2022 Annual Bridge Report

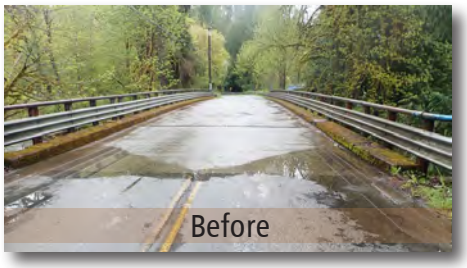
Prepared by: Snohomish County Public Works
Engineering Services Bridge Group

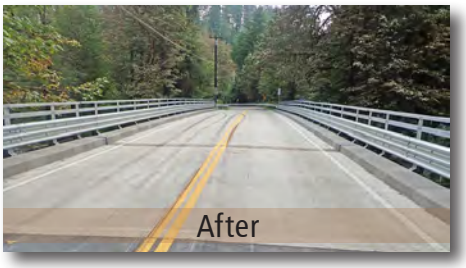
Submitted: April 2023

Snohomish County
Public Works

Cover Photo

Madden Bridge 58 underwent an extensive rehabilitation project during the summer of 2022.





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This document is available online at
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Snohomish County

2022 Bridge Report

Submitted: April 2023

This bridge report is prepared by Snohomish County Public Works Engineering Services Bridge Group each year to fulfill requirements of the Washington Administrative Code (WAC) 136-20-060. This WAC requires the County Engineer's report of bridge inspections as follows:

"Each county engineer shall furnish the county legislative authority with a written report of the findings of the bridge inspection effort. This report shall be made available to said authority and shall be consulted during the preparation of the proposed six-year transportation program revision. The report shall include the county engineer's recommendations as to replacement, repair or load restriction for each deficient bridge. The resolution of adoption of the six year transportation program shall include assurances to the effect that the county engineer's report with respect to deficient bridges was available to said authority during the preparation of the program. It is highly recommended that deficient short span bridges, drainage structures and large culverts be included in said report."

Prepared by: v ladimir malinsky 4/20/2023
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Bridge Condition Project Manager

Reviewed by: 4/20/2023
Tim Tipton, P.E., S.E.
Bridge Engineer

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Approved by: Douglas W McCormick 4/28/2023
Douglas W. McCormick, P.E.
Deputy Director/County Engineer

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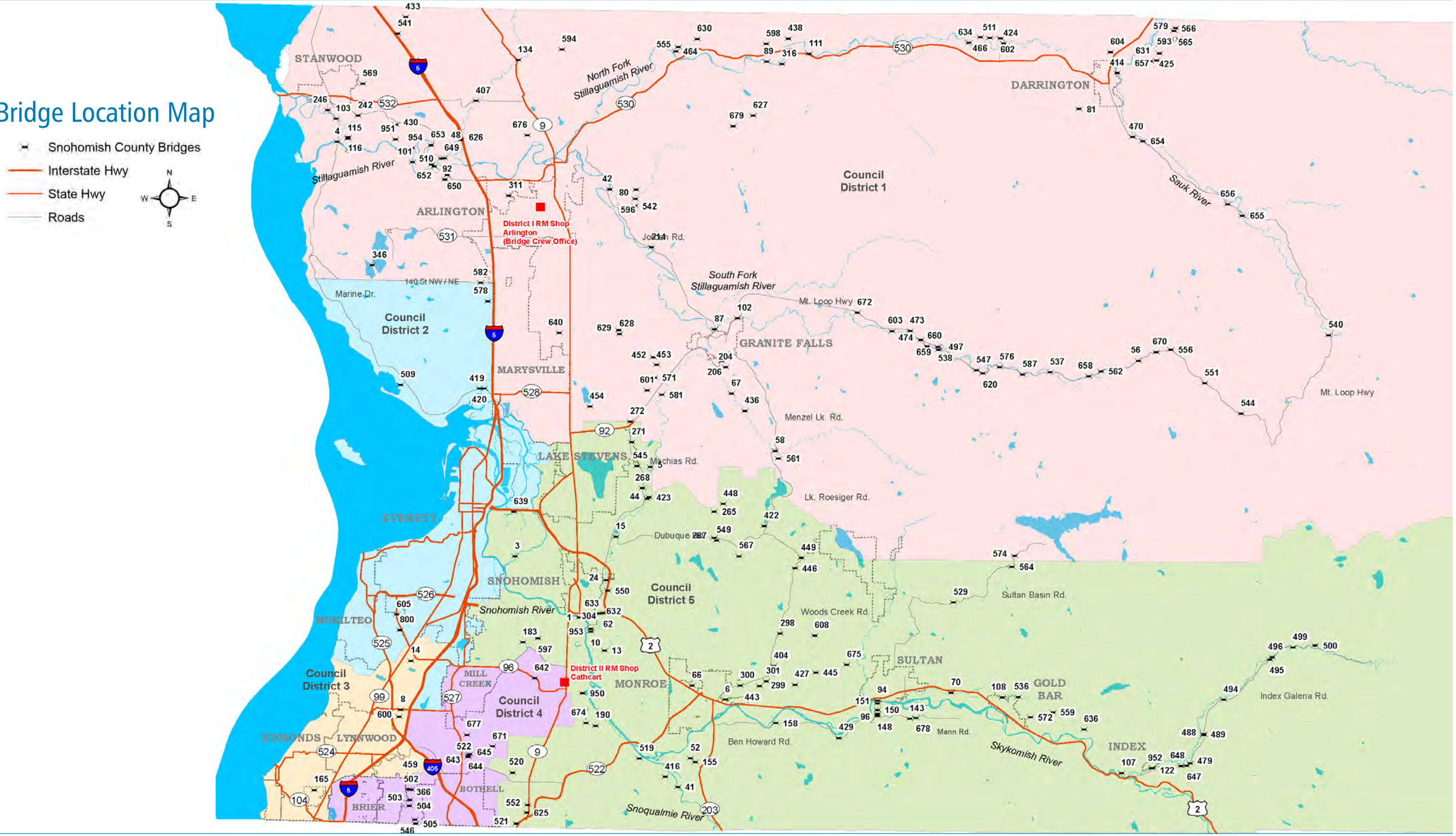
Contents

Acronyms

The following is a list of common acronyms widely used in the bridge inspection field:

ADT	Average Daily Traffic
BIRM	Bridge Inspector's Reference Manual
EV	Emergency Vehicles
FC	Fracture Critical
FHWA	Federal Highway Administration
FO	Functionally Obsolete
HBRRP	Highway Bridge Replacement and Rehabilitation Program
NBIS	National Bridge Inspection Standard
RCW	Revised Code of Washington
RID	Road Improvement District
SD	Structurally Deficient
SID	Structure Identification Number
SR	Sufficiency Rating
SUV	Single Unit Vehicles
UBIT	Under Bridge Inspection Truck
WAC	Washington Administrative Code
WSBIM	Washington State Bridge Inspection Manual
WSBIS	Washington State Bridge Inventory System
WSDOT	Washington State Department of Transportation

Bridge Location Map



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Executive Summary

This report has been completed in compliance with WAC 136-20-060, which requires that each County Road Engineer furnish a written report of the county's bridge inspection efforts to the county legislative authority. It is also the intention of this report that information presented here be incorporated into a comprehensive program strategy to preserve the county's roadways.

Summary of bridge inventory

As of the end of 2022, the unincorporated Snohomish County road system contained 205 bridges which provided continuity between approximately 1,600 miles of county roads. Three of our bridges are considered structurally deficient. We have secured federal bridge funds to replace or improve three of these bridges. Appendix A on page 29 includes a complete list of county bridges and key information.

Highlights in 2022

- A total of 113 Snohomish County bridge condition inspections were completed by county forces.
- Snohomish County provided bridge inspection services for 31 city-owned bridges.
- A total of 10 major bridge repair work orders were completed by Snohomish County Road Maintenance crews.
- Load ratings for single-unit vehicles have been completed for all county bridges.
- Construction was completed for Jim Creek Culvert 679 (span length 23 feet), which is a steel plate arch culvert installed as part of the Surface Water Management project on Jim Creek Road.
- Madden Bridge 58 underwent an extensive rehabilitation during the summer of 2022. See photo and caption below.
- A larger than normal number of UBIT inspections were completed successfully to catch up from COVID-19 deferrals.

The 2022 rehabilitation package for Madden Bridge 58 included a new concrete deck, bridge rail, bearings, and guardrail approaching the structure. The bridge was built in 1956 and carries Menzel Lake Rd across the Pilchuck River.

Bridge Inventory

Bridge inventory

11	culverts
22	steel
29	combination
38	timber
105	concrete
205	total bridges

Out of the 205 bridges in Snohomish County, 38 are of timber construction, 105 are of concrete construction, and 22 are predominately of steel construction (11 of which are fracture-critical), 29 are a combination of wood, concrete and steel construction and 11 are culverts (for reporting purposes, culverts with spans longer than 20 feet are considered "bridges").

Overall, 67 of our 205 bridges are at least partially timber. This is a significant improvement from 1976, when nearly 90% of our bridge spans were timber.

See Appendix A on page 29 for a complete list of Snohomish County bridges and some of their key information.

Short span bridges

The Highway Bridge Replacement and Rehabilitation Program (HBRRP) excludes short span bridges (NBIS length of 20 feet or less; see diagram on page 34) and non-NBIS bridges (railroad, pedestrian and privately owned bridges) from receiving federal funding. Out of the 205 bridges in Snohomish County's inventory, 33 of these bridges are classified as short span bridges and they are listed at the end of Appendix A on pages 34 and 35.

Other local agency bridges

Snohomish County provides inspection services to cities upon request and staff availability. The county works with cities under Interlocal Agreements (ILA), with conditions set forth in the Revised Code of Washington (RCW) Chapter 39.34. In 2022 the county provided inspection services on 31 bridges for local agencies.

