

Deterioration of Mixed Rebar and Fiber-Reinforced Concrete Bridge Decks

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EXECUTIVE SUMMARY

Long-term deterioration of concrete bridge decks is an issue because of the de-icing materials used on the decks. Concrete decks are typically reinforced with a layer of steel rebar in the top and the bottom of the cross section. The de-icing materials reach the steel rebar through cracks in the top of the concrete deck and via diffusion through the concrete matrix. The steel becomes corroded from these materials, which causes the surrounding concrete to deteriorate. The Minnesota Department of Transportation (MnDOT) has been implementing different policies to reduce concrete bridge deck deterioration by protecting the reinforcement from corrosion and reducing cracking in the concrete. In the early 1970s until approximately 1989, epoxy-coated rebar was used in the top layer of the concrete deck with uncoated rebar in the bottom layer (i.e., mixed rebar deck). In the 2010s, MnDOT began using polypropylene fibers in the concrete mix to reduce the width and amount of cracking in the top of the deck.

The goal of this research was to compare the rate of deterioration of mixed rebar concrete decks and fiber-reinforced concrete decks with control group structure decks and to determine the factors that historically had the largest impact on the rate of deterioration for mixed rebar and fiber-reinforced decks. This was accomplished by evaluating historical inspection data to compare how different types of decks deteriorated over time. A select number of *in-situ* inspections were also performed to compare visual observations to the historical inspection data. MnDOT will be able to use the mixed rebar deck results to predict future deck conditions and plan future bridge deck maintenance. This will allow MnDOT to estimate future construction costs and secure proper funding to perform necessary maintenance and deck replacements. MnDOT can use the results from the comparison of the fiber-reinforced decks to their control structure decks to determine whether spending money on fiber-reinforcement for future construction or rehabilitation of bridge decks will provide a significant benefit to the service life of the structure. Results could also influence MnDOT's decision to use other deck protection strategies such as low-slump wearing courses.

Approximately 471 bridges built between 1973 and 1989 with mixed rebar decks were included in the study and 35 decks with epoxy-coated top and bottom mat rebar (built before 1990) served as the control structures. Approximately 18 fiber-reinforced decks built between 2012 and 2017 were included in the study and four non-fiber-reinforced decks with epoxy-coated top and bottom mat rebar (built between 2013 and 2016) served as the control structures. One hundred and fifteen bridge decks were visually inspected and photographically documented in this project. This included both the documentation of visible cracks, leaching or efflorescence, spalling and delamination, spalling with exposed rebar, and rust staining and recording the type and spacing of the cracks through visual estimation.

Results were derived using the National Bridge Inventory (NBI) rating system and individual element ratings. Before 2016, Commonly Recognized (CoRe) Structural Elements were used to provide the individual element ratings. In 2016, National Bridge Element (NBE) ratings replaced the CoRe Structural Element ratings. The following observations were drawn from analysis of the ratings:

- All mixed rebar decks spent an average of 8.5 years at condition state 2 before dropping to condition state 3 for CoRe Element #359 Cracking on the Underside of Deck.
- Approximately 30% more mixed rebar decks with steel superstructures had reached condition states 3 and/or 4 for NBE Element #12 Reinforced Concrete Deck (underside of deck) than mixed rebar decks with a prestressed concrete superstructure. Decks with steel superstructures also had a higher percentage of the entire deck area in condition states 3 and/or 4 (1.83%) than the decks with prestressed concrete superstructures (1.15%).
- Of the 52 bridge decks that had at least 2% of the deck in condition states 3 and/or 4 for NBE Element #12 Reinforced Concrete Deck (underside of deck), 92.3% were mixed rebar decks and 7.7% were control structures. More than 50% of these mixed rebar decks carried a State Highway, had a steel superstructure, and were not skewed. The mixed rebar decks were split almost equally between each level of average daily traffic (ADT).

The following conclusions for mixed rebar decks were drawn from the results of this study.

- The mixed rebar decks reached worse condition states than the control structure decks when considering CoRe Elements #26 Top of Deck with Epoxy Rebar (No Overlay), #358 Cracking on the Top of Deck, #359 Cracking on the Underside of Deck, and NBE Element #12 Reinforced Concrete Deck (underside of deck). Negligible differences between the mixed rebar decks and the control structures were observed when considering Deck NBI (overall condition of the deck), NBE Element #510 Deck Wearing Surface, and NBE Element #810 Concrete Wearing Surface (cracking and sealing).
- Mixed rebar decks remained at condition state 2 for an average of 8.5 years before dropping to condition state 3 when considering CoRe Element #359 Cracking on the Underside of the Deck.
- ADT did not appear to affect the deterioration of the deck.
- Wearing surface crack density did not appear to affect the deterioration of the deck since many of the cracks may extend only to the bottom of the 2-in., low-slump concrete wearing course and not into the underlying structural concrete deck. The wearing surface crack density was provided by MnDOT and is calculated by dividing the Element #810 quantity by the combined area of the wearing course and approach panels to give units of linear foot per square foot (LF/SF).
- Mixed rebar decks with steel superstructures reached worse condition states than mixed rebar decks with prestressed concrete superstructures. Insufficient data prevented conclusions from being drawn on decks with a reinforced concrete superstructure.
- Mixed rebar decks with no skew reached worse condition states than mixed rebar decks with skew when considering data for NBE Element #12 Reinforced Concrete Deck (underside of deck). There were likely other factors not included in this study that affected these results since it was expected that skewed decks would reach a worse condition state than decks with no skew.

No conclusions were drawn based on the results for the fiber-reinforced decks due to the small sample size and the limited amount of data available over time.

The following recommendations were made based on the results of this study.

1. Create a new rating element for use during inspection of mixed rebar decks that quantifies the crack density on the underside of the deck. Through-deck cracking may be a key indicator for future underdeck spalling of mixed bar decks since the cracks provide a clear path for the chlorides to reach the uncoated bottom mat. This element would be less valuable for decks constructed with two mats of epoxy-coated rebar or two mats of uncoated rebar since the rebar corrosion typically occurs in the top mat of those bridge decks.
2. Consider a more robust crack sealing method such as flood coating with methyl methacrylate (MMA) or applying an impermeable wearing course such as premixed polymer concrete (PPC) or epoxy chip seal on mixed rebar decks when they have been at NBE Element #12 condition state 2 for approximately 7 years. This could reduce the number of bridges that reach condition state 3. This recommendation was based on the average number of years that a deck remained at condition state 2 for CoRe Element #359. CoRe Element #359 is no longer used and Element #12 in the NBE system is the most similar. It is recommend that MnDOT continue to use epoxy-coated rebar in both mats of bridge decks as the mixed bar decks deteriorate more quickly.
3. Continue comparing the fiber-reinforced decks to their control structure decks when more inspection data are available to analyze the deck deterioration over time.

CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION AND MOTIVATION

Long-term deterioration of concrete bridge decks is often what dictates the service life of a bridge in Minnesota. De-icing materials used on the deck generally accelerate this deterioration. Concrete decks are typically reinforced with a layer of steel rebar in the top and the bottom of the cross section. The de-icing materials reach the steel rebar through cracks in the top of the concrete deck and via diffusion through the concrete matrix. The steel becomes corroded from these materials, which causes the surrounding concrete to deteriorate.

The Minnesota Department of Transportation (MnDOT) has been implementing different policies to reduce concrete bridge deck deterioration by protecting the reinforcement from corrosion and reducing cracking in the concrete. In the early 1970s until approximately 1989, epoxy-coated rebar was used in the top layer of the concrete deck with uncoated rebar in the bottom layer (i.e., mixed rebar deck). Epoxy-coated rebar was used in both layers of the concrete deck for bridges with high average daily traffic (ADT) and large amounts of de-icing materials. All bridges built after 1989 had epoxy-coated rebar in both layers of the concrete deck (Nelson, 2014). In the 2010s, MnDOT began using polypropylene fibers in the concrete mix to reduce the width and amount of cracking in the top of the deck.

1.2 OBJECTIVES

The goal of this research was to compare the rate of deterioration of mixed rebar concrete decks and fiber-reinforced concrete decks with control group structures and to determine the factors that historically had the largest impact on the rate of deterioration for mixed rebar and fiber-reinforced decks. This was accomplished by evaluating historical inspection data to compare how different types of decks deteriorated over time. A select number of on-site inspections were also performed to compare visual observations to the historical inspection data. MnDOT will be able to use the mixed rebar deck results to predict future deck conditions and plan future bridge deck maintenance. This will allow MnDOT to estimate future construction costs and secure proper funding to perform necessary maintenance and deck replacements. MnDOT can use the results from the comparison of the fiber-reinforced decks to their control structures to determine whether spending money on fiber-reinforced decks for future construction or rehabilitation of bridge decks will provide a significant benefit to the service life of the structure.

A similar study was conducted through the Undergraduate Research Opportunities Program (UROP) at the University of Minnesota Duluth during the Fall 2017 semester. This similar study focused on the deterioration of concrete bridge decks with galvanized reinforcing. The results are shown in Appendix A.

1.3 BACKGROUND

1.3.1 MnDOT Inspection History

MnDOT conducts inspections of bridges at regular intervals. Initial inspections are performed when the bridge is built to determine the original structural conditions. Routine inspections occur every two years to assess the condition of the bridge through visual observation and measurement. Changes from the original or previous structural condition are recorded during routine inspections. In-depth inspections may be performed on bridges to assess the condition of specific members or to find deficiencies that cannot be detected during routine inspections. In-depth inspections do not need to be performed on all bridges and the frequency is determined by the bridge owner (MnDOT, 2018).

Deterioration of the concrete deck is often identified by cracks with efflorescence and/or rust staining, delamination, and spalling on the underside of the deck. Efflorescence occurs when the de-icing materials leach through full-depth cracks to the bottom of the concrete deck. Severe leaching may cause the formation of stalactites (The Concrete Society, n.d.). A stalactite is a formation, typically resembling an icicle, caused by significant build-up of leaching materials (National Oceanic and Atmospheric Administration [NOAA], 2018). Occasionally, these cracks with efflorescence will also have rust staining from the steel rebar. Rust staining can also occur where metal rebar chairs have been placed. Rebar chairs are used to support the rebar and keep it in place as concrete is poured around it. Expansion of the corroding rebar causes the surrounding concrete to crack and separate, which is referred to as delamination. If severe delamination occurs, the concrete may become loose and break off entirely from the structure. This is referred to as spalling and can be hazardous to traffic and pedestrians traveling under the bridge (Concrete Preservation Technologies, 2017). Typically, the rebar will become exposed when spalling occurs. The bridge deck may need to be replaced if extensive spalling occurs. Scaling is the loss of mortar or aggregate on the surface of the concrete, typically on the top of the deck. Examples of cracking with efflorescence and rust staining, delamination, spalling with exposed rebar, and scaling are shown in Figure 1.1, Figure 1.2, Figure 1.3, and Figure 1.4, respectively.

1.3.2 MnDOT Rating History

A bridge is currently rated using the National Bridge Inventory (NBI) system and individual element ratings. Before 2016, Commonly Recognized (CoRe) Structural Elements were used to provide the individual element ratings. In 2016, National Bridge Element (NBE) ratings replaced the CoRe Element ratings.

The Deck NBI codes are used to rate the overall condition of the deck. These codes rate the underside of the deck and the wearing surface on top of the deck. The Deck NBI does not include ratings for railings, sidewalks, curbs, expansion joints, or deck drains. Decks are rated on a scale of 0 to 9, with 9 being the best condition. Descriptions for each Deck NBI condition code are shown in Table 1.1.

The CoRe Structural Elements rated the condition of individual elements of a bridge using condition states 1 to 5 or 1 to 4, with 1 being the best condition. These elements included Element #12 Top of

Concrete Deck with Uncoated Rebar (No Overlay), Element #26 Top of Concrete Deck with Epoxy Reinforcement (No Overlay), Element #358 Concrete Deck Cracking Smart Flag, and Element #359 Underside of Concrete Deck Smart Flag. Smart flag elements were used to identify conditions that were not effectively addressed by the conventional element ratings. A smart flag may address issues that require immediate attention or follow-up action, or it may provide information about a specific element or material on the bridge. For example, bridges with a concrete wearing surface were rated using Element #358 Concrete Deck Cracking. The definitions of each condition state for Elements #12 and #26 are shown in Table 1.2. The definitions of each condition state for Elements #358 and #359 are shown in Table 1.3 and Table 1.4, respectively. Table 1.4 references structural underpinning in the definitions for condition states 4 and 5. Structural underpinning is when temporary or permanent supports are added to a structure to strengthen the foundation.

The NBE Element ratings use condition states 1 to 4, with 1 being the best condition. These ratings identify the amount of the deck in square feet (SF) or linear feet (LF) that is in each condition state. For example, a bridge may have a total quantity of 3821 SF with 3501 SF in condition state 1 and 320 SF in condition state 2 for a certain element rating. The abbreviations SF and LF were the notations used by MnDOT instead of the conventional ft² and ft. These elements include NBE Element #12 Reinforced Concrete Deck – SF; NBE Element #510 Wearing Surface – SF; and NBE Element #810 Concrete Wearing Surface (Cracking and Sealing) – LF. The definitions of the condition states for NBE Elements #12, #510 and #810 are shown in Table 1.5, Table 1.6, and Table 1.7, respectively.

1.3.3 Previous Research

1.3.3.1 Nelson 2014

A study performed by Nelson (2014) and published by MnDOT looked at the deterioration rates of concrete bridge decks in Minnesota. The deterioration rates were determined based only on historical Deck NBI ratings and did not include CoRe or NBE Element ratings. This study was done to help MnDOT estimate future maintenance and construction costs. The results from the study were used by MnDOT to estimate the remaining service life and predict future repairs for certain concrete bridge decks.

Inventory and inspection data from 1983 to 2014 were provided by MnDOT for 2,601 bridges with concrete decks. The deterioration rates were calculated by determining the average number of years a bridge deck remained at a Deck NBI condition code. The bridges were divided into subsets to determine which factors had the largest impact on the rate of deterioration. Some of the information needed to divide the bridges into these subsets was not available and instead was inferred by Nelson based on the year the bridge was built and the MnDOT policies from that year. The categories analyzed were:

- uncoated rebar, mixed rebar, or all epoxy-coated rebar
- concrete overlay or no overlay
- cover to top bar less than 3 in. or equal to 3 in.
- ADT less than 4,000, ADT between 4,000 and 10,000, and ADT greater than 10,000
- prestressed concrete or steel superstructure

- Metro District or all other districts

The results from the study were presented in tables and deterioration curves that plotted the Deck NBI code versus the average number of years that a bridge stayed at each Deck NBI code. The results showed that the type of reinforcement in the deck and the location of the bridge had the largest effect on the deterioration rate. Bridge decks with epoxy-coated rebar performed better than bridge decks with uncoated rebar. A direct comparison of mixed rebar decks and decks with all epoxy-coated rebar was not made. The bridges in the Metro District (i.e., near Minneapolis and St. Paul) dropped to a Deck NBI code of 7 from a code of 8 sooner than the bridges outside of the Metro. It was recommended that the data be updated every four years.

1.3.3.2 Nelson 2017

A supplemental report was published by Nelson (2017) to incorporate the inspection data from 2014 to 2017. In addition to updating the data, three new goals were set. The first goal was to evaluate inspection data of bridge decks that were no longer in service to calculate the number of years the decks stayed at a Deck NBI condition rating of 5 and/or 4. The second goal was to determine the number of years that a new or re-overlay adds to the service life of the deck. An overlay is an additional layer of material, typically concrete, on the top of the deck. Mill and overlay repairs with deck patching are beneficial to remove unsound concrete, remove chloride saturated concrete from the surface, and increase cover to the top layer of reinforcement. The final goal was to create deterioration curves for concrete slab span superstructures.

The results were presented in tables that showed the average number of years a bridge stayed at the Deck NBI condition codes. It was found that concrete decks remained at a Deck NBI code of 5 for an average of 10 years and remained at a Deck NBI code of 4 for an average of 8 years. No conclusions were made in respect to the additional service life that a re-overlay provided to a bridge deck. It was suggested that the decks that had a re-overlay be compared to bridge decks with no overlay that have a similar ADT, but there were a limited number of bridges that fell into this category, so a comparison was not made.

1.3.3.3 Zimmerman 2007

Zimmerman (2007) performed a study for MnDOT that focused on repair and replacement costs for concrete bridge decks with low-slump concrete overlays in Minnesota. Specifically, 492 bridges with an overlay placed between 1974 and 1981 were analyzed.

A statistical analysis was performed to determine which factors had a significant impact on the rate of deterioration for decks with a low-slump overlay. To perform the analysis, 21 years of Deck NBI inspection data were used. The factors analyzed were:

- superstructure type
- superstructure continuity

- old or new bridge when the overlay was placed (new meant the overlay was placed within three years of the bridge being constructed)
- ADT
- average daily truck traffic (ADTT)
- bridge length
- age of the bridge
- skew
- maximum superstructure span length
- MnDOT district
- deck width
- epoxy-coated or uncoated rebar

Continuity, ADTT, skew, and rebar type were not found to have a statistically significant effect on the rate of concrete bridge deck deterioration. Superstructure type, maximum superstructure span length, and ADT were found to have the most statistically significant effect on the rate of deterioration. Superstructure type had the most significant impact on the rate of deterioration. The decks with a cast-in-place concrete superstructure had higher rates of deterioration than decks with a steel or prestressed concrete superstructure. The decks with a steel superstructure performed slightly worse than the decks with a prestressed concrete superstructure. Bridges with an ADT greater than 20,000 had higher rates of deterioration than bridges with an ADT less than or equal to 20,000. Bridges with a maximum superstructure span greater than 100 ft performed worse than those with a superstructure span less than 100 ft.

Table 1.1 Deck NBI condition rating descriptions (MnDOT, 2013)

Code	NBI Deck Condition Description
N	Not Applicable: Use for culverts, roadway tunnels, or filled spandrel arch bridges.
9	Excellent Condition: Deck is in new condition (recently constructed).
8	Very Good Condition: Deck has very minor (and isolated) deterioration. <ul style="list-style-type: none"> Concrete: minor cracking, leaching, scale, or wear (no delamination or spalling).
7	Good Condition: Deck has minor (or isolated) deterioration. <ul style="list-style-type: none"> Concrete: minor cracking, leaching, scale, or wear (isolated delamination, spalling, or temporary patches).
6	Satisfactory Condition: Deck has minor to moderate deterioration (no repairs are necessary). <ul style="list-style-type: none"> Concrete: moderate cracking, leaching, scale, or wear (minor delamination or spalling).
5	Fair Condition: Deck has moderate deterioration (repairs may be necessary). <ul style="list-style-type: none"> Concrete: extensive cracking, leaching, scale, or wear (moderate delamination or spalling).
4	Poor Condition: Deck has advanced deterioration (replacement or overlay should be planned). <ul style="list-style-type: none"> Concrete: advanced cracking, leaching, scale, or wear (extensive delamination or spalling) – isolated full-depth failures may be imminent.
3	Serious Condition: Deck has severe deterioration – immediate repairs may be necessary. <ul style="list-style-type: none"> Concrete: severe cracking, leaching, delamination, or spalling – full depth failures may be present.
2	Critical Condition: Deck has failed – it may be necessary to close the bridge until repairs are completed.
1	“Imminent” Failure Condition: Bridge is closed – corrective action is required to open to restricted service.
0	Failed Condition: Bridge is closed – deck replacement is necessary.

