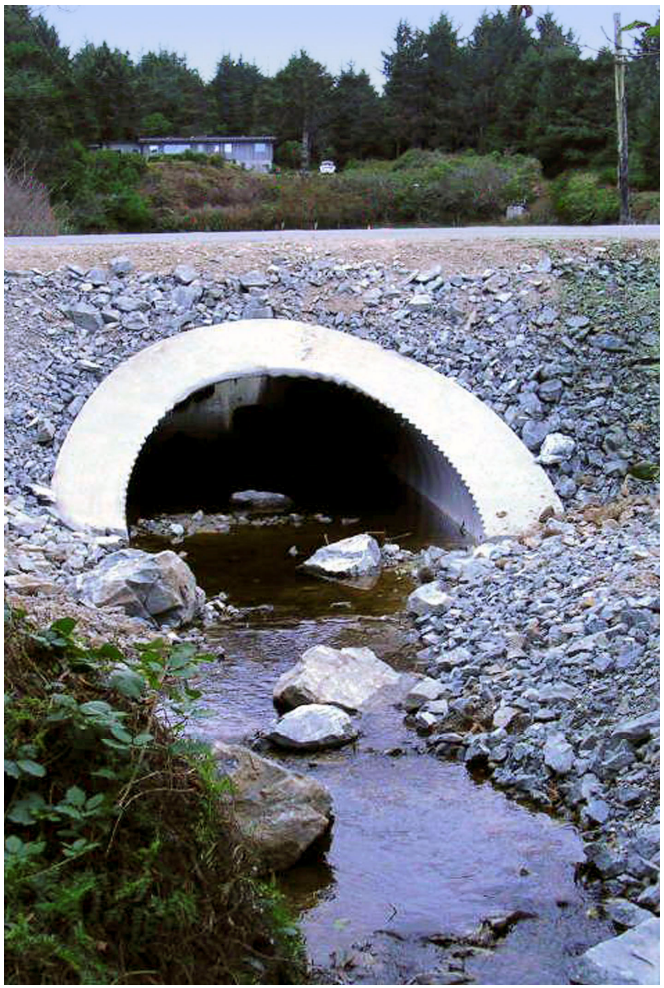
Oregon DOT
1R Culvert Inventory Training

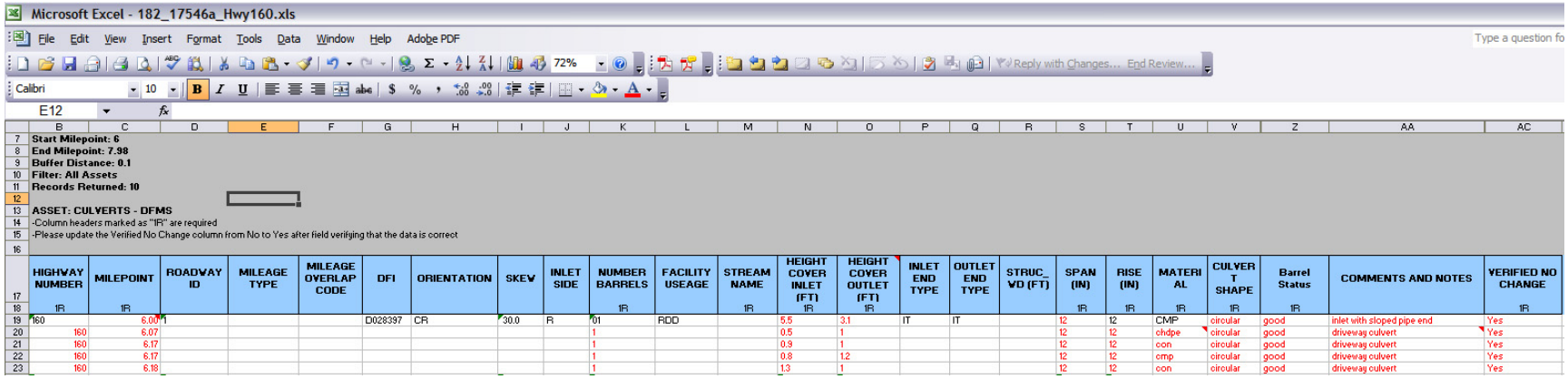


Background

This training is provided to help field crews with the 1R culvert information down loaded from the FACS STIP tool in spreadsheet form as shown below. Field crews should follow the contents of this training as closely as possible to ensure program wide uniformity and consistency.

The 1R inventory is best described as a basic inventory. Information collected for this level would include site and barrel location and geometric information. This basic information is the “core” of the information needed to populate a culvert inventory and is required to be collected for all ODOT 1R projects.

The 1R inventory is also accompanied by a single general culvert status listed as Fair/Better, Further Inspection Needed, and Urgent. Culverts with a status of “Further Inspection Needed” and “Urgent” require an additional site visit, by an experienced and trained inspector, to gather enough information to identify and determine the severity of the problem.



Microsoft Excel - 182_17546a_Hwy160.xls

File Edit View Insert Format Tools Data Window Help Adobe PDF

Start Milepoint: 6
End Milepoint: 7.98
Buffer Distance: 0.1
Filter: All Assets
Records Returned: 10

ASSET: CULVERTS - DFMS
-Column headers marked as "1R" are required
-Please update the Verified No Change column from No to Yes after field verifying that the data is correct

HIGHWAY NUMBER 1R	MILEPOINT 1R	ROADWAY ID	MILEAGE TYPE	MILEAGE OVERLAP CODE	DFI	ORIENTATION	SKEW	INLET SIDE	NUMBER BARRELS 1R	FACILITY USEAGE	STREAM NAME 1R	HEIGHT COVER INLET (FT) 1R	HEIGHT COVER OUTLET (FT) 1R	INLET END TYPE	OUTLET END TYPE	STRUC_WD (FT)	SPAN (IN) 1R	RISE (IN) 1R	MATERIAL 1R	CULVERT SHAPE 1R	Barrel Status 1R	COMMENTS AND NOTES	VERIFIED NO CHANGE 1R
160	6.00	1			D028397	CR	30.0	R	01	RDD		5.5	3.1	IT	IT		12	12	CMP	circular	good	inlet with sloped pipe end	Yes
160	6.07								1			0.5	1				12	12	chdpe	circular	good	driveway culvert	Yes
160	6.17								1			0.9	1				12	12	con	circular	good	driveway culvert	Yes
160	6.17								1			0.8	1.2				12	12	cmp	circular	good	driveway culvert	Yes
160	6.18								1			1.3	1				12	12	con	circular	good	driveway culvert	Yes

Electronic Equipment

Install and calibrate DMI in vehicle and read instruction manual.

Optional

The TruPulse is a laser rangefinder that has an integrated compass for measuring azimuth and a missing line solution. The missing line is a simple 2 shot routine that calculates the distance (vertical & horizontal), inclination and azimuth values between any two remote points.

Culvert Parameters

- The culverts to be surveyed fall within the range of 12 inches up to 20 feet. If multiple culverts are located at one location and the total structure width for all exceed 20 feet then, they should be inventoried.

- Survey all cross culverts including those with grated or drop inlets with an open end at the outlet of the culvert. Do collect cross pipe information if a manhole is used only as an energy dissipator.

Important Note:

Do not collect the following types of culverts:

- Slotted drains or perforated drains
- Culverts under private approaches
- Sanitary systems
- Storm water systems attached via manholes
- Culverts smaller than 12 inches

Locating Culverts

- **Observe** the surrounding topography and drainage patterns carefully for indications of potential culverts.
  - Pooling water in ditch line
  - Localized heavy wetland vegetation
  - Dips in roadway or shoulder
  - Stream channel scour
  - Localized roadway cracking
  - Downward sloping grade
  - Swampy areas
  - Low lying or sunken areas
  - Swales

Tip: Culverts that don't cross under highways are commonly located around guardrail section, bridges, and pullouts.

Locating Culverts …

- **Be aware** not all culverts are recorded in the field inventory report, region or maintenance records.
- **Diligently search** for unmarked, forgotten, or abandon culverts. Many may be buried or obscured by dense vegetation.
- **Walk the ditch** line and inspect suspicious low lying areas or sunken areas with a probe where a culvert would normally be expected.
- **After searching** one side of the road, turn around and search in the opposite direction. Some culverts can only be seen from one side of the highway.