In addition, the Road Maintenance Division contracts with local agencies for the maintenance of city bridges. The county's services are provided primarily to cities that lack resources and expertise to inspect and maintain their bridge inventory.

Bridge 14 is a corrugated aluminum culvert carrying Swamp Creek at the intersection of Gibson Road and Admiralty Way. A scour mitigation work order was completed in the fall of 2017.

Hogarty Creek Bridge 636 on Reiter Rd in Sultan is a short span built in 1997. It's an example of one of our bridges that is a combination of wood and concrete construction.

Bridge Inspection and Findings

Bridge inspections on Snohomish County bridges are performed in accordance with the National Bridge Inspection Standards (NBIS) in conformance with 23 CFR 650.3. The standards mandate that public agencies inspect all of their bridges, except short span structures, at least once every two years. These regularly scheduled inspections are defined as routine inspections and are reported to the Federal Highway Administration (FHWA) upon their completion. A small number of bridges are inspected more frequently due to certain deficiencies that require additional monitoring.

A certain number of our bridges require specific access assistance, equipment and professional services during the inspection process. There are three types of special inspections that may be performed. Under-Bridge Inspection Truck (UBIT) is required for bridges that cannot be given an adequate visual inspection from the ground. Steel bridges with fracture critical members (FCM) may require special inspection equipment (ultrasonic testing). Underwater inspections are required every five years for bridges with piers that extend below ordinary low-water levels (see Exhibit B on page 12).

The inspector uses the NBIS standards to document the current condition of each bridge element listed. The deficiencies are coded to NBIS standards and show the degree of deterioration in various elements. The three primary elements being (see the "Basic Bridge Parts" drawing on page 26): deck, superstructure and substructure.

Wes Smith Bridge 122 over the N.F. Skykomish River in Index. WSDOT inspectors are inspecting the bridge's steel arch and cables from a boom lift.

A bridge is classified as structurally deficient (SD) if any of these important elements are rated as follows: being in poor condition due to damage and/or deterioration, its load carrying capacity is lower than current design standards, or the waterway below frequently overtops the bridge during floods.

As deterioration accelerates, the coding values drop and work orders for repairs are issued. In the case where the coding factors are extremely low, recommendations are made for repair, replacement or rehabilitation. Bridges with identified deficiencies may be inspected at more frequent intervals.

The results of our inspection program are forwarded to the Washington State Department of Transportation (WSDOT) Highway and Local Programs Division for review. Once the report has been accepted by WSDOT it is available for Federal Highway Administration (FHWA) review.

The NBIS also has other factors which contribute to developing the overall rating of a bridge. Sufficiency Rating (SR) is a calculated score based on numbers assigned to all factors reviewed by the inspector. The SR is a number from 0 to 100, with 100 being an entirely sufficient bridge, and 0 being an entirely insufficient or deficient bridge. Items that go into the determination of the SR include: load bearing capacity, average daily traffic, availability and length of detour, the geometry of the bridge and the risk of scour on bridge foundations at waterway crossings.

During 2022, yearly routine inspections were performed on 144 bridges, including 31 city bridges.

Bridges are classified as functionally obsolete (FO) if they are too narrow for the volume of traffic they carry, narrower than the road approaches, or have limited sight distance. Appendix A on page 29 shows the bridges in our inventory that are FO.

Bridges must be SD to be eligible for federal rehabilitation or replacement funds. The amount of available grant funds is never enough to be allocated to bridges that are FO unless they are also SD.

See our master list of special inspections (Exhibit B, page 12) for details on inspection frequencies and schedules for all of our UBIT and underwater bridge inspections, as well as special inspections done on suspended spans.

Additional findings and recommendations as a result of bridge inspections are described more fully in the following sections:

- Load Restricted Bridges
- Width and Height Restricted Bridges
- Bridge Replacement Plan
- Bridge Maintenance and Repairs

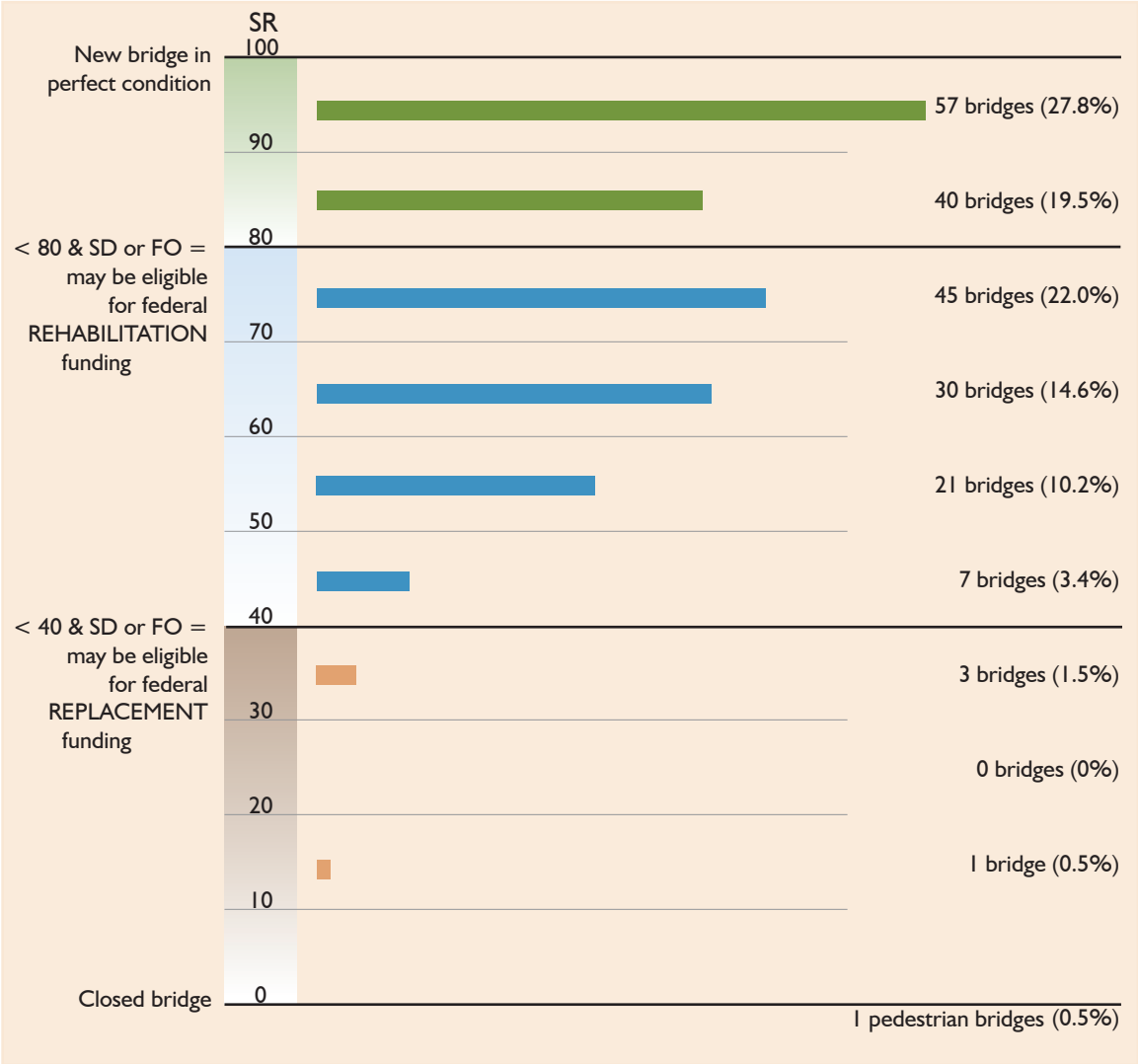
Norman Slough Bridge 430 on Olson Rd. County bridge inspector is evaluating the condition of the timber members.

Red Bridge 538 on the Mountain Loop Highway. County and WSDOT inspectors are inspecting the bridge's steel truss via a WSDOT UBIT.

Ebey Slough Bridge 3 on Home Acres Rd. County bridge inspector is measuring settlement of the approach roadway.

Exhibit A

Snohomish County Bridge Sufficiency Ratings (SR) – 2022 (including short spans)



SD = structurally deficient | FO = functionally obsolete

Exhibit B

Snohomish County Special Bridge Inspections

Bridge Number	Bridge Name	2024 UBIT	2026 UBIT	UW	UT	FC
1	Snohomish River	April	April	2024		Yes
3	Ebey Slough			2026		
4	Jim Donner Bridge			2026		
10	Pilchuck River					
15	Dubuque	May				
41	High Bridge					
44	Machias-OK	June	June			Yes
48	Jackson Gulch		May			
56	Silverton		May			
58	Madden		May			
67	Pilchuck River		May			
80	Vos Creek					
87	Chappell		June			
89	Oso Bridge					
94	Sultan	May	May			
101	Larson	June	June		2028	
102	Granite Falls	June	June			Yes
103	Thomle					
111	Halterman Spur					
115	Peterson					
122	Wes Smith Bridge	June	June		2026	Yes
151	Shinglebolt Slough		May			
165	Chase Lake					
204	Robe-Menzel					
206	Robe-Menzel					
304	6th Street	June	June			Yes
414	Sauk River	June	June			Yes
416	Crescent	May	May			
424	Swede Heaven					
427	Woods Creek					
430	Norman Slough	July	July			
433	Fisher Creek	June	June			
499	N.F. Skykomish River	July				

FC = fracture critical inspection (11 bridges)
UW = under water inspection (5 bridges)
* UBIT scheduled for odd year shown

UBIT = under-bridge inspection truck
UT = ultrasonic testing (3 bridges)

(chart continues on next page)

Exhibit B (cont.) – Snohomish County Special Bridge Inspections

Bridge Number	Bridge Name	2024 UBIT	2026 UBIT	UW	UT	FC
509	Battle Creek					
537	Red Bridge	June	June	2023		Yes
538	S.F. Stillaguamish River	June	June			Yes
540	S.F. Sauk River	*2023 (June)	*2025 (June)			Yes
581	Pilchuck River	*2023 (June)	*2025 (June)			Yes
626	Pilchuck Creek	July	July		2028	
633	Pilchuck River		June			
642	Thomas Creek					
650	Thomsen Slough					
651	Silvana					
653	Old Stillaguamish River	Aug		2025		
655	Sauk River	May				
656	Dutch Creek	May				
660	Monte Cristo	June	June			Yes

FC = fracture critical inspection (11 bridges)
UW = under water inspection (5 bridges)
* UBIT scheduled for odd year shown

UBIT = under-bridge inspection truck
UT = ultrasonic testing (3 bridges)

Red Bridge 537 undergoes a required Fracture Critical Inspection every 24 months. All members of the steel truss bridge are carefully inspected for signs of stress and fatigue.

