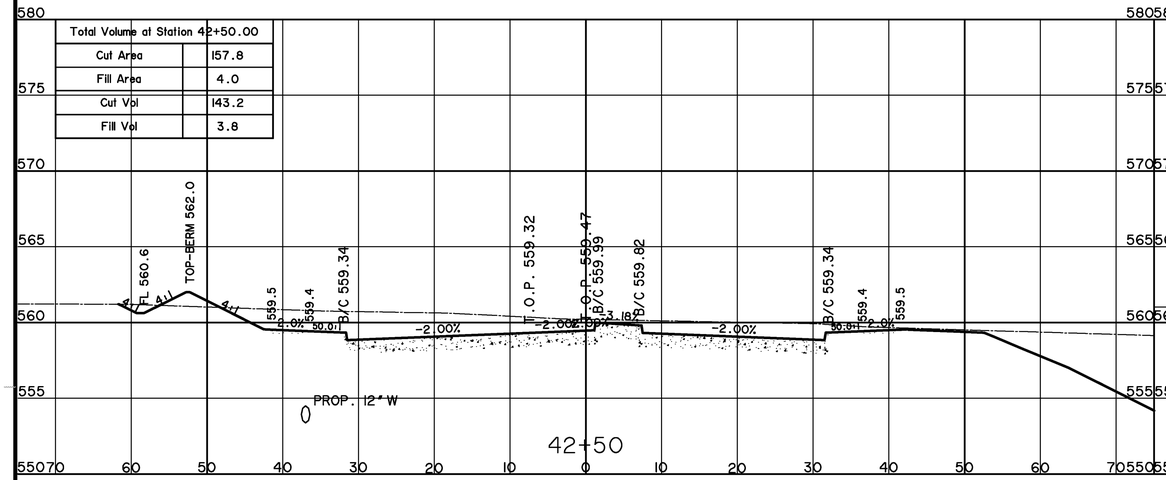
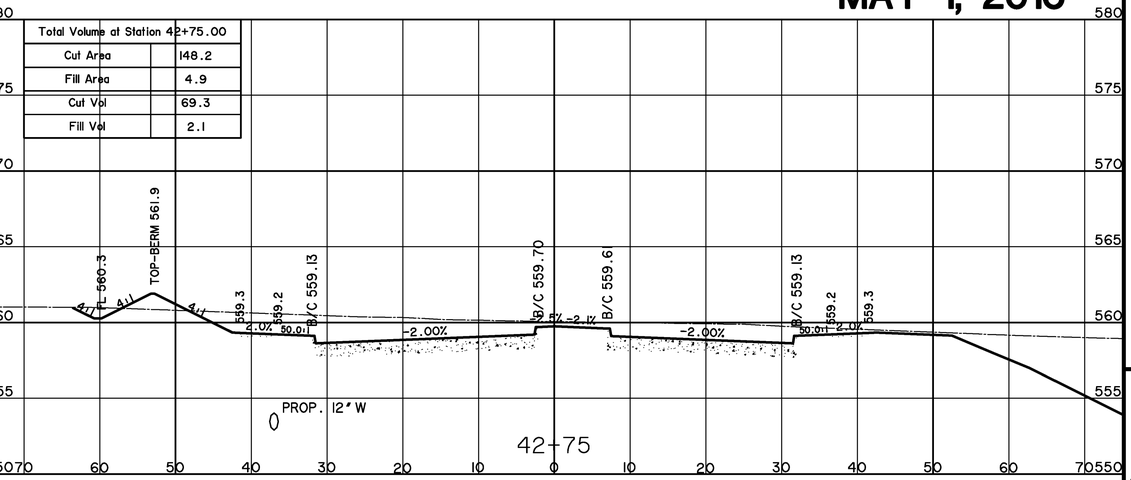
RECORD PLANS
MAY 1, 2015

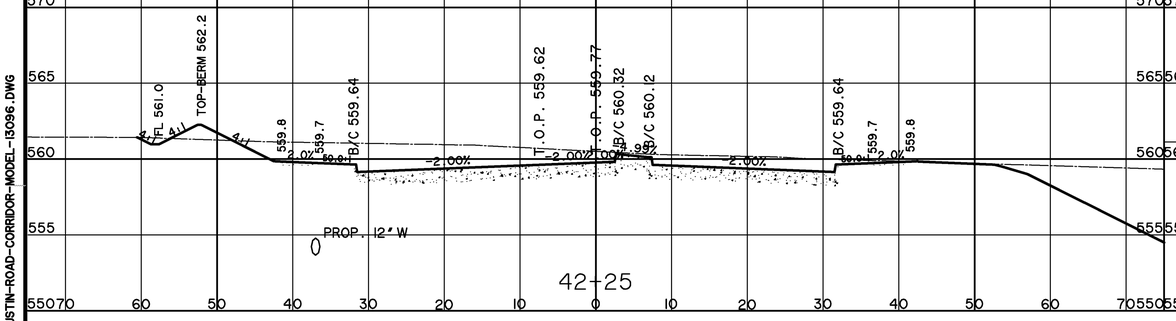
Total Volume at Station 42+50.00	
Cut Area	157.8
Fill Area	4.0
Cut Vol	143.2
Fill Vol	3.8



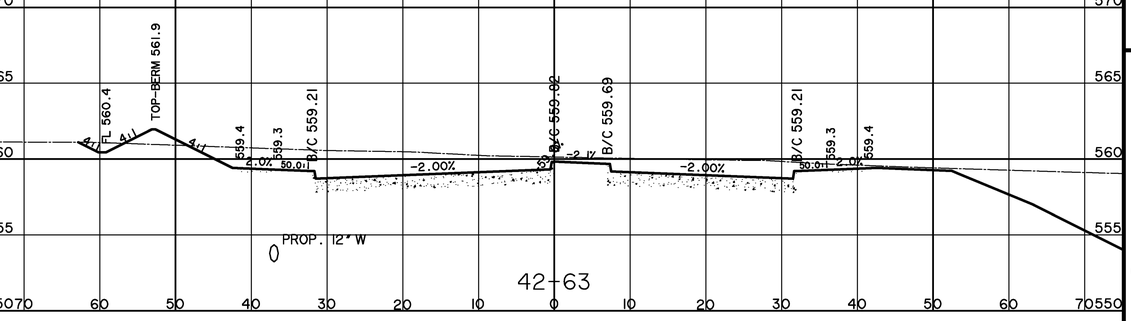
Total Volume at Station 42+75.00	
Cut Area	148.2
Fill Area	4.9
Cut Vol	69.3
Fill Vol	2.1



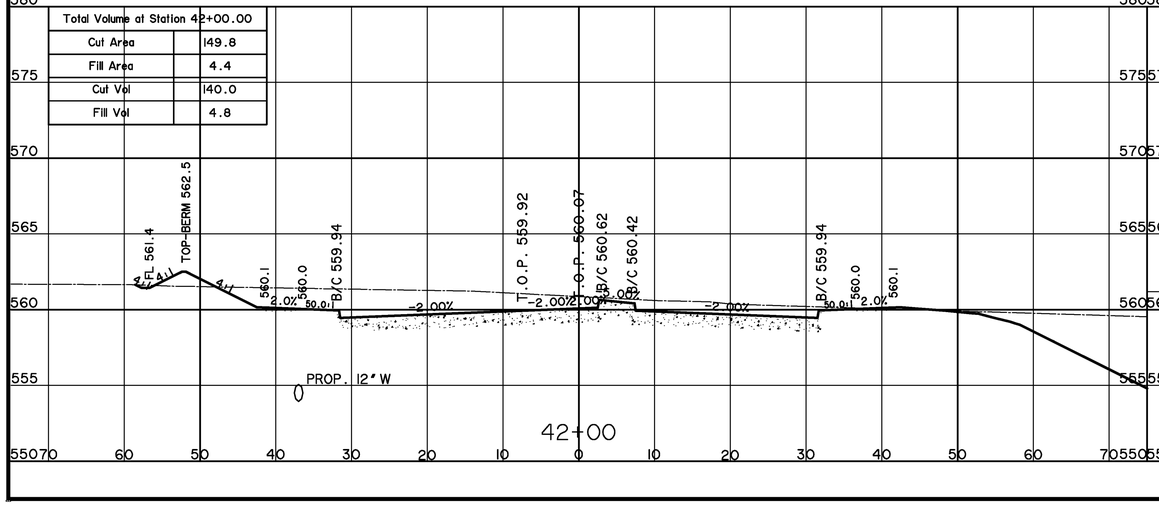
Total Volume at Station 42+25.00	
Cut Area	151.5
Fill Area	4.2
Cut Vol	139.5
Fill Vol	4.0



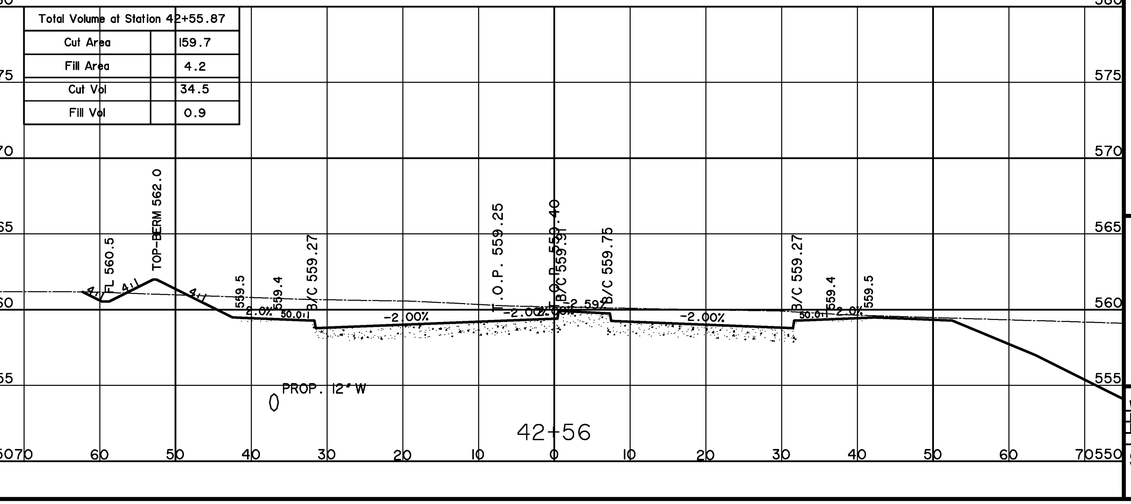
Total Volume at Station 42+62.50	
Cut Area	151.2
Fill Area	4.4
Cut Vol	38.2
Fill Vol	1.1



Total Volume at Station 42+00.00	
Cut Area	149.8
Fill Area	4.4
Cut Vol	140.0
Fill Vol	4.8



Total Volume at Station 42+55.87	
Cut Area	159.7
Fill Area	4.2
Cut Vol	34.5
Fill Vol	0.9



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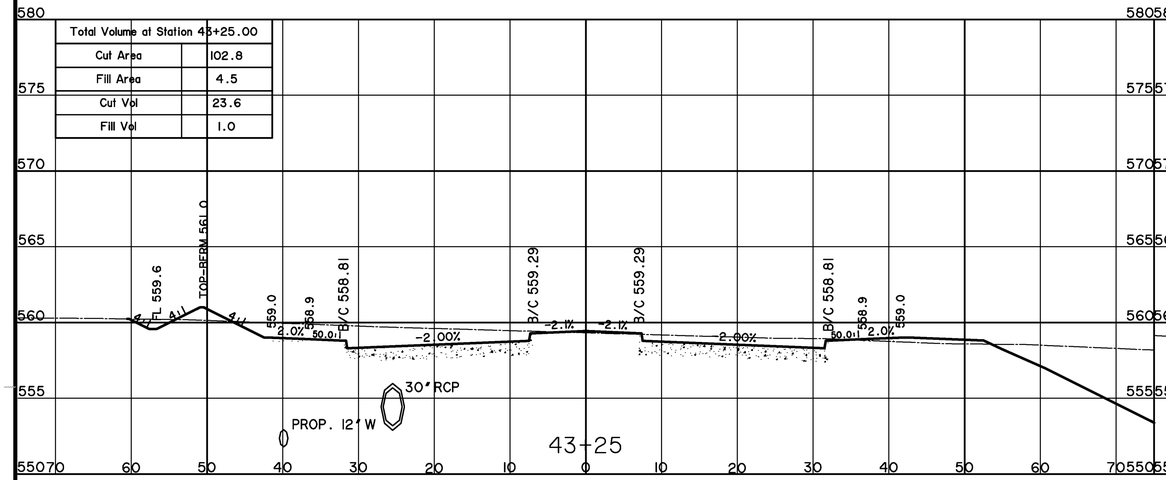
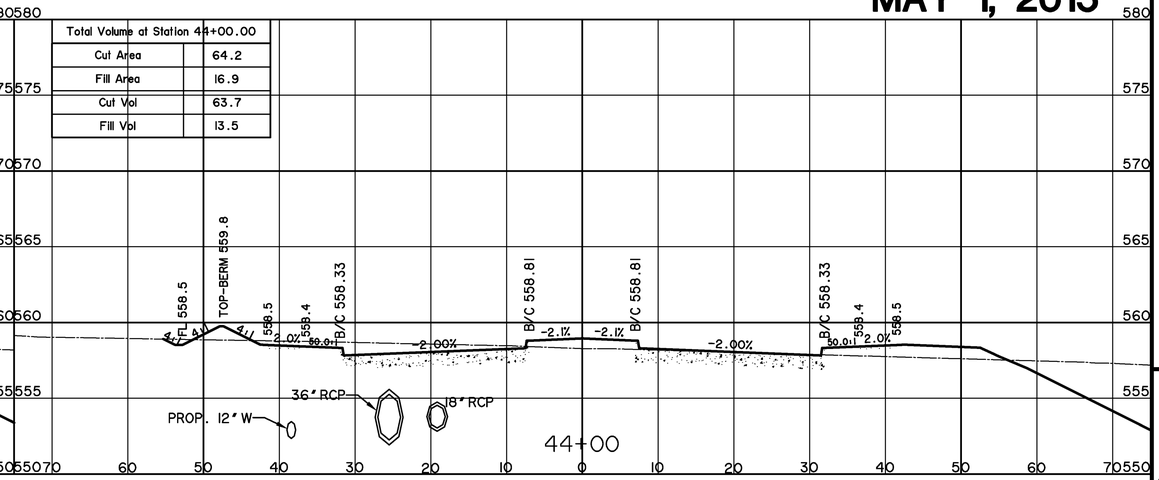
RECORD PLANS
MAY 1, 2015

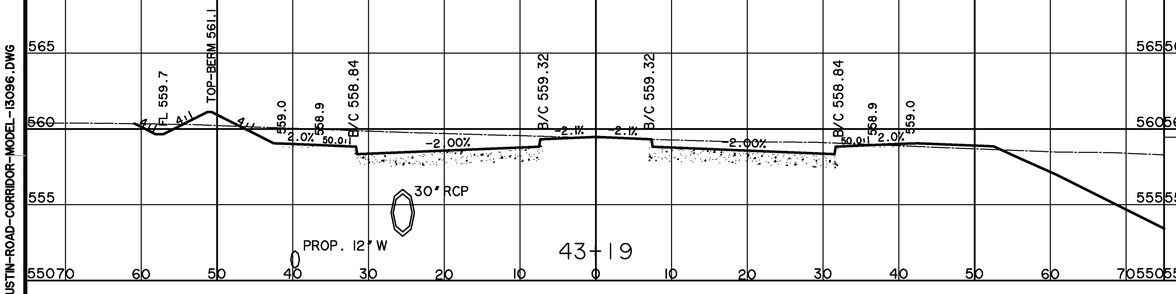
Total Volume at Station 43+25.00	
Cut Area	102.8
Fill Area	4.5
Cut Vol	23.6
Fill Vol	1.0



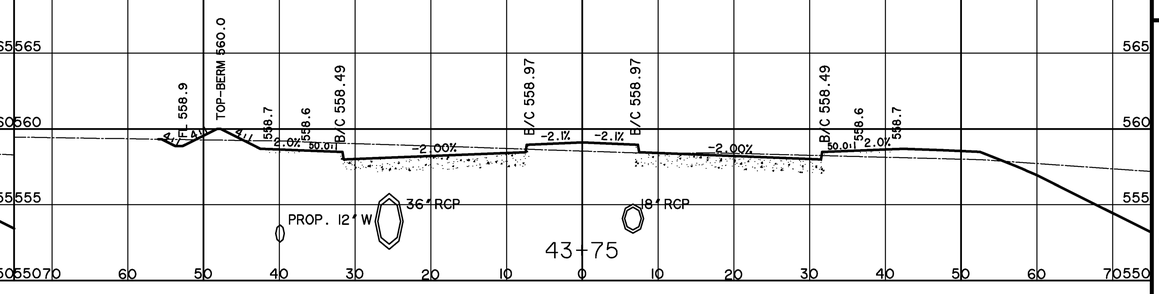
Total Volume at Station 44+00.00	
Cut Area	64.2
Fill Area	16.9
Cut Vol	63.7
Fill Vol	13.5



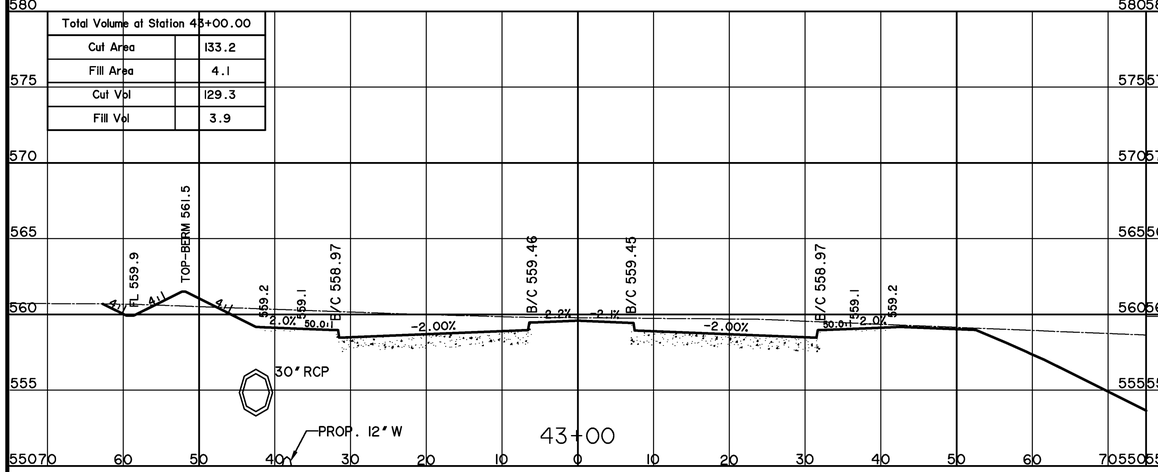
Total Volume at Station 43+18.96	
Cut Area	108.5
Fill Area	4.0
Cut Vol	84.1
Fill Vol	2.7



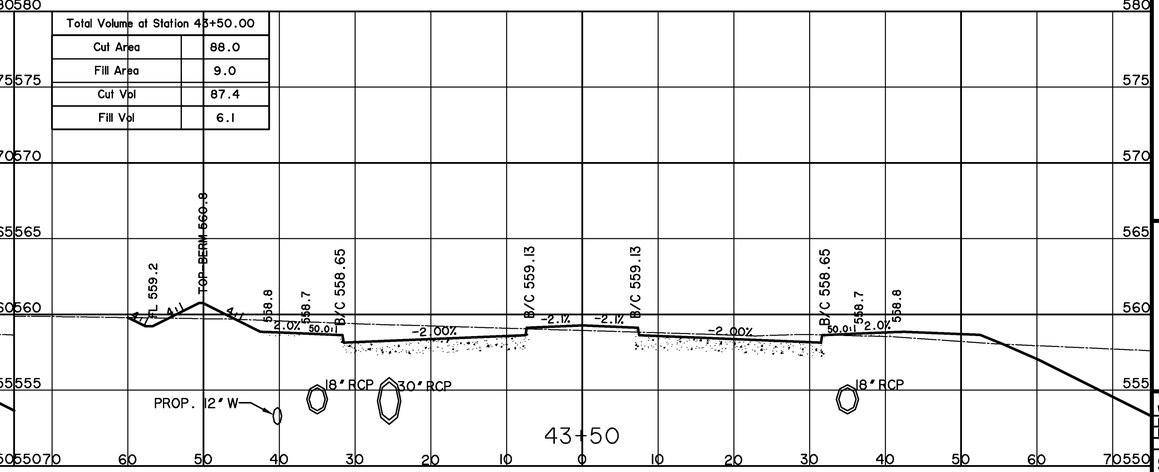
Total Volume at Station 43+75.00	
Cut Area	74.9
Fill Area	12.3
Cut Vol	74.6
Fill Vol	9.7



Total Volume at Station 43+00.00	
Cut Area	133.2
Fill Area	4.1
Cut Vol	129.3
Fill Vol	3.9



Total Volume at Station 43+50.00	
Cut Area	88.0
Fill Area	9.0
Cut Vol	87.4
Fill Vol	6.1



