

Vermont Agency of Transportation

Statewide Small Culvert Inventory (SCI)

Visual Pocket Guide



Last Updated
June 2020

BARREL OBSERVATIONS AND ASSESSMENTS:

Material

STEEL



HDPE



PVC



METAL



CONCRETE



Modifications

Cured in Place Lining



Sleeve



Asphalt Coated



Plastic Coated



OUTLET OBSERVATIONS AND ASSESSMENTS:

Functional Rating *continued*

parts of the culvert functionality are compromised. Culvert requires immediate action to prevent catastrophic failure.

Functional Status

Abandoned - Culvert has been intentionally un-maintained. A change in the ditching or drainage design within the area has rendered it obsolete

Discontinued - Culvert has intentionally been plugged with a foreign material or object to cease its ability to accept drainage

Filled - Culvert has been purposefully filled, but not removed. Fill substances such as flowable fill or concrete are used to render the asset no longer functioning.

Foreword:

The Agency is responsible for the maintenance of a large, complex drainage system composed of culverts, drop inlets, and access holes.

Currently, the Agency goal is to reinspect 20% of the entire inventory every year, meaning that the full inventory will be inspected every five years.

BARREL OBSERVATIONS AND ASSESSMENTS:

Barrel Separation

None – Default: no evidence of pipe separation. No detectable gaps between sections, and no misalignment visible.

Minor - Minor separations less than 3” wide at isolated locations along the culvert. Slight misalignment of culvert sections visible.

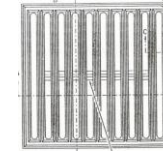
Moderate - Significant separation less than 3” wide and separation greater than 3” at outlet or inlet end section. Misalignment visible throughout culvert.

Major - Separations greater than 3” wide throughout the culvert resulting in joint dislocation and possible sediment backfill and infiltration of water. Integrity of culvert is compromised due to misalignment.

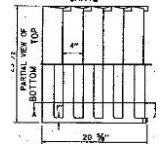
Unknown - Culvert barrel was not accessible for assessment.

DROP INLET(DI) OBSERVATIONS AND ASSESSMENTS:

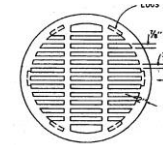
Grate Type



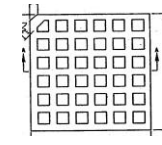
Grate Type A.



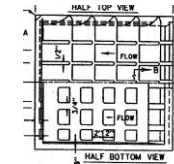
Grate Type B.



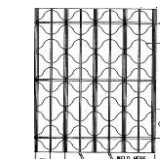
Grate Type C.



Grate Type D.



Grate Type E.



Steel Grate

Condition

Good - DI appears to be performing as designed: deficiencies are superficial.

Fair - DI possesses minor deficiencies, none of which significantly affect the performance of the outlet. Minor cracks or spalling are visible.

Poor - DI possesses significant deficiencies, which result in a decrease in efficiency. Collar infiltration is present.

Critical - The DI is not performing as designed and is in immediate need of attention. Water entering through DI. Substantial spalling of concrete.

Data Collection:

A typical team will consist of an inspector and a technician.

Inspector	Technician
<ul style="list-style-type: none">Running & maintaining GIS equipmentData collection	<ul style="list-style-type: none">Clearing brush, trees, debris, and sediment from inlet & outletAssist with traffic controlClearing and opening drop inlet grates (when necessary)

Essential Equipment:

- Data Collection Equipment (iPad)
- Flashlight
- Shovel
- Metric/English Tape
- Traffic Control Sign Package

Optional Equipment:

- Metal detector
- Air horn
- Brush cutters
- Pry Bar
- Grade stakes
- Spray paint
- Sledgehammer

BARREL OBSERVATIONS AND ASSESSMENTS:

Barrel Condition – METAL

Good Condition:

- Little to no settlement or misalignment
- Horizontal diameter: 0-10% of design
- Superficial rust, corrosion, or staining observed
- Minor isolated distortions and/or cracking at bolts
- Tight fitting joints

Fair Condition:

