



MnDOT State Aid Bridge

# Advanced Timber Bridge Inspection Manual



# Background



**Advanced Timber  
Bridge Inspection**

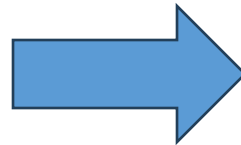
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Field Manual for Inspection of  
Minnesota Timber Bridges

**Natural Resources  
Research Institute**  
UNIVERSITY OF MINNESOTA DULUTH  
*Driven to Discover*

**IOWA STATE  
UNIVERSITY**    
*Forest Products  
Laboratory*  
*Research Working For You*



**Advanced Timber Bridge Inspection Manual Supplement**

**Final Document**

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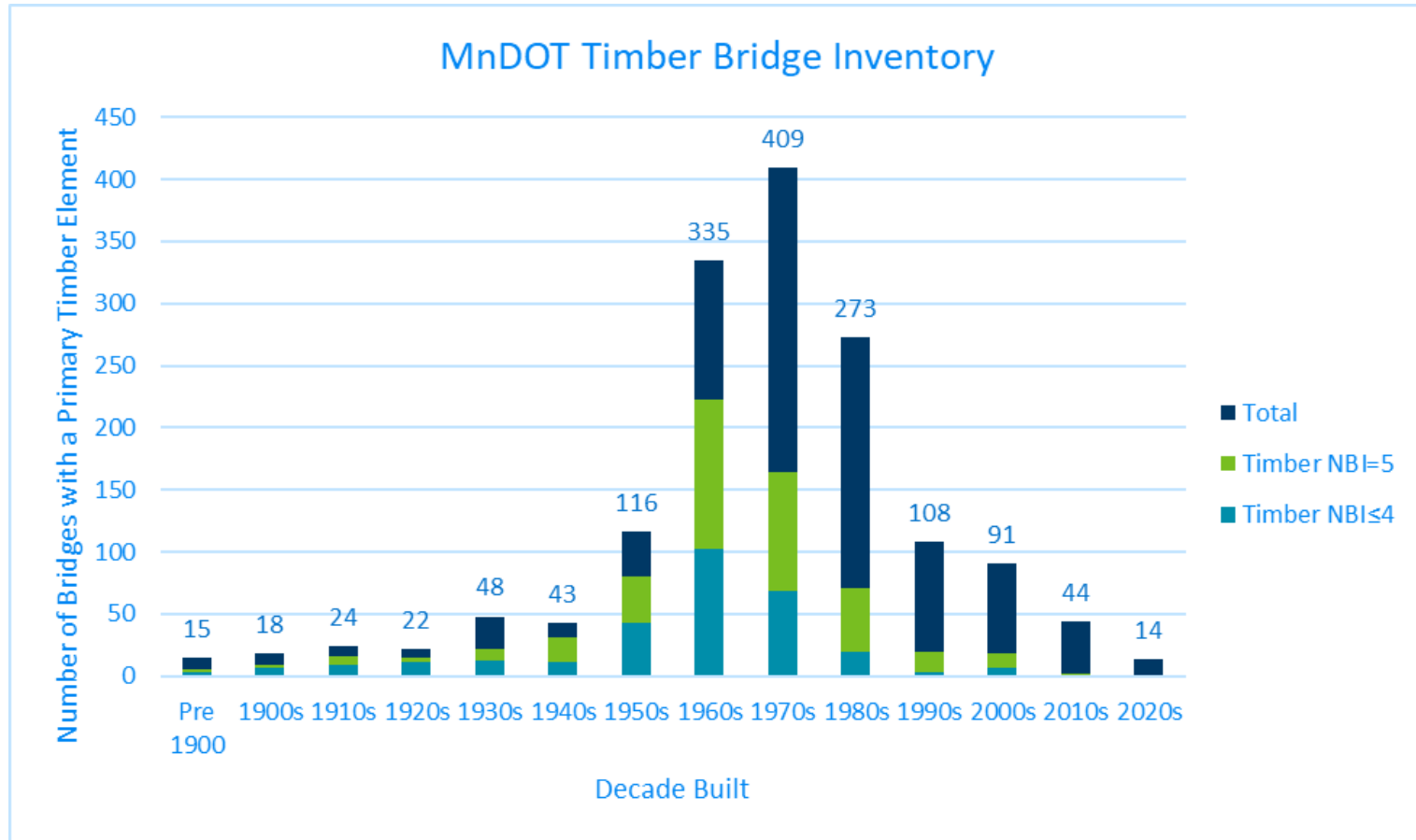
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# Manual Contents

