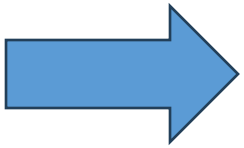
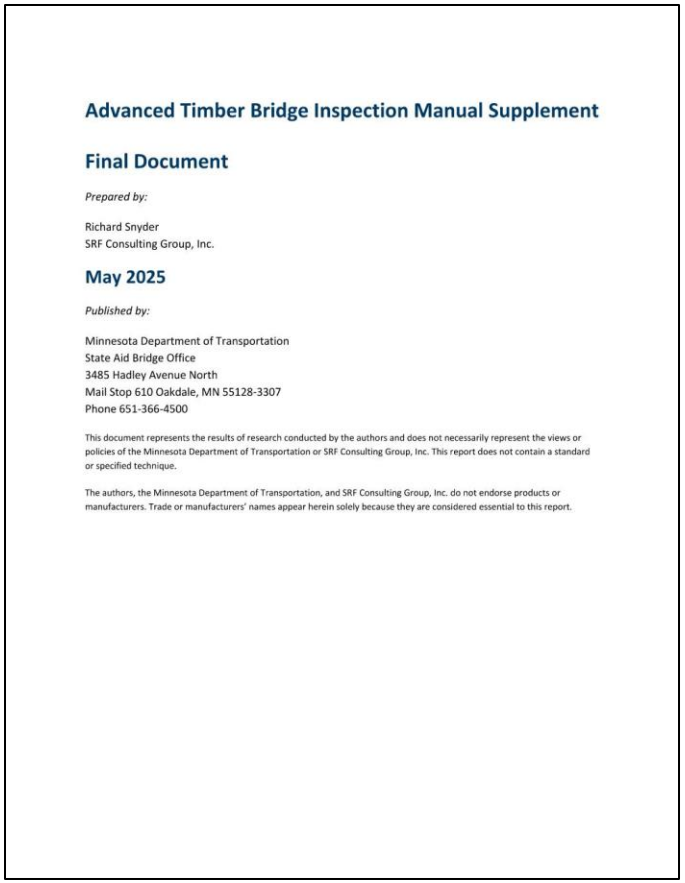
MnDOT State Aid Bridge

Advanced Timber Bridge Inspection Manual

SRF

Background





Advanced Timber Bridge Inspection Manual Supplement

Final Document

Prepared by:

Richard Snyder
SRF Consulting Group, Inc.

May 2025

Published by:

Minnesota Department of Transportation
State Aid Bridge Office
3485 Hadley Avenue North
Mail Stop 610 Oakdale, MN 55128-3307
Phone 651-366-4500

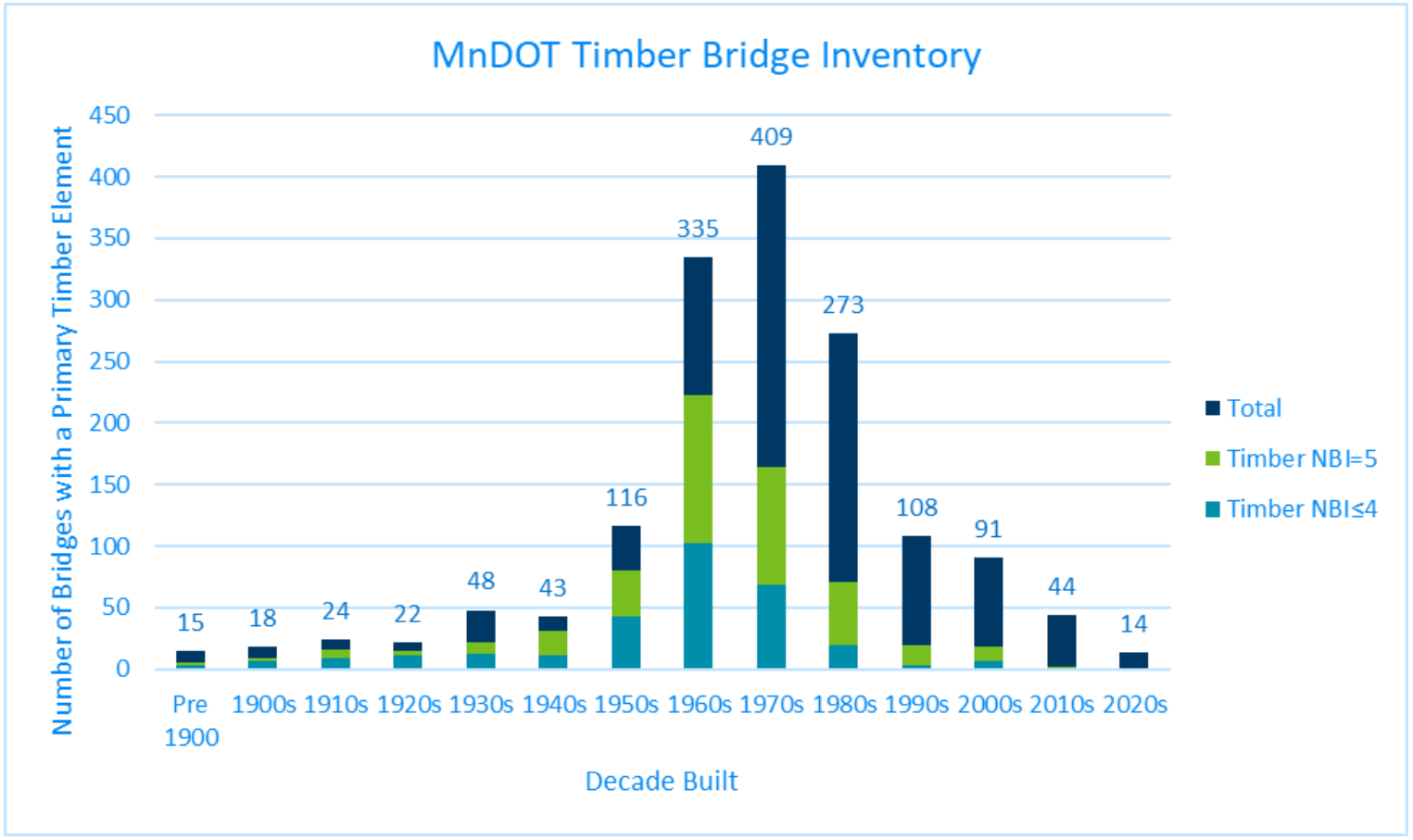
This document represents the results of research conducted by the authors and does not necessarily represent the views or policies of the Minnesota Department of Transportation or SRF Consulting Group, Inc. This report does not contain a standard or specified technique.

