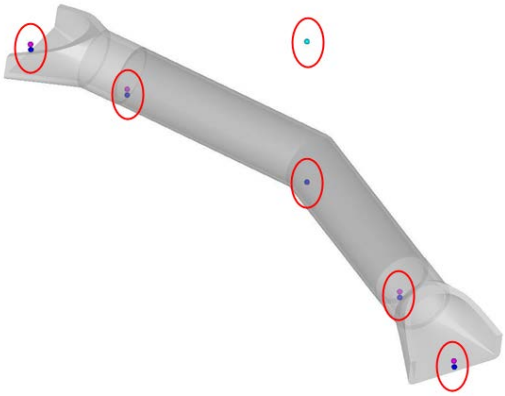
Culvert Data Collection

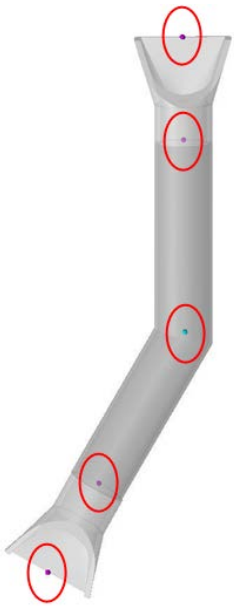
Design Manual
Chapter 40
Design Survey
Specifications

Originally Issued: 12-30-11

1.) All pipe culverts must be shot at enough locations to record pertinent information from one end of the structure to the other. This includes the flowline (PIP), dirt flowlines (PRO) and the location of the pipe (SOP). When referring to the end of a pipe, when that pipe has an apron, the end of the pipe is the joint where the apron attaches to the last pipe segment.

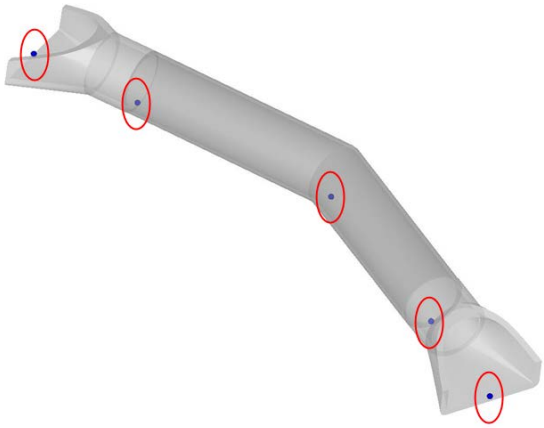
Top and side view examples show of all shots necessary for a pipe culvert. (Shots are located.)

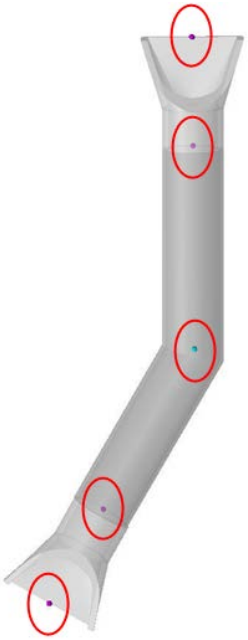




2.) The feature code PIP is used to show the flowline of the pipe at the end of pipe, the end of the aprons (if attached) and any horizontal or vertical breaks in the pipe. A survey chain should be created from these points. The point descriptions should be “INLET FLOWLINE”, “OUTLET FLOWLINE”, “INLET END OF APRON”, “OUTLET END OF APRON” and “BREAK IN PIPE”.

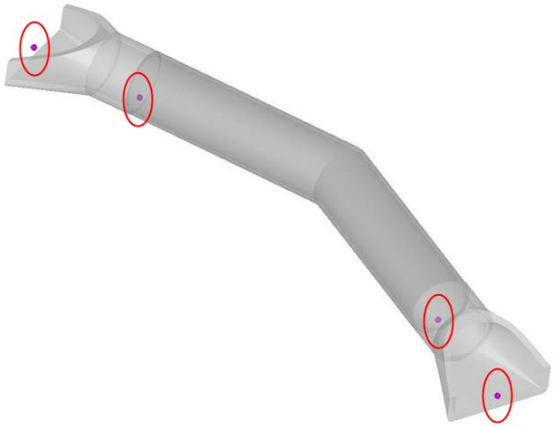
Top and side view examples show of all shots necessary for the flowline of a pipe culvert. (Shots are located.)

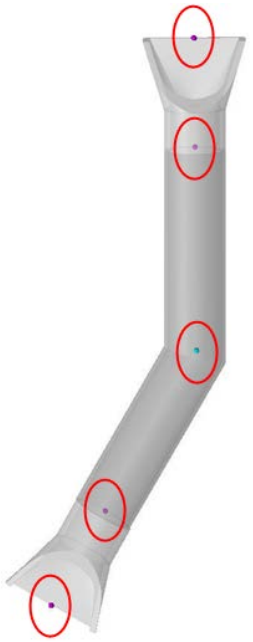




3.) If the pipe contains a considerable amount of dirt, shots should be taken to record the depth. The feature PRO should be taken at the end of the pipe, end of the apron or at the location of the dirt depending on the situation. The point description should be “DIRT PROFILE”.

Top and side view examples show of all shots necessary for the Dirt Profile of a pipe culvert. (Shots are located.)

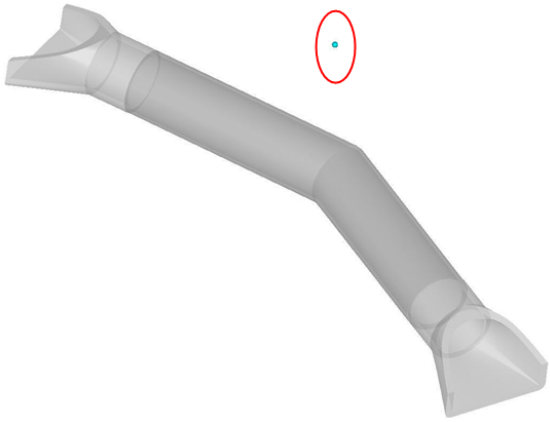


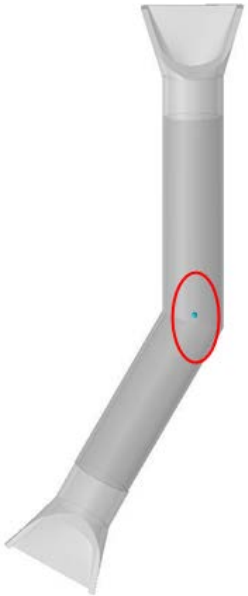


4.) A point with the feature code of SOP should be created to show the location of the pipe. The location of the SOP will be at the intersection of the pipe and the horizontal roadway alignment at the elevation of the roadway. If the pipe does not cross centerline, the SOP point should be at the intake flowline location at the end of the pipe. The description of the SOP point should include the pipe ID, dimensions, condition, skew angle, drainage area and terrain type (F= FLAT, R = ROLLING, H= HILLY, VH= VERY HILLY).

