

Vermont Agency of Transportation Statewide Small Culvert Inventory Field Manual

PHASE II DATA COLLECTION



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INTRODUCTION

The Agency is responsible for the maintenance of a large, complex drainage system composed of culverts, drop inlets and access holes. Deterioration of these hidden assets poses potential safety hazards to the traveling public through roadway sinkholes and side slope instability caused by drainage erosion. In addition to the immediate safety concerns, lack of knowledge regarding the location and condition of small culverts may also contribute to a growing economic burden for the state.

Traditionally, VTrans has maintained a well-developed program to address culverts 72" or greater in diameter. The Small Culvert Inventory (SCI) was designed as a compliment to that program intended to locate and catalog all state-owned culverts less than 72" in diameter. The inventory of these structures assesses their location, composition, structural condition and local site conditions. The SCI provides the framework for continued monitoring and condition assessments in the future providing the ability to prioritize maintenance, repairs and replacements.

At the current point in the program's maturity, the Agency has collected the initial inventory of culvert data across the state and the focus has shifted from collection of new data to the maintenance and improvement of existing data. The focus of this phase is to implement a plan utilizing modern Mobile GPS / GNSS device technology to conduct Statewide Small Culvert Reinspections by local District staff.

Data Collection

Similar to the initial inspection, inspection teams should consist of two members, typically as an inspector and a district representative. The team inspector is responsible for running and maintaining the Mobile GPS/GNSS equipment (iPad, Tablet, Smart Phone). The district personnel are responsible for clearing brush, trees, debris and sediment from the inlet and outlet of the culverts as well as clearing and opening drop inlet grates where necessary.

Prior to a day's field work the inspector is responsible for all scheduling, weather cancellations, daily work plans and various other general issues that develop during the work day. The inspector is also responsible for ensuring that the team is supplied with Personal Protective Equipment (PPE) and for acquiring the necessary resources for the day's field work including the following:

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

Upon arriving at the work site location established the previous working day, the inspection team should establish a work area. The inspector sets up sign packages with or without the help of the district personnel depending on the most efficient use of time.

Unlike conducting initial inventory with the Trimble GPS Device, the PID (Pipe Identification) number is auto generated through an overnight process when new culvert features are created within the Esri Collector Application when using a mobile smart device. Therefore, it is not necessary for field staff to populate PID values for new features collected in the field using the Esri Collector application.

To begin field work, the Mobile GPS / GNSS device should be turned on and the Esri Collector Application opened. A two-person inspection team should have one person performing the inspection and recording the condition and spatial information while the district personnel works to clear the next location.

The inventory should operate as follows:

1. The inspector should use their iPad Collector App to assist the district personnel in finding the locations of the culvert inlets and outlets. This can be done by providing distance off the roadway and distance between culvert ends.

2. The district personnel should clear debris, brush and trees that may possibly block GPS reception and opens drop inlet grates for inspection when practical.
3. Once cleared, the GPS shot and culvert assessment can be performed by the inspector.
4. Once the GPS location has been stored the inspector will proceed through the data dictionary reporting the necessary attributes for each feature type. If the culvert end has a drop inlet treatment a second shot should be taken from the middle of the drop inlet grate.

At the end of the workday the inspector is responsible for syncing any offline collected features from their downloaded map and charging the device for next day use.

The SCI Phase II inspection initiative is a large undertaking and will bring inspection teams to different locations within the State of Vermont. Numerous hazards such as steep embankments, heavy traffic, unstable slopes, and flowing water may be encountered. The intent is to obtain a 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 so that it does not become a hazard. If you are using a private vehicle, be sure to display your AOT placard. If you are using a crossover on a limited access highway, you must use an amber light and follow the procedures in the Safety Manual for using crossovers.
- Once you leave the vehicle, you are required to wear the standard AOT vest and orange ball cap as well as trousers and safety shoes.
- Be aware of the noxious plants in the Right of Way. Poison ivy and poison parsnip are prevalent residents along our highways. If you don't know how to recognize them in the field, ask someone who does.
- Any culvert which is less than 60 inches in diameter or any culvert where the inlet or outlet do no exit at grade is considered a permit confined space and cannot be entered without following confined space procedures. Do not physically enter any culverts less than 5 feet in diameter/height.
- **If you have any questions or concerns, please ask your supervisor or the Agency Safety Office.**

DATA DICTIONARY

This Data Dictionary makes up the attribute table within the Collector App used to record structural and conditional information about each small culvert. Many of the small culvert barrels will be difficult or impossible to inspect due to the lack of access. The data dictionary allows the inspection team to collect external site characteristics that will help gage the overall condition of the culvert. Collection feature classes also exist for drop inlets and access holes.

Admin Data

PID (numeric) – Unique numeric identifier auto generated through an overnight process.

District (text menu) – Records the District culvert is located in.

District 1

District 2

District 3

District 4

District 5

District 6

District 7

District 8

District 9

Unit Name (text field) - Records the VTrans Garage responsible for the maintenance of that culvert.