Table 1.2 Condition state definitions for CoRe Elements #12 and #26 (MnDOT, 2013)

Condition State	Definition
1	Top (wearing) surface of deck has no spalls, delaminations, or temporary patches.
2	The combined area of unsound wearing surface (spalls, delaminations, temporary patches, etc.) is 2% or less of the total deck area.
3	The combined area of unsound wearing surface (spalls, delaminations, temporary patches, etc.) is more than 2% but not more than 10% of the total deck area.
4	The combined area of unsound wearing surface (spalls, delaminations, temporary patches, etc.) is more than 10% but not more than 25% of the total deck area.
5	The combined area of unsound wearing surface (spalls, delaminations, temporary patches, etc.) is more than 25% of the total deck area.

Table 1.3 Condition state definitions for CoRe Element #358 (MnDOT, 2013)

Condition State	Definition
1	Cracks in the concrete wearing surface are sealed or insignificant in size and density.
2	Concrete wearing surface has unsealed cracks of moderate size or density.
3	Concrete wearing surface has unsealed cracks of moderate size and density.
4	Concrete wearing surface has unsealed cracks of severe size and/or density.

Table 1.4 Condition state definitions for CoRe Element #359 (MnDOT, 2013)

Condition State	Definition
1	Underside of the concrete deck (or slab) has little or no distress. There may be minor cracking or light leaching. Stay-in-place forms have no corrosion.
2	The total “distressed area” on the underside of the concrete deck (or slab) is 2% or less of the total deck area.
3	The total “distressed area” on the underside of the concrete deck (or slab) is more than 2%, but not more than 10% of the total deck area.
4	The total “distressed area” on the underside of the concrete deck (or slab) is more than 10%, but not more than 25% of the total deck area. There may be impending full-depth deck failures - structural underpinning may be present (or required).
5	The total “distressed area” on the underside of the concrete deck (or slab) is more than 25% of the total deck area. There may be full-depth deck failures - structural underpinning may be present (or required).

Table 1.5 Condition state definitions for NBE Element #12 Reinforced Concrete Deck (underside of deck) - SF (MnDOT, 2018)

Item or Defect	Condition States			
	1	2	3	4
	Good	Fair	Poor	Severe
Structural Review, Repairs, or Underpinning	No deck repairs present	Repaired area that is sound	Repaired area that is unsound or distressed. Structural underpinning present.	Immediate repairs or structural review required. Full-depth failures present or imminent.
Delamination, Spall, or Exposed Reinforcement	None	Delamination (not yet loose) Spall 1" or less deep and 6" or less in diameter.	Loose delamination. Spall more than 1" deep or more than 6" diameter. Exposed rebar with corrosion or section loss.	Loose delamination (safety hazard). Spalling greater than 3" deep. Rebar has severe section loss.
Efflorescence (Leaching)	None	Light leaching (little or no build-up).	Heavy leaching (significant build-up or stalactites).	Severe leaching (deck failure imminent).
Water/Salt Saturation, or Rust Staining	None	Water saturation. Minor rust stains (rebar chairs).	Significant water/salt saturation. Rust stains indication rebar corrosion.	Severe salt/water saturation (deck failure imminent).
Cracking	Minor Cracks	Moderate width cracks or moderate density map cracking	Wide cracks or heavy density map cracking.	Severe cracks or fractures (deck failure imminent).

Table 1.6 Condition state definitions for NBE Element #510 Wearing Surface - SF (MnDOT, 2018)

Item or Defect	Structural Element Condition States			
	1	2	3	4
	Good	Fair	Poor	Severe
General Condition	Little or no deterioration	Minor to moderate deterioration (no repairs needed)	Significant deterioration (repairs recommended)	Severe deterioration (repairs required)

Table 1.7 Condition state definitions for NBE Element #810 Concrete Wearing Surface (Cracking and Sealing) - LF (MnDOT, 2018)

Defect or Item	Condition State			
	1	2	3	4
	Good	Fair	Poor	Severe
Unsealed Cracks	Unsealed cracks less than 0.012" wide	Unsealed cracks from 0.012" wide up to 0.05" wide	Unsealed cracks from 0.05" wide up to 0.125" wide	Unsealed cracks 0.125" or wider
Sealed Cracks	Crack is effectively sealed	Crack seal is slightly deteriorated	Crack seal has failed	Not Applicable

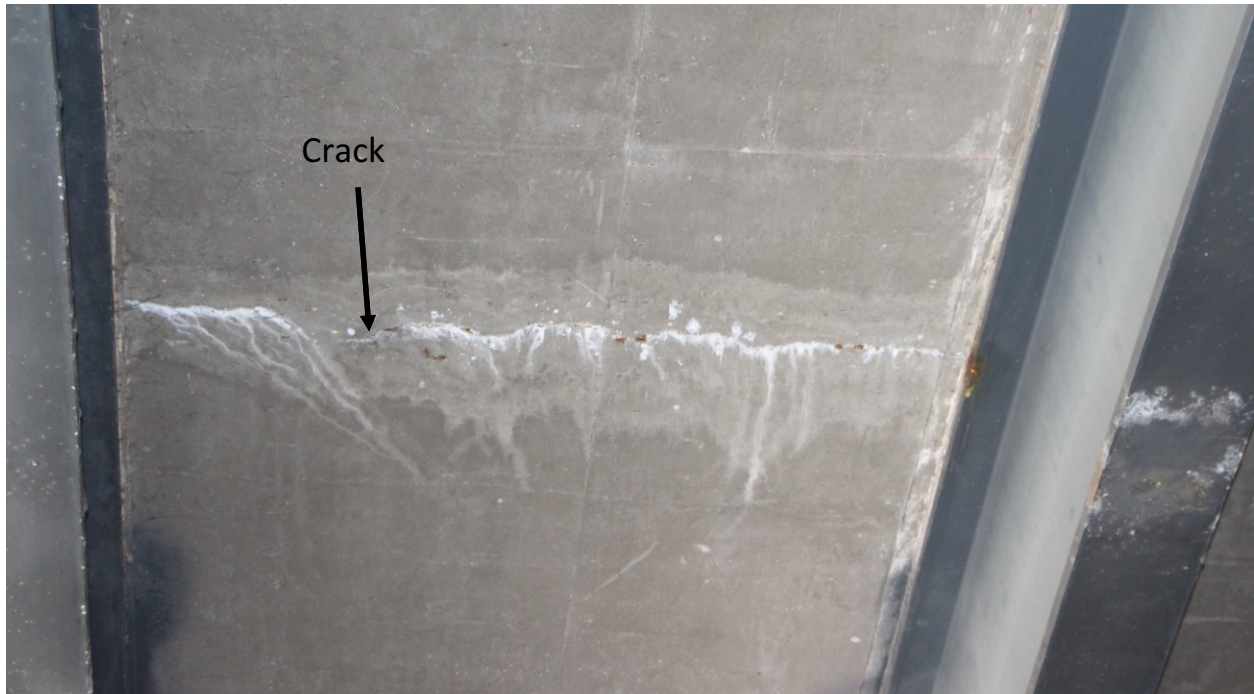


Figure 1.1 Crack with efflorescence and rust staining on the underside of the deck

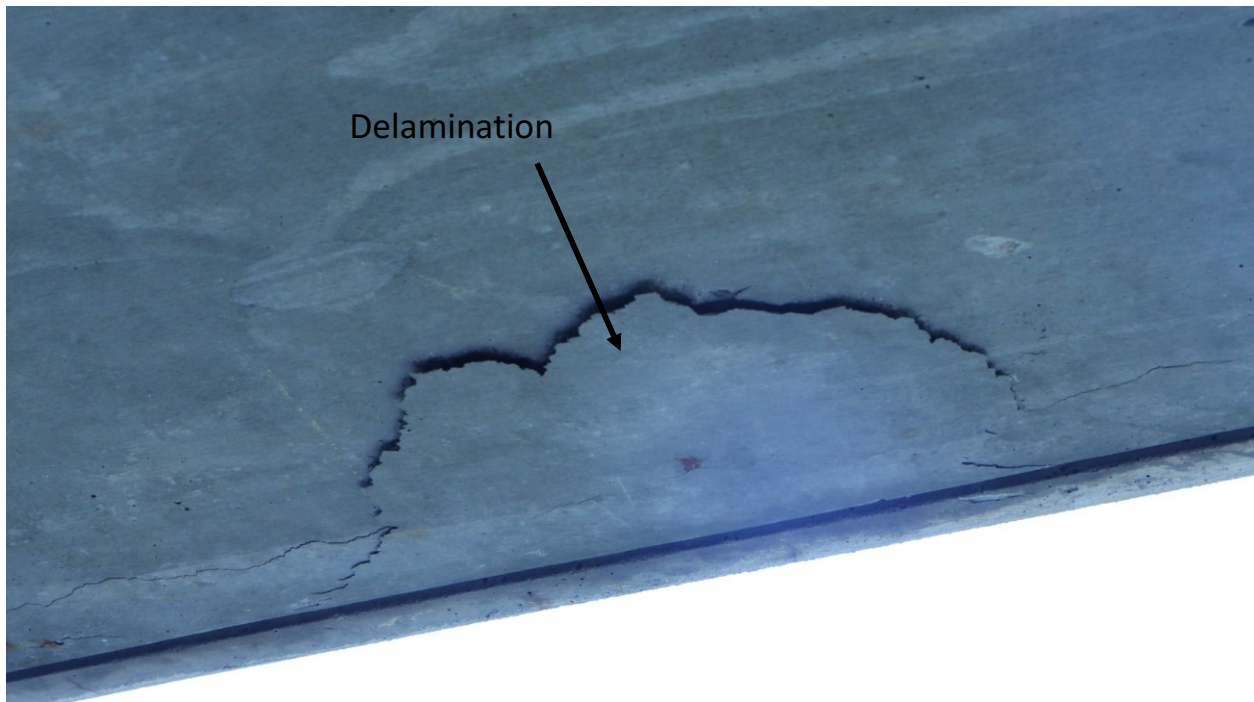


Figure 1.2 Delamination on the underside of the deck

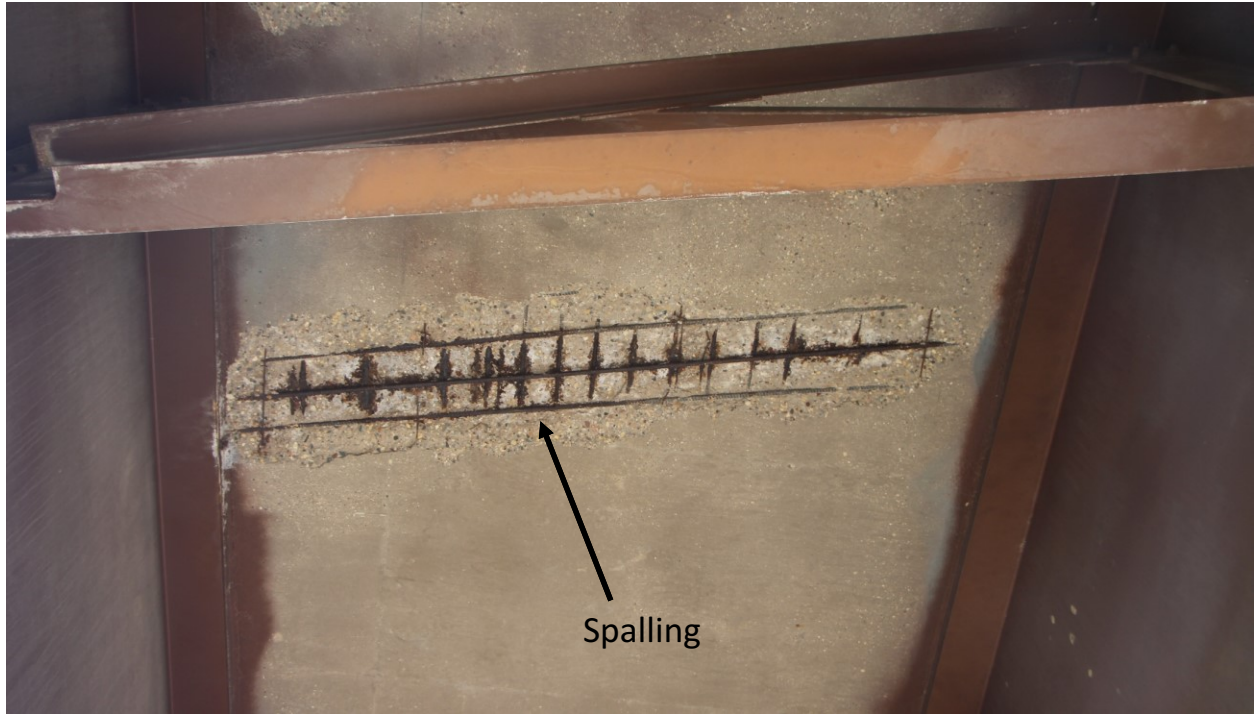


Figure 1.3 Spalling with exposed rebar on the underside of the deck



Figure 1.4 Scaling of concrete on the top of the deck (MnDOT, 2017)

CHAPTER 2: METHODS

2.1 SELECTION OF BRIDGES TO STUDY

The process of identifying bridges started with two databases provided by MnDOT. The database with epoxy-coated rebar decks included bridges built between 1975 and 1989 that were assumed to have either mixed rebar or epoxy-coated top and bottom mat rebar. The decks with epoxy-coated top and bottom mat rebar served as the control structures for the mixed rebar decks. Parameters included in this database included the location, year built, Deck NBI rating as of 2017, and bridge type (i.e., beam span, box girders, or slab span) for 549 bridges. The other database included all of the bridges built with fiber-reinforced decks in MnDOT's inventory from 2012 to early 2017. This database included the location and date of the deck placement for 18 fiber-reinforced bridges. The control structures for the fiber-reinforced bridges were decks with no fiber-reinforcing that were built between 2012 and 2017 and chosen from MnDOT's bridge inventory. The bridges from these databases were combined into a table of bridges to be studied that can be seen in Appendix B.

The database with epoxy-coated rebar decks was filtered to include the bridges in MnDOT Districts 1, 3, and 5 (Metro) to determine which mixed rebar decks and their control structures were to be visually inspected. MnDOT's BridgeMAP (2017) software tool was used to find the exact location of each bridge in these districts. This tool uses Google Maps, which has a street view feature. This feature was used to determine if inspection access was possible and safe without stopping traffic on or below the structure. A column was added to the database to describe how easily each bridge could be inspected. Bridges were deemed easily accessible if they had an area to safely park a car and space to walk to the bridge. Bridges that were not easily accessible and had high traffic volumes on both intersecting roadways were labeled as "busy." The underside of the deck is the most important to inspect, so bridges that had high traffic volumes on top of the bridge, but not underneath, were not labeled as "busy" and were deemed easily accessible. The database was filtered to remove the "busy" bridges, which narrowed the possibilities for visual inspections from 280 to 109 bridges. The design plans for the remaining bridges were inspected to determine the type of rebar used in the deck. Another column was added in the database to identify the type of deck rebar: mixed rebar, epoxy-coated top and bottom mat rebar (control structures), or uncoated rebar. The bridge decks that did not contain mixed rebar and the control structures were removed from the list. The remaining 100 structures were identified as the mixed rebar and control structures accessible for visual inspections. The bridges chosen for visual inspection that had mixed rebar decks were marked with "INSP" in the Mixed Rebar column in the table shown in Appendix A. The bridges chosen for visual inspection with epoxy-coated rebar in the top and bottom were marked with "INSP" in the Control Structures (Mixed) column in the same Appendix B table. The same process was used to determine which fiber-reinforced bridges were good candidates for visual inspection. The bridges with fiber-reinforced decks chosen for visual inspection were marked with "INSP" in the Fiber column in the Appendix B table. The fiber-reinforced control group bridges chosen for visual inspection were marked with "INSP" in Control Structures (Fiber) column in the Appendix B table.

The bridges selected for visual inspection are shown in Table 2.1. A chart showing the number of bridges chosen for visual inspection at each Deck NBI rating is shown in Figure 1.1. The distribution of bridges at each Deck NBI rating level was similar for the bridges chosen for visual inspection and the full list of bridges for the study. A chart showing the distribution for the full database of bridges is shown in Figure 2.2. A map with the location of the bridges chosen for visual inspection in Districts 1, 3, and 5 (Metro) is shown in Figure 2.3.

2.2 EVALUATION OF INSPECTION DATA

2.2.1 Mixed Rebar Decks

The following NBE and CoRe elements were included in the study:

- CoRe Element #12 Top of Concrete Deck with Uncoated Rebar (No Overlay)
- CoRe Element #26 Top of Deck with Epoxy Rebar (No Overlay)
- CoRe Element #358 Cracking on the Top of Deck
- CoRe Element #359 Cracking on the Underside of Deck
- NBE Element #12 Reinforced Concrete Deck (underside of deck)
- NBE Element #510 Deck Wearing Surface
- NBE Element #810 Concrete Wearing Surface (cracking and sealing)

The Deck NBI ratings were also included in the evaluation. Historical inspection data were provided by MnDOT in three databases: (1) CoRe inspection data from 1992 to 2016 that included Elements #12, #26, #358, and #359; (2) NBE inspection data from 2014 to 2018 that included Elements #12, #510, and #810; and (3) Deck NBI data. Each database included the bridge number, the inspection date, and the quantity of the deck at each condition state or the Deck NBI rating for each inspection date. The data were sorted by bridge number and then by inspection date. Bridges that did not have mixed rebar decks, did not have fiber-reinforced decks, and were not the control structures were not included in the study and were deleted from the databases. The number of bridges included in the study and the range of the year built for each type of deck is shown in Table 2.2.

The NBE element-level data uses condition states ranging from 1 to 4 to quantify the level of deterioration of the element based on a unit measurement (e.g., SF or LF). These ratings identify the quantity of the deck that is in each condition state. To show one condition state for each bridge at each inspection date, the condition state with the largest quantity recorded was used. For example, a bridge may have a total quantity of 13,100 SF. If the condition state 1 quantity was 13,000 SF and the condition state 2 quantity was 100 SF in 2017, the bridge was recorded to be at condition state 1 for that year. If the quantity at a condition state was the same as a different condition state, the bridge was recorded as the worse condition state of the two. For example, a bridge may have a total quantity of 1900 SF. If the condition state 1 quantity was 950 SF and the condition state 2 quantity was 950 SF in 2017, the bridge was recorded to be at condition state 2 for that year. For the CoRe inspection data, the condition states ranged from 1 to 5, and the entire deck was documented as one condition state.

The number of years each bridge stayed at each condition state was calculated by subtracting the last inspection date by the first inspection date it was at that condition state. The approximate age of the deck during the last inspection cycle at a certain condition state was calculated by subtracting the year of the last inspection date by the year the bridge was built. All of the decks that had an improvement in condition state from a previous inspection were flagged to identify the data that may need to be manually changed. If the condition state was constant over time, changed for two inspection cycles or less and then reverted to the previous condition state, the condition state was manually changed to match the condition state before and after the short period of change. For NBE Elements #510 and #810, there was only a maximum of two inspections recorded for each bridge because the inspection data for these elements was from 2014 to 2017. In this case, only the most recent condition state was analyzed for each bridge because there was not enough data to show the behavior of the condition state over time.

All of the NBE and CoRe data were separated by element. Information was added to indicate the year built, deck type, superstructure type, ADT, route type, and current wearing surface crack density. The wearing surface crack density was provided by MnDOT and calculated by dividing the Element #810 quantity by the combined area of the wearing course and approach panels to give units of linear foot per square foot (LF/SF). The data for each element were divided into subsets:

- all mixed rebar decks or all control structures
- mixed rebar decks with an ADT less than 4,000, between 4,000 and 10,000, or greater than 10,000
- mixed rebar decks with current wearing surface crack density less than 0.01 LF/SF, between 0.01 and 0.1 LF/SF, or greater than 0.1 LF/SF
- mixed rebar decks carrying Interstates, U.S. Highways, State Highways, County Roads, or Town Roads
- mixed rebar decks with a reinforced concrete, steel, or prestressed concrete superstructure
- mixed rebar decks that had a skew less than or equal to 20° (not skewed) or greater than 20° (skewed)

For each subset, the average number of years that a bridge stayed at each condition state and the average age of the deck at the last cycle the bridge was at a condition state were calculated. Line charts were used to compare the average number of years each subset of bridges stayed at each condition state for the elements that were analyzed over time. Bar charts were used to show the current condition states for Elements #510 and #810 because there was not enough inspection data to show the condition state behavior over time. Separate charts were created to compare mixed rebar decks to the control structures, different ranges of ADT, different ranges of current wearing surface crack density, different route types, and different superstructure types. Tables were also made for each subset that show the average number of years each subset of bridges stayed at each condition state, the average age of the deck at the last inspection date for each condition state, and the number of bridges used to generate these averages.