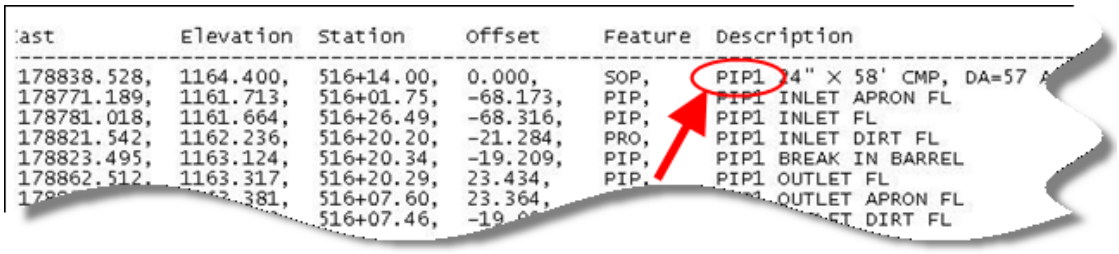
Top and side view examples show the shot necessary for the pipe location. (Shot is located.)

Example:
PIP51, 24” X 44’ RCP, FAIR CONDITION FILLING W\ DIRT,
SKEW ANGLE= 44° RT AH, DA = 33 AC - H



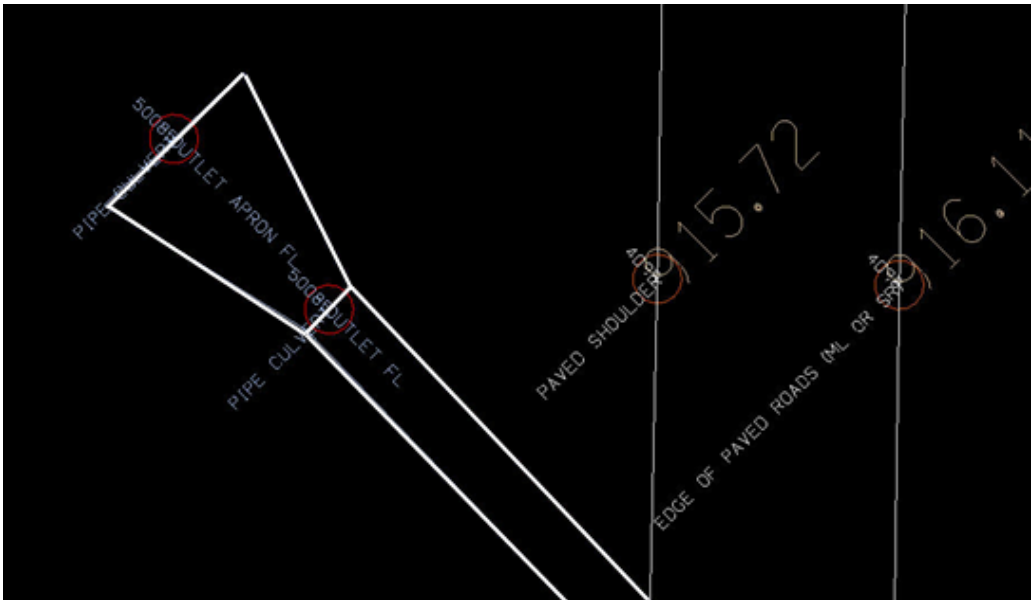


5.) The first item entered in the description for each pipe shot is an identifier. The easiest method of identification is to label the first pipe surveyed as PIP1. The number will increase sequentially for each pipe surveyed thereafter. This identifier will be used by the customer to group all shots together that are associated with each drainage structure.



ast	Elevation	Station	Offset	Feature	Description
178838.528,	1164.400,	516+14.00,	0.000,	SOP,	PIP1 24" X 58' CMP, DA=57 A
178771.189,	1161.713,	516+01.75,	-68.173,	PIP,	PIP1 INLET APRON FL
178781.018,	1161.664,	516+26.49,	-68.316,	PIP,	PIP1 INLET FL
178821.542,	1162.236,	516+20.20,	-21.284,	PRO,	PIP1 INLET DIRT FL
178823.495,	1163.124,	516+20.34,	-19.209,	PIP,	PIP1 BREAK IN BARREL
178862.512,	1163.317,	516+20.29,	23.434,	PIP,	PIP1 OUTLET FL
178	1162.381,	516+07.60,	23.364,		OUTLET APRON FL
		516+07.46,	-19.0		FL DIRT FL

6.) The final product for each pipe in MicroStation should show the outline of the pipe (its diameter) and the outline of any aprons used on the pipe. There are two different methods that can be used to accomplish this. The first method is to use the points shot in the field and create the pipe and apron outlines using MicroStation tools. The other option is to outline the pipe and aprons in the field with survey shots. A survey chain should be created using the PIP feature for the pipe and another chain for each apron that is attached. The field shots needed for the outlining is in addition to the PIP shots showing the pipe's flowline. After the outline is drawn, the PIP survey chain for the flowline may be deleted from the MicroStation File.



7.) A Form 621001-E (Pink Sheet) must be completed for each pipe that crosses a roadway.

