Quarterly Progress Report #1

To the
New England Transportation Consortium (NETC)

Project 20211012000000000359

In-Service Performance Evaluation of New England Transportation Consortium (NETC) Steel Bridge Railings

Funds expended this quarter: $3,976.95
Funds expended total: $3,976.95

Percent of project completed: 3.3%

For period
January 20, 2021 to March 31, 2021
Submitted March 30, 2021

RoadSafe LLC

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Introduction

The predominate bridge rail and approach guardrail transition (AGT) systems used in New England include details for 2-bar, 3-bar, and 4-bar designs which were developed and tested under the auspices of the NETC. The tests were performed in compliance with the AASHTO Guide Specification for Bridge Railings Performance Level 2 (GSBR PL2) and/or NCHRP Report 350 (R350) test procedures. These bridge rail systems have been used in the New England states for more than 20 years. According to the Joint Agreement between AASHTO and FHWA, each state is required to specify MASH compliant bridge rails for new and full replacements on the National Highway System (NHS) with contract letting after December 31, 2019. In accordance with those requirements, a project was recently completed to evaluate the crash performance of the New England bridge rail systems under the MASH criteria using finite element analysis. The study concluded that the existing designs would meet the new crash testing standards, but also recommended minor design modifications to further improve performance. Establishing that these long-standing designs are performing well in the field would provide further confidence that the current, as well as the improved, designs adequately meet the higher performance criteria of MASH without further full-scale testing. While the in-service performance of the NETC bridge railing is believed to be good, an in-service performance evaluation (ISPE) has never been conducted.

The objective of this work is to determine the in-service performance of the NETC steel bridge railings and transition systems. The project was initiated on January 20, 2021. The work plan includes these tasks and the outlined accomplished and planned activities:

Task 1. Develop an inventory of NETC steel bridge railings

Coordinate with member states to obtain available data to develop an inventory of NETC steel bridge railings and the transitions to the bridge railing.

This task was initiated this quarter. Initial contacts for each member state were identified during the kick-off meeting on February 22, 2021. An email was sent to the contacts following the kick-off meeting to request the initial data dictionaries and begin the data mapping.

Attached to this QPR are data mapping plans for Maine (Attachment A01), New Hampshire (Attachment B01), Vermont (Attachment C01), and Rhode Island (Attachment D01). Each data mapping plan includes four sections, as follows:

1   Crash Data Mapping
2   Identifying Bridges with NETC Style Bridge Railings
3   Linking Crash Location and Applicable Bridge Rail Installations
4   Questions

Plans were not developed for Massachusetts and Connecticut. Discussions with the Connecticut representative have revealed that Connecticut does not use the NETC style bridge railing. We do not have a contact person for Massachusetts, however, we have searched the available information on the internet. It appears that Massachusetts also does not use the NETC style bridge railings. This should be verified.

This coming quarter, the research team plans to attend a meeting with the member states to discuss the data mapping, including section 4 labeled "questions." Following agreement from the member states on the data mapping, the research team will request the available data and extract the bridge railing and transition inventory from the available data. At the conclusion of

this task, the research team plans to prepare and email an electronic copy of the Microsoft Excel Workbook of Inventoried Bridge Railings.

Task 2. Assemble ISPE dataset

Collect crash data for five years (more if possible) and available traffic data for the NETC bridge railings identified in the inventory. Assemble into a single dataset following the NCHRP Project 22-33 Guidance Document specifications for ISPE datasets.

This task was initiated this quarter. This task is progressing in parallel with task 1 and is documented under Task 1. At the conclusion of this task, the research team plans to prepare and email an electronic copy of the Task 1 dataset augmented by the assembled crash and traffic data.

Task 3. Conduct ISPE

Analysis the dataset assembled to conduct an in-service performance evaluation of the NETC bridge railings and transitions.

This task has not been initiated. At the conclusion of this task, the research team plans to develop and submit a single ISPE report for each member state (i.e., six reports) and a collaborative report. The available data from Connecticut and Massachusetts indicates that the NETC steel railing are not used, which is anticipated to impact the ability to develop an ISPE report these two states. These two states could find useful the meta-analysis ISPE report which combines the findings of the New England states and implement the research in that way.

Task 4. Draft Final Deliverables

Submit the draft final deliverables which documents the results, summarizes the findings, and presents: (a) final report (b) an implementation plan, (c) a technology transfer strategy and toolbox, (d) PowerPoint presentation, (e) one-page fact sheet, (f) project poster, and (g) project closeout webinar.

This task has not been initiated.

Task 5. Final Deliverables

Address the comments received on the draft final deliverables and submit the final deliverables.

This task has not been initiated.

Task 6. 508 Compliance

*Adjust deliverables to be 508 compliant.*

This task has not been initiated.

Teleconferences
1. *Kick off meeting with TC*: A teleconference was held on February 22, 2021. A copy of the kick-off meeting slides is included here as Attachment E01. Initial contacts for each member state were identified to support the data collection and assemblage.