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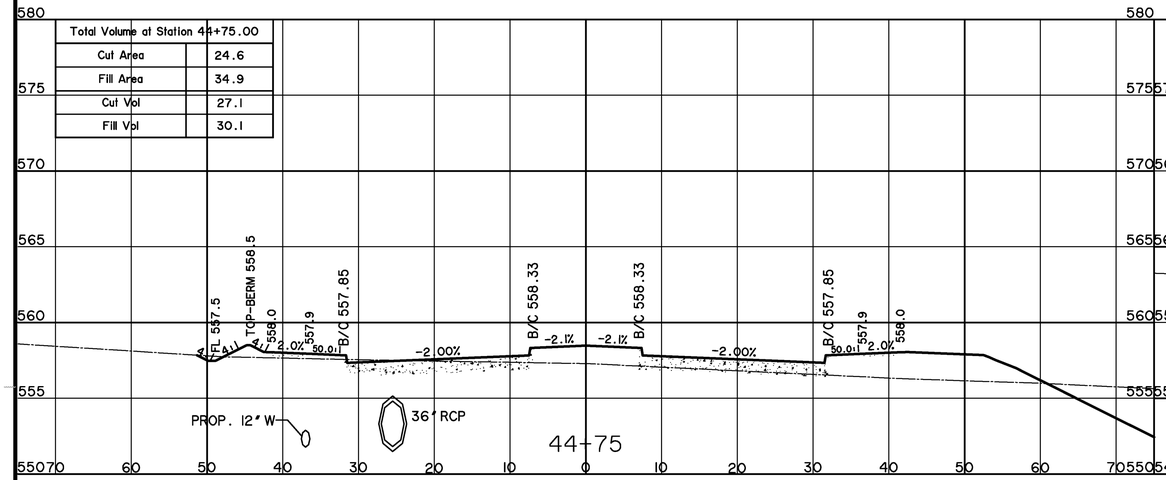
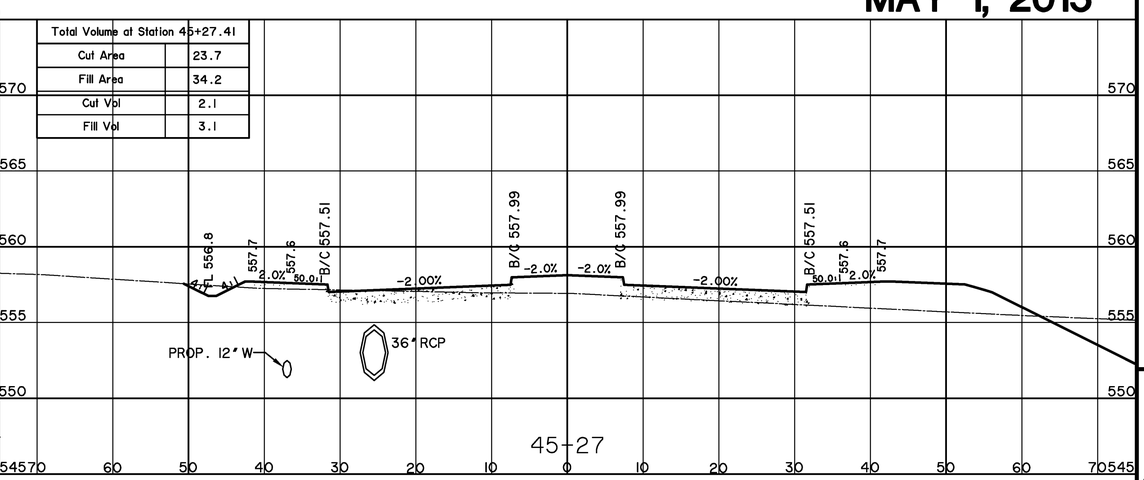
RECORD PLANS
MAY 1, 2015

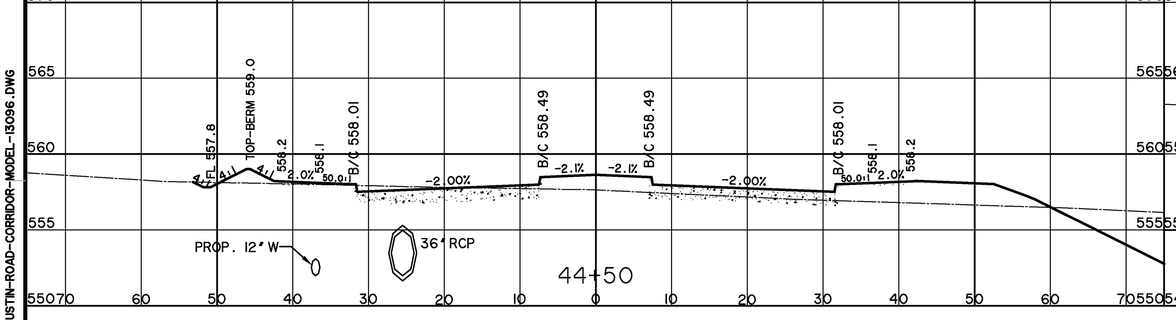
Total Volume at Station 44+75.00	
Cut Area	24.6
Fill Area	34.9
Cut Vol	27.1
Fill Vol	30.1



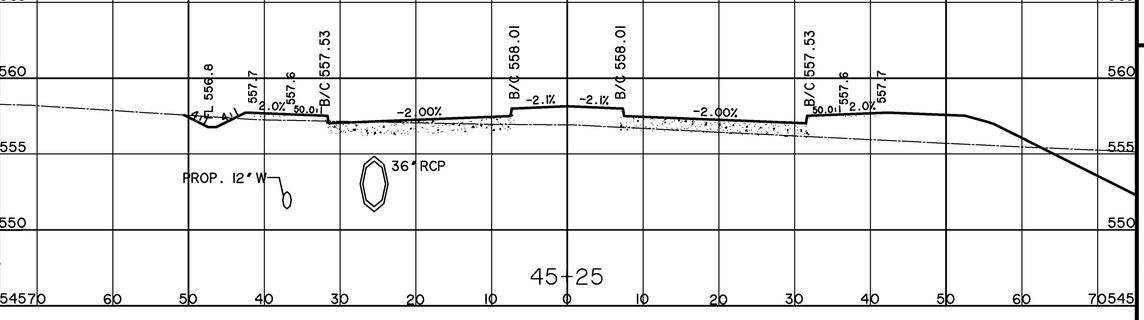
Total Volume at Station 45+27.41	
Cut Area	23.7
Fill Area	34.2
Cut Vol	2.1
Fill Vol	3.1



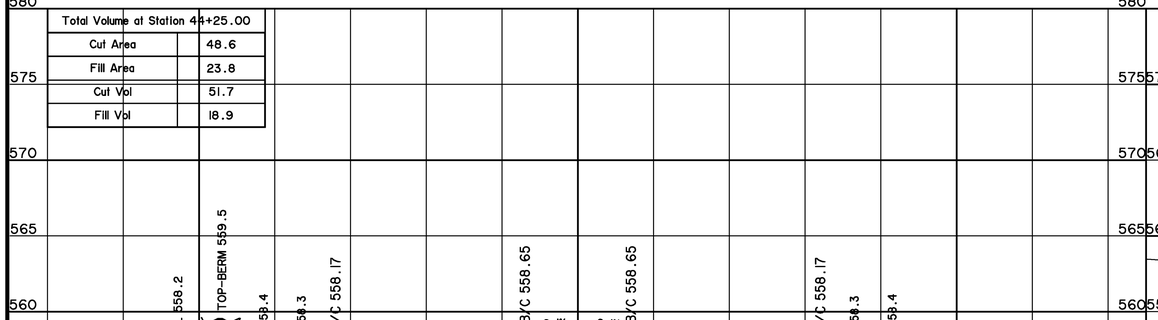
Total Volume at Station 44+50.00	
Cut Area	34.9
Fill Area	29.4
Cut Vol	38.2
Fill Vol	24.8



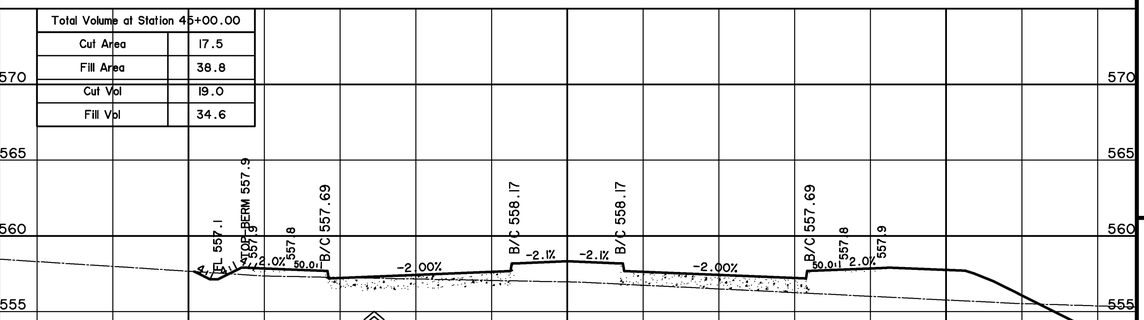
Total Volume at Station 45+25.00	
Cut Area	23.1
Fill Area	34.7
Cut Vol	18.3
Fill Vol	34.5



Total Volume at Station 44+25.00	
Cut Area	48.6
Fill Area	23.8
Cut Vol	51.7
Fill Vol	18.9



Total Volume at Station 45+00.00	
Cut Area	17.5
Fill Area	38.8
Cut Vol	19.0
Fill Vol	34.6



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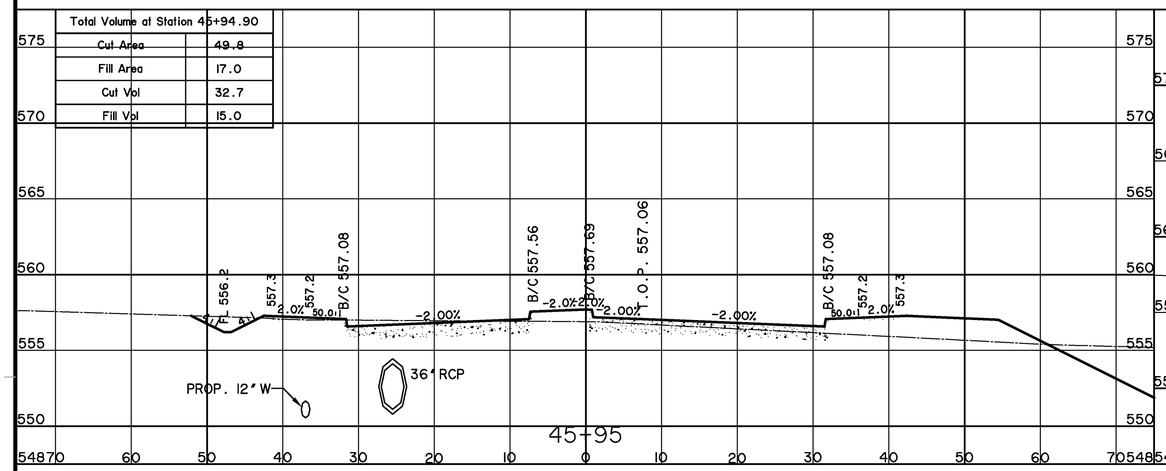
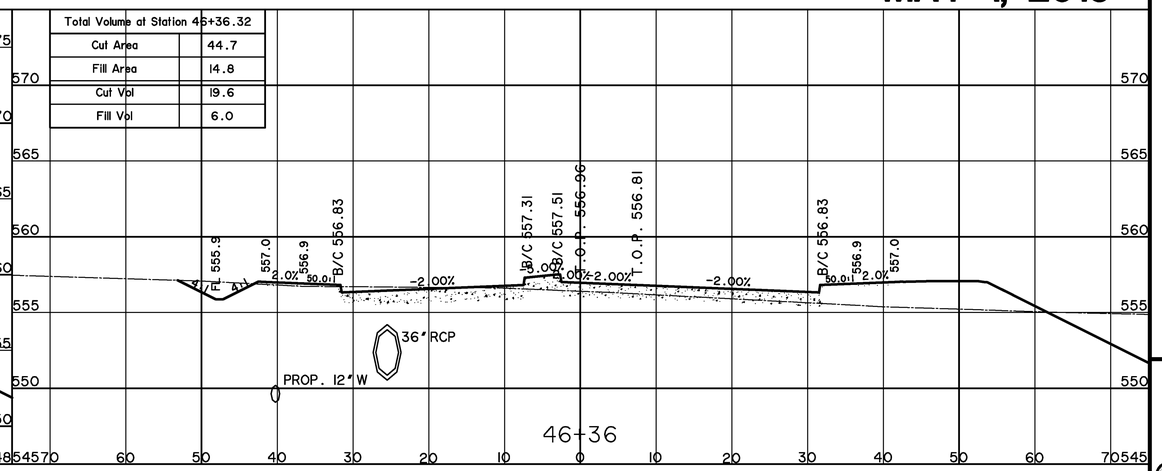
RECORD PLANS
MAY 1, 2015

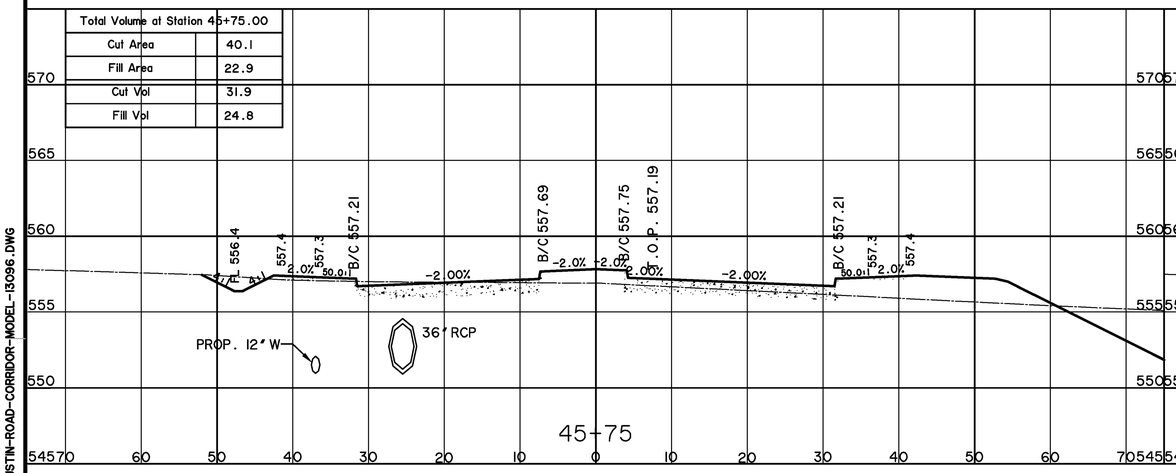
Total Volume at Station 45+94.90	
Cut Area	49.8
Fill Area	17.0
Cut Vol	32.7
Fill Vol	15.0



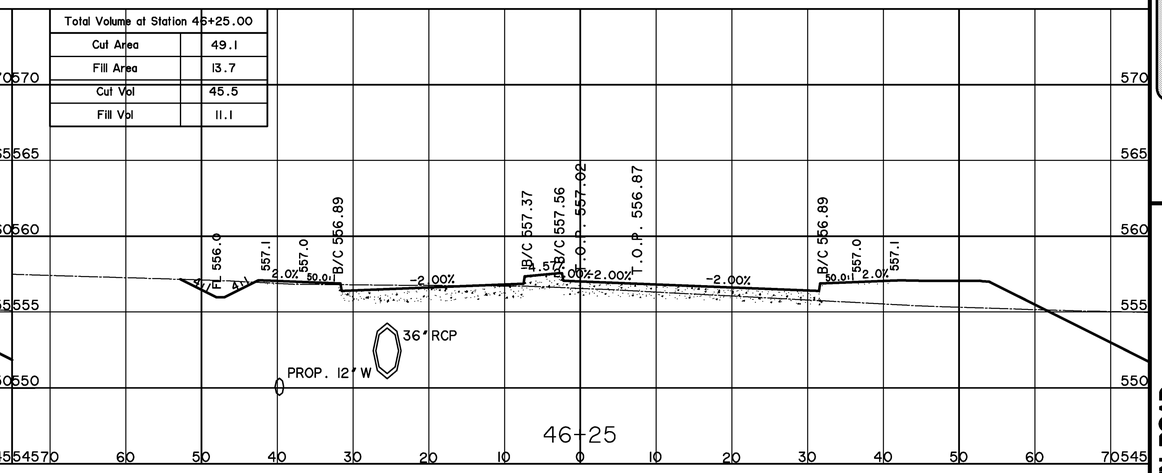
Total Volume at Station 46+36.32	
Cut Area	44.7
Fill Area	14.8
Cut Vol	19.6
Fill Vol	6.0



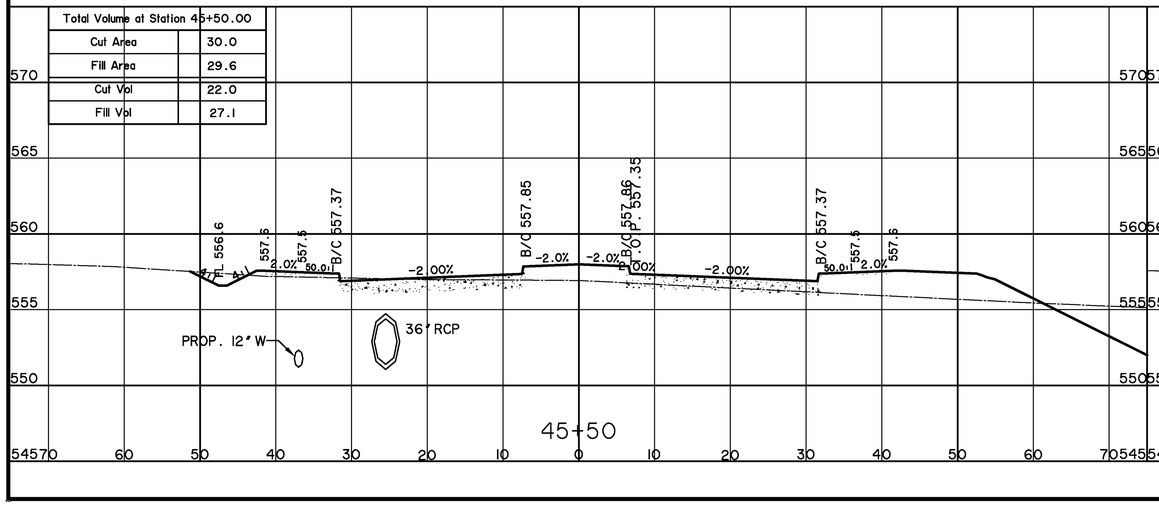
Total Volume at Station 45+75.00	
Cut Area	40.1
Fill Area	22.9
Cut Vol	31.9
Fill Vol	24.8



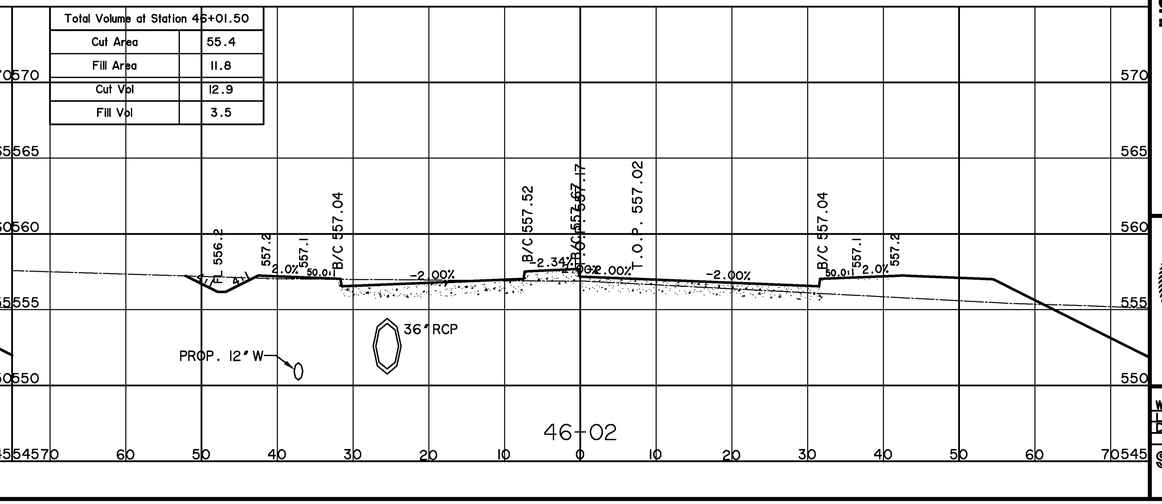
Total Volume at Station 46+25.00	
Cut Area	49.1
Fill Area	13.7
Cut Vol	45.5
Fill Vol	11.1



Total Volume at Station 45+50.00	
Cut Area	30.0
Fill Area	29.6
Cut Vol	22.0
Fill Vol	27.1



Total Volume at Station 46+01.50	
Cut Area	55.4
Fill Area	11.8
Cut Vol	12.9
Fill Vol	3.5



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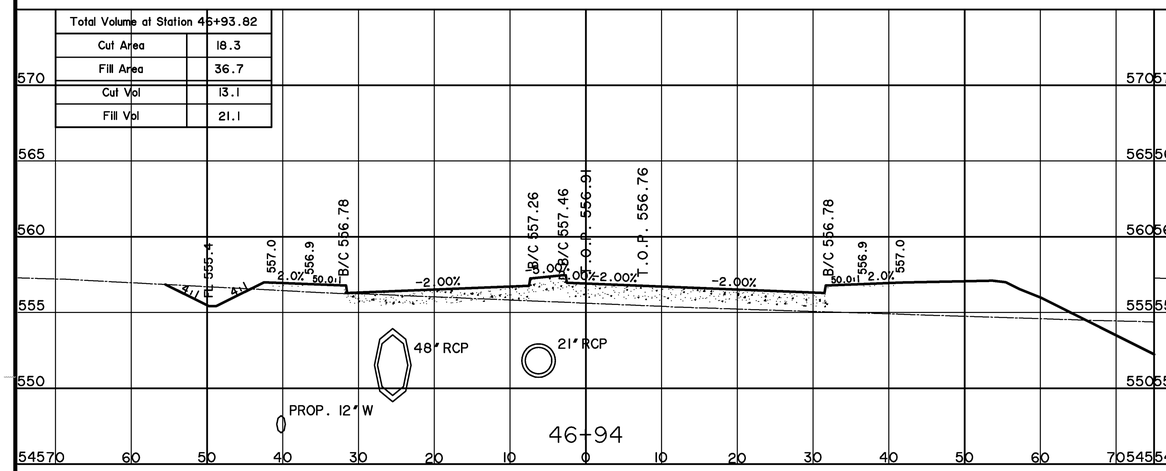
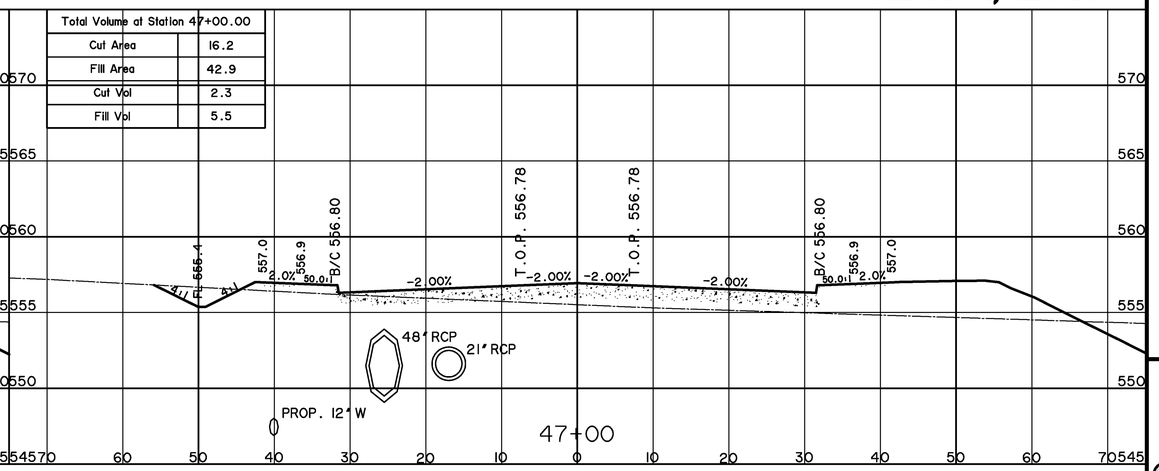
RECORD PLANS
MAY 1, 2015