Description (text field) - Auto generated Description/Location field through a nightly process.

MS4 (text menu) -	Records if the culvert is within a MS4 (Municipal Storm Water permitted area).
Chittenden MS4	
Rutland MS4	
St Albans MS4	
No	
Last Inspection Date (date field) -	Records the last known date of previous inspection performed on culvert.
Inspector (text field) -	Identifies the culvert inspector.
Retire Date (date field) -	Records the date culvert was noticed to no longer exist due to removal or replacement at the site.
Inspection Date (date field) -	Records the date upon day of inspection.

INLET

Structure Data

Inlet Treatment (text menu) -	This defines the inlet treatment of the culvert.
No Treatment -	Default setting, culvert installed at grade.
Drop Inlet -	Includes grated and throated drop inlet or catch basin structures.
Flared -	Concrete, metal, or plastic reinforcements attached to the culvert terminals to channel water, stabilize side slopes and reduce scour and/or undercutting.

Mitered -	Culvert is cut at an angle similar to the slope of the bank (base of the culvert inlet extends out past the top of the culvert inlet).
Concrete Headwall -	Full height retaining wall at the end of culvert made of solid concrete.
Stone Headwall -	Full height retaining wall at the end of culvert made of stone material. Concrete rubble masonry is included in this category.
Concrete Cradled -	Half of a full concrete headwall on which the culvert inlet rests.
Stone Cradled -	Half of a full Stone headwall on which the culvert inlet rests.
Junction Box -	An underground connection between culverts that is not associated with any of the other inlet treatments. Junction boxes do not have an inlet capable of passing surface water. For this assessment, all underground pipe intersections have been assumed to be junction boxes.
Access Hole -	An access hole at the junction of two or more culverts.
Unknown -	The inlet was not located or could not be accessed.
Other -	The inlet treat is not included in the list of options. Record details in the comment field.
Inlet Tie-In (text menu) -	Records the presence of a town, private or other closed system that discharges into the state system.
No -	Default, no observed private or town tie in points.
Yes -	Observed private or town connections outletting into the state system.
Unknown -	The inlet was not located or could not be accessed.
Inlet Extension (text menu) -	The culvert has a visible extension
Yes -	Observed culvert extension has been added to the culvert inlet

No -	No observed culvert extension at the culvert inlet
Inlet Marker Post (text menu) -	Records the presence of a marker post at the culvert inlet. Only to be considered present if the post is 3ft or greater in height to allow for moderate snow depth.
Yes -	Default, observed marker post at the culvert inlet.
No -	No observed marker post at the culvert inlet.
Not Applicable -	Marker post is not a practical application at this location.
Unknown -	The inlet was not located or could not be accessed.

Condition Assessment

Inlet Separation (text menu) -	Separation of individual pipe sections at joints or seams within segment of pipe between inlet and pavement shoulder.
None -	Default setting, no evidence of pipe separation. No gaps visible between sections or misalignment.
Minor -	Visible separations less than 1-inch-wide at isolated locations along the inlet. Slight misalignment of inlet sections visible.
Moderate -	Significant separation less than 3 inches wide and not exceeding the bell of a concrete pipe. Misalignment visible throughout inlet.
Major -	Separations greater than 3 inches 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 accessed, and therefore was not assessed.

Inlet Condition (text menu) –

Records the condition of the culvert inlet, and inlet treatment.

Excellent -

Inlet appears to be performing as designed. Culvert in new or similar condition. Evidence of recent installation.

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 accessed, and therefore was not assessed.

Inlet Sediment (text menu) –

Records the level of sediment in culvert at the inlet.

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, 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 accessed, and therefore was not assessed.

Inlet Erosion (text menu) –	Records the severity of erosion associated with a culvert.
None -	Default setting, 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 in and/or around the culvert.
Unknown -	The inlet was not located, or could not be accessed, and therefore was not assessed.
Inlet Piping (text menu) –	Records any evidence of water running on the perimeter of the structure.
Yes -	There is evidence of water running along the outside of the culvert rather than through the culvert.
No -	There is no evidence of water running along the outside of the culvert rather than through the culvert.
Unknown -	The inlet was not located, or could not be accessed, and therefore was not assessed.
Inlet Comment (text field) –	230 character text field for any additional notes.

OUTLET

Structure Data

Drain Type (text menu) –	Records the risk classification of the drainage feature.
Cross -	A culvert that crosses under the roadway centerline, to include culverts within State Right of Way that cross under Town Highways and side roads. (Not parking lots or drives)
Lateral -	A culvert running parallel to the roadway not crossing under the traveled way, and does not cross under Town Highways and side roads.
Slope -	A culvert extending from a drainage structure on the roadway shoulder that typically follows the slope of the embankment and ultimately outlets near the toe of slope.
Drive -	A culvert that passes under a private drive but is within state ROW and ditch line.
Other -	Drainage type not covered under the preceding five classifications.
System Type (text menu) –	Records the type of drainage system classification.
Single Pipe -	Culvert that is not attached to any other culverts. May have Drop Inlets as inlet and/or outlet treatments.
Closed System -	Connected to one or more additional culverts.
Structure Type (text menu) –	Records the specific culvert type.
Round	
Box	
Squash -	Closed bottom pipe arch.
Arch -	Open bottom pipe arch.
Other	
Unknown	

Material (text menu) –

Records the specific culvert material. Corrugation reflects the interior condition of the culvert.