Location Information

Location

HIGHWAY NUMBER	MILEPOINT	ROADWAY ID	MILEAGE TYPE	MILEAGE OVERLAP CODE	DFI
1R	1R				

Informational Note:
Fields designated as 1R are required fields for 1R inventory.

Road ID (Highway Number) 1R: is the official ODOT highway number and can be up to 5 characters. All Road ID's are alphanumeric. The highway identifier is a 3-digit code. Frontage roads and connections are coded by those three digits plus a 2-letter code.

Main road ID example: 001 (Interstate-5); ***Frontage road / Connector example:*** 001AA, 001AB

Mile Point (1R): A number that represents the distance in miles from the original beginning of the highway. ***Example:*** MP 012.4500

Roadway ID: The roadway identifier is a one digit code used in conjunction with the highway number and mile point to identify the alignment on which the mile point exists.

1 = Mile point exists on the primary roadway (add-mileage alignment of the highway).
2 = Mile point exists on the non-add alignment.

Location Information

HIGHWAY NUMBER	MILEPOINT	ROADWAY ID	MILEAGE TYPE	MILEAGE OVERLAP CODE	DFI
1R	1R				

Mileage Type: Mileage types are used to make mile points unique in areas where there are multiple occurrences of a mile point on a single highway.

Z = Overlapping mileage. When a road is lengthened in the middle due to realignment, Z-mileage is created.

Mileage Overlap Code: Overlap Mileage is used only in conjunction with mileage type 'Z' and indicates a unique series of overlapping 'Z' mileages.

DFI: The Drainage Facility ID (DFI) is used to uniquely identify culverts within ODOT's highway system. The approved DFI will be either:

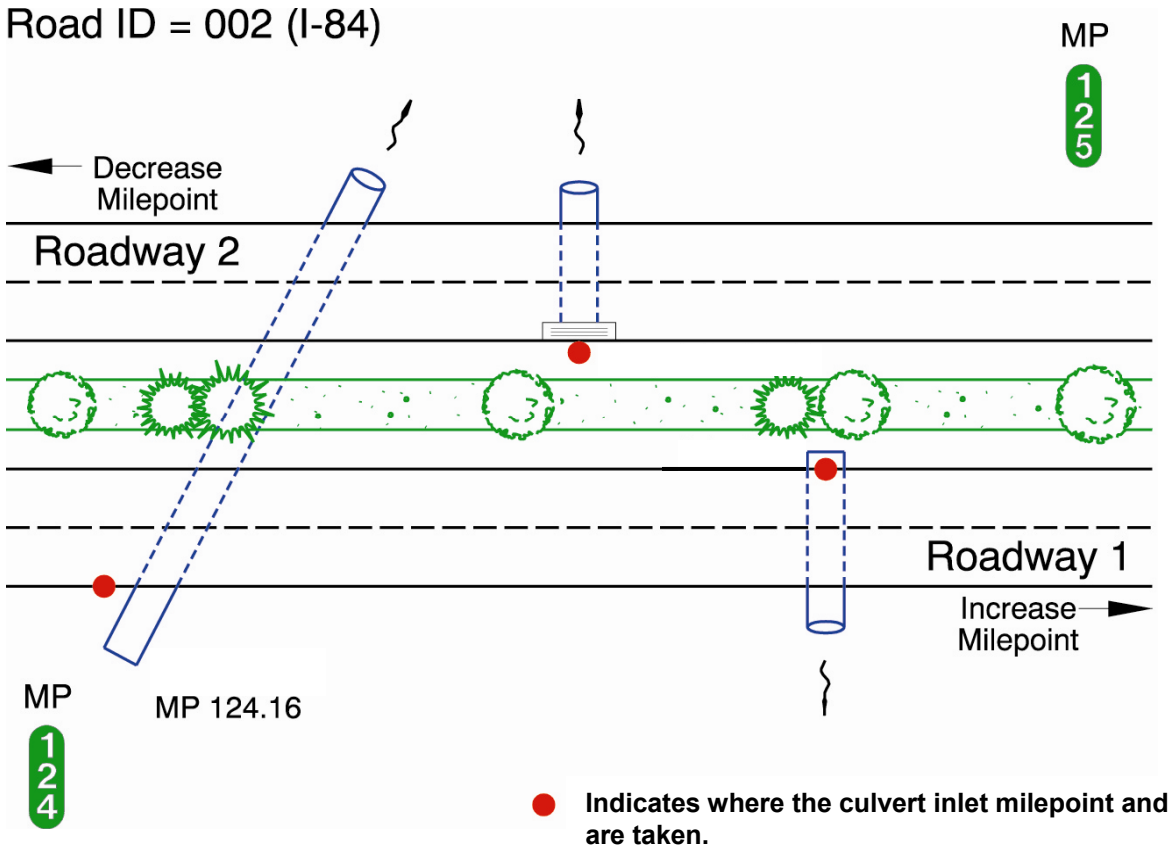
- A Bridge Structure number or
- A DFI that begins with a 'D'

Informational Note:
DFI's that begin with a 'T' are temporary and have not been field verified.

Describing Milepoint (1R)

Location

- Take the milepoint at the beginning of the culvert on the inlet side.



● **Indicates where the culvert inlet milepoint and GPS points are taken.**

Field Inventory Report

Location

The Field Inventory Report is a printout from ITIS / TransInfo that shows features along the highway and their mile point. This report is very helpful to identify mile point equations and resetting the DMI. Contact the Office of Asset Management to inquire about obtaining a similar report.