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

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# Timber Bridge Inspection Procedures

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


# Timber Inspection Equipment

## Moisture Meter




**VISUAL PROCEDURES**


Turn on Delmhorst moisture meter




Press the cal check button



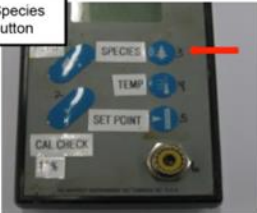
Use the Temp. button to select the testing temperature




Meter and slide hammers



Species button









Take reading and record on data sheet



# Timber Inspection Equipment

## Stress Wave Timer




VISUAL PROCEDURES	
 <p>Fakopp should be stored with all parts in durable case.</p>	 <p>Cap testing can be done in either the vertical or transverse direction. Start at midline near ends or areas of concern.</p>
 <p>Hold down reset button when turning on.</p> <p><b>Red/Start</b></p>	
 <p>Insert probes across from each other in same plane.</p>	 <p>Typical areas of concern are below the cap, at water line and slightly below water line. Waterproof transducers are available.</p>

# Timber Inspection Equipment


## Timber Resistance Microdrill




**VISUAL PROCEDURES**




IML PD and Case



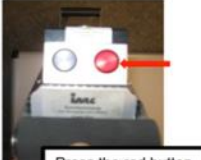
Install battery by sliding it forward




Turn on the unit




Main menu allows changes to made




Press the red button to start drilling



Visually inspect drill tip after each drill.



Silicone Should be used to fill the tiny hole.



Press the drill firmly against the member, and press the start trigger, hold firmly until the drill reverses the bit out

# Timber Inspection Equipment

## How to Request

[https://mndotforms.formstack.com/forms/timber\\_bridge\\_inspection\\_equipment](https://mndotforms.formstack.com/forms/timber_bridge_inspection_equipment)

Bridges and Structures

Home Scoping Design Standards Structural Metals Construction Maintenance **Rating** Safety Inspection Inventory Contacts

### Bridge safety inspection guidance

#### Manuals

- [MnDOT Bridge and Structure Inspection Program Manual \(PDF\)](#)
- [Bridge Inspection Field Manual - 2025 \(PDF\)](#)
- [National Bridge Inspection Standards - 2022 \(PDF\)](#)
- [FHWA Tunnel Operations, Maintenance, Inspection, and Evaluation Manual - July 2015 \(PDF\)](#)
- [FHWA Specifications for the National Tunnel Inventory - July 2015 \(PDF\)](#)
- [FHWA Bridge Inspector's Reference Manual - 2023](#)
- [FHWA Culvert Inspection Manual - 1986 \(PDF\)](#)

#### **Timber bridge inspection and maintenance**

- [Advanced timber inspection equipment online request form](#)
- [USFS Timber Bridge Manual - 1992](#)
- [Minnesota Advanced Timber Bridge Inspection Manual - 2014 \(PDF\)](#)
- [Minnesota Timber Bridge Repair Manual - 2015](#)
- [Cost effective repairs of timber bridges video \(YouTube\)](#)
- [Timber bridge inspection: Stress wave timer demonstration video \(YouTube\)](#)
- [Timber bridge inspection: Resistance microdrilling demonstration video \(YouTube\)](#)
- [Timber research project summary \(PDF\)](#)