Pilchuck Creek Bridge 626, built in 1933, requires a Special Feature Inspection of the steel pins every 72 months. Ultrasonic Testing (UT) equipment provides an effective, non-destructive method to assess the condition of steel members.

Load Restricted Bridges

Each bridge is required by NBIS standards to have a "Load Rating" calculation. The Load Rating establishes how much weight the bridge can carry compared to a series of standard trucks. A bridge that can't safely carry the full load of any of the standard trucks is classified as a "Load Restricted Bridge" and is required to be posted with load limit signs. The photograph below illustrates a typical load limit sign.

Currently there are 18 bridges on the list of load restricted bridges, an increase of four from 2021.

Shinglebolt Slough Bridge 151 on 311th Ave SE has new weight limits posted restricting larger trucks with six or more axles.

Prior to 2017 there were three standard load rating trucks. In 2017 six additional standard load rating trucks were added. All bridges have been rated for all these new load rating trucks. The new standard load rating trucks are a result of new trucks that have been introduced by manufacturers over the last decade.

Four of the new standard trucks are designated SU4 – SU7. The SU designation stands for Single Unit and the number represents the total number of axles. The new trucks have "lift axles" in addition to the standard front and rear axles. Lift axles are raised when the truck is empty and lowered when the truck is loaded. Photographs of a Single Unit 4 Axle Truck and Single Unit 7 Axle Truck are shown to the right.

The remaining two new standard trucks are designated EV2 and EV3. The EV designation stands for Emergency Vehicle and the number represents the total number of axles. The emergency vehicles are heavily loaded at all times; therefore, they do not have lift axles.

Exhibit C on page 15 lists all the load restricted bridges, has a table of the maximum allowable loads for each of the standard load rating trucks, and has photographs of EV2 and EV3 vehicles.

Example of a SU4.

Example of a SU7.

Exhibit C

Snohomish County Bridges with Weight Restrictions

Bridges listed below have some rating factors below 100% of a standard rating truck. The maximum legal load tonnages are shown below in Table 1660a from the January 2019 WSBIM page 2-C-41. See the WSDOT Bridge Design Manual M23-50, Chapter 13 for more information.

Bridge #	Bridge Name	Tonnage						
		AASHTO Type 3	AASHTO Type 352	AASHTO Type 3-3	SU4	SU5	SU6	SU7
111	Halterman Spur				24	26	27	29
143	Haystack Creek				25	26	27	30
148	South Slough							36
151	Shinglebolt Slough						32	34
214	Jordan Creek	22	32	36	22	25	28	31
304	6th Street				22	25	27	31
433	Fisher Creek				24	24	27	30
464	Grant Creek						32	32
503	Swamp Creek	21	35	39	19	22	25	28
537	Red Bridge				25			38
538	Blue Bridge				24			37
540*	S.F. Sauk River				23	26	29	32
544	Buck Creek				25	27	27	29
551	Perry Creek				24	25	25	26
576	Schweitzer Creek					29	29	31
620	Wisconsin Creek	22	34	40	20	22	22	24
626**	Pilchuck Creek	19	30	33	21	24	27	30
634	Swede Creek	21	33	40	19	21	22	24

* Bridge 540 also has a width restriction. See Exhibit D, page 16.
* Bridge 626 also has EV and width restrictions. See Exhibit D, page 16.

Table 1660a - Legal Loads

Configuration	Tonnage
AASHTO Type 3	25 tons
AASHTO Type 352	36 tons
AASHTO Type 3-3	40 tons
SU4	27 tons
SU5	31 tons
SU6	34.7 tons
SU7	38.7 tons
EV2	28.7 tons
EV3	43 tons

Example of an EV2 (above) and EV3 (below).

Width and Height Restricted Bridges

Bridges that have traffic portals of 15 feet or less are required to be posted with the allowable height limit. Snohomish County has seven roads passing through posted height restricted bridge structures, four of which are railroad under crossings. In 2022 there are 16 bridges with restrictions. Width and height restricted bridges are listed in Exhibit D below and also on the Snohomish County website, along with a vicinity map, aerial photo and picture of each bridge. See www.snohomishcountywa.gov/494.

Exhibit D

Snohomish County Crossings with Width and Height Restrictions

Bridge #	Bridge Name	Width	Height
56	Silverton Bridge	16'0"	
81	Brown Creek	15'0"	
107	Deer Creek	16'0"	
214	Jordan Creek	16'0"	
304	6th St (Snohomish)		14'3"
448	Carpenter Creek	11'0"	
537	Red Bridge		14'9"
538	S.F. Stillaguamish River		14'9"
540*	S.F. Sauk River	13'2"	
626*	Pilchuck River (Lane Closed)	12'0"	
627	Lake Riley	15'0"	
660	S.F. Stillaguamish River	12'0"	
950	Connelly Road (BNRR 1G34.7U)		12'0"
951	Olson Road (BNRR 2B51.5U)		9'4"
952	Index-Galena Road (BNRR 2A1746.2U)		15'6"
954	Norman Road (BNRR 2B50.8U)		10'5"

* Bridge 540 also has a weight restriction. See Exhibit C on page 15.
* Bridge 626 also has a weight restriction. See Exhibit C on page 15.

Olsen Road Railroad Underpass is height restricted.
In 2019 BNSF replaced an all timber trestle with a steel and concrete bridge.

Bridge Replacement and Rehabilitation Plan

The county's current focus is to replace or rehabilitate bridges that are classified as structurally deficient (SD) and/or functionally obsolete (FO) per NBIS.

In order to improve hydraulic and fish passage parameters, the shorter span bridges are replaced with longer span bridges, and culverts are replaced with short span bridges.

Since 2002, 54 bridges have been replaced or re-built in Snohomish County. Lists of future replacement/ rehabilitation candidates, including short-span bridges, are shown in Exhibit E on page 19.

Replacement/rehabilitation design projects

Swamp Creek Bridge 503 replacement
This 41-foot long two span bridge was built in 1960 and carries Locust Way over Swamp Creek between Bothell and Brier. Federal bridge replacement funds for the replacement project were received in 2020 and construction is planned for 2024.

Jordan Creek Bridge 214 replacement
This 107-foot long trestle style multi-span bridge was last re-built in 1981 and carries Jordan Road over Jordan Creek between Granite Falls and Arlington. Federal bridge replacement funds for the project were received in 2020 and construction is planned for 2024.

Above: Goodman Creek metal culvert pipe was damaged in early 2020. Below: Mountain Loop Highway is currently restricted to one lane.

Goodman Creek Culvert replacement
Mountain Loop Highway crosses Goodman Creek about 6 miles southeast of Darrington. The large metal culvert pipe was damaged in early 2020 by heavy storm flows. The road is currently restricted to one lane. Snohomish County Public Works has secured FHWA funding to replace the culvert with a bridge and restore fish passage along Goodman Creek. Construction is expected to begin in 2024 pending environmental approvals.

Richardson Creek Bridge 300 replacement
This 18-foot long short span bridge was built in 1961 and is located on Woods Creek Road north of Monroe. Design for the replacement project has been funded and was started in 2018. County staff hosted a public meeting in October 2019 to discuss the proposed project. Construction is planned for 2026 pending permit approvals and construction funding.

Granite Falls Bridge 102 replacement
The steel arch truss bridge, built in 1934, is located north of Granite Falls. It carries the Mountain Loop Highway above the South Fork of the Stillaguamish River. This narrow and fracture critical bridge will have a wider and more resilient replacement. This project received a USDOT RAISE grant in November 2021. Staff is working to complete engineering and environmental permitting with construction targeted to begin in 2025.

Pilchuck Creek Bridge 626 Replacement
Bridge 626 located northeast of Arlington carries Old 99 Highway over Pilchuck Creek and was built in 1933. It is posted for restricted loads and has been reduced to one lane. The existing structure is 3-spans with two in-span hinges and both piers within the ordinary high water. The county proposes to replace the existing bridge with a 180-foot-long single span structure that will clear the creek, with two travel lanes and a protected walkway. Federal bridge replacement funds are available, and construction is planned for 2027.

Snohomish River Bridge I Scour Mitigation
Bridge 1 carries Airport Way/Avenue D over the Snohomish River in Snohomish. The 360-foot-long three span bridge was built in 1983with drilled shafts in the river. Snohomish River Bridge 1 is on our priority "Flood Watch" list and "Seismic Lifeline" bridge route list. The proposed project will add supplemental deeper shafts to improve scour and seismic resiliency. Federal bridge funds are available, and construction is planned for 2025.

Exhibit E

Future Replacement and Rehabilitation Candidates

The following county bridges are replacement and rehabilitation candidates (see photos on next page).

Bridge	Name	Deficiencies/Concerns	Sufficiency Rating	Road Name	Rd Func Class	SD
101	Larson	Seismic upgrade, deterioration	72	Larson Rd	8	N/A
183	Cattle Pass	Rotten timber piles and pile caps	54	Lowell-Larimer Rd	16	Yes
547	Black Creek	Rotten piles and pile caps, scour	55	Mt. Loop Hwy	8	N/A
556	Coal Creek	Rotten timber piles and caps	62	Mt. Loop Hwy	7	N/A
522	North Creek	Rotting timber piles	62	196th St SE	19	N/A
670	Deer Creek	Rotten timber piles	56	Mt. Loop Hwy	7	N/A

Future short span replacement bridges

Bridges with a length of 20' or less are classified as short span bridges and are not eligible for federal replacement or rehabilitation grant funding. Of the county's 33 short span bridges, the following three are planned for replacement using County Road Fund dollars. Two of the bridges are functionally obsolete (FO) and one is a fish passage (FP) restriction.