INVENTORY_SUMMARY_REPORT.TXT - Notepad

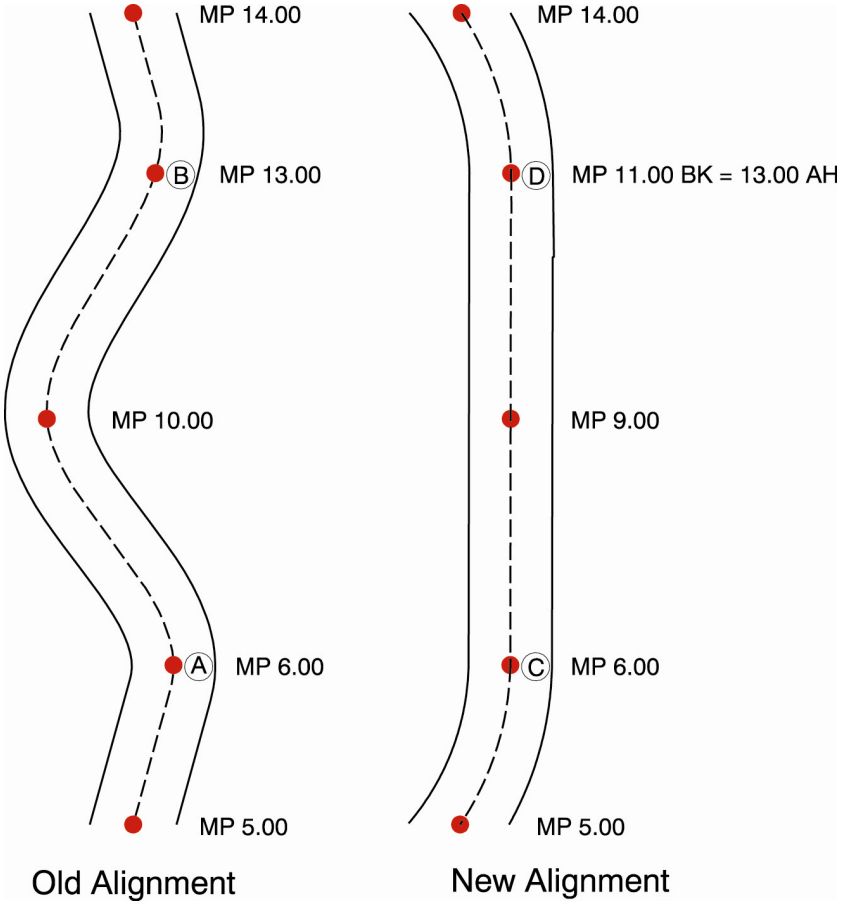
File Edit Format View Help

```
                              INVENTORY SUMMARY REPORT RUN ON: 09/24/2009 FOR: HWYE86Q
                             ROAD INVENTORY AND CLASSIFICATION SERVICES (503) 986-3158
                                       DATA SOURCE REFRESHED ON 09/19/2009
                                       HIGHWAY #: 045     UMPQUA
                               BEGIN MILEPOINT:  010.0000   END MILEPOINT:  040.0000
                                     CONNECTORS AND FRONTAGE ROADS NOT SHOWN
------------------------------------------------------------------------------------------------------------------------------------------
RDWY  MLGE OVLP MP   CAC       MILE    DUP   ROADWAY   MILEPOILEPOINT                                           ENGINEERING            LRS
 CD   TYPE  CD  EQU             PT     CD    CODES     DESCRIPTION                                              STATION ID
------------------------------------------------------------------------------------------------------------------------------------------
   1             N          039.9900         | | + | |              END STRUCTURE                               1260+61.67        004500100S00
   1             N          039.9700         = | W | = 0240' 20585  ELK CREEK                                   1259+42.3         004500100S00
   1             N          039.9400 10      | | + | |              BEG. STRUCTURE                              1258+19           004500100S00
   1             N          039.9400         W L | L W ELK CREEK TUNNEL FOREST WAYSIDE                        1258+19           004500100S00
   1             N          039.9300           L T L                END TUNNEL                                  1257+60           004500100S00
   1             N          039.8300         > | T | < 1080' 03437  ELK CREEK TUNNEL                            1252+20           004500100S00
   1             N          039.7300           E T E                BEG. TUNNEL                                 1246+80           004500100S00
   1             N          039.6800         | | + | |              END STRUCTURE                               1244+05           004500100S00
   1             N          039.6400         = | W | = 0340' 20584  ELK CREEK                                   1242+31.93        004500100S00
   1             N          039.6100         | | + | |              BEG. STRUCTURE                              1240+58.85        004500100S00
   1             N          039.5700 80      - ) W ( - (DFMS)S(1)      012" CPP CIRC ROADSIDE DRAINAGE                            004500100S00
   1             N          039.5200 80      - ) W ( - (DFMS)S(1)      015" CMP CIRC ROADSIDE DRAINAGE                            004500100S00
   1             N          039.5200             | = Z ROAD                                                                       004500100S00
   1             N          039.4300 80      - ) W ( - (DFMS)S(1)      018" CMP CIRC ROADSIDE DRAINAGE                            004500100S00
   1             N          039.3600         W E | E W ELK CREEK TUNNEL FOREST WAYSIDE                        1227+40           004500100S00
   1             N          039.2300 80      - ) W ( - (DFMS)S(1)      012" CON CIRC STREAM                                       004500100S00
   1             N          039.2300             | = F ROAD, TO ELK CREEK GUARD STATION                                           004500100S00
   1             N          039.1000 80      - ) W ( - (DFMS)S(1)      018" CON CIRC ROADSIDE DRAINAGE                            004500100S00
   1             N          039.0600 80      - ) W ( - (DFMS)S(1)      012" CON CIRC ROADSIDE DRAINAGE                            004500100S00
   1             N          039.0500             |      MILEPOST 39.00                                                            004500100S00
   1             N          039.0200 80      - ) W ( - (DFMS)S(1)      024" CON CIRC STREAM                                       004500100S00
   1             N          039.0000             |       MILEPOINT 39.00                                1206+35.16        004500100S00
   1             N          038.8300 80      - ) W ( - (DFMS)S(1)      024" CPP CIRC ROADSIDE DRAINAGE                            004500100S00
   1             N          038.8300         J = |     ROAD                                                                       004500100S00
   1             N          038.8200 80      - ) W ( - (DFMS)S(1)      012" CPP CIRC ROADSIDE DRAINAGE                            004500100S00
   1             N          038.7900         | | + | |              END STRUCTURE                               1195+30           004500100S00
   1             N          038.7600         = | W | = 0290' 20583  ELK CREEK                                   1193+85           004500100S00
   1             N          038.7400         | | + | |              BEG. STRUCTURE                              1192+40           004500100S00
   1             N          038.7100 80      - ) W ( - (DFMS)S(1)      012" CPP CIRC ROADSIDE DRAINAGE                            004500100S00
   1             N          038.6100             | = K HANCOCK MOUNTAIN RD.                                                       004500100S00
   1             N          038.4900 80      - ) W ( - (DFMS)S(1)      018" CAP CIRC ROADSIDE DRAINAGE                            004500100S00
   1             N          038.3500 80      - | W | - 01632 S(1)      072" CON  BOX HANCOCK CREEK                1171+80           004500100S00
   1             N          038.2800         Z = |     ROAD                                                     1167+58           004500100S00
   1             N          038.2400 80      - | W | - 01631 S(1)      072" CON  BOX HANCOCK CREEK                1166+00           004500100S00
   1             N          038.2100             | = J ROAD                                                     1163+59           004500100S00
   1             N          038.1700             | = P ROAD                                                                       004500100S00
   1             Y          038.1400             E     AH = 38.07BK                                             1161+00           004500100S00
   1             Y          038.0700             E     BK = 38.14AH                                             1156+36.18BK =1161+00.0AH 004500100S00
   1             N          038.0010             |      MILEPOST 38.00                                                            004500100S00
   1             N          038.0000             |       MILEPOINT 38.00                                1152+48.46        004500100S00
   1             N          037.8700 80      - ) W ( - (DFMS)S(1)      018" CON CIRC ROADSIDE DRAINAGE                            004500100S00
   1             N          037.7500 80      - ) W ( - (DFMS)S(1)      018" CON CIRC ROADSIDE DRAINAGE          1+317.65          004500100S00
   1             N          037.5300 80      - ) W ( - (DFMS)S(1)      018" CMP CIRC ROADSIDE DRAINAGE          0+970.17          004500100S00
   1             N          037.3400 80      - ) W ( - (DFMS)S(1)      018" CON CIRC ROADSIDE DRAINAGE                            004500100S00
   1             N          037.2800         Z = |     ROAD                                                                       004500100S00
   1             N          037.1200 80      - ) W ( - (DFMS)S(1)      018" CON CIRC ROADSIDE DRAINAGE          1105+90           004500100S00
```

Milepoint Equations

An equation usually occurs when a section of the highway is realigned due to construction. A milepoint equation is the result of shortening the highway. Figure below shows a highway being straightened, eliminating two miles of the highway between point C and point D.

					Location	
1	N	014.0100	= J ROAD		1163+59	004500100S00
1	N	013.1400	= P ROAD			004500100S00
1	Y	013.0000	E	AH = 011.0000 BK	1161+00	004500100S00
1	Y	011.0000	E	BK = 013.0000 AH	1156+36.18BK =1161+00.0AH	004500100S00
1	N	010.6800				004500100S00



Informational Note:

- If culvert is located at the milepoint equation, then assign the ahead mile point of 013.00
- The milepoint range between 011 to 013 does not exist !!!
- Reset the DMI at all milepoint equations.

Important Note:

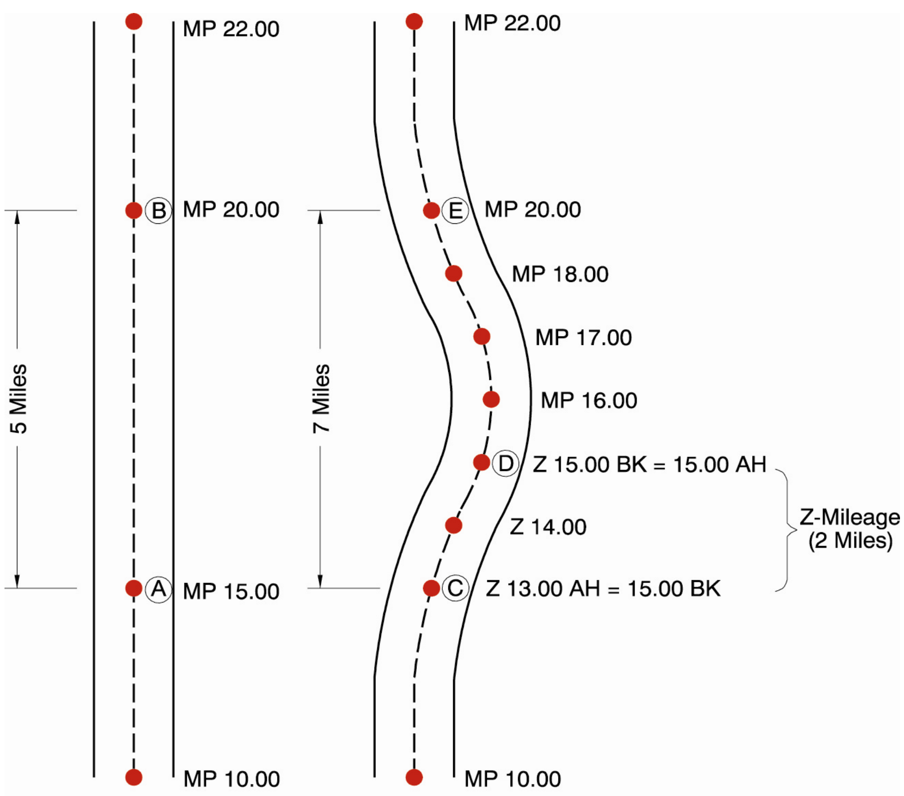
- If DMI is not reset at point D then culverts not listed on field inventory sheet will have the wrong MP.
- All culvert passed the equation will be off by the distance in the milepoint equation.

