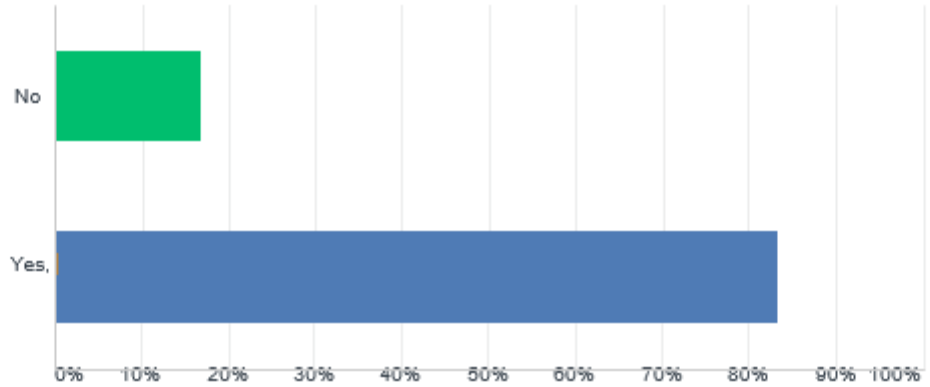
NEBPP Bridge Fracture Survey

Burlington, VT

September 9, 2019

Q1 Has your DOT experienced any fractures in steel bridge members from 2009 to the present?

Answered: 6 Skipped: 0



ANSWER CHOICES	RESPONSES	
No	16.67%	1
Yes, approximately how many incidents/bridges?	83.33%	5
TOTAL		6

#	YES, APPROXIMATELY HOW MANY INCIDENTS/BRIDGES?	DATE
1	One	8/1/2019 9:12 AM
2	4	7/26/2019 12:40 PM
3	CT doesn't track, but we do find cracks due to impact and fatigue.	7/16/2019 3:36 PM
4	(50+ incidents at 30+ different bridges) Several bridges have weld details at the intermediate diaphragms that are prone to cracking. We address them as we find them.	7/11/2019 10:12 AM
5	4	7/8/2019 9:18 AM

Q2 What were the ages of those bridges when the fractures were detected?

Answered: 5 Skipped: 1

#	RESPONSES	DATE
1	47 years, built in 1964	8/1/2019 9:12 AM
2	1) 90, 2) 50, 3) 90, 4) 45	7/26/2019 12:40 PM
3	50 years of age on average.	7/16/2019 3:36 PM
4	30 years +	7/11/2019 10:12 AM
5	around 50 years	7/8/2019 9:18 AM

Q3 What types of structures were involved (e.g. deck girders, trusses, arches, other)?

Answered: 5 Skipped: 1

#	RESPONSES	DATE
1	Continuous Steel Girders	8/1/2019 9:12 AM
2	1) Riveted Plate Girder, 2) WF Floor beam, 3) Truss, 4) Welded Plate Girder	7/26/2019 12:40 PM
3	Multi-girder steel supers and two-girder/floor beam bridges. Girder flanges for impact and fatigue prone welded connections.	7/16/2019 3:36 PM
4	Rolled beams with short intermediate diaphragm connection plates. Plate girders with intersecting welds for lateral sway bracing and vertical web stiffeners. Welds between the bottom flange and sole plates at "frozen" large rocker bearings. Welds between the girder web and the bottom of the top flange for a think web plate girder. "I" bars at pin connections for Rhomboid girders	7/11/2019 10:12 AM
5	girders, floorbeams	7/8/2019 9:18 AM

Q4 What types of steel fabrication were involved - welding or riveting?

Answered: 5 Skipped: 1

#	RESPONSES	DATE
1	Welding	8/1/2019 9:12 AM
2	1) Riveted, 2) rolled shape - not adjacent to connections, 3) truss vertical above a bolted connection, 4) rolled shape at	7/26/2019 12:40 PM
3	Usually welded steel.	7/16/2019 3:36 PM
4	Welding	7/11/2019 10:12 AM
5	no	7/8/2019 9:18 AM

Q5 Describe the types of fractures detected (e.g. fatigue cracking a cover plate weld on rolled beam).