Form 621001-E
07-05

Iowa Department of Transportation
Highway Division
Bridge Survey Record

FIELD NOTES FOR CULVERTS

Township 89N Range 43W Section 35 Civil Township Richland
Station Present Structure or Stream 554+78.56 Station Proposed Culvert
Drainage Area in Hectares ??? El. Hi. Water Character Water Shed FI
Upstream Land Use Cultivated Anticipate Any Change? No
Bench Mark No. 731, Cut X Back of Row Rail, Sta. 556+48.52, 81.05 Rt., Elev. = 1345.62
Type and Elev. of Low Upstream Building
Present Structure: Type 30" x 73' RCP Design No. Br. Rdwy.
Spans Ht.
Length: B. to B. Pts. Pipe Flume
Elevation: Grade 1345.82 Inlet 1339.07 Outlet 1228.23 Flume Outlet 1310.03
Condition Fair, filling with dirt Skew Angle 10
Proposed Culvert: Type Fin. Rdwy. Width (Sh-Sh)
Spans Ht.
Length New Constr: RC Pipe + Apron Inlet Apron Outlet Flume
Elevation: Profile Grade F.L.Lt. F.L. Rt.
F.L. Other Ext. Lt. + Apr. Rt. + Apr.
Total Length Lt. Rt. Skew Angle ☐ Lt ☐ Rt. Ahead
Contr. Dike Sta. El. Type
Contr. Ditch Design Q C.M.S. Frequency Yr.
Design High Water Elev. Depth M Design Fill Height M
Pipe Class D. Class Bedding ADT= VPD
Disposition of Present Structure
Remarks

Computations

Left		Right	
Profile Grade Elevation		Profile Grade Elevation	
Vert. Drop {Subgrade or Hinge Point}	-	Vert. Drop {Subgrade or Hinge Point}	-
Working Point Elev.	=	Working Point Elev.	=
Flow Line	-	Flow Line	-
Difference	=	Difference	=
(D + "T") or (H + Hdwl.)	-	(D + "T") or (H + Hdwl)	-
Difference	=	Difference	=
Slope (6:1, 3:1, ect.)	X	Slope (6:1, 3:1, ect.)	X
Working Point to End of Foreslope		Working Point to End of Foreslope	
Dist. = CL to Working Point	+	Dist. = CL to Working Point	+
(1.5:1) or (Dimen. "B")	+	(1.5:1) or (Dimen. "B")	+
Length, Calc. or Min ( )		Length, Calc. or Min ( )	
Secant of Skew Angle	X	Secant of Skew Angle	X
Length on skew		Length on skew	
Add for hdwl. skew	+	Add for hdwl. skew	+
Length		Length	
Length pres. struct.	-	Length pres. struct.	-
Extension		Extension	

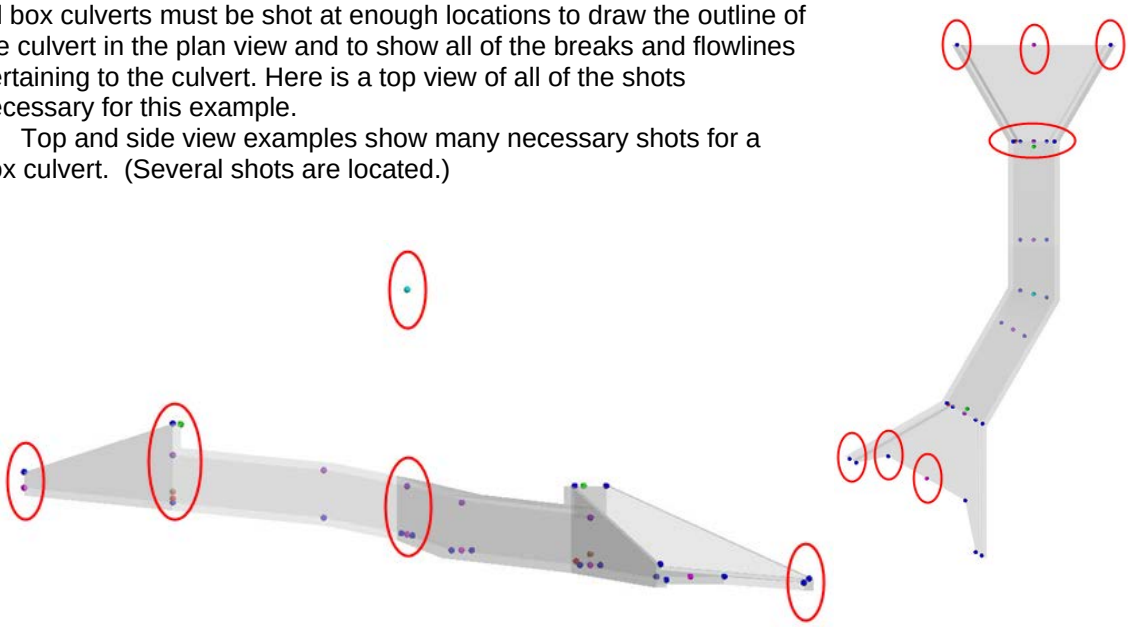
Road Design To Check For

☐ Tile Line ☐ Ditch Grades ☐ Channel Change
☐ Utilities ☐ Raise Inlet ☐ Dikes
☐ Ditching ☐ Ponding Survey to Elev. ☐ Pres. Structure

Are additional notes or sketches for this culvert attached to here? Yes
County Woodbury Project No. NHS-20-1(77)--19-97
Design No. File No. Notes by John doe Date 10/13/2010
PIN Designer Date