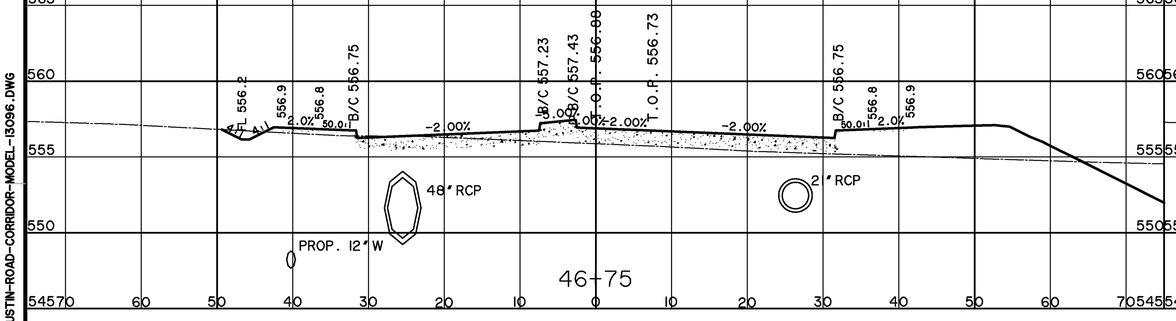
Total Volume at Station 46+93.82	
Cut Area	18.3
Fill Area	36.7
Cut Vol	13.1
Fill Vol	21.1



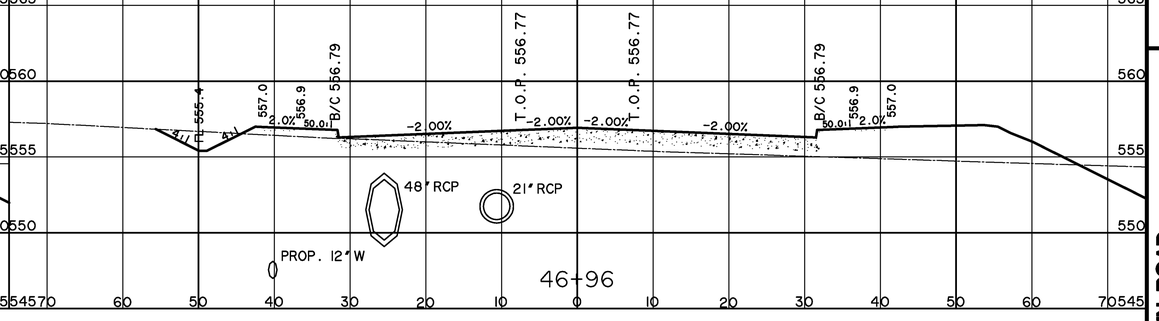
Total Volume at Station 47+00.00	
Cut Area	16.2
Fill Area	42.9
Cut Vol	2.3
Fill Vol	5.5



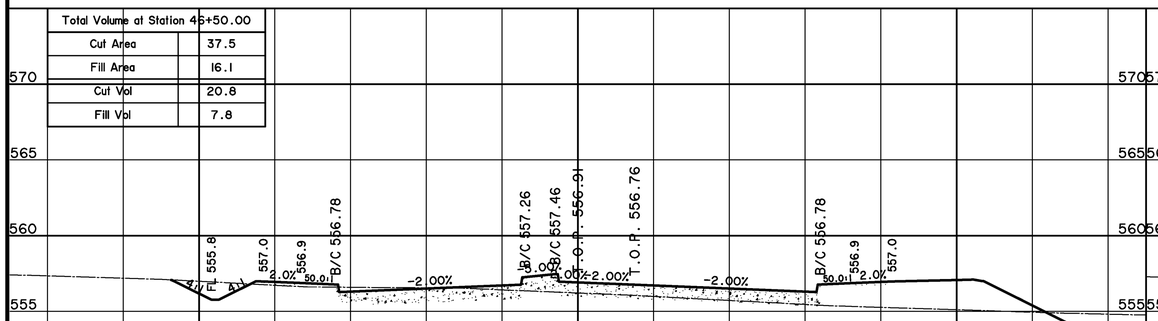
Total Volume at Station 46+75.00	
Cut Area	19.3
Fill Area	23.7
Cut Vol	26.3
Fill Vol	18.4



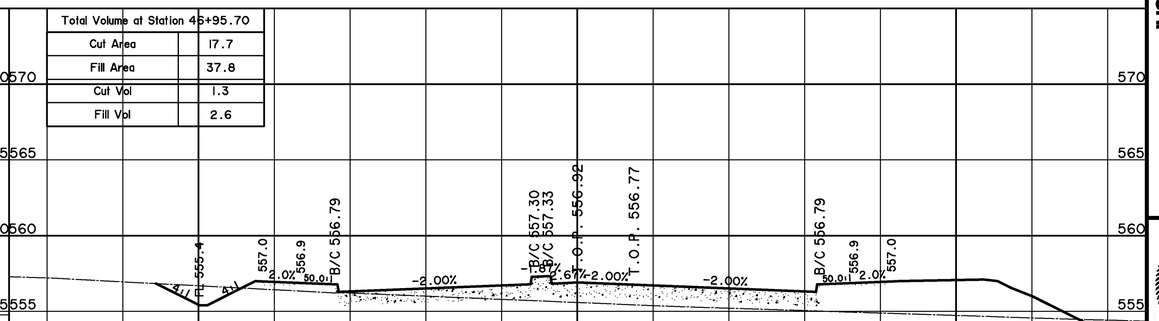
Total Volume at Station 46+96.35	
Cut Area	17.5
Fill Area	38.4
Cut Vol	0.4
Fill Vol	0.9



Total Volume at Station 46+50.00	
Cut Area	37.5
Fill Area	16.1
Cut Vol	20.8
Fill Vol	7.8



Total Volume at Station 46+95.70	
Cut Area	17.7
Fill Area	37.8
Cut Vol	1.3
Fill Vol	2.6



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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
CROSS-SECTIONS

STATE OF TEXAS
PHILIP L. GRAHAM
94719
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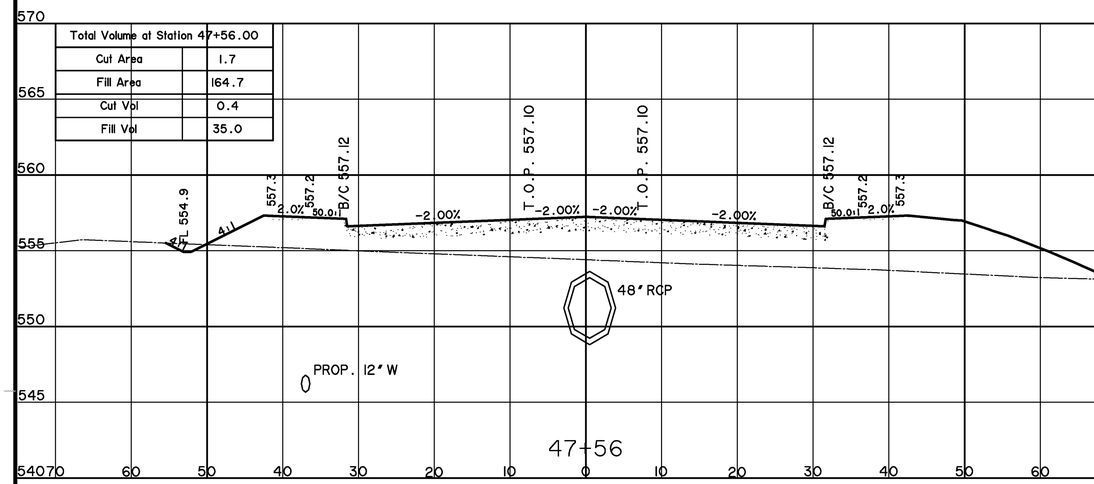

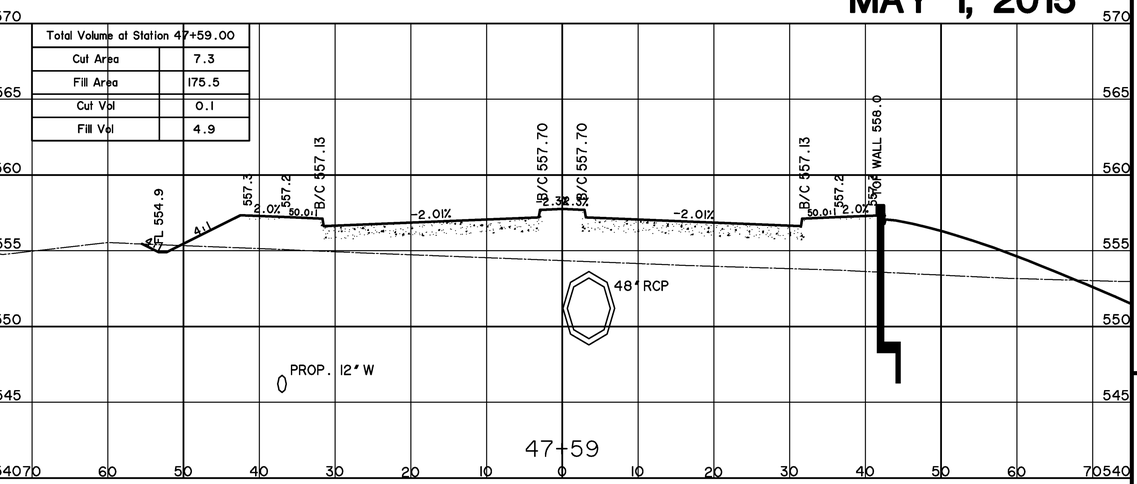

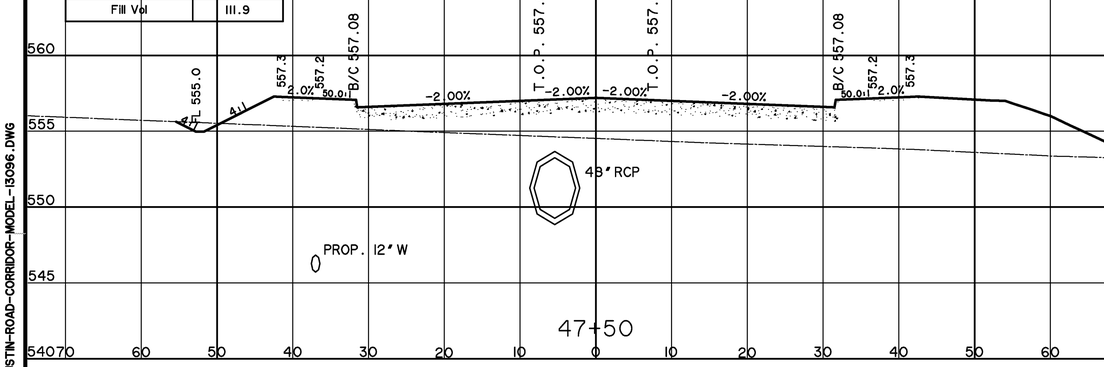

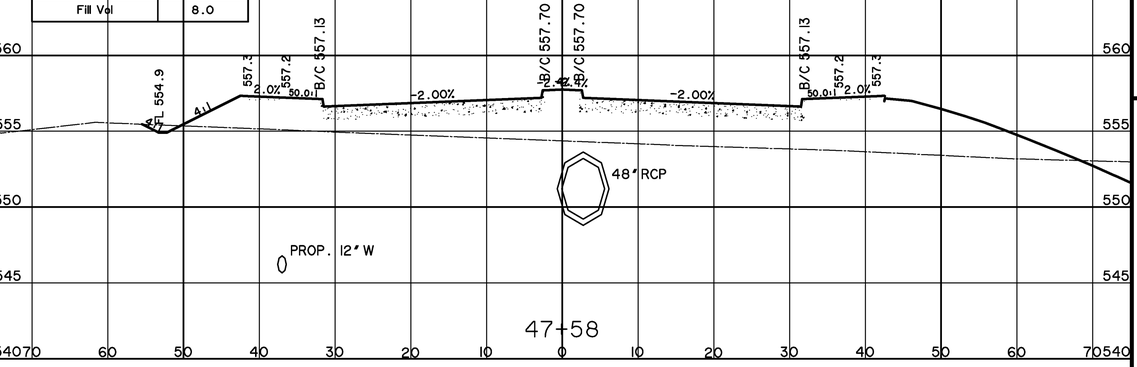

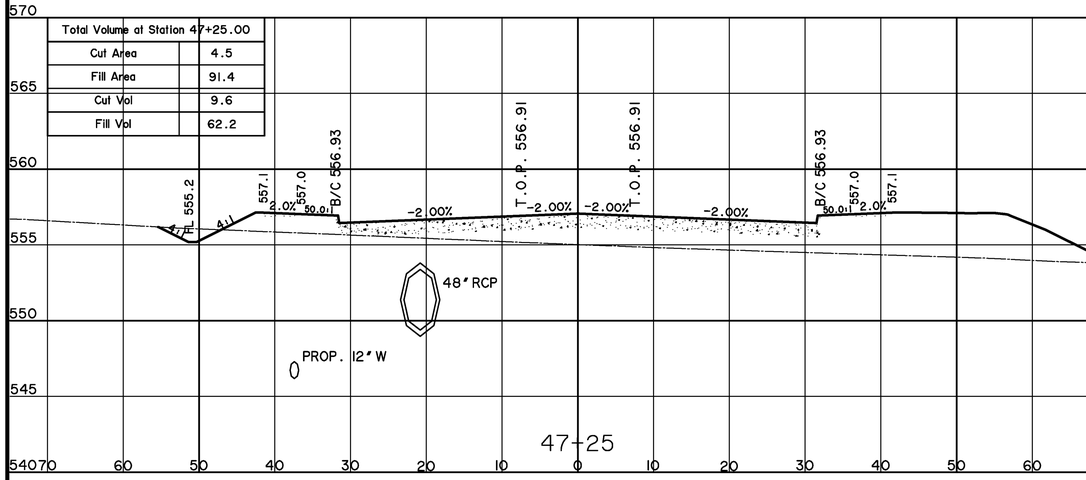

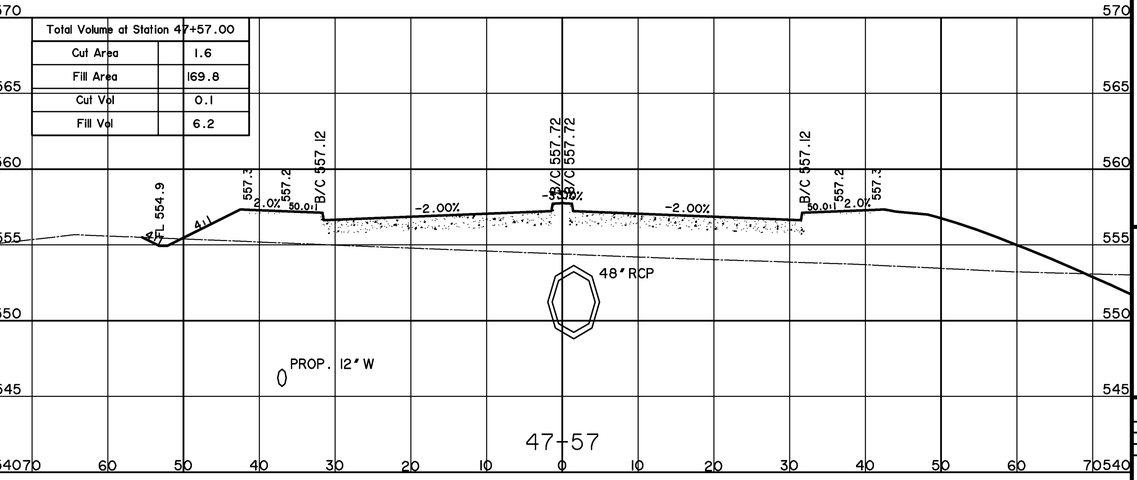

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RECORD PLANS
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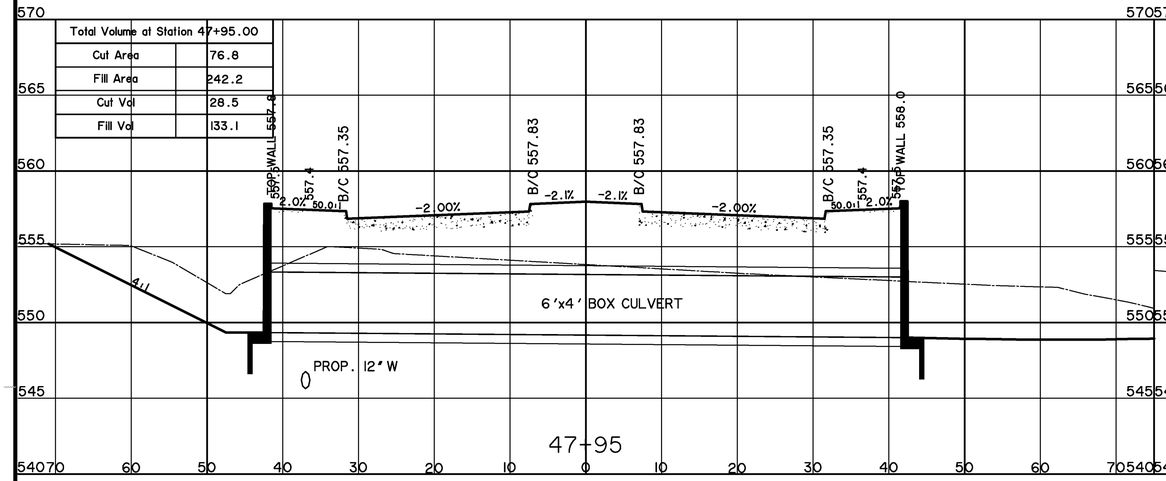
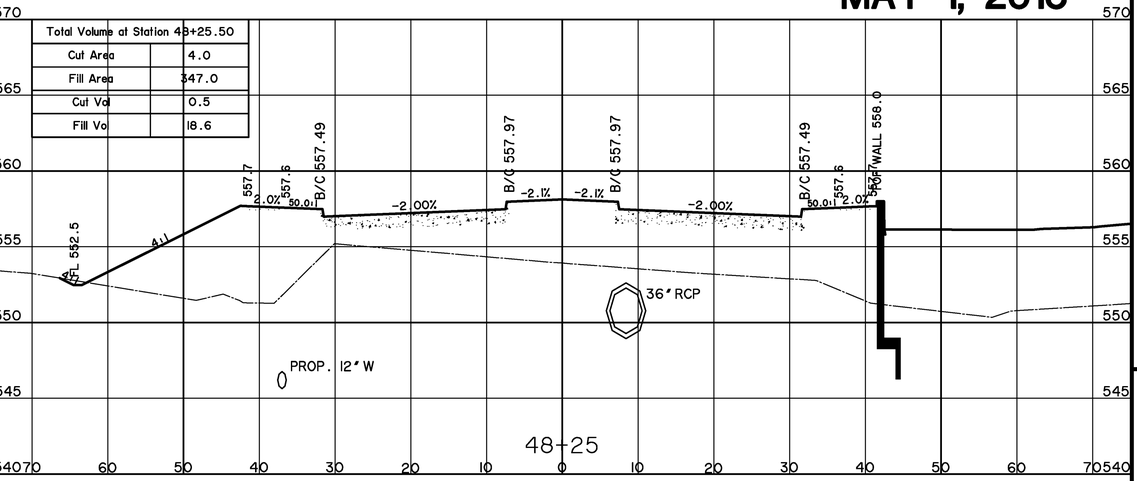
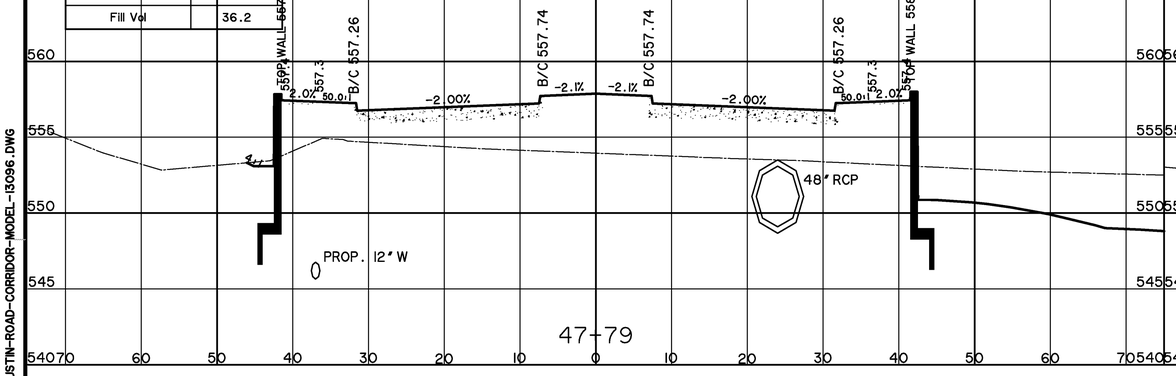
Total Volume at Station 47+95.00	
Cut Area	76.8
Fill Area	242.2
Cut Vol	28.5
Fill Vol	133.1