Z - Mileage

When a roadway has been lengthened due to realignment, a section of z-mileage is added to the highway. This could occur if a road is modified to go around a landslide or sink hole. The figure below shows the original section from 'A' to 'B' has been lengthened by two miles.

Location

```
1           N      015.7300        | = Z NW 13TH AVE.                               000900100S00
1           Y      015.0000        E     AH = Z15.00BK                              000900100S00
1   Z   2   Y      015.0000        E     BK = 15.00AH                               000900100S00
1   Z   2   N      014.5500 80   - ) + ( - (DFMS)S(1)      018" CON CIRC             000900100S00
1   Z   2   N      013.4800 80   - ) + ( - (DFMS)S(1)               CIRC             000900100S00
1   Z   2   Y      013.3700 10   L   |   L "FISHERY POINT"                          000900100S00
1   Z   2   Y      013.0000        E     AH = 15.00BK                               000900100S00
1           Y      015.0000        E     BK = Z13.00AH                              000900100S00
1           N      014.5200 80   - ) + ( - (DFMS)S(1)               CIRC             000900100S00
```



Old Alignment New Alignment

Informational Note:

- If a culvert is located at the beginning of 'Z' mileage, then assign the ahead mile point of 013.00 and a mile type of 'Z'.
- If a culvert is located at the end of the 'Z' mileage, then assign the ahead mile point of 015.00.
- Reset the DMI at beginning and end of the 'Z' mileage.

Important Note:

- If DMI is not reset at point D then culverts not listed on field inventory sheet will have the wrong MP.
- All culvert passed the equation will be off by the distance in the milepoint equation.

Culvert Features 1

ORIENTATION	SKEW	INLET SIDE	NUMBER BARRELS 1R	FACILITY USEAGE	STREAM NAME 1R

Informational Note:
Fields designated as 1R are required fields for 1R inventory.

Orientation: Orientation of the culvert in relation to the roadway when looking in the increasing mile point direction.

Skew: The measure of the angle of intersection between a line normal to the roadway centerline and the direction of the flow in a channel in the lineal direction of the main channel. Measured in degrees.

Inlet Side: Left or right side of the highway that the culvert inlet is located. Left or right side is determined by looking in the increasing mile point direction.

Number of Barrels (1R): Number of barrels assigned to a single site culvert.

Facility Usage: Identifies the primary purpose of the facility, and what passes through the structure i.e., stream, equipment pass, overflow, pedestrian pass, etc.

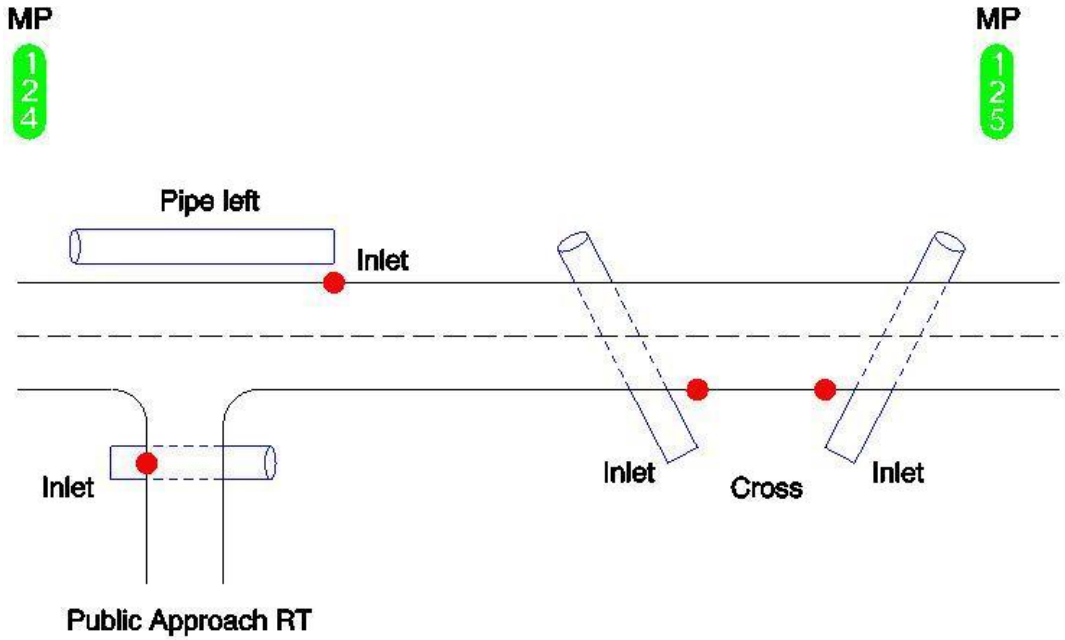
Stream Name (1R): Name of offical stream passing through the culvert.

Culvert Orientation

Cross - Culverts that cross underneath the roadway. Culverts or structures that cross over the highway are the Bridge section's responsibility.

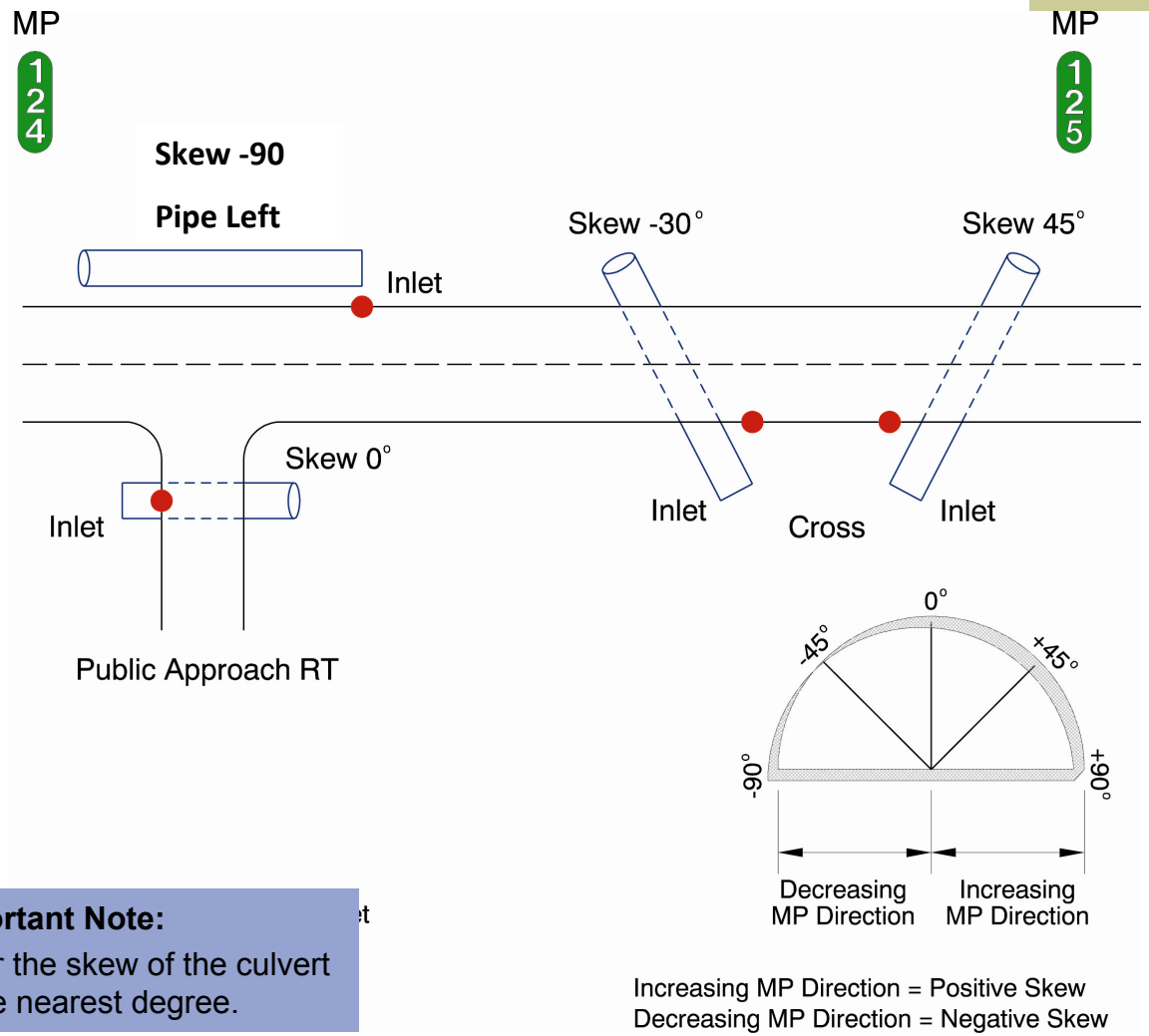
Pipe Left & Pipe Right - Culverts that can run perpendicular, parallel or at a skew to the highway but do not cross under any travel lanes.