CoRe Element #359 Cracking on the Underside of Deck was analyzed in more depth for the bridges that had reached condition state 3, specifically the number of years that bridges remained at condition state 2 before dropping to condition state 3 was investigated. Initially, the bridges that never reached condition state 3 were removed from the database. To accurately represent the number of years at condition state 2, all of the bridges with a beginning tail at condition state 2 were removed from the database. A beginning tail refers to a set of data that starts at least three years after the bridge was built. If the data had a beginning tail at condition state 2, the first year that the bridge was recorded at condition state 2 was unknown, and the number of years at condition state 2 could not be accurately calculated. Bridges that had inspection data starting at condition state 3 were also removed since the number of years at condition state 2 were unknown. After all appropriate bridges were removed, 17 bridges remained in the database with data that could be used to investigate the number of years that bridges remained at condition state 2 before dropping to condition state 3. To increase the sample size to 32, bridges with a beginning tail of at least 7 years at condition state 2 were included in the calculations.

The procedure described earlier for calculating the number of years a bridge remained at each condition state was used for the remaining 32 bridges in the database to calculate the number of years at condition state 2. Three bridges dropped from condition state 1 directly to condition state 3. These bridges were included in the calculations, and the number of years at condition state 2 was recorded as zero. The bridges were divided into the same six subsets previously described, and the average number of years each subset remained at condition state 2 before dropping to condition state 3 was calculated. The average deck age at the first inspection date that a bridge was at condition state 3 was also calculated.

The same procedure was used to calculate the average number of years that each subset of bridges remained at condition state 3 before dropping to condition state 4. Two bridges dropped from condition state 2 directly to condition state 4. One bridge dropped from condition state 1 directly to condition state 4 (Bridge 01007). These bridges were included in the calculations, and the number of years at condition state 3 was recorded as zero. Bar chart results showing the average number of years each subset of bridges remained at condition state 2 before dropping to condition state 3 and remained at condition state 3 before dropping to condition state 4 are discussed in Chapter 3.

The most recent inspection data for NBE Element #12 Reinforced Concrete Deck (underside of deck) was analyzed in more depth to determine the percentage of the deck at condition state 3 and/or 4. The bridges that had no data in condition states 3 and/or 4 were removed from the database. The quantity of deck in condition state 3 was added to the quantity of deck in condition state 4. This sum was divided by the total area of the deck and multiplied by 100 to get the percentage of deck in condition states 3 and/or 4. The bridges were separated into the six subsets previously discussed. The average percentage of the deck in condition states 3 and/or 4 was calculated for each subset. The number of bridges in each subset that had a percentage of the deck in condition states 3 and/or 4 was divided by the total number of bridges in that subset that had data for NBE Element #12. This number was multiplied by 100 to get the percentage of bridges in each subset that most recently had a portion of the deck in condition states 3 and/or 4. Tabular results showing the total number of bridges that had NBE Element #12 data in each

subset, the average percentage of the deck in condition states 3 and/or 4, and the percentage of bridges in each subset that were most recently at condition states 3 and/or 4 are discussed in Chapter 3.

The bridges that had at least 2% of the deck in condition states 3 and/or 4 for NBE Element #12 Reinforced Concrete Deck (underside of deck) were analyzed. Bridges that had less than 2% of the deck in condition states 3 and/or 4 were removed from the database. The percentage of these bridges that had mixed rebar decks was calculated, and the percentage of the mixed rebar decks that were in each subset was calculated. Additionally, the same procedure was used to analyze bridges that had at least 5% of the deck in condition states 3 and/or 4 for NBE Element #12 Reinforced Concrete Deck (underside of deck). Bar chart results showing the percentage of bridges that had at least 2% and at least 5% of the deck in condition states 3 and/or 4 in each subset are discussed in Chapter 3.

The relationship between wearing surface crack density and the deterioration of the underside of the deck using NBE Element #12 Reinforced Concrete Deck (underside of deck) was analyzed. Scatter plot results comparing the wearing surface crack density to the percentage of the deck at condition states 3 and/or 4 are discussed in Chapter 3. Similar scatter plot results were generated for bridges with monolithic decks, which are decks that do not have a wearing course.

CoRe Element #359 Cracking on the Underside of Deck and NBE Element #12 Reinforced Concrete Deck (underside of deck) data for nine bridges that had been re-decked were analyzed. The inspection data prior to the year the bridge was re-decked was summarized in a table as discussed in Chapter 3. The year and the reason for the re-decking was also included in the table.

2.2.2 Fiber-Reinforced Decks

NBE Elements #12, #510, and #810 were analyzed for the fiber-reinforced bridge decks. There was not enough inspection data to show the changes in condition state over time since these decks were all built after 2012. The condition state from 2017 was used to compare the fiber-reinforced decks to the control structures. Bar charts were created for each element that show the percentage of fiber-reinforced decks compared to the percentage of control structures at each condition state. Tables were also made for each element and each bridge type that show the number of bridges at each condition state and the percentage of bridges at each condition state.

2.3 VISUAL INSPECTIONS

The 11 trips to visually inspect 115 bridges were planned using GPS and latitude/longitude coordinates to ensure efficient travel routes. During the inspections, pictures of both the top and bottom of the deck were taken from both ends of the main span and of midspan, if possible. Pictures of areas with significant degradation were taken for each structure. Visual inspection forms were created to have consistency in the UMD inspection notes. The visual inspection forms had space to collect data on visible cracks, cracks with leaching or efflorescence, spalling and delamination, spalling with exposed rebar, and rust staining. There was also a space on the form to record the type and spacing of the cracks. Each condition was divided into three size intervals, and the numerical quantity in each condition was

recorded for each size interval. The crack lengths were categorized by a length less than 6 in., between 6 in. and 4 ft, and greater than 4 ft. The spalls, delamination, and rust staining were broken up by an area less than 3 in.², between 3 in.² and 1 ft², and greater than 1 ft². The approximate area of spalls and delamination greater than 5 ft² were recorded in the notes section of the inspection form. For example, on page B-1, Bridge 10004 had two cracks with efflorescence that were greater than 4 ft in length. These inspections did not involve a tape measure, so all of the sizes were visually estimated. The completed inspection forms for all of the fiber-reinforced decks and the control structures visually inspected are shown in Appendix C. The completed inspection forms for all of the mixed rebar decks and the control structures visually inspected are shown in Appendix D. A blank visual inspection form is shown in Figure 2.4.

Cracking with efflorescence, spalling with exposed rebar, and delamination on the underside of the deck were categorized for each bridge to indicate the level of severity after all of the inspections were completed. The categories used were:

- None
- Isolated
- Minor
- Moderate
- Extensive
- Advanced
- Severe

The isolated category was only used for spalling with exposed rebar and delamination. The naming convention for these categories were words used to describe the Deck NBI condition codes used by MnDOT. However, these categories are not related to MnDOT's rating system and were only used to compare the mixed rebar decks and fiber-reinforced decks to their control structures. The interpretation of these words may be different than the interpretation used by MnDOT, so the results that include discussions using these categories should not be directly compared to MnDOT's inspection ratings.

Descriptions for each category of cracking with efflorescence, spalling with exposed rebar, and delamination are shown in Table 2.3, Table 2.4, and Table 2.5, respectively. No tools were used during the inspections, so all of the measurements were approximate. The percent of bridges with each deck type at each category was calculated and recoded in bar charts. Representative images for each observed category of cracking with efflorescence, spalling with exposed rebar, and only the advanced category of delamination are shown in Figure 2.5, Figure 2.6, and Figure 2.7, respectively.

2.4 COMPARISON OF INSPECTION DATA AND VISUAL INSPECTIONS

Cracking on the underside of the deck observed during the visual inspections was compared to the NBE Element #12 Reinforced Concrete Deck (underside of deck) inspection data. The notes from the MnDOT inspection reports included the linear feet of cracking on the underside of the deck for 79 of the bridges visually inspected. Only these 79 bridges were included in this comparison since the UMD visual

inspection data did not include the measured length of the cracks and not all areas were accessible on every bridge. The linear feet of cracking was divided by the area of the deck to give the crack density in LF/SF. Scatter plot results for the underside crack density versus the percentage of the deck in condition states 3 and/or 4 for NBE Element #12 are discussed in Chapter 3.

Table 2.1 Number of bridges selected for visual inspection and their MnDOT District location

Type of Bridge	# Bridge Inspections	MnDOT District
Mixed rebar deck	75	1, 3, or 5 (Metro)
Control structure for mixed rebar	25	
Fiber-reinforced deck	11	
Control structure for fiber-reinforced	4	
<i>Total:</i>	115	

Table 2.2 Number of bridges included in the study and the range of the year built for each type of bridge deck

Type of Bridge	Number of Bridges	Range of Year Built	Average Deck Age (Years)
Mixed rebar	471	1955 - 1989	36
Control structures for mixed rebar	35	1965 - 1990	30
Fiber-reinforced	18	2012 - 2017	3
Control structures for fiber-reinforced	4	2013 - 2016	4

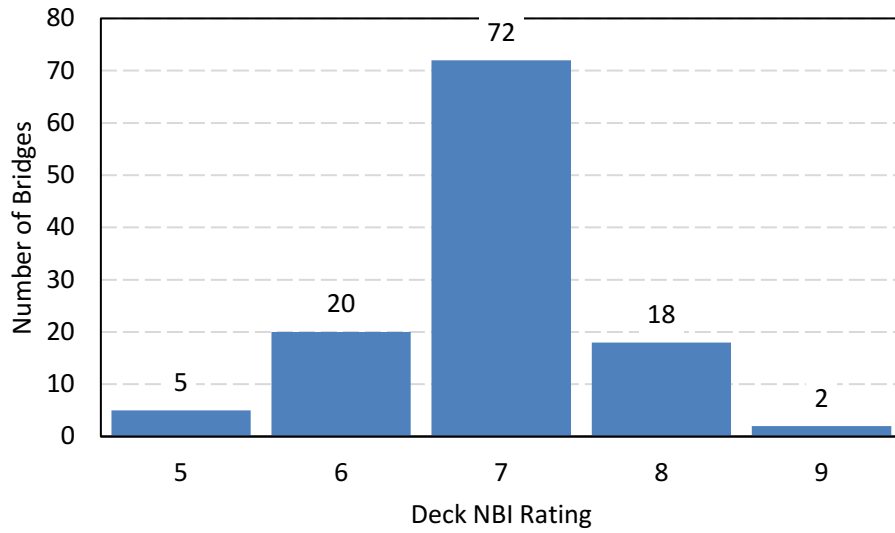


Figure 2.1 Number of bridges selected for visual inspection at each Deck NBI rating

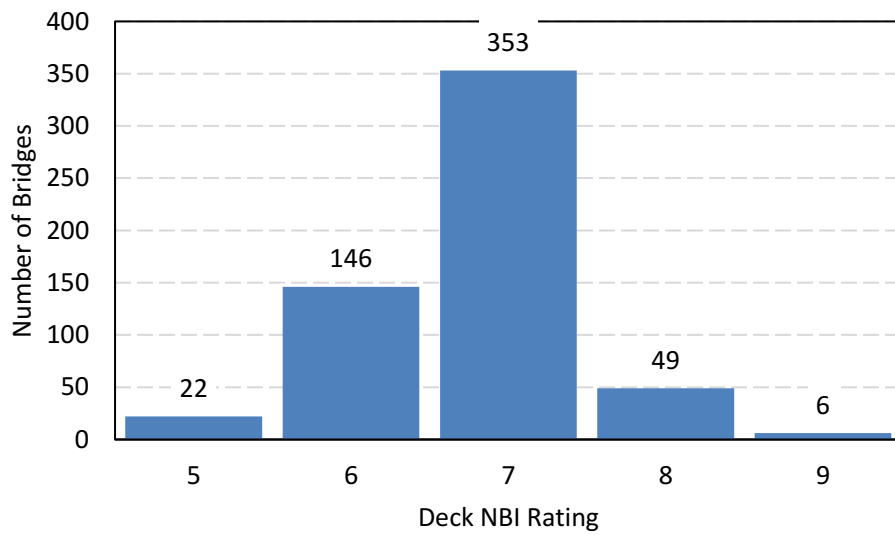


Figure 2.2 Number of bridges studied at each Deck NBI rating

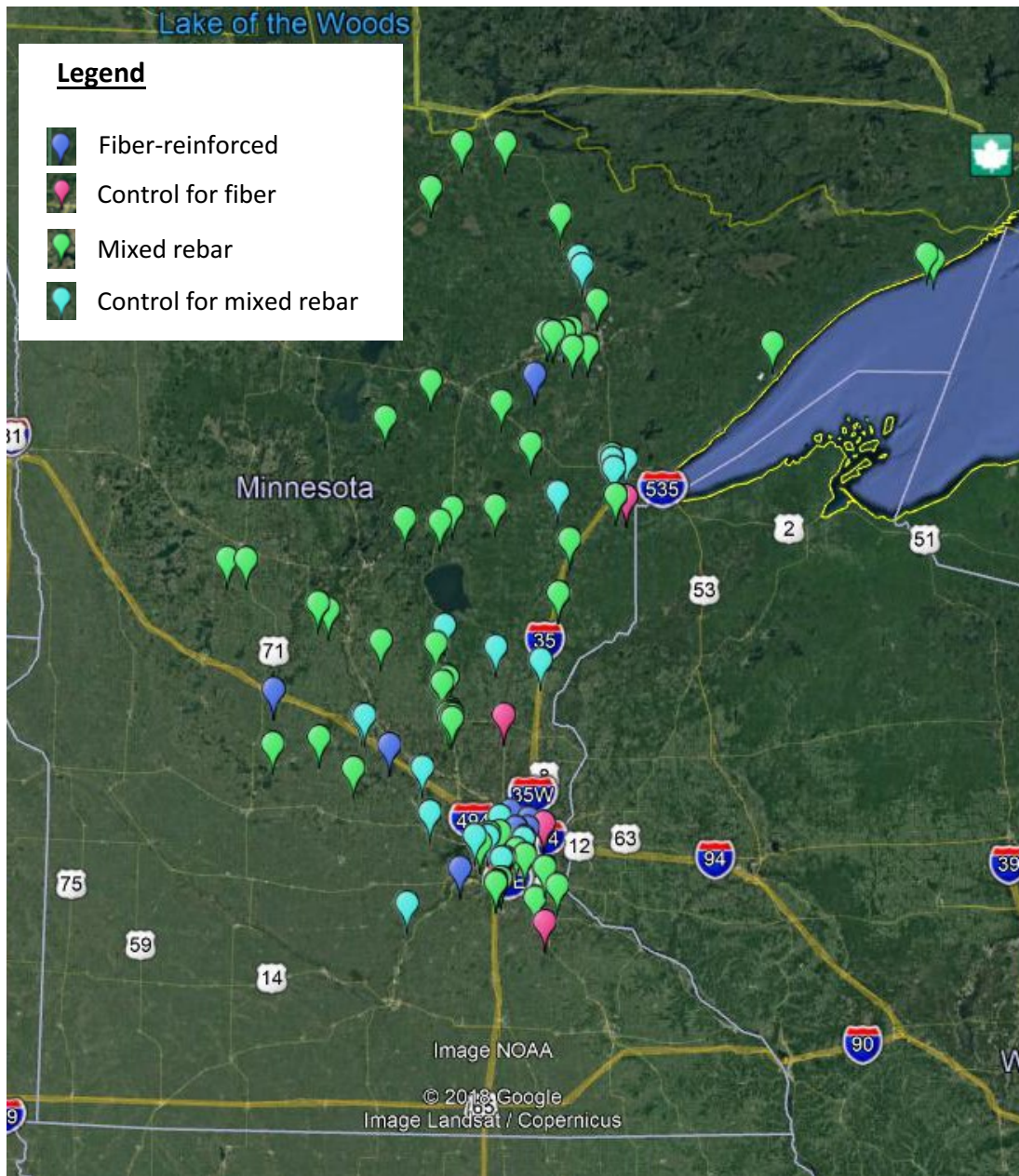


Figure 2.3 Map of bridges selected for visual inspection (MnDOT Districts 1, 3, and Metro)

SAMPLE VISUAL INSPECTION FORM

BRIDGE NUMBER:

REINFORCING TYPE:

INSPECTION DATE:

CURRENT DECK NBI RATING:

INSPECTORS:

NUMBER OBSERVED FOR EACH CONDITION

CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

MnDOT INSPECTION NOTES:

Figure 2.4 Sample visual inspection form

Table 2.3 Description of the categories for spacing of cracks with efflorescence in ft

Category	Description
None	No visible cracks with efflorescence
Isolated	(not used)
Minor	> 20 ft spacing, isolated cracks, or cracks with very light efflorescence
Moderate	Approximately 10 to 20 ft crack spacing
Extensive	Approximately 5 to 10 ft crack spacing
Advanced	Approximately 2 to 5 ft crack spacing
Severe	Approximately 2 to 5 ft crack spacing with very heavy efflorescence



Figure 2.5 Representative images for each category of cracking with efflorescence

Table 2.4 Description of the categories for the area of spalling with exposed rebar in square feet (SF)

Category	Description
None	No visible spalling with exposed rebar
Isolated	Isolated spalling, typically at the deck joint
Minor	All spalls < 1 SF in area
Moderate	Largest spalls approximately 1 to 2 SF
Extensive	Largest spalls approximately 2 to 3 SF
Advanced	Largest spalls approximately 3 to 5 SF
Severe	Largest spalls approximately > 5 SF



Figure 2.6 Representative images of each category of spalling with exposed rebar

Table 2.5 Description of the categories for delamination area in square feet (SF)

Category	Description
None	No visible delamination
Isolated	Isolated delamination, typically at the deck joint
Minor	All areas < 1 SF in area
Moderate	Largest areas approximately 1 to 2 SF
Extensive	Largest areas approximately 2 to 3 SF
Advanced	Largest areas approximately 3 to 5 SF
Severe	Largest areas approximately > 5 SF



Figure 2.7 Representative image for advanced delamination

CHAPTER 3: RESULTS AND DISCUSSION

3.1 EVALUATION OF INSPECTION DATA

3.1.1 Mixed Rebar Decks

Observations were drawn from several sources and summarized independently as follows. The observations are typically divided into the subsections discussed in Chapter 2. The line charts and tables reporting the average number of years each subset of bridges remained at each Deck NBI rating or element condition state are shown in Appendix E.

The quality of the concrete is largest factor in the condition of the deck when at Deck NBI ratings 9 through 6. This means the type of reinforcement does not affect the condition of the deck until it has reached a rating of 5. Similarly for CoRe and NBE element data, the deterioration at condition state 2 is largely driven by concrete and construction quality, not reinforcement. The focus of the data summarized below should be on Deck NBI levels 5 and below and CoRe or NBE level 3 or below. However, all of the observations and results are presented for completeness.