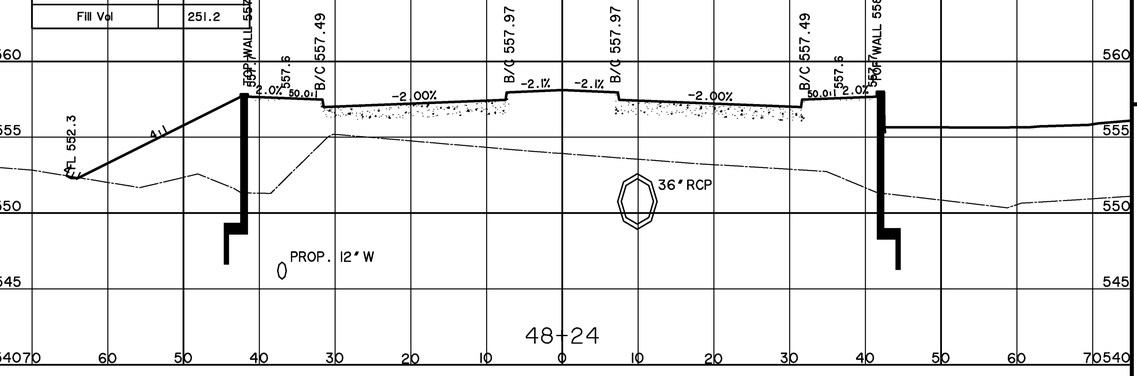
Total Volume at Station 48+25.50	
Cut Area	4.0
Fill Area	347.0
Cut Vol	0.5
Fill Vol	18.6



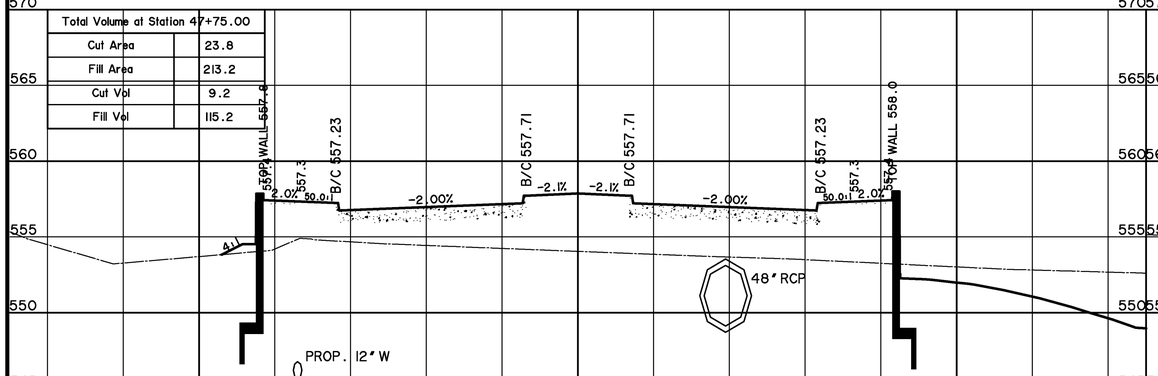
Total Volume at Station 47+79.50	
Cut Area	22.3
Fill Area	221.5
Cut Vol	3.8
Fill Vol	36.2



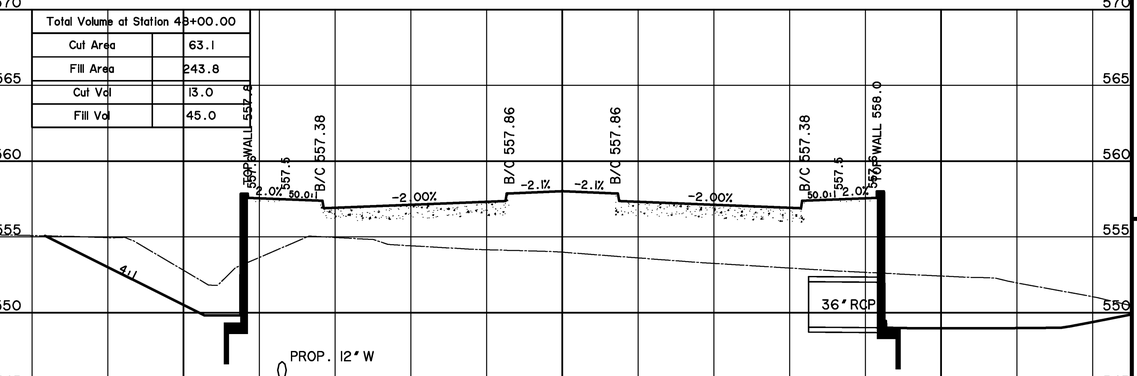
Total Volume at Station 48+24.00	
Cut Area	14.3
Fill Area	321.5
Cut Vol	34.4
Fill Vol	251.2



Total Volume at Station 47+75.00	
Cut Area	23.8
Fill Area	213.2
Cut Vol	9.2
Fill Vol	115.2



Total Volume at Station 48+00.00	
Cut Area	63.1
Fill Area	243.8
Cut Vol	13.0
Fill Vol	45.0



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RECORD PLANS
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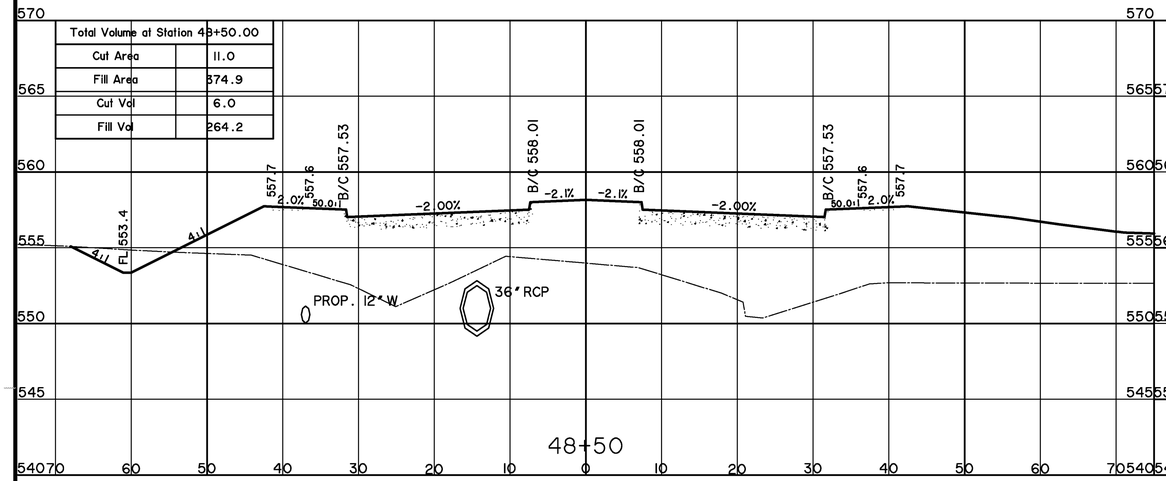
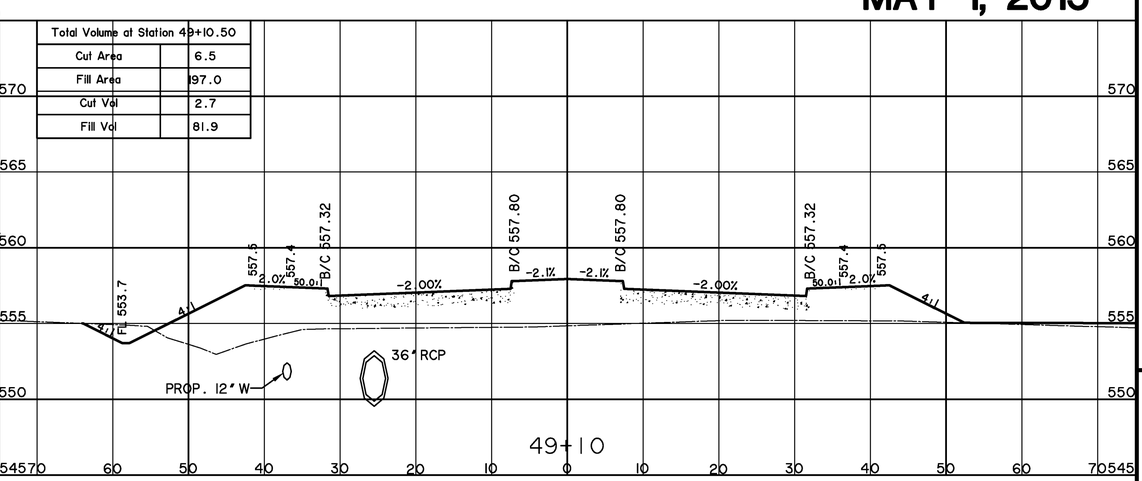
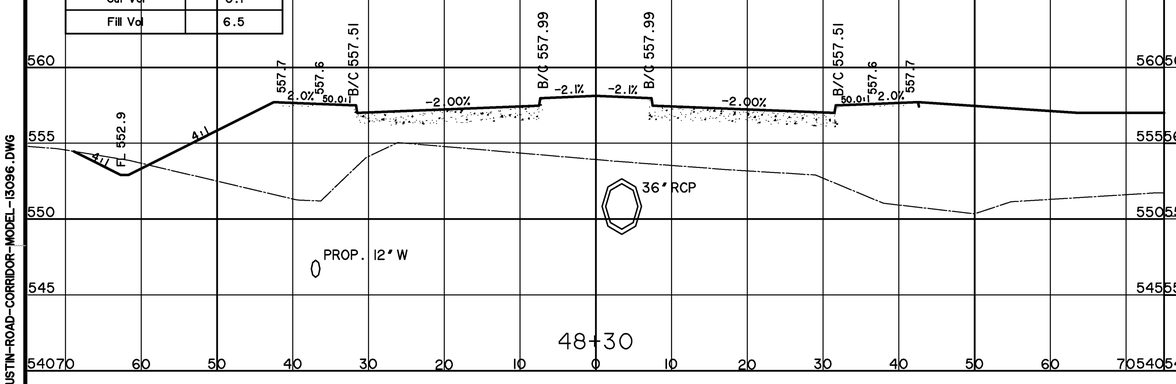
Total Volume at Station 48+50.00	
Cut Area	11.0
Fill Area	374.9
Cut Vol	6.0
Fill Vol	264.2



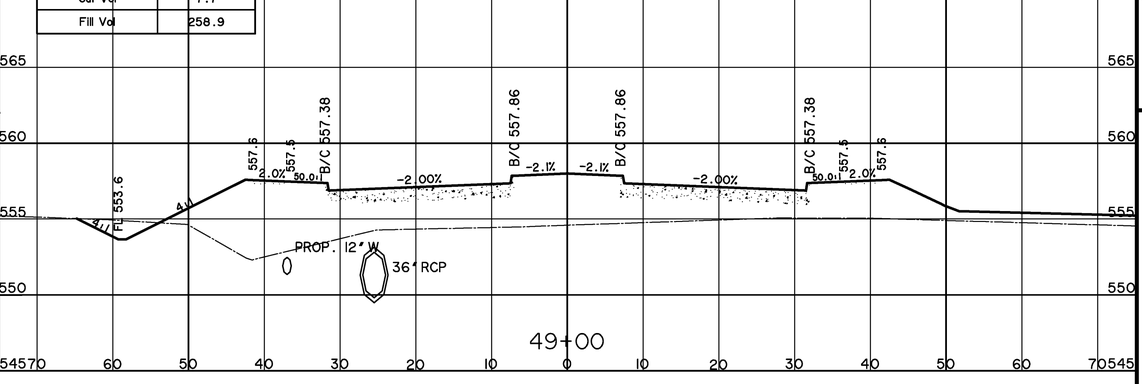
Total Volume at Station 49+10.50	
Cut Area	6.5
Fill Area	197.0
Cut Vol	2.7
Fill Vol	81.9



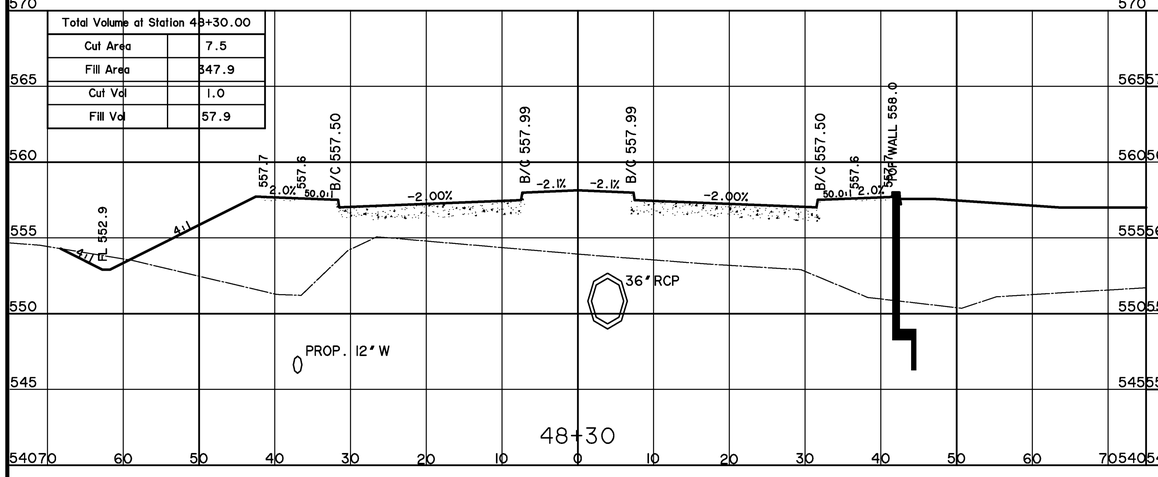
Total Volume at Station 48+30.50	
Cut Area	5.5
Fill Area	356.8
Cut Vol	0.1
Fill Vol	6.5



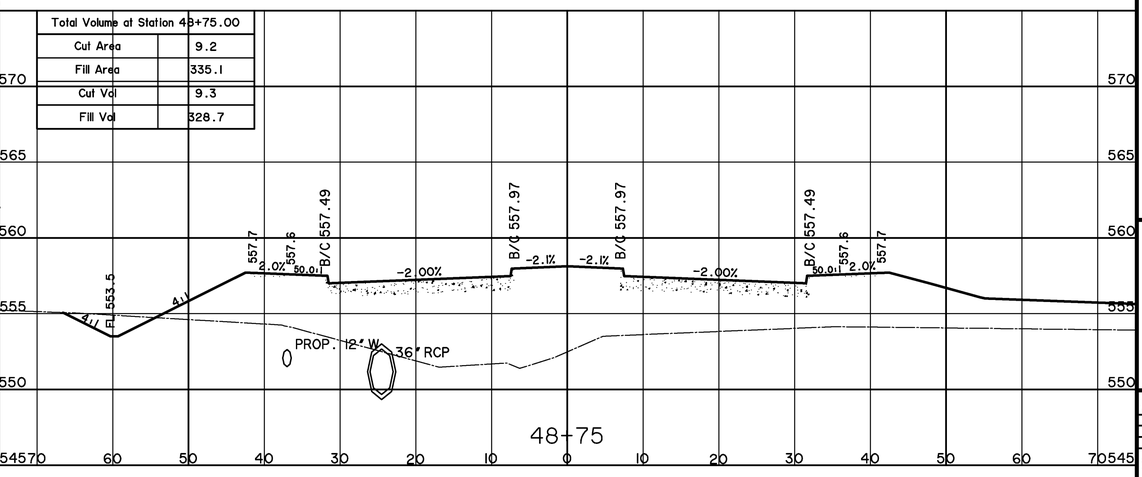
Total Volume at Station 49+00.00	
Cut Area	7.4
Fill Area	224.2
Cut Vol	7.7
Fill Vol	258.9



Total Volume at Station 48+30.00	
Cut Area	7.5
Fill Area	347.9
Cut Vol	1.0
Fill Vol	57.9



Total Volume at Station 48+75.00	
Cut Area	9.2
Fill Area	335.1
Cut Vol	9.3
Fill Vol	328.7



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RECORD PLANS
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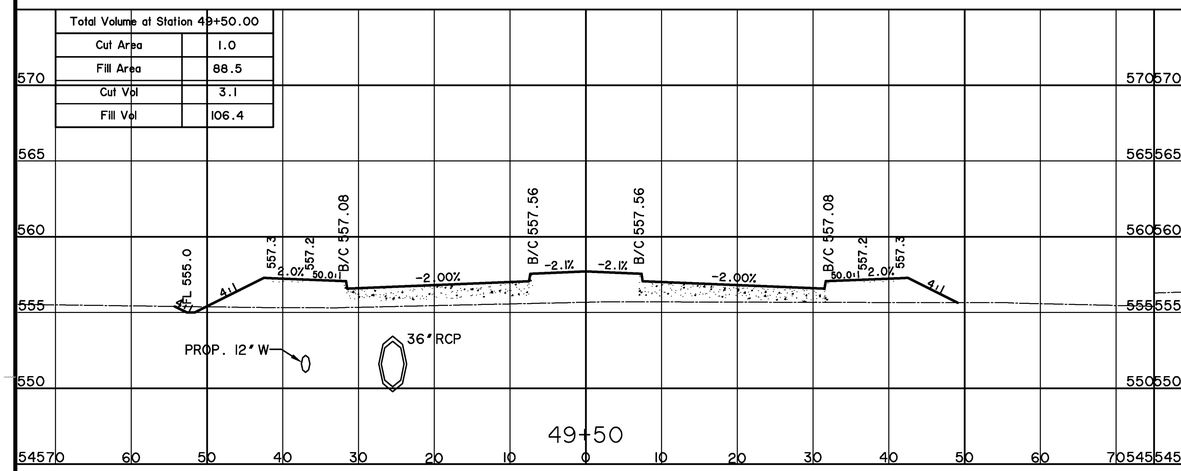
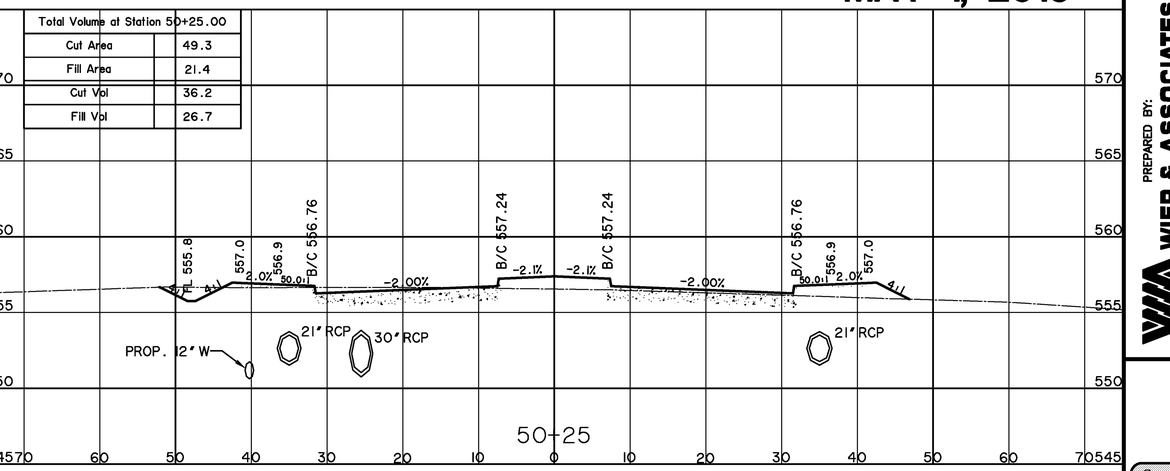
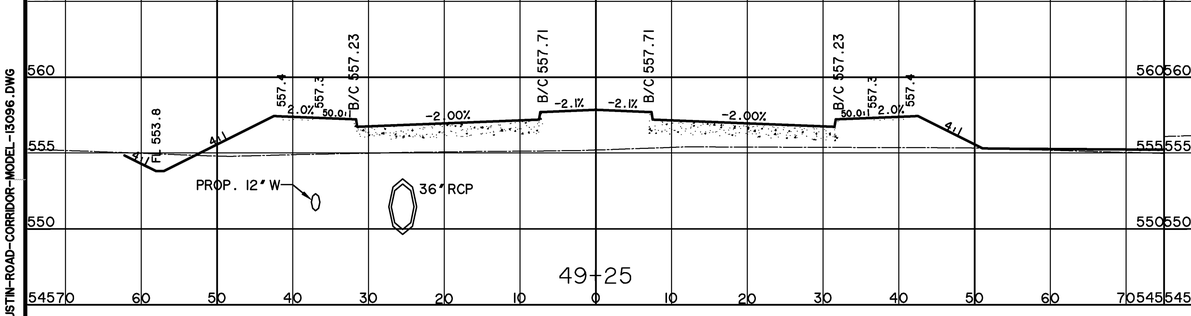
Total Volume at Station 49+50.00	
Cut Area	1.0
Fill Area	88.5
Cut Vol	3.1
Fill Vol	106.4



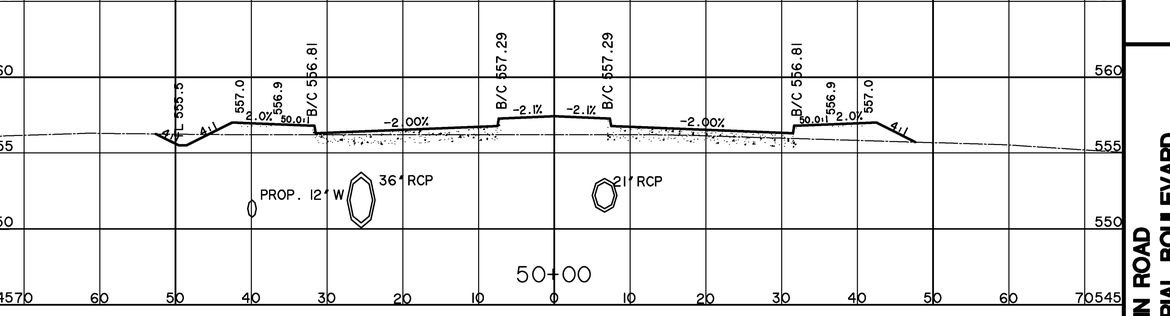
Total Volume at Station 50+25.00	
Cut Area	49.3
Fill Area	21.4
Cut Vol	36.2
Fill Vol	26.7