- Minor settlement/misalignment observed, pitting, sediment deposits, and/or separation of joints/seams
- Significant distortion observed in isolated location
- Horizontal diameter: 10-20% of design
- Spotty heavy rust and corrosion
- Noticeable non-symmetric shape

Poor Condition:

- Significant settlement or misalignment
- Horizontal diameter: 20-30% of design
- Perforations, severe corrosion, and moderate pitting present
- Moderate non-symmetric shape
- Evidence of significant material deposits
- Evidence of infiltration/exfiltration of water/sediment due to joint separation

Critical Condition:

- Culvert has collapsed, or collapse is imminent
- Major settlement/misalignment
- Major distortion and/or joint separations

DROP INLET(DI) OBSERVATIONS AND ASSESSMENTS:

Brick Collar

No Image Available

None - No brick collar is present.

Good - Brick collar and mortar are intact and working as designed.

Fair - Brick collar is starting to deteriorate. Bricks still intact with possible missing mortar between bricks. Deficiencies do not significantly affect the performance of the DI.

Poor - Brick collar possesses significant loss of mortar and minor loss of bricks. Bricks visible in sump. DI still functioning with minor decrease in efficiency.

Critical - Brick collar shows signs of extensive brick and mortar deterioration. Evidence of water draining through collar instead of top grate. The DI needs immediate attention.

Field Work Procedure:

- Mobile device should be turned on and the ESRI Collector Application opened
 - New feature PID values are autopopulated
- Perform inspection and input date in the “INSPECTION DATE” field.
Overnight processing will not run on inspection record without a valid “INSPECTION DATE”.
- A photo of each inlet and outlet and barrel should be taken.
- At least one photo should be taken for each drop inlet or access hole.
- Additional photos should be added to record other observations like sinkholes, road settling, or erosion.
(IMPORTANT: rename photos to be more descriptive)
- Sync any offline collected features or inspections from downloaded map and charge the mobile device.

BARREL OBSERVATIONS AND ASSESSMENTS:

Barrel Condition – METAL *continued*

- Horizontal diameter > 30% of design
- Severe perforations, corrosion, and pitting
- Extreme non-symmetric shape
- Structural cracks throughout culvert
- Evidence of major material deposits

Barrel Condition – HDPE

Good Condition:

- Little to no settlement or misalignment
- Minor distortion
- Horizontal diameter: 0-20% of design
- Relatively smooth wall, minor deflection
- No separations

Fair Condition:

- Minor settlement or misalignment
- Horizontal diameter: 20-35% of design
- Minor dimpling in isolated, small areas
- Moderate deflection observed, resulting in non-symmetric shape
- Minor separation at joints
- Minor isolated perforations
- Evidence of minor material deposits

Poor Condition:

- Significant settlement or misalignment
- Horizontal diameter > 35% of design
- Wall crushing, tearing, or cracking
- Significant deflection, extreme non-symmetric shape
- Significant material deposits

DROP INLET(DI) OBSERVATIONS AND ASSESSMENTS:

Sediment

None - No sediment blocking water flow through the DI vault. No sediment present in culvert(s).

Light - Minor accumulation in the culvert(s) without blocking water flow through the DI vault. Less than 25% of total culvert opening(s) are filled.

Moderate - Culvert(s) are 25-50% clogged with sediment. The DI vault is still capable of conveying water through the culvert opening(s) within.

Heavy - Over 50% of the culvert opening(s) are full of sediment and the DI vault is no longer functioning as intended.

Plugged - The sediment level in the DI vault prevents the culvert opening(s) from passing water.

Erosion

Light - Soil is showing early signs of eroding away from DI collar.

Moderate - Clear signs of progressing erosion. Gaps and rills will become evident around DI on one or more sides.

Severe - Soil/gravel is severely eroded away around the DI. Drainage is not functioning as intended. Water is beginning to travel its own course into and/or around the DI.

Safety Considerations:

The intent is to obtain an updated condition assessment of all small culverts; However, the inspection team should not compromise their safety.