2. *Data attributes meeting with TC*: A teleconference is planned prior to commencing data assemblage to discuss the proposed list of attributes to be assembled under Tasks 1 and 2.
3. *Assembled data meeting with TC*: A teleconference is planned at the conclusion of Task 1 and 2 to discuss both the quantity and the quality of the data assembled and to permit a discussion of the preliminary recommendations of the appropriate analysis to be conducted.
4. *Preliminary results meeting with TC*: A teleconference to discuss the analysis and findings of Task 3 is planned to discuss the results for each bridge rail and transition studied. Preliminary discussions regarding the implementation plan are also anticipated to occur during this teleconference.
5. *Draft final deliverables meeting with TC*: A teleconference to discuss the draft final deliverables is planned to discuss the finalized ISPE results, the documentation of this project, the implementation of the results, and the technology transfer strategy and toolbox.
6. *Project closeout*: A project closeout meeting is planned to discuss any remaining questions and/or areas of interest. This meeting may take place after the project contract end date has passed.

Sincerely,
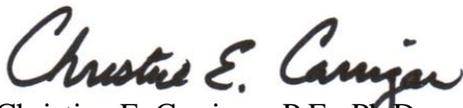
Christine E. Carrigan, P.E., Ph.D.

Attachment A01:	Maine Data Mapping
Attachment B01:	New Hampshire Data Mapping
Attachment C01:	Vermont Data Mapping
Attachment D01:	Rhode Island Data Mapping.
Attachment E01:	Slides from Kick-off Meeting

ATTACHMENT A

Task 1 and 2 Data Mapping: Maine DOT

Project 20211012000000000359

In-Service Performance Evaluation of New England Transportation Consortium (NETC) Steel Bridge Railings

March 2021

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MaineDOT Crash Data and Bridge Inventory Mapping for ISPE of NETC Bridge Rails

1 Crash Data Mapping

Column	Field	Source
A	SFUE	= "1" if one of the following codes appears in the Unit Section - **SEQUENCE OF EVENTS** '28' Bridge Pier or Support '29' Bridge Rail '35' Guardrail Face _And_ located on a bridge identified as having an NETC type bridge rail
B	CRN	Location Section - **REPORT NUMBER**
C	CRASH DATE	Location Section - **CRASH DATE**
D	TOTAL UNITS	Will have to be determined by looking at Location Section – **REPORT NUMBER** _and_ **Unit Section UNIT ID**.
E	MAX SEV	Person Section – **Injury Degree**; see equivalency table below.
F	VEH TYPE	Unit Section - **UNIT TYPE** _and_ Unit Section - **VEHICLE CONFIGURATION** (for SUT and TT); See equivalency table below.
G	SPEED LIMIT	Environment Section – **POSTED SPEED LIMIT**.
H	PostHE	Harmful event coded directly after SUFE (ignore '00' codes) Unit Section **- SEQUENCE OF EVENTS 1-4**, see equivalency table below.
I	MHE	Unit Section - **MOST HARMFUL EVENT** coded with '20' Bridge Pier or Support (from MaineDOT Reporting Manual "Support for a bridge structure including the ends (abutments).") '21' Bridge Rail '27' Guardrail Face Note: **MOST HARMFUL EVENT** codes are different than the codes used in **SEQUENCE OF EVENTS**.
J	FHE	If '28', '29', or '35' appears in the Unit Section - **SEQUENCE OF EVENTS** _and_ is only preceded by event codes listed in 00 row of PostHE table.
K	AHE	If '28', '29', or '35' appears anywhere in the Unit Section - **SEQUENCE OF EVENTS**.
L	FOHE	If '28', '29', or '35' appears in the Unit Section - **SEQUENCE OF EVENTS** _and_ is only preceded by and followed by event codes listed in 00 row of PostHE table.
M	BREACH	Will require reviewing crash narrative and/or photos. _Or_ we can make assumption if '3' Immersion follows '28', '29', or '35' in the Unit Section - **SEQUENCE OF EVENTS**.

N	BREAK	N/A
O	PRS	N/A
P	PEN	Will require reviewing crash narrative and/or photos.
Q	ICP	Will require reviewing crash narrative and/or photos. _Or_ we can assume of Unit Section – **MOST DAMAGED AREA** is equal to ICP.
R	NAME	Linking to Bridge Inventory to identify NETC 2-bar, 3-bar, 4-bar, 2-bar AGT, 3-bar AGT and 4-bar AGT
S	AADT	Not available in Crash Data, can be pulled from Assetwise Inspection Report – Age of Service Section.
T	INSTALL	
U	MAINT	

MAX_SEV	Crash data field code INJURY DEGREE	
K	'1'	(K) Fatal Injury
A	'2'	(A) Suspected Serious Injury
B	'3'	(B) Suspected Minor Injury
C	'4'	(C) Possible Injury
O	'5'	(O) No Apparent Injury
U	' '	Null