# Timber Bridge Inspection Procedures



Establish naming convention  
Measure geometry  
Visual inspection, sounding & probing

BASIC



Take Moisture meter readings at areas of high compression



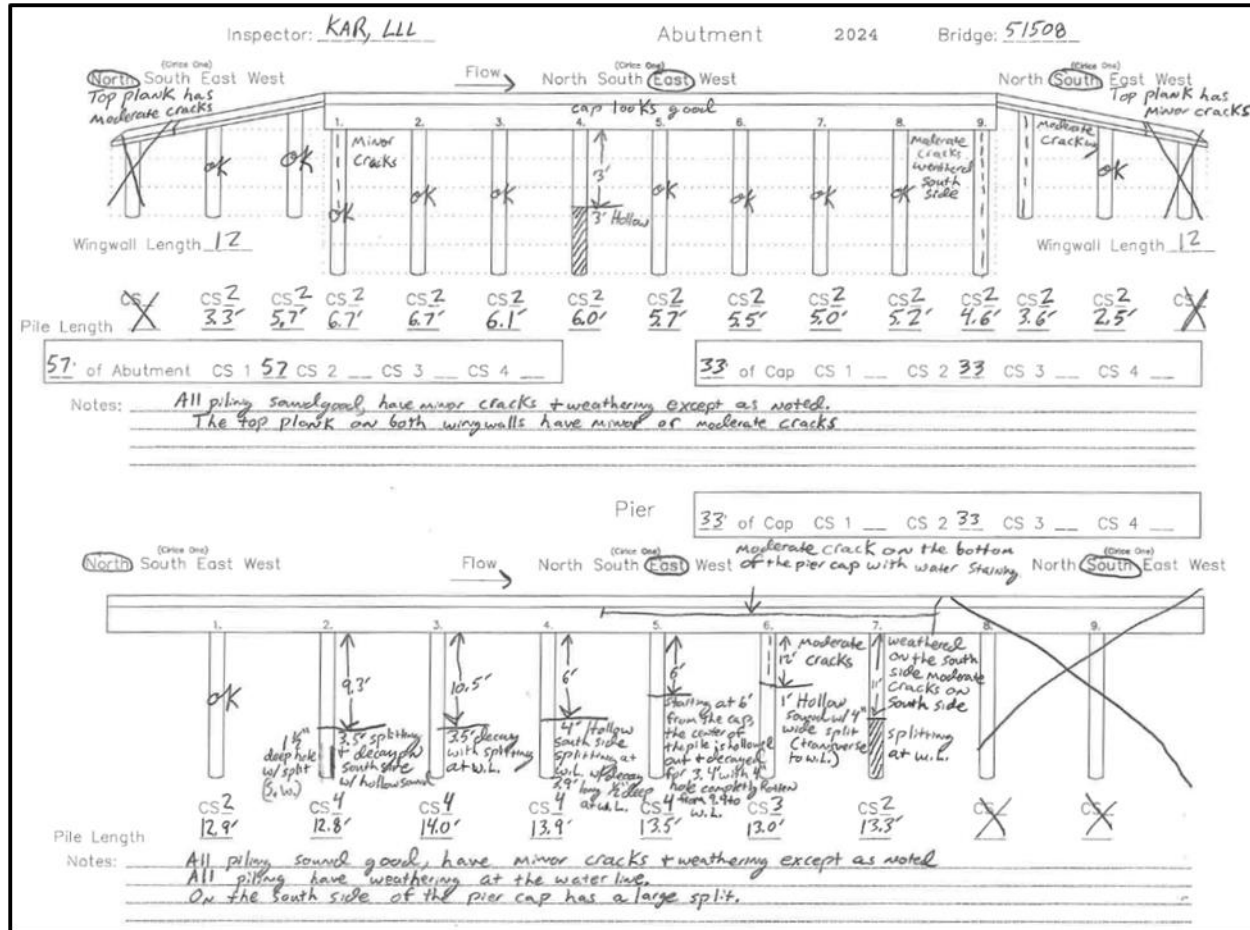
Perform stress wave timing at regular intervals along element