Please follow the following safety precautions:

- Park your vehicle off the road & clear of the white line
 - If you are using a private vehicle, be sure to display your AOT placard, equipped with a visible amber light and that the light is activated.
- Once you leave the vehicle, you are required to wear the standard AOT Personal Protective Equipment (PPE)
- Be aware of noxious plants in the Right of Way (ROW).
- Be aware of ticks. Make sure to thoroughly check yourself and keep any eye out for ticks on others.
- Culverts that are < 60 inches in diameter & culverts where the inlet or outlet do not exit at grade, are considered permit required confined spaces and cannot be entered without following permit required confined space procedures. Do not physically enter any culverts without a permit, proper training and equipment.

BARREL OBSERVATIONS AND ASSESSMENTS:

Barrel Condition – HDPE *continued*

- Infiltration/exfiltration of water/sediment from joint separations

Critical Condition:

- Major settlement or misalignment
- Collapse of culvert crown
- Major wall crushing, tearing, or cracking
- Major deflection, extreme non-symmetric shape
- Significant perforations
- Major material deposits
- Infiltration/exfiltration of water/sediment from joint separations
- Culvert has collapsed, or a collapse is imminent

Barrel Condition – CONCRETE

Good Condition:

- Little to no settlement or misalignment
- Isolated, shallow mortar deterioration
- Hairline cracking present, < 1/16" inch

Fair Condition:

- Minor settlement or misalignment
- Minor joint separation
- Mortar loose or missing, isolated spalling
- Evidence of minor material deposits
- Horizontal cracking present, < 1/8" inch

Poor Condition:

- Significant settlement or misalignment
- Significant openings or dislocated joints
- Extensive areas of missing mortar, spalling

DROP INLET(DI) OBSERVATIONS AND ASSESSMENTS:

Functional Status

Abandoned - DI has been intentionally unmaintained due to a change in the ditching or drainage design within the area rendering it obsolete. DI is no longer functioning but has not been removed.

Discontinued - DI has intentionally been plugged with a foreign material or object to cease its ability to accept drainage but DI has not been removed.

Filled – DI has been purposefully filled but not removed. Fill substances such as flowable fill or concrete have been used to render the asset as no longer functioning.

INLET OBSERVATIONS AND ASSESMENTS:

Inlet Treatment - Defines the inlet treatment of the culvert.

No Treatment - Default setting: culvert installed at grade.

Drop Inlet



Flared



Mitered



Concrete Headwall



Stone Headwall



BARREL OBSERVATIONS AND ASSESMENTS:

Barrel Condition – CONCRETE *continued*

- Evidence of significant material deposits
- Evidence of infiltration or exfiltration of water or sediment at joints
- Significant horizontal and diagonal cracking present
- Cracking less than ½” Rebar may be exposed

Critical Condition:

- Culvert is collapsed/collapse is imminent
- Major settlement or misalignment
- Significant dislocated joints
- Widespread areas of missing mortar/spalling.
- Major material deposits
- Significant horizontal and diagonal cracking present
- Multiple large cracks > ½”
- Deterioration causing rebar to become exposed

Barrel Sediment

None - No sediment blocking culvert channel: clean culvert.

Light - Minor accumulation in the culvert without blocking culvert channel. Less than 25% of total opening is filled.

Moderate - Culvert is 25-50% clogged with sediment. The culvert channel is still capable of conveying water.

Heavy - Over 50% of the culvert opening full of sediment and is no longer functioning as intended.

ACCESS HOLE (AH) OBSERVATIONS AND ASSESMENTS:

Functional Status

Abandoned - AH has been intentionally unmaintained due to a change in the ditching or drainage design within the area rendering it obsolete. AH is no longer functioning but has not been removed.

Discontinued - AH has intentionally been plugged with a foreign material or object to cease its ability to accept drainage but the AH has not been removed

Filled – AH has been purposefully filled but not removed. Fill substances such as flowable fill or concrete have rendered the asset no longer functioning.

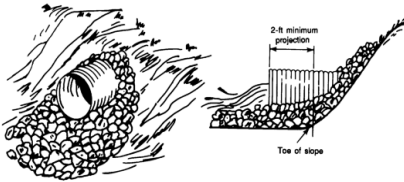
INLET OBSERVATIONS AND ASSESMENTS:

Inlet Treatment *continued* - Defines the inlet treatment of the culvert.