Bridge #	Name	Deficiencies/Concerns	Sufficiency Rating	Road Name	Rd Func Class	FP/FO
158	Barr Creek	Narrow bridge deck	55	Ben Howard Rd	7	FO
565*	Everett Creek	Fish passage	72	Crawford Loop	9	FP
582	Quilceda Creek	Narrow bridge deck	42	140th NE	16	FO

* As a condition of the last deck and stringers replacement, Washington Department of Fish & Wildlife required a complete replacement of Bridge 565.

Everett Creek Bridge 565 located 3.5 miles northeast of Darrington on Crawford Loop Road was built in 1985. It is a short span with an overall length of 15 feet (NBIS length of 12 feet) and has a fish passage restriction. The bridge is planned to be replaced with a longer structure.

Photos of Future Rehabilitation and/or Replacement Candidates

Larson Bridge 101 is a three span bridge built in 1962 prior to current seismic design standards. The bridge carries Larson Rd over the South Slough of the Stillaguamish River in Silvana. Snohomish County is seeking federal funds to support a seismic retrofit project that would reduce vulnerability to collapse in a heavy seismic event.

Black Creek Bridge 547 built in 1952 on Mountain Loop Highway. Exposure of shallow concrete spread footings classifies this scour critical bridge as a future rehabilitation candidate.

Deer Creek Bridge 670 built in 1949 on Mountain Loop Highway has original 8 x 24-inch treated timber sawn girders, and original concrete deck and railing.

Coal Creek Bridge 556 built in 1949 on Mountain Loop Highway has original 6 x 20-inch (spans 1 and 3) and 8 x 24-inch (span 2) treated timber sawn girders, and original cast-in-place concrete piers, deck and railing.

Bridge Maintenance and Repairs

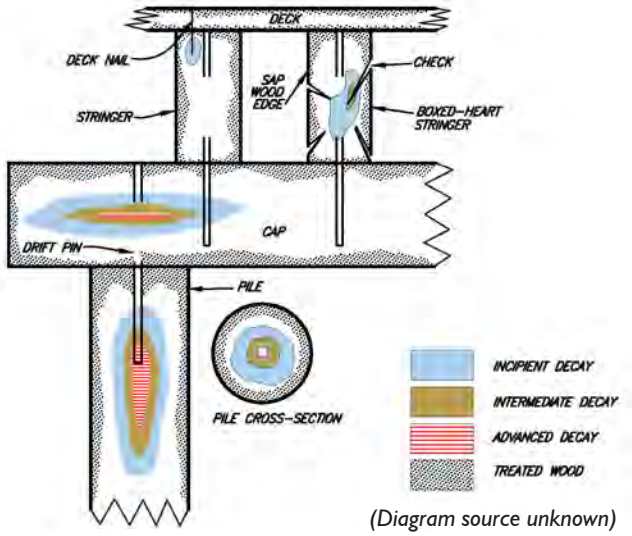
Routine repairs and preventive maintenance are an essential part of our overall bridge program. They are vital in preventing bridge service disruptions and deterioration of bridge components. Thus, they significantly extend a structure's lifespan and save valuable time, money and resources.

The majority of bridge repair and maintenance work is done by county forces, with occasional support from various vendors. General maintenance includes annual functions such as cleaning, minor painting, guardrail repairs, debris removal, brush cutting and tree trimming.

Routine repairs include restoring and replacing damaged, worn, missing or defective elements whose failure can significantly affect bridge service. Common examples are repairing rotten and split timber, concrete cracks and spalls, pier and abutment scour, rusting steel and asphalt failures.

Work planned for 2023 includes routine repairs and maintenance, as well as major work orders. The major work orders include repairing approach slab settlements, removing under bridge debris, repairing pile scour, installing sheet piling behind bridge abutments, cleaning bridge components, reinforcing piles, restoring bridge embankments and replacing expansion joints, piles, caps, bracing and deck/abutment planks.

Typical Timber Bridge Decay Types



(Diagram source unknown)

The recycled pre-fabricated steel pedestrian bridge is a major improvement for pedestrians using Swamp Creek Bridge 459.

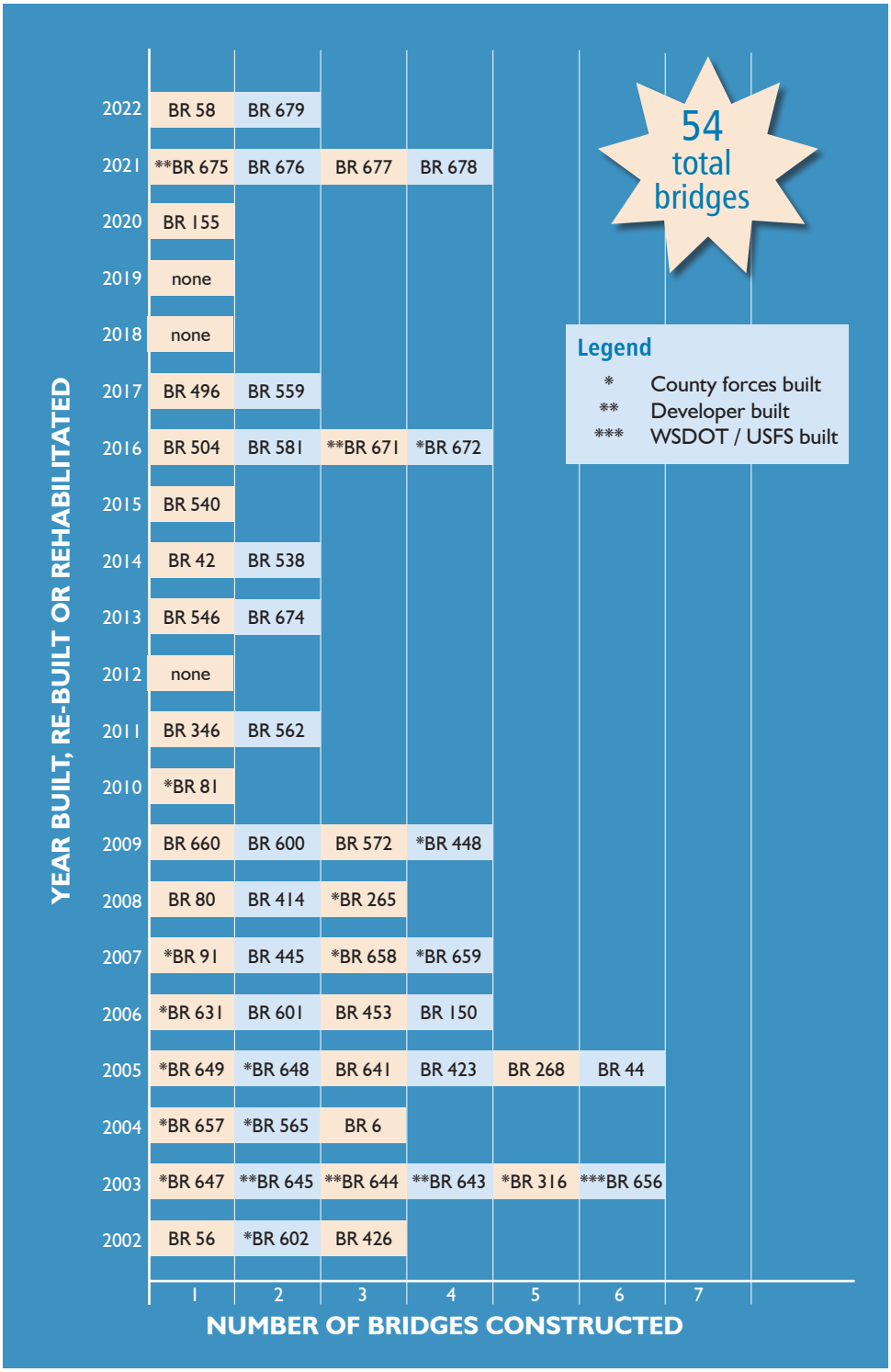
Exhibit F

Major Work Orders Completed in 2022

Bridge #	Name	Work Order	Date	Description of Work
304	6th Street	22-304	January	Wash Bridge Structure.
44	Machias	22-044	March	Wash Bridge Structure.
510	Koch's Slough	22-510	May	Replace Timber Cap.
536	Wallace River	20-536	May	Repair Damaged Abutment Wraps.
433	Fisher Creek	22-433	June	Remove/Re-Install Cross Bracing.
503	Swamp Creek	21-503	July	Scour Repair.
52	Riley Slough	25-052	September	Install Helper Pile.
422	Roesiger Creek	22-422	September	Replace Jack Stringers.
443	Woods Creek	21-443	October	Replace Cap, Install Helper Pile.
300	Richardson Creek	21-300	November	Replace Timber Cap.
459	Swamp Creek	21-443	November	Replace Timber Walkway.

South Fork Stillaguamish Bridge 660 retrofit. The crew is attaching pressure-treated nailer planks to steel stringers for decking system replacement.

Bridge Construction 2002-2022



Emergency Preparedness Bridges

The county has developed a list of lifeline routes as part of its Emergency Preparedness Plan. There are 69 bridges located on the lifeline routes (see Appendix C, page 38). Many of these bridges are in flood prone or seismically vulnerable areas.

Flood prone bridges

The county has many roads and bridges located in flood zones. Due to the high frequency of flooding, the county also has a lot of experience responding to flood damage. The biggest concern for bridges is the washing away of soil at bridge pier foundations, which can create a potentially unstable situation. The washing away of soil is known as "scour."