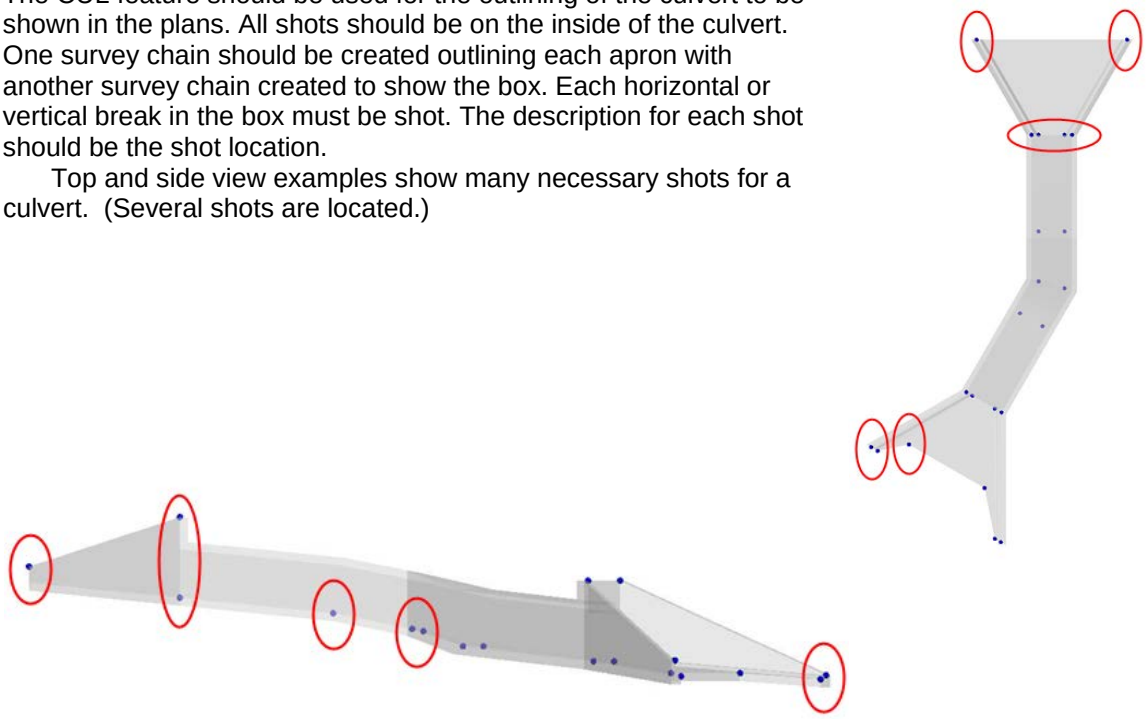
8.) All box culverts must be shot at enough locations to draw the outline of the culvert in the plan view and to show all of the breaks and flowlines pertaining to the culvert. Here is a top view of all of the shots necessary for this example.

Top and side view examples show many necessary shots for a box culvert. (Several shots are located.)



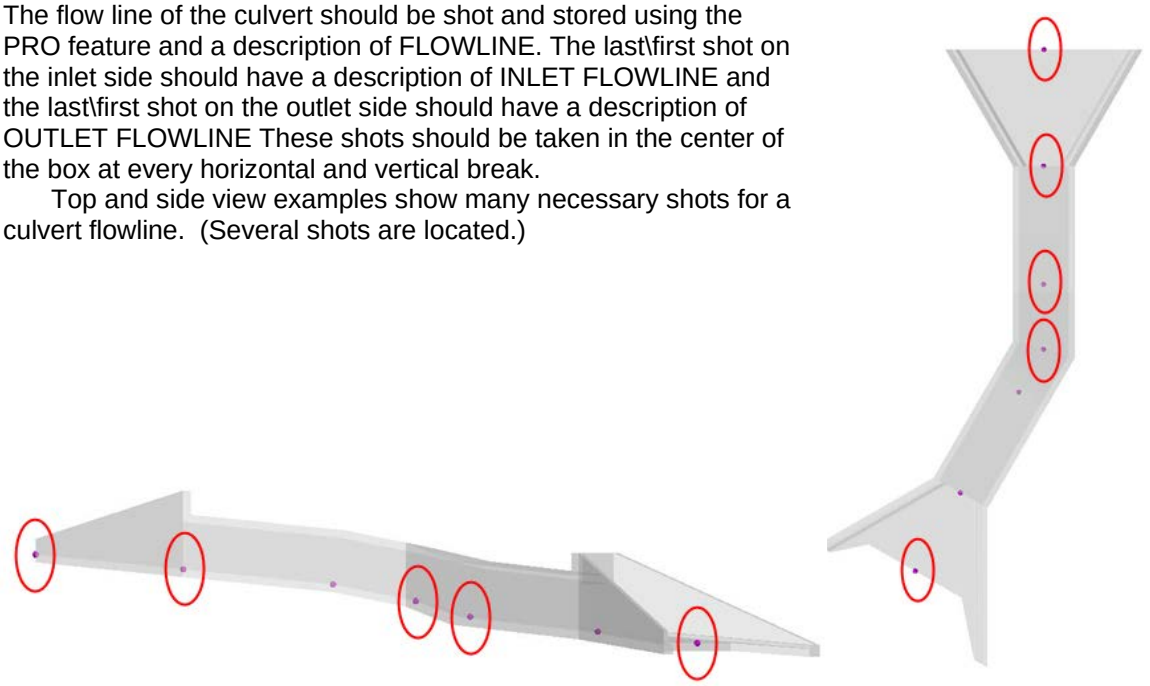
9.) The CUL feature should be used for the outlining of the culvert to be shown in the plans. All shots should be on the inside of the culvert. One survey chain should be created outlining each apron with another survey chain created to show the box. Each horizontal or vertical break in the box must be shot. The description for each shot should be the shot location.

Top and side view examples show many necessary shots for a culvert. (Several shots are located.)



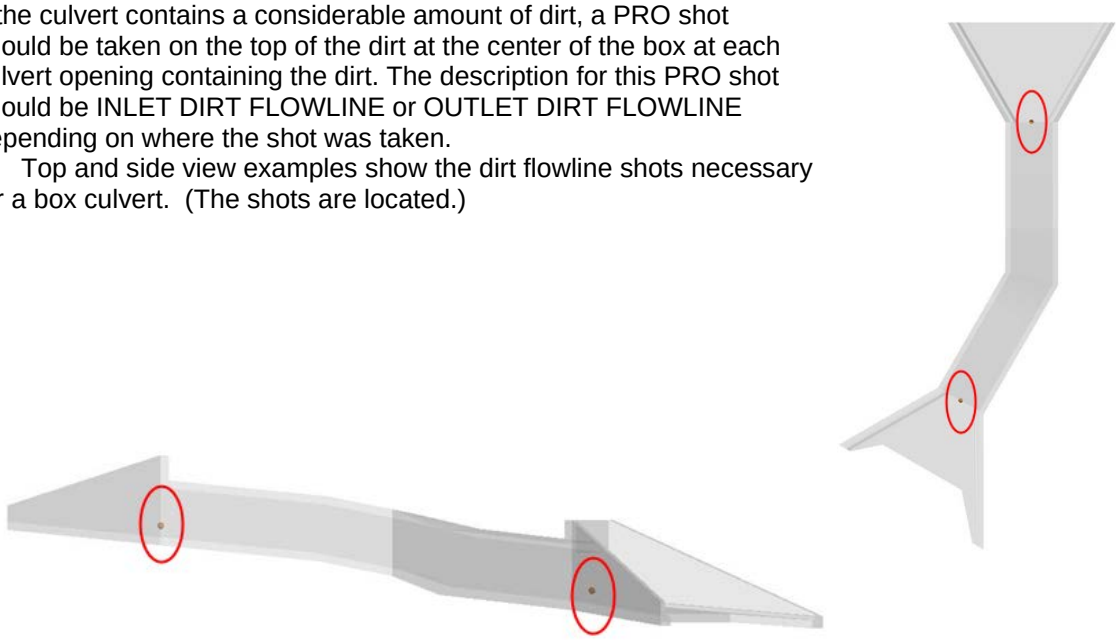
10.) The flow line of the culvert should be shot and stored using the PRO feature and a description of FLOWLINE. The last\first shot on the inlet side should have a description of INLET FLOWLINE and the last\first shot on the outlet side should have a description of OUTLET FLOWLINE These shots should be taken in the center of the box at every horizontal and vertical break.