Concrete Cradled



Stone Cradled



Junction Box



Access Hole



BARREL OBSERVATIONS AND ASSESMENTS:

Barrel Sediment *continued*

Plugged - The sediment level in the culvert prevents the culvert from completely passing water.

Unknown - Culvert barrel was not accessible for assessment.

Non-existent, Discontinued, Retiring and Replacing Culverts

If a new culvert has been installed, you will need to first retire the old culvert, and then create a new feature to collect the inspection data for the newly installed culvert.

Below are examples of potential situations and the proper procedures to follow:

Discontinued - A culvert that has intentionally been plugged or covered at the inlet and outlet by fill, pavement, or foreign objects to arrest the functionality of the culvert and eliminate the ability for water to enter or exit the culvert.

Procedure:

1. Select the culvert to discontinue and begin editing.
2. Update the "Functional Change" field to "Discontinued".
3. Update the "Inspection Date" field to the current date.
4. Click "Done" within the edit window and select "Update" to grey out the feature on the map.

INLET OBSERVATIONS AND ASSESMENTS:

Inlet Separation

None - Default: no evidence of pipe separation. No gaps visible between sections or misalignment.

Minor - Visible separations less than 1” wide at isolated locations along the inlet. Slight misalignment of inlet sections visible.

Moderate - Significant separation less than 3” wide and not exceeding the bell of a concrete pipe. Misalignment visible throughout inlet.

Major - Separations greater than 3” wide throughout the inlet resulting in joint dislocation and possible sediment backfill and infiltration of water. Integrity of inlet is compromised due to misalignment.

Unknown - The inlet was not located or could not be viewed or accessed.

Inlet Condition

Good - Inlet appears to be performing as designed without significant deficiencies.

Fair - Inlet possesses minor deficiencies, none of which significantly affect the performance of the inlet.

Poor - Inlet possesses significant deficiencies, resulting in a decreased efficiency.

Critical - Inlet is not performing as designed and is in immediate need of attention.

Unknown - The inlet was not located or could not be viewed or accessed.

OUTLET OBSERVATIONS AND ASSESMENTS:

Outlet Separation

None – Default: no evidence of pipe separation. No detectable gaps between sections or visible misalignment.

Minor - Visible separations less than 1”-wide at isolated locations along the outlet: slight misalignment of outlet sections visible.

Moderate - Significant separation less than 3” wide and not exceeding the bell of a concrete pipe: misalignment visible throughout outlet.

Major - Separations greater than 3” wide throughout the outlet resulting in joint dislocation and possible sediment backfill and infiltration of water: integrity of outlet is compromised due to misalignment.

Unknown - Culvert outlet was not accessible for assessment.

Outlet Condition

Good - Outlet appears to be performing as designed: deficiencies are superficial.

Fair - Outlet possesses minor deficiencies, none of which significantly affect the performance of the outlet.

Poor - Outlet possesses significant deficiencies, resulting in a decrease in efficiency.

Critical - Outlet is not performing as designed and is in immediate need of attention.

Unknown - Culvert outlet was not accessible for assessment

Non-existent, Discontinued, Retiring and Replacing Culverts

Retiring - A culvert that has signs of recent installation and has replaced the existing culvert shown within the SCI app. This is especially relevant if the material and size values do not match those of the culvert being inspected in the field.

Procedure:

1. Select the culvert you want to retire and begin editing the feature.
2. Update only the “RETIRE DATE” to the current date, select “Done”, and then “Update” to grey out that feature on the map.
3. Create a new feature in the location of the new culvert and populate all necessary fields. The “INSPECTION DATE” field will need to be updated.

Replacement – When retiring an existing culvert, within the new feature populate the “New Install” field with “Replacement” to identify the type of install that was performed.

INLET OBSERVATIONS AND ASSESMENTS:

Inlet Sediment*

None - No sediment blocking culvert channel: clean culvert.

Light - Minor accumulation in the culvert without blocking the culvert channel. Less than 25% of total opening is filled.