Scour is often caused by the accumulation of flood debris at bridge piers. The flood debris reduces the waterway opening which results in higher water elevations, higher water velocities and potentially scour.

If the bridge's foundational elements are a possible scour risk, the bridge may be categorized as scour critical. If a bridge is determined to be scour critical, then a scour plan of action is developed. A plan of action outlines actions to be taken in the event scour damage is observed after a flood event.

Snohomish County also maintains a list of "Flood Watch" bridges shown in Appendix B (page 36). These are bridges that have historically had accumulations of debris or have been submerged by flood events. During and after flood events these bridges are monitored, and road closures are implemented as conditions warrant. The Flood Watch list is not limited to lifeline route bridges.

Seismic vulnerable bridges

An increased understanding of how bridges react to an earthquake has led to an effort to identify and protect seismically vulnerable bridges. The upper layer of soils along most county rivers is liquefiable, which means that in the event of an earthquake, the upper layer of soils will temporarily liquify. When the soils liquify, they cease to provide full support to bridge foundations located in the liquefiable zone.

All county bridges are in the zone of influence for the Seattle Fault Line and Cascadia Subduction Zone, and a few of them are also located in the Southern Whidbey Island Fault. Many bridge foundations are also located in liquefiable soils. Other factors affecting seismic vulnerability are types of construction, number of spans, levels of redundancy and geometric constraints.

Appendix C

The county bridges that are on lifeline routes are listed in Appendix C (page 38). The list is sorted first by priority route and second by road name. Each road name has a common background color.

Ebey Slough Bridge 3 built in 1976 on Home Acres Road is one of the county's Lifeline Route bridges. It is located in Everett in the Snohomish River valley 1.3 miles east of Lowell and the Snohomish River.

Sultan Bridge 94 on Mann Road and over the Skykomish River in Sultan was built in 1961. WSDOT maintenance crew members were hired by the county to break up some of the trapped wood debris at Pier 2.

Glossary of Bridge Terms

Abutment – a substructure supporting the end of a super-structure and, in general, retaining or supporting the bridge approach fill.

Approach span – the span or spans connecting the abutment with the main span or spans.

Beam – a linear structural member designed to span from one support to another.

Bent – a supporting unit of the beams of a span made up of one or more columns connected at their top-most ends by a cap.

Bracing – a system of tension or compression members connected to beams or columns. It transfers wind, impact, vibratory and dynamic stresses to the substructure, and gives rigidity throughout the complete assemblage.

Cap – the horizontally-oriented, top-most piece or member of a bent.

Cast-in-place (CIP) – concrete poured within form work on site to create a structural element in its final position.

Chord – in a truss, the upper-most and the lower-most longitudinal members, extending the full length of the truss.

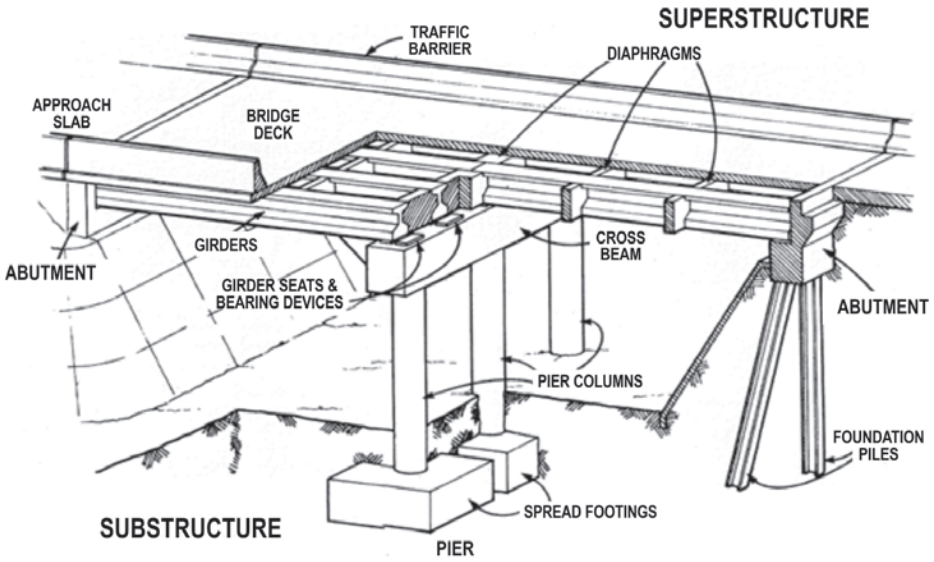
Column – a vertical structural member that transfers dead and live load from the bridge deck and girders to the footings or shafts.

Compression – a type of stress involving a pressing or squeezing together; tends to shorten a member; opposite of tension.

Culvert – a pipe or structure used for drainage under an embankment. A culvert with a diameter greater than 20 feet is included in the National Bridge Inventory.

Dead load – a static load due to the weight of the structure itself.

Basic Bridge Parts



Deck – the roadway portion of a bridge that provides direct support for vehicular and pedestrian traffic.

Diagonal – a sloping structural member of a truss or bracing system.

Elastomeric pads – rectangular pads made of neoprene, found between the sub-structure and superstructure that bear the entire weight of the superstructure. Elastomeric pads can deform to allow for thermal movements of the superstructure.

End wall – the wall located directly under each end of a bridge that holds back approach roadway fills. The end wall is part of the abutment.

Expansion joint – a joint designed to provide means for expansion and contraction movements produced by temperature changes, load, or other forces.

Fatigue – cause of structural deficiencies, usually due to repetitive loading alternating between tension and compression over time.

Footing – the enlarged, lower portion of a concrete sub-structure that distributes structure load to the earth.

Fracture critical member – a member in tension or with a tension element whose failure would probably cause a portion of, or the entire bridge, to collapse.

Functionally Obsolete – a status used to describe a bridge that is no longer by design functionally adequate for its task. Reasons for this status include that the bridge doesn't have enough lanes to accommodate the traffic flow or it may not have space for emergency shoulders. Functionally obsolete does not communicate anything of a structural nature. A functionally obsolete bridge may be perfectly safe and structurally sound, but may be the source of traffic jams or may not have enough clearance to allow an oversized vehicle.

Girder – a main support member for the structure that usually receives loads from floor beams and stringers.

Hanger – a tension member serving to suspend an attached member.

Hinge – a point in a structure at which a member is free to rotate.

Live load – vehicular traffic, wind, water, and/or earthquakes.

Lower chord – the bottom horizontal member of a truss.

Pier – a vertical structure comprised of concrete, steel, or wood that supports the spans of a multi-span superstructure between abutments. A pier is usually a solid structure as opposed to a bent, which is usually made up of columns.

Pile – a linear (vertical) member of timber, steel, concrete, or composite materials driven into the earth to carry structure loads into the soil.

Pile bent – a row of driven or placed piles with a pile cap to hold them in their correct positions; see "Bent."

Plate girder – a large, solid web steel plate with flange plates attached to the web plate by flange angles or fillet welds.

Post or column – a member resisting compressive stresses, in a vertical or near vertical position.

Scour – erosive action of removing streambed material around bridge substructure due to water flow. Scour is of particular concern during high-water events.

Short span bridge – these bridges have a single NBIS span length of 20 feet or less.

Spall – a deficiency wherein a portion of the concrete surface is popped off from the main structure due to the expansive forces of corroding steel rebar.

Span – the distance between piers or abutments.

Stringer – a longitudinal beam (less than 30 feet long) supporting the bridge deck, and in large bridges, framed into or upon the floor beams.

Structurally Deficient (SD) Status – a highway bridge is classified as structurally deficient if the deck, superstructure, substructure or culvert is rated in "poor" condition (0 to 4 on the NBI rating scale). A bridge can also be classified as structurally deficient if its load carrying capacity is significantly below current design standards or if a waterway below frequently overtops the bridge during floods.

Sufficiency rating – the sufficiency rating is a numeric value from 100 (a bridge in new condition) to 0 (a bridge incapable of carrying traffic). The sufficiency rating is the summation of four calculated values: Structural Adequacy and Safety, Serviceability and Functional Obsolescence, Essentiality for Public Use, and Special Reductions.

Substructure – the abutment, piers, or other structure built to support the span or spans of a bridge superstructure, and distributes all bridge loads to the ground. Includes abutments, piers, bents and foundations.

Superstructure – the entire portion of a bridge structure which primarily supports traffic loads and in turn transfers loads to the bridge substructure; usually consists of the deck and beams or trusses.

Tension – type of stress involving an action which pulls apart; opposite of compression.

Tie – a member carrying tension.

Torsion – a twisting force or action.

Trestle – a bridge structure consisting of beam spans supported upon bents. Trestles are usually made of timber and have numerous diagonal braces, both within each bent and from bent to bent.

Truss – a rigid, jointed structure made up of individual straight pieces arranged and connected, usually in a triangular pattern, so as to support longer spans.

Web – the portion of a beam located between and connected to the flanges.

Welded joint – a joint in which the assembled elements and members are united through fusion of metal.

Wing wall – walls connected to the abutment ends that support roadway fill of the approach.

Source of glossary and bridge parts diagram is unknown.