Steel Pipe

Concrete

Stone

HDPE

PVC

Other

Unknown

Size (numeric menu) –

Records the culvert diameter in inches. If the size is not available in the pre-selected list it can be entered as "OTHER" in this field, and a value can be added in the fields "Other Width" and/or "Other Height".

12

15

18

24

30

36

42

48

54

60

66

72

OTHER

UNKNOWN

Other Width (numeric) –	Records the width of culverts not falling into one of the above size categories. Should be recorded in inches.
Other Height (numeric) –	Records the height of culverts not falling into one of the above size categories. Should be recorded in inches.
Outlet Treatment (text menu) –	This defines the outlet treatment of the culvert.
No Treatment -	Default setting, culvert installed at grade.
Drop Inlet -	Includes grated and throated drop inlet or catch basin structures.
Flared -	Concrete, metal, or plastic reinforcements attached to the culvert terminals to channel water, stabilize side slopes and reduce scour and/or undercutting.
Mitered -	Culvert is cut at an angle similar to the slope of the bank (base of the culvert outlet extends out past the top of the culvert outlet).
Concrete Headwall -	Full height retaining wall at the end of culvert made of solid concrete.
Stone Headwall -	Full height retaining wall at the end of culvert made of stone material. Concrete rubble masonry is included in this category.
Concrete Cradled -	Half of a full concrete headwall on which the culvert outlet rests.
Stone Cradled -	Half of a full Stone headwall on which the culvert outlet rests.
Junction Box -	An underground connection between culverts that is not associated with any of the other inlet treatments. Junction boxes do not have an inlet capable of passing surface water. For the purpose of this assessment all underground pipe intersections have been assumed to be junction boxes.
Access Hole -	An access hole at the junction of two or more culverts.

Unknown -	The outlet was not located, or could not be accessed, and therefore was not assessed.
Other -	The outlet treatment is not included in the list of options. Record details in the comment field.
Extension (text menu) -	The culvert has a visible extension
YES -	Observed culvert extension has been added to the culvert outlet
NO -	No observed culvert extension at the culvert outlet
Depth Fill (numeric menu) –	Records the approximate depth of fill above the culvert. Depths of fill over 50 feet will be recorded as 50+. Depth of fill should be estimated at the roadway centerline, or culvert midpoint.
5	
10	
15	
20	
25	
30	
35	
40	
45	
50+	
Elbows (text menu) –	Records the presence of one or more angle connections in a culvert run.
YES -	One or more elbow(s) are present
NO -	No elbow(s) are observed

Mods (text menu) -	Records any modifications or repair work that has been done on a specific culvert.
None -	Default field, no modifications have been made to the culvert.
Cured in Place Lining -	A cured in place liner has been installed within the existing culvert.
Sleeve -	A culvert sleeve has been inserted into the existing culvert.
Asphalt Coated -	The culvert is or shows evidence of being coated with an asphalt lining. Typically found on CGMP culverts.
Plastic Coated -	The culvert is or show evidence of being coated with a thin plastic coating. Typically found on CGMP culverts.
Other -	Other modification not covered in the above list. Record details in the comment field.
Outlet Tie-In (text menu) –	Records the presence of the state system outletting into a town, private or other closed system.
No -	Default, no observed private or town tie in points.
Yes -	Observed private or town connection outletting from state system into other closed system.
Unknown -	The outlet was not located, or could not be accessed, and therefore was not assessed.
Marker Post (text menu) -	Records the presence of a marker post at the culvert outlet. To be considered present it must provide the service it was intended to with moderate snow cover conditions.
Yes -	Default, observed marker post at the culvert outlet.
No -	No observed marker post at the culvert outlet.
Not Applicable -	Marker post is not a practical at this location.
Unknown -	The inlet was not located, or could not be accessed.