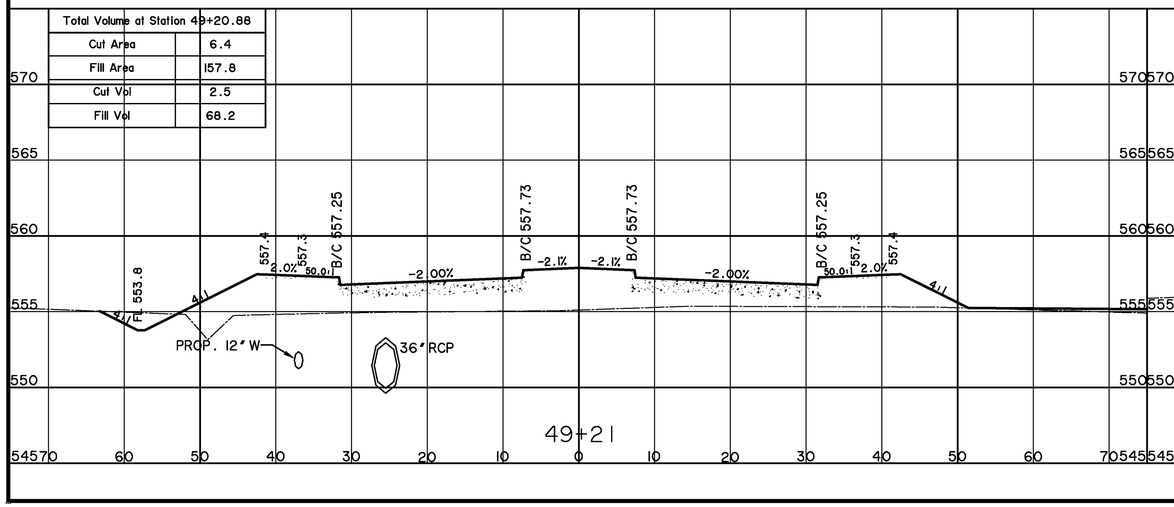
Total Volume at Station 49+25.00	
Cut Area	6.3
Fill Area	142.3
Cut Vol	1.0
Fill Vol	22.9



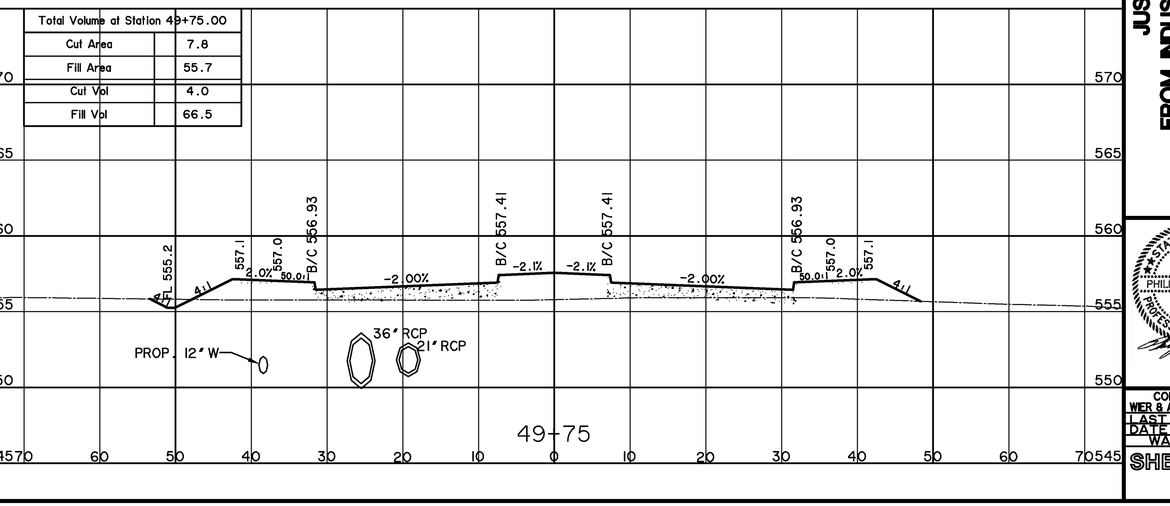
Total Volume at Station 50+00.00	
Cut Area	29.7
Fill Area	35.6
Cut Vol	17.2
Fill Vol	42.4



Total Volume at Station 49+20.88	
Cut Area	6.4
Fill Area	157.8
Cut Vol	2.5
Fill Vol	68.2



Total Volume at Station 49+75.00	
Cut Area	7.8
Fill Area	55.7
Cut Vol	4.0
Fill Vol	66.5



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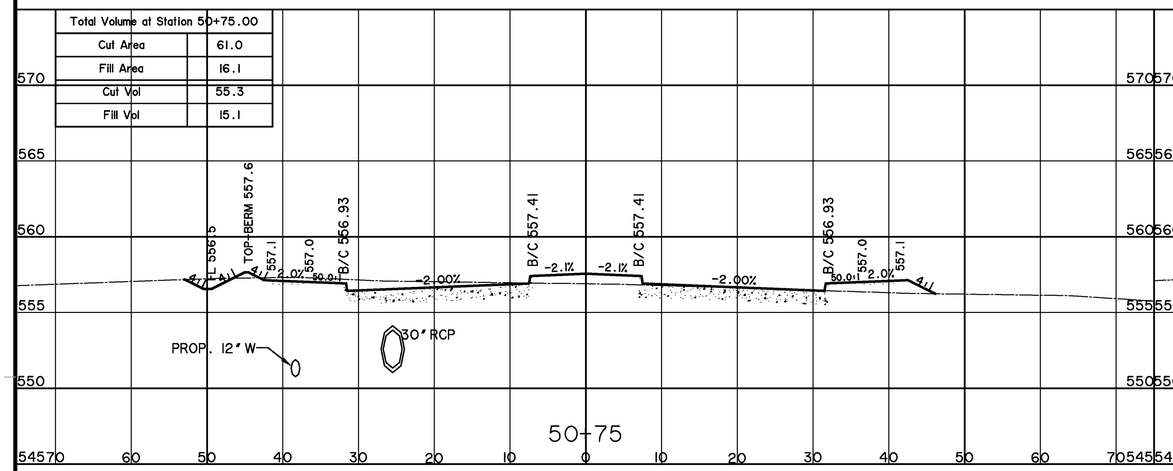
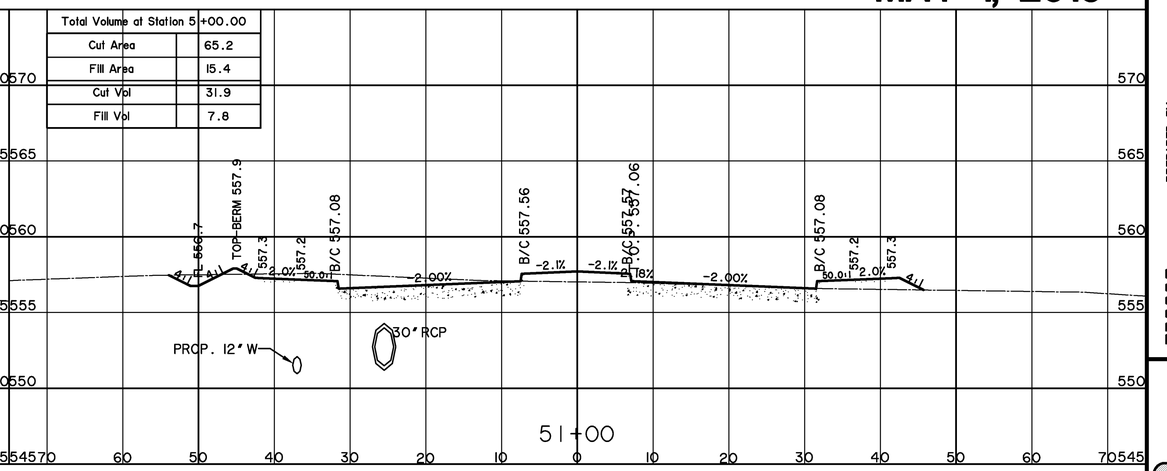
RECORD PLANS
MAY 1, 2015

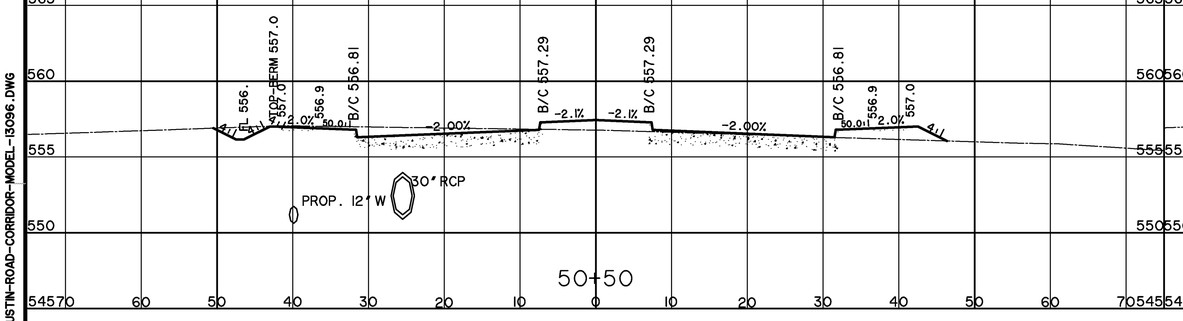
Total Volume at Station 50+75.00	
Cut Area	61.0
Fill Area	16.1
Cut Vol	55.3
Fill Vol	15.1



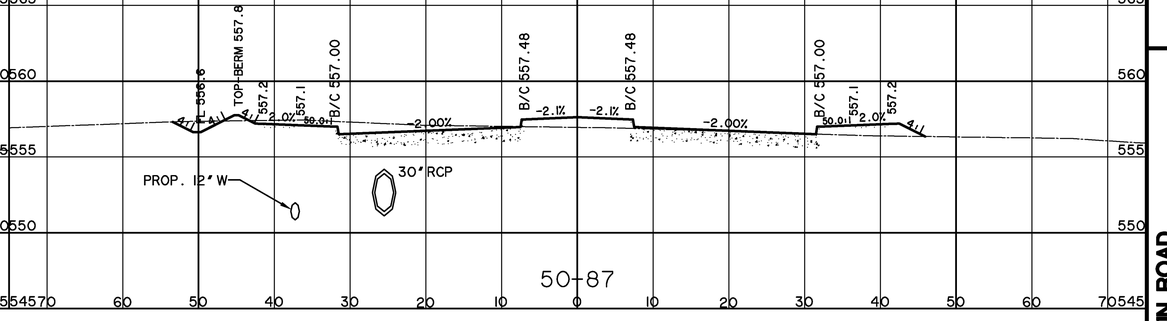
Total Volume at Station 51+00.00	
Cut Area	65.2
Fill Area	15.4
Cut Vol	31.9
Fill Vol	7.8



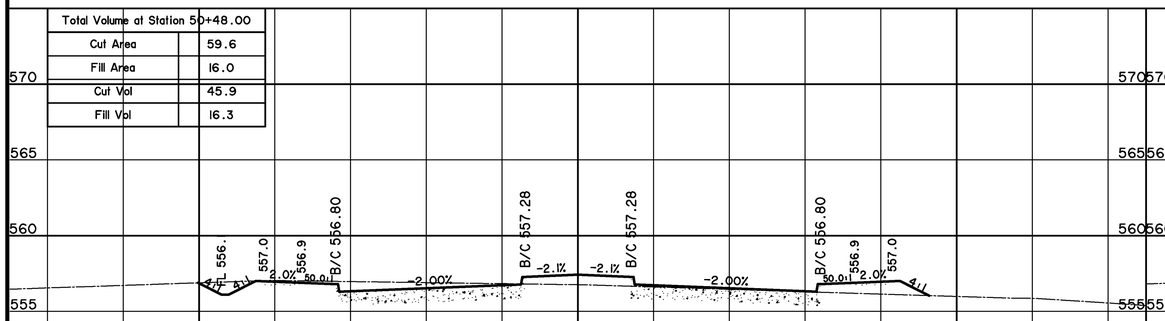
Total Volume at Station 50+50.00	
Cut Area	59.8
Fill Area	15.9
Cut Vol	4.4
Fill Vol	1.2



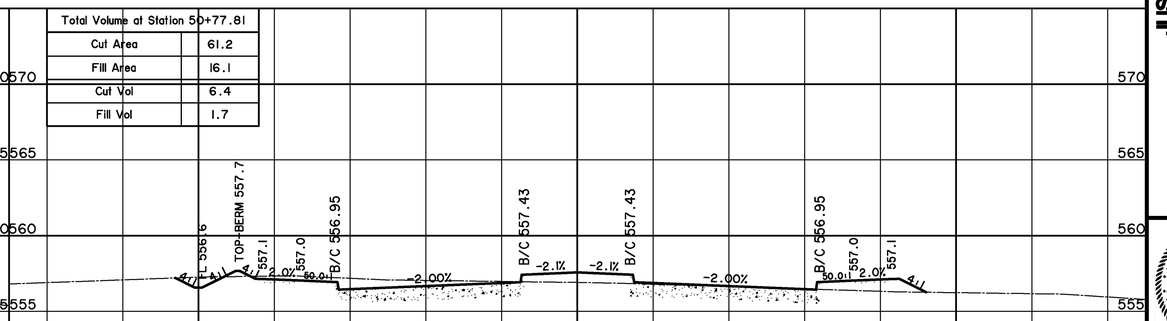
Total Volume at Station 50+86.51	
Cut Area	62.4
Fill Area	16.0
Cut Vol	19.9
Fill Vol	5.2



Total Volume at Station 50+48.00	
Cut Area	59.6
Fill Area	16.0
Cut Vol	45.9
Fill Vol	16.3



Total Volume at Station 50+77.81	
Cut Area	61.2
Fill Area	16.1
Cut Vol	6.4
Fill Vol	1.7



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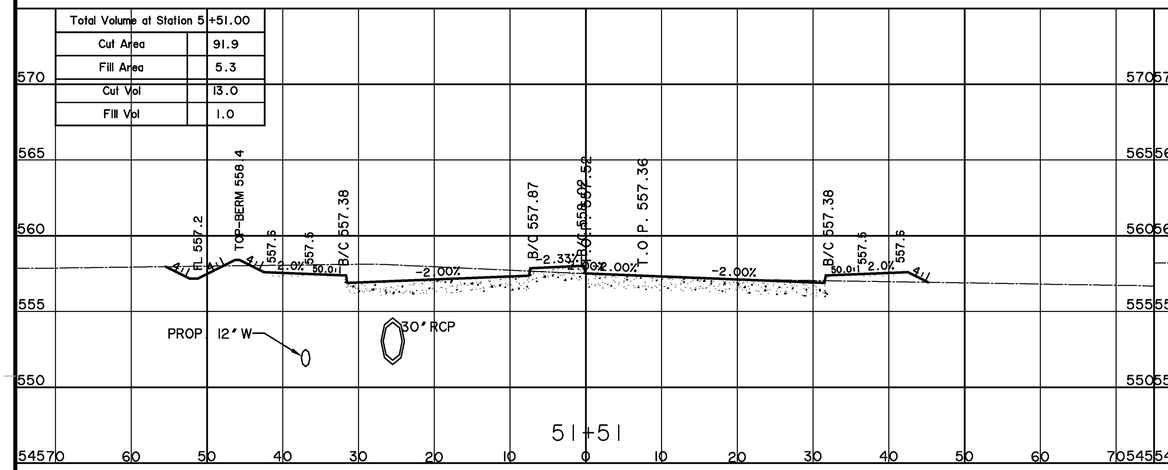
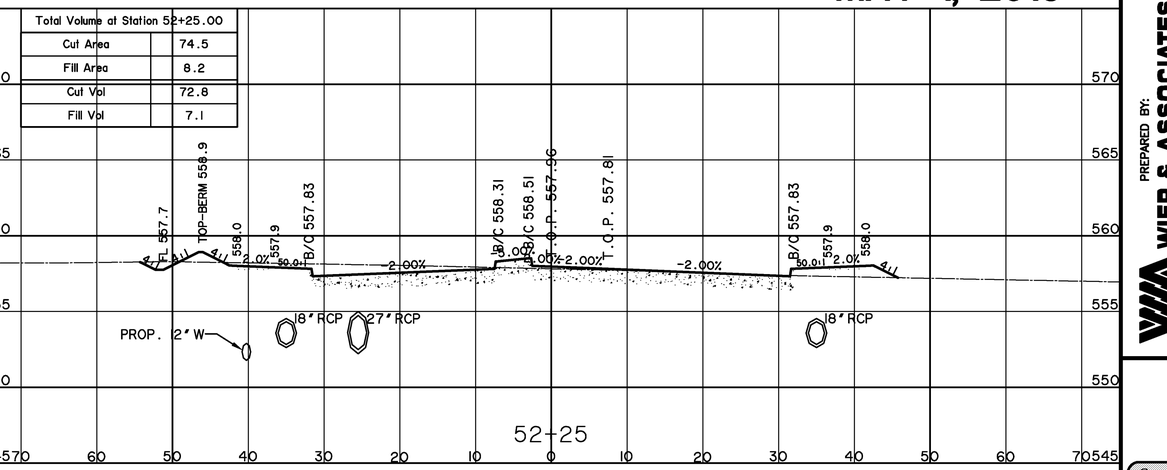
RECORD PLANS
MAY 1, 2015

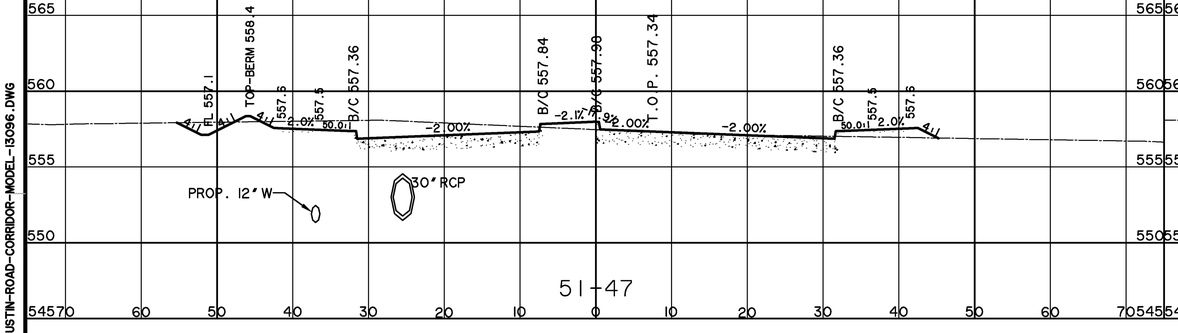
Total Volume at Station 51+51.00	
Cut Area	91.9
Fill Area	5.3
Cut Vol	13.0
Fill Vol	1.0



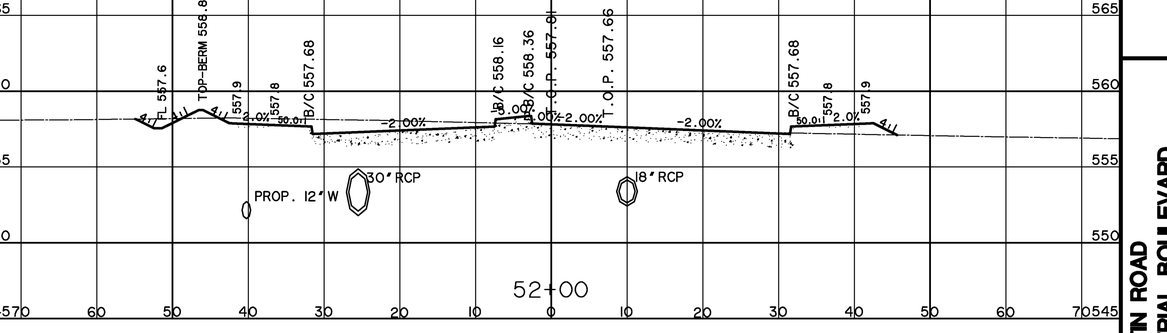
Total Volume at Station 52+25.00	
Cut Area	74.5
Fill Area	8.2
Cut Vol	72.8
Fill Vol	7.1



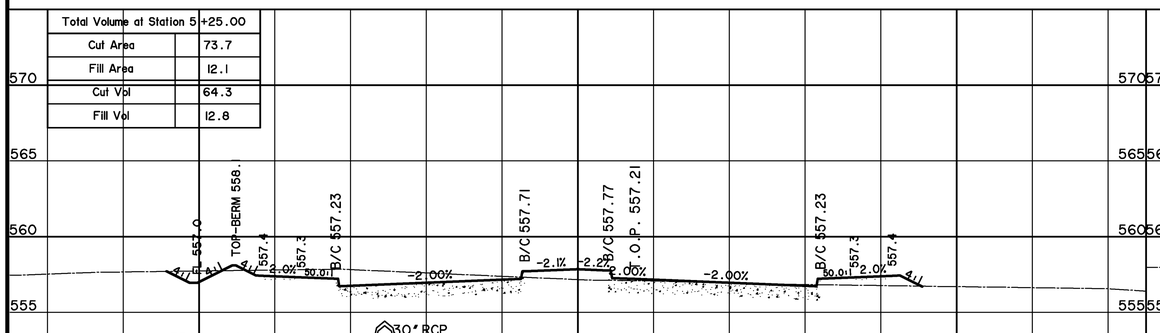
Total Volume at Station 51+47.00	
Cut Area	83.9
Fill Area	7.8
Cut Vol	64.2
Fill Vol	8.1



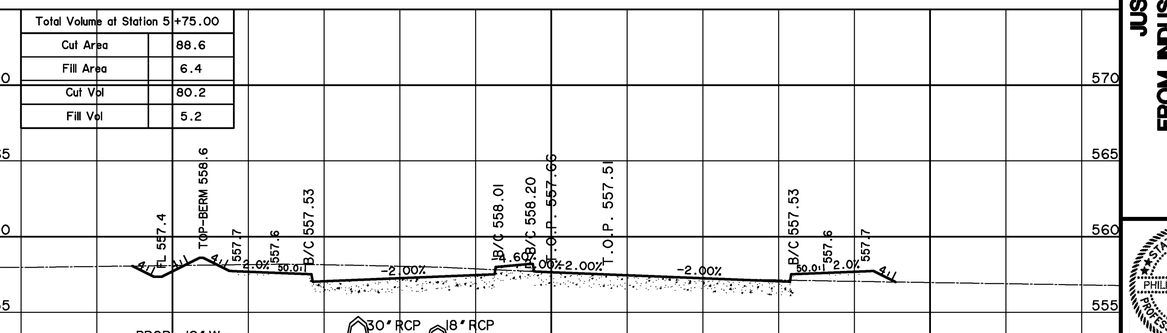
Total Volume at Station 52+00.00	
Cut Area	82.8
Fill Area	7.2
Cut Vol	79.4
Fill Vol	6.3



