



# Small Structure Inventory Handbook

A Guide for  
Counties and Townships



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SD Association of County Commissioners	(605) 224-4554 <a href="https://sdcountycommissioners.org">https://sdcountycommissioners.org</a>
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SD Department of Transportation Geographic Information Systems Coordinator	(605) 773-3278 <a href="mailto:kimberly.zerr@state.sd.us">kimberly.zerr@state.sd.us</a> <a href="https://dot.sd.gov/transportation/highways/planning/gis">https://dot.sd.gov/transportation/highways/planning/gis</a>

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## SECTION 1: SMALL STRUCTURE INVENTORY

### *Rural Access Infrastructure Fund*

The 2021 South Dakota Legislature appropriated funding to improve small structures on township and county secondary roads<sup>1</sup>. The first distribution of \$3 million was made to South Dakota counties in 2021 to plan and perform a small structure inventory. A second distribution of \$3 million in 2022 will be made to counties in proportion to the number of small structures they report in the inventory.

This **Small Structure Inventory Handbook** defines the process for collecting the statewide inventory of small structures to:

- enable townships and counties to perform an objective and consistent inventory of small structures
- compile inventory data in a statewide geographical database
- allow townships and counties to view and maintain their inventory data
- support townships' and counties' efforts to develop small structure improvement plans
- provide information to support investment decisions at the state and local level

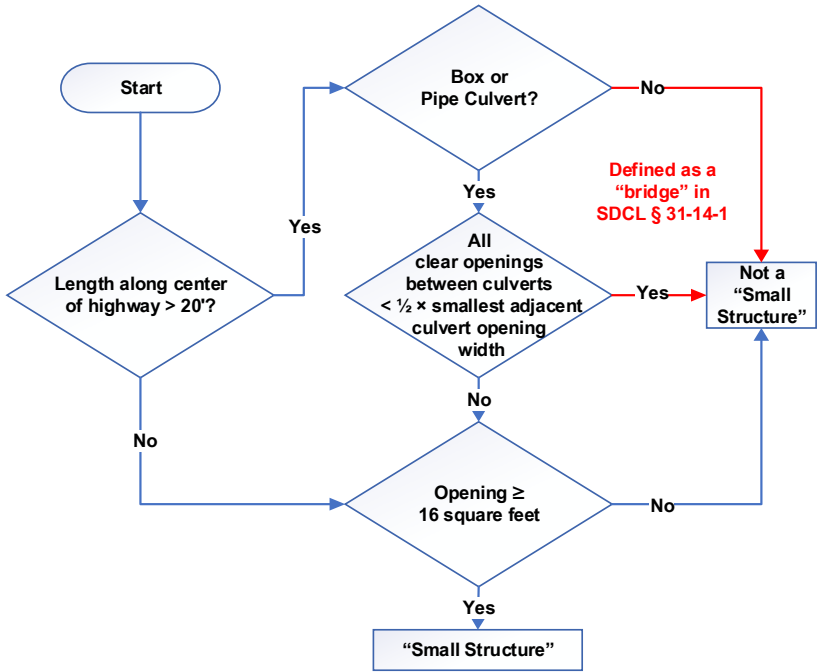
### *What is a Small Structure?*

South Dakota Codified Law § 31-34-1 defines a small structure as “any small bridge or culvert with an opening of sixteen square feet or more located on a township road or county secondary road, excluding bridges as defined in § 31-14-1”. SDCL § 31-14-1 in turn defines a bridge to be “a structure, including supports, erected over a depression or an obstruction, as water, highway, or railway, the structure having a length measured along the center of the roadway of more than twenty feet between undercopings of abutments or extreme ends of openings for multiple boxes and pipes where the clear distance between openings is less than half of the smaller contiguous opening”.

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<sup>1</sup> HB1259 An Act to make an appropriation for rural access infrastructure improvements and to declare an emergency, 2021 South Dakota Legislature, Pierre, SD, <https://mylrc.sdlegislature.gov/api/Documents/220118.pdf>, enacted in South Dakota Codified Law SDCL § 31-34 Rural Access Infrastructure, [https://sdlegislature.gov/Statutes/Codified\\_Laws/2079026](https://sdlegislature.gov/Statutes/Codified_Laws/2079026).

Together, the two sections of codified law define the township and county secondary road structures that qualify as “small structures”:



Example configurations that do and do not qualify as small structures are shown below:

Small Structure	Not Small Structure
<p>60" 20 ft<sup>2</sup></p>	<p>36" 7 ft<sup>2</sup></p> <p><i>Area &lt; 16 ft<sup>2</sup></i></p>
<p>21' 48" 48" 48" 12.6 ft<sup>2</sup> 12.6 ft<sup>2</sup> 12.6 ft<sup>2</sup></p>	<p>21' 48" 48" 48" 48" 12.6 ft<sup>2</sup> 12.6 ft<sup>2</sup> 12.6 ft<sup>2</sup> 12.6 ft<sup>2</sup></p> <p><i>Length &gt; 20', Spacing &lt; 1/2 of opening width</i></p>
<p>13' 42 ft<sup>2</sup></p>	<p>21' 80 ft<sup>2</sup></p> <p><i>Length &gt; 20'</i></p>
<p>17.5' 80 ft<sup>2</sup></p>	<p>25' 120 ft<sup>2</sup></p> <p><i>Length &gt; 20'</i></p>

All small structures located within the right of way of township or county secondary roads should be inventoried.

### **Individual Culverts and Culvert Groups**

The language of SDCL § 31-34-1 allows box or pipe culverts to meet the 16 square foot opening requirement two ways:

- An individual culvert may have an opening greater than or equal to 16 square feet. Examples include a box culvert with a single 54" x 54" opening (20.2 ft<sup>2</sup>), a box culvert with two 36" x 36" openings (18 ft<sup>2</sup> total), or a 60" round pipe (19.6 ft<sup>2</sup>). (Cross-section areas of standard culvert shapes are listed on page 47.)
- A group of culverts lying in the same drainage may have a combined total opening greater than or equal to 16 square feet. Examples include a pair of 48" round pipes (25.2 ft<sup>2</sup>) or a group of three 36" round culverts (21.3 ft<sup>2</sup>).