Condition Assessment

Outlet Condition (text menu) –	Records the condition of the culvert outlet, and outlet treatment.
Excellent -	Outlet appears to be performing as designed. Culvert in new or similar condition. Evidence of recent installation.
Good -	Outlet appears to be performing as designed.
Fair -	Outlet possesses minor deficiencies, none of which significantly affect the performance of the outlet.
Poor -	Outlet possesses significant deficiencies, which result in a decrease in efficiency.
Critical -	Outlet is not performing as designed, and is in immediate need of attention.
Unknown -	The outlet was not located, or could not be accessed, and therefore was not assessed.
Barrel Condition (text menu) –	Records the overall condition of the culvert barrel. See Appendix A, B, and C for detailed descriptions.
Excellent -	
Good -	
Fair -	
Poor -	
Critical -	
Unknown -	Culvert barrel was not accessible for assessment.
Projected End (text menu) –	Culvert end extends out from embankment resulting in a drop of 1 foot or greater creating conditions conducive to scour holes.
No -	Default setting, there is no projecting end at outlet

Yes -	There is a projecting end at outlet.
Not Applicable -	Marker post is not a practical application at this location.
Unknown -	The outlet was not located, or could not be accessed, and therefore was not assessed.
Barrel Separation (text menu) –	Separation of individual pipe sections at joints or seams.
None -	Default setting, no evidence of pipe separation. No gaps visible between sections or misalignment.
Minor -	Minor isolated separations less than 3 inches wide at isolated locations along the culvert. Slight misalignment of culvert sections visible
Moderate -	Significant separation less than 3 inches wide and separation greater than 3 inches at outlet or inlet end section. Misalignment visible throughout culvert.
Major -	Separations greater than 3 inches 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 -	The barrel was not located, or could not be accessed, and therefore was not assessed.
Outlet Separation (text menu) -	
None -	Default setting, no evidence of pipe separation. No gaps visible between sections or misalignment.
Minor -	Visible separations less than 1-inch-wide at isolated locations along the outlet. Slight misalignment of outlet sections visible.
Moderate -	Significant separation less than 3 inches wide and not exceeding the bell of a concrete pipe. Misalignment visible throughout outlet.
Major -	Separations greater than 3 inches 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 -	The outlet was not located, or could not be accessed, and therefore was not assessed.
Stone Pad (text menu) –	Records the presence of a constructed stone pad and/or sufficient channel lining.
N/A -	Not a suitable application at this location.
Yes -	Adequate stone pad present at outlet.
No -	No stone pad present at outlet or an inadequate stone pad present.
Unknown -	The outlet was not located, or could not be accessed, and therefore was not assessed.
Barrel Sediment (text menu)	Records the level of sediment within culvert barrel.
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.
Plugged -	The sediment level in the culvert prevents the culvert from passing water.
Unknown -	The outlet was not located, or could not be accessed, and therefore was not assessed.
Outlet Sediment (text menu) –	Records the level of sediment in the culvert at the outlet.
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.
Plugged -	The sediment level in the culvert prevents the culvert from passing water.
Unknown -	The outlet was not located, or could not be accessed, and therefore was not assessed.
Outlet Erosion (text menu) –	Records the severity of erosion associated with a culvert.
None -	Default setting, no evidence of erosion at culvert outlet.
Light -	Soil is showing early signs of eroding away from culvert outlet.
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. Culvert is ceasing to function as intended, and water is beginning to travel its own course in and/or around the culvert.
Unknown -	The outlet was not located, or could not be accessed, and therefore was not assessed.
Rd Settle (text menu) –	Records whether there is roadway settling present at culvert location.
None -	Default setting, no roadway settlement observed.
Repair -	Location shows evidence of district repair, but no visible current roadway settlement.
Grade Change -	Location shows visible grade change, or roadway settlement. May still display evidence of district repair.

Sink Holes (text menu) –	Records whether sinkholes or areas of settlement are present on the roadway embankment slopes.
None -	Default setting, no sinkholes were observed.
Minor -	Sinkholes less than 3 feet in diameter and/or sinkholes located more than 15 feet from the edge of pavement.
Moderate -	Sinkholes between 3-5 feet in diameter, and/or sinkholes located less than 15 feet from the edge of pavement.
Major -	Sinkholes greater than 5 feet in diameter and/or sinkholes that are located less than 10' from the edge of pavement.
Critical -	Sinkholes of any size that are within the pavement.
Outlet Piping (text menu) –	Records any evidence of water running on the perimeter of the structure.
Yes -	There is evidence of water running along the outside of the culvert rather than through the culvert.
No -	There is no evidence of water running along the outside of the culvert rather than through the culvert.
Unknown -	The outlet was not located, or could not be accessed, and therefore was not assessed.
Presence of Plants -	Invasive, poisonous and endangered plants in and around immediate culvert area. See Appendix F.
Outlet Comment (text field) –	230-character text field for any additional notes.

DROP INLET

DI Type (text menu) -	Distinguishes regular drop inlet structures from stand pipe inlets.
Drop Inlet -	Structure connected to a pipe that allows the intake of surface water.
Stand Pipe [SP] -	Inlet consisting of a vertical pipe with a grate that is connected into the top of another culvert.
Junction Box -	Connection structure between two or more pipes buried or above ground that does not allow for the intake of surface water.
Dry Sump -	Type of Drop Inlet that has no pipes connected to structure and allows captured surface water to percolate into ground through a dirt bottom.
Inspector (text field) -	Identifies the culvert inspector. Populate this field with Inspectors Initials.
Grate Type (text menu) -	Describes the material and design of the grate covering the DI structure.
A – E -	Letter refers to grate type taken from our Vermont State Standards and reflected on the Grate Type Key.
Half B -	Grate exhibits the characteristics of the B grate but is half the dimensions in the direction of flow. Common on bridges and bridge approaches.
Steel Grate -	Grate made of steel matching or similar to the design captured on the Grate Type Key.
Throated -	Drop Inlet without a grate covered with concrete slabs that accepts drainage flow below the top surface of the drop inlet.
Other -	Any grate type not falling into one of the classifications listed above.
Unknown -	The DI was not located, or could not be accessed, and therefore was not assessed.