The authors, the Minnesota Department of Transportation, and SRF Consulting Group, Inc. do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to this report.

Manual Contents

- Advanced Timber Inspection Equipment
- Inspection Procedures
- Inspection Documentation
- Revisions to Structural Element Condition Ratings
- Timber Element Load Ratings

Background


MnDOT Timber Bridge Inventory
Number of Bridges with a Primary Timber Element
450
400
350
300
250
200
150
100
50
0
15
18
24
22
48
43
116
335
409
273
108
91
44
14
Pre 1900
1900s
1910s
1920s
1930s
1940s
1950s
1960s
1970s
1980s
1990s
2000s
2010s
2020s
Decade Built
Total
Timber NBI=5
Timber NBI≤4

Background

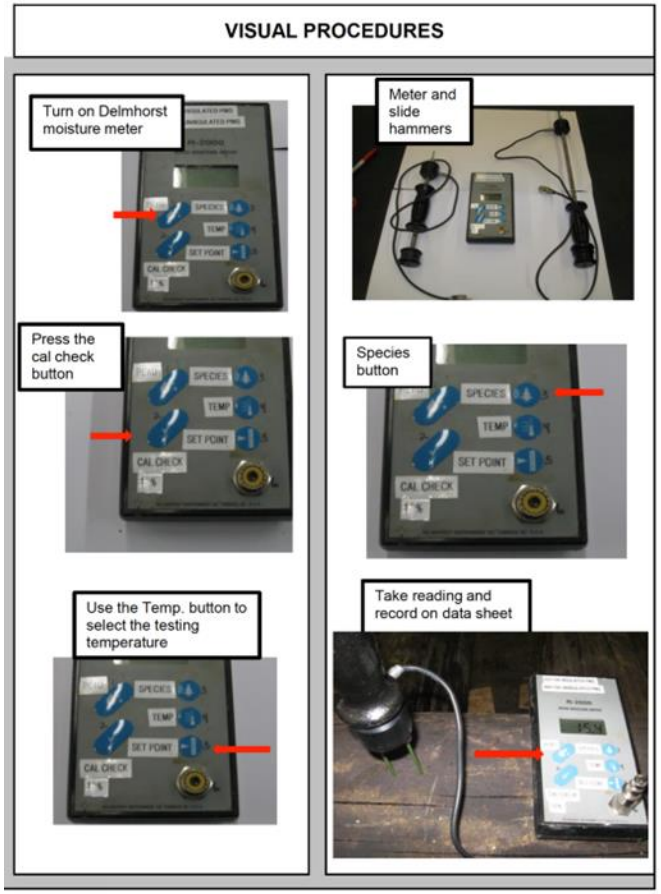
Timber Bridge Inspection Procedures

Substructure Condition	Recommended Advanced Timber Inspection Frequency
Structural Elements in CS1 and Substructure NBI ≥ 5	Perform advanced inspection on CS1 elements every 48-72 months.
Structural Elements in CS2 and Substructure NBI ≥ 5	Perform advanced inspection on CS2 elements every 48 months.
Structural Elements in CS3 and Substructure NBI ≥ 5	Perform advanced inspection on CS3 elements every 24 months.
Structural Elements in CS4 or Substructure NBI ≤ 4	Perform advanced inspection on CS4 elements or elements responsible for NBI rating every 12 months.