Within a group of culverts lying in the same drainage, individual pipes that meet the 16 square foot opening requirement may be considered separate small structures. For example, a pair of 60" round pipes in the same drainage may be individually inventoried as two small structures.

Each small structure—whether an individual bridge or culvert, or a group of culverts lying in the same drainage—must be inventoried separately. Multiple culverts forming one small structure should be inventoried in sequence, to avoid losing or confusing their relationship to each other.

Local agencies should assign a unique, meaningful name (*Inventory Item 4 Small Structure Local Identifier*, page 11) to each of their small structures. When the inventory information is submitted later, each small structure will automatically be assigned a permanent Small Structure Number (*Inventory Item 10, Small Structure Number*, page 12) related to its location within its county. The Small Structure Local Identifier should be unique within the agency, but the Small Structure Number will be unique statewide.



## SECTION 2: USING THE INVENTORY TOOLS

### General

Inventory information may be recorded with a mobile app, an Excel spreadsheet, or paper forms. All three methods accept information in the order and format described in this Handbook.

### Small Structure Inventory Handbook

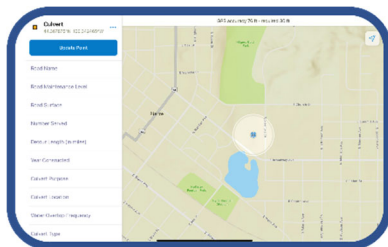
Sections 3 – 6 of this handbook lead the user through the complete inventory item by item. Sections 3, 4, and 6 are used for pipe and box culverts. Sections 3, 5, and 6 are used for small bridges.

Section	Section Title	Pipe & Box Culverts	Small Bridges
3	Common Inventory Items	✓	✓
4	Culvert Inventory Items	✓	
5	Small Bridge Inventory Items		✓
6	Small Structure Summary Items	✓	✓

Electronic copies of this Handbook are available at <http://sdtownships.com> and <https://sdcountycommissioners.org>.

### Mobile Device Data Collector

The **South Dakota Small Structure Inventory** mobile app is based on the ESRI platform (Field Maps or Collector for ArcGIS). Users must have an ArcGIS Online account to use Field Maps or Collector on their mobile phone



or tablet. Users must also contact the South Dakota Department of Transportation Geographic Information Systems Coordinator ([kimberly.zerr@state.sd.us](mailto:kimberly.zerr@state.sd.us)) to be included in the app user group.

Using the mobile app makes acquiring certain information—such as latitude, longitude, and photographs of small structures—easier, as many mobile devices have global positioning and cameras. Information entered into the mobile app is saved directly into the Statewide Small Structure Database. Complete instructions are posted at <http://sdtownships.com> and <https://sdcountycommissioners.org>.

## **Excel Spreadsheet**

Users may also use the **South Dakota Small Structure Inventory Spreadsheet** to acquire inventory information. A blank copy of *SDSSI.xlsx* can be downloaded from <http://sdtownships.com> or <https://sdcountycommissioners.org>. Users should rename their spreadsheets with unique filenames that identify their county or township, such as *Beadle12.xlsx*.

Completed spreadsheets must be uploaded to <https://sdcountycommissioners.org> for import into the South Dakota Small Structure Database. Complete instructions are included in the “Help” tab of the spreadsheet.

## **Paper Forms**

Anyone unable to use the Small Structure Inventory Collector or Excel Spreadsheet may use paper forms to record inventory information. Two forms—one for box and pipe culverts and another for small bridges—are available in Portable Document Format (PDF) from <https://sdcountycommissioners.org> and <http://sdtownships.com>.

Information recorded on paper forms must be entered later into a **South Dakota Small Structure Inventory Spreadsheet** and then uploaded to <https://sdcountycommissioners.org> for import into the South Dakota Small Structure Database.

## **Small Structure Database**

Local officials may choose whether to submit inventory data at the county or township level. All information submitted via the Small Structure Inventory Collector or the Small Structure Inventory Spreadsheet will be stored in a statewide geospatial database hosted by the South Dakota Department of Transportation. Local jurisdictions will be able to access the database online later.<sup>2</sup>

## **Help**

Questions about the inventory process and tools may be directed to the South Dakota Local Transportation Assistance Program at (800) 422-0129 or [sdlitap@sdstate.edu](mailto:sdlitap@sdstate.edu).

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<sup>2</sup> Data will be available at <https://bit.ly/3zL8aBO> beginning in September 2021.

## SECTION 3: COMMON INVENTORY ITEMS

The inventory items in this section are to be collected for both culverts and small bridges.

### **Location**

#### **Item 1 County Name**

Identify the county. The mobile app and spreadsheet provide pull-down lists of all South Dakota counties.

#### **Item 2 Town or Township Name**

Identify the town or township. The mobile app and spreadsheet provide pull-down lists of all towns, townships, and unorganized areas.

#### **Item 3 Road System**

Identify the administrative road system, as defined in SDCL § 31-1-5.

- Township
- County Secondary
- County<sup>3</sup>
- Other

#### **Item 4 Small Structure Local Identifier**

Identify the small structure with a unique, meaningful name up to 25 alphanumeric characters long. If the small structure comprises multiple culverts of different types, shapes, sizes, or condition, each one must be inventoried separately. In this example, two unequally-sized culverts must be inventoried individually, sharing the same Small Structure Local Identifier (Owl Creek) with Sequence Numbers 1 and 2.



#### **Item 5 Sequence Number**

For each individually inventoried culvert in a multi-culvert group, enter the sequence number (“1” for the first culvert inventoried, “2” for the second, etc.). For all other small structures, enter “1”.

#### **Item 6 Inventoried By**

Enter the full name of the person performing the inventory.

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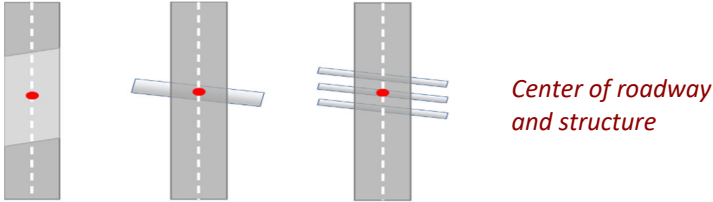
<sup>3</sup> Although only small structures on the County Secondary and Township systems are eligible for Rural Access Infrastructure funding, the inventory process may be used for other small structures.