No Grate -	DI structure has no grate cover
Small Pipes (text menu) –	Culverts less than 12 inches enter or exit the DI
NO -	No small pipes enter or exit the DI
YES -	Small pipes enter or exit the DI
Number of Grates	Number of metal grates on DI structure. Default is 1 grate. Do not include concrete slabs of throated DIs
DI Condition (text menu) –	Records the condition of the drop inlet including grate, cement collar connection to pipes and other parts of the structure.
Excellent -	DI appears to be performing as designed. DI in new or similar condition. Evidence of recent installation or rehab.
Good -	DI appears to be performing as designed.
Fair -	DI possesses minor deficiencies, none of which significantly affect the performance of the outlet. Minor cracks or spalling.
Poor -	DI possesses significant deficiencies, which result in a decrease in efficiency. Collar infiltration
Critical -	The DI is not performing as designed, and is in immediate need of attention. Water entering through DI. Substantial spalling of concrete.
Unknown -	The DI was not located, or could not be accessed, and therefore was not assessed.
Brick Collar (text menu) –	Records the condition of the drop inlet including grate, cement collar connection to pipes and other parts of the structure.
Excellent -	Brick collars appears to be performing as designed. Culvert in new or similar condition. Evidence of recent installation or rehab.
Good -	Brick collar and mortar is intact and working as designed.

Fair -	Brick Collar is starting to deteriorate. Bricks still intact 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 is missing extensive brick and mortar and evidence of water draining through collar instead of top grate. The DI needs attention.
Unknown -	The DI was not located, or could not be accessed, and therefore was not assessed.
Sediment (text menu) –	Records the level of sediment in the culvert at the outlet.
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.
Plugged -	The sediment level in the culvert prevents the culvert from passing water.
Unknown -	The outlet was not located, or could not be accessed, and therefore was not assessed.
Erosion (text menu) –	Records the severity of erosion associated with a culvert.
None -	Default setting, no evidence of erosion at DI.
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.

Severe -	Soil/gravel is severely eroded away from around the DI. Drainage is not functioning as intended, and water is beginning to travel its own course in and/or around the DI.
Unknown -	The DI was not located, or could not be accessed, and therefore was not assessed.
Collar Infiltration (text menu) –	Records any evidence of drainage entering the DI through means other than the surface grate.
Yes -	There is evidence of water entering in areas not designed to take drainage.
No -	There is no evidence of water entering DI though non-designed entries.
Unknown -	The DI was not located, or could not be accessed, and therefore was not assessed.
Comments (text field) –	230-Character text field for any additional notes regarding condition.

ACCESS HOLE

Cover Text (text field) –	30-character text field for labeling on top of Access Hole cover, if legible.
Condition Comment (text field) –	230-character text field for any additional notes regarding condition.

ACTION TAKEN ON FEATURE

Functionality Change (text menu) –	Records a permanent change in the functionality of culverts due to an alteration to its original design as well as culverts that are out of tolerance by VTrans Policy.
Abandoned –	Culvert has been intentionally un-maintained due to a change in the ditching or drainage design within the area or is no longer needed to direct drainage. i.e. (old field access drive pipe that no longer gets used or sees drainage).
Discontinued –	Culvert has intentionally been plugged with a foreign object to cease its ability to accept drainage. i.e. new drainage structures have been installed in the area and this culvert is no longer needed but not removed See Page 34 for further description.
Undersized –	Culvert does not meet VTrans policy on minimum culvert size requirements on US and State Routes and State Access Drives. (crossing US or SH minimum = 18in, crossing State Maintained Access Drive minimum = 15in).
New Install (text menu) -	Records culverts that have been identified in the field that are not already part of the current Inventory.

Replacement –	Culvert shows signs of recent installation and its criteria does not match what is currently on Inventory for that site. See Page 36 for further description.
New Construction –	Culvert has been installed within that site for the first time due to a new roadway construction or to improve drainage within the area. See Page 36 for further description.
Discovered –	Culvert has never been inventoried before and is not a recent install.
Delete – (text menu)	Use this field only to delete features that were mistakenly digitized on map during editing or features assumed to be there previously but after further review was determined to never exist. See Page 34 for further description.
YES –	Delete features that were mistakenly digitized on map, or created in database.

DISCHARGE (Feature Not Yet Available)

The discharge feature is used to locate and classify the possibility of Illicit Discharges of stormwater in to or out of the State system.