Total Volume at Station 51+25.00	
Cut Area	73.7
Fill Area	12.1
Cut Vol	64.3
Fill Vol	12.8



Total Volume at Station 51+75.00	
Cut Area	88.6
Fill Area	6.4
Cut Vol	80.2
Fill Vol	5.2



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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
CROSS-SECTIONS

STATE OF TEXAS
PHILIP L. GRAHAM
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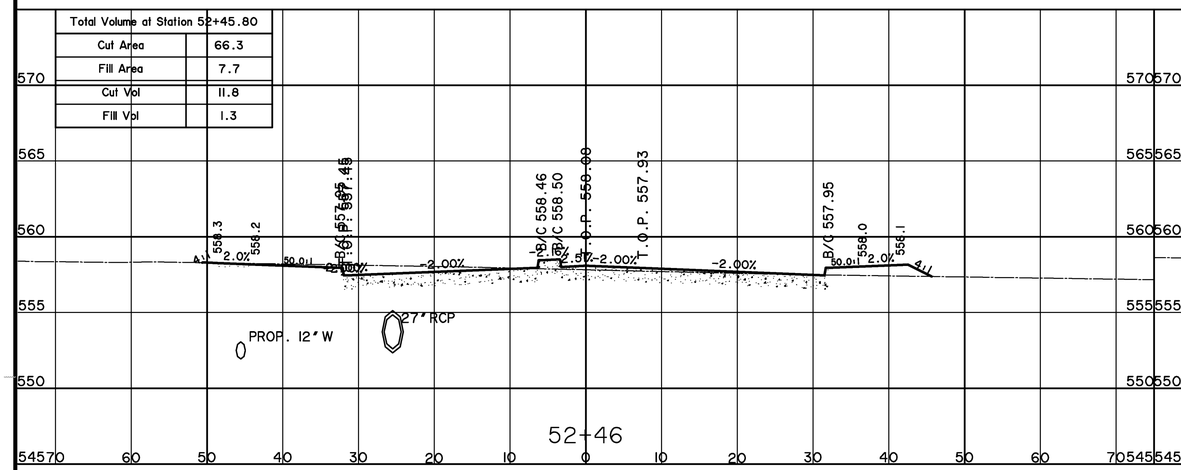
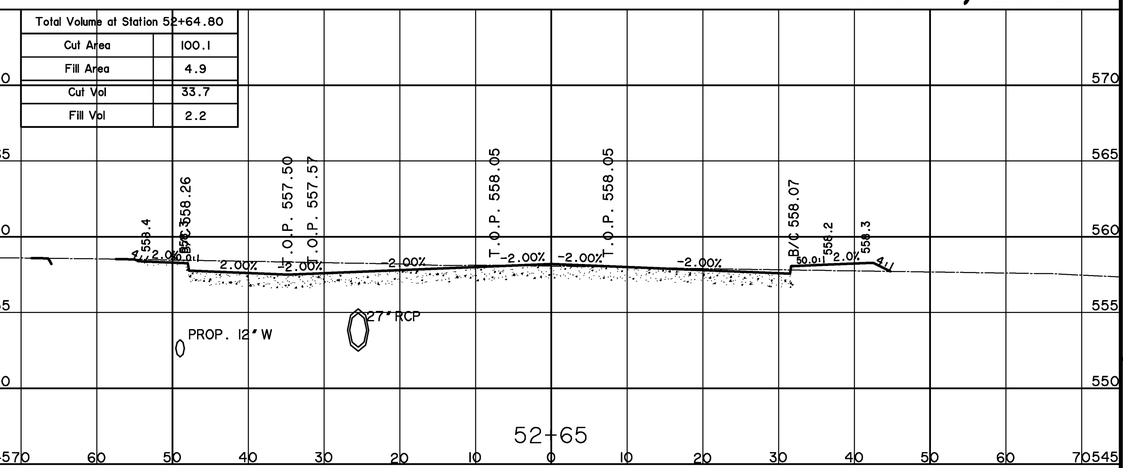
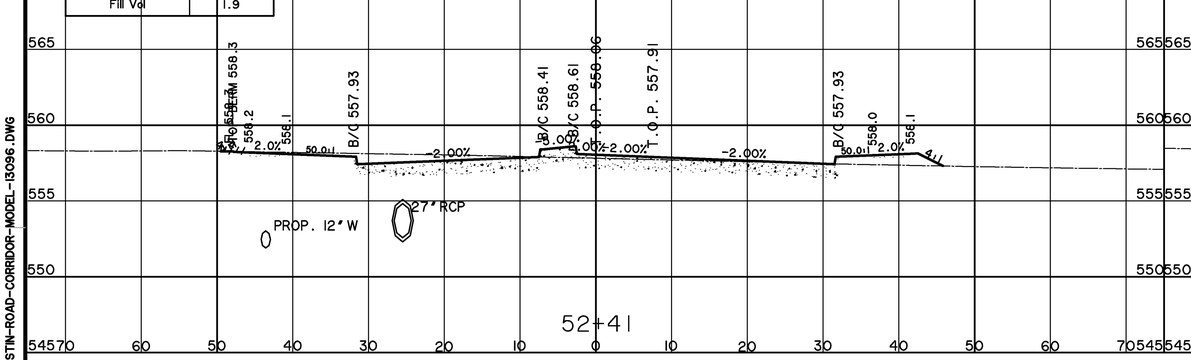
Total Volume at Station 52+45.80	
Cut Area	66.3
Fill Area	7.7
Cut Vol	11.8
Fill Vol	1.3



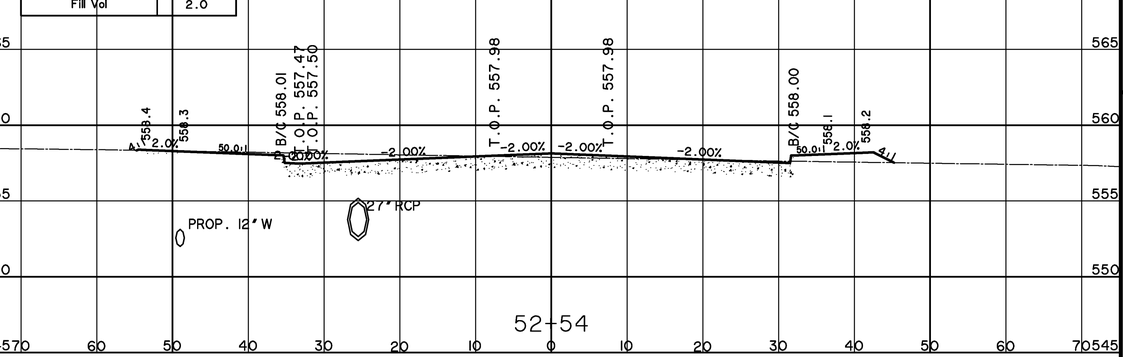
Total Volume at Station 52+64.80	
Cut Area	100.1
Fill Area	4.9
Cut Vol	33.7
Fill Vol	2.2



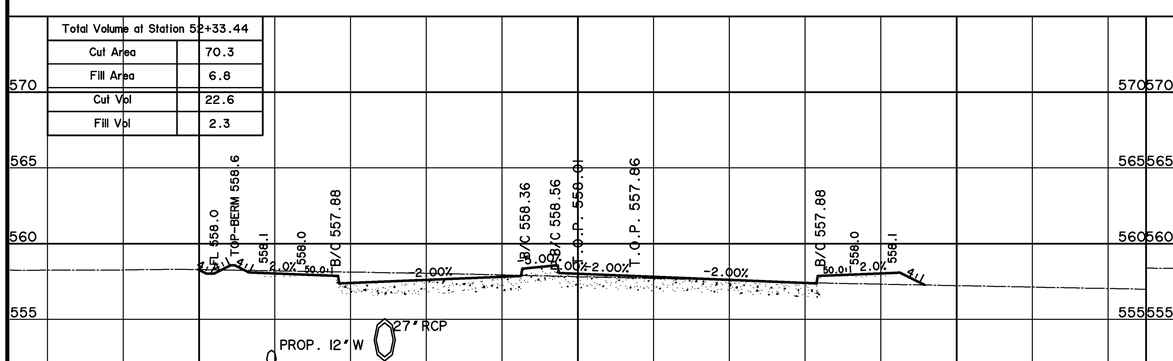
Total Volume at Station 52+41.01	
Cut Area	67.0
Fill Area	6.4
Cut Vol	19.3
Fill Vol	1.9



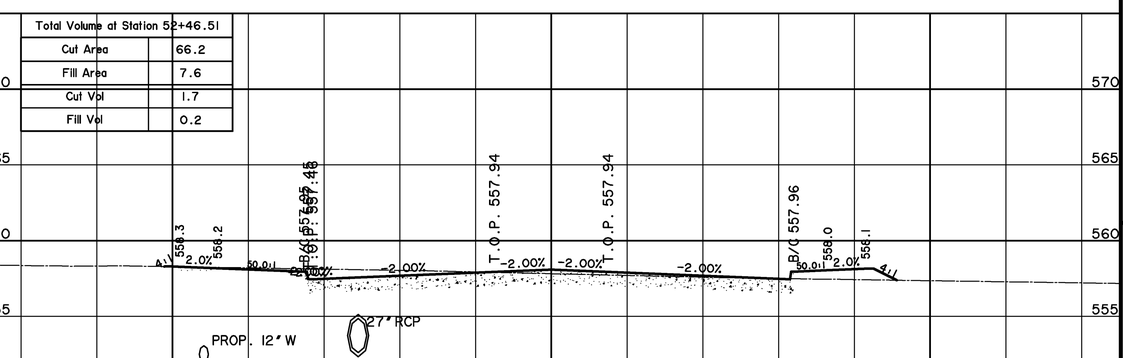
Total Volume at Station 52+54.23	
Cut Area	71.9
Fill Area	6.5
Cut Vol	19.7
Fill Vol	2.0



Total Volume at Station 52+33.44	
Cut Area	70.3
Fill Area	6.8
Cut Vol	22.6
Fill Vol	2.3



Total Volume at Station 52+46.51	
Cut Area	66.2
Fill Area	7.6
Cut Vol	1.7
Fill Vol	0.2



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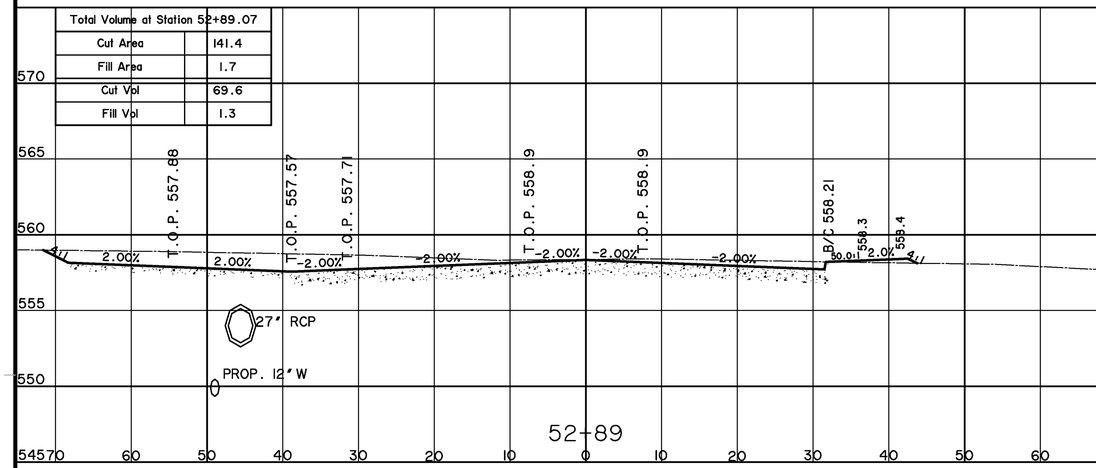
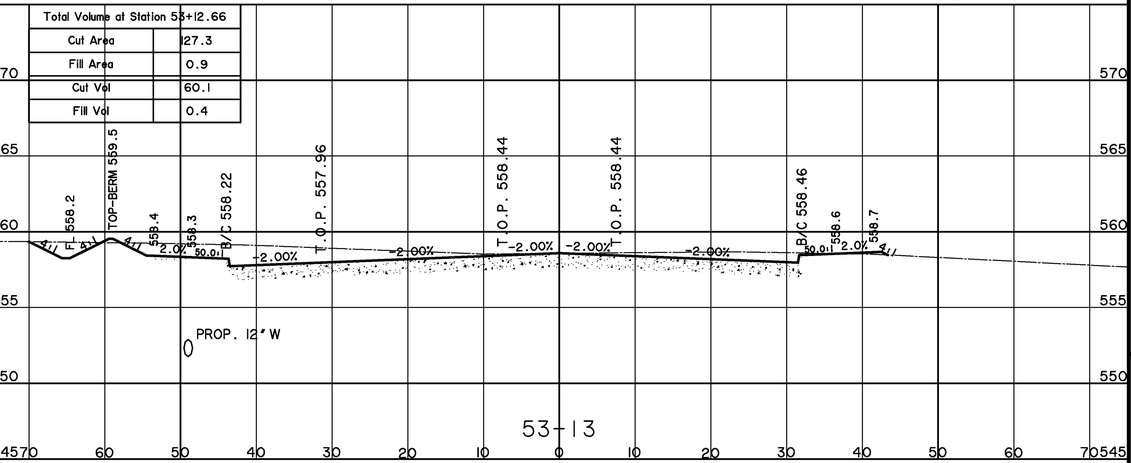
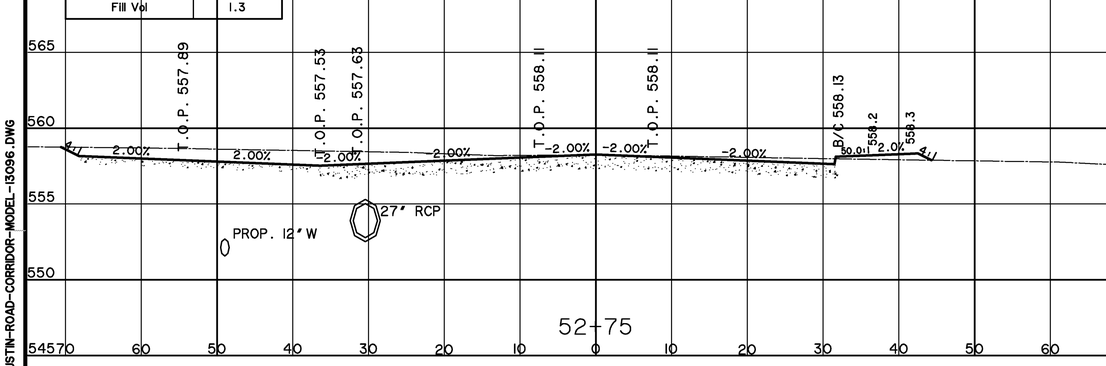
Total Volume at Station 52+89.07	
Cut Area	141.4
Fill Area	1.7
Cut Vol	69.6
Fill Vol	1.3



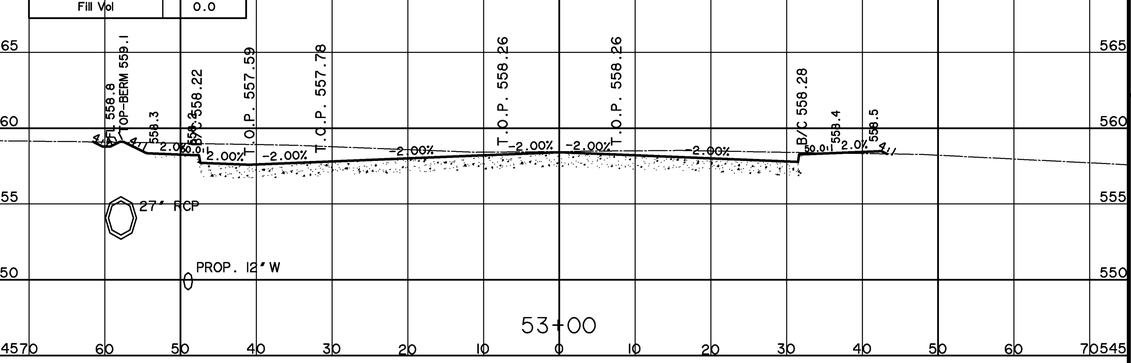
Total Volume at Station 53+12.66	
Cut Area	127.3
Fill Area	0.9
Cut Vol	60.1
Fill Vol	0.4



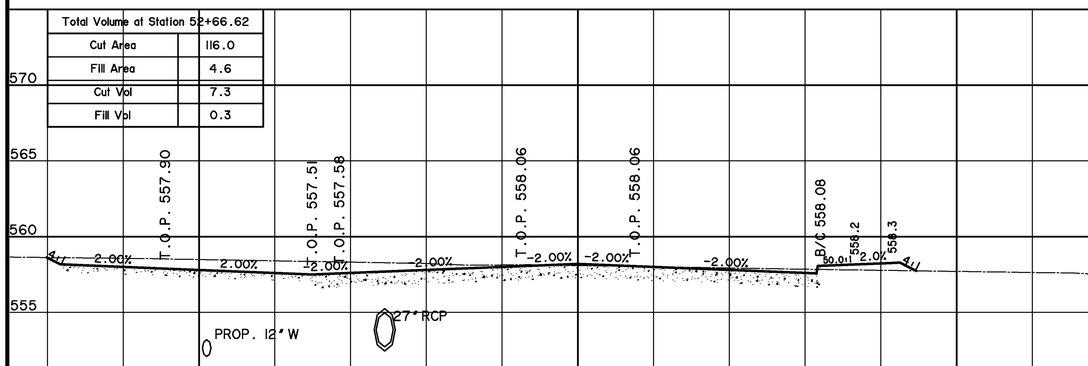
Total Volume at Station 52+75.00	
Cut Area	125.7
Fill Area	3.5
Cut Vol	37.5
Fill Vol	1.3



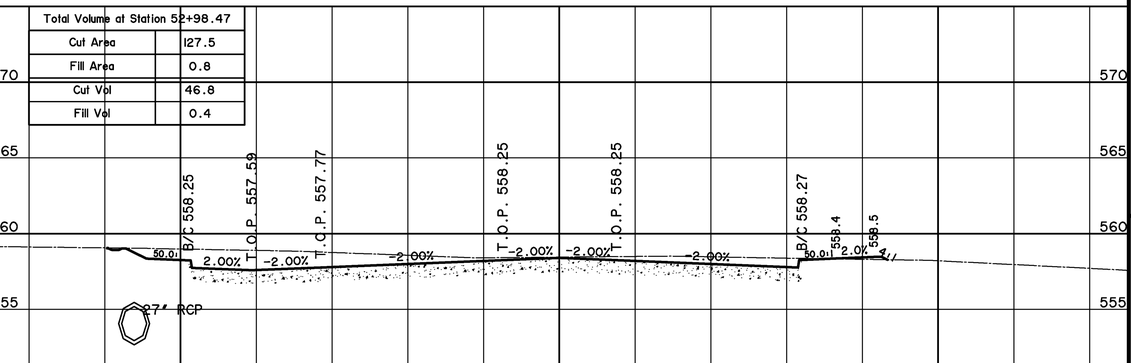
Total Volume at Station 53+00.00	
Cut Area	129.1
Fill Area	0.7
Cut Vol	7.3
Fill Vol	0.0



Total Volume at Station 52+66.62	
Cut Area	116.0
Fill Area	4.6
Cut Vol	7.3
Fill Vol	0.3



Total Volume at Station 52+98.47	
Cut Area	127.5
Fill Area	0.8
Cut Vol	46.8
Fill Vol	0.4