Public Approach Left & Right - Culverts that pass under public approach roads are termed 'Public Approach Left' & 'Public Approach Right'. To determine if a road is a public road consult the field inventory report.



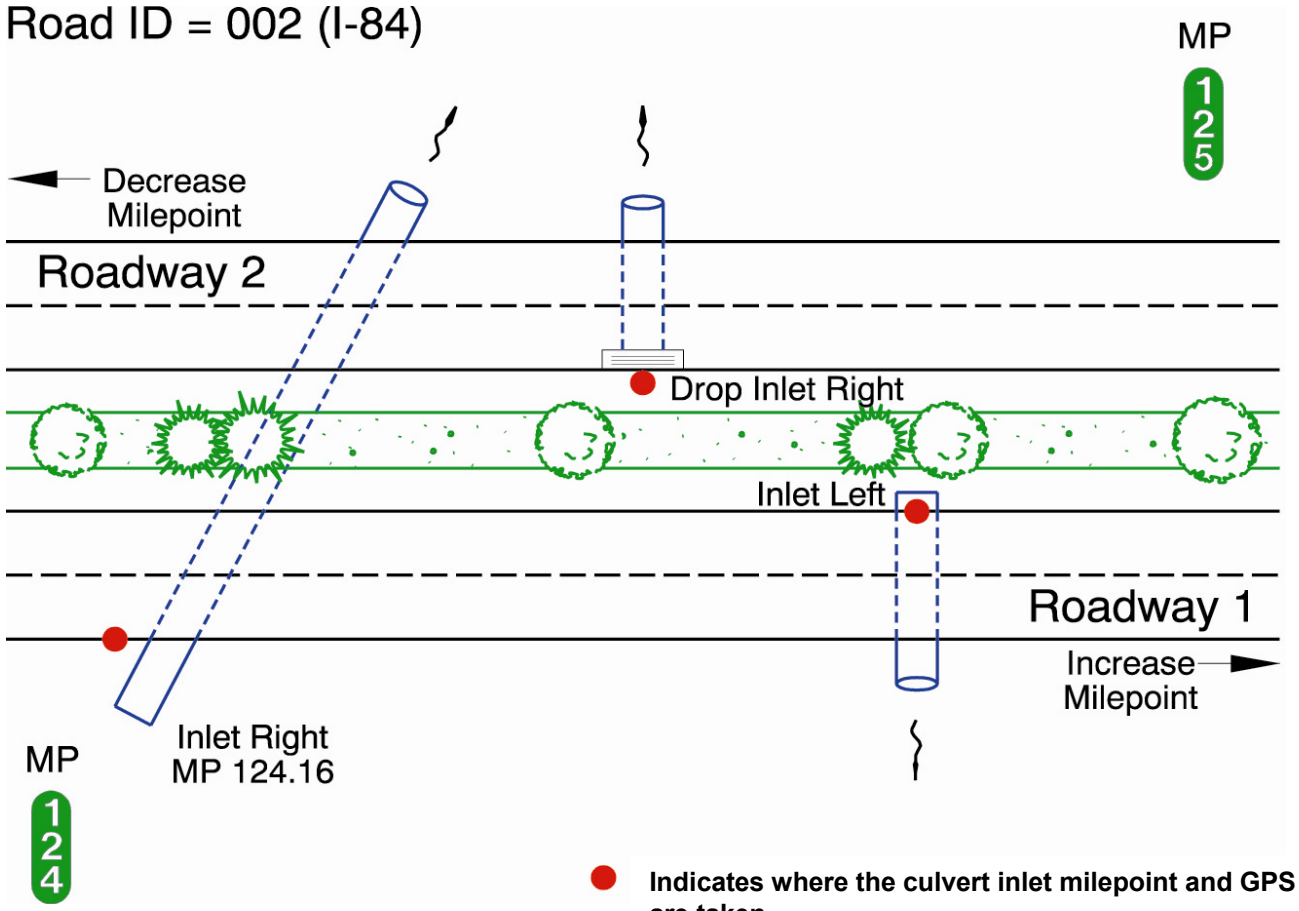
Important Note:
Do not include private roadway or field approaches

Skew



Important Note:
Enter the skew of the culvert to the nearest degree.

Inlet Side



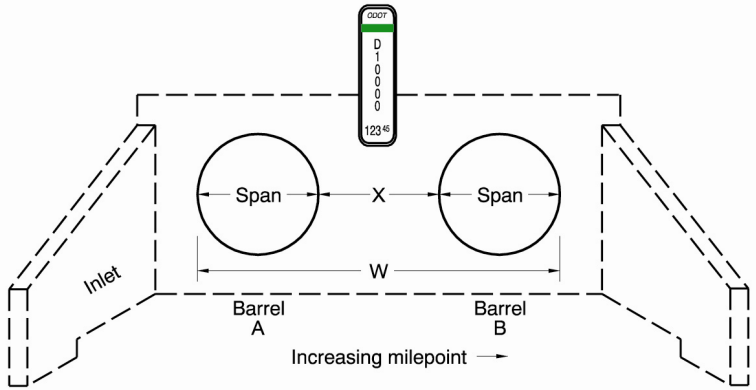
● Indicates where the culvert inlet milepoint and GPS points are taken.

Number of Barrels (1R)

When multiple culverts are encountered at the same mile point a decision is to be made whether to record this location as a single facility with multiple barrels or as separate facilities.

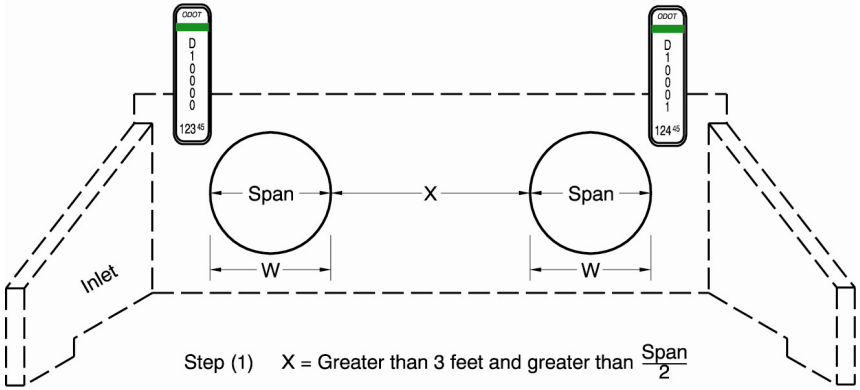
Features 1

Single Drainage Facility



Step (1) X = 3 feet or less
Step (2) X = Greater than 3 feet, but less than or equal to $\frac{Span}{2}$

Multiple Drainage Facilities



Step (1) X = Greater than 3 feet and greater than $\frac{Span}{2}$

W = Structure width
X = Minimum Distance between culverts

Single Facility

- Minimum distance between culverts 'X' meets requirements listed in steps 1 & 2 in top figure.
- With multiple barrels, assign the *Barrel ID's* alphabetically in direction of increasing milepoints
- This location would have 2 barrels

Multiple Culverts

- Minimum distance between culverts 'X' meets requirement listed in step 1 of bottom figure.
- Treat as separate culverts
- This location each culvert will have 1 barrel.