VEH_TYPE	Crash data field code UNIT TYPE	
MC	'11'	Motorcycle
	'12'	Moped
	'14'	Autocycle
PC	'1'	Passenger Car
PU	'2'	(Sport) Utility Vehicle
	'3'	Passenger Van
	'4'	Cargo Van (10k lbs or less)
	'5'	Pickup
SUT	'17'	Medium/Heavy Trucks (More than 10,000 lbs) _and_ **VEHICLE CONFIGURATION**
		'5' Single-Unit Truck (2 axles, 6 tires)
		'6' Single-Unit Truck (3 axles)
		'7' Single-Unit Truck (4 axles with rear tri-axle)
		'8' Single-Unit Truck (5 or more axles)
BUS	'7'	School Bus
	'8'	Transit Bus
	'9'	Motor Coach
TT	'17'	Medium/Heavy Trucks (More than 10,000 lbs) _and_ **VEHICLE CONFIGURATION**
		'10' Truck Tractor (without trailer, bobtail or saddle mount)
		'11' Tractor/Semi-Trailer (one trailer - 5 axles)
		'12' Tractor/Semi-Trailer (one trailer - 6 axles)
		'13' Tractor/Semi-Trailer (one trailer – All other axle configurations)
Other	'6'	Motor Home

	'10'	Other Bus
	'13'	Low Speed Vehicle
	'15'	Experimental
	'16'	Other Light Trucks (10,000 lbs or Less)
	'17'	Medium/Heavy Trucks (More than 10,000 lbs) *and*
		VEHICLE CONFIGURATION
		'9' Truck/Trailer(s) [Single-Unit Truck with Trailer(s)]
		'14' Tractor/Doubles (two trailers)
		'15' Tractor/Triples (three trailer)
		'99' Other Truck Greater than 10,000 lbs. (not listed above)
	'18'	ATV – (4 wheel)
	'19'	ATV – (3 wheel)
	'20'	ATV – (2 wheel)
	'21'	Snowmobile
	'22'	Pedestrian
	'23'	Bicyclist
	'24'	Witness
	'25'	Other
	'26'	Construction
	'27'	Farm Vehicle
99	' '	Null

PostHE	Crash data field codes for SEQUENCE OF EVENTS, fields 1-4.	
00	'6'	Equipment Failure (blown tire, brake failure, etc.)
	'7'	Separation of Units
	'8'	Went Off Roadway Right
	'9'	Went Off Roadway Left
	'10'	Cross Median
	'11'	Cross Centerline
	'12'	Downhill Runaway
	'14'	Reentering Roadway
	'49'	Pressure Ridge
	'50'	No Other Events
99	'47'	Unknown
	' '	Null
RFS	*Not used*	
RSS	*Not used*	
ROLL	'1'	Overturn / Rollover
TER	'31'	Culvert
	'33'	Ditch
	'34'	Embankment
VEH	'21'	Motor Vehicle in Transport
PED	'17'	Pedestrian
	'18'	Pedalcycle

FO	'28'	Bridge Pier or Support
	'39'	Tree
	'40'	Utility Pole/Light Support
	'42'	Traffic Signal Support
	'43'	Other Post, Pole, or Support
	'45'	Mailbox
	'46'	Other Fixed Object (wall, building, tunnel, etc.)
BA	'41'	Traffic Sign Support
BAR	'26'	Impact Attenuator/Crash Cushion
	'29'	Bridge Rail
	'30'	Cable Barrier
	'35'	Guardrail Face
	'36'	Guardrail End
	'37'	Concrete Traffic Barrier
	'38'	Other Traffic Barrier
CURB	'32'	Curb
OTR	'2'	Fire / Explosion
	'3'	Immersion
	'4'	Jackknife
	'5'	Cargo / Equipment Loss Or Shift
	'13'	Fell/Jumped From Motor Vehicle
	'15'	Thrown or Falling Object
	'16'	Other Non-Collision
	'19'	Railway Vehicle (train, engine)
	'20'	Animal
	'22'	Parked Motor Vehicle
	'23'	Struck by Falling, Shifting Cargo or Anything Set in Motion by a Motor Veh.
	'24'	Work Zone/Maintenance Equipment
	'25'	Other Non-Fixed Object
	'27'	Bridge Overhead Structure
	'44'	Fence
	'48'	Gate or Cable

2 Identifying Bridges with NETC Style Bridge Railings

Maine bridges are located on a map at this link:

AASHTOWARE BrM
(330) = **Metal Bridge Railing**
(330 Unit)   **Total Bridge Length** x 1 = rail only one side   **Total Bridge Length** x 2 = rail on both sides   **Total Bridge Length** x 4 = rail on both sides of each direction (divided road)
Assetwise Database/Inspection Reports
Bridge Components Section – Superstructure Sub-Section – **Left Side Rail** (Material, Shape, Attached To, Number of Bars)
Bridge Components Section – Superstructure Sub-Section – **Right Side Rail** (Material, Shape, Attached To, Number of Bars)
Geometric Data Section – **(50A) LEFT CURB SIDEWALK (ft)** → Width
Geometric Data Section – **(50B) RIGHT CURB SIDEWALK (ft)** → Width
Age of Service Section - **(29) AVERAGE DAILY TRAFFIC**
Age of Service Section - **(30) YEAR OF AVERAGE DAILY TRAFFIC**
Age of Service Section – **(109) AVERAGE DAILY TRUCK TRAFFIC**
Proposed Improvements Section – **(114) FUTURE ADT**
Proposed Improvements Section – **(115) YEAR OF FUTURE ADT**
Pictures Section
Classification Section – **(26) FUNCTIONAL CLASSIFICATION OF INVENTORY ROUTE**
Classification Section – **(104) HIGHWAY SYSTEM OF THE INVENTORY ROUTE**