Top and side view examples show many necessary shots for a culvert flowline. (Several shots are located.)



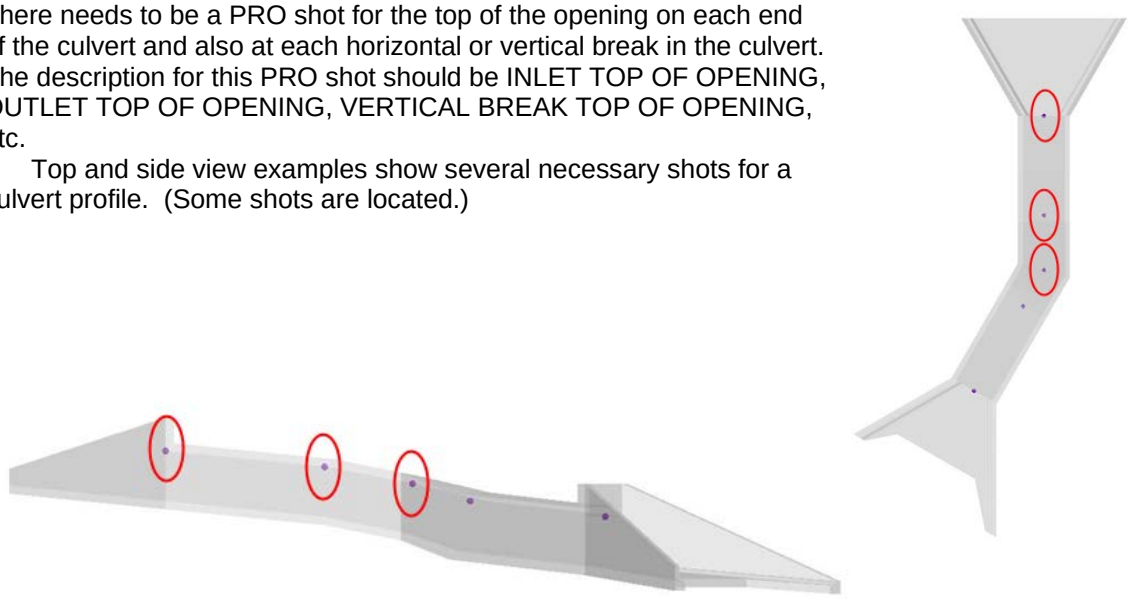
11.) If the culvert contains a considerable amount of dirt, a PRO shot should be taken on the top of the dirt at the center of the box at each culvert opening containing the dirt. The description for this PRO shot should be INLET DIRT FLOWLINE or OUTLET DIRT FLOWLINE depending on where the shot was taken.

Top and side view examples show the dirt flowline shots necessary for a box culvert. (The shots are located.)



12.) There needs to be a PRO shot for the top of the opening on each end of the culvert and also at each horizontal or vertical break in the culvert. The description for this PRO shot should be INLET TOP OF OPENING, OUTLET TOP OF OPENING, VERTICAL BREAK TOP OF OPENING, etc.

Top and side view examples show several necessary shots for a culvert profile. (Some shots are located.)

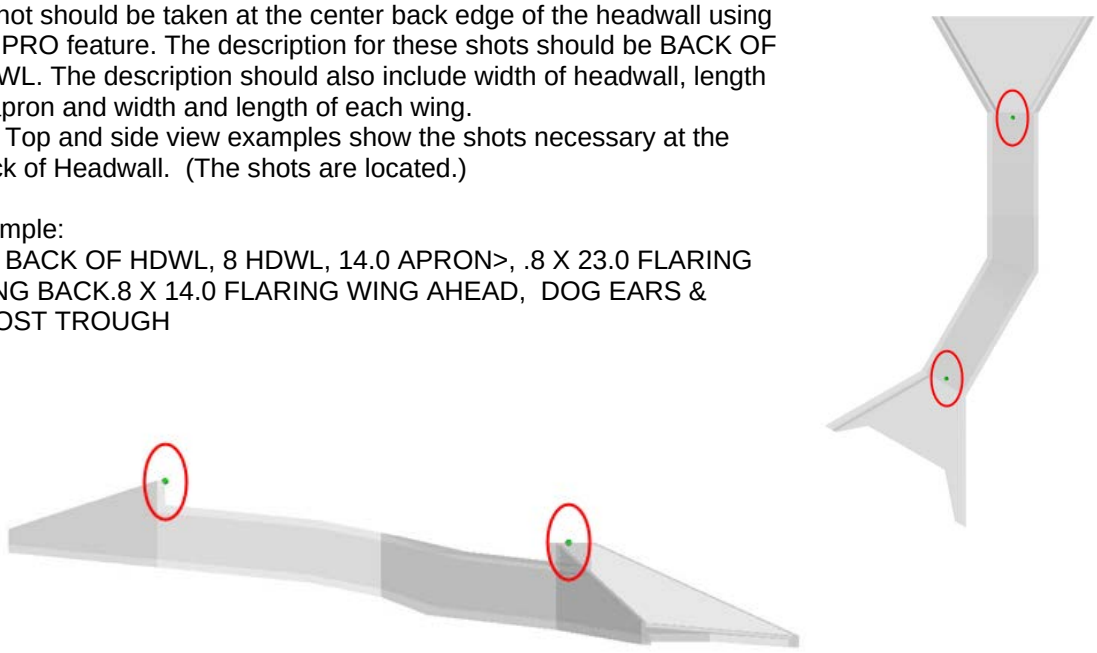


13.) A shot should be taken at the center back edge of the headwall using the PRO feature. The description for these shots should be BACK OF HDWL. The description should also include width of headwall, length of apron and width and length of each wing.