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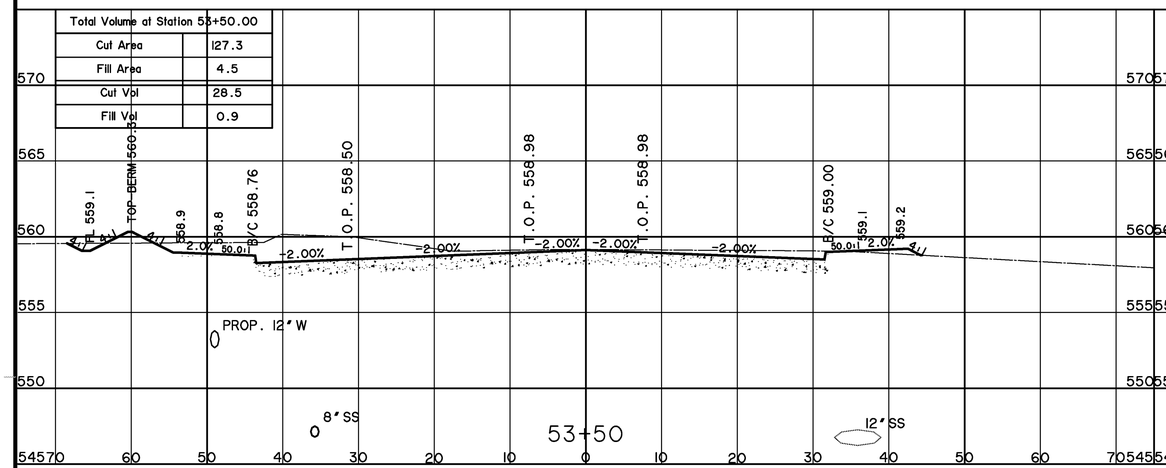
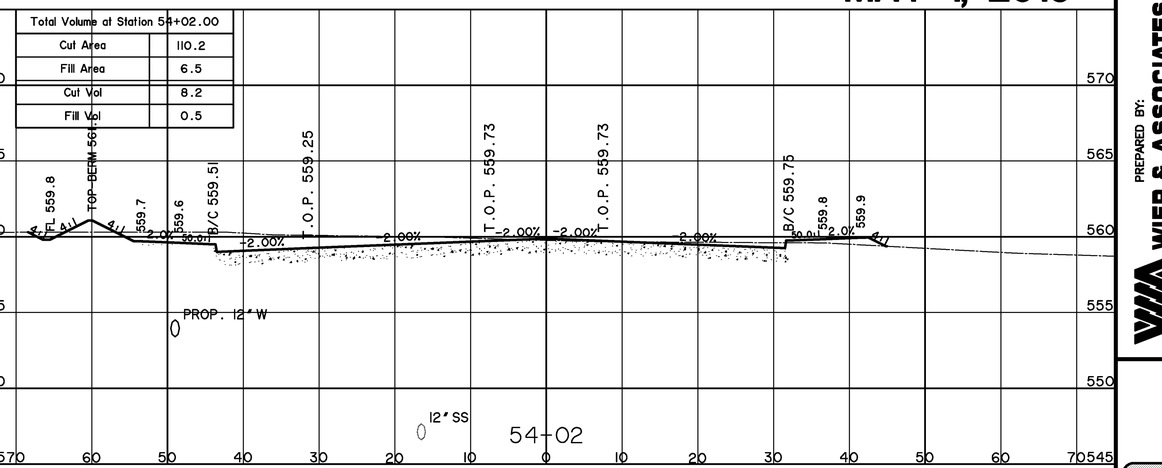
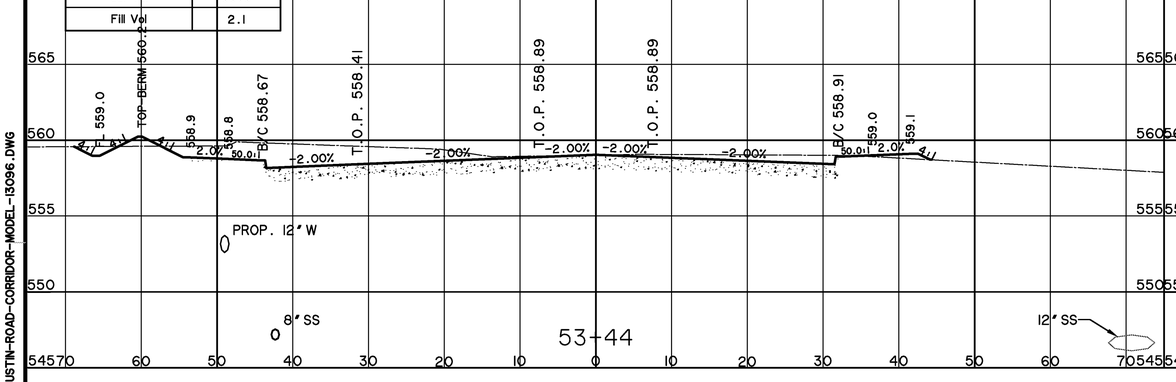
Total Volume at Station 53+50.00	
Cut Area	127.3
Fill Area	4.5
Cut Vol	28.5
Fill Vol	0.9



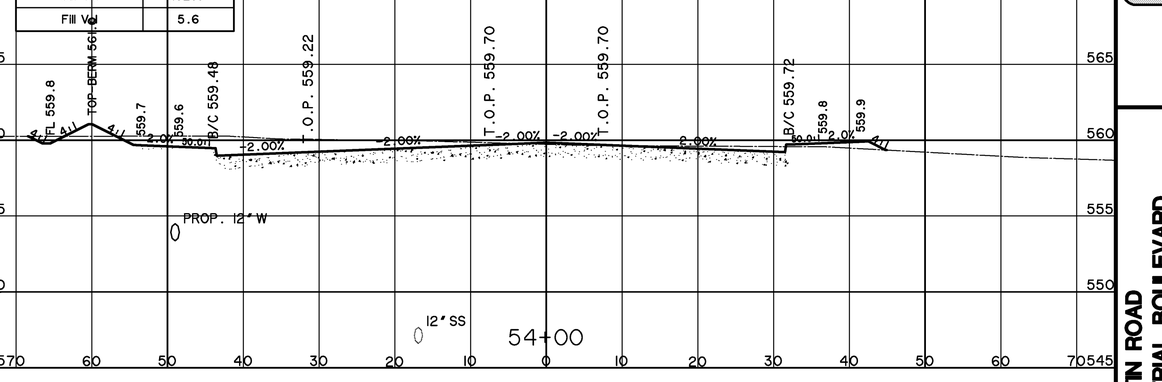
Total Volume at Station 54+02.00	
Cut Area	110.2
Fill Area	6.5
Cut Vol	8.2
Fill Vol	0.5



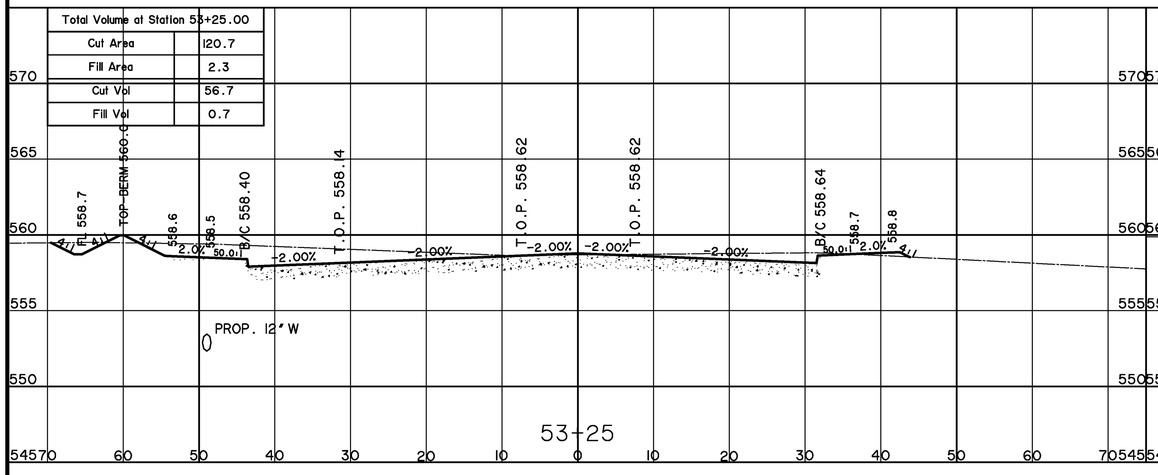
Total Volume at Station 53+43.97	
Cut Area	127.7
Fill Area	3.7
Cut Vol	88.8
Fill Vol	2.1



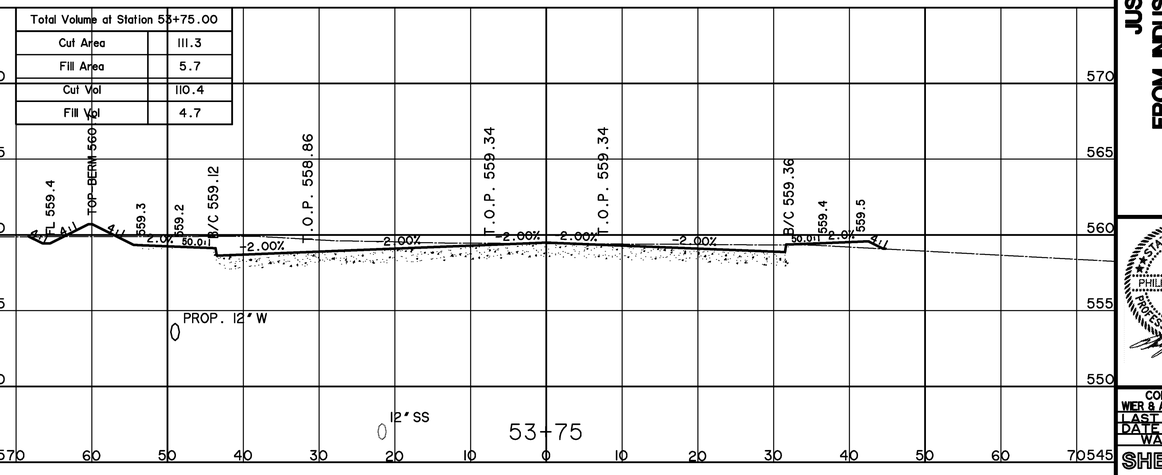
Total Volume at Station 54+00.00	
Cut Area	110.0
Fill Area	6.5
Cut Vol	102.5
Fill Vol	5.6



Total Volume at Station 53+25.00	
Cut Area	120.7
Fill Area	2.3
Cut Vol	56.7
Fill Vol	0.7



Total Volume at Station 53+75.00	
Cut Area	111.3
Fill Area	5.7
Cut Vol	110.4
Fill Vol	4.7



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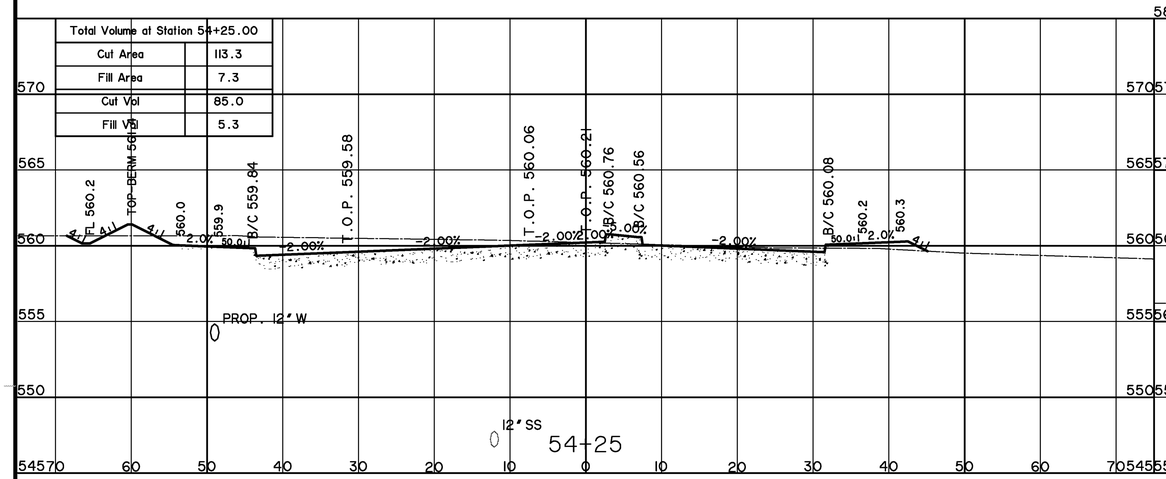
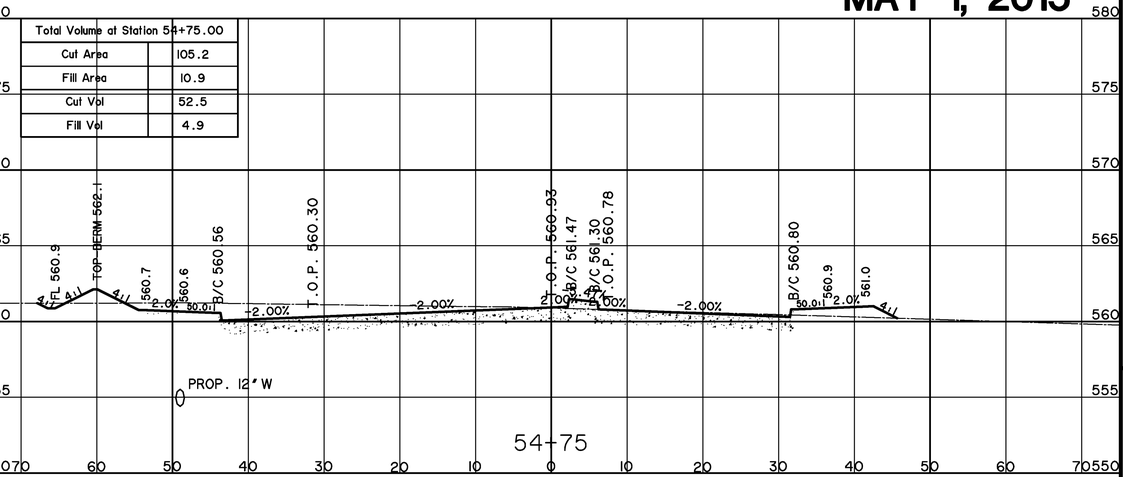
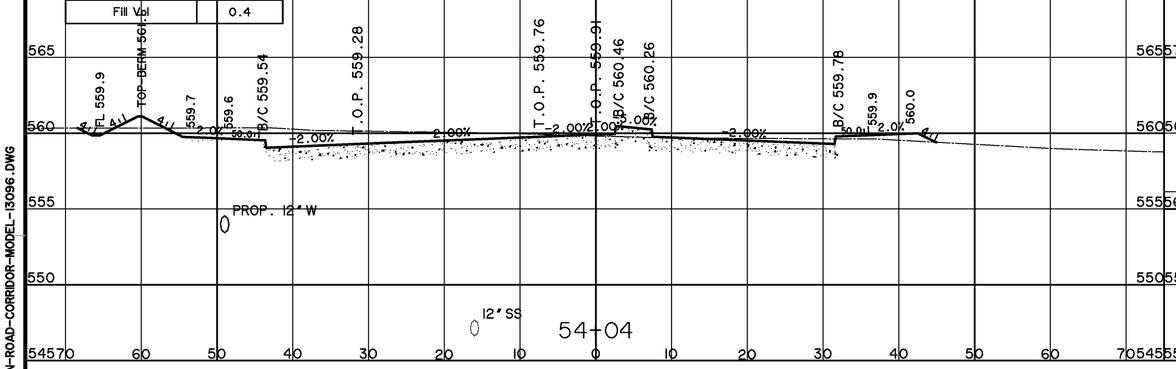
Total Volume at Station 54+25.00	
Cut Area	113.3
Fill Area	7.3
Cut Vol	85.0
Fill Vol	5.3



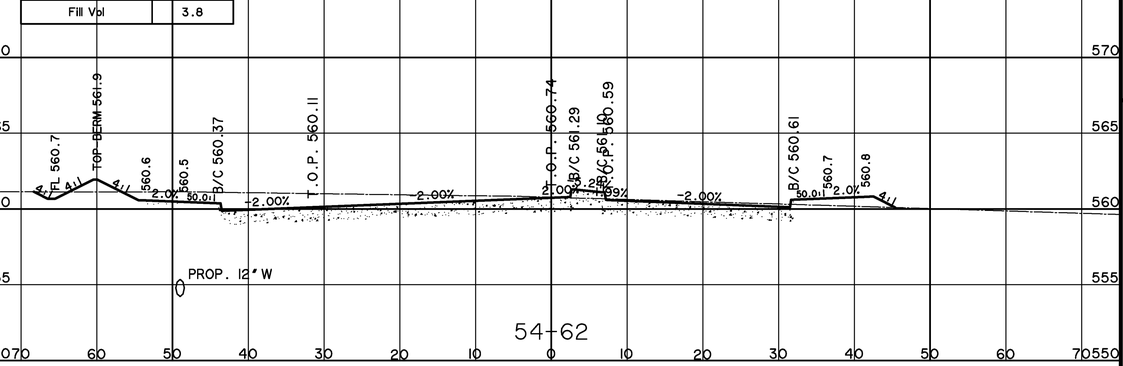
Total Volume at Station 54+75.00	
Cut Area	105.2
Fill Area	10.9
Cut Vol	52.5
Fill Vol	4.9



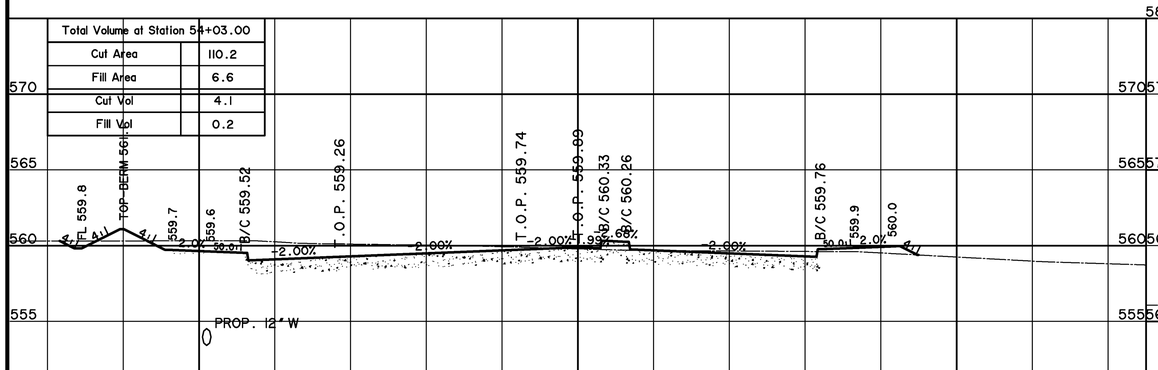
Total Volume at Station 54+04.45	
Cut Area	110.0
Fill Area	6.6
Cut Vol	5.9
Fill Vol	0.4



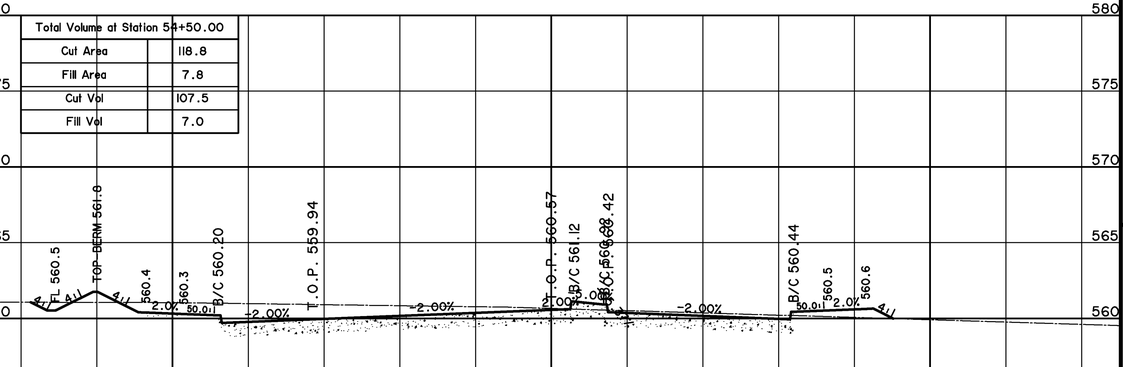
Total Volume at Station 54+61.95	
Cut Area	112.2
Fill Area	9.3
Cut Vol	51.1
Fill Vol	3.8



Total Volume at Station 54+03.00	
Cut Area	110.2
Fill Area	6.6
Cut Vol	4.1
Fill Vol	0.2



Total Volume at Station 54+50.00	
Cut Area	118.8
Fill Area	7.8
Cut Vol	107.5
Fill Vol	7.0



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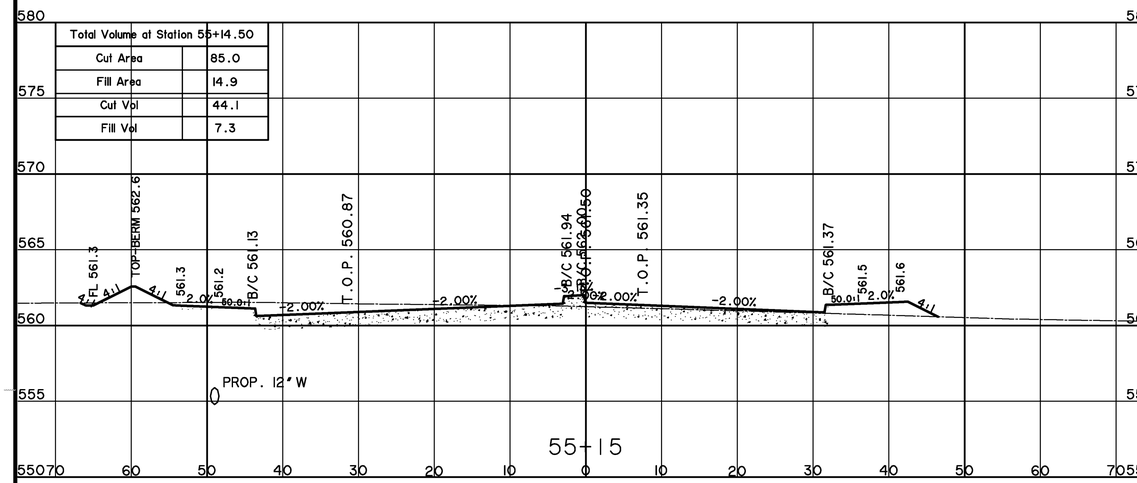
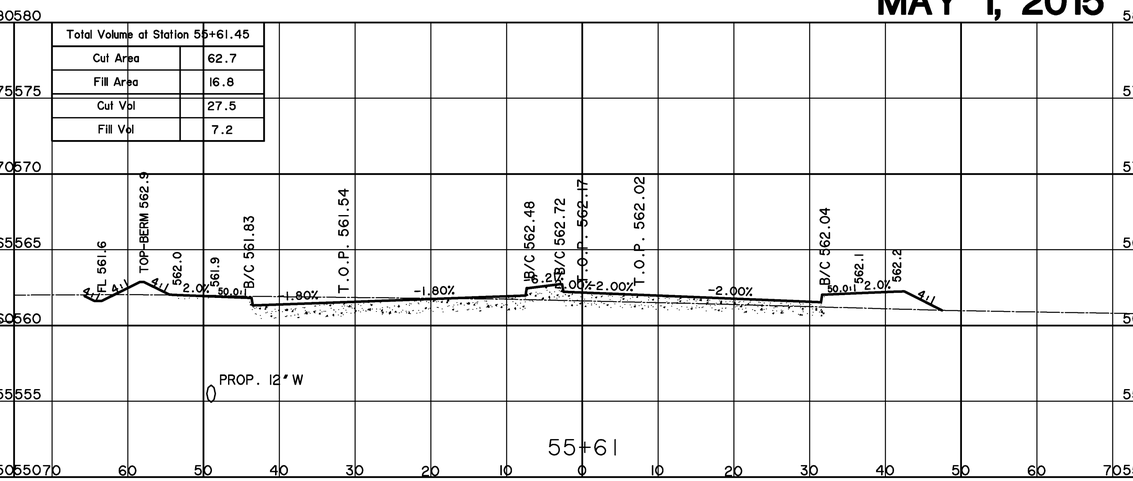
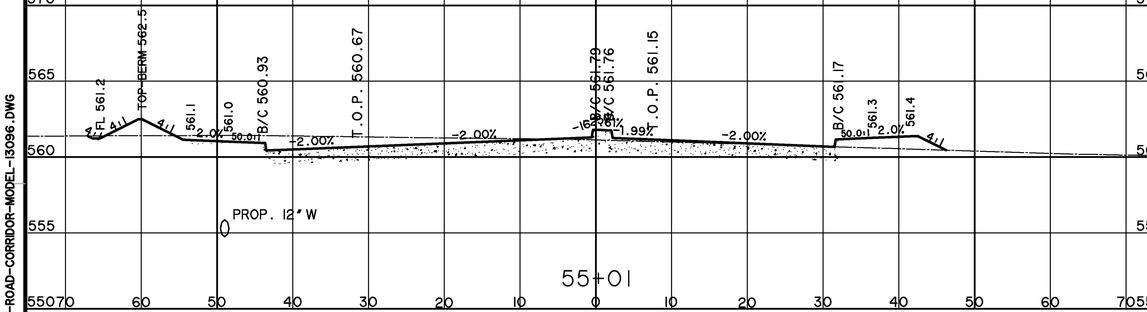
Total Volume at Station 55+14.50	
Cut Area	85.0
Fill Area	14.9
Cut Vol	44.1
Fill Vol	7.3