1. Identify all bridges with element **330-Metal Bridge Railing** (Not 331-Reinforced concrete bridge railing, 332-Timber bridge railing, 333-Other bridge railing, or 334-Masonry bridge railing)
2. Review inspection report Bridge Components section, Superstructure sub-section for left and right side rail. Identify bridges where:
    a. Material = Steel
    b. Shape = Rectangular
    c. Attached To: Curb, Sidewalk, Deck
    d. Number of Bars: 2, 3 or 4.
    NOTE: This may be a manual review of only bridges with AASHTOWARE BrM Element 330.
3. Record Bridge #/Structure Number.
4. In the database keep only structures with NETC bridge railings as outlined in steps 1-3. The additional elements in the table above will likely be helpful.

3 Linking Crash Location and Applicable Bridge Rail Installations

Assetwise Database/Inspection Report	Crash Data		
	Location Section – **TYPE OF LOCATION** '7' Bridge		
Cover Page - **Town**	Location Section – **CITY OR TOWN**		
Cover Page & Page Header - **Facility Carried**	Automatically populate when the responding officer selects the CITY OR TOWN and uses MAP function	Location Section – **STREET OR HIGHWAY**
Identification Section – **(9) Location**		Location Section – **NEAREST INTERSECTING STREET**
		Location Section – **DIRECTION FROM NEAREST INTERSECTION**
		Location Section – **DISTANCE AND UNITS**
Location Map & Identification Section - **Latitude**		Location Section – **LATITUDE AND LONGITUDE**
Location Map & Identification Section - **Longitude**		
Cover Page – **Bridge #** Page Header – **Structure Number**		

4 Questions

1. Is there a database of inspection reports that we can have access to?
2. Is the information contained in the inspection reports available as a database (excel, etc…)
3. Is there a database that contains the information on the map viewer + links to reports/pictures?
4. Does crash data include:
   a. All crashes on <u>all roads</u> in the state?
   b. All crashes on <u>only state maintained</u> roads?
5. Does bridge inventory include:
   a. All bridges on <u>all roads</u> in the state?
   b. All bridges on <u>only state maintained</u> roads?
6. What bridge rails should we include in this ISPE (from MaineDOT Standard Details)?
   a. 2-Bar Traffic Railing - 507(04)
   b. 3-Bar Traffic/Bicycle Railing – 507(05)
   c. 4-Bar Traffic/Bicycle Railing - 507(06)
   d. 4-Bar Traffic/Pedestrian Railing - 507(07)
   e. Steel Approach Railing, 2-Bar – 507(16)
   f. Steel Approach Railing, 3-Bar – 507(20)
   g. Concrete Transition Barrier (2-Bar Traffic Railing) – 526(25)
   h. Concrete Transition Barrier (3-Bar Traffic/Bicycle Railing) – 526(28)
   i. Concrete Transition Barrier (4-Bar Traffic/Bicycle Railing) – 526(31)
   j. Concrete Transition Barrier (4-Bar Traffic/Pedestrian Railing) – 526(34)

ATTACHMENT B

Task 1 and 2 Data Mapping:
New Hampshire DOT

Project 20211012000000000359

In-Service Performance Evaluation of New England Transportation Consortium (NETC) Steel Bridge Railings

March 2021

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RoadSafe LLC

NHDOT Crash Data and Bridge Inventory Mapping for ISPE of NETC Bridge Rails

1 Crash Data Mapping

Column	Field	Source
A	SFUE	= "1" if '10' is coded in **TYPE OF ACCIDENT**, followed by '3' (Guard Rail), '9' (Bridge/Pier), or '11' (Barrier/Fence) in **FIXED OBJECT STRUCK** *And* be located on a bridge listed in the inventory as having a NETC type bridge rail or approach, or review of narrative and/or photos.
B	CRN	**CASE NUMBER**
C	CRASH DATE	**DATE OF ACCIDENT**
D	TOTAL UNITS	**TOTAL VEHICLES**
E	MAX SEV	**OCCUPANT CONDITION**, see equivalency table below.
F	VEH TYPE	**VEHICLE TYPE**, see equivalency table below.
G	SPEED LIMIT	**POSTED SPEED**
H	PostHE	No sequence of events not available in the NH Uniform Police Traffic Accident Report, will require reviewing the **GIST OF ACCIDENT** and/or photos.
I	MHE	N/A
J	FHE	Will require reviewing the **GIST OF ACCIDENT** and/or photos.
K	AHE	Must have '10' coded in **TYPE OF ACCIDENT**, followed by '3' (Guard Rail), '9' (Bridge/Pier), or '11' (Barrier/Fence) in **FIXED OBJECT STRUCK**
L	FOHE	Will require reviewing the **GIST OF ACCIDENT** and/or photos.
M	BREACH	Will require reviewing the **GIST OF ACCIDENT** and/or photos.
N	BREAK	N/A
O	PRS	N/A
P	PEN	Will require reviewing the **GIST OF ACCIDENT** and/or photos.
Q	ICP	Will require reviewing the **GIST OF ACCIDENT** and/or photos. *Or* we can assume of **DAMAGED AREA** is equal to ICP.