### Item 7 Inventory Date

Enter the date (mm/dd/yyyy) the inventory information is being collected.

### Item 8 Latitude

Record the latitude at the center of the roadway and structure, in decimal degrees to five decimal places (for example, 44.12345). The mobile app records the latitude automatically.



### Item 9 Longitude

Record the longitude at the center of the roadway and structure, in decimal degrees to five decimal places (for example, -100.12345). The mobile app records the longitude automatically.

### Item 10 Small Structure Number

When the inventory information is imported into the Small Structure Inventory Database, each small structure will be assigned a permanent identifier based on the county number, the distance east of the county's westmost point, and the distance south of the county's northmost point.<sup>4</sup>

$$\text{Small Structure Number} = \text{CC} - \text{WWWW} - \text{NNNN}$$

CC	2-digit county number	<p>The diagram shows a gray map of Pennington County with a dashed white outline. A red dot is placed on the map. A red arrow points from the westmost point of the county to the red dot, labeled 'WW.WW'. Another red arrow points from the northmost point of the county to the red dot, labeled 'NN.NN'. The text 'Pennington County Example' is written in red below the diagram.</p>
WWWW	4-digit distance from the westmost point in the county, in hundredths of miles	
NNNN	4-digit distance from the northmost point in the county, in hundredths of miles	

<sup>4</sup> This method is similar to how SDDOT numbers bridges in the National Bridge Inventory, but the Small Structure Number uses 4 digits to designate distance in hundredths of miles, while the NBI Structure Number uses only 3 digits to designate distance to tenths of miles. Also, the Small Structure Number is calculated strictly from distance, while NBI Structure Numbers shift to follow range and township correction lines.

## Road Attributes

### Item 11 Road Name

Enter the 911 rural addressing name of the roadway, for example "314th Avenue".

### Item 12 Road Maintenance Level

Indicate the maintenance level this road receives.

- Full Maintenance
- Minimum Maintenance, as defined in SDCL § 31-12-46
- No Maintenance, as defined in SDCL § 31-12-48

### Item 13 Road Surface

Identify the roadway's surface type.

- Dirt
- Gravel
- Blotter
- Asphalt Mat
- Concrete
- Other

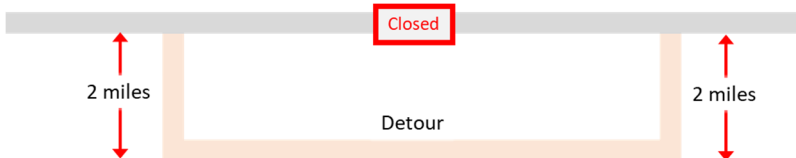
### Item 14 Number Served

If the culvert is on a dead-end road (one that terminates) specify the number of homes or farmsteads it provides access to.

- Not a dead end
- No homes, farms, or ranches
- 1 home, farm, or ranch
- More than 1 home, farm, or ranch

### Item 15 Detour Length

Specify the minimum additional length of travel for through traffic to bypass the small structure using only full maintenance roads if this roadway were to close at the small structure location.



## SECTION 4: CULVERT INVENTORY ITEMS

The inventory items in this section are collected only for pipe and box culverts.

### ***Culvert Attributes***

#### ***Item 16 Culvert Purpose***

Identify the primary purpose of the culvert.

- Drainage
- Livestock Passage
- Drainage and Livestock Passage
- Pedestrian or Bicycle Trail
- Other

#### ***Item 17 Culvert Location***

Identify whether the culvert lies beneath the main road or an approach.

- Culvert lies beneath mainline
- Culvert lies beneath an approach
- Other




#### ***Item 18 Water Overtop Frequency***

Estimate how often water overtops the roadway.

- Unknown
- Multiple times per year
- Yearly
- Every two years
- Every five years
- Every ten years
- Every twenty years
- Never

**Item 19 Culvert Type**

Identify the culvert type.

	<input type="checkbox"/> Box Culvert <i>Usually precast or cast-in-place concrete. Cattle passes are often box culverts</i>
	<input type="checkbox"/> Pipe Culvert <i>Usually corrugated metal, concrete or plastic</i>
	<input type="checkbox"/> Multi-plate <i>Culvert assembled from curved metal plates to create large circular or semicircular tube</i>
<p>Different from types shown above</p>	<input type="checkbox"/> Other

**Item 20 Number of Cells**

Report the total number of cells for this small structure.

	
<p><i>2 cells</i></p>	<p><i>3 cells</i></p>

### Item 21 Material

Identify the material the culvert is principally made of.

- Precast Concrete
- Cast-in-place Concrete
- Galvanized Steel
- Aluminized Steel
- Steel
- HDPE (High Density Polyethylene)
- PP (Polypropylene)
- PVC (Polyvinyl Chloride)
- Wood
- Masonry
- Other

### Item 22 Lining

A culvert may be lined as a preservation or rehabilitation measure. Liners may be a material different from the original culvert. Report whether a liner is present.

- Lining Present
- No Lining












## Culvert Dimensions

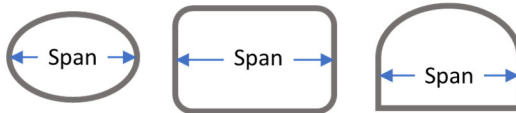
### Item 23 Shape

Identify the culvert's shape.