SRF

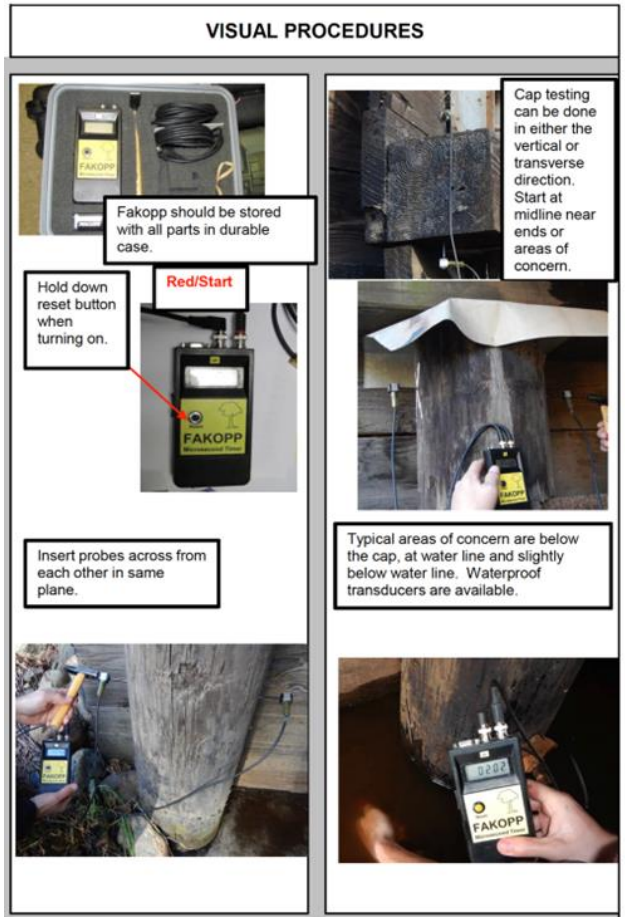
Timber Inspection Equipment

Moisture Meter



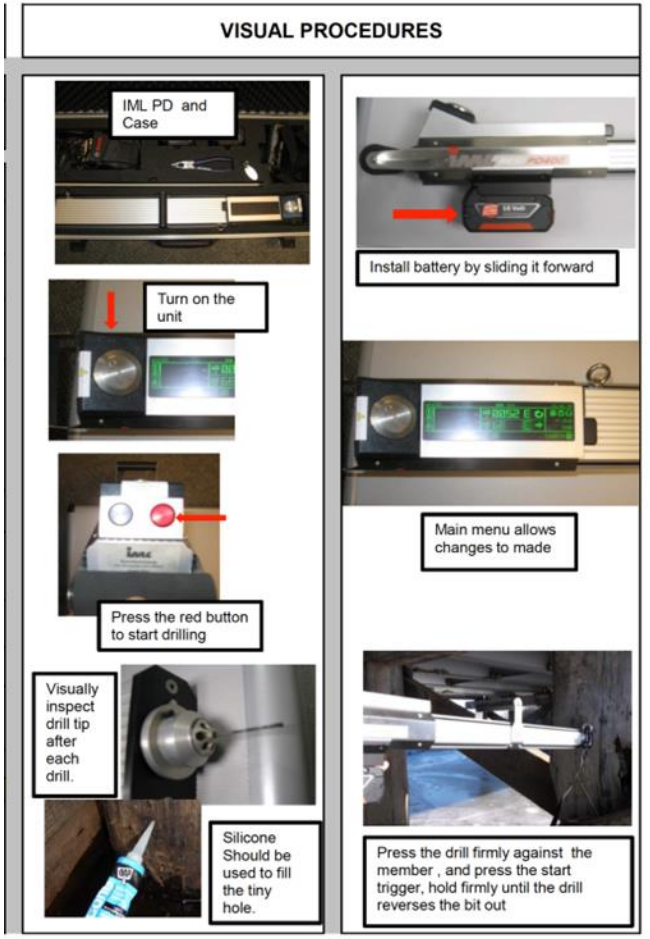
Timber Inspection Equipment

Stress Wave Timer



Timber Inspection Equipment

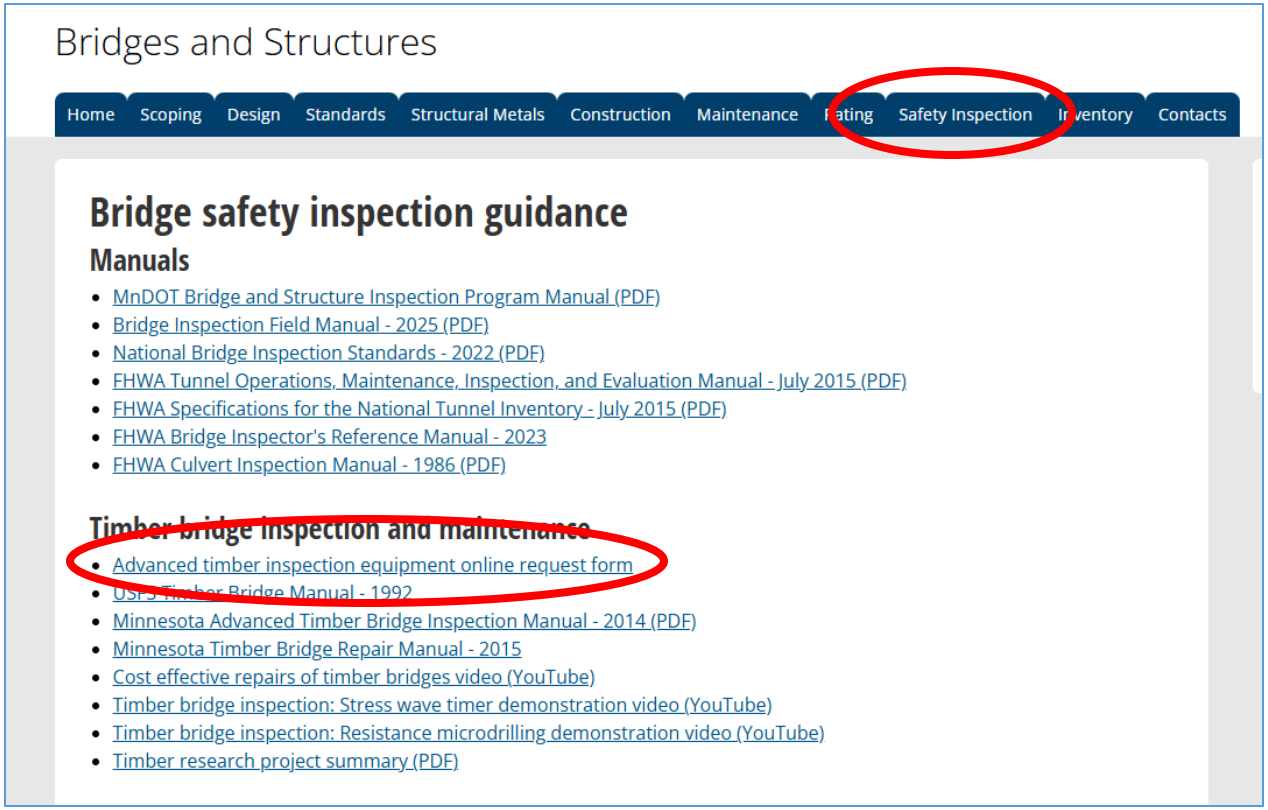
Timber Resistance Microdrill



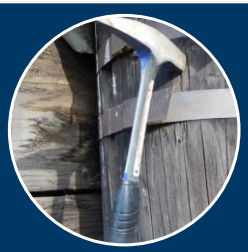
Timber Inspection Equipment

How to Request