Top and side view examples show the shots necessary at the Back of Headwall. (The shots are located.)

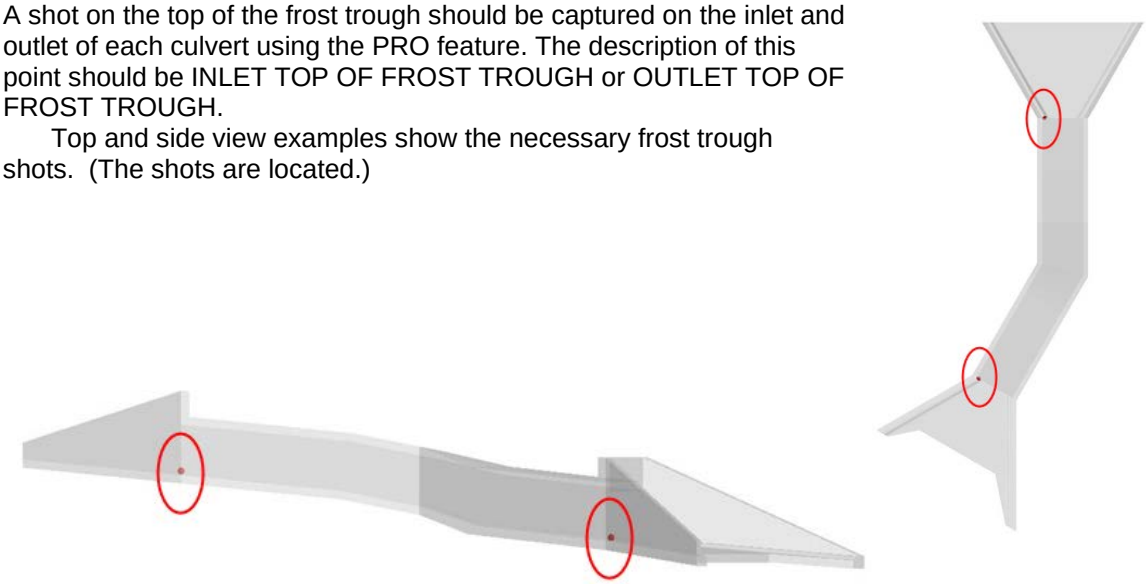
Example:

BACK OF HDWL, 8 HDWL, 14.0 APRON>, .8 X 23.0 FLARING WING BACK.8 X 14.0 FLARING WING AHEAD, DOG EARS & FROST TROUGH



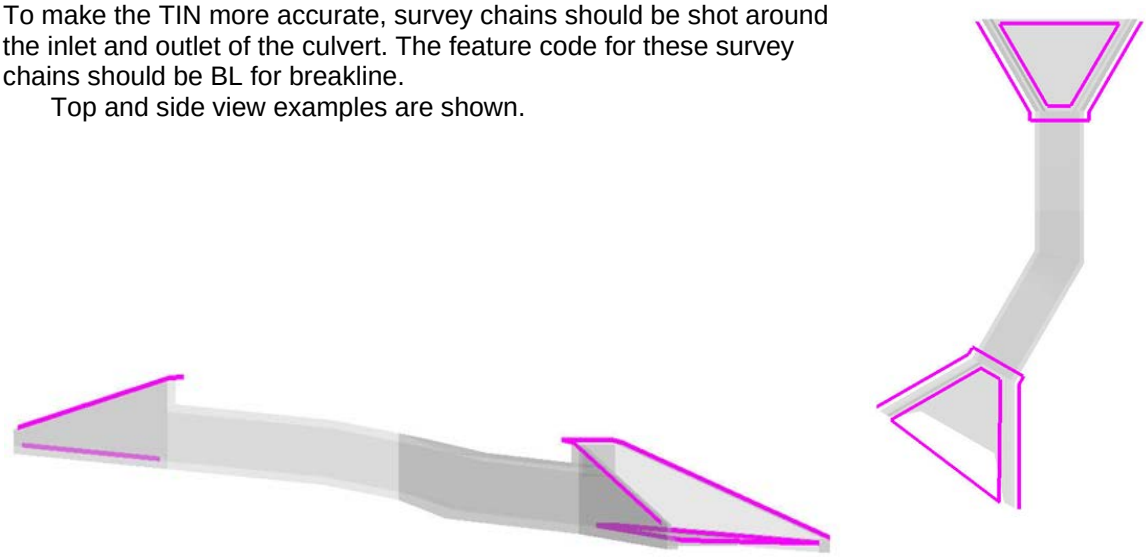
14.) A shot on the top of the frost trough should be captured on the inlet and outlet of each culvert using the PRO feature. The description of this point should be INLET TOP OF FROST TROUGH or OUTLET TOP OF FROST TROUGH.

Top and side view examples show the necessary frost trough shots. (The shots are located.)



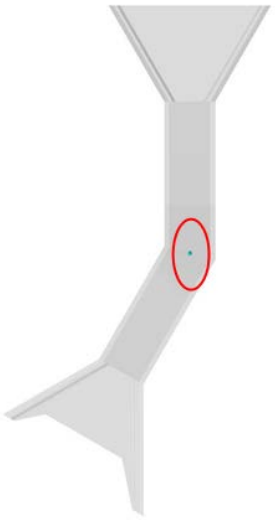
15.) To make the TIN more accurate, survey chains should be shot around the inlet and outlet of the culvert. The feature code for these survey chains should be BL for breakline.

Top and side view examples are shown.