Culverts with differing skews are coded separately as multiple facilities.

Headwalls are not used in the determination of multiple culverts

Facility Usage

Data Values

- Abandoned
- Cattle Pass
- Equipment Pass
- Irrigation
- Overflow
- Pedestrian Pass
- Roadside Drainage
- Siphon
- Slough
- Stream
- Utilities
- No Data

Roadside Drainage

If Equipment Pass and Pedestrian Pass are a rigid frame structure, then do not collect any culvert information for this structure.

Culvert Features 2

HEIGHT COVER INLET (FT)	HEIGHT COVER OUTLET (FT)	INLET END TYPE	OUTLET END TYPE	STRUC_WD (FT)
1R	1R			

Informational Note:
Fields designated as 1R are required fields for 1R inventory.

Inlet Ht of Cover (1R): The vertical distance from the top of the inlet barrel to the edge of pavement of the roadway. Round values to the nearest foot.

Outlet Ht of Cover (1R): The vertical distance from the top of the outlet barrel to the edge of pavement of the roadway. Round values to the nearest foot.

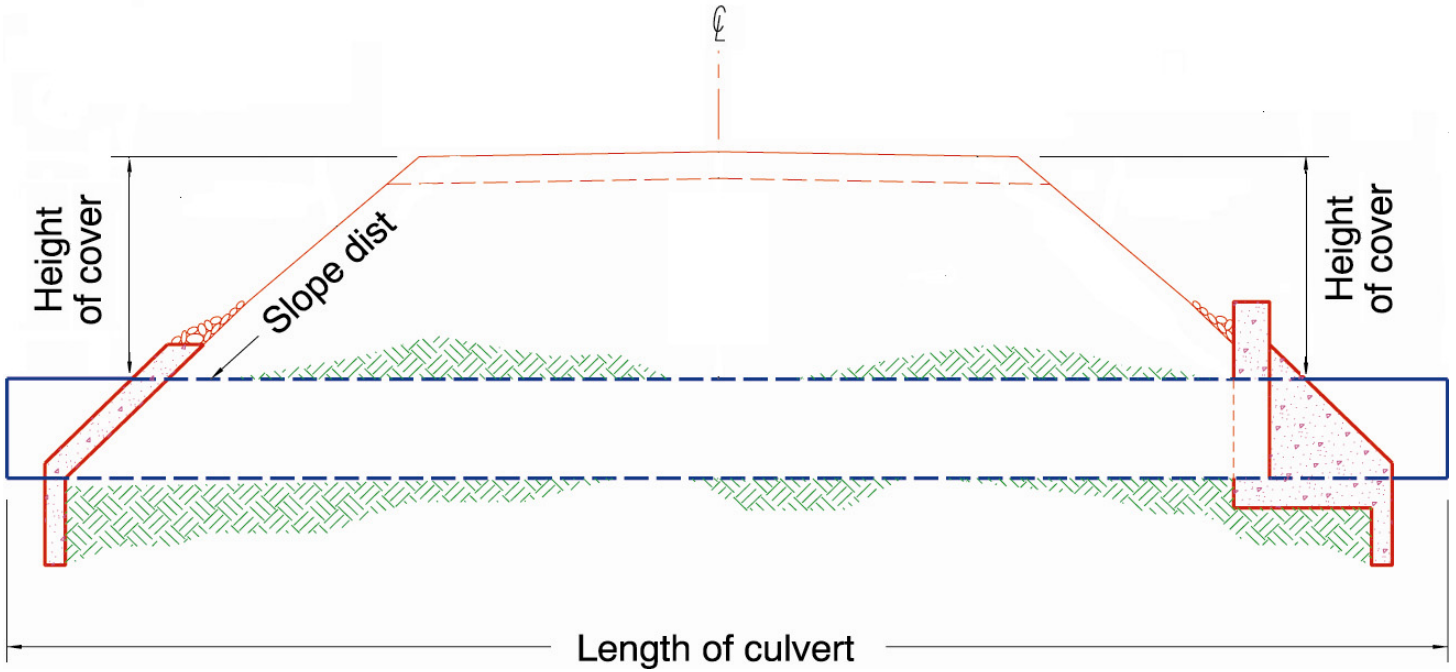
Inlet / Outlet End Treatment: A structure feature at the end of a culvert for improving discharge, providing anchorage, to help limit scour, or retain embankment material from entering into the stream. These are two different fields.

Structure Width: Total width of the culvert(s) **measured in decimal feet** from the outside to outside of all the culvert barrels. Neither the headwall nor the wing wall are included in this measurement.

Important Note:
In deep fill areas the 'Inlet and Out Height of Cover' can be hard to obtain. The accuracy of this measurement must be within 10% of the actually height. The 1R culvert data is information about the asset and is not intended for design purposes. **Example:** An acceptable measurement for a 45 ft height of cover would be in the range from 41 to 49 feet. Guessing the height is not acceptable.

Height of Cover (1R)- There are two different options for measuring the embankment height above the culvert inlet and outlet.

- **Shallow Fills -**
  - Measure the height using a hand level and survey rod.
  - Make sure to measure the height of your eye.
  - If the survey rod base is below you, subtract your eye height from the measurement on the survey rod.



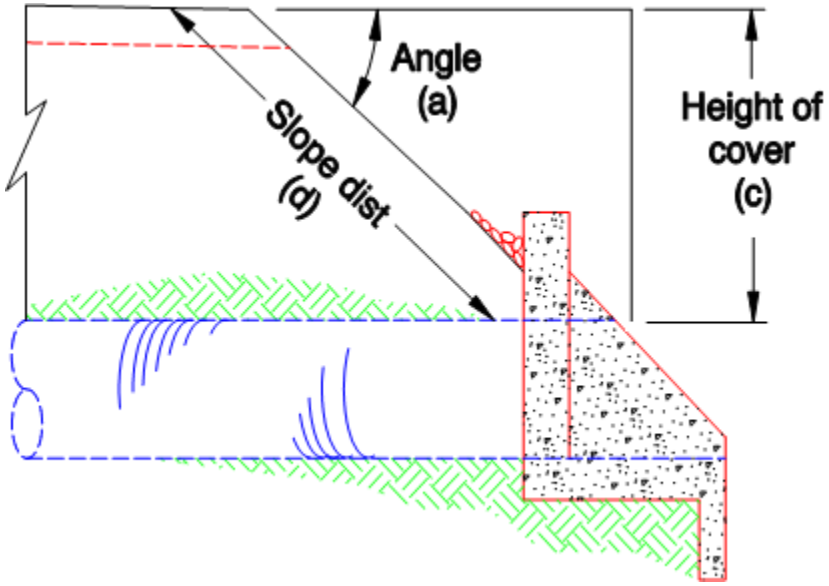
Height of Cover (1R) cont …

Height of Cover cont …

Features 2

- **Deep Fills -**
  - Use an inclinometer to measure and record the slope angle (a)
  - Measure the slope length to the top of culvert using either a rag tape or range finder (d)
  - The embankment horizontal length can be found by using basic trigonometry functions. SinΘ = Opposite / Hypotenuse

- **TruePulse** laser will find the height of cover using the missing line routine. The height can be obtained by taking just two shots.