https://mndotforms.formstack.com/forms/timber_bridge_inspection_equipment



Timber Bridge Inspection Procedures

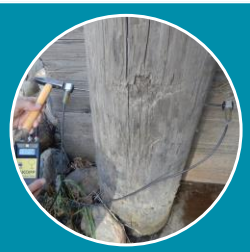


Establish naming convention

Measure geometry

Visual inspection, sounding & probing

Take Moisture meter readings at areas of high compression



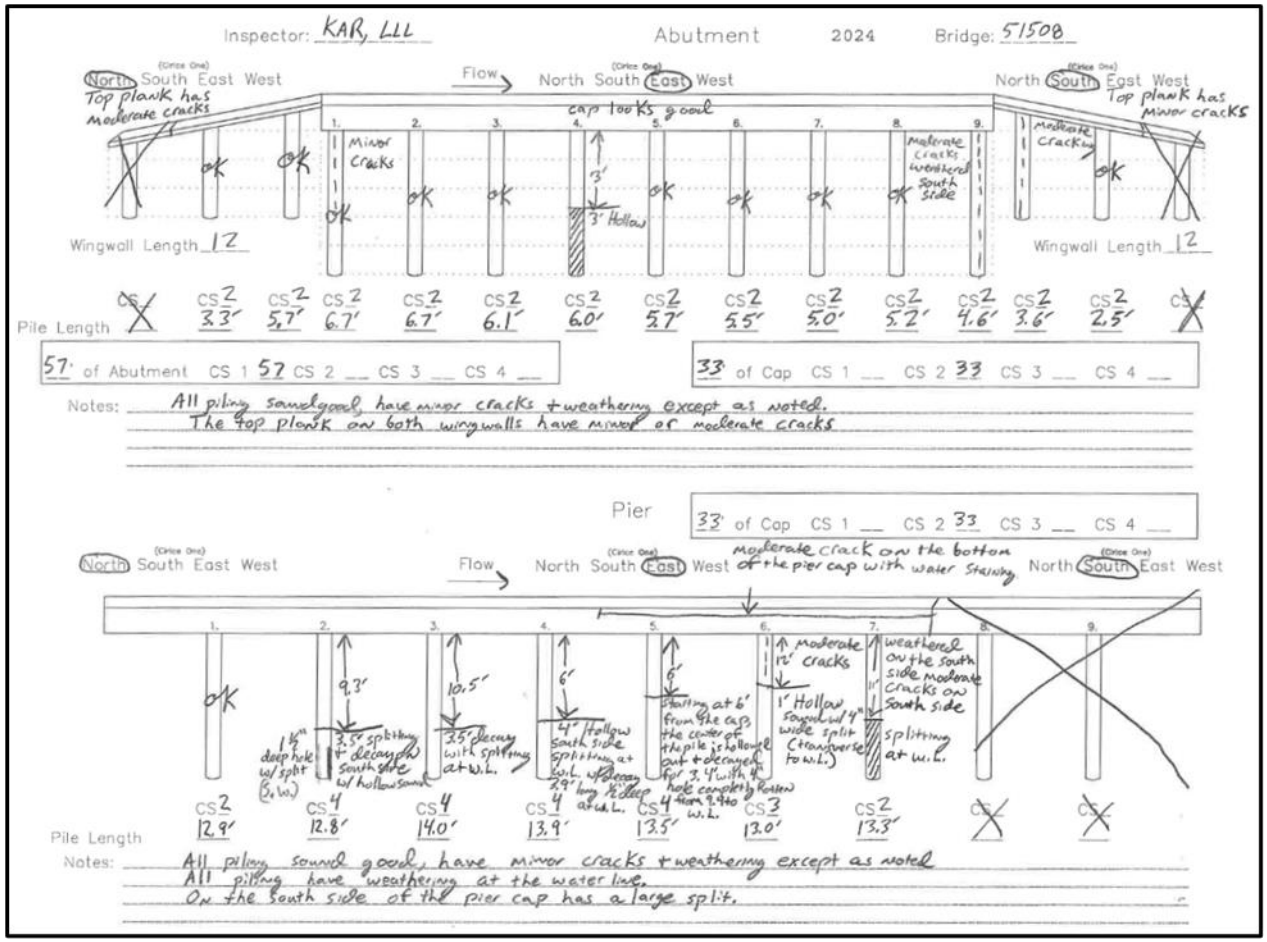
Perform stress wave timing at regular intervals along element