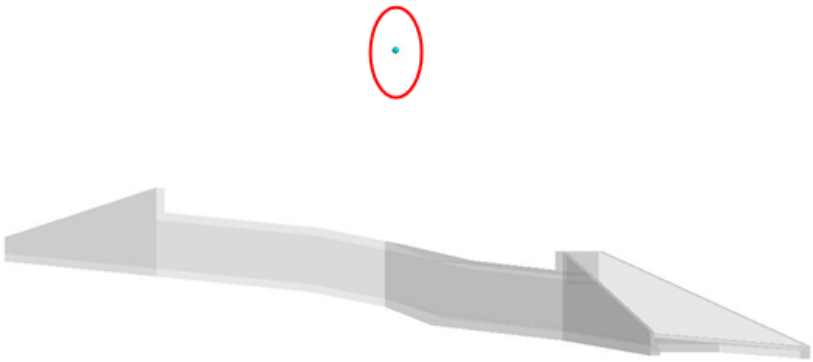


16.) The location point for the culvert is stored as an SOP feature. The location of this shot should be where the centerline of the culvert intersects the roadway alignment and at the elevation of the roadway. If the culvert does not cross the centerline, the SOP should be at the inlet flowline. The description of the SOP point should include the culvert ID, dimensions, condition, skew angle, drainage area and terrain type (F= FLAT, R = ROLLING, H= HILLY, VH= VERY HILLY).

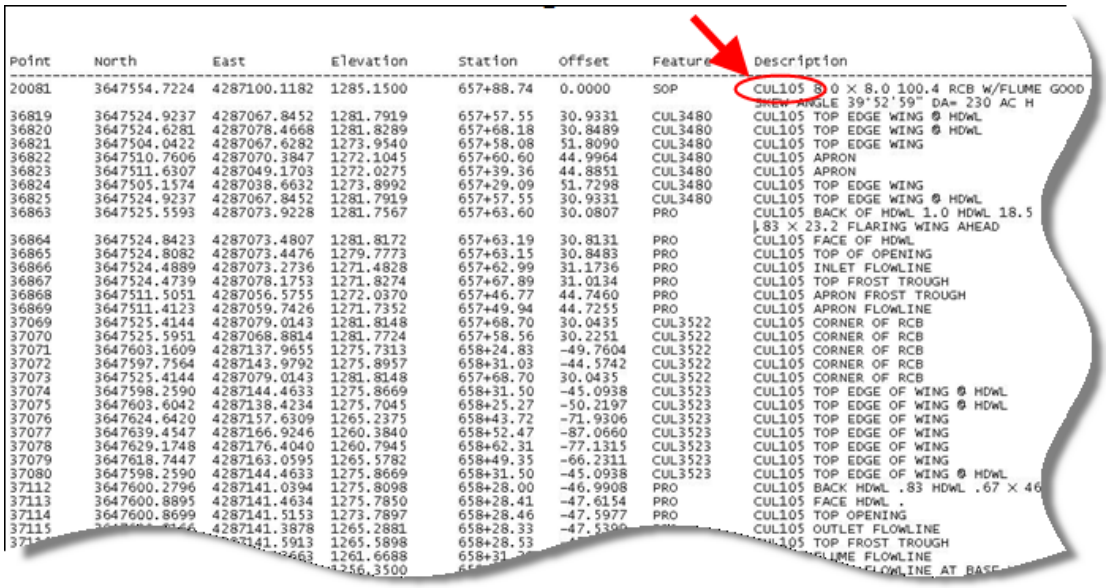
Top and side view examples show the culvert “location” shot.



Example:
CUL62, 8.0 X 8.0 X 176.42 RCB, FAIR CONDITION FILLING W\ DIRT,
SKEW ANGLE= 44° RT AH, DA = 33 AC - H



17.) The first item entered in the description for each shot associated with the culvert is an identifier. The easiest method for naming the identifier is to use CUL1 for the first culvert surveyed, with the number increasing sequentially for each culvert surveyed after that, e.g., CUL2, CUL3, CUL4. This identifier will be used by the customer to group all shots together that are associated with each drainage structure.