Deck NBI Data Observations

- Both the mixed rebar decks and the control structures reached a Deck NBI rating of 4.
- The two mixed rebar decks that reached a Deck NBI rating of 4 had
 - an ADT less than 4,000.
 - a current wearing surface crack density less than 0.01 LF/SF or greater than 0.1 LF/SF.
 - a route type of State Highway or County Road.
 - a steel superstructure.
- ADT for mixed rebar decks
 - Decks with an ADT less than 4,000 stayed at a Deck NBI rating of 8 for an average of 11 years. The average number of years decreased by two years for each increase in ADT range: between 4,000 and 10,000, and greater than 10,000.
- Current wearing surface crack density for mixed rebar decks
 - A current wearing surface crack density less than 0.1 LF/SF dropped from a Deck NBI rating of 8 an average of two years later than those with a current wearing surface crack density greater than 0.1 LF/SF.
- Superstructure type for mixed rebar decks
 - The decks with a prestressed concrete superstructure stayed at a Deck NBI rating of 7 three to four years longer than the mixed rebar decks with a steel or reinforced concrete superstructure.

CoRe Element #12 Top of Concrete Deck Data Observations

- The mixed rebar decks reached condition states 1 through 4.
- The mixed rebar decks that reached condition states 3 and 4 had
 - an ADT less than 4,000.

- a current wearing surface crack density less than 0.01 LF/SF.
- a route type of County Road.
- a steel superstructure.
- The mixed rebar decks that remained at condition state 1 had
 - an ADT greater than 4,000.
 - a route type of Interstate.
- Current wearing surface crack density for mixed rebar decks
 - At the last inspection cycle of condition state 1, the decks with a current wearing surface crack density less than 0.01 LF/SF were four years older than those with a current wearing surface crack density greater than 0.1 LF/SF.
- Route type for mixed rebar decks
 - The one bridge that carried a Town Road remained at condition state 1 six to 15 years longer than the decks with other route types.
- Superstructure type for mixed rebar decks
 - The mixed rebar decks that had a prestressed concrete superstructure reached no worse than condition state 2.
 - The mixed rebar decks that had a steel superstructure reached condition states 1 through 4.

CoRe Element #26 Top of Deck with Epoxy Rebar Data Observations

- The mixed rebar decks reached condition states 1 through 4.
- The control structures reached no worse than condition state 2.
- The mixed rebar decks that reached condition states 3 or 4 had
 - an ADT less than 4,000.
 - a wearing surface crack density less than 0.01 LF/SF.
 - a route type of State Highway.
 - a steel superstructure.
- The mixed rebar decks that remained at condition state 1 had
 - a route type of Interstate.
 - a reinforced concrete superstructure.
- ADT for mixed rebar decks
 - Decks with an ADT less than 4,000 remained at condition state 1 an average of nine years longer than mixed rebar bridge decks with an ADT greater than 10,000.
- The mixed rebar decks that had a prestressed concrete superstructure reached condition state 2.

CoRe Element #358 Cracking on the Top of Deck Data Observations

- The mixed rebar decks reached condition state 4.
- The control structures reached condition state 3.
- The mixed rebar decks that reached condition state 3 had
 - all ranges of ADT.
 - all ranges of current wearing surface crack densities.
 - a route type of Interstate or U.S. Highway.

- all types of superstructures.
- The mixed rebar decks that reached condition state 4 had
 - an ADT less than 4,000 or greater than 10,000.
 - a current wearing surface crack density of either between 0.01 LF/SF and 0.1 LF/SF or greater than 0.1 LF/SF.
 - a route type of Interstate.
 - a steel or prestressed concrete superstructure.
- Current wearing surface crack density for mixed rebar decks
 - At the last inspection cycle of condition state 1, the decks with a current wearing surface crack density less than 0.01 LF/SF were
 - approximately two years older than decks with a current wearing surface crack density between 0.01 LF/SF and 0.1 LF/SF.
 - approximately four years older than decks with a current wearing surface crack density greater than 0.1 LF/SF.
- Route type for mixed rebar decks
 - Bridges carrying a County Road were the only mixed rebar decks that did not reach condition state 3.
- Superstructure type for mixed rebar decks
 - The decks with a prestressed concrete superstructure stayed at condition state 1 for an average of 11 years and
 - approximately two years longer than the decks with a steel superstructure.
 - approximately one year longer than the decks with a reinforced concrete superstructure.

CoRe Element #359 Cracking on the Underside of Deck

- The mixed rebar decks reached condition states 1 through 5.
- The control structures reached condition states 1 through 3.
- The mixed rebar decks that reached condition state 3 had
 - all ranges of ADT.
 - all ranges of current wearing surface crack densities.
 - a route type of Interstate, U.S. Highway, or State Highway.
 - all types of superstructures.
- The mixed rebar decks that reached condition state 4 had
 - all ranges of ADT.
 - all ranges of current wearing surface crack densities.
 - a route type of Interstate, U.S. Highway, or State Highway.
 - a steel or prestressed concrete superstructure.
- The mixed rebar decks that reached condition state 5 had
 - an ADT greater than 10,000.
 - a current wearing surface crack density greater than 0.1 LF/SF.
 - a route type of State Highway.
 - a steel superstructure.
- ADT for mixed rebar decks

- The decks with an ADT less than 4,000 stayed at condition state 1 approximately three years longer than decks with an ADT greater than 10,000.
- Current wearing surface crack density for mixed rebar decks
 - The decks with a current wearing surface crack density less than 0.01 LF/SF remained at condition state 1 approximately three years longer than decks with a current wearing surface crack density greater than 0.1 LF/SF.
- Route type for mixed rebar decks
 - Bridges carrying Town Roads were the only mixed rebar decks that remained at condition state 1.

NBE Element #510 Deck Wearing Surface Data Observations

- Both mixed rebar decks and control structures that reached condition state 2.
- None of the decks reached a condition state worse than 2.
- The mixed rebar decks that remained at condition state 1 had
 - a current wearing surface crack density less than 0.01 LF/SF.
 - a route type of County Road or Town Road.
 - a reinforced concrete superstructure.

NBE Element #810 Concrete Wearing Surface (cracking and sealing) Data Observations

- Both mixed rebar decks and the control structures reached condition state 3.
- There was a higher percentage (approximately 17%) of control structures at condition state 2 compared to the mixed rebar decks.
- The mixed rebar decks that reached condition state 3 had
 - an ADT less than 10,000.
 - all ranges of current wearing surface crack densities.
 - a route type of Interstate, U.S. Highway, or State Highway.
 - a steel or prestressed concrete superstructure.

The mixed rebar decks reached worse condition states than the control structures when considering data from CoRe Elements #26 Top of Deck with Epoxy Rebar (No Overlay), #358 Cracking on the Top of Deck, and #359 Cracking on the Underside of Deck. This difference in performance was the most evident considering CoRe Element #26 condition state data for the control structures. All of the control structure decks had a condition state of 1 or 2 for CoRe Element #26, even though the average age of the decks was approximately 27 years. NBE Elements #510 Deck Wearing Surface and #810 Concrete Wearing Surface Cracking and Sealing appeared to be unaffected by uncoated rebar in the bottom mat. Since these elements only rate the wearing surface, it was reasonable that uncoated rebar in the bottom mat would not affect these element condition states.

The mixed rebar decks that reached the worst condition states considering data from CoRe Element #12 Underside of Reinforced Concrete Deck had an ADT less than 4,000, a current wearing surface crack density less than 0.01 LF/SF, a route type of County Road, and a steel superstructure. The decks that remained at the best condition states for CoRe Element #12 had an ADT greater than 4,000 and a route type of Interstate. The route type and superstructure type had a larger effect on the underside of the

deck than the ADT because the decks with that reached the worst condition states had the lowest ADT and the decks that remained at the best condition states had the highest ADT. The County Roads reached the worst condition states and they typically had lower ADT than Interstates, which remained at the best condition states. The difference in performance between route types may be linked to the maintenance and amount of plowing. Overweight trucks could be contributing to the degradation of decks, but this was not considered in the scope of the study.

The mixed rebar decks that reached the worst Deck NBI ratings had an ADT less than 4,000, a route type of State Highway or County Road, and a steel superstructure. Similar to CoRe Element #12 Underside of Reinforced Concrete Deck, the Deck NBI ratings appeared to be most affected by route type and superstructure type. The decks on County Roads and steel superstructures reached the worst condition states in both rating systems.

A total of 32 mixed rebar deck bridges had data that could be used to determine the number of years a bridge remained at condition state 2 before dropping to condition state 3 for CoRe Element #359 Cracking on the Underside of the Deck. These 32 structures did not include beginning tails less than 7 years. A beginning tail refers to a set of data that starts at least three years after the bridge was built. If the data had a beginning tail at condition state 2, the first year that the bridge was recorded at condition state 2 was unknown, and the number of years at condition state 2 could not be accurately calculated. All mixed rebar decks spent an average of 8.5 years at condition state 2 before dropping to condition state 3. Mixed rebar decks with all levels of wearing surface crack density, with an Interstate, U.S. Highway, State Highway, steel superstructure, skew, and no skew all remained at condition state 2 for an average of 7.5 to 9.5 years, which is within one year of the average for all mixed rebar decks. This indicated that these factors did not affect the number of years that the decks remained at condition state 2 before dropping to condition state 3. The bar charts for the number of years at condition state 2 for CoRe Element #359 are shown in Figure 3.1 and Figure 3.2.

All bridge decks with usable data (no beginning tails less than 7 years) for calculating the number of years a deck remained at condition state 3 before dropping to condition state 4 for CoRe Element #359 had mixed rebar decks. All mixed rebar decks spent an average 0.5 years at condition state 3 before dropping to condition state 4. Bridge decks with an ADT between 4,000 and 10,000, an Interstate, a State Highway, a steel superstructure, and skewed bridges all remained at condition state 3 for zero years. This means that the bridge decks dropped from a condition state 1 or condition state 2 directly to a condition state 4, spending no time at condition state 3. Data from four bridges were used to calculate the average number of years all bridge decks with usable data remained at condition state 3 (0.5 years), which is too small of a sample size to draw any conclusions. The bar chart with the number of years each subset remained at condition state 3 is shown in Figure 3.3.

The following observations were drawn from the calculation of the percentage of the deck in condition states 3 and/or 4 and the percentage of each subset that had reached condition states 3 and/or 4 for NBE Element #12 Reinforced Concrete Deck (underside of deck).

- A higher percentage of mixed rebar decks reached condition states 3 and/or 4 compared to the control structures.
- Approximately 30% more mixed rebar decks with an ADT greater than 10,000 had reached condition states 3 and/or 4 than the mixed rebar decks with an ADT less than 4,000. This indicated that ADT may have affected the level of deterioration on the underside of the deck (e.g., spalling, delamination, and cracking with heavy efflorescence).
- Mixed rebar decks with a wearing surface crack density less than 0.01 LF/SF had 13% more bridges reach condition states 3 and/or 4 than bridges with a wearing surface crack density greater than 0.1 LF/SF. However, the decks with the lower wearing surface crack density had a lower average percent of the entire deck area (1.31%) at condition states 3 and/or 4 than the decks with the higher wearing surface crack density (2.25%). This indicated that the wearing surface crack density affected the amount of deterioration visible on the underside of the deck, but it may not have been the best indicator of deterioration present on the underside of the deck.
- Approximately 30% more mixed rebar decks with a steel superstructure had reached condition states 3 and/or 4 than mixed rebar decks with a prestressed concrete superstructure. Decks with a steel superstructure also had a higher percentage of the entire deck area in condition states 3 and/or 4 (1.83%) than the decks with prestressed concrete superstructures (1.15%).

The tables with the total number of bridges that had NBE Element #12 data in each subset, the average percentage of the deck in condition states 3 and/or 4, and the percentage of bridges in each subset that were most recently at condition states 3 and/or 4 are shown in Appendix F.

The following observations were drawn from the analysis of bridge decks with at least 2% of the deck in condition states 3 and/or 4 for NBE Element #12 Reinforced Concrete Deck (underside of deck). Of the 52 bridge decks that had at least 2% of the deck in condition states 3 and/or 4, over 90% were mixed rebar decks and less than 10% were the control structures. More than 50% of these mixed rebar decks carried a State Highway, had a steel superstructure, and were not skewed. The mixed rebar decks were split almost equally between each level of ADT. This indicated that ADT did not affect the amount of the deck in condition states 3 and/or 4. The bar chart reporting the percentage of bridges in each subset with at least 2% of the deck in condition states 3 and/or 4 is shown in Figure 3.4.

The following observations were drawn from the analysis of bridges with at least 5% of the deck in condition states 3 and/or 4 for NBE Element #12 Reinforced Concrete Deck (underside of deck). Of the 11 bridge decks that had at least 5% of the deck in condition states 3 and/or 4, over 90% were mixed rebar decks and less than 10% were the control structures. Only 11 bridges in the study had at least 5% of the deck in condition states 3 and/or 4, which is too small of a sample size to make any accurate conclusions. The bar chart reporting the percentage of bridges in each subset with at least 5% of the deck in condition states 3 and/or 4 is shown in Figure 3.5.

Plots of the wearing surface crack density versus the percentage of the deck in condition states 3 and/or 4 for NBE Element #12 Reinforced Concrete Deck (underside of deck) did not show any trends.

Additional analysis was conducted with the outliers removed to enlarge the concentration of data. The

axes were shorted to 0.3 LF/SF for the wearing surface crack density and 3% of the deck at condition states 3 and/or 4. However, there was still no trend observed with the outliers removed. Similarly, no trend was observed when plotting wearing surface crack density versus the percentage of the deck in condition states 3 and/or 4 considering only monolithic decks. The wearing surface crack density did not correlate to deterioration on the underside of the deck. The plots of wearing surface crack density versus the percentage of the deck in condition states 3 and/or 4 for NBE Element #12 Reinforced Concrete Deck (underside of deck) are shown in Appendix F.

Inspection data were evaluated for nine bridges that had been re-decked. Of the nine bridges, five of them were re-decked due to deterioration (Bridges 27734, 27891, 9300, 62090, and 7263). Four of those bridges had data available prior to being re-decked for CoRe Element #359 Cracking on the Underside of the Deck and one had data available for NBE Element #12 Reinforced Concrete Deck (underside of the deck). Results related to the number of years each bridge stayed at condition states 2, 3, or 4 are shown in Table 3.1. The term “at least” was used in the table to describe data that had a beginning tail at a condition state.

3.1.2 Fiber-Reinforced Decks

The following observations were drawn from the fiber-reinforced deck and the corresponding control structure deck data.

- NBE Element #12 Reinforced Concrete Deck (underside of deck)
 - The fiber-reinforced decks and the control structures remained at condition state 1.
- NBE Element #510 Deck Wearing Surface
 - Two fiber-reinforced decks were at condition state 2, which was 10.5% of the fiber-reinforced bridges in the study with Element #510 data.
 - All of the control structures remained at condition state 1.
- NBE Element #810 Concrete Wearing Surface (cracking and sealing)
 - One fiber-reinforced deck was at condition state 2, which was 14% of the fiber-reinforced decks in the study with Element #810 data.
 - 33% of the control structures in the study with Element #810 data were at condition state 2.

The fiber-reinforced decks remained at better condition states than the control structure decks when considering data from NBE Element #810 (concrete wearing surface cracking and sealing). A larger percentage of the control structure decks reached condition state 2 compared to the fiber-reinforced decks. However, the control structure decks remained at better condition states than the fiber-reinforced decks when considering NBE Element #510 (deck wearing surface). No conclusions were drawn on the performance of the fiber-reinforced decks due to the limited inspection data available on the fiber-reinforced decks and their control structure decks. It would be beneficial to continue comparing the fiber-reinforced bridge decks to their control structure decks when more inspection data are available to analyze the deck condition over time. The bar charts and tables for the fiber-reinforced decks and the control structures are shown in Appendix E.

3.2 VISUAL INSPECTIONS

Based on the visual inspection observations, the mixed rebar decks showed more signs of deterioration on the underside of the deck than the control structures. Of the bridges that were visually inspected, 47% of the mixed rebar decks and 26% of the control structures had spalling with exposed rebar. Delamination was present on 54% of the mixed rebar decks and 13% of the control structures. The decks with the most severe spalling and delamination had mixed rebar, but the decks with the most severe cracking with efflorescence were the control structures (epoxy-coating on both layers of rebar). This may indicate that the epoxy-coating on the bottom layer of rebar has been delaying corrosion of the rebar. The efflorescence may not have been as severe in the mixed rebar decks compared to the control structures because the bottom layer of rebar had likely corroded and caused the concrete to spall off the structure. The percentages of each type of deck that had cracking with efflorescence, spalling with exposed rebar, and delamination are shown in Figure 3.6, Figure 3.7, and Figure 3.8, respectively. The completed inspection forms for the mixed rebar decks and their control structures are in Appendix D.

The fiber-reinforced decks showed more signs of leaching but fewer signs of concrete deterioration (e.g., spalling) than the control structures. Of the bridges that were visually inspected, 60% of the fiber-reinforced decks showed cracks with efflorescence, while 25% of the control structures showed cracks with efflorescence. Isolated spalling with exposed rebar was observed in 25% of the control structures, which was one bridge due to the lower number of structures visually inspected. This deck (Bridge 09017) was constructed in 2013, which is older than the average age of the visually inspected fiber-reinforced decks and their control structures (Table 2.2). This deck appeared to be in worse condition than the MnDOT inspection report represented because the report did not note any spalling. None of the fiber-reinforced decks showed spalling with exposed rebar, but one deck (Bridge 69072) had honeycombs with rust staining on the underside of the deck. The Bridge 69072 deck also had scaling with exposed fibers on the top of the deck. The fiber-reinforced and control structure decks did not show any signs of delamination. Due to the small sample size, conclusions were not drawn based on the visual inspections of the fiber-reinforced decks and the control structures. The completed inspection forms for the fiber-reinforced decks and their control structures are in Appendix C.

3.3 COMPARISON OF INSPECTION DATA AND VISUAL INSPECTIONS

No trend was observed when comparing the underside of the deck crack density versus the percent of the deck in condition states 3 and/or 4 for NBE Element #12 Reinforced Concrete Deck (underside of deck). Condition states 3 and 4 for NBE Element #12 typically measure the amount of spalling and delamination on the underside of the deck. It was generally observed during the visual inspections that bridges with significant spalling on the underside of the deck did not show much cracking on the underside of the deck, which was likely because the concrete at the cracks is typically the area that spalls off the structure. It is reasonable that there was no trend observed, since the underside crack density and percentage of the deck in condition states 3 and/or 4 were taken from the same inspection date. Correlation between the underside of the deck crack density from years past may be a better indicator of current spalling and delamination observed during the visual inspections, but these data

were not evaluated in this project. It would be beneficial for MnDOT to create a new rating element that tracks the underside of the deck crack density to better predict future spalling and delamination. The plots of the underside of the deck crack density versus the percentage of the deck in condition states 3 and/or 4 are shown in Appendix F.