Perform timber resistance drilling at decayed areas indicated by stress wave timing/basic inspection

BASIC

ADVANCED

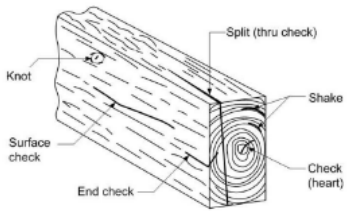
Timber Bridge Inspection Procedures



BSIPM Changes

Timber Deck & Slab Elements #31: Timber Deck (SF) #54: Timber Slab (SF)				
Defects	**Condition States**			
	1 **Good**	**2** **Fair**	**3** **Poor**	**4** **Severe**
Structural Review	Structural review is not required.	Structural review is not required.	Structural review is not required **or** structural review has determined that strength or serviceability has not been impacted.	Condition warrants structural review **or** structural review has determined that the defects impact strength or serviceability.
Repairs	No repairs are present.	Existing repair in sound condition.	Repairs are recommended **or** existing repair is deteriorated.	Immediate repairs are required (failures present or imminent).
Decay or Fire Damage	No evidence of decay (no section loss).	Less than 10% section loss. Staining. Soot (superficial charring).	10% to 20% section loss. Negative camber. Significant charring.	More than 20% section loss. Crushing or severe sagging. Severe charring.
Delamination (Glulam)	None	Minor	Significant	Severe
Weathering, or Abrasion	Minor surface deterioration (no section loss).	Section loss less than 10% of the member thickness.	Section loss 10% - 20% of the member thickness.	Section loss more than 20% of the member thickness.
Connection or Misalignment	Components are properly aligned and securely connected.	Loose fasteners or slight misalignment of components.	Fasteners broken or missing. Components loose or significantly misaligned.	Failed connections. Components severely misaligned or missing.
Shakes, Checks, or Splits	Less than 5% of the member thickness.	5% to 50% of the member thickness.	More than 50% of the thickness.	Severe split or fracture that impacts the stability or capacity of the deck/slab.

- **Shake:** A separation along the grain (between the growth rings). Usually forms within a standing tree or during felling.
- **Check:** A separation perpendicular to the grain (across the growth rings). Usually results from stress due to drying shrinkage.
- **Split (or Thru Check):** A check extending further through the timber member due to tearing apart of wood cells.



Reduced from 40%

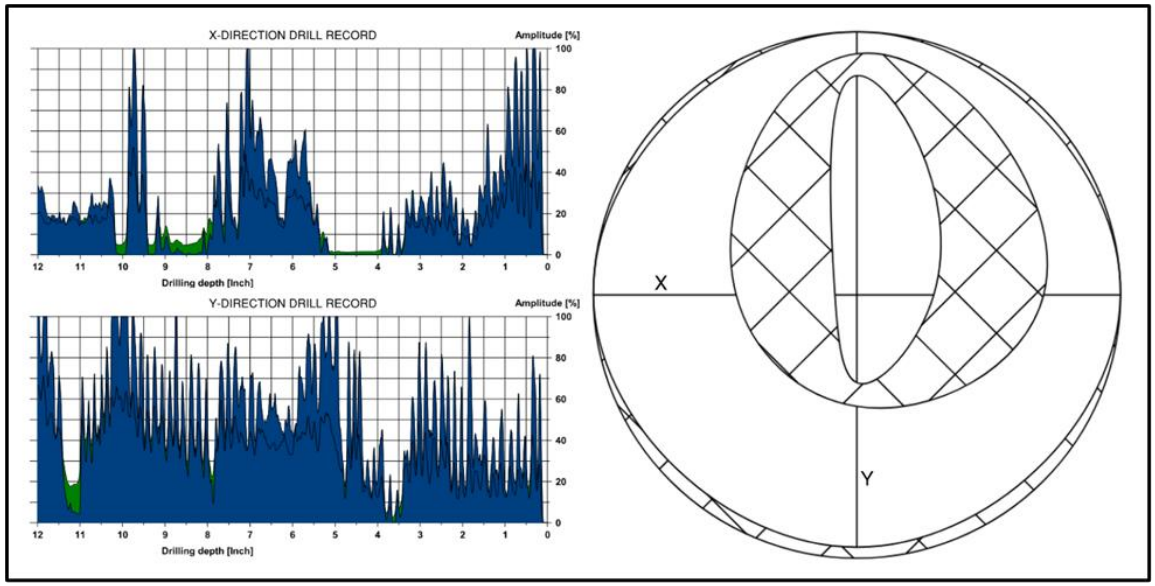
Added charring criteria and removed crushing and sagging from C3.