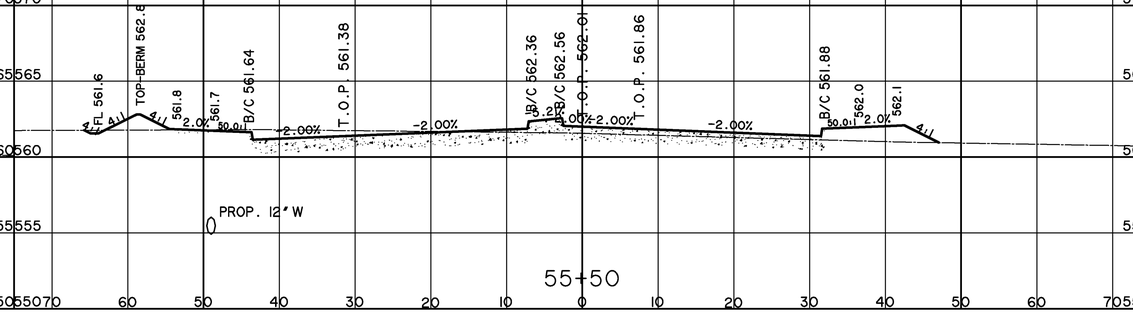
Total Volume at Station 55+61.45	
Cut Area	62.7
Fill Area	16.8
Cut Vol	27.5
Fill Vol	7.2



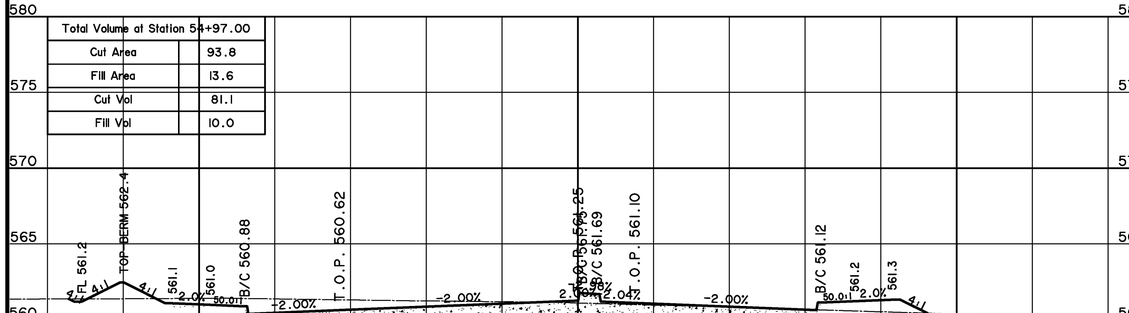
Total Volume at Station 55+01.00	
Cut Area	91.3
Fill Area	14.1
Cut Vol	13.7
Fill Vol	2.1



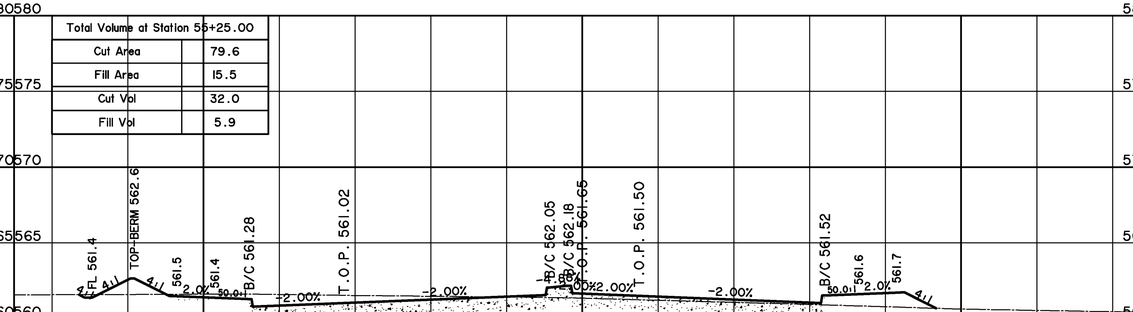
Total Volume at Station 55+50.00	
Cut Area	67.0
Fill Area	17.1
Cut Vol	67.8
Fill Vol	15.1



Total Volume at Station 54+97.00	
Cut Area	93.8
Fill Area	13.6
Cut Vol	81.1
Fill Vol	10.0



Total Volume at Station 55+25.00	
Cut Area	79.6
Fill Area	15.5
Cut Vol	32.0
Fill Vol	5.9



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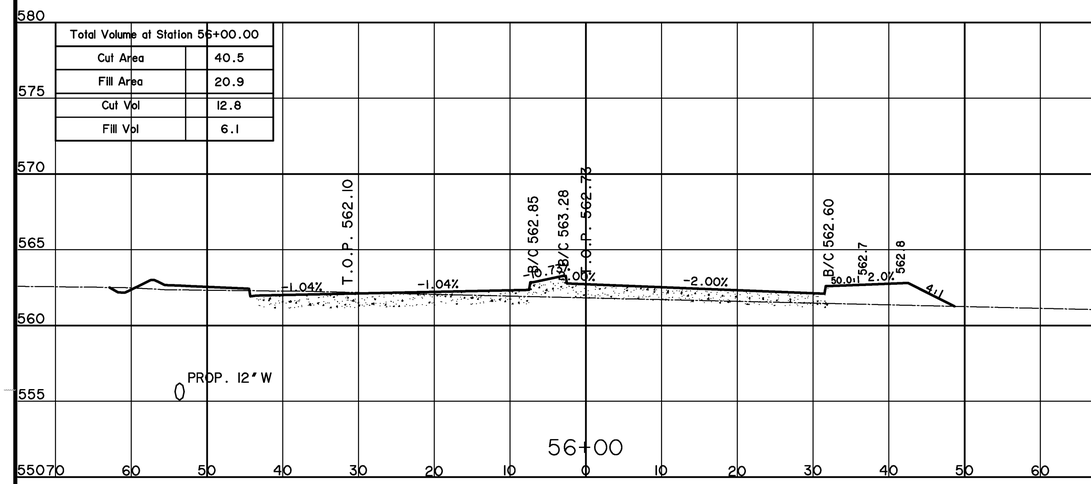

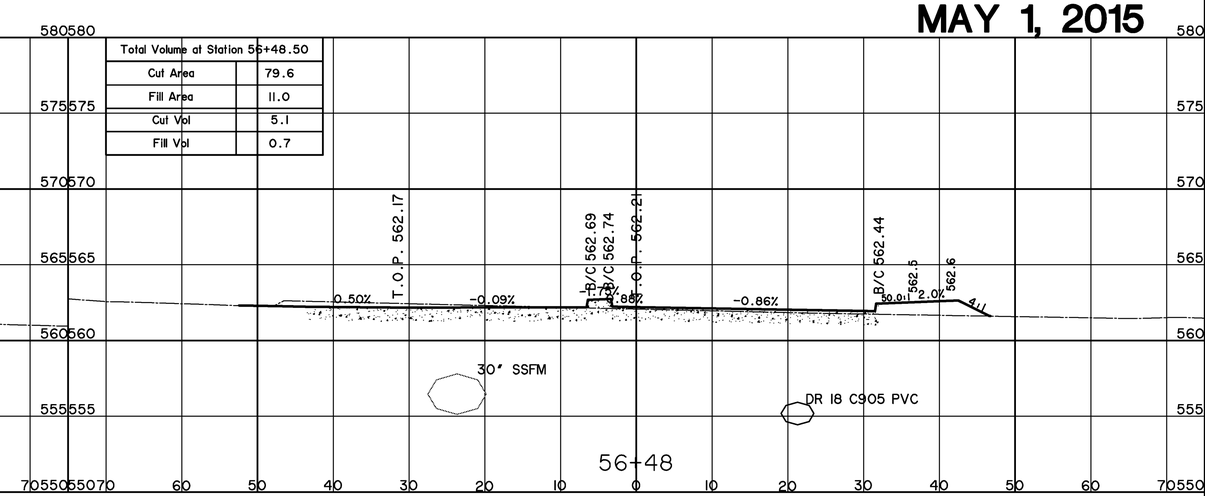

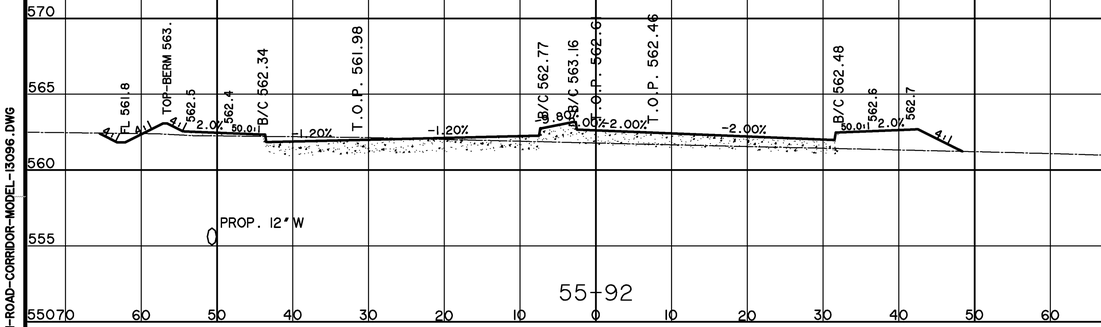

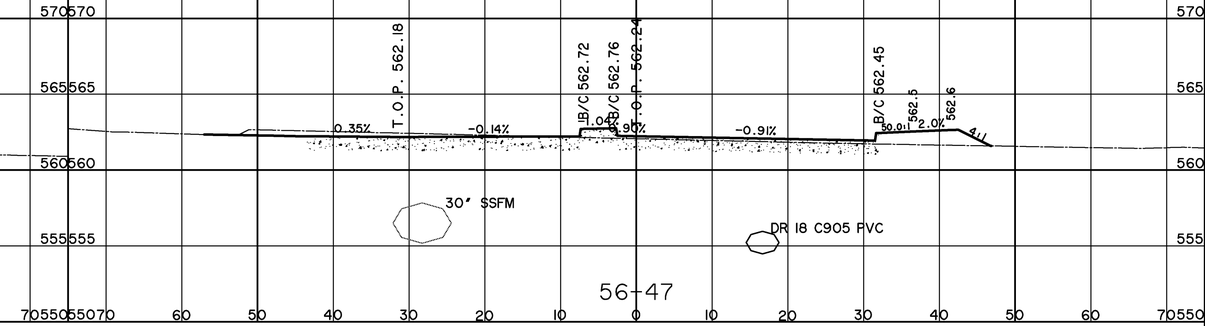

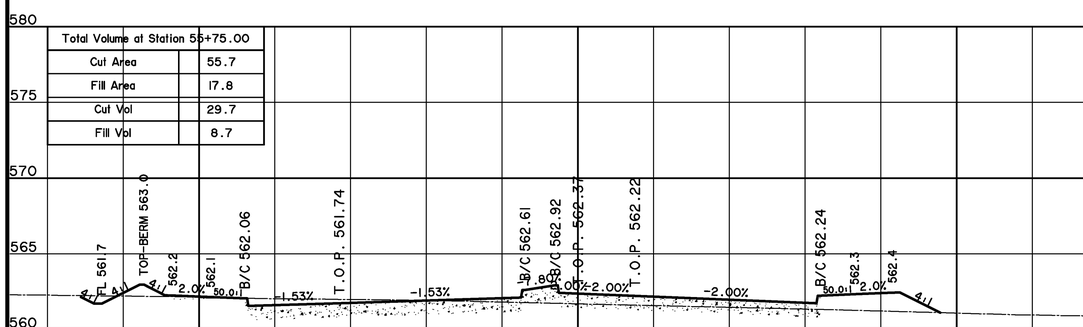

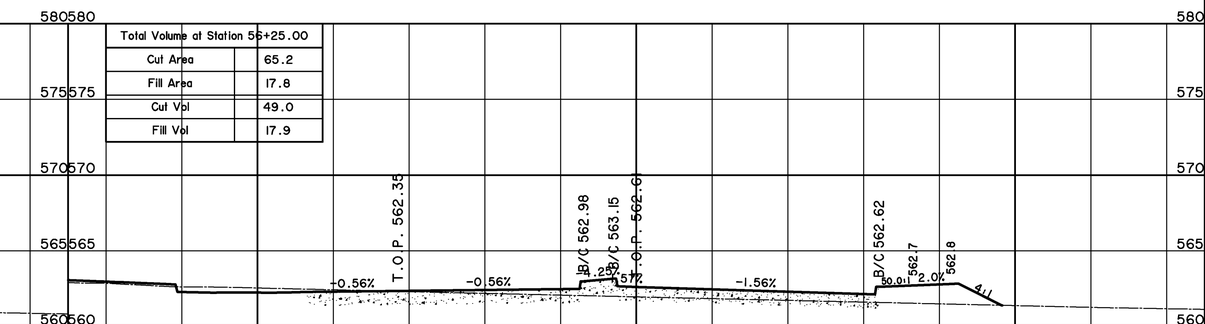

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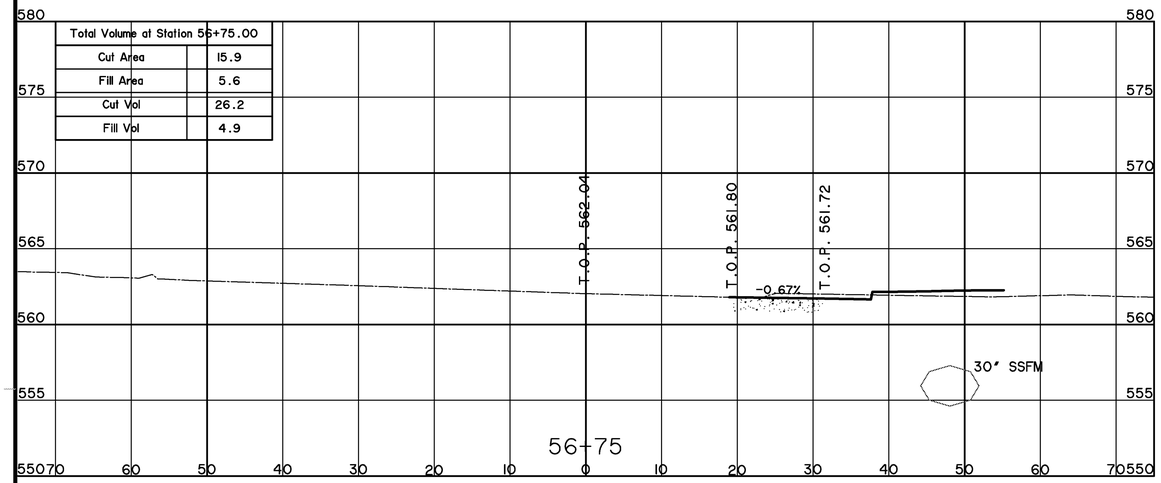

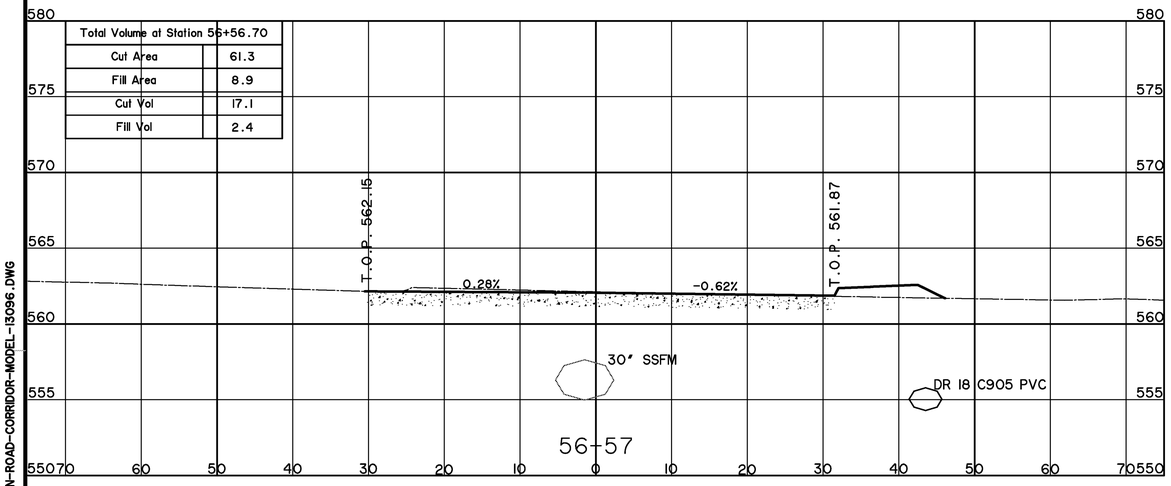

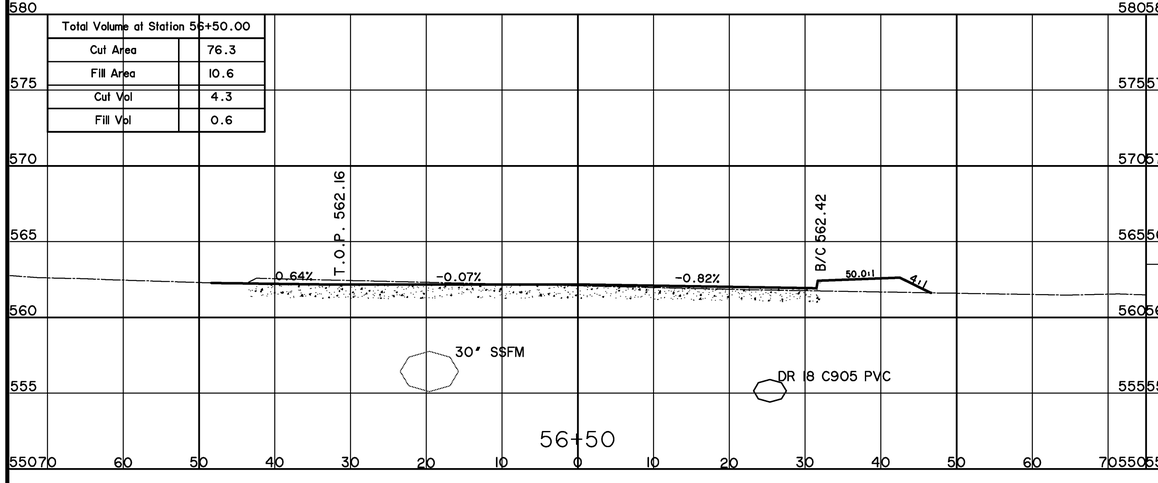

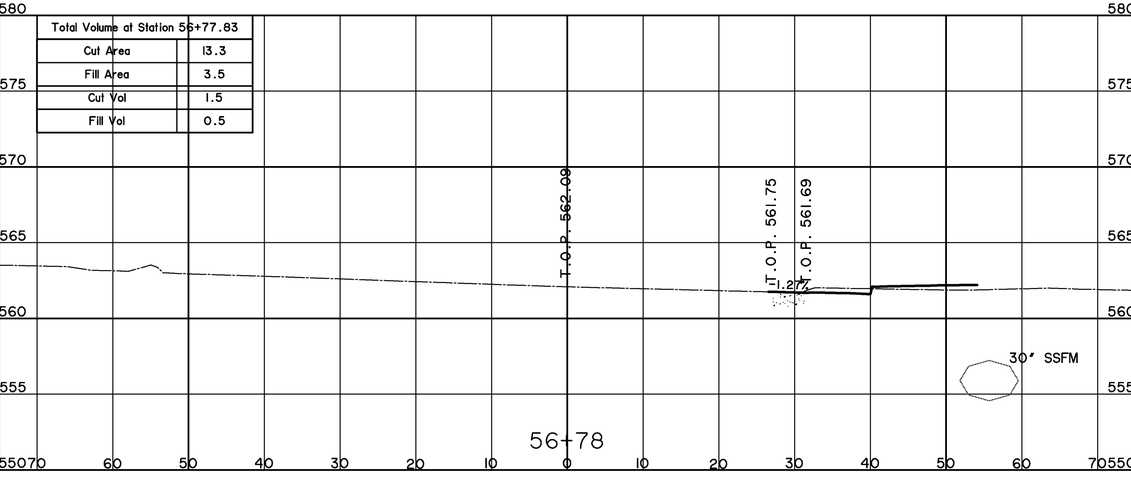

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JUSTIN ROAD
FROM INDUSTRIAL BOULEVARD
TO JOHN KING BOULEVARD
CROSS-SECTIONS

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PHILIP L. GRAHAM
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LAST SHEET EDIT
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PRINTED: 5/1/2015 LAST SAVED: 4/21/2015 4:09 PM SAVED BY: PHILIPG FILE: JUSTIN-ROAD-CORRIDOR-MODEL-13096.DWG