Example:

Angle (a) = 36°
Slope Distance (d) = 55 feet

Sin (a) = opposite (c) / Hypotenuse (d)

c = sin(a) x d
c = sin(36) x 55

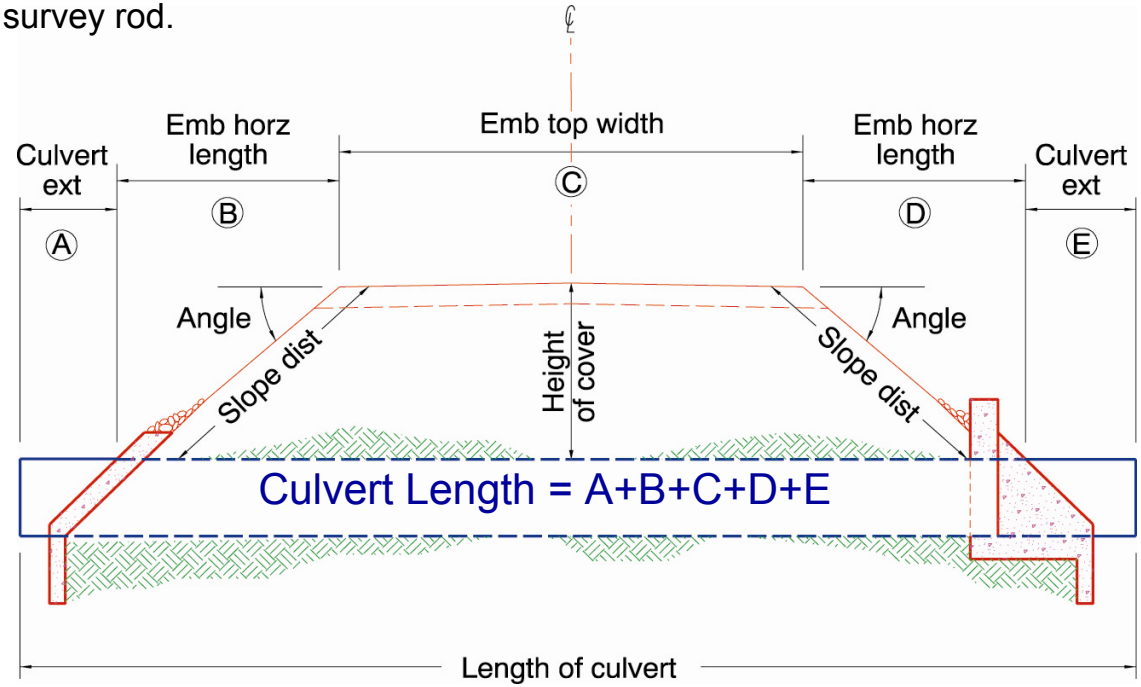
c = 32.3 ft
Height of cover = 32 ft

Profile

Culvert Length - There are two different options for measuring culvert length.

Features 2

- **Shallow Fills -**
  - Measure the horizontal embankment length **(B)** & **(D)** using the rag tape from the top of the roadway embankment to the point where the slope intersects the culverts.
  - Measure the culvert extension from the roadway embankment **(A)** & **(E).**
  - Simply add these measurements to the embankment top width **(C)** to get the overall length of the culvert.
- **TruePulse** laser will find the length with just one shot. Just make sure to shoot your eye height on the survey rod.

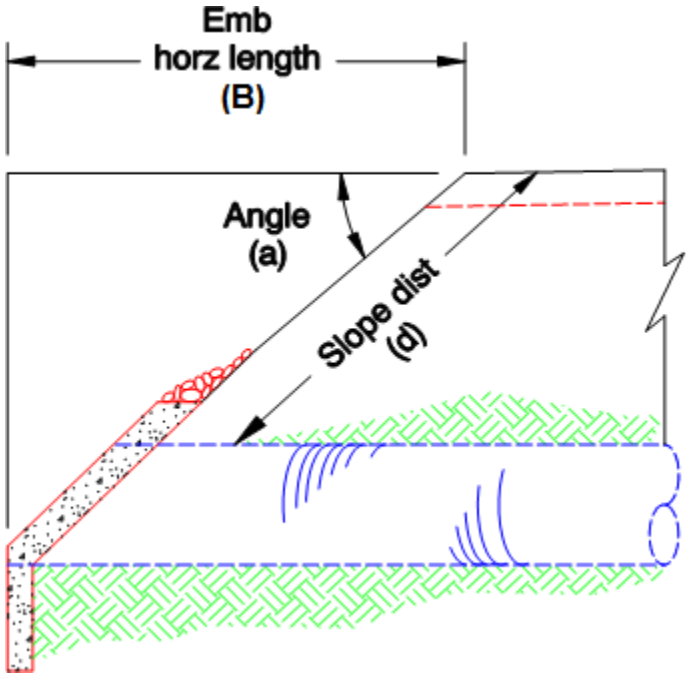


Profile

Culvert Length cont …

Features 2

- **Deep Fills -** Culvert Length = A+B+C+D+E
  - Use an inclinometer to measure and record the slope angle (**a**)
  - Measure the slope length using either a rag tape or range finder (**d**)
  - The embankment horizontal length can be found by using basic trigonometry functions. CosΘ = Adjacent / Hypotenuse
- **TruePulse** laser will find the horz length (I) using the missing line routine. The two horz lengths plus the embankment with will equal the culvert length.



Example:

Angle (a) = 36°
Slope Distance (d) = 55 feet

Cos (a) = Adjacent (I) / Hypotenuse (d)

I = cos(a) x d
I = cos(36) x 55

I = 44.5 ft
Embankment horizontal length = 44.5 ft

Inlet End Types

A structure feature at the end of a culvert for improving discharge, providing anchorage, to help limit scour, or retain embankment material from entering into the stream.

Features 2

Data Values

- Projecting
- Debris Rack
- Headwall Concrete
- Headwall -Wingwall
- Headwall –Non Engr'd
- Drop Inlet
- Mitered Collar
- Mitered Slope Paved
- Mitered
- Manhole
- Beaver Cone
- Stand Pipe
- Safety End Section
- Flared
- No Data

Photos clockwise direction:

Projecting	Mitered Collar
	Mitered Collar
	Stand Pipe

Don't collect information if the culvert is part of a storm water system. Manholes can be used in rare cases as an energy dissipator.

Outlet End Types

A structure feature at the end of a culvert for improving discharge, providing anchorage, to help limit scour, or retain embankment material from entering into the stream.

Data Values

- Projecting
- Debris Rack
- Headwall Concrete
- Headwall -Wingwall
- Headwall –Non Engr'd
- Mitered Collar
- Mitered Slope Paved
- Mitered
- Manhole
- Beaver Cone
- Safety End Section
- Flared
- Energy Dissipater
- Tide Gate
- No Data

Photos clockwise direction:

Headwall Non Engr'd

Slope Paved

Tide Gate

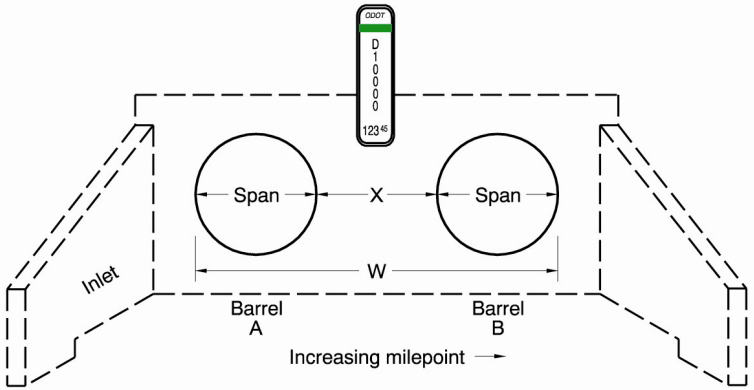
Headwall / Wingwall

Don't collect information if the culvert is part of a storm water system. Manholes can be used in rare cases as an energy dissipater.

Culvert Structure Width

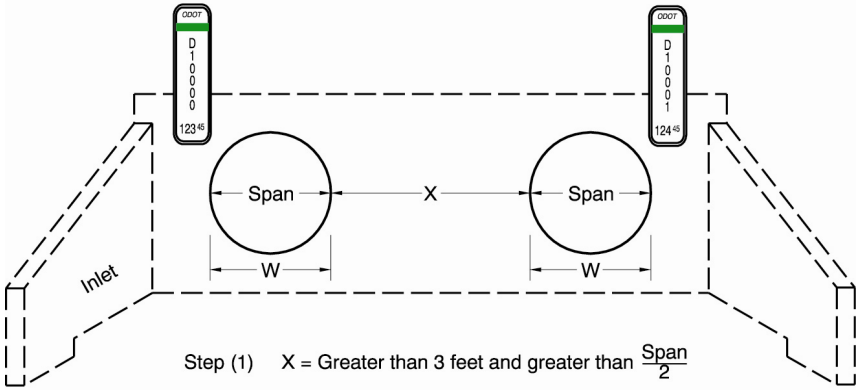
Total width of the culvert(s), measured in decimal feet, from the outside to outside of all the culvert barrels. Measurement is taken perpendicular to the profile of the culvert.

Single Drainage Facility



Step (1) X = 3 feet or less
Step (2) X = Greater than 3 feet, but less than or equal to $\frac{\text{Span}}{2}$

Multiple Drainage Facilities



Step (1) X = Greater than 3 feet and greater than $\frac{\text{Span}}{2}$

W = Structure width
X = Minimum Distance between culverts

Single Facility

- Structure width equals dimension 'W'

Multiple Facility

- Structure width equals dimension 'W' for each barrel
- In these cases structural width would be the same as the span.