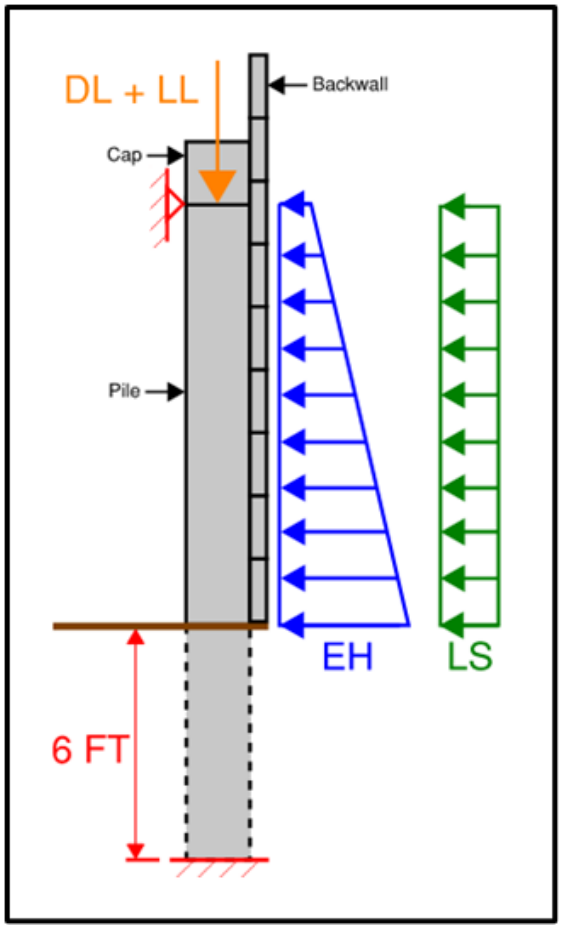
Reduced from 40%

Previously, "Split through entire member (or more than 25% of the member thickness in a tension zone)."

2025 edition removed references to "tension zone" for Shakes, Checks, or Splits criteria to avoid confusion in the field.