	<input type="checkbox"/> Round
	<input type="checkbox"/> Pipe Arch
	<input type="checkbox"/> Arch
	<input type="checkbox"/> Elliptical
	<input type="checkbox"/> Rectangle
	<input type="checkbox"/> Cattle Pass
	<input type="checkbox"/> Open Bottom
Different from all other shapes shown	<input type="checkbox"/> Other

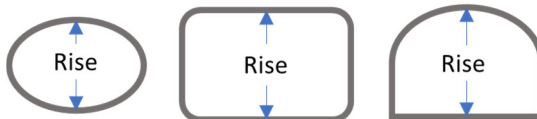
### Item 24 Span

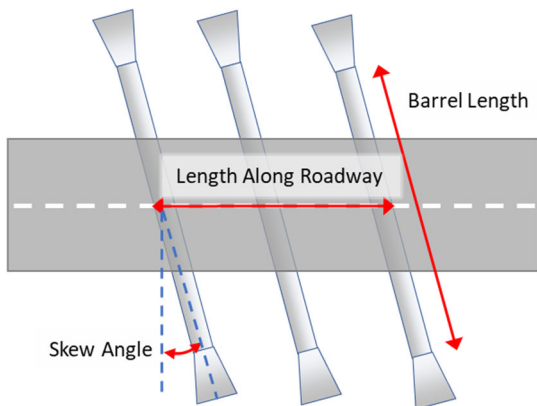
Measure the inside width (in inches) at the culvert's widest point.



### Item 25 Rise

Measure the inside height (in inches) at the culvert's tallest point.





***Item 26 Barrel Length***

Measure the end-to-end length of the culvert to the nearest foot. Do not include inlet or outlet treatments.

***Item 27 Length Along Roadway***

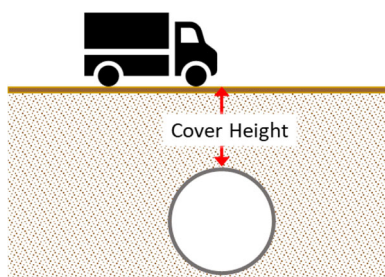
Measure or estimate the length of the culvert along the centerline of roadway in feet.

***Item 28 Skew Angle***

Measure the skew angle (the angle between the culvert's centerline and a line perpendicular to the roadway centerline) in degrees.

***Item 29 Cover Height***




Measure or estimate the thickness of fill over the top of the culvert to the nearest foot.



### Culvert Condition




Report any evident distresses and rate their severity, using the photographs for reference.

#### Item 30 Crushing

	<input type="checkbox"/> None
	<input type="checkbox"/> Mild <i>Culvert shape is slightly distorted or flattened</i>
	<input type="checkbox"/> Moderate <i>Crushing is significant enough that the culvert's stability and water flow may be reduced</i>
	<input type="checkbox"/> Severe <i>Major shape distortion significantly impacts stability and flow</i>

### Item 31 Joint Separation

Report separation at joints between culvert sections.

	<input type="checkbox"/> None
	<input type="checkbox"/> Mild <i>Widest separation &lt; 2"</i>
	<input type="checkbox"/> Moderate <i>Widest separation 2" - 4"</i>
	<input type="checkbox"/> Severe <i>Widest separation &gt; 4"</i>

### Item 32 Infiltration

Report infiltration, where soil migrates into the culvert through cracks or joints and collects there.

- None
- Inlet or Outlet Only
- Middle Only
- Full Length
- Other



*Full Length Infiltration*

### Item 33 Material Deterioration

Indicate damage or wear to the culvert material.

- None
- Mild
- Moderate
- Severe



*Mild: Minor rust or scaling, no section loss*



*Moderate: Rust or scaling with minor section loss*



*Severe: Complete material section loss (holes)*

### Item 34 Damage

Indicate damage not described elsewhere—such as bending, cracking, punctures, and faulting (alignment shifts at cracks or joints).

- None
- Mild
- Moderate
- Severe



*Mild damage to outlet*



*Mild cracking, no impact to flow*



*Moderate damage*



*Moderate cracking, up to 1/4" wide, slight faulting or impact on flow*



*Severe damage*



*Severe cracking, wider than 1/4", with significant faulting*

### Item 35 Plugging

Estimate the portion of the culvert area plugged by soil or debris.

None



0-25%



25-50%



50-75%



75-100%



Completely plugged

**Item 36 Embankment Settlement**

Check for holes above the culvert and end sections. Score severity according to the impact it would have on an errant vehicle driving over it.

None



Mild

*Minimal impact*



Moderate

*Minor impact*



Severe

*Major impact*



### *Item 37 Road Surface Distress*

Check for bumps, dips, or cracks in the roadway above or adjacent to the culvert. Any patching directly over a culvert should also be taken as evidence of roadway stress.

- Road surface distress present
- Negligible road surface distress present



*Common Culvert-Related Road Surface Distresses*

## Culvert Inlet

### Item 38 Inlet End Treatment

Identify the end treatment used at the culvert inlet.

None



Flared End

*Apron section attached to end of culvert barrel*

Sloped or Safety End



*Extension of the culvert floor, sloped to match embankment, may have transverse bars, designed for vehicles to safely cross*

Sectional End



*Extension of the culvert's sidewalls*

Headwall



### Item 39 Perched Inlet

Indicate whether the inlet is higher than the streambed, creating a vertical barrier to flow and potential for flow beneath the culvert.

- Yes
- No



### Item 40 Inlet Water Level

Indicate whether water is present in the culvert.

- None  
*(no water present)*



- Water Level Below Culvert



- Culvert Partially Filled

- Culvert Submerged

**Item 41 Inlet Erosion Control**

Identify the erosion control device at the culvert inlet.

None



Rip Rap



Gabion Baskets



Geogrid



Energy Dissipator



Drop Structure



Lined Channel

### Item 42 Inlet Erosion

Check for erosion of the channel or inslope at the culvert inlet.

None



Mild

*Visible erosion but no sloughing or loss of slopes*



Moderate

*Erosion over a larger area and/or causing some slope loss*



Severe

*Obvious erosion over a large area; if culvert ends have lost soil support, erosion is severe*

### Item 43 Inlet Erosion Outside of Right of Way

Indicate whether erosion at the inlet extends outside of the Right of Way.

Erosion extends outside of ROW

No erosion outside of ROW

## Culvert Outlet

### Item 44 Outlet End Treatment

Identify the end treatment used at the culvert inlet.