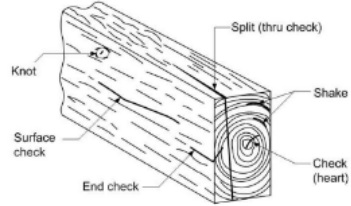
Perform timber resistance drilling at decayed areas indicated by stress wave timing/basic inspection

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
<b>Structural Review</b>	Structural review is not required.	Structural review is not required.	Structural review is not required <b>or</b> structural review has determined that strength or serviceability has not been impacted.	Condition warrants structural review <b>or</b> structural review has determined that the defects impact strength or serviceability.
<b>Repairs</b>	No repairs are present.	Existing repair in sound condition.	Repairs are recommended <b>or</b> existing repair is deteriorated.	Immediate repairs are required (failures present or imminent).
<b>Decay or Fire Damage</b>	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.
<b>Delamination (Glulam)</b>	None	Minor	Significant	Severe
<b>Weathering, or Abrasion</b>	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.
<b>Connection or Misalignment</b>	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.
<b>Shakes, Checks, or Splits</b>	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.
<ul style="list-style-type: none"> <li><b>Shake:</b> A separation along the grain (between the growth rings). Usually forms within a standing tree or during felling.</li> <li><b>Check:</b> A separation perpendicular to the grain (across the growth rings). Usually results from stress due to drying shrinkage.</li> <li><b>Split (or Thru Check):</b> A check extending further through the timber member due to tearing apart of wood cells.</li> </ul>				

Reduced from 40%

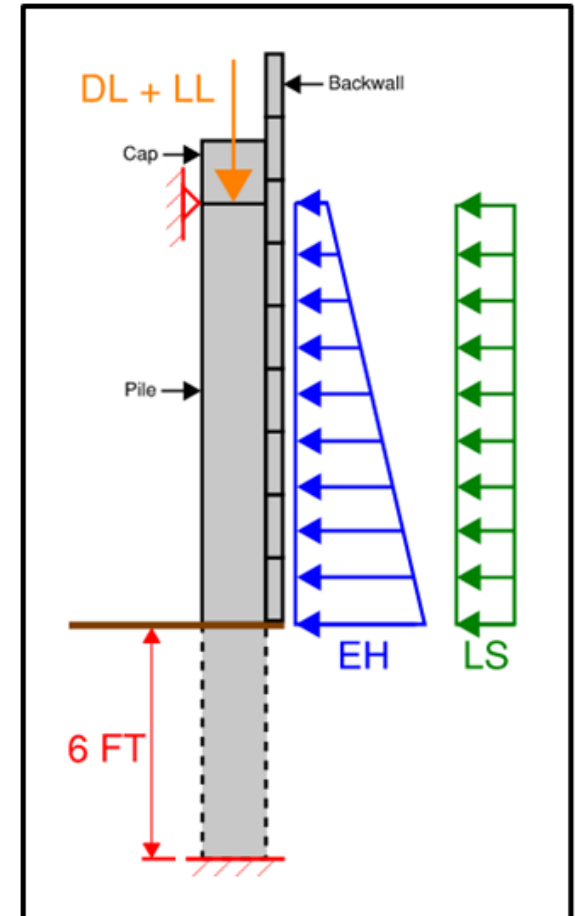
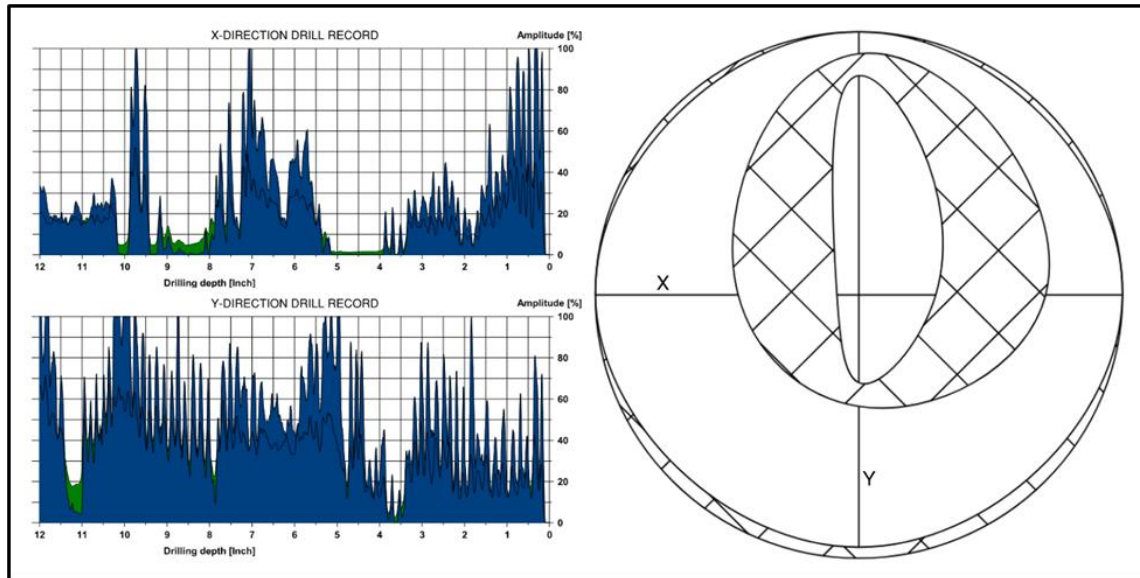
Added charring criteria and removed crushing and sagging from C3.