R	NAME	Linking to Bridge Inventory to identify NETC 2-bar, 3-bar, 4-bar, 2-bar AGT, 3-bar AGT and 4-bar AGT
S	AADT	Not available in Crash Data, can be pulled from AASHTOWARE BrM Inspection Report
T	INSTALL	
U	MAINT	

MAX_SEV	Crash data field code OCCUPANT CONDITION	
K	K	Fatal Injury
A	A	Suspected Serious Injury
B	B	Suspected Minor Injury
C	C	Possible Injury
O	O	No Apparent Injury
U	U	Unknown

VEH_TYPE	Crash data field code VEHICLE TYPE	
MC	8	Motorcycle
	9	Moped
PC	1	Automobile
PU	2	Pick-up/Light-Truck
	3	Panel Van
	11	Passenger Light Van
	12	Utility Vehicle (4X4)
SUT		
BUS		
TT		
Other	10	Motor Home
	98	Other
99	13	Other/Unknown Light Truck
	97	Motor Carrier

2 Identifying Bridges with NETC Style Bridge Railings

AASHTOWARE BrM
(330) = **Metal Bridge Railing**
(330 Unit)   **Total Bridge Length** x 1 = rail only one side   **Total Bridge Length** x 2 = rail on both sides   **Total Bridge Length** x 4 = rail on both sides of each direction (divided road)
Inspection Reports
Element Details section contains **Material Notes and Condition Notes** for Element 330. May indicate steel/aluminum, # of bars, etc…
R/L Curb/Sidewalk Width
Curb Reveal
Plan Location
AADT & **Year** and **Future AADT** & **Year**
PT
Latitude and Longitude
Route Carried

1. Identify all bridges with element **330-Metal Bridge Railing** (Not 331-Reinforced concrete bridge railing, 332-Timber bridge railing, 333-Other bridge railing, or 334-Masonry bridge railing)
2. Inspection reports Elements Details section under Material Notes and Condition Notes for Element 330 to determine if **=and("Steel",(or("2-bar", "3bar", "4-bar")))** This may require a manual review of inspection reports for only bridges with AASHTOWARE BrM Element 330.
3. Record NBI Structure Number and/or NHDOT Bridge ID.
4. In the database keep only structures with NETC bridge railings as outlined in steps 1-3. The additional elements in the table above will likely be helpful.

3 Linking Crash Location and Applicable Bridge Rail Installations

https://www.nh.gov/dot/org/projectdevelopment/bridgedesign/documents.htm Look under Maps (half way down page), click NH Bridges, launches Google Earth with all bridges (short and long structure) mapped.

AASHTOWARE BrM or Inspection Report	Crash Data
Latitude and **Longitude** mapped in Google Earth	Lat/Long not present on Uniform Crash Report Form.
Inspection report contains **Route Carried**	**ROUTE NO. AND/OR STREET NAME** on Uniform Crash Report Form.
Inspection report contains **NBI Structure Number**	
	DISTANCE from INTERSECTING ROAD, BRIDGE, TOWNLINE
	DISTANCE UNIT from INTERSECTING ROAD, BRIDGE, TOWNLINE
	DIRECTION from INTERSECTING ROAD, BRIDGE, TOWNLINE
	ROUTE NO. AND/OR STREET NAME of INTERSECTING ROAD, BRIDGE, TOWNLINE

4 Questions:

1. Please clarify what **Plan Location** is within the AASHTO BrM, can it be used to link to the as-built drawings?
2. Where are Inspection Photos located?
3. Is Latitude/Longitude available in the electronic crash database?
4. Is there really no Sequence of Events in the crash data?
5. Is there no **Fixed Object Struck** code for bridge railing?
6. Are there no vehicle codes for SUT, BUS, TT?
7. Does crash data include:
   a. All crashes on <u>all roads</u> in the state?
   b. All crashes on <u>only state maintained</u> roads?
8. Does bridge inventory include:
   a. All bridges on <u>all roads</u> in the state?
   b. All bridges on <u>only state maintained</u> roads?
9. What bridge rails should we include in this ISPE?
   a. T2 Steel Bridge Rail
   b. T3 Steel Bridge Rail
   c. T4 Steel Bridge Rail
   d. T2 Steel Bridge Approach Rail (Steel Post)
   e. T3 Steel Bridge Approach Rail (Steel Post)
   f. T4 Steel Bridge Approach Rail (Steel Post)
   g. T101?? → Probably not.