Appendix A

2022 Snohomish County Bridge Inventory | 205 Bridges

Bridge #	Bridge Name	Overall Length (ft)	Overall Width (ft)	# of Lanes	Traffic (ADT)	Detour (miles)	Suff. Rating	Functionally Obsolete	Year Built
1	Snohomish River	359	36	3	16,383	3	71	Y	1983
3	Ebey Slough	714	28	2	1,116	9	79		1976
4	Jim Donner Bridge	800	40	2	7,160	13	93		1985
5	Pilchuck River	213	34	2	773	8	99		1996
6	Woods Creek	82	40	2	10,281	4	93		2004
8	Culvert C8	23/21**	65	5	29,286	4	89		1960
10	Pilchuck River	138	39	2	4,458	13	92		1999
13	French Creek	116	40	2	4,129	13	95		2000
14	Culvert C14	21/21**	65	2	9,000	2	92		1995
15	Dubuque	284	40	2	4,682	7	98		1991
24	Pilchuck River	212	40	2	4,922	4	94		1992
41	High Bridge	426	34	2	2,317	13	95		1996
42	Jim Creek	113	44	2	1,651	26	96		2014
44	Machias-O.K. Mill Road	244	40	2	8,197	10	90		2005
48	Jackson Gulch	185	26	2	1,445	5	85		1968
52	Riley Slough	76	17	2	146	3	67	Y	1970
56	Silverton	275	16	1	18	none	81	Y	1989
58	Madden	138	24	2	1,076	12	69	(SD)	1956
62	Culvert C62	50	36	2	13,397	6	96		1986
66	Fairgrounds Entrance	51	21	2	3,540	5	98		1985
67	Pilchuck River	190	28	2	2,124	13	79		1978
70	Startup	227	28	2	302	none	87	Y	1993
80	Vos Creek	293	28	2	145	none	93		2008
87	Chappell	297	26	2	4,263	22	51	Y	1966
89	Oso Bridge	580	24	2	410	4	88		1990
92	Portage Creek	129	34	2	1,307	9	99		1990
94	Sultan	469	26	2	1,793	18	64	Y	1961
96	Skykomish River Slough	90	21	2	1,852	18	54	Y	1970
101	Larson	302	26	2	3,883	12	72	Y	1963
102	Granite Falls	340	20	2	6,285	94	61	Y	1934
103	Thomle	255	28	2	5,524	5	59		1959
107	Deer Creek	37	16	2	117	14	80	Y	1978
108	Whiteman	161	24	2	306	none	81		1988
111	Halterman Spur	230	26	2	135	none	73		1980

SD = Structurally Deficient
** NBIS length (see diagram on page 36)

(chart continues on next page)

Appendix A (cont.) – 2022 Snohomish County Bridge Inventory

Bridge #	Bridge Name	Overall Length (ft)	Overall Width (ft)	# of Lanes	Traffic (ADT)	Detour (miles)	Suff. Rating	Functionally Obsolete	Year Built
115	Peterson	206	26	2	459	9	72		1963
122	Wes Smith Bridge	271	26	2	842	15	81		1999
134	"Pilchuck Creek - Old SR 9"	120	17	1	63	1	87	Y	1916
143	Haystack Creek	26	34	2	1,166	none	64		1991
148	South Slough	188	34	2	2,323	18	77		1984
150	Skykomish River Slough	92	34	2	2,263	18	91	Y	2006
151	Shinglebolt Slough	140	26	2	1,793	18	57	Y	1962
155	Riley Slough	207	32	2	1,136	3	98		2020
165	Chase Lake	455	30	2	4,386	1	68		1968
183	Cattle Pass	61	23	2	5,034	4	54	(SD)	1972
190	Cattle Pass	30	23	2	4,155	8	64	Y	1970
204	Robe-Menzel	211	28	2	2,473	12	82		1997
206	Robe-Menzel	117	27	2	2,828	12	77	Y	1997
214	Jordan Creek	107	21	2	1,145	26	31	(SD)	1981
246	Jorgenson Slough	61	25	2	5,697	8	61	Y	1967
265	Carpenter Creek	25	24	2	828	7	80		1964
267	Woods Creek	31	19	2	2,461	7	68	Y	1935
268	Little Pilchuck Creek	85	40	2	5,803	5	94		2005
272	Gregory Road	40	23	2	1,013	1	59		1961
298	Woods Creek	50	34	2	1,481	5	76		1991
299	Woods Creek	60	26	2	1,335	3	76		1968
301	Woods Creek	61	26	2	1,425	3	75		1968
304	6th Street	228	18	2	421	3	39	Y	1924
316	Fry Creek	30	18	2	135	4	77	Y	2003
404	Woods Creek	60	23	2	1,378	5	70	Y	1967
407	Pilchuck Creek	280	34	2	3,290	12	96		1996
414	Sauk River	472	34	2	801	none	82		2008
416	Crescent	277	28	2	1,754	22	75		1983
419	Quilceda Creek	907	48	4	16,620	4	75	Y	1988
420	Sturgeon Creek	432	48	3	16,436	24	74		1988
422	Roesiger	28	19	2	57	1	85		1985
423	Dubuque Creek	62	40	2	8,018	7	94		2005
424	Swede Heaven	308	34	2	986	none	85		1991

SD = Structurally Deficient

* = *Under construction*

(chart continues on next page)

Appendix A (cont.) – 2022 Snohomish County Bridge Inventory

Bridge #	Bridge Name	Overall Length (ft)	Overall Width (ft)	# of Lanes	Traffic (ADT)	Detour (miles)	Suff. Rating	Functionally Obsolete	Year Built
425	Dan Creek	95	28	2	574	none	75		1971
427	Woods Creek	165	40	2	3,232	7	97		1990
429	Elwell Creek	101	28	2	953	17	72		1973
430	Norman Slough	167	19	2	50	1	87		1979
433	Fisher Creek	129	21	2	163	4	56		1987
436	Scherrer Road	88	21	2	37	none	91		1985
438	Brooks Creek	57	26	2	72	none	91		1984
443	Woods Creek	81	17	2	51	none	71	Y	1989
445	Woods Creek	82	34	2	1,783	7	99		2007
446	Woods Creek	41	23	2	1,341	19	68	Y	1966
448	Carpenter Creek	41	11	1	15	none	71	Y	1984
449	Woods Creek	27	23	2	1,336	19	63	Y	1963
453	Little Pilchuck Creek	34	28	2	9,511	3	78	Y	2006
459	Swamp Creek	25	23	2	10,486	2	65	Y	1963
464	Grant Creek	83	30	2	348	none	70		1978
466	Swede Creek	31	24	2	529	none	72		1985
470	Backman Creek	44	33	2	812	94	83		1979
473	Turlo Creek	114	35	2	1,962	94	82		1995
474	Benson Creek	67	34	2	1,907	94	79		1995
479	Lewis Creek	30	22	2	186	none	74		1968
488	South Bitter Creek	52	22	2	132	none	82		1967
489	North Bitter Creek	51	23	2	132	none	83		1967
494	Trout Creek	120	19	2	128	none	49	Y	1966
496	Howard Creek	82	28	2	31	none	93		2017
497	Twentytwo Creek	31	26	2	1,380	94	71	Y	1952
499	N.F. Skykomish River	173	26	2	54	none	86		1970
500	Troublesome Creek	204	28	2	86	none	90		1973
502	Swamp Creek	55	30	2	3,514	4	81		1993
503	Swamp Creek	41	23	2	7,454	4	16	Y	1960
504	Swamp Creek	70	32	2	11,382	2	98		2016
505	Swamp Creek	40	26	2	4,739	5	71	Y	1968
509	Battle Creek	143	36	2	1,224	2	98		1989
510	Koch's Slough	52	21	2	77	none	76		1981
511	Segelson Creek	55	28	2	629	none	81		1981

SD = Structurally Deficient

(chart continues on next page)

Appendix A (cont.) – 2022 Snohomish County Bridge Inventory

Bridge #	Bridge Name	Overall Length (ft)	Overall Width (ft)	# of Lanes	Traffic (ADT)	Detour (miles)	Suff. Rating	Functionally Obsolete	Year Built
519	Ricci Creek	93	34	2	1,733	19	97		1994
520	Bear Creek	55	29	2	1,033	none	75		1993
521	Bear Creek	31	23	2	1,146	3	82	Y	1969
522	North Creek	31	23	2	579	none	62		1969
529	Olney Creek	86	28	2	174	none	93		1990
536	Wallace River	106	28	2	1,061	none	74		1970
537	Red Bridge	209	26	2	824	94	74		1954
538	S.F. Stillagaumish River	211	26	2	1,756	94	41	Y	1954
540	S.F. Sauk River	205	14	1	11	none	76		2015
542	Jim Creek	87	19	2	29	none	88		1987
544	Buck Creek	91	26	1	377	94	57		1960
545	Hjort Road	30	19	2	27	none	85		1985
546	Swamp Creek	92	33	2	3,021	3	97		2013
547	Black Creek	91	26	2	1,118	94	55		1952
550	Sexton Creek	23	23	2	15	none	76		1964
551	Perry Creek	61	26	2	444	94	47		1958
552	Bear Creek	41	53	4	7,573	3	81		1989
555	Grant Creek	48	26	2	31	none	88		1984
556	Coal Creek	70	26	2	686	94	62		1949
559	May Creek	103	28	2	416	7	98		2017
561	Purdy Creek	86	24	2	73	none	94		1980
562	Marten Creek	135	38	2	757	94	90		2011
564	Olney Creek	100	24	4	77	none	92		1991
567	Woods Creek	28	21	2	24	none	93		1985
572	May Creek	79	26	2	215	none	91		2009
574	Olney Creek	47	26	2	77	none	94		1991
576	Schweitzer Creek	31	26	2	1,025	94	54		1952
581	Pilchuck River	184	15	1	73	none	74		2016
587	Boardman Creek	91	26	2	824	94	59		1952
596	Jim Creek	101	22	2	22	none	92		1981
597	Marshland	54	36	2	9,049	5	94		1994
600	Swamp Creek	30	32	2	8,808	2	96		2009
601	Little Pilchuck Creek	43	18	2	289	none	72	Y	2006
602	Black Creek	25	21	2	657	none	65	Y	2002
605	Airport Road	32	73	6	21,004	2	77	Y	1967

SD = Structurally Deficient

(chart continues on next page)