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

# Background

COVID 19

+

Labor Shortage

+

Supplier  
Acquisitions



# Document Contents

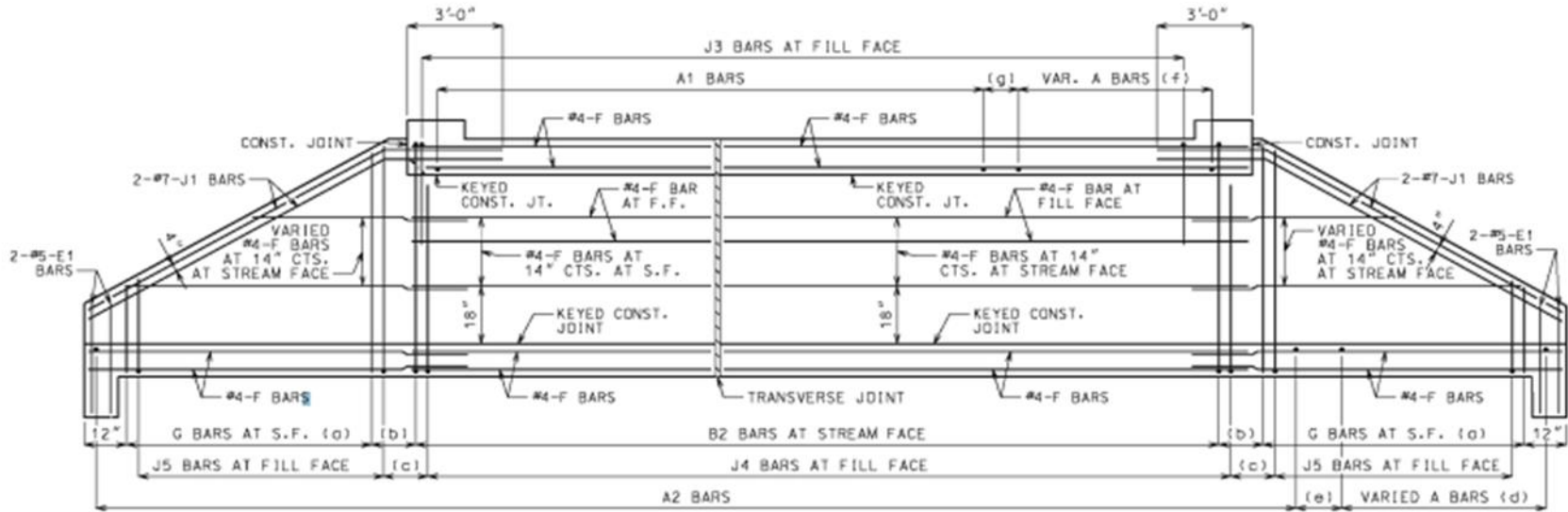


- CIP vs. Precast Boxes in MN
- MO Standard Box Culvert Plan Usage in MN

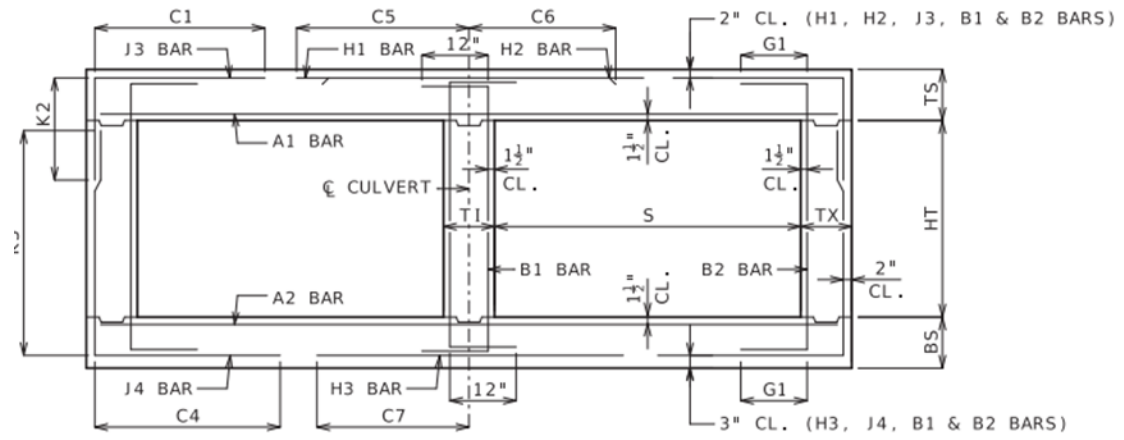
# CIP vs. Precast Box Culverts

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.