ATTACHMENT C

Task 1 and 2 Data Mapping: Vermont

Project 20211012000000000359

In-Service Performance Evaluation of New England Transportation Consortium (NETC) Steel Bridge Railings

March 2021

Ethan Ray
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VTrans Crash Data and Bridge Inventory Mapping for ISPE of NETC Bridge Rails

1 Crash Data Mapping

Column	Field	Source
A	SFUE	= "1" **Vehicle Collided With 1ˢᵗ or 2ⁿᵈ** coded with '14' Guard Rail, Curb *And* located on a bridge with applicable NETC bridge rail
B	CRN	**Incident Number**
C	CRASH DATE	**Date**, reformatting will likely be required
D	TOTAL UNITS	Likely determined using **Incident Number** and **Vehicle Number**
E	MAX SEV	**Crash Type**, see equivalency table below
F	VEH TYPE	**Make** and **Model**, or **Plate Type** probably have to wait on this field until dataset is filtered to only NETC bridge rail crashes. Also a **Vehicle Configuration** field (closely matches 22-33 VEH_TYPE) but may only be applicable to commercial vehicles…
G	SPEED LIMIT	**Posted Speed**
H	PostHE	**Vehicle Collided With 1ˢᵗ or 2ⁿᵈ**, see equivalency table below **Sequence of Events** does not include barriers as a specific category code.
I	MHE	Not available in crash data
J	FHE	If '14' appears in **Vehicle Collided With 1ˢᵗ**
K	AHE	If '14' appears in **Vehicle Collided With 1ˢᵗ or 2ⁿᵈ**
L	FOHE	If '14' appears in **Vehicle Collided With 1ˢᵗ** and **Vehicle Collided With 2ⁿᵈ** coded with ' ' (Null)
M	BREACH	Will require reviewing crash narrative and/or photos.
N	BREAK	N/A
O	PRS	N/A
P	PEN	Will require reviewing crash narrative and/or photos.
Q	ICP	Will require reviewing crash narrative and/or photos.

R	NAME	Linking to NBI to identify NETC 2-rail, 3-rail, 4-rail, 2-rail AGT, 3-rail AGT and 4-rail AGT
S	AADT	Can possibly can be pulled from NBI **Data Item 29** or **114** _Or_ can be pulled from **ADT** and **Year of ADT** in inspection report.
T	INSTALL	
U	MAINT	

MAX_SEV	Crash data field code - Crash Type	
K	'3'	Fatal
A	'2'	Injury
B		_Not Used_
C		_Not Used_
O	'1'	Property Damage Only
U	' '	Null

VEH_TYPE	Crash data field code – Vehicle Configuration Note: Might not be applicable to Non-commercial vehicle crashes, will have to see the crash data to confirm. If only applicable to commercial vehicles then Make/Model or scene photos will be source of VEH_TYPE.	
MC	_Not Used_	
PC	'3'	Passenger Car
PU	'2'	Light Truck
SUT	'5' '6'	Single Unit Truck: 2 Axle, 6 Tires Single Unit Truck: 3 or More Axles
BUS	'1' '4'	Bus (Seats more than 15 Including Driver) Bus (Seats 9 to 15 Including Driver)
TT	'8' '9'	Truck Tractor (Bobtail) Truck/Semi-trailer
Other	'7' '10' '11' '14'	Truck/Trailer Tractor/Doubles Other – Explain in Narrative Tractor/Triple
99	'12' '13'	Unknown Heavy Truck Any 4-tire Vehicle with Placard

PostHE	Crash data field codes for – Vehicle Collided With 1-2	
00	_Not Used_	
99	'22' ' '	Unknown Null
RFS	_Not Used_	
RSS	_Not Used_	
ROLL	'12'	Overturned
TER	_Not Used_	
VEH	'2' '19' '20'	MV in Traffic Motor Driven Cycle Motorcycle

PostHE	Crash data field codes for – Vehicle Collided With 1-2	
PED	'1'	Pedestrian
	'5'	Pedalcycle
FO	'15'	Tree
	'16'	Pole, Sign
	'17'	Ledge, Boulder
	'18'	Other Fixed Object
BA	*Not Used*	
BAR	'14'	Guard Rail, Curb
CURB	*Not Used*	
OTR	'3'	MV Parked
	'4'	RR Train
	'6'	Deer
	'7'	Moose
	'8'	Other Wild Animal
	'9'	Domestic Animal
	'10'	Snowmobile
	'11'	Other Moveable Object
	'13'	Other, Non-collision
	'18'	Other Fixed Object
	'21'	Work Zone Equipment

2 Identifying Bridges with NETC Style Bridge Railings

It does not appear that VTrans is using AASHTOWARE BrM so filtering based on Data Element 330 is not possible. <u>Identification of bridges with NETC style bridge rails may require manual review of inspection photos or Google Street View</u>.

In database keep only structures identified as NETC bridge railings as outlined above. The following elements from the inspection report will likely also be helpful:

    a. **Bridge No.**
    b. **Located on**
    c. **Approximately** (give location relative to a junction)
    d. **Owner**
    e. **ADT**
    f. **ADT Year**
    g. **% Truck ADT**

3 Linking Crash Location and Applicable Bridge Rail Installations

Chris Mooney mentioned that there might be a way to identify crashes within {user specified distance} from bridges. The output might only include incident number, but that would be enough to link to the crash database. Although the data available in the crash database is somewhat lacking.