Moderate - Culvert is 25-50% clogged with sediment, but the culvert channel is still capable of conveying water.

Heavy - Over 50% of the culvert opening full of sediment and is no longer functioning as intended.

Plugged - The sediment level in the culvert prevents the culvert from passing water.

Unknown - The inlet was not located or could not be viewed or accessed.

Inlet Erosion*

None – Default: no evidence of erosion at culvert inlet.

Light - Soil is showing early signs of eroding away from culvert inlet.

Moderate - Clear signs of progressing erosion. Gaps and rills will become evident around culvert and/or culvert terminals.

Severe - Soil/gravel is severely eroded away from around the culvert and/or culvert terminals. The culvert is ceasing to function as intended, and water is beginning to travel its own course into and/or around the culvert.

Unknown - The inlet was not located or could not be viewed or accessed.

*Indication that this field's values will be mentioned again in another field

OUTLET OBSERVATIONS AND ASSESMENTS:

Outlet Sediment*

Same values as the inlet sediment field

Outlet Erosion*

Same values as the inlet erosion field

Projected End



Input: YES/NO

Stone Pad



Input: YES/NO

Sink Holes



None - No sinkholes were observed.

Minor - Sinkholes < 3' in diameter and/or sinkholes located > 15' from the edge of pavement.

Moderate - Sinkholes 3-5' in diameter, and/or sinkholes located < 15' from the edge of pavement.

Major - Sinkholes > 5' in diameter and/or sinkholes that are located < 10' from the edge of pavement.

Non-existent, Discontinued, Retiring and Replacing Culverts

New Construction Culvert Installations -

There will be times when you come across newly constructed drainage infrastructure or networks that are not replacing or upgrading existing infrastructure. These are new culverts installed due to roadway reconstruction, redesign or to improve drainage within the area.

Procedure

1. Create a new feature in the location of the newly constructed culvert or drainage network. This may require creation of new DI, Jct. Box or AH features based on the system type installed.
2. Verify and complete every field within the attribute window.
3. Within the "New Install" field, select "NEW CONSTRUCTION". This will allow the Agency to revisit these locations and improve the spatial accuracy of the data collected in the field.

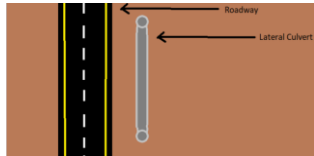
BARREL OBSERVATIONS AND ASSESSMENTS:

Drain Type

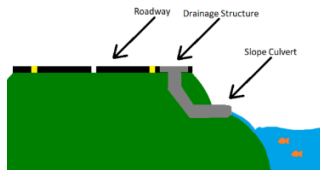
Cross



Lateral



Slope



Private



Structure Type

Round



Box



Squash



Arch



OUTLET OBSERVATIONS AND ASSESSMENTS:

Sink Holes *continued*

Severe - Sinkholes of any diameter that are within the pavement area.

Unknown - Evidence of void influenced erosion is present near the culvert, but no visual evidence of sink holes can be found or seen.

Structural Rating

No Action Needed (GREEN) - Culvert is structurally sound and does not require monitoring.

Monitoring Needed (YELLOW) - Culvert is showing signs of structural deterioration. Asset requires further monitoring to ensure the structural failure does not occur.

Action Needed (RED) - Culvert is no longer structurally sound: one or multiple areas of the structure are failing. Culvert requires immediate action to prevent catastrophic failure.

Functional Rating

No Action Needed (GREEN) - Culvert is structurally sound and does not require monitoring.

Monitoring Needed (YELLOW) - Culvert is showing signs of functional issues. Asset requires further monitoring to ensure that proper functioning is ensured. **Action Needed (RED)** - Culvert is no longer functioning as intended: one or multiple

Non-existent, Discontinued, Retiring and Replacing Culverts

Delete Record – There may be times when you accidentally add a new feature (culvert) to the map. If this happens populate the “Delete Record” field with “Yes”.

***Important Note:** Do not use the “Delete Record” field to retire an old culvert, instead use the procedure detailed previously

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