MnDOT State Aid Bridge

# Implements of Husbandry (IoH) Bridge Load Postings

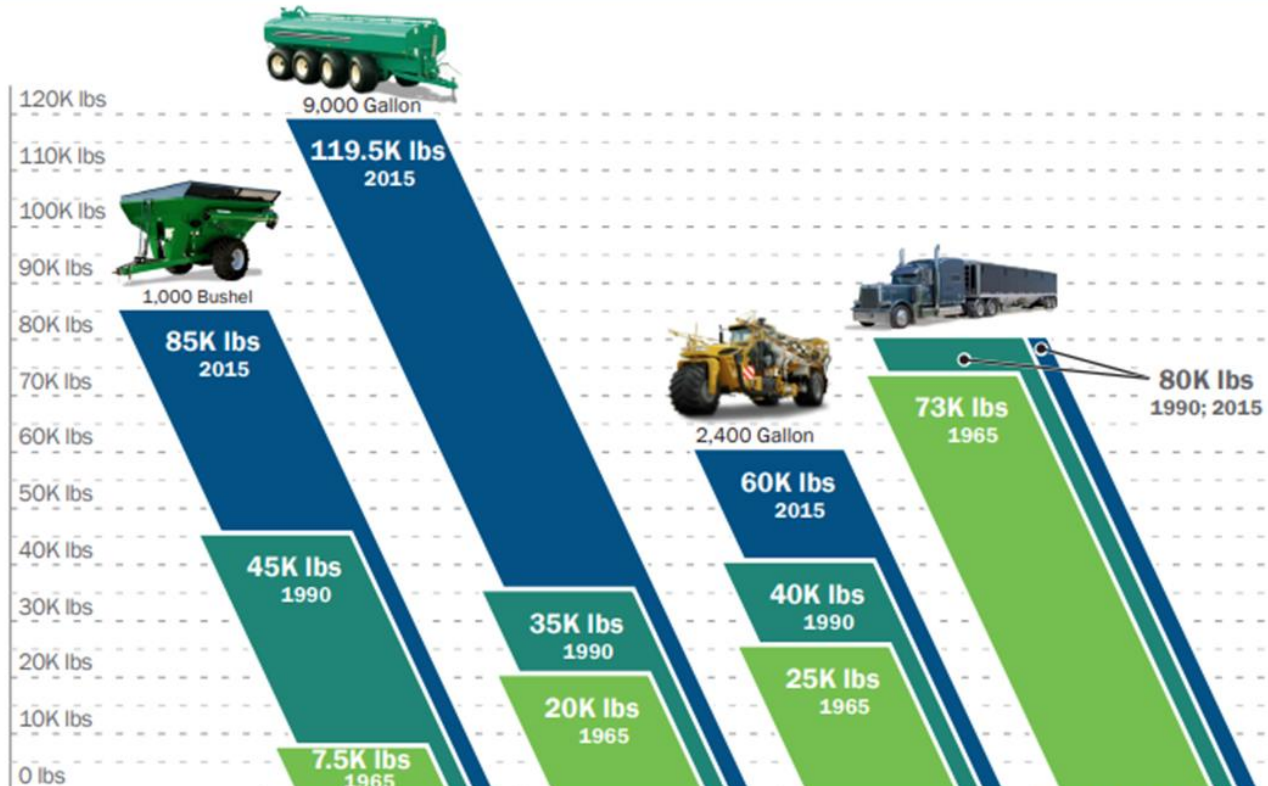
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## How IOH Have Increased In Size Over Time

	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

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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)

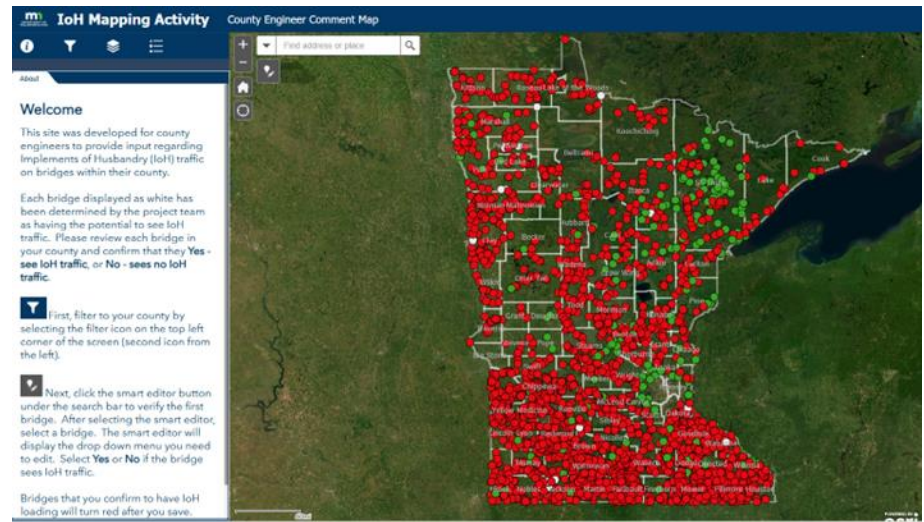
\*These weights do not include the weight of the tractor that pulls them

# 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