Type (text menu) –	Type of discharge observed
"Surface Flow",[SURF]	Discharge via an open ditch, swale or sheet flow
"Open Pipe",[OPEN]	Discharge from a pipe that ends short of the state system but flows into our system
"Closed Pipe",[CLOSED]	Discharge tied directly into a state DI, JCTBOX or culvert
"Other",[OTHER]	Discharge that doesn't fit in to the above categories.
Discharge (text menu)-	What is the actual issue if being flagged
"Oil Sheen",[SHEEN]	Shiny coloring to the surface of the water
"Foamy",[FOAMY]	Foam bubbles present on the surface of the water
"Discoloration",[DISCOL]	Obvious coloring of discharge
"Debris",[DEBRIS]	Garbage or litter in and around discharge
"Algae",[ALGAE]	Algae growth on rock and culvert surface
"Odor",[ODOR]	Foul or strong odor emitted from discharge
"Other",[OTHER]	Other type of discharge that might indicate discharge
Source (text menu)-	Possible source of the discharge in question
"Residence",[RESID]	Private residence
"Industrial",[INDUST]	Industrial activities
"Agricultural",[AG]	Farming or other agricultural types
"Other",[OTHER]	Other source not included above
"Unknown",[UNKNW]	Source of discharge unknown
Cond_Com (text field) –	230 character text field for any additional notes regarding discharge.

Mile Marker (Feature Not Yet Available)

Mile markers work as reference markers for a lot of different uses in the field. Locating these features will help us tie the field locations to our LRS and improve the translation of data between X/Y and LRS. Mile Marker sign placards are arranged with three lines of information as follows:

Route (text) –	Four digit route code
Town_Code (text)-	Four digit town code
Mile (text)	Four digit mile code
Comments	Any relevant information to be conveyed regarding the mile marker, its condition, location or other

Structure Inlet **(Feature Not Yet Available)**

For culverts that are larger than 6 feet (72 inches) record them as structures

- "Bridge_Num" (text field) - Record the bridge number on the bridge placard.
- "In_Comment" (text field) - 230 character text field for any additional notes.

Structure Outlet **(Feature Not Yet Available)**

Struc_Type (text menu) – Records the specific culvert type.

"Round",[RND], default

"Box",[BOX]

"Squash/Ellipse",[SQUASH] - Closed bottom pipe arch.

"Arch",[ARCH] - Open bottom pipe arch.

"Other",[OTHER]

"Unknown",[UNKNW]

Material (text menu) -	Records the specific culvert material. Corrugation reflects the interior condition of the culvert.
"Steel Pipe",[CMP]	
"Concrete",[RCP]	
"Stone",[STONE]	
"HDPE",[HDPE]	
"PVC",[PVC]	
"Other",[OTHER]	
"Unknown",[UNKNW]	
Other_Width (numeric) –	Records the width of culverts in inches
Other_Height (numeric) –	Records the height of culverts in inches.
"Bridge_Num" (text field) -	Record the bridge number on the bridge placard.
"Out_Comment" (text field) -	230 character text field for any additional notes.

Issues and Clarifications

Large Culverts and Small Culverts

The SCI program has been developed for State Ultra Short structures (<6ft). The VTrans Structures Section maintains a National Bridge Inventory System (NBIS) and inspects State and Town Long Structures (≥ 20 ft) and State Short Structures (≤ 20 ft ≥ 6 ft). Using this logic all structures should be covered under the two programs. The reason this logic falls short however, is because of a difference in the definition of the size measurement. The VTrans structures section uses definitions developed by the Federal Highway Administration and designed primarily for bridge inspection. Therefore, the bridge and culvert span is a measurement from interior wall to interior wall. The SCI was designed to inventory culverts and therefore records a design diameter. This leaves a possibility that culverts have a span that has an internal dimension less than 72" and be designed at a diameter of 72" or greater. In this case these culverts, of an important size, would be lost to both inventories.

To ensure that there are no culverts that fall between the NBIS and the SCI, the SCI will inventory all culverts 72" and less. The post-processed data will be compared to the existing NBIS, using the transtruc GIS data layer. All 72" culverts not in that database will be provided to the Structures Section for inclusion into the NBIS.

Though this procedure might seem redundant, the benefits greatly outweigh the associated time and cost. During the first year of collection, over 2700 culverts were located of which only 17 had a size of 72". Of those 17 culverts, 15 of them were redundant to the transtruc inventory.

Bridge Plaques on Ultra Shorts

In some cases Ultra Short culverts have been assigned bridge plaques to aid in the district inspection of culverts of 4'-6'. The presence of a bridge plaque does not mean it is contained in the bridge and culvert inventory and should be inventoried in this effort. In this case the bridge plaque information should be added in the comment field.