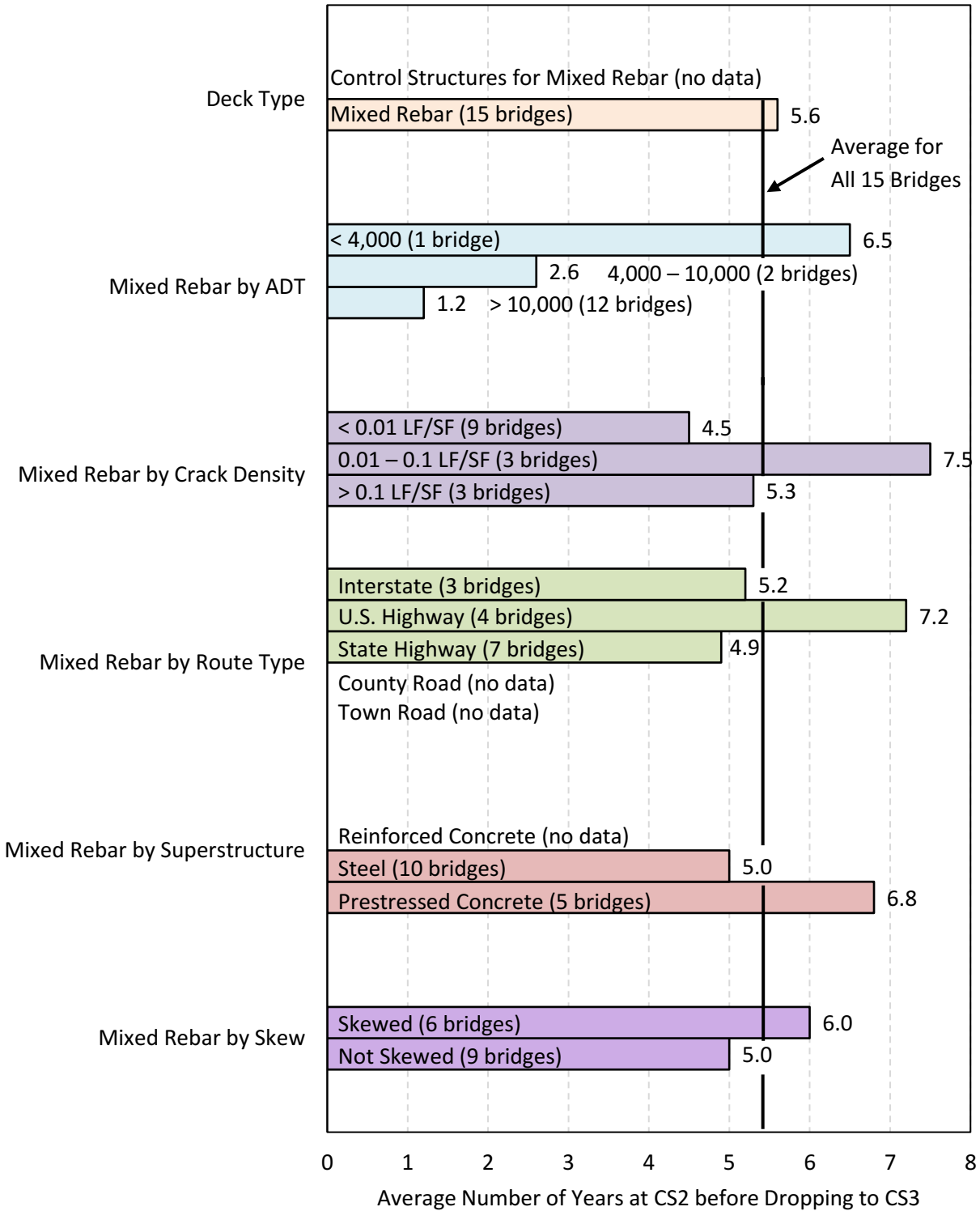


Figure 3.1 Average number of years each subset remained at condition state 2 (< 2% distressed) before dropping to condition state 3 (> 2% but < 10% distressed) for CoRe Element #359 not including beginning tails (15 bridges)

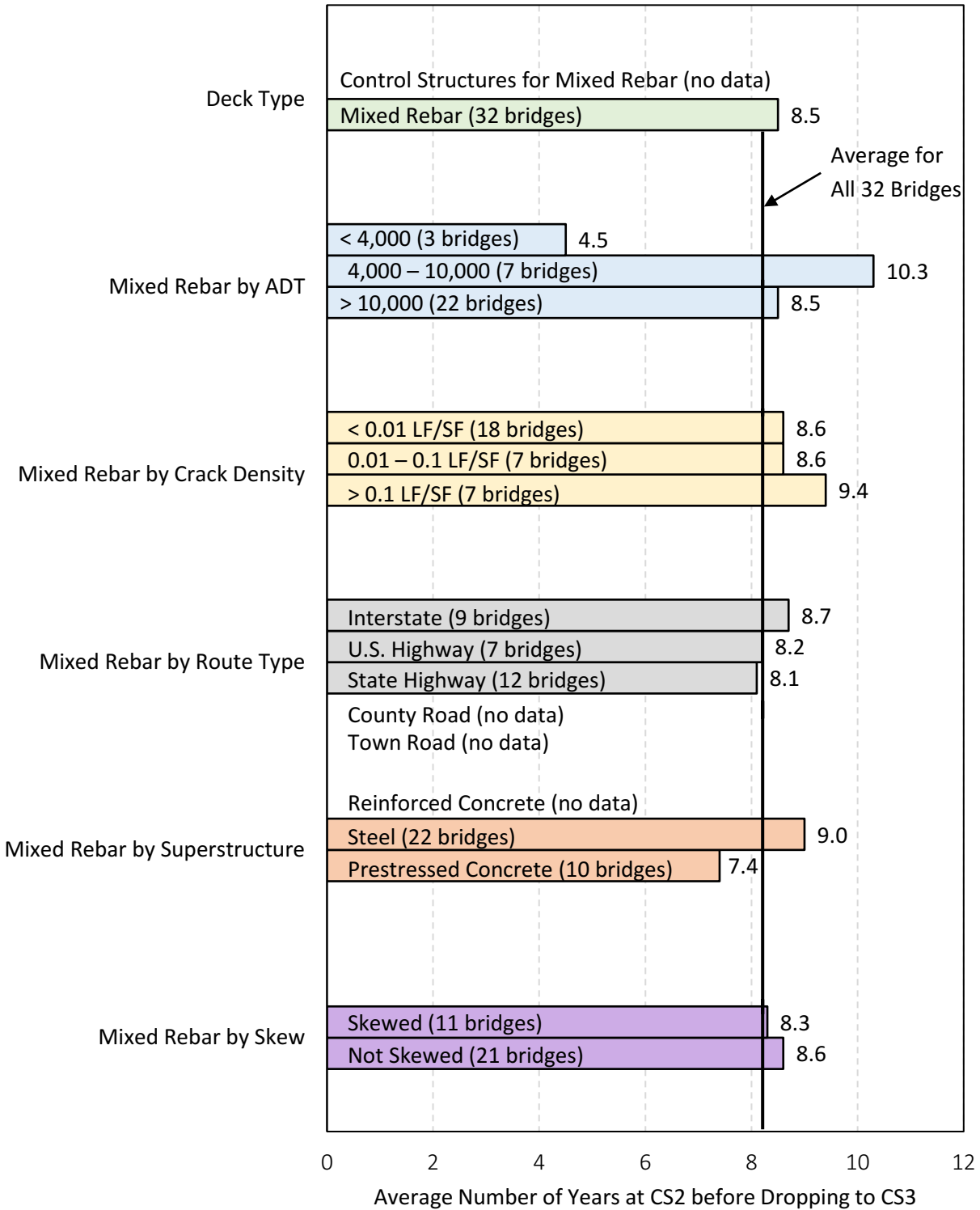


Figure 3.2 Average number of years each subset remained at condition state 2 (< 2% distressed) before dropping to condition state 3 (> 2% but < 10% distressed) for CoRe Element #359 including beginning tails of at least 7 years (32 bridges)

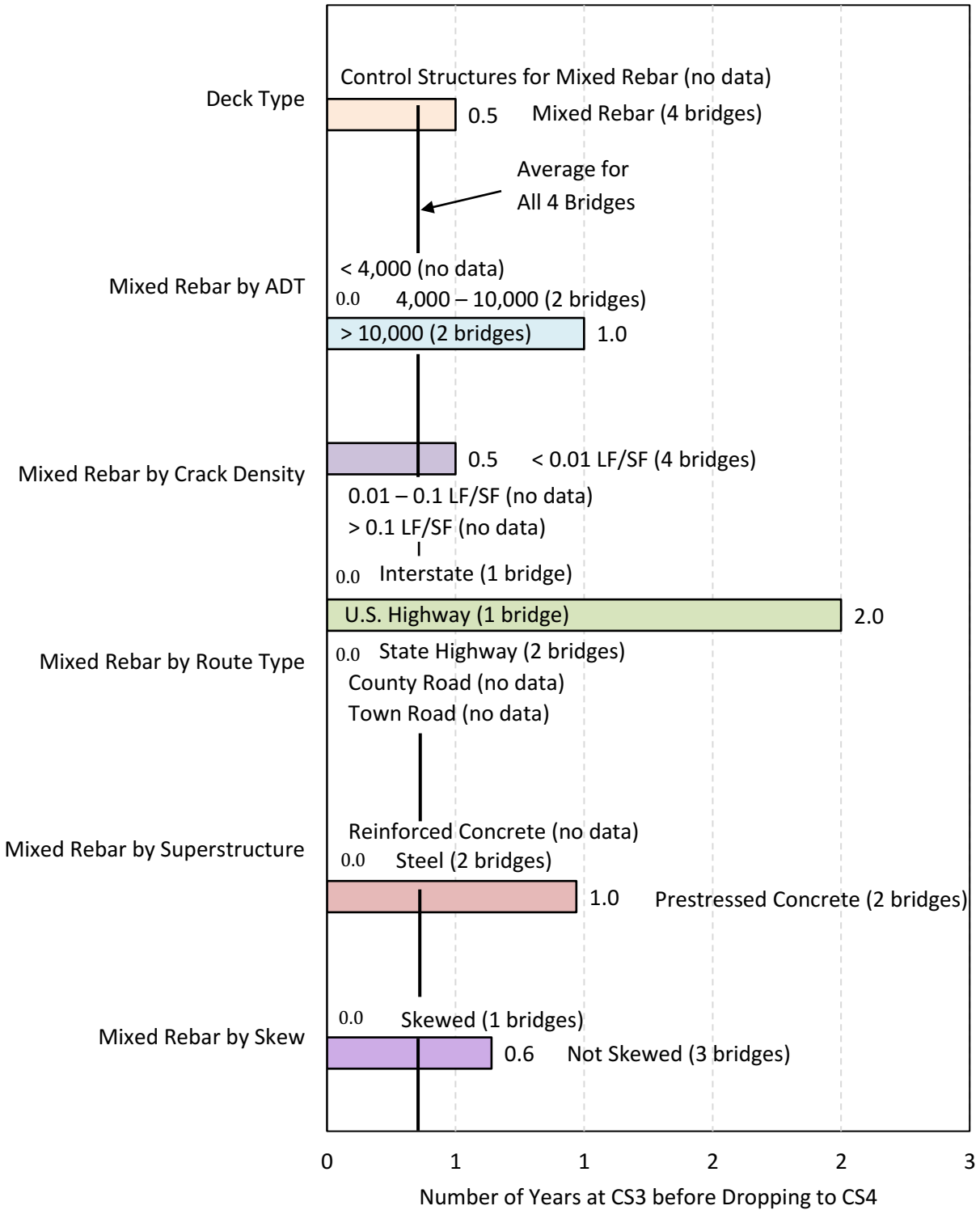


Figure 3.3 Average number of years each subset remained at condition state 3 (> 2% but < 10% distressed) before dropping to condition state 4 (> 10% but < 25% distressed) for CoRe Element #359 not including beginning tails (4 bridges)

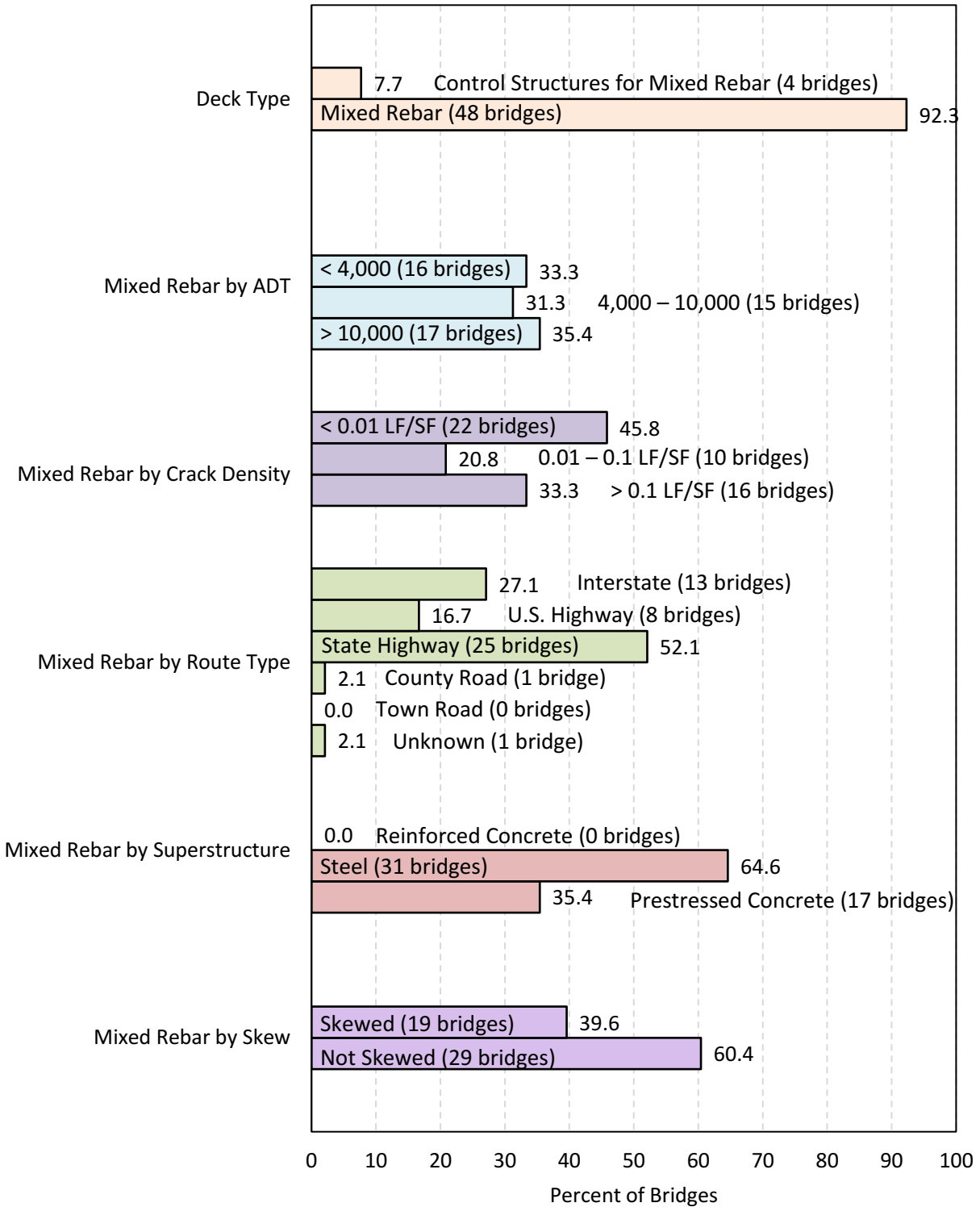


Figure 3.4 Percent of bridges in each subset that have greater than or equal to 2% of the deck area in condition states 3 and/or 4 for NBE Element #12 (52 bridges)

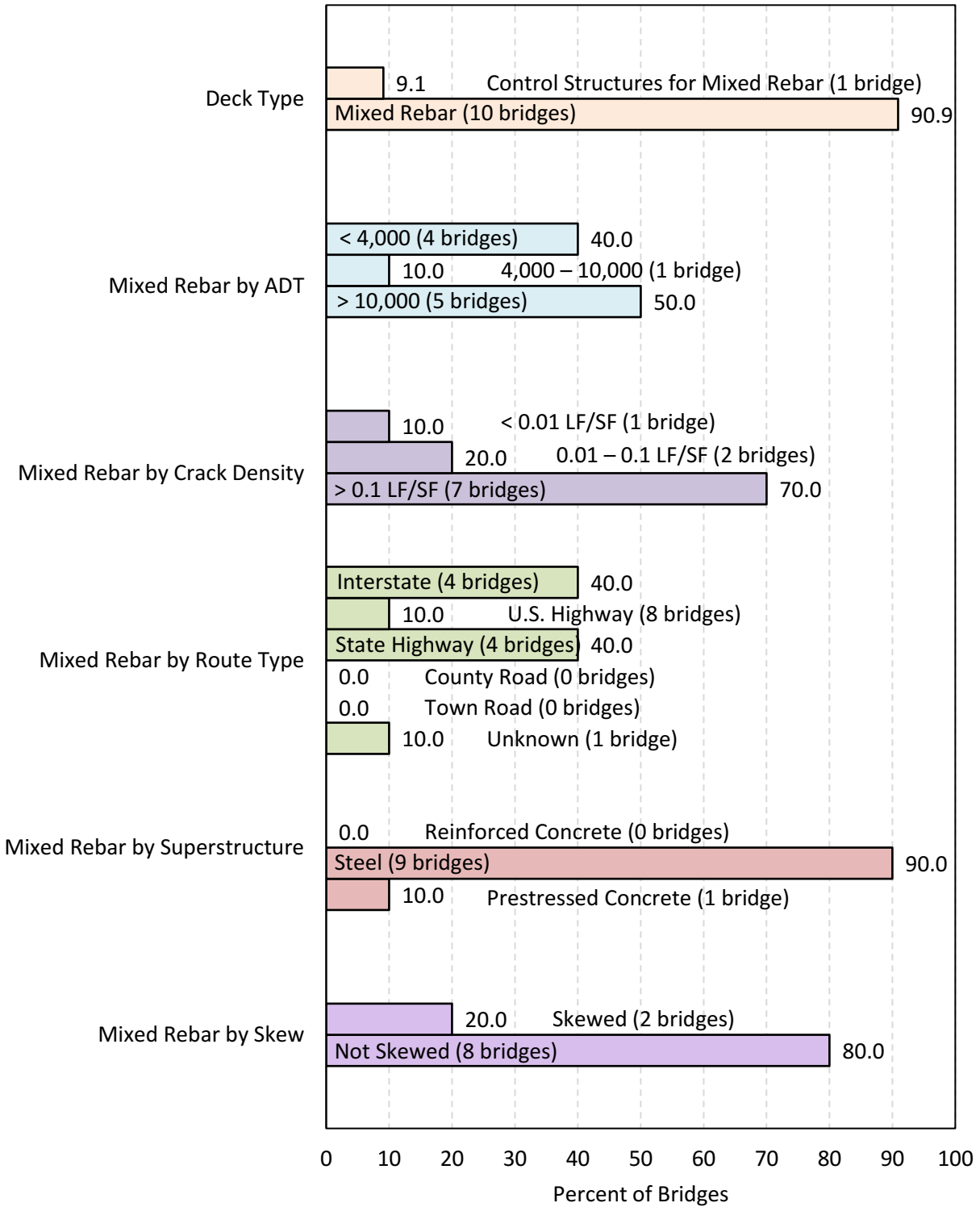


Figure 3.5 Percent of bridges in each subset that have greater than or equal to 5% of the deck area in condition states 3 and/or 4 for NBE Element 12 (11 bridges)