Informational Note:

- Headwalls are not used in the determination of Structure Width.
- Culvert structure width is different from Bridge structure width.

Barrel Data

SPAN (IN)	RISE (IN)	MATERIAL	CULVERT SHAPE	Barrel Status	COMMENTS AND NOTES	VERIFIED NO CHANGE
1R	1R	1R	1R	1R		1R

Span (1R): Horizontal width dimension of structure measured in inches.

Rise (1R): Vertical height dimension of structure measured in inches.

Material (1R): Value representing the primary culvert material.

Shape (1R): Value for the transverse cross sectional shape of the culvert. Values are Arch; Box; Circular; Open Bottom Arch; Elliptical.

Informational Note:
Fields designated as 1R are required fields for 1R inventory.

Barrel Data

Barrel

SPAN (IN)	RISE (IN)	MATERIAL	CULVERT SHAPE	Barrel Status	COMMENTS AND NOTES	VERIFIED NO CHANGE
1R	1R	1R	1R	1R		1R

Barrel Status (1R): Identifier that determines if culvert needs further inspection (Ex: Fair/Better; Needs Inspection; Needs urgent attention).

This field is not a condition or rating assessment.

Comments: Are for short notes that are not captured from the 1R inventory fields above.

Verified No Change (1R): Used to verify if existing data has been verified and no changes to the data were warranted.

Material Types (1R)

Code representing the primary culvert material.

Barrel

Data Values

- Clay
- Corrugated Aluminum Pipe
- Corrugated Metal Pipe
- Concrete
- Ductile Iron
- Fiberglass
- HDPE Corrugated
- HDPE Smooth Wall
- Iron / Steel
- PVC Smooth Wall
- Timber
- No Data

Most common types of material encountered in the field

When a culvert is encountered with two different type of materials, record the main material and make note of the extension in the comments.

HPDE Corrugated

HPDE Smooth Wall

Barrel Status (1R)

Metal Culverts

- **Fair/Better:** No visual evidence of damage or only minor rusting or scaling in the barrel. No visual evidence or only minor isolated distortions, horizontal diameter is within 0% to 5% of design. Barrel is blocked less than 25% of the cross-section area at the worst section.
- **Further Inspection Needed:** Significant rusting, no holes to isolated holes in the invert of the barrel. Significant distortions of the invert or crown at isolated locations, horizontal diameter is within 5% to 15% of design. Barrel is blocked from 25% to 50 % of the cross-section area at the worst section.
- **Urgent**: Major rusting and deterioration with loss of sections and holes developing at isolated sections of the culvert. Major settlement / distortions of the invert or crown, horizontal diameter is within 15% to 20% of design. Barrel is blocked 50% or more of the cross-section area at the worst section.

Fair/Better

Further Inspection

Urgent

Important Note:

The culvert doesn't need to meet each item listed in order to meet the barrel status.

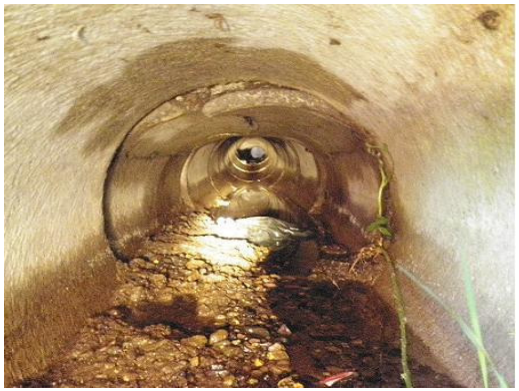
Barrel Status (1R)

Concrete Culverts

- **Fair/Better:** No visual evidence of damage, settlement or misalignment. Joints and seams are tight with no openings. No visual evidence or only minor isolated distortions, horizontal diameter is within 0% to 1% of design. Barrel is blocked less than 25% of the cross-section area at the worst section.
- **Further Inspection Needed:** Minor misalignment and settlement at isolated locations. Minor separation of joints and seams allowing possible backfill infiltration. Isolated cracks. Distortions of the invert or crown at isolated locations, horizontal diameter is within 1% to 5% of design. Barrel is blocked from 25% to 50 % of the cross-section area at the worst section.
- **Urgent:** Significant settlement and misalignment, causing possible ponding. Significant separation of joints and seams allowing backfill infiltration into culvert. Large longitudinal cracks larger, possible exposed rebar. Significant distortions of the invert or crown, horizontal diameter greater than 5% of design. Barrel is blocked 50% or more of the cross-section area at the worst section.

Fair/Better

Further Inspection



Urgent

Important Note:

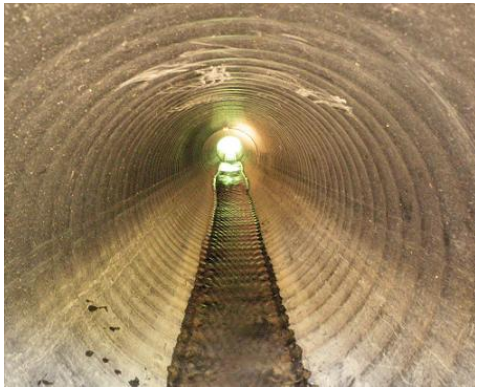
The culvert doesn't need to meet each item listed in order to meet the barrel status.

Barrel Status (1R)

Plastic Culverts

- **Fair/Better:** No visual evidence of damage, minor discolorations or minor isolated rips or tear caused by debris. No visual evidence or only minor isolated distortions, pipe deflection up to 5% of design. Barrel is blocked less than 25% of the cross-section area at the worst section.
- **Further Inspection Needed:** Isolated perforations, rips or tears. Gouges to end sections of culvert. Significant distortions throughout the culvert, some dimpling present, pipe deflection is within 5% to 10% of design. Barrel is blocked from 25% to 50 % of the cross-section area at the worst section.
- **Urgent:** Perforations located throughout the pipe, small split opening causing loss of backfill material. Major distortions throughout the pipe, moderate degree of dimpling present. Pipe deflection is within 10% to 15% of design. Barrel is blocked 50% or more of the cross-section area at the worst section.

Fair/Better



Further Inspection

Urgent

Important Note:

The culvert doesn't need to meet each item listed in order to meet the barrel status.

Culvert Features 1 Data Values:

Use the code in the value column to populate the data fields.

Orientation

Value List

Value	Description
CR	Cross
PR	Pipe Right
PL	Pipe Left
UR	Public Approach Right
UL	Public Approach Left
ND	No Data

Inlet Side

Value List

Value	Description
L	Left
R	Right
N	No Data

Culvert Features 1 Data Values:

Use the code in the value column to populate the data fields.

Facility Usage

Value List

Value	Description	Value	Description
ABD	Abandoned	SIP	Siphon
CLP	Cattlepass	SLG	Slough
DRT	Drainage Tunnel	STR	Stream
EQP	Equipment Pass	UTL	Utilities
IRG	Irrigation	ND	No Data
OVF	Overflow		
PPS	Pedestrian Pass		
RDD	Roadside Drainage		

Culvert Features 2 Data Values:

Use the code in the value column to populate the data fields.

Culvert End Types

Value List

Value	Description	Value	Description
PJ	Projecting	MC	Mitered-Collar
FL	Flared End	DR	Debris Rack
HW	Headwall-Wingwall	TG	Tide Gate
HC	Headwall Concrete	IT	Inlet
HO	Headwall Other	MH	Manhole
HN	Headwall NonEngr	SE	Safety end sections
MR	Mitered	ND	No Data
MP	Mitered Slope Paved	ED	Energy Dissipater

Barrel Data Values:

Use the code in the value column to populate the data fields.

Culvert Material

Value List

Value	Description	Value	Description
SHP	HDPE Smooth Wall	SPV	PVC Smooth Wall
ISP	Iron/Steel	TMR	Timber
DIP	Ductile Iron	CLY	Clay
CMP	Corrugated Metal Pipe	ALU	Aluminum
CAP	Corrugated Aluminum Pipe	ND	No Data
CON	Concrete	CIP	Corrugated Iron Pipe
CPP	HDPE Corrugated		

Barrel Data Values Cont…

Culvert Shape

Value List

Value	Description
ARCH	Arch
OBAR	Open Bottom Arch
BOX	Box
CIRC	Circular
ELIP	Elliptical
ND	No Data