Drainage Systems and State Right of Way

Drainage systems are complex systems that do not adhere to the bounds of State Right of Way, parcel bounds or the separation of state, municipal and private drainage in a convenient manner. When following a drainage outflow the rule of thumb is to follow the system one pipe end beyond the State ROW. This means if the pipe outlets outside the ROW that outlet should be inventoried regardless of whether it is the outflow of the system or a connection into another system, such as a private, municipal or even another state route system. This same rule holds true for inletting systems as they enter the state system. Follow the pipe from the state system out to the inlet end of the pipe and take an inlet location there.

In both of these cases, when taking the location of the most remote inlet or outlet, assign the tie-in point field as positive. This will serve as an indicator that those locations are not a true end or beginning to the drainage system.

Non-existent, Discontinued, Retiring and Replacing Culverts

There will be times while conducting Small Culvert Re-inspections that data displayed on culvert map from previous inventory, contradict or are just not logical for what is being re-inspected. There will also be times when it is visually clear that a culvert has been intentionally discontinued and is no longer functional. Finally, there will be times where it is visually clear that a culvert has been recently replaced and you need to retire the old and re-collect the new. Below are examples of these situations and how to properly deal with them.

1. **Delete (Non-existent)** – This is when you notice a culvert mapped on the Small Culvert Inspection Map that is not in the field at all. This is a case where the initial culvert inventory inspector assumed a culvert was present and was not verified by an experienced VTrans employee or local expert or was drawn on the map by accident. This can easily be resolved by following the steps provided below.
 - a. Select the culvert you want to delete and begin to edit that feature.
 - b. Set the “Delete” field to “YES”
 - c. Click “Done” within the edit window and Click “Update” to remove that feature from the map.
2. **Discontinued** – This is when you come across a culvert that has intentionally been plugged or covered at the inlet and outlet by fill, pavement or foreign objects to seize the functionality of the culvert and eliminate the ability for water to enter the culvert.
 - a. Select the culvert you want to discontinue and begin editing.
 - b. Update the “Functional Change” field to Discontinued.
 - c. Update the “Inspection Date” field to the date you realized this change.
 - d. Click “Done” within the edit window and Click “Update” to grey out that feature from the map.
3. **Retiring** - This is when you come across a culvert that has signs of recent installation and has replaced the existing culvert shown within the Small Culvert Inspection app. This should also be taken into consideration if the material and size of the culvert within the Inspection app does not match the culvert being inspected within the field.
 - a. Select the culvert you want to retire and begin editing.
 - b. Update Only the “RETIRE DATE” and click “Done” and “Update” to grey out that feature on the map.
 - c. Create a new feature in the location of the new culvert and populate all necessary fields. The “INSPECTION DATE” field still needs to be updated in this situation.

4. **Replacement** - This subtype within the “New Install” is used when you have retired an existing culvert and created a new feature in its place. Within the new feature populate the “New Install” field with “Replacement” in or to identify the type of install that was performed.

New Construction Culvert Installations

There will be times when you come across newly constructed drainage infrastructure or networks that are not replacing existing infrastructure but have been installed due to roadway reconstruction, design or to improve drainage within the area.

1. Using the Collector App with a mobile device, create a new feature in the location of 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 each and every field within the attribute window.
3. Within the “New Install” field, select “NEW CONSTRUCTION”. This will allow the AMP team to revisit these locations with a Higher Accuracy GNSS device if required to meet our minimum accuracy requirements.

Appendix A

Metal Culverts: The following lists potential culvert characteristics that may result in a Good, Fair, Poor, or Critical culvert condition. These lists are not comprehensive and engineering judgement should be used at the site.

Excellent Condition:

- No settlement or misalignment observed
- Horizontal diameter within 0-10% of design
- Tight fitting joints
- Evidence suggest recent installation

Good Condition:

- No appreciable settlement or misalignment observed
- Horizontal diameter within 0-10% of design
- Superficial rust, corrosion or staining observed
- Minor isolated distortions
- Minor isolated cracking at bolts
- Tight fitting joints

Fair Condition:

- Minor settlement or misalignment observed
- Significant distortion observed in isolated location
- Horizontal diameter within 10-20% of design
- Scattered heavy rust and corrosion
- Minor pitting present
- Noticeable non-symmetric shape
- Minor separation of joints and seams
- Evidence of minor material deposits

Poor Condition:

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

Critical Condition

- Culvert has collapsed or a collapse is imminent
- Major settlement or misalignment observed
- Major distortion observed
- Horizontal diameter greater than 30% of design
- Severe perforations, corrosion and pitting present
- Extreme non-symmetric shape
- Structural cracks observed throughout culvert
- Evidence of major material deposits
- Major joint separations

Appendix B

Plastic Culverts: The following lists potential culvert characteristics that may result in a Good, Fair, Poor, or Critical culvert condition. These lists are not comprehensive and engineering judgment should be used at the site.