None



Flared End

*Apron section attached to end of culvert barrel*

Sloped or Safety End



*Extension of the culvert floor, sloped to match embankment, may have transverse bars, designed for vehicles to safely cross*

Sectional End



*Extension of the culvert's sidewalls*

Headwall



### Item 45 Perched Outlet

Indicate whether the outlet is higher than the streambed, creating a potential for erosion and a vertical barrier to fish passage.

- Yes
- No



### Item 46 Outlet Water Level

Indicate whether water is present in the culvert.

- None  
*(no water present)*
- Water Level Below Culvert
- Culvert Partially Filled
- Culvert Submerged



**Item 47 Outlet Erosion Control**

Identify the erosion control device at the culvert outlet.

None



Rip Rap



Gabion Baskets



Geogrid



Energy Dissipator



Drop Structure



Lined Channel



### Item 48 Outlet Erosion

Check for erosion of the channel or inslope at the outlet end of the culvert.

None



Mild

*Visible erosion but no sloughing or loss of slopes*

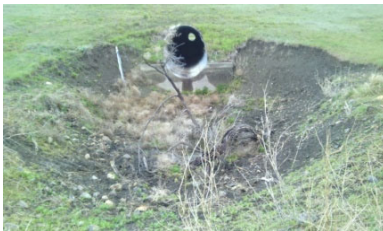
Moderate

*Erosion over a larger area and/or causing some slope loss*



Severe

*Obvious erosion over a large area; if culvert ends have lost soil support, erosion is severe*



### Item 49 Outlet Erosion Outside of Right of Way

Indicate whether erosion at the outlet extends outside of the Right of Way.

Erosion extends outside of ROW

No erosion outside of ROW

## SECTION 5: SMALL BRIDGE INVENTORY ITEMS

The inventory items in this section are to be collected only for small bridges.

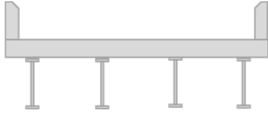
### Bridge Attributes

#### Item 50 Structure Design Type

Identify the bridge type from the list of choices.



Slab



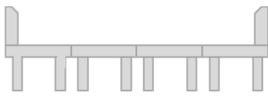
Girder



Box Beam



Channel Beam



Tee Beam

*(including Double-Tee)*



Deck Truss



Through Truss



Deck Arch



Through Arch

Rigid Frame

Combination

Other

### Item 51 Structure Material

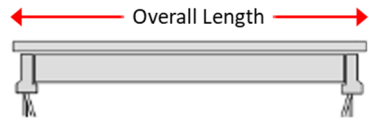
Identify the predominant material in the bridge structure.

- Concrete
- Steel
- Prestressed concrete
- Wood
- Masonry
- Other

### Bridge Dimensions

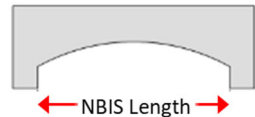
#### Item 52 Overall Length

Report the overall length of the structure, to the nearest foot.



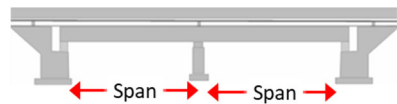
#### Item 53 NBIS Length

Report the total opening length on the structure, from inside of abutment to inside of abutment. (This definition matches National Bridge Inspection Standards.)



#### Item 54 Number of Spans

Report the total number of spans—lengths of bridge extending between support points.

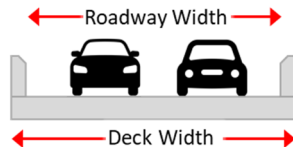


#### Item 55 Traffic Lanes

Report the number of traffic lanes carried on the bridge.

#### Item 56 Deck Width

Measure the bridge deck width, from outer edge to outer edge, to the nearest foot.

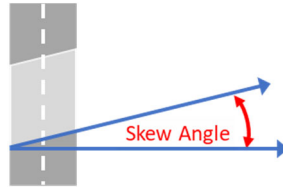


#### Item 57 Roadway Width

Measure the roadway width from curb to curb or rail to rail at the most restrictive point on the bridge, to the nearest foot.

## Item 58 Skew Angle

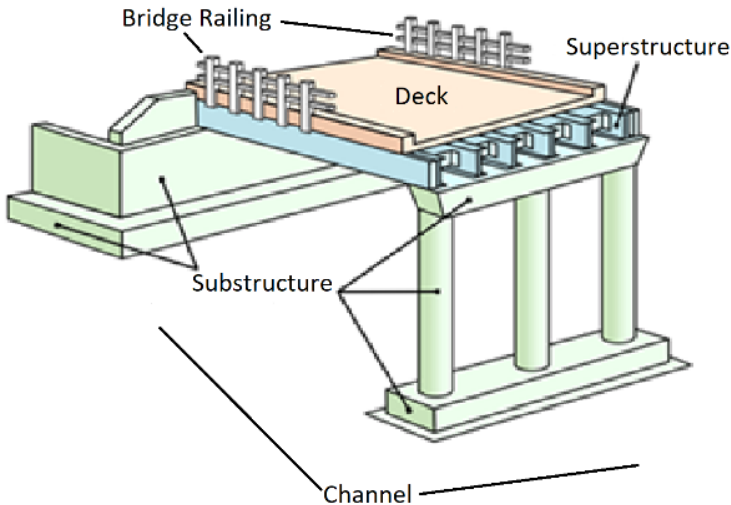
Report the skew angle—the angle between the end of the bridge and a line perpendicular to the roadway direction.



## Bridge Condition

Inventory items in this section address the condition of major bridge components:

- Deck—the surface that carries traffic
- Superstructure—girders, beams, braces, and connections that support the deck and connect substructure elements to each other
- Substructure—piers, abutments, piles, and footings that support the superstructure and distribute loads into the ground
- Channel—the waterway under and near the structure
- Bridge Railing—elements attached at the edges of the deck to redirect errant vehicles



### Item 59 Deck Condition

Examine the top, sides, and bottom of concrete decks for visible deterioration, which may include cracking, scaling, delamination, spalling, leaching, and full- or partial-depth voids or patches. Examine timber decks for splitting, breaking, crushing, rotting, and fastener failure. Examine steel grid decks for cracking, broken welds, broken grids, corrosion, and growth of concrete-filled steel grids from corrosion. Examine all decks for material loss resulting in loss of deck cross section.