Answered: 5 Skipped: 1

#	RESPONSES	DATE
1	Fatigue cracking	8/1/2019 9:12 AM
2	1) Web fracture at high corrosion area, 2) Unknown cause partial fracture through the thickness of the flange in a floor beam, 3) Partial flange fracture just above a floor beam constraint, 4) Web fracture at area of corrosion next to a welded stiffener,	7/26/2019 12:40 PM
3	Girder flanges for impact damage. Fatigue prone welded connections - usually secondary member connections.	7/16/2019 3:36 PM
4	Fatigue cracks around the bottom weld, along with the base metal in some cases, between the intermediate connection plate and the beam/girder web. Fatigue cracks in the weld, along with the base metal, between the bottom flange and the sole plate. Fatigue cracks in the toe of the weld between a girder web and the bottom of the top flange.	7/11/2019 10:12 AM
5	floor beam connection, crack for vehicular strike	7/8/2019 9:18 AM

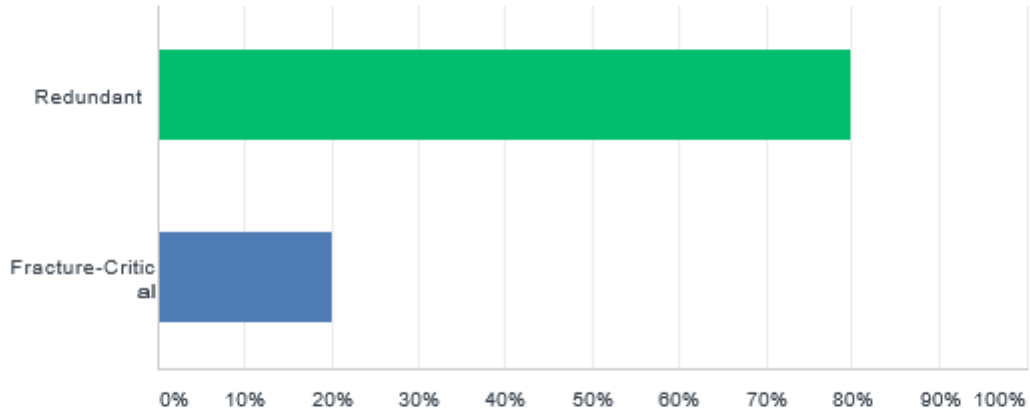
Q6 If known, what types of steel were involved (low-carbon/carbon steels such as those meeting ASTM A7, A373 or A36; high-strength low alloy steels such as those meeting ASTM A242, A441, A572, A588; quenched and tempered steels such as those meeting US Steel T1, ASTM A514, A517)?

Answered: 4 Skipped: 2

#	RESPONSES	DATE
1	A36, and A441	8/1/2019 9:12 AM
2	1) unknown, 2) A7, 3) unknown, 4) A36	7/26/2019 12:40 PM
3	Typically ASTM A7, A373 or A36.	7/16/2019 3:36 PM
4	A36	7/11/2019 10:12 AM

Q7 Were the impacted structural members redundant or fracture-critical?

Answered: 5 Skipped: 1



ANSWER CHOICES	RESPONSES	
Redundant	80.00%	4
Fracture-Critical	20.00%	1
TOTAL		5

Q8 What was the primary cause of fractures –dormantweld-fabrication cracking, constraint-induced fracture or (low- or high-cycle) fatigue?

Answered: 5 Skipped: 1

#	RESPONSES	DATE
1	constraint induced fracture exacerbated by super loads and extreme cold temperatures	8/1/2019 9:12 AM
2	1) Stress riser corrosion, 2) Assumed rolling defect and fatigue, 3) Corrosion and bending at floor beam, 4) Constraint and corrosion	7/26/2019 12:40 PM
3	CT doesn't typically research root cause.	7/16/2019 3:36 PM
4	fatigue	7/11/2019 10:12 AM
5	constraint-induced, collision	7/8/2019 9:18 AM