Excellent Condition:

- No settlement or misalignment observed
- Horizontal diameter within 0-10% of design
- Tight fitting joints with no separation
- Evidence suggest recent installation

Good Condition:

- No, or no appreciable settlement or misalignment observed
- Minor distortion
- Horizontal diameter within 0-20% of design
- Relatively smooth wall, minor deflection
- No separations

Fair Condition:

- Minor settlement or misalignment observed
- Horizontal diameter within 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 observed
- Horizontal diameter greater than 35% of design
- Wall crushing, tearing or cracking observed
- Significant deflection, resulting in extreme non-symmetric shape
- Evidence of significant material deposits
- Evidence of infiltration or exfiltration due to joint separations

Critical Condition

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

Appendix C

Concrete Culverts: The following lists potential culvert characteristics that may result in a Good, Fair, Poor, or Critical culvert condition. These lists are not comprehensive and engineering judgment should be used at the site.

Excellent Condition:

- No settlement or misalignment observed
- Tight fitting joints
- Evidence suggest recent installation

Good Condition:

- No, or no appreciable settlement or misalignment observed
- Horizontal diameter within 0-10% of design
- Shallow mortar deterioration observed at isolated locations
- Hairline cracking present, less than 1/16 of an inch

Fair Condition:

- Minor settlement or misalignment observed
- Minor joint separation
- Mortar loose or missing, spalling at isolated locations
- Evidence of minor material deposits
- Horizontal cracking present, less than 1/8 of an inch

Poor Condition:

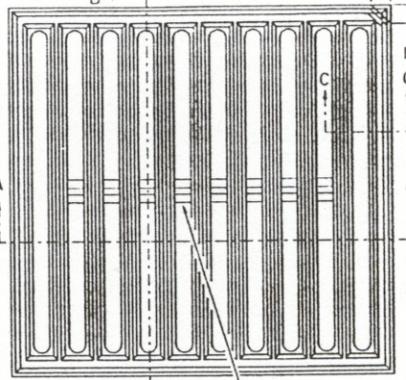
- Significant settlement or misalignment observed
- Significant openings or dislocated joints
- Extensive areas of missing mortar, spalling
- Evidence of significant material deposits
- Evidence of infiltration or exfiltration at joints
- Significant horizontal and diagonal cracking present
- Cracking less than 1/2 inch

Critical Condition

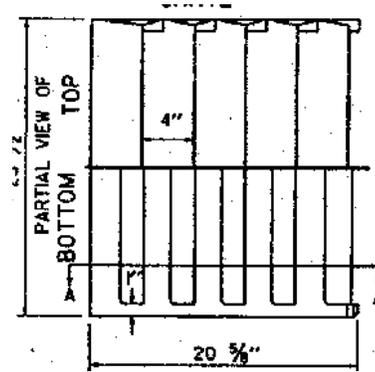
- Culvert has collapsed or a collapse is imminent
- Major settlement or misalignment observed
- Significant dislocated joints
- Widespread areas of missing mortar, spalling
- Major material deposits
- Significant horizontal and diagonal cracking present
- Multiple large cracks

Appendix D

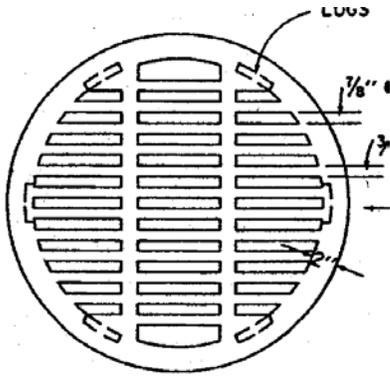
Grate Type Key



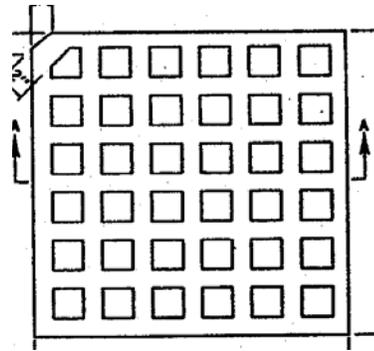
Grate Type A.



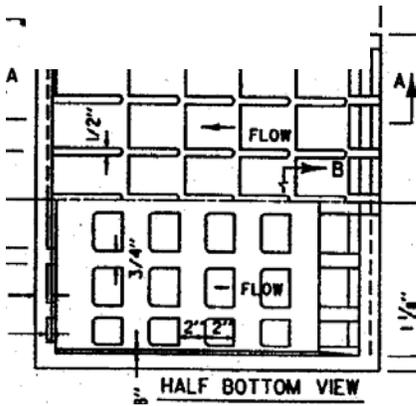
Grate Type B.



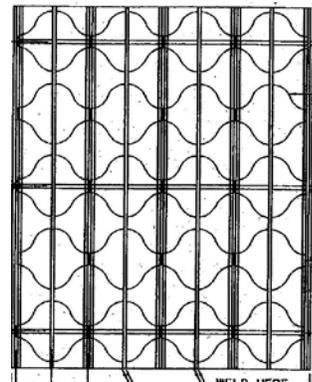
Grate Type C.



Grate Type D.



Grate Type E.



Steel Grate