Load Ratings





MnDOT State Aid Bridge

Cast-In-Place Box Culvert Guidance Document

SRF

Background

COVID 19

+

Labor Shortage

+

Supplier Acquisitions

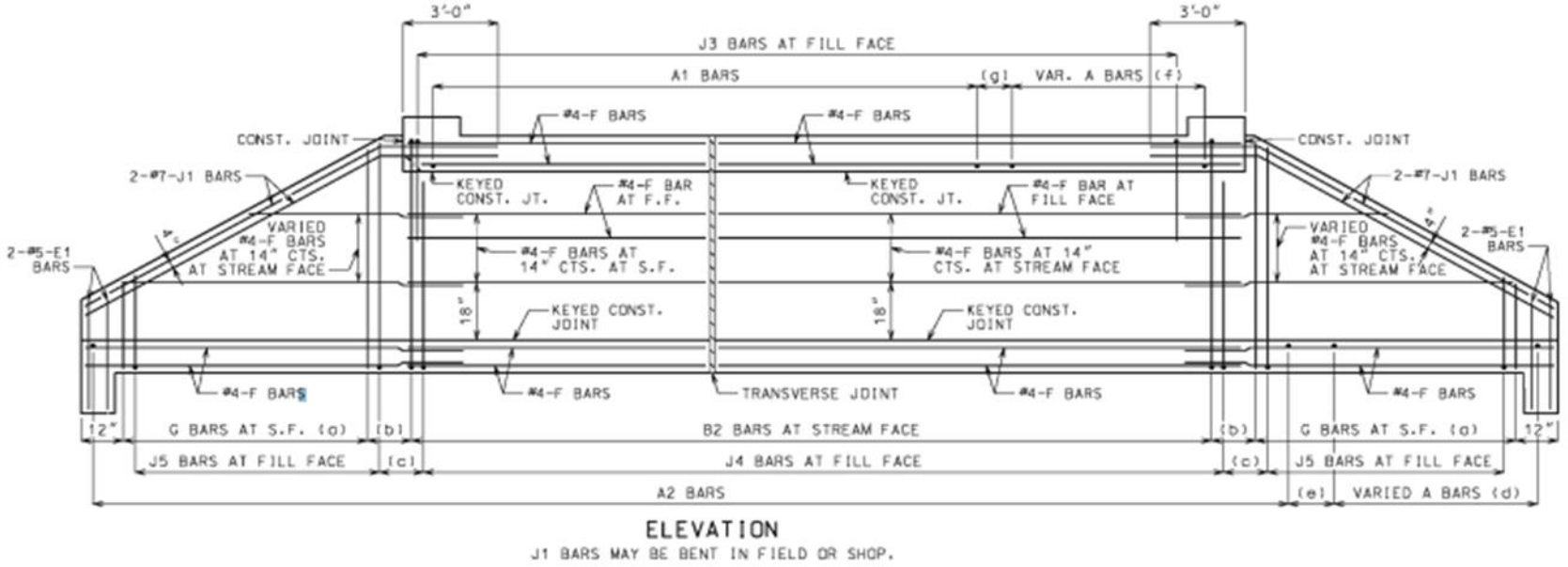
Document Contents

- CIP vs. Precast Boxes in MN
- MO Standard Box Culvert Plan Usage in MN

CIP vs. Precast Box Culverts

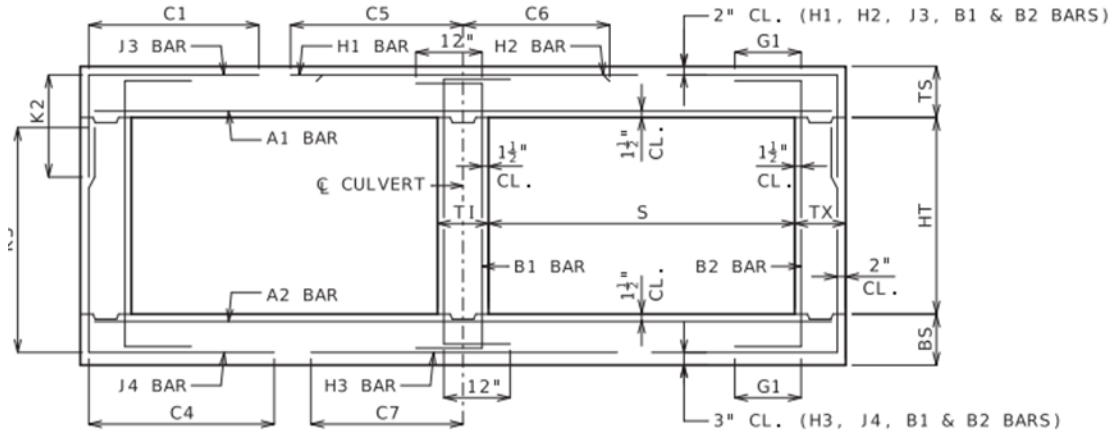
BARRIERS TO CIP USE	CIP BENEFITS
Construction Duration	Deep Fills
Lack of Standards	Shallow Fills
Limited In-State Expertise	High Settlement Areas
Increased Field Inspection Needs	Hard to Access Sites
	Curved/Kinked Alignments
	Placement on Bedrock
	High Skews
	Fewer Joints
	Increased Durability

MoDOT Standard Plan Usage in MN



ELEVATION

J1 BARS MAY BE BENT IN FIELD OR SHOP.



LRRB
LOCAL
ROAD RESEARCH
BOARD

MnDOT State Aid Bridge

Implements of Husbandry (IoH) Bridge Load Postings

SRF

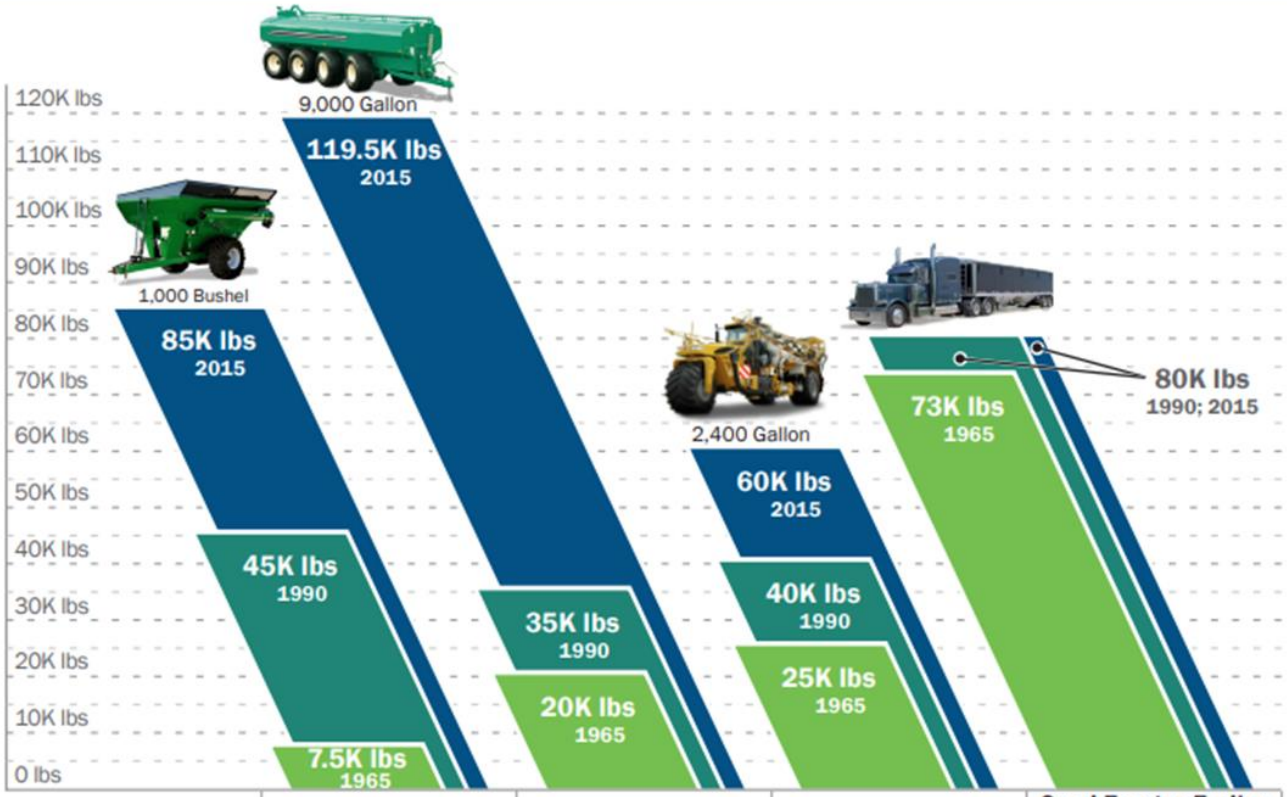
Background

How IOH Have Increased In Size Over Time

	Grain Cart	Liquid Manure	Terragator
1965	 125 Bushel	 1,200 Gallon	 1,500 Gallon
1990	 600 Bushel	 4,600 Gallon	 1,800 Gallon
2015	 1,000 Bushel	 9,000 Gallon	 2,400 Gallon