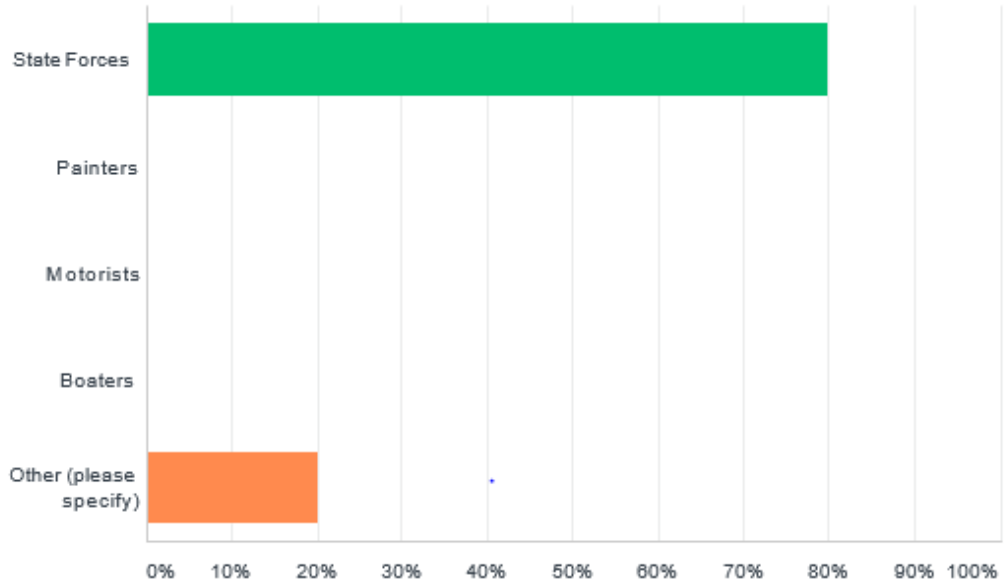
Q9 What contributory factors were known or believed to be involved (weld defects, fatigue-prone weld details, Hoan-type or other weld constraint details, thick steel plates, previous damage (impacts), corrosion (loss-of-section), improper repairs, utility encroachments.

Answered: 5 Skipped: 1

#	RESPONSES	DATE
1	Fatigue Prone Weld Details	8/1/2019 9:12 AM
2	1) Corrosion and previous welded repair, 2) assumed rolling defect, constraint and corrosion, constraint and corrosion	7/26/2019 12:40 PM
3	Fatigue prone weld details and previous damage (impacts) are the most common factors.	7/16/2019 3:36 PM
4	Knife edge section loss in a thin web plate girders has resulted in the formation of cracks. Fatigue prone weld details are by far the most prevalent cause of cracks. The out of plane distortion at intermediate connection plates to the web of a beam/girder has resulted in numerous cracks in the weld material and the base metal of the web. Corrosion at bearings of large rocker bearings has induced fatigue in the welds between the bottom flange and the rocker that results in cracks forming. Our sister agency at the Maryland toll authority had a Hoan-type crack form in a deep girder.	7/11/2019 10:12 AM
5	impact	7/8/2019 9:18 AM

Q10 How were the fractures detected (state forces, painters, motoristsor boaters)?

Answered: 5 Skipped: 1



ANSWER CHOICES	RESPONSES	
State Forces	80.00%	4
Painters	0.00%	0
Motorists	0.00%	0
Boaters	0.00%	0
Other (please specify)	20.00%	1
TOTAL		5

#	OTHER (PLEASE SPECIFY)	DATE
1	State NBI bridge inspection program	7/16/2019 3:36 PM

Q11 How does your agency address steel bridge fractures (a programto eliminate constraint-induced fracture details, field NDE of high-risk structures, biennial inspections, fracture-critical member inspections, targeted arm's length inspections of problematic details)?

Answered: 6 Skipped: 0

#	RESPONSES	DATE
1	All the above except a program to eliminate constraint-induced fracture details.	8/1/2019 9:12 AM
2	Biennial and Fracture critical inspections	7/26/2019 12:40 PM
3	Address on a case-by-case basis by Maint. forces or monitor through inspections when warranted.	7/16/2019 3:36 PM
4	Biennial inspections. We have started a process for evaluating a certain group of bridges with the same details to determine if they are prone to having similar cracking to bridges with somewhat similar details which already have cracks.	7/11/2019 10:12 AM
5	We monitor through Fracture Critical Inspections which require being within arm's length reach.	7/8/2019 2:11 PM
6	inspections, fix with StopEx	7/8/2019 9:18 AM