Like new or superficial deterioration.	<input type="checkbox"/> Good
Deck is sound but may exhibit distress, deterioration, or section loss in localized areas. Cracks in concrete are infrequent and too fine to affect structural integrity.	<input type="checkbox"/> Fair
Deck is significantly deteriorated, and numerous local failures may exist. Cracks may be present in steel or concrete. Serious or extensive material deterioration or loss of section may exist in concrete or wooden decks. Significant corrosion may be present in steel or steel frame decks.	<input type="checkbox"/> Poor
Deck exhibits extensive advanced deterioration. Cracks, breaks, voids, or material degradation may affect structural integrity. Vertical or horizontal displacement of the deck may affect structural stability. Close monitoring, load restriction, or bridge closure may be necessary until corrective action is taken. Worst case, the bridge may be beyond corrective action.	<input type="checkbox"/> Critical

### Item 60 Superstructure Condition

Examine the physical condition of beams, girders, braces, and connections for visible distress or deterioration, which may include cracking, broken welds, delamination, spalling, corrosion, rotting, or section loss. Observe misalignment and rotation that may affect structure capacity and stability.

Like new or superficial deterioration.	<input type="checkbox"/> Good
Structural elements are sound but may exhibit minor section loss, cracking, spalling, or deterioration in localized areas. Displacement and rotation of elements is minor, not affecting the ability of the structure to function and carry load.	<input type="checkbox"/> Fair
Structural elements are significantly deteriorated, and numerous localized failures may exist. Cracks may be present in steel or concrete. Serious or extensive material deterioration or loss of section may exist in concrete or wooden elements. Significant corrosion may be present in steel. Deterioration, misalignment, or rotation of structural elements may affect the structure's ability to function and carry load.	<input type="checkbox"/> Poor
Structural elements exhibit extensive advanced deterioration. Cracks in steel or concrete may affect structural integrity. Serious or extensive material deterioration or loss of section may exist in concrete or wooden elements. Significant corrosion may be present in steel. Significant displacement or rotation of elements may threaten structural stability or load capacity. Structural elements may be missing or nonfunctional.  Close monitoring, load restriction, or bridge closure may be necessary until corrective action is taken. Worst case, the bridge may be beyond corrective action.	<input type="checkbox"/> Critical

### Item 61 Substructure Condition

Examine the physical condition of piers, abutments, piles, fenders, footings, and other substructure components for visible distress which may include cracking, splitting, crushing, corrosion, rotting, section loss, settlement, and collision damage from stream debris. Observe misalignment and rotation that may affect structure capacity and stability.

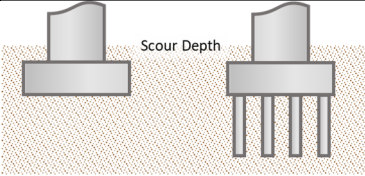
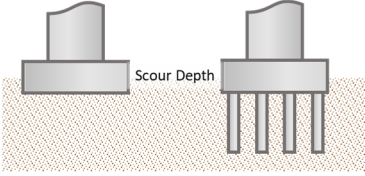
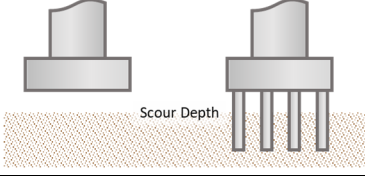
Like new or superficial deterioration.	<input type="checkbox"/> Good
Structural elements are sound but may exhibit minor section loss, cracking, spalling, or deterioration in localized areas. Displacement and rotation of elements is minor, not affecting the ability of the structure to function and carry load.	<input type="checkbox"/> Fair
Structural elements are significantly deteriorated, and numerous localized failures may exist. Cracks may be present in steel or concrete. Serious or extensive material deterioration or loss of section may exist in concrete or wood elements. Significant corrosion may be present in steel. Deterioration, misalignment, or rotation of structural elements may affect the structure's ability to function and carry load.	<input type="checkbox"/> Poor
Structural elements exhibit extensive advanced deterioration. Cracks in steel or concrete may affect structural integrity. Serious or extensive material deterioration or loss of section may exist in concrete or wood elements. Significant corrosion may be present in steel. Significant displacement or rotation of elements may threaten structural stability or load capacity. Structural elements may be missing or nonfunctional. Close monitoring, load restriction, or bridge closure may be necessary until corrective action is taken. Worst case, the bridge may be beyond corrective action.	<input type="checkbox"/> Critical

**Item 62 Channel Condition**

Examine physical conditions associated with the flow of water through the bridge, such as stream stability and the condition of the channel, riprap, slope protection, or stream control devices including spur dikes. Observe signs of excessive water velocity, which may undermine slope protection or erode banks.

<p>No noteworthy deficiencies affect the condition of the channel.</p> <p>Banks are protected or well vegetated. River control devices such as spur dikes and embankment protection are not needed or are in a stable condition.</p>	<p><input type="checkbox"/> Good</p>
<p>Bank protection is eroding. Flow control devices or embankment show significant damage. Trees and brush restrict flow. All observed scour is above footings and piles. (Example A)</p>	<p><input type="checkbox"/> Fair</p>
<p>Bank protection has failed. Stream control devices may be destroyed. Stream bed channel may have moved to threaten the bridge or roadway. Scour exists within spread footings or above pile tips. (Example B)</p> <p>A foundation investigation may be needed to determine whether the structure is stable. Close monitoring or bridge closure may be necessary until corrective action is taken.</p>	<p><input type="checkbox"/> Poor</p>
<p>The channel has shifted to the extent the bridge is near a state of collapse. The bridge has scour depth below the spread footing or pile tips. (Example C)</p> <p>The bridge is or should be closed.</p>	<p><input type="checkbox"/> Critical</p>



Observed Scour Depth		Example
		<p><b>A</b></p> <p><i>Observed scour above the footing or pile tips</i></p>
		<p><b>B</b></p> <p><i>Observed scour at the footing or pile tips</i></p>
		<p><b>C</b></p> <p><i>Observed scour below the footing or pile tips</i></p>
<b>Spread Footing</b>	<b>Pile Footing</b>	