Appendix A (cont.) – 2022 Snohomish County Bridge Inventory

Bridge #	Bridge Name	Overall Length (ft)	Overall Width (ft)	# of Lanes	Traffic (ADT)	Detour (miles)	Suff. Rating	Functionally Obsolete	Year Built
608	Woods Creek	31	23	2	529	10	84		1960
620	Wisconsin Creek	31	26	2	1,118	94	45	Y	1960
625	Bear Creek	31	28	2	4,650	3	68		1973
626	Pilchuck Creek	181	24	1	428	6	37	Y	1933
631	Mouse Creek	30	26	2	599	none	82		2006
632	Pilchuck Overflow	84	36	2	13,746	6	81		1948
633	Pilchuck River	230	28	2	13,700	6	71		1948
634	Swede Creek	25	24	2	167	none	85		1992
639	Deadwater Slough	206	44	2	1,427	10	99		1994
640	Lauck Road	113	34	2	5,481	6	96		1998
642	Thomas Creek	127	66	5	16,353	3	95		2000
643	Glengarry PRD 1	70	24	2	111	1	92		2003
644	Glengarry PRD 2	88	24	2	111	1	92		2003
645	Glengarry PRD 3	66	36	2	857	2	97		2003
647	Lewis Creek	40	22	2	186	none	76		2003
648	Lewis Creek	30	24	2	186	none	85		2005
649	North Meander	80	23	2	77	none	69		2005
650	Thomsen Slough	80	28	2	4,110	6	80		1919
651	Silvana	236	39	2	4,105	6	97		1998
653	Old Stillaguamish River	352	32	2	2,426	6	94		1979
654	Clear Creek	125	28	2	724	94	89		1960
655	Sauk River	169	28	2	650	94	88		1983
656	Dutch Creek	108	27	2	644	94	87		2003
657	Bob Lewis Creek	29	23	2	712	none	74		2004
659	Mt. Pilchuck Road	24	23	2	810	none	68		2007
660	S.F. Stillaguamish River	249	12	1	44	none	67		2009
670	Deer Creek	187	26	2	1,621	94	56		1949
671	Lidera Bridge	139	36	2	954	2	99		2015
674	Elliott Creek	28	25	2	2476	7	98		2013
675	Riener Bluff	53	31	2	50	none	91		2021
676	Kackman Creek	119	31	2	200	none	93		2021
677	Thompson Creek	23	8	5	11,759	1	72		2021
678	Haystack Creek	21	26	2	1,166	none	67		2021
679	Jim Creek Culvert	22	21	2	228	None	92		2022
800	Transfer Station	71	27	2	844	none	77		2002

SD = Structurally Deficient

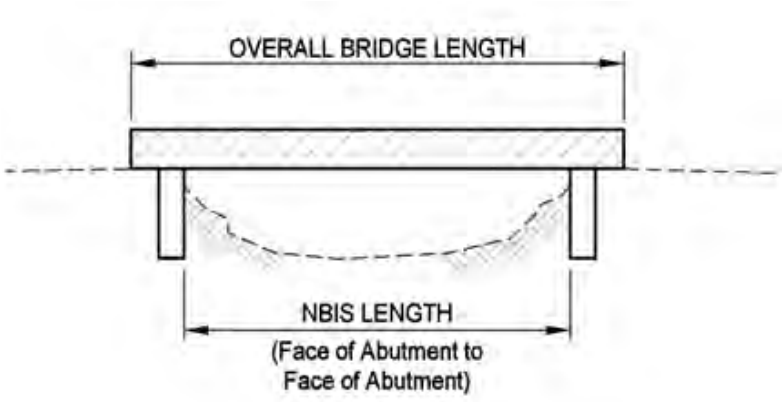
(chart continues on next page, showing short span bridges)

Appendix A (cont.) – 2022 Snohomish County Bridge Inventory - Short Span Bridges

Bridge #	Bridge Name	Overall Length (ft)	NBIS Length (ft)	Overall Width (ft)	# of Lanes	Traffic (ADT)	Detour (miles)	Suff. Rating	Year Built
81	Brown Creek	17	(N/A)	15	1	25	none	82	1951
116	Miller Road Cattle Pass	19	16	24	2	91	none	80	1963
158	Barr Creek	21	18	23	2	1,731	18	55	1956
271	Hyland Road	21	18	23	2	1,839	3	59	1957
300	Richardson Creek	21	18	23	2	6,911	3	58	1961
311	Portage Creek	21	18	23	2	1,501	2	57	1972
346	West Lake Goodwin	18	(N/A)	24	2	1,329	3	48	1944
366	Scriber Creek	21	17	23	2	1,191	2	59	1963
452	Little Pilchuck Creek	21	18	21	2	448	3	60	1970
454	Catherine Creek	19	16	22	2	1,484	6	59	1985
495	Lost Creek	16	(N/A)	22	2	31	none	90	1972
541	Brandstrom Road	20	17	21	2	312	5	59	1985
549	Woods Creek	21	19	19	2	134	none	61	1984
565	Everett Creek	12	(N/A)	21	2	129	4	72	1985
566	Green Creek	20	17	21	2	91	4	80	1984
569	Church Creek	20	17	22	2	118	3	72	1990
571	Little Pilchuck Creek	20	18	23	2	675	3	75	1961
578	Quilceda Creek	21	18	23	2	1,086	3	56	1967
579	Dutch Creek	18	(N/A)	21	2	97	4	86	1985
582	Quilceda Creek	20	17	21	2	12,657	3	42	1940
593	Green Creek	18	(N/A)	21	2	313	4	66	1985
594	Harvey Creek	20	18	20	2	65	3	70	1974

NBIS length only applies to bridges 19-23 feet long
N/A = not applicable because overall length is <19'

(chart of short span bridges continues on next page)



(Diagram source unknown)

Appendix A (cont.) – 2022 Snohomish County Bridge Inventory - Short Span Bridges

Bridge #	Bridge Name	Overall Length (ft)	NBIS Length (ft)	Overall Width (ft)	# of Lanes	Traffic (ADT)	Detour (miles)	Suff. Rating	Year Built
598	Merritt Creek	20	17	21	2	85	none	68	1935
603	Trout Creek	21	19	21	2	43	none	63	1984
604	Giles Road	20	17	21	2	91	none	82	1984
627	Lake Riley	18	(N/A)	16	1	32	none	59	1985
628	Star Creek	20	17	21	2	1,845	4	63	1984
629	Star Creek	21	18	21	2	145	4	66	1984
630	McGovern Creek	20	18	21	2	53	2	73	1985
636	Hogarty Creek	20	18	23	2	342	14	74	1997
652	Johnson Slough	20	20	39	2	4,100	6	66	1919
658	Little Beaver Creek	22	20	28	2	757	94	53	2007
672	Cranberry Creek	20	20	60	2	3,500	94	80	2016

NBIS length only applies to bridges 19-23 feet long
N/A = not applicable because overall length is <19'

(chart continues below, showing non-vehicle bridges)

Barr Creek Bridge 158 is a short span bridge on Ben Howard Road and built in 1956 in the Monroe area. It is functionally obsolete due to its narrow deck width and high ADT, which classifies it as a future replacement candidate.

Appendix A (cont.) – 2022 Snohomish County Bridge Inventory - Non-Vehicle Bridges

Bridge #	Bridge Name	Overall Length (ft)	Overall Width (ft)	# of Lanes	Traffic (ADT)	Detour (miles)	Suff. Rating	Year Built
242	Woodland	146	21	0	0	4	N/A	1984

N/A = not applicable because bridge is not open to vehicles

Appendix B

2022 Snohomish County Flood Watch Bridges (see explanation on page 24)

Bridge #	Bridge Name	Road Name	Equipment	Road Maint.	Plan of Action Engr. Services
1	Snohomish River	Avenue D	Crane	Yes	Yes
4	Jim Donner	Marine Drive	Crane	Yes	
6	Woods Creek	Old Owen Road		Yes	
10	Pilchuck River	Snohomish Mnro Road		Yes	
67	Pilchuck River	Robe Menzel Road		Yes	Yes
89	Oso Bridge	Oso Loop Road	Crane	Yes	
94	Sultan	311th Avenue SE	Crane	Yes	Yes
101	Larson	Larson Road		Yes	
111	Halterman Spur	Whitman Road		Yes	
155	Riley Slough	Tualco Road	Load Rating	Yes	
158	Barr Creek	Ben Howard Road		Yes	
268	Little Pilchuck Creek	28th Street NE		Yes	
271	Hyland Road	28th Street NE		Yes	
299	Woods Creek	Yeager Road		Yes	
300	Richardson Creek	Woods Creek Road		Yes	
301	Woods Creek	Yeager Road		Yes	
304	6th Street	86th Street SE			Yes
407	Pilchuck Creek	Stanwood Bryant		Yes	
414	Sauk River	Sauk Prairie Road		Yes	
416	Crescent Creek	High Bridge Road			Yes
429	Elwell Creek	Ben Howard Road		Yes	
443	Woods Creek	Van Ess Farm Road		Yes	
446	Woods Creek	Woods Creek Road		Yes	
448	Carpenter Creek	Sanders Road		Yes	
466	Swede Creek	Swede Heaven Road		Yes	
494	Trout Creek	Index-Galena Road	Load Rating	Yes	Yes
497	Twenty Two Creek	Mt. Loop Hwy		Yes	Yes
503	Swamp Creek	Locust Way			Yes
505	Swamp Creek	Lockwood Road			Yes
510	Koch's Slough	Hevly Road		Yes	
521	Bear Creek	58th Avenue SE		Yes	
522	North Creek	196th Street SE		Yes	
536	Wallace River	Ley Road		Yes	

(chart continues on next page)

Appendix B (cont.) – 2022 Snohomish County Flood Watch Bridges

Bridge #	Bridge Name	Road Name	Equipment	Road Maint.	Plan of Action Engr. Services
537	Red Bridge	Mt. Loop Hwy		Yes	Yes
538	Blue Bridge	Mt. Loop Hwy		Yes	
540	SF Sauk River	Mt. Loop Hwy			Yes
542	Jim Creek	Nicks Road		Yes	
544	Buck Creek	Mt. Loop Hwy			Yes
547	Black Creek	Mt. Loop Hwy		Yes	Yes
551	Perry Creek	Mt. Loop Hwy		Yes	
556	Coal Creek	Mt. Loop Hwy			Yes
564	Olney Creek	Sultan Basin Road		Yes	
572	May Creek	419th Avenue SE		Yes	
576	Schweitzer Creek	Mt. Loop Hwy			Yes
587	Boardman Creek	Mt. Loop Hwy		Yes	
625	Bear Creek	233rd Place SE		Yes	
626	Pilchuck Creek	Old Hwy 99		Yes	
633	Pilchuck River	92nd Street SE		Yes	
636	Hogarty Creek	Reiter Road		Yes	
642	Thomas Creek	Cathcart Way			Yes
648	Lewis Creek	Index-Galena Road			Yes
C14	Culvert	Admiralty Way		Yes	Yes

Jim Donner Bridge 4 with a log jam at one of the internal piers due to flood waters. The bridge was built over the Stillaguamish River on Marine Drive in 1985.