Background

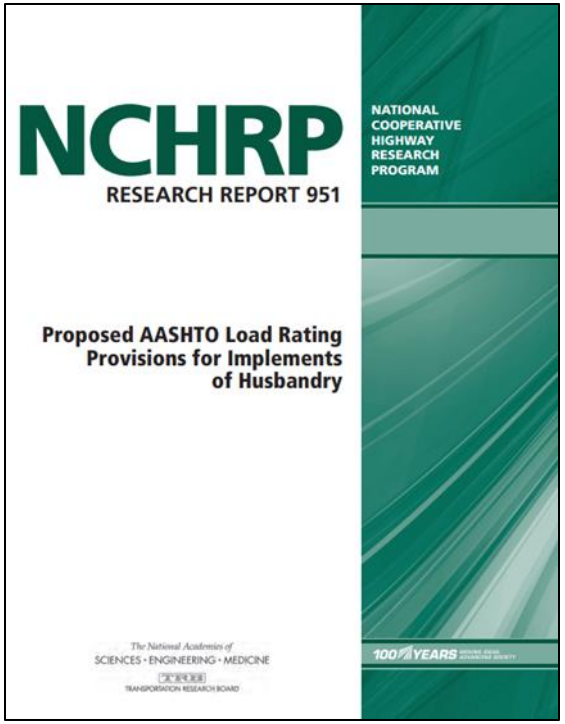
Average Fully-Loaded Gross Weights of Different IOH Over Time



	Grain Cart*	Liquid Manure*	Terragator	Semi Tractor Trailer (Legally Loaded)
1965	7,500 lbs	20,000 lbs	25,000 lbs	73,000 lbs
1990	45,000 lbs	35,000 lbs	40,000 lbs	80,000 lbs (on designated roads)
2015	85,000 lbs	119,500 lbs	60,000 lbs	80,000 lbs (on all roads)

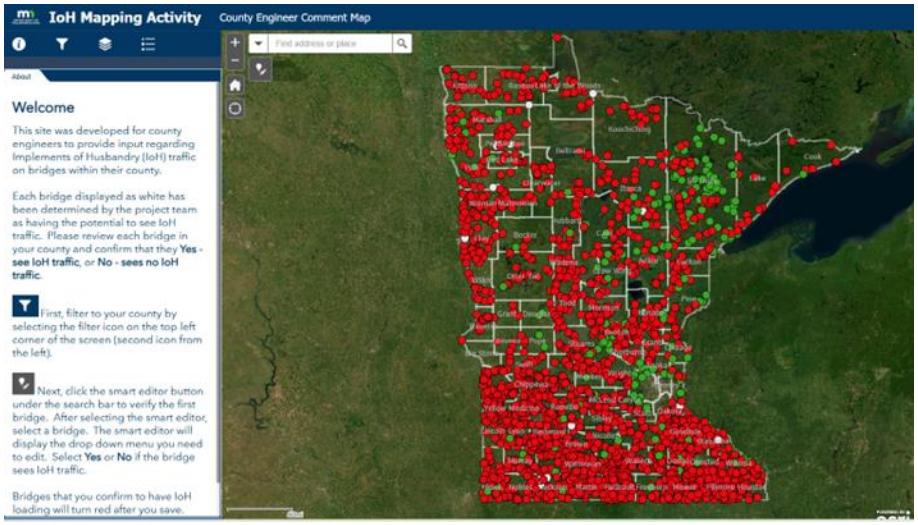
*These weights do not include the weight of the tractor that pulls them

Background



- NCHRP 951
  Proposed AASHTO Load Rating Provisions for Implements of Husbandry
- NCHRP 12-110-3 *(draft)*
  Guide Manual for Bridge Evaluation for IoH

IoH Load Rating Guide – Phase 1



IoH Tiers for Mapping tool:

- **Tier I** **Analogous to routine loads**
  (<20kip axle load)
- **Tier II** **Analogous to overweight permit loads**
  (>20 kip axle load)
- **Tier III** **Analogous to OSOW loads (super heavy, HUGE)**

Tier I is completed for Mapping tool

IoH Load Rating Guide – Phase 2

Balzer 1250 and 1500

Balzer 6350 Narrow

Better-Bilt 4950 and 6600

Houle 2 and 3 axle tank

J&M 1075-22

Kinze 1050 ROW and SOF

Survey is to identify what IoHs are used in your county

IoH Load Rating Guide – Phase 2

- Survey Process
- Sent via State Aid…June
- Asking you to identify:
  - What types of Tier II and III vehicles are used in your county
  - Affected Bridges
- May require some investigation
- Very Important to get your input