### Item 63 Bridge Rail Condition

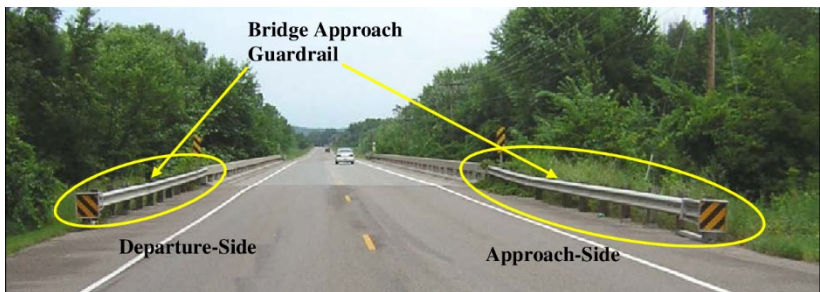
Report the condition of bridge railing.

- Railing runs full bridge length in sound condition
- Railing is partially missing or needs repair
- No functional railing is present

### Item 64 Approach Rail

Report whether bridge approach guardrail is present.

- Railing is present and in sound condition
- Railing is partially missing or needs repair
- No functional railing is present



## SECTION 6: SMALL STRUCTURE SUMMARY ITEMS

### Summary

The inventory items in this section are collected for both culverts and small bridges.

#### Item 65 Year Constructed

Report or estimate the 4-digit year of construction. A reasonable estimate is preferable to no answer, but if the date is completely unknown, the year may be left blank.

Year Constructed: \_\_\_\_\_

#### Item 66 Overall Structure Condition

Assess the overall condition and performance of the structure. Consider whether the structure appears sound, stable, and in good repair and the channel flows as designed.

<input type="checkbox"/> Good	Little or no deterioration, structurally sound, and performing adequately
<input type="checkbox"/> Fair	Minor deterioration but in good structural condition and performing well
<input type="checkbox"/> Poor	Significant deterioration or no longer functioning as designed
<input type="checkbox"/> Critical	At risk of imminent failure or already failed

#### Item 67 Other Comments

Enter up to 250 characters of additional comments.

#### Item 68 Traffic Status

Select the structure's current traffic status.

- Open without load restrictions
- Posted for load
- Closed to all traffic

#### Item 69 Axle Weight Load Posting

If the structure is posted for a restricted axle weight, enter the load limit in tons. If the structure is not posted for axle weight, enter zero.

#### Item 70 Load Posting for Single Unit Vehicles

If the weight of single unit vehicles (a truck or tractor with no trailers) is restricted, enter the load limit in tons. If the structure is not posted for single unit vehicles, enter zero.

#### ***Item 71 Load Posting for Combination Vehicles***

If the weight of combination vehicles (a truck or tractor with one or more trailers) is restricted, enter the load limit in tons. If the structure is not posted for combination vehicles, enter zero.

#### ***Item 72 Load Rating Evaluation Recommended***

If evidence of overloading or insufficient load capacity is visible but no load rating is posted, check this option to recommend an evaluation.

- Load rating evaluation recommended
- Load rating evaluation not recommended

#### ***Item 73 Further Inspection Needed***

Recommend further inspection by a qualified bridge inspector if portions of the inventory could not be completed or if observed distress, deterioration, or damage warrants closer evaluation.

- Further inspection needed
- Inspection complete

#### ***Photographs (Optional)***

The mobile app can capture photographs if the mobile device has a camera. The spreadsheet can import image files already stored in a folder on the computer.

#### ***Item 74 Roadway Photograph***

Supply a photograph of the roadway approaching and crossing the small structure.

#### ***Item 75 Inlet Photograph***

Supply a photograph of the small structure, facing toward the small structure inlet.

#### ***Item 76 Upstream Photograph***

Supply a photograph of the channel, facing upstream from the small structure inlet.

#### ***Item 77 Outlet Photograph***

Supply a photograph of the small structure, facing toward the small structure outlet.

#### ***Item 78 Downstream Photograph***

Supply a photograph of the channel, facing downstream from the small structure outlet.

## APPENDICES

### Glossary

Term	Meaning
Abutment	A part of the bridge substructure at either end of a bridge that supports the superstructure and provides lateral support for the approach roadway embankment
Barrel	The main portion of a culvert, excluding inlet and outlet structures
Bearing	A substructure element supporting the superstructure while permitting limited movement
Box Culvert	A culvert of rectangular cross-section, typically concrete
Bridge	According to SDCL 31-14-1, “a structure, including supports, erected over a depression or an obstruction, as water, highway, or railway, the structure having a length measured along the center of the roadway of more than twenty feet between undercopings of abutments or extreme ends of openings for multiple boxes and pipes where the clear distance between openings is less than half of the smaller contiguous opening”
Channel	The waterway under and near a structure
Cover Height	The depth of embankment over the top of a culvert
Crushing	Load-induced deformation reducing the culvert cross-section area and restricting flow
Culvert	A drainage structure beneath an embankment
Delamination	A mode of failure where a material splits into layers parallel to its surface; in concrete, typically caused by freezing
Embankment	Earth constructed above natural ground to carry a road
Fatigue	The tendency of a component to fail when subjected to repetitive loading
Faulting	Lateral or vertical displacement at joints or cracks
Fender	A structure that protects bridge substructure elements from damage from collisions by floating debris
GPS	Global Positioning System
Infiltration	Migration of soil into a culvert through joints or defects
Joint Separation	Physical displacement between individual sections of culvert
Inlet	A component that collects surface water into a culvert
Inslope	The slope from the edge of the shoulder of the road to toe of the ditch