Appendix C

2022 Snohomish County Seismic Lifeline Route Bridges (see explanation on page 24)

Route Priority	Road Name	Bridge Number	Bridge Name	Structure Type	Bridge Length	Scour Critical
Priority 1						
1	Airport Road	605	Airport Rd	CIP concrete slab on CIP concrete pier walls	32	No
1	Airport Way	1	Snohomish R.	Steel thru truss, CIP deck precast concrete girders	359	Yes
1	Cathcart Way	642	Thomas Cr.	Prestressed girders w/ CIP conc. deck on abut. walls	127	Yes
1	Lowell-Larimer	183	Cattle Pass	Reinf. concrete tubs on timber pile abutments	61	No
1	Marine Drive	419	Quilceda Cr.	Prestressed concrete girders	906	No
1	Mt. Loop	102	Granite Falls .	Steel arch (truss) concrete deck	340	No
1	Old Hwy 99	626	Pilchuck Cr.	Steel girders w/ CIP deck 2 hinges in middle span	180	No
1	44th St. NE	272	Gregory Road	Multi-web concrete beams timber x-beams, timber piles	41	No
1	92nd St. SE	632	Pilch. O'flow	CIP slab w/ CIP X-beams on concrete pilings	84	No
1	92nd St. SE	633	Pilchuck R.	Reinforced concrete CIP beams, CIP concrete deck	229	No
1	164th St. SW	C8	Culvert C8	Double barrel concrete box culvert	23	No
1	180th St. SE	677	Thompson Sl.	Concrete pre-cast 4 sided box culvert	23	No
1	228th St. SE	552	Bear Creek	Precast concrete slab on concrete pier walls	40	No
1	311th Ave. SE	94	Sultan	Cont. welded plate girders w/ CIP deck, wall type piers	469	Yes
1	311th Ave. SE	96	Skykomish Sl.	Timber stringer, timber deck, timber pile bents	90	No
1	311th Ave. SE	148	South Slough	Prestressed Bulb T-girders, concrete abutments	188	No
1	311th Ave. SE	150	Skykomish Sl.	Prestressed Bulb T-girders, concrete abutments	91	No
1	311th Ave. SE	151	Shingle-Bolt	Glu-lam. Girders, CIP deck, timber piles w/ CIP caps	140	No

(chart continues on next page)

Appendix C (cont.) – 2022 Snohomish County Seismic Lifeline Route Bridges

Route Priority	Road Name	Bridge Number	Bridge Name	Structure Type	Bridge Length	Scour Critical
Priority 2						
2	Ben Howard	158	Barr Creek	Reinf. concrete tubs on timber pile abutments	21	No
2	Ben Howard	429	Elwell Cr.	Reinf. CIP girders double column piers	101	No
2	Carter Road	546	Swamp Cr.	Prestressed concrete bulb T- girders	92	No
2	Creswell Rd	265	Carpenter Cr.	Timber stringer on timber piles	24	No
2	Dubuque Rd	15	Dubuque	Prestressed concrete bulb T-girders	279	No
2	Dubuque Rd	267	Woods Cr.	Timber stringer, CIP concrete deck timber piles	31	No
2	Elliott Road	190	Cattle Pass	Reinf. concrete tubs on timber pile abutments	30	No
2	English Grade	433	Fisher Creek	Timber stringer	129	No
2	Jordan Road	42	Jim Creek	Prestressed concrete girders (old arch under)	112	No
2	Jordan Road	87	Chappell	Steel girders w/ CIP deck seismic retrofit.	297	No
2	Jordan Road	214	Jordan Creek	Timber trestle	107	No
2	Larch Way	459	Swamp Cr.	Multi-web concrete beams timber x-beams, timber piles	25	No
2	Lockwood	505	Swamp Cr.	PCC T-beams on timber pile abutment	40	No
2	Marine Drive	4	Jim Donner	Prestressed concrete girders	800	No
2	Marine Drive	103	Thomle	CIP reinforced concrete slab continuous	255	No
2	Marine Drive	246	Jorgenson Sl.	Precast T-beams on timber pile abutments	61	No
2	Marine Drive	420	Sturgeon Cr.	Prestressed concrete girders, concrete slab	432	No
2	Marsh Road	597	Marshland	Precast pre-stressed concrete slab on pier walls.	53	No
2	Menzel Lake	58	Madden	Steel girders w/ CIP deck, conc. girders at appr., 2 column piers	138	No
2	Norman Rd	115	Peterson	Prestressed concrete girders	206	No
2	Old Sno.-Monroe	13	French Cr.	Prestressed concrete bulb T-girders	116	No
2	Old Sno.-Monroe	10	Pilchuck R.	Prestressed concrete bulb T-girders	138	No

(chart continues on next page)

Appendix C (cont.) – 2022 Snohomish County Seismic Lifeline Route Bridges

Route Priority	Road Name	Bridge Number	Bridge Name	Structure Type	Bridge Length	Scour Critical
2	O.K. Mill Rd	44	Machias	Steel truss (thru), concrete deck	244	No
2	O.K. Mill Rd	423	Dubuque Cr.	Prestressed concrete bulb T-girders	62	No
2	Old Owen Rd	6	Woods Cr.	Decked bulb T-girders concrete abutment walls	82	No
2	Pioneer Hwy	650	Thomsen Sl.	Earth filled concrete arch w/precast concrete deck	80	No
2	Pioneer Hwy	651	Silvana	Prestressed girders post-tensioned CIP box girders	230	No
2	Pioneer Hwy	652	Johnson Sl.	Earth filled concrete arch	28	No
2	Pioneer Hwy	653	Old Stilly R.	Prestressed concrete girders	352	No
2	Reiter Road	107	Deer Creek	Steel girders embedded in conc. abutments, timber deck	37	No
2	Reiter Road	636	Hogarty Cr.	Recycled reinf. concrete tubs on timber pile abutments	20	No
2	Robe-Menzel	67	Pilchuck R.	Prestressed concrete girders, concrete deck	189	Yes
2	Robe-Menzel	204	Robe Menzel	Prestressed concrete bulb T-girders	211	No
2	Robe-Menzel	206	Robe Menzel	Prestressed concrete bulb T-girders	116	No
2	S. Machias	268	L. Pilchuck Cr.	Prestressed concrete bulb T-girders	85	No
2	Stanwood-Bryant	407	Pilchuck Cr.	Prestressed concrete girders	280	No
2	Three Lakes	24	Pilchuck R.	Continuous prestressed concrete girders w/ CIP deck	210	No
2	Woods Creek	300	Richardson Cr.	Reinf. concrete tubs on timber pile abutments	21	No
2	Woods Creek	298	Woods Creek	Prestressed concrete slabs on conc. pier walls	50	No
2	Woods Creek	446	Woods Creek	Reinforced concrete tubs on timber pile abutments	41	No
2	Woods Creek	449	Woods Creek	Reinforced concrete tubs on timber pile abutments	27	No
2	5th St - Index	122	Wes Smith	Steel tied arch w/ CIP deck, steel hangers/floor beams	271	No
2	84th St. NE	453	L. Pilchuck Cr.	Steel girders w/ composite precast deck panels	31	No
2	108th St. NE	640	Lauck Road	Prestressed concrete girder	112	No
2	140th St. NE	582	Quilceda Cr.	Timber stringer	20	No
2	212th St. NE	92	Portage Cr.	Prestressed concrete girders	129	No

(chart continues on next page)

Appendix C (cont.) – 2022 Snohomish County Seismic Lifeline Route Bridges

Route Priority	Road Name	Bridge Number	Bridge Name	Structure Type	Bridge Length	Scour Critical
Priority 3						
3	Crescent Lake	41	High Bridge	Post-tensioned box girders w/ CIP deck on wall piers	426	No
3	High Bridge	519	Ricci Creek	Prestressed concrete bulb T- girders	92	No
3	High Bridge	416	Crescent	Curved steel girders, CIP concrete deck, single column piers	272	No
3	Home Acres	3	Ebey Slough	CIP slab on prestressed concrete girders, concrete piles	714	No
3	Larson Road	101	Larson	Steel girders, CIP deck, one col. pier, eyebar hinge	304	No

Snohomish County Bridge Group

2022 Snohomish County Bridge Maintenance Crew:
Top row (left to right) - Roy Ristine, Bart Beduhn, John Williamson
Bottom row (left to right) - Loran Spear, Steve Short, Ray Bailey,
Dwight Kaestner, Chris Brunner

Snohomish County Bridge Engineering Design and Inspection Staff

- Giles Leonard
- Irving Trejo
- Kelly Kauk
- Larry Brewer
- Makhan Ranu
- Mario Accetturo
- Matthew Hwang
- Mike Zitkovich
- Nolan Anderson
- Tim Tipton
- Vladimir Malinsky

Snohomish County Bridge Maintenance Crew

- Bart Beduhn
- Chris Brunner
- Dwight Kaestner
- John Williamson
- Loran Spear
- Ray Bailey
- Roy Ristine
- Steve Short