NBI/Bridge Inventory	Crash Data
Bridge Number	
Structure Number	
	City/Town
	TH#
	VT#
	US#
	I
	Nearest Intersecting Street or Landmark
	Distance (From Nearest Intersecting Street)
	Direction (From Nearest Intersecting Street)
Coordinates available at VTrans.maps.arcgis.com	**Coordinates**
	Mile Marker

4 Questions

1. Is there no **Sequence of Events** code for guardrail or bridge railing?

2. Is there a database for bridge inventory, even just AASHTOWARE BrM to get a rough filter using Element 330?

3. Does crash data include:

    a. All crashes on <u>all roads</u> in the state?

    b. All crashes on <u>only state maintained</u> roads?

4. Does bridge data include:

    a. All bridges on <u>all roads</u> in the state?

    b. All bridges on <u>only state maintained</u> roads?

5. What bridge rails should we include in this ISPE, (standard drawings available <u>here</u>?

    a. Standard Drawing S-360A (2-rail box beam bridge railing)

    b. Standard Drawing S-360B (2-rail box beam AGT)

    c. Standard Drawing S-364A (3-rail box beam bridge railing) {somewhat dissimilar from NETC design – two 6x6 rails & one 5x3 rail}

    d. Standard Drawing S-364B (3-rail box beam AGT)

ATTACHMENT D

Task 1 and 2 Data Mapping:
Rhode Island DOT

Project 20211012000000000359

In-Service Performance Evaluation of New England Transportation Consortium (NETC) Steel Bridge Railings

March 2021

Ethan Ray
Christine E. Carrigan, P.E., Ph.D.

RIDOT Crash Data and Bridge Inventory Mapping for ISPE of NETC Bridge Rails

1 Crash Data Mapping

Column	Field	Source
A	SFUE	= "1" if one of the following codes appears in the **Sequence of Events** '18' Bridge Pier or Support '19' Bridge Rail '24' Guardrail Face *And* located on a bridge with applicable NETC bridge rail
B	CRN	**Report Number** on crash form
C	CRASH DATE	**Crash Date** on crash form
D	TOTAL UNITS	Determined by looking at **Report Number** and **Unit ID**.
E	MAX SEV	**Injury**, see equivalency table below
F	VEH TYPE	**Unit Type** and **Truck/Bus Supplemental - Vehicle Configuration** (for SUT and TT), see equivalency table below
G	SPEED LIMIT	**Posted Speed Limit** on crash form
H	PostHE	Harmful event coded directly after SUFE (ignore '00' codes) **Sequence of Events 1-4**, see equivalency table below
I	MHE	**Most Harmful Event** coded with '18', '19', or '24'
J	FHE	If '18', '19', or '24' appears in the **Sequence of Events** <u>and</u> is only preceded by event codes listed in 00 row of PostHE table.
K	AHE	If '18', '19', or '24' appears anywhere in the **Sequence of Events**.
L	FOHE	If '18', '19', or '24' appears in the **Sequence of Events** <u>and</u> is only preceded by and followed by event codes listed in 00 row of PostHE table.
M	BREACH	Will require reviewing crash narrative and/or photos. *Or* we can make assumption if '2' Fire/explosion or '3' Immersion follows '18', '19', or '24' in the **Sequence of Events**.
N	BREAK	N/A
O	PRS	N/A
P	PEN	Will require reviewing crash narrative and/or photos.
Q	ICP	**Initial Impact Area** (Uses MMUCC)

R	NAME	Linking to NBI to identify NETC 2-bar, 3-bar, 4-bar, 2-bar AGT, 3-bar AGT and 4-bar AGT
S	AADT	Not in crash report, it is available in the brm.dot.ri.gov database as **adttotal** under ADT layout or RIDOT Lat Lon layout
T	INSTALL	
U	MAINT	

MAX_SEV	Crash data field code - Injury	
K	'4'	Fatal
A	'3'	Incapacitating
B	'2'	Non-Incapacitating
C	'1'	Complains of Pain
O	'5'	No Injury
U	'6'	Unknown

VEH_TYPE	Crash data field code – Unit Types	
MC	'11' '12'	Motorcycle Moped
PC	'1'	Passenger Car
PU	'2' '3' '4' '5'	(Sport) Utility Vehicle Passenger Van Cargo Van (10K lbs[4,536 kg] or Less) Pickup
SUT	'16'	Medium/ Heavy Trucks (More than 10K lbs [4,536 kg]) *- and* **Vehicle Configuration** '5' Single-Unit Truck (2 axles, 6 tires) '6' Single-Unit Truck (3 or more axles)
BUS	'7' '8' '9'	School Bus Transit Bus Motor Coach
TT	'15' '16'	Tractor Trailer or Combination (More than 10K lbs [4,536 kg]) *- or* Medium/ Heavy Trucks (More than 10K lbs [4,536 kg]) *- and* **Vehicle Configuration** '8' Truck Tractor (without trailer, bobtail or saddlemount) '9' Tractor/Semi-Trailer (one trailer)
Other	'6' '10' '13' '14' '15' '16'	Motor Home Other Bus Low Speed Vehicle Other Light Trucks (10K lbs [4,536 kg] or Less) Tractor Trailer or Combination (More than 10K lbs [4,536 kg]) *- or* Medium/ Heavy Trucks (More than 10K lbs [4,536 kg]) *- and* **Vehicle Configuration** '7' Truck/Trailer(s) [Single-Unit Truck with Trailer(s)]