Point	North	East	Elevation	Station	Offset	Feature	Description
20081	3647554.7224	4287100.1182	1285.1500	657+88.74	0.0000	SOP	CUL105 8.0 X 8.0 100.4 RCB W/FLUME GOOD
							SKEW ANGLE 39°52'59" DA= 230 AC H
36819	3647524.9237	4287067.8452	1281.7919	657+57.55	30.9331	CUL3480	CUL105 TOP EDGE WING @ HDWL
36820	3647524.6281	4287078.4668	1281.8289	657+68.18	30.8489	CUL3480	CUL105 TOP EDGE WING @ HDWL
36821	3647504.0422	4287067.6282	1273.9540	657+58.08	51.8090	CUL3480	CUL105 TOP EDGE WING
36822	3647510.7606	4287070.3847	1272.1045	657+60.60	44.9964	CUL3480	CUL105 APRON
36823	3647511.6307	4287049.1703	1272.0275	657+39.36	44.8851	CUL3480	CUL105 APRON
36824	3647505.1574	4287038.6632	1273.8992	657+29.09	51.7298	CUL3480	CUL105 TOP EDGE WING
36825	3647524.9237	4287067.8452	1281.7919	657+57.55	30.9331	CUL3480	CUL105 TOP EDGE WING @ HDWL
36863	3647525.5593	4287073.9228	1281.7567	657+63.60	30.0807	PRO	CUL105 BACK OF HDWL 1.0 HDWL 18.5
							.83 X 23.2 FLARING WING AHEAD
36864	3647524.8423	4287073.4807	1281.8172	657+63.19	30.8131	PRO	CUL105 FACE OF HDWL
36865	3647524.8082	4287073.4476	1279.7773	657+63.15	30.8483	PRO	CUL105 TOP OF OPENING
36866	3647524.4889	4287073.2736	1271.4828	657+62.99	31.1736	PRO	CUL105 INLET FLOWLINE
36867	3647524.4739	4287078.1753	1271.8274	657+67.89	31.0134	PRO	CUL105 TOP FROST TROUGH
36868	3647511.5051	4287056.5755	1272.0370	657+46.77	44.7460	PRO	CUL105 APRON FROST TROUGH
36869	3647511.4123	4287059.7426	1271.7352	657+49.94	44.7255	PRO	CUL105 APRON FLOWLINE
37069	3647525.4144	4287079.0143	1281.8148	657+68.70	30.0435	CUL3522	CUL105 CORNER OF RCB
37070	3647525.5951	4287068.8814	1281.7724	657+58.56	30.2251	CUL3522	CUL105 CORNER OF RCB
37071	3647603.1609	4287137.9655	1275.7313	658+24.83	-49.7604	CUL3522	CUL105 CORNER OF RCB
37072	3647597.7564	4287143.9792	1275.8957	658+31.03	-44.5742	CUL3522	CUL105 CORNER OF RCB
37073	3647525.4144	4287079.0143	1281.8148	657+68.70	30.0435	CUL3522	CUL105 CORNER OF RCB
37074	3647598.2590	4287144.4633	1275.8669	658+31.50	-45.0938	CUL3523	CUL105 TOP EDGE OF WING @ HDWL
37075	3647603.6042	4287138.4234	1275.7045	658+25.27	-50.2197	CUL3523	CUL105 TOP EDGE OF WING @ HDWL
37076	3647624.6420	4287157.6309	1265.2375	658+43.72	-71.9306	CUL3523	CUL105 TOP EDGE OF WING
37077	3647639.4547	4287166.9246	1260.3840	658+52.47	-87.0660	CUL3523	CUL105 TOP EDGE OF WING
37078	3647629.1748	4287176.4040	1260.7945	658+62.31	-77.1315	CUL3523	CUL105 TOP EDGE OF WING
37079	3647618.7447	4287163.0595	1265.5782	658+49.35	-66.2311	CUL3523	CUL105 TOP EDGE OF WING
37080	3647598.2590	4287144.4633	1275.8669	658+31.50	-45.0938	CUL3523	CUL105 TOP EDGE OF WING @ HDWL
37112	3647600.2796	4287141.0394	1275.8098	658+28.00	-46.9908	PRO	CUL105 BACK HDWL .83 HDWL .67 X 46
37113	3647600.8895	4287141.4634	1275.7850	658+28.41	-47.6154	PRO	CUL105 FACE HDWL .
37114	3647600.8699	4287141.5153	1273.7897	658+28.46	-47.5977	PRO	CUL105 TOP OPENING
37115		4287141.3878	1265.2881	658+28.33	-47.5390		CUL105 OUTLET FLOWLINE
		4287141.5913	1265.5898	658+28.53			CUL105 TOP FROST TROUGH
			1261.6688	658+31			FLUME FLOWLINE
			1256.3500				FLOWLINE AT BASE

18.) A Form 621001-E (Pink Sheet) must be completed for each culvert that crosses a roadway.

Print Form

Form 621001-E
07-06

Iowa Department of Transportation
Highway Division
Bridge Survey Record

FIELD NOTES FOR CULVERTS

Township 89N Range 44W Section 36 Civil Township Arlington

Station Present Structure or Stream 304+79.77 Station Proposed Culvert

Drainage Area in Acres ????? El. HI. Water Character Water Shed H - V.H.

Upstream Land Use Cultivated Anticipate Any Change? No

Bench Mark No. and Description 512 IDOT Plug Top HDWL 8.0 x 8.0 RCB, Station 304+13.55, 65.88 Lt. Elevation= 1292.44

Type and Elev. of Low Upstream Buildings

Present Structure: Type 8.0 X 8.0 X 176.4 RCB Design No. Br. Rdwy.

Spans Ht.

Length: B. to B. Ppts. 176.4 Pipe Flume

Elevation: Grade 1306.15 F.L Lt. 1282.06 F.L. Rt. 1279.67 Flume Outlet

Condition Fair, filling with dirt. Skew Angle 44° 53' 11"

Proposed Culvert: Type Fin. Rdwy. Width (Sh-Sh)

Spans Ht.

Length New Constr: RCB Pipe + Aprons Flume

Elevation: Profile Grade F.L Lt. F.L. Rt.

F.L. Other Ext. Lt. + Apr. Rt. + Apr.

Total Length Lt. Rt. Skew Angle (Lt.) (Rt.) Ahead

Contr. Dike Sta. El. Type

Contr. Ditch Design Q C.F.S. Frequency Yr.

Design High Water Elev. Depth Ft. Design Fill Height Ft.

Pipe Class D. Class Bedding ADT= VPD

Disposition of Present Structure

Remarks

Computations

Left		Right	
Profile Grade Elev.		Profile Grade Elev.	
Vert. Drop {Subgrade or Hinge Point	-	Vert. Drop {Subgrade or Hinge Point	-
Working Point Elev.	=	Working Point Elev.	=
Flow Line	-	Flow Line	-
Difference	=	Difference	=
(D + "T" or (H + Hdwl.)	-	(D + "T" or (H + Hdwl.)	-
Difference	=	Difference	=
Slope 6:1, 3:1, etc.)	X	Slope 6:1, 3:1, etc.)	X
Working Point to End of Foreslope		Working Point to End of Foreslope	
Dist. = ℄ to Working Point	+	Dist. = ℄ to Working Point	+
(1.5 x D) or Dimen. "B")	+	(1½:1) or Dimen. "B")	+
Length, Calc. or Min (_____)		Length, Calc. or Min (_____)	
Secant of Skew Angle	X	Secant of Skew Angle	X
Length on skew		Length on skew	
Add for hdwl. or Apr. skew	+	Add for hdwl. or Apr. skew	+
Length		Length	
Length pres. struct.	-	Length pres. struct.	-
Extension		Extension	

Road Design To Check For

☐ Tie Lines ☐ Ditch Grades ☐ Channel Change

☐ Utilities ☐ Raise Inlet ☐ Dikes

☐ Ditching ☐ Ponding Survey to Elev. ☐ Pres. Structure

Are additional notes or sketches for this culvert attached hereto? Yes

County Woodbury Project No. NHS-20-1(77)--19-97

Design No. File No. Survey by Michael Rummelhart Date 10/09/2006

PIN Designer Date

Project Path

Chronology of Changes to Design Manual Section:

040B-008 Culvert Data Collection

12/30/2011	NEW New