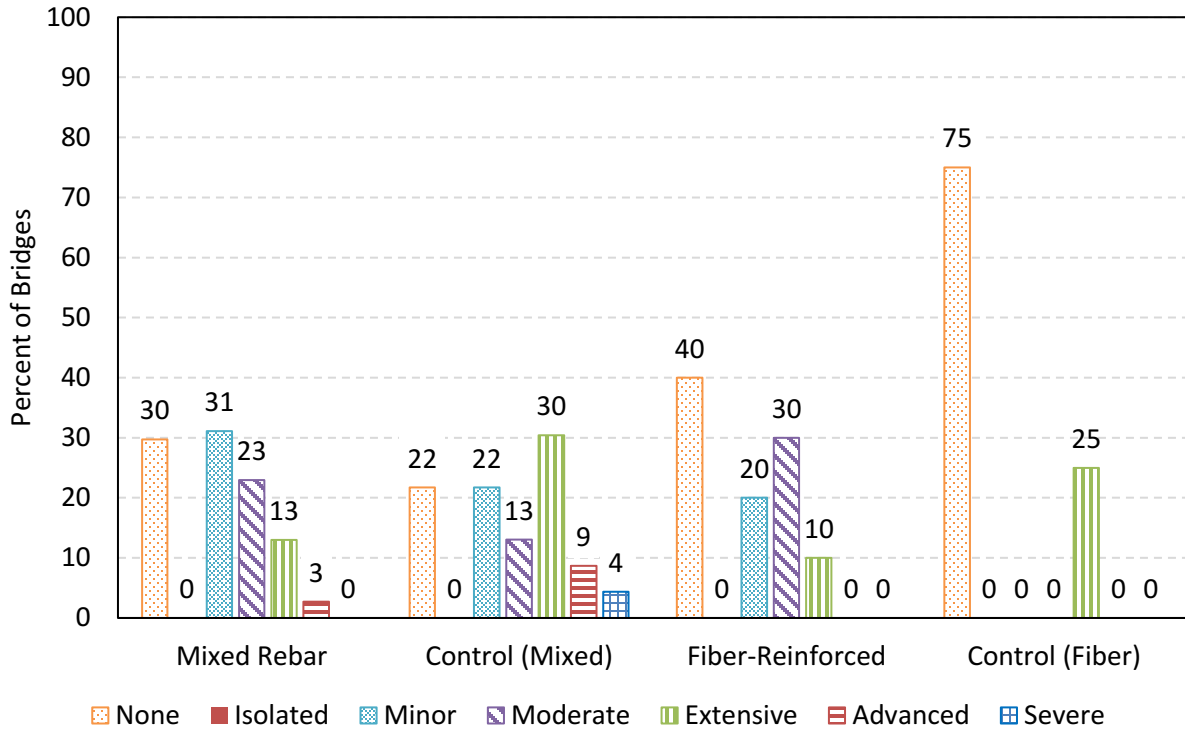


Figure 3.6 Percent of bridges visually inspected at each category for cracking with efflorescence

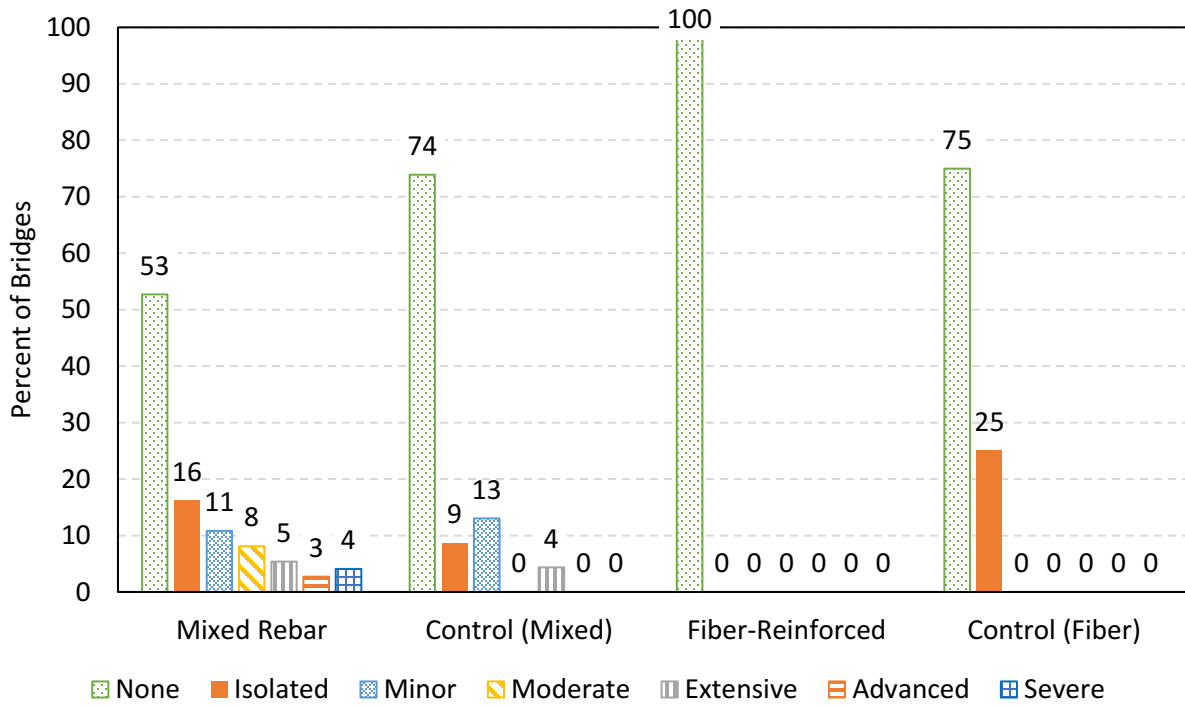


Figure 3.7 Percent of bridges visually inspected at each category for spalling with exposed rebar

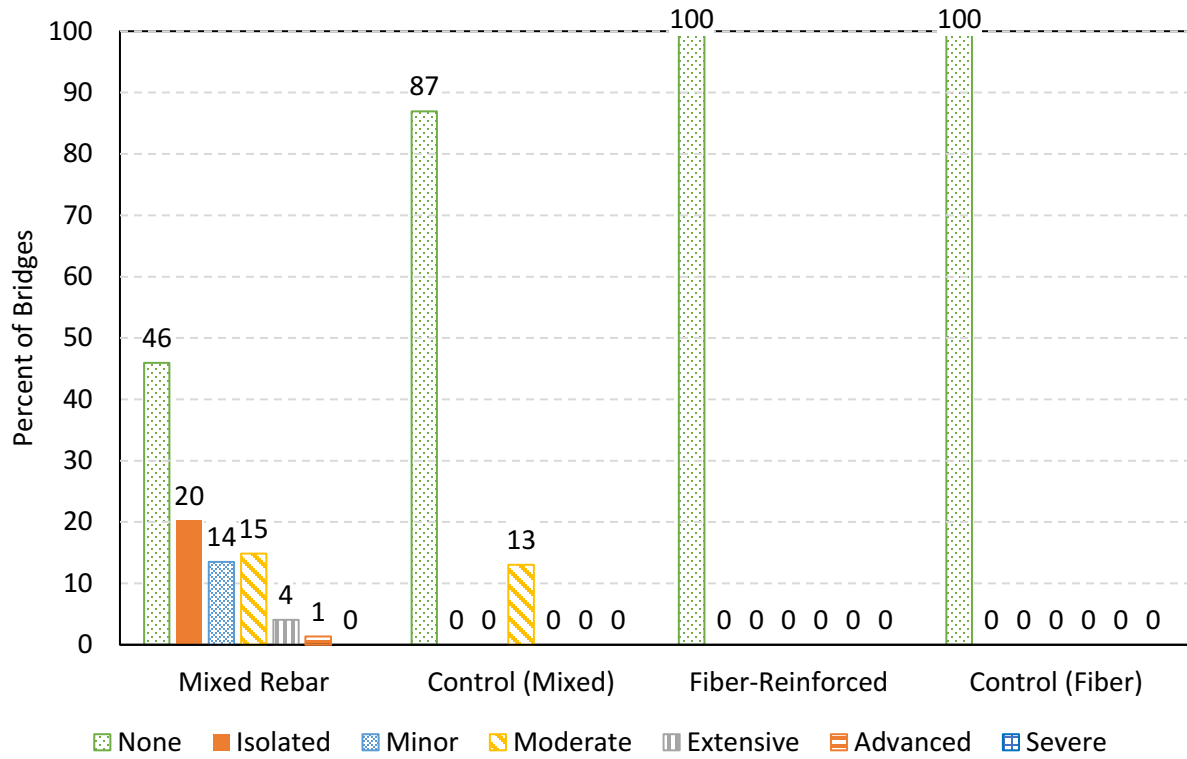


Figure 3.8 Percent of bridges visually inspected at each category for delamination

Table 3.1 Inspection data prior to re-decking for CoRe Element #359 and NBE Element #12 for nine bridges that were re-decked

Bridge #	Year Re-decked	Reason for Re-deck	CoRe Element 359 Prior to Re-deck	NBE Element 12 Prior to Re-deck
27713	2003	Widened	Remained at CS1	No data prior to 2003
27734	2013	Deterioration	3 years at CS2 11 years at CS3	No data prior to 2013
27891	2013	Deterioration	At least 4 years at CS2 10 years at CS3	No data prior to 2013
73023	2003	Widened	No data prior to 2003	No data prior to 2003
9300	2016	Deterioration	At least 12 years at CS4	No data prior to 2016
19865	2018	Widened	At least 12 years at CS2 At least 6 years at CS3	97.4% CS1, 0.6% CS2, 2% CS3
62090	2018	Deterioration	At least 4 years at CS3 3 years at CS5 At least 5 years at CS3	100% CS1
7263	2018	Deterioration	No data	No data
04023	2014	Vehicle impact	No data	No data

CHAPTER 4: CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

The following conclusions for mixed rebar decks were drawn from the results of this study.

- The mixed rebar decks reached worse condition states than the control structure decks when considering CoRe Elements #26 Top of Deck with Epoxy Rebar (No Overlay), #358 Cracking on the Top of Deck, #359 Cracking on the Underside of Deck, and NBE Element #12 Reinforced Concrete Deck (underside of deck). Negligible differences between the mixed rebar decks and the control structures were observed when considering Deck NBI (overall condition of the deck), NBE Element #510 Deck Wearing Surface, and NBE Element #810 Concrete Wearing Surface (cracking and sealing).
- Mixed rebar decks remained at condition state 2 for an average of 8.5 years before dropping to condition state 3 when considering CoRe Element #359 Cracking on the Underside of the Deck.
- ADT did not appear to affect the deterioration of the deck.
- Wearing surface crack density did not appear to affect the deterioration of the deck since many of the cracks extend only to the bottom of the 2-in., low-slump concrete wearing course and not into the underlying structural concrete deck.
- Mixed rebar decks with steel superstructures reached worse condition states than mixed rebar decks with prestressed concrete superstructures. Insufficient data prevented conclusions from being drawn on decks with a reinforced concrete superstructure.
- Mixed rebar decks with no skew reached worse condition states than mixed rebar decks with skew when considering data for NBE Element #12 Reinforced Concrete Deck (underside of deck). There were likely other factors not included in this study that affected these results since it was expected that skewed decks would reach a worse condition state than decks with no skew.

No conclusions were drawn based on the results for the fiber-reinforced decks due to the small sample size and the limited amount of data available over time.

4.2 RECOMMENDATIONS

The following recommendations were made based on the results of this study.

1. Create a new rating element for use during inspection of mixed rebar decks that quantifies the crack density on the underside of the deck. Through-deck cracking may be a key indicator for future underdeck spalling of mixed bar decks since the cracks provide a clear path for the chlorides to reach the uncoated bottom mat. This element would be less valuable for decks constructed with two mats of epoxy-coated rebar or two mats of uncoated rebar since the rebar corrosion typically occurs in the top mat of those bridge decks.
2. Consider a more robust crack sealing method such as flood coating with methyl methacrylate (MMA) or applying an impermeable wearing course such as premixed polymer concrete (PPC) or

epoxy chip seal on mixed rebar decks when they have been at NBE Element #12 condition state 2 for approximately 7 years. This could reduce the number of bridges that reach condition state 3. This recommendation was based on the average number of years that a deck remained at condition state 2 for CoRe Element #359. CoRe Element #359 is no longer used and Element #12 in the NBE system is the most similar. It is recommend that MnDOT continue to use epoxy-coated rebar in both mats of bridge decks as the mixed bar decks deteriorate more quickly.

3. Continue comparing the fiber-reinforced decks to their control structure decks when more inspection data are available to analyze the deck deterioration over time.

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APPENDIX A: PERFORMANCE OF GALVANIZED REBAR IN CONCRETE
BRIDGE DECKS

The performance over time of bridge decks built with galvanized, uncoated, or epoxy-coated rebar in both layers is shown in Figure A-1 through A-4. General trends indicated that galvanized reinforcement provided a narrow benefit compared to epoxy-coated and uncoated reinforcement because no structures with galvanized reinforcement had lower than a Deck NBI of 6. Reinforcement type will not have a significant impact on Deck NBI ratings above 5. Drops in Deck NBI rating above 5 are more related to the concrete quality, not the reinforcement type. The effects of corrosion on the reinforcement are often only observed when the Deck NBI rating drops to a 5. Additional time is required to make conclusions about the performance of bridge decks with galvanized reinforcement once a deck has reached a Deck NBI of 5 or lower. The benefits related to using galvanized rebar were difficult to discern because the data set had to be combed for equivalent conditions between galvanized and coated reinforcement.

In 1976 and 1977, the Minnesota Department of Transportation constructed multiple concrete bridge decks reinforced with galvanized rebar. The protective coating was intended to delay corrosion and lengthen the service life of the bridge. While many studies have been performed to quantify deterioration rates of concrete bridge decks in Minnesota, none of them addressed how the use of galvanized rebar in the deck affected the deterioration rates.

The primary objective of this Undergraduate Research Opportunities Program (UROP) research was to evaluate how the use of galvanized steel affected bridge deck deterioration over time. This was accomplished by evaluating existing bridge inspection reports provided by MnDOT and by performing four on-site inspections of bridges built using galvanized rebar. MnDOT identified 56 bridge decks with galvanized rebar. Of these 56 bridges, four had a twin structure, which is a bridge built at the same time and location using a different type of rebar in the deck. This would allow for a side-by-side visual comparison of deck deterioration. This UROP research evaluated both Deck NBI condition ratings and state-level Pontis deck element ratings.

The Deck NBI condition ratings evaluated decks based on a scale of nine to zero with nine representing a deck in excellent condition (newly constructed) and zero representing a failed condition (unusable and closed to traffic). All available Deck NBI condition ratings were compiled for decks with galvanized rebar and decks built during the same period using alternate types of rebar. The decks were divided into sub-categories based on the average daily traffic (ADT) that the bridges accommodated, the maximum span length of the bridges, and the type of superstructure that supported the deck. This was done to address some of the other factors that could affect the rate at which the deck condition ratings changed.

The state-level Pontis deck element ratings evaluated the severity and extent of deterioration in specific deck elements and allowed for detailed inspection notes to be recorded. The Pontis element rating system is based on a scale of one to five with one representing a deck with no deterioration and five representing a deck with more than 25% of the wearing surface in a distressed or unsound condition. While it was the intent to collect the Pontis deck element ratings to both supplement the NBI deck condition ratings and to provide an indication of what specific type of deterioration was prevalent in the decks being evaluated, this proved to be infeasible.

Deck NBI condition ratings were collected for the 56 bridge decks with galvanized rebar by accessing the MnDOT Bridge Office's publicly available Bridge Inspection Condition History database. Bridge Inspection Condition History reports were collected and compiled in a database for each bridge deck with galvanized rebar. These reports provided Deck NBI condition ratings starting from approximately 1992 up to the most recent inspection. While collecting the Deck NBI condition ratings, it was discovered that one of the bridges (L8837) identified as having galvanized rebar was a wood-framed bridge with a gravel wear surface that had been mistakenly included, and this bridge was removed from the database.

The bridge numbers for the twin structures were determined using MnDOT's BridgeMAP software as follows:

- Bridge 19079 was the twin for Bridge 9108
- Bridge 55005 was the twin for Bridge 55006
- Bridge 55026 was the twin for Bridge 55025
- Bridge 73855 was the twin for Bridge 73783

Based on bridge inspection reports and archived construction plans for these four twin bridges, it was found that two were built using galvanized rebar (Bridges 55026 and 73855), and one was built using epoxy-coated rebar in the top mat and uncoated rebar in the bottom mat (i.e., mixed rebar) (Bridge 19079). It was not possible to determine the type of rebar used in the deck of the fourth twin structure (Bridge 55005), and it was assumed to have been built using uncoated rebar.

MnDOT provided data from the study by Nelson (2014), which contained an additional decade of Deck NBI condition ratings for bridge decks with galvanized rebar, as well as data for approximately 3,000 additional bridges built between 1916 to 2017 that had other types of rebar in the bridge decks. The Nelson data also included additional information on the bridges such as ADT, the maximum span length, and the type of superstructure that supported the bridge deck. The Nelson data did not include two of the bridge decks with galvanized rebar initially included in the study. These two bridges were excluded from this study due to a lack of available Deck NBI data.

To compile Pontis Element deck ratings and inspector notes, MnDOT provided access to the Structure Information Management System (SIMS) database, which is used to record findings for each bridge inspection performed. Individual inspection records were accessed for each bridge being evaluated, and the Pontis deck element ratings and inspector notes were compiled in a database.

Before attempting to determine how the use of galvanized rebar may have affected deck deterioration rates, the database of the bridge decks with other types of rebar used for comparison was reduced to remove some of the factors that could skew the results. The following factors were considered:

- when the bridges were built
- whether a new overlay was installed after the deck was initially constructed
- the type of superstructure that supported the deck

Only bridges constructed between 1975 and 1979 were compared to the decks with galvanized rebar. All the bridge decks using galvanized rebar were built in 1976 and 1977. Bridges built prior to 1975 were excluded because they were assumed to have two inches of top cover and would not provide an accurate comparison to the decks with galvanized rebar and three inches of top cover. Additionally, bridges built prior to 1975 would have a larger period for which bridge deck ratings were not available and it is assumed that this would result in a larger portion of the available Deck NBI condition ratings being at a lower value. Bridges built after 1979 were excluded because they would have a more complete inspection record that would include a larger portion of high value Deck NBI condition ratings. It was assumed that bridge deck ratings are highest when the decks are newly constructed. This would skew results towards categories that had a higher quantity of younger bridges. By limiting the bridges being evaluated to those built between 1975 and 1979, there were 53 bridges with galvanized rebar, 110 bridges with mixed rebar, and 45 bridges with uncoated rebar that remained in the database.

The database was further reduced by removing any bridges that had new overlays installed after the deck was initially constructed. This was determined by comparing the date the bridge was built with the date the deck surface was installed. If these two dates differed by more than one year, it was assumed that a new overlay had been installed on the bridge deck, and the bridge was excluded from the study. For many of the bridges with monolithic concrete decks, there was no date listed for when the deck surface was installed, and it was assumed that no overlay was present. After removing bridges that had new overlays installed, there were 37 bridges with galvanized rebar, 85 bridges with mixed rebar, and 20 bridges with uncoated rebar remaining in the database. Almost half of the bridge decks with uncoated rebar had new overlays installed approximately 11 years after the decks were initially constructed. Additionally, one of the bridges with galvanized rebar was built in 1958 and re-decked in 1976, and this bridge was removed from the database.

For the bridges that remained in the database, all had a continuous steel or prestressed concrete superstructure except for six bridges that had a steel superstructure. These six bridges were removed from the database. The remaining bridges included 36 bridges with galvanized rebar, 80 bridges with mixed rebar, and 19 bridges with uncoated rebar.

Bridge deck deterioration rates for the remaining bridges were compared based on the type of rebar in the deck. The average number of years that a bridge stayed at a certain Deck NBI rating was determined for decks with each type of rebar. The results were plotted and are shown in Figure A-1.

Bridge deck deterioration rates were evaluated based on ADT and the type of rebar in the deck. Bridges were grouped if the ADT was less than 4,000, between 4,000 and 10,000, and greater than 10,000. All but one of the bridge decks with uncoated rebar had ADT levels less than 4,000, and two bridge decks with galvanized rebar had an ADT between 4,000 and 10,000. The only bridge decks with uncoated rebar that were evaluated had an ADT less than 4,000. The bridge decks with galvanized rebar with an ADT between 4,000 and 10,000 were excluded due to the small sample size. The average number of years that a bridge stayed at a certain Deck NBI rating was determined for decks with each type of rebar and level of ADT. The results were plotted and are shown in Figure A-2.