	'10'	Tractor/Doubles (two trailers)
	'11'	Tractor/Triples (three trailers)
	'99'	Other Truck >20,000 lbs. (not listed above)
	'17'	Tow Truck
	'18'	Pedestrian
	'19'	Bicyclist
	'20'	Witness
	'21'	Other
99	' '	Null

PostHE	Crash data field codes for sequence of events 1-4	
00	' '	Null
99	'40'	Unknown
RFS	*Not used*	
RSS	*Not used*	
ROLL	'1'	Overturn/ Rollover
TER	'3'	Immersion
	'20'	Culvert
	'22'	Ditch
	'23'	Embankment
VEH	'13'	Motor Vehicle In Transport
PED	'9'	Pedestrian
	'10'	Pedalcycle
FO	'18'	Bridge Pier or Support
	'28'	Tree (Standing)
	'29'	Landscaping
	'30'	Utility Pole(Elec/Tele)/ Light Support
	'31'	Highway Lighting/ Light Standard
	'33'	Traffic Signal Support
	'34'	Traffic Control Box
	'36'	Other Post, Pole, or Support
	'38'	Mailbox
	'39'	Other Fixed Obj. (Wall, Building, Tunnel, etc.)
BA	'32'	Traffic Sign/ Support
BAR	'16'	Impact Attenuator/ Crash Cushion
	'19'	Bridge Rail
	'24'	Guardrail Face
	'25'	Guardrail End
	'26'	Jersey/ Concrete Traffic Barrier
	'27'	Other Traffic Barrier
CURB	'21'	Curb

OTR	'2'	Fire/ Explosion
	'4'	Jackknife
	'5'	Cargo/ Equipment Loss or Shift
	'6'	Fell/ jumped from Motor Vehicle
	'7'	Thrown or Falling Object
	'8'	Other Non-Collision
	'11'	Railway Vehicle (Train, Engine)
	'12'	Animal
	'14'	Work Zone/ Maintenance Equip.
	'15'	Other Non-Fixed Object
	'17'	Bridge Overhead Structure
	'35'	Variable Message Board/ Arrow Board
	'37'	Fence

2   Identifying Bridges with NETC Style Bridge Railings

AASHTOWARE BrM
(330) = **Metal Bridge Railing**
(330 Unit)
Total Bridge Length x 1 = rail only one side
Total Bridge Length x 2 = rail on both sides
Total Bridge Length x 4 = rail on both sides of each direction (divided road)
brm.dot.ri.gov database/Inspection Reports
Review pictures in latest inspection file to identify bridge rail and AGT
adttotal in ADT layout or RIDOT Lat Lon layout
adtyear in ADT layout
adtfuture in ADT layout
adtfutureyear in ADT layout

1. Identify all bridges with element **330-Metal Bridge Railing** (Not 331-Reinforced concrete bridge railing, 332-Timber bridge railing, 333-Other bridge railing, or 334-Masonry bridge railing)
2. Review inspection photos. Identify bridges that have NETC style bridge rails, or NETC style AGT. This may be a manual review of only bridges with AASHTOWARE BrM Element 330. The Element 330 list has been provided by RIDOT and includes 315 bridges.
3. Click check mark on brm.dot.ri.gov database listing for that bridge.
4. In the database keep only structures with NETC bridge railings as outlined in steps 1-3. Click "toggle just selected" on left side, export RIDOT Lat Lon and ADT layouts to excel using quick button at top of page.

3 Linking Crash Location and Applicable Bridge Rail Installations

brm.dot.ri.gov database	Crash Data
Municipality in RIDOT Lat Lon layout	**City or Town Name**
Facility Carried in RIDOT Lat Lon layout	**Street or Highway**
	Nearest Intersection Street
	Direction From Nearest Intersection to Crash Site
	Distance From Nearest Inter.
	Distance From Nearest Inter. Units
precise lat in RIDOT Lat Lon layout	**Latitude**
precise lon in RIDOT Lat Lon layout	**Longitude**
Bridge ID in all brm.dot.ri.gov database layouts	
NBIS in RIDOT Lat Lon layout	
NHS in RIDOT Lat Lon layout	

4 Questions

1. Does crash data include:

    a. All crashes on <u>all roads</u> in the state?

    b. All crashes on <u>only state maintained</u> roads?

2. Does bridge data include:

    a. All bridges on <u>all roads</u> in the state?

    b. All bridges on <u>only state maintained</u> roads?

3. What bridge rails should we include in this ISPE (from RIDOT Standard Details)?

    a. Baldwin Four Bar Ornamental Rail – Dwg # 10.21 → Probably not.

    b. Four Bar Steel Bridge Rail (Crash Tested TL-4) – Dwg # 10.22

    c. Two Bar Steel Bridge Rail (Crash Tested TL-4) – Dwg # 10.30

    d. TL-5 Railing – Dwg # 10.35 → Probably not.