<b>Term</b>	<b>Meaning</b>
Leaching	The process of removing substances from a material by passing water through it
Multi-plate	Culvert assembled from curved metal plates to create a large circular or semicircular tube
NBIS	National Bridge Inspection Standards
Outlet	A component that disperses water out of a culvert
Perching	A condition where the culvert inlet or outlet sits above the stream bed
Pier	A substructure unit, located between abutments, that supports spans of a multi-span bridge
Pile or Piling	A foundation shaft driven or cast into underlying rock or soil
Right of Way	The full width of publicly owned land between the property lines on either side of a road
Rise	The maximum inside height of a culvert
Scaling	Gradual disintegration of a concrete surface due to failure of the cement paste exposed to chemicals or freeze-thaw
Scour	Erosion of streambed or bank material due to stream flow, often localized around bridge piers and abutments
SDACO	South Dakota Association of County Officials
SDACC	South Dakota Association of County Commissioners
SDACHS	South Dakota Association of County Highway Superintendents
SDATT	South Dakota Association of Towns & Townships
SDCL	South Dakota Codified Law
SDDOT	South Dakota Department of Transportation
SDLTAP	South Dakota Local Transportation Assistance Program
Section Loss	Material loss of a structural element's cross sectional area, often by corrosion or deterioration
Skew Angle	The angle formed by the structure and a line perpendicular to the roadway
Small Bridge	Specific to this Handbook, a Small Structure, supported by abutments and possibly piers, that spans a depression or an obstruction and directly bears traffic
Small Structure	According to SDCL § 31-34, "any small bridge or culvert with an opening of sixteen square feet or more located on a township road or county secondary road, excluding bridges as defined in § 31-14-1"

Term	Meaning
Spalling	Localized material loss in a concrete surface caused by fracture
Span	The maximum inside width of a culvert
Spur Dike	An elongated structure having one end on the bank of a stream and the other end projecting into the stream, used to protect eroding stream banks
Streambed	The bottom of the stream channel
Substructure	Piers, abutments, piles, and footings that support the superstructure and distribute loads into the ground
Superstructure	Girders, beams, braces, and connections that support the deck and connect substructure elements to each other
Undercoping	The front face of a bridge abutment
<i>(Add other terms as desired)</i>	

## Cross-Section Areas of Standard Culvert Shapes

**Cross-Section Areas (ft<sup>2</sup>) of Circular and Elliptical Culvert Shapes (ft<sup>2</sup>)**

		Rise (inches)										
		18	24	30	36	42	48	54	60	72	84	96
Span (inches)	18	1.8	2.4	2.9	3.5	4.1	4.7	5.3	5.9	7.1	8.2	9.4
	24	2.4	3.1	3.9	4.7	5.5	6.3	7.1	7.9	9.4	11.0	12.6
	30	2.9	3.9	4.9	5.9	6.9	7.9	8.8	9.8	11.8	13.7	15.7
	36	3.5	4.7	5.9	7.1	8.2	9.4	10.6	11.8	14.1	16.5	18.8
	42	4.1	5.5	6.9	8.2	9.6	11.0	12.4	13.7	16.5	19.2	22.0
	48	4.7	6.3	7.9	9.4	11.0	12.6	14.1	15.7	18.8	22.0	25.1
	54	5.3	7.1	8.8	10.6	12.4	14.1	15.9	17.7	21.2	24.7	28.3
	60	5.9	7.9	9.8	11.8	13.7	15.7	17.7	19.6	23.6	27.5	31.4
	72	7.1	9.4	11.8	14.1	16.5	18.8	21.2	23.6	28.3	33.0	37.7
	84	8.2	11.0	13.7	16.5	19.2	22.0	24.7	27.5	33.0	38.5	44.0
	96	9.4	12.6	15.7	18.8	22.0	25.1	28.3	31.4	37.7	44.0	50.3

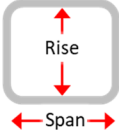
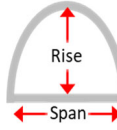
**Cross-Section Area (ft<sup>2</sup>) of Corrugated Steel Standard Pipe Arch Sizes**

Pipe Arch Size (in.)	Cross-Section Area (ft <sup>2</sup> )	Pipe Arch Size (in.)	Cross-Section Area (ft <sup>2</sup> )	Pipe Arch Size (in.)	Cross-Section Area (ft <sup>2</sup> )
17 x 13	1.1	49 x 33	8.9	95 x 67	37.0
21 x 15	1.6	53 x 41	11.7	103 x 71	42.4
20 x 16	1.7	57 x 38	11.6	112 x 75	48.0
23 x 19	2.3	60 x 46	15.6	117 x 79	54.2
24 x 18	2.2	64 x 43	14.7	128 x 83	60.5
27 x 21	3.0	66 x 51	19.3	137 x 87	67.4
28 x 20	2.9	71 x 47	18.1	142 x 91	74.5
33 x 26	4.7	73 x 55	23.2	150 x 96	81
35 x 24	4.5	77 x 52	21.9	157 x 101	89
40 x 31	6.7	81 x 59	27.4	164 x 105	98
42 x 29	6.5	83 x 57	26.0	171 x 110	107
46 x 36	9.2	87 x 63	32.1		

**Cross-Section Area (ft<sup>2</sup>) of Reinforced Concrete Standard Pipe Arch Sizes**

Pipe Arch Size (in.)	Cross-Section Area (ft <sup>2</sup> )	Pipe Arch Size (in.)	Cross-Section Area (ft <sup>2</sup> )	Pipe Arch Size (in.)	Cross-Section Area (ft <sup>2</sup> )
11 x 18	1.1	28 <sup>5</sup> / <sub>8</sub> x 43 <sup>3</sup> / <sub>4</sub>	6.4	45 x 73	17.7
13 <sup>1</sup> / <sub>2</sub> x 22	1.6	31 <sup>5</sup> / <sub>16</sub> x 51 <sup>1</sup> / <sub>8</sub>	8.8	54 x 88	25.6
18 x 22 <sup>1</sup> / <sub>2</sub>	2.8	36 x 58 <sup>1</sup> / <sub>2</sub>	11.4		
22 <sup>1</sup> / <sub>2</sub> x 36 <sup>1</sup> / <sub>4</sub>	4.4	40 x 65	14.3		

**Cross-Section Area (ft<sup>2</sup>) of Rectangular and Arch Culverts**

	<p>Area (ft<sup>2</sup>) = Span (ft) x Rise (ft)</p>		<p>Area (ft<sup>2</sup>) ≈ 0.78 x Span (ft) x Rise (ft)</p>
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