Bridge deck deterioration rates were compared based on the type of superstructure present and type of rebar in the deck. The average number of years that a bridge stayed at a certain Deck NBI rating was determined for decks with each type of rebar and superstructure. The results were plotted and are shown in Figure A-3.

Additionally, the maximum span length of bridges was considered. While Zimmerman et al. (2007) found that bridge decks with maximum span lengths greater than 100 feet deteriorated at faster rate, none of the bridge decks in this study had a span length greater than 65 feet. To evaluate how span length may affect deck deterioration rates, bridges were grouped based on superstructure, reinforcement type, and if there were maximum span lengths greater than 30 feet. The average number of years that a bridge stayed at a certain Deck NBI rating was determined for decks with each type of rebar, superstructure, and maximum span length. The results were plotted and are shown in Figure A-4.

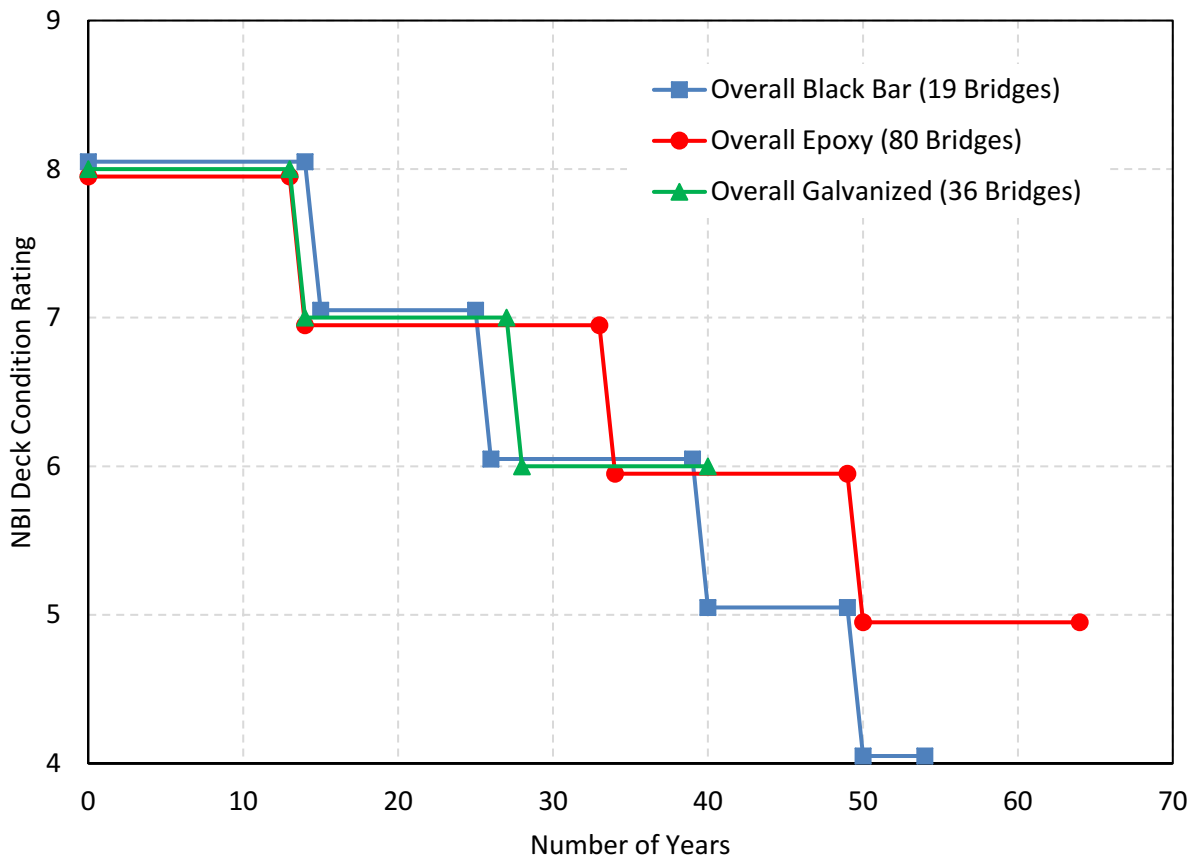


Figure A-1 Deck deterioration rates based on reinforcement type

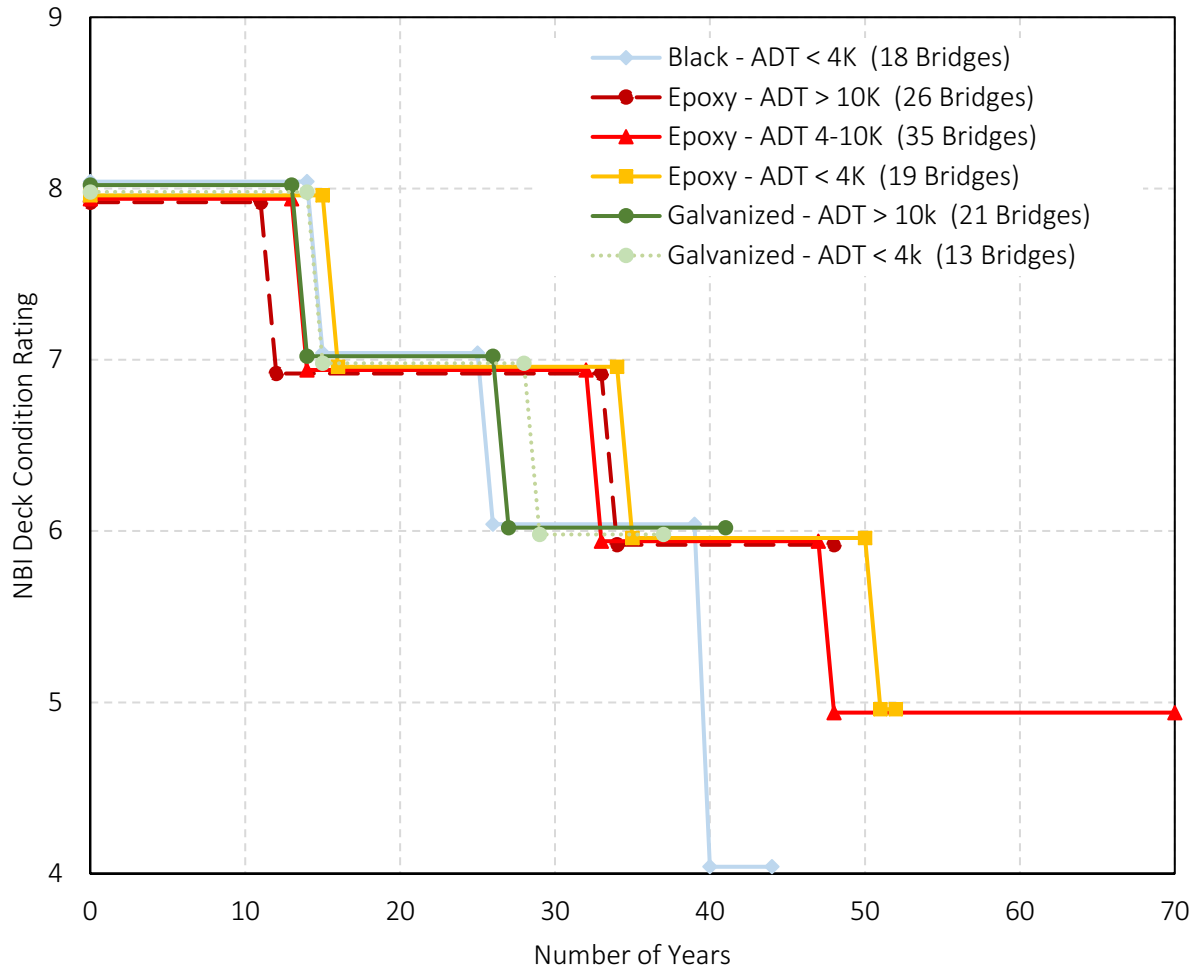


Figure A-2 Deck deterioration rates based on ADT and reinforcement type

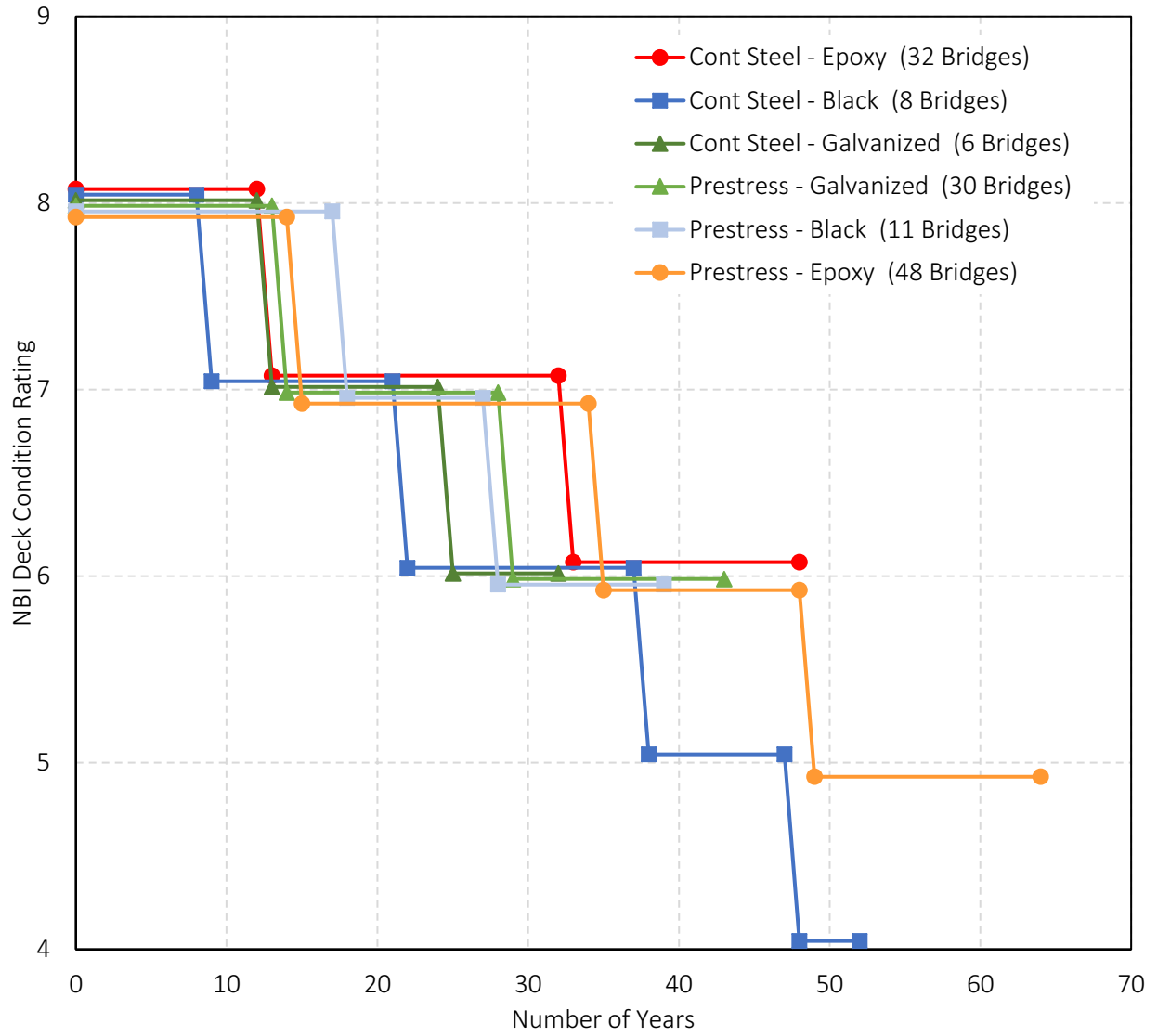


Figure A-3 Deck deterioration rates based on superstructure and reinforcement type

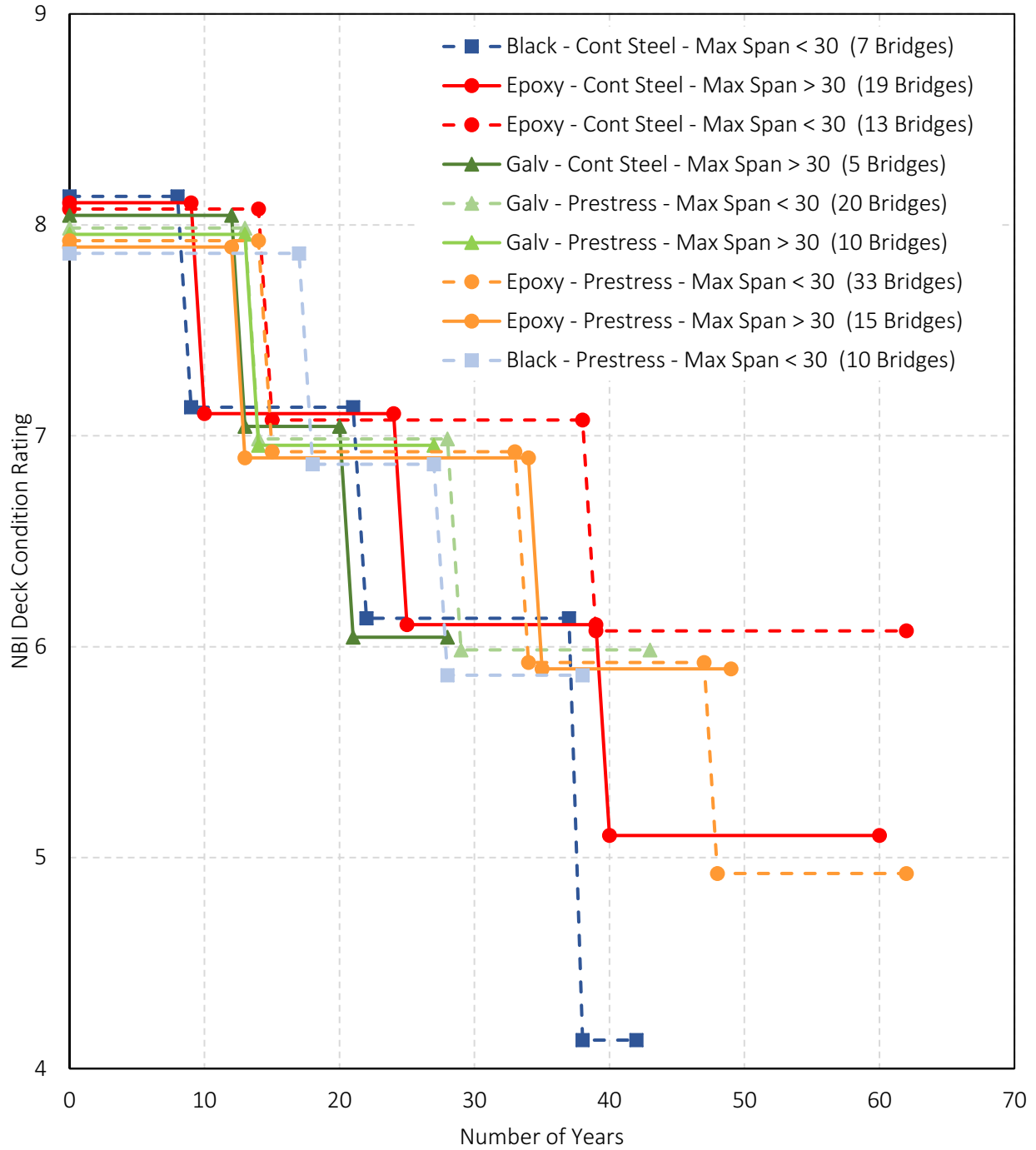


Figure A-4 Deck deterioration rates based on superstructure, reinforcement type, and maximum span length

APPENDIX B: LIST OF ALL BRIDGES IN STUDY

Table B-1 List of all bridges in the study (INSP = bridge included in the study and visually inspected, X = bridge included in the study but not visually inspected)

BRIDGE #	YEAR BUILT	CURRENT DECK NBI RATING	WEARING SURFACE CRACK DENSITY [LF/SF]	FIBER	CONTROL STRUCTURES (FIBER)	MIXED REBAR	CONTROL STRUCTURES (MIXED)
10004	2015	7	N/A	INSP			
40005	2015	9	0.002	X			
40009	2016	9	0.002	X			
52005	2015	8	0.007	X			
62037	2013	8	0.032	INSP			
62729	2015	8	0	INSP			
62730	2015	8	0.003	INSP			
62731	2016	8	0	INSP			
62732	2016	8	N/A	INSP			
62734	2016	8	0	INSP			
62831	2012	8	0	X			
62925	2015	8	0.056	INSP			
69072	2013	7	0	INSP			
71004	2017	8	1	INSP			
73047	2015	8	0.873	INSP			
85014	2016	9	0	X			
85850	2016	7	0	X			
02586	2014	9	N/A	X			
09017	2013	8	0.003		INSP		
30001	2014	9	1.065		INSP		
82023	2013	8	0		INSP		
19009	2016	8	0.001		INSP		
09011	1990	6	0.113				INSP
9300	1961	8	0.012			X	
24807	1968	6	0.305			X	
48031	1990	7	0				INSP
58818	1990	7	0.039				INSP
62802	1985	5	0.367				X
69039	1990	8	0				INSP
69046	1990	7	0				INSP
69117	1990	8	0				INSP
69118	1990	7	0				INSP
01005	1980	7	0.494			INSP	
01006	1984	7	0.185			INSP	
01007	1983	7	0			INSP	

BRIDGE #	YEAR BUILT	CURRENT DECK NBI RATING	WEARING SURFACE CRACK DENSITY [LF/SF]	FIBER	CONTROL STRUCTURES (FIBER)	MIXED REBAR	CONTROL STRUCTURES (MIXED)
02023	1986	7	0.038			X	
02024	1986	6	0.174			X	
02025	1986	7	0.172			X	
02026	1986	7	0.182			X	
02027	1986	7	0.181			X	
02028	1986	7	0.222			X	
02811	1988	7	0				INSP
02813	1988	7	0			X	
02815	1988	5	0			X	
04005	1978	6	0.035			X	
04006	1978	6	0.009			X	
04007	1978	6	0.095			X	
04008	1978	6	0.211			X	
04009	1978	5	0.17			X	
04010	1978	5	0.146			X	
04012	1979	8	0.049			X	
04013	1979	8	0.014			X	
04014	1979	8	0.011			X	
04017	1979	9	0			X	
04018	1979	8	0.024			X	
07023	1976	6	0.201			X	
07036	1978	7	0.032			X	
07037	1979	7	0.04			X	
07038	1984	6	0.232			X	
07039	1987	6	0			X	
07040	1987	6	0.228			X	
07041	1987	6	0.45			X	
07042	1985	6	0.253			X	
08010	1983	7	0			X	
08011	1988	6	0.131			X	
09005	1976	7	0			X	
09006	1982	5	0.134			INSP	
09007	1987	7	0			INSP	
09838	1982	7	0.281			X	
11006	1987	7	0			INSP	
12000	1986	6	0.238			X	
12001	1975	7	0.118			X	
12002	1975	7	0.28			X	

BRIDGE #	YEAR BUILT	CURRENT DECK NBI RATING	WEARING SURFACE CRACK DENSITY [LF/SF]	FIBER	CONTROL STRUCTURES (FIBER)	MIXED REBAR	CONTROL STRUCTURES (MIXED)
12003	1975	7	0.202			X	
12004	1975	7	0.157			X	
12007	1985	7	0.073			X	
12008	1988	8	0.02			X	
12009	1987	7	0.035			X	
12010	1988	7	0.106			X	
12011	1987	7	0.077			X	
14005	1979	7	N/A			X	
14006	1988	7	0.104			X	
15002	1982	7	0.013			X	
15004	1988	7	0.021			X	
16001	1981	6	0.06			INSP	
16002	1981	7	0.13			INSP	
17003	1978	7	0.081			X	
17004	1978	7	0.009			X	
17005	1978	7	0.043			X	
17006	1987	7	0.088			X	
17007	1987	6	0.044			X	
18001	1984	7	0.054			INSP	
19013	1978	7	0.012			X	
19014	1978	7	0.013			X	
19033	1978	7	0.005			INSP	
19037	1984	7	0				INSP
19038	1984	7	0.061			INSP	
19055	1978	7	0.017			X	
19056	1978	6	0.077			X	
19075	1978	7	0.041			INSP	
19076	1983	7	0			INSP	
19077	1979	7	0			X	
19078	1978	7	0.092			X	
19079	1978	7	0.056			X	
19811	1978	7	0.074			INSP	
19812	1978	6	0.051			INSP	
19813	1979	7	0.004			INSP	
19814	1979	7	1.18			INSP	
19819	1981	6	0.266			X	
19823	1982	6	0			X	
19824	1982	6	0			X	

BRIDGE #	YEAR BUILT	CURRENT DECK NBI RATING	WEARING SURFACE CRACK DENSITY [LF/SF]	FIBER	CONTROL STRUCTURES (FIBER)	MIXED REBAR	CONTROL STRUCTURES (MIXED)
19827	1981	5	0.201			X	
19832	1985	5	0			X	
19853	1985	6	0			X	
19855	1984	6	0			X	
19856	1984	6	0			X	
19857	1984	7	0			X	
19859	1979	7	2.064			X	
19860	1979	7	0.04			X	
19865	1980	5	0			X	
19878	1982	6	0			X	
19884	1985	7	0			X	
19891	1980	6	0.151			INSP	
19892	1980	5	0.125			INSP	
19893	1979	6	0.005			INSP	
19896	1988	7	0.123			X	
19897	1983	6	0			X	
19898	1983	7	0			X	
19899	1983	7	0			X	
19900	1983	6	0			X	
20001	1975	7	0.13			X	
20002	1975	7	0.163			X	
22002	1978	7	0.369			X	
22004	1979	8	0.006			X	
22811	1975	6	0			X	
23006	1978	7	0.045			X	
23007	1988	7	0.11			X	
23008	1983	7	0.271			X	
23009	1986	7	0.032			X	
23011	1987	7	0.23			X	
23015	1988	7	0.033			X	
24004	1979	7	0.114			X	
24005	1983	7	0.375			X	
25003	1989	7	0.024			X	
25008	1979	7	0.053			X	
25009	1983	7	0.168			X	
25013	1982	7	0.131			X	
25014	1983	6	0.246			X	
25016	1987	7	0.108			X	

BRIDGE #	YEAR BUILT	CURRENT DECK NBI RATING	WEARING SURFACE CRACK DENSITY [LF/SF]	FIBER	CONTROL STRUCTURES (FIBER)	MIXED REBAR	CONTROL STRUCTURES (MIXED)
25017	1984	7	0.09			X	
27015	1981	7	0.318			X	
27031A	1989	7	0.224			X	
27031B	1989	7	0.227			X	
27033	1981	6	0.152			X	
27044	1986	7	0.032				INSP
27045	1988	7	0			X	
27047	1988	7	0.171			X	
27048	1988	6	0.279			X	
27050	1988	7	0.388			X	
27051	1988	6	N/A			X	
27051A	1988	7	N/A			X	
27052A	1989	6	0.404			X	
27052B	1989	7	0			X	
27052C	1989	6	0.271			X	
27052D	1989	7	0			X	
27053	1988	7	0			X	
27053A	1988	6	0.242			X	
27056	1988	7	0.085				INSP
27058	1988	7	0.133				INSP
27068	1981	5	0.033			INSP	
27070	1988	7	0			X	
27117	1988	7	0.062				INSP
27134	1985	7	0			INSP	
27164	1987	7	0.092			X	
27193	1981	7	0.095			X	
27237	1984	6	0			INSP	
27239	1985	6	0			X	
27572	1986	6	0.334			X	
27573	1986	6	0.39			X	
27586	1978	7	0			X	
27587	1980	7	0				X
27713	1983	7	0			X	
27713A	1983	7	0			X	
27714	1983	7	0			X	
27717	1980	7	0			X	
27726	1979	7	0			X	
27726A	1979	6	0			X	

BRIDGE #	YEAR BUILT	CURRENT DECK NBI RATING	WEARING SURFACE CRACK DENSITY [LF/SF]	FIBER	CONTROL STRUCTURES (FIBER)	MIXED REBAR	CONTROL STRUCTURES (MIXED)
27726B	1979	5	0			X	
27727	1978	6	0			X	
27727A	1978	6	0			X	
27727B	1978	6	0.078			X	
27728	1978	5	0.065			X	
27731	1988	7	0				X
27734	1980	7	0			X	
27739	1987	7	0			INSP	
27740	1987	7	0				INSP
27741	1987	7	0				INSP
27742	1987	6	0			X	
27743	1987	7	0			X	
27743A	1987	7	0			X	
27743B	1987	7	0			X	
27748	1989	7	0.047			X	
27749	1989	7	0.065				INSP
27750	1989	7	0.046			X	
27750A	1989	7	0.049			X	
27751	1989	7	0.201			X	
27751A	1989	7	0.225			X	
27752	1989	7	0.138			X	
27752A	1989	7	0			X	
27753	1989	7	0.321			X	
27753A	1989	7	0.238			X	
27754	1989	7	0			X	
27754A	1989	7	0.049			X	
27763	1982	6	0			X	
27764	1983	7	0			X	
27765	1983	6	0			INSP	
27766	1983	7	0			X	
27767	1982	6	0			X	
27769	1983	6	0			X	
27770A	1987	7	0.034			X	
27770B	1987	7	0.043			X	
27770C	1987	7	0			X	
27770D	1987	7	0.292			X	
27770E	1987	7	0.027			X	
27770F	1987	7	0.077			X	

BRIDGE #	YEAR BUILT	CURRENT DECK NBI RATING	WEARING SURFACE CRACK DENSITY [LF/SF]	FIBER	CONTROL STRUCTURES (FIBER)	MIXED REBAR	CONTROL STRUCTURES (MIXED)
27776A	1987	7	0.133			X	
27776B	1987	6	0.12			X	
27776C	1987	7	0.148			X	
27776D	1987	6	0			X	
27776E	1987	7	0			X	
27776F	1987	7	0.199			X	
27776G	1987	7	0			X	
27776H	1987	7	0			X	
27781	1980	6	0			X	
27785	1979	5	0			X	
27788	1989	7	0.2			X	
27789	1989	6	0.101			X	
27789A	1989	7	0.137			X	
27791	1989	7	0.335			X	
27801	1988	7	0			X	
27810	1982	7	0			X	
27816N	1982	7	0			X	
27816S	1982	7	0			X	
27817	1980	6	0			X	
27818	1980	7	0			X	
27829	1986	7	0.011			X	
27830	1986	7	0.001			X	
27890	1988	7	0.136				X
27891	1980	7	0			X	
27904	1980	7	0.023			X	
27909	1980	5	0			X	
27913	1980	6	0			X	
27914	1980	6	0			X	
27960	1980	7	0.219			X	
27962	1980	6	0.165			X	
27971	1988	7	0.077			X	
27982	1980	7	0.282			X	
27983	1982	7	0			X	
27984	1982	6	0			X	
28003	1982	7	0.047			X	
28008	1986	6	0.116			X	
28009	1986	6	0.272			X	
28010	1986	7	0.168			X	

BRIDGE #	YEAR BUILT	CURRENT DECK NBI RATING	WEARING SURFACE CRACK DENSITY [LF/SF]	FIBER	CONTROL STRUCTURES (FIBER)	MIXED REBAR	CONTROL STRUCTURES (MIXED)
28011	1986	7	0.209			X	
31019	1976	7	0.002			X	
31020	1976	7	0.048			X	
31022N	1976	7	0.034			X	
31022S	1976	6	0.041			X	
31023	1976	7	0.025			X	
31027	1979	7	0.029			X	
31028	1979	7	0.259			INSP	
31030	1983	7	0			INSP	
32001	1979	7	0.072			X	
32002	1987	7	0.028			X	
32003	1987	7	0.055			X	
32004	1987	8	0.129			X	
33003	1989	6	0.838				INSP
34007	1977	7	0.049			X	
34008	1977	7	0.067			X	
34009	1978	7	0.136			X	
34011	1983	7	0.132			X	
34021	1979	7	0			INSP	
34023	1988	7	0.124			X	
34024	1983	7	0.26			X	
35006	1986	6	0.004			X	
35007	1982	6	0.016			X	
36002	1980	8	N/A			X	
36005	1976	7	0.04			X	
36007	1985	6	0.022			INSP	
36009	1977	7	0.281			X	
36010	1977	7	0.248			X	
36011	1979	7	0.266			INSP	
36012	1979	7	0.288			INSP	
36013	1980	5	0.008			INSP	
36019	1986	7	0.002			X	
36020	1986	7	0.056			X	
37005	1981	7	0.038			X	
37006	1984	7	0.012			X	
37007	1983	7	0.009			X	
37010	1987	7	0.048			X	
38002	1986	7	0.047			INSP	

BRIDGE #	YEAR BUILT	CURRENT DECK NBI RATING	WEARING SURFACE CRACK DENSITY [LF/SF]	FIBER	CONTROL STRUCTURES (FIBER)	MIXED REBAR	CONTROL STRUCTURES (MIXED)
39006	1977	6	0.003			X	
39007	1983	6	0.008			X	
39011	1985	6	0.012			X	
40001	1987	6	0.176			X	
41002	1986	7	0.132			X	
41003	1987	6	0.186			X	
42011	1986	7	0.062			X	
42012	1986	7	0.07			X	
42013	1987	7	0.027			X	
42014	1987	7	0.153			X	
43010	1982	7	0.104			X	
43011	1989	7	0.002			X	
44002	1979	7	0.066			X	
45003	1980	6	0.181			X	
45004	1982	7	0			X	
45005	1989	7	0.08			X	
46003	1977	7	0.293			X	
46004	1982	7	0.044			X	
47001	1988	7	0			X	
48001	1979	7	0			INSP	
48003	1984	7	0			INSP	
48005	1986	7	0			INSP	
48006	1986	7	0			INSP	
48007	1985	7	0			INSP	
48008	1985	7	0			INSP	
48009	1979	7	0			INSP	
48010	1979	6	0			INSP	
48011	1978	6	0			INSP	
48012	1978	7	0			INSP	
48013	1979	7	0			INSP	
48015	1979	7	0			INSP	
48016	1979	6	0			INSP	
48019	1986	7	0			INSP	
48020	1986	7	0			INSP	
49023	1978	7	0.022			INSP	
49024	1978	7	0			INSP	
49031	1979	7	0			INSP	
49032	1989	7	N/A			INSP	

BRIDGE #	YEAR BUILT	CURRENT DECK NBI RATING	WEARING SURFACE CRACK DENSITY [LF/SF]	FIBER	CONTROL STRUCTURES (FIBER)	MIXED REBAR	CONTROL STRUCTURES (MIXED)
50004	1977	6	0.142			X	
50006	1983	7	0.155			X	
50007	1988	7	0.145			X	
51001	1988	7	0.05			X	
52009	1985	6	0.109			X	
53001	1980	7	0.131			X	
53002	1980	7	0.117			X	
53005	1987	8	0.074			X	
54002	1979	8	0.015			X	
54003	1980	8	0			X	
55005	1976	6	0.129			X	
55021	1976	7	0.076			X	
55022	1976	7	0.076			X	
55026	1976	5	0.729			X	
55028	1982	7	0			X	
55029	1980	7	0.305			X	
56009	1975	7	0.192			X	
56010	1975	7	0.159			X	
56011	1976	6	0.126			X	
56012	1976	7	0.248			X	
58001	1984	6	0			X	
58002	1981	7	0			INSP	
60008	1980	8	0			X	
60523	1986	6	0.053			X	
61001	1981	7	0			X	
61002	1987	7	0.223			X	
62028	1978	6	0.052			X	
62090	1986	5	0.186			X	
62703	1987	6	0			X	
62706	1987	7	0.167			X	
62810	1989	7	0.117				INSP
62810A	1989	7	0.097			X	
62817	1989	7	0.109			X	
62858	1989	7	0.101			X	
62875	1989	7	0.038			X	
62875A	1989	7	0.02			X	
62876	1989	7	0.015			X	
62876A	1989	7	0.095			X	

BRIDGE #	YEAR BUILT	CURRENT DECK NBI RATING	WEARING SURFACE CRACK DENSITY [LF/SF]	FIBER	CONTROL STRUCTURES (FIBER)	MIXED REBAR	CONTROL STRUCTURES (MIXED)
62876B	1989	7	0.017			X	
62882	1989	6	0.278			X	
62883	1988	7	0.583			X	
64004	1987	7	0.045			X	
64005	1988	7	0.024			X	
65006	1983	7	0			X	
68004	1979	6	0.08			X	
68005	1984	6	0.177			X	
6870	1955	7	0			X	
6896	1956	6	0			X	
6897	1956	6	0			X	
69011	1979	7	0			X	
69076	1979	7	0.022			INSP	
69081	1979	6	0.021			INSP	
69082	1979	7	0.027			INSP	
69083	1979	7	0.044			INSP	
69084	1979	7	0.057			INSP	
69085	1979	7	0.024			INSP	
69086	1979	7	0.045			INSP	
69087	1983	7	0			X	
69088	1983	8	0.013			INSP	
69100	1982	7	0			X	
69101	1983	7	0.003			X	
69102	1983	8	0.01			X	
69103	1979	8	0.025			INSP	
69106	1983	7	0			X	
69107	1982	6	0.075			INSP	
69108	1982	6	0.101			INSP	
69109	1983	8	0			X	
69110	1986	7	0.109				INSP
69111	1985	6	0			INSP	
69113	1986	7	0			INSP	
69114	1986	8	0			INSP	
69115	1987	7	0				INSP
69116	1987	7	0.026				INSP
69575	1988	7	0			X	
69814	1975	7	0.036			X	
69816E	1984	7	0.07			X	

BRIDGE #	YEAR BUILT	CURRENT DECK NBI RATING	WEARING SURFACE CRACK DENSITY [LF/SF]	FIBER	CONTROL STRUCTURES (FIBER)	MIXED REBAR	CONTROL STRUCTURES (MIXED)
69816F	1984	7	0.114			X	
69816G	1984	7	0.792			X	
69816H	1984	7	0.008			X	
69817	1987	6	0.129			X	
69818A	1985	7	0.043			X	
69818B	1985	7	0.046			X	
69818N	1985	7	0.005			X	
69818S	1985	7	0.003			X	
69841	1988	7	0			X	
69860	1989	7	N/A				X
69870A	1985	7	0.089			X	
69870C	1985	7	0.004			X	
69870D	1986	7	0.056			X	
69891	1976	7	0.016			X	
69892	1975	8	0.015			X	
69894	1975	8	0			X	
70027	1987	7	0.18				INSP
71007	1979	6	0			INSP	
71008	1979	6	0			INSP	
71012	1987	6	0				INSP
72003	1978	6	0.276			X	
72004	1978	6	0.01			X	
72005	1983	6	0.322			X	
72007	1984	7	0.255			X	
73020	1980	6	N/A			INSP	
73023	1987	8	0			INSP	
73025	1987	7	0				INSP
73026	1987	7	0				INSP
73566	2003	8	0				X
73804	1965	8	0			X	
73805	1965	6	0				X
73806	1965	8	0			X	
73807	1965	7	0			X	
73808	1965	7	0			X	
73809	1965	6	0			X	
73811	1967	6	0			X	
73812	1967	6	0.561			X	
73813	1967	6	0.57			X	

BRIDGE #	YEAR BUILT	CURRENT DECK NBI RATING	WEARING SURFACE CRACK DENSITY [LF/SF]	FIBER	CONTROL STRUCTURES (FIBER)	MIXED REBAR	CONTROL STRUCTURES (MIXED)
73816	1965	6	0			X	
73817	1967	7	0			X	
73818	1965	6	0			X	
73819	1965	7	0			X	
73820	1965	6	0			X	
73842	1972	8	0			X	
73849	1974	6	0			X	
73850	1974	6	0.92			X	
73852	1976	7	0			X	
73864	1976	7	0			X	
75000	1977	6	0.028			X	
75002	1984	7	0.101			X	
76005	1977	7	0.077			X	
76007	1977	7	0.169			X	
76008	1977	7	0.095			X	
76009	1984	7	0.194			X	
77013	1984	7	0			INSP	
77014	1983	7	0.003			INSP	
77802	1965	6	0			X	
79000	1987	7	0.127			X	
79018	1977	7	0.077			X	
79020	1983	7	0.116			X	
79022	1984	7	0.061			X	
79023	1985	7	0.05			X	
79024	1985	7	0.135			X	
79025	1987	7	0.125			X	
82003	1982	7	0.026			INSP	
82004	1982	7	0.029			INSP	
82005	1986	7	0			X	
82009	1987	7	N/A			X	
82018	1975	6	0			X	
82022	1978	7	0.162			X	
82849	1982	7	0			X	
82850	1982	7	0			X	
83005	1975	7	0.053			X	
83015	1975	7	0.119			X	
83016	1975	6	0.099			X	
83017	1975	7	0.156			X	

BRIDGE #	YEAR BUILT	CURRENT DECK NBI RATING	WEARING SURFACE CRACK DENSITY [LF/SF]	FIBER	CONTROL STRUCTURES (FIBER)	MIXED REBAR	CONTROL STRUCTURES (MIXED)
83018	1975	6	0.052			X	
83021	1975	7	0.121			X	
83022	1975	6	0.391			X	
83029	1975	6	0.096			X	
83030	1975	7	0.222			X	
83037	1985	6	0.007			X	
84009	1986	7	0.256			X	
85015	1978	7	0.189			X	
85016	1978	7	0.129			X	
85017	1979	7	0.067			X	
85018	1979	8	0.019			X	
85020	1988	7	0.679			X	
85023	1982	7	0.182				X
86530	2005	8	0				X
86802	1971	8	0			X	
86803	1972	7	0			X	
86807	1972	6	0			X	
86808	1972	7	0			X	
86809	1971	7	0			X	
86810	1971	5	0			X	
86811	1973	7	0			X	
86812	1972	6	0			X	
86815	1971	6	0			X	
86817	1971	5	0.935			X	
86818	1971	5	0				X
86820	2010	8	0.888			X	
87007	1978	7	0.143			X	
87009	1977	7	0.223			X	
87010	1977	7	0.536			X	
87015	1989	7	0.038			X	
87019	1986	7	0.135			X	
87020	1986	7	0.125			X	
87021	1983	7	0.03			X	
9217E	1981	6	0			X	
9217W	1981	6	0.01			X	

BRIDGE #	YEAR BUILT	CURRENT DECK NBI RATING	WEARING SURFACE CRACK DENSITY [LF/SF]	FIBER	CONTROL STRUCTURES (FIBER)	MIXED REBAR	CONTROL STRUCTURES (MIXED)
9600N	1978	6	0.069			X	
9600S	1978	6	0.055			X	
	Average	6.8	0.101				
	Minimum	5	0				
	Maximum	9	2.064				
Total Number of Inspections				11	4	75	25
Total Number of Bridges				18	4	471	35

APPENDIX C: FIELD INSPECTION FORMS FOR FIBER-REINFORCED
DECKS

VISUAL INSPECTION FORM

BRIDGE NUMBER: 10004

REINFORCING TYPE: Fiber

INSPECTION DATE: 7/24/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		2
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: two transverse cracks with efflorescence

UMD NOTES:

Could only see approx. 1/10 of bridge

MnDOT INSPECTION NOTES:

[2016] 6 full width transverse cracks with efflorescence south half of 13th span from north and north half of 14th span from north. 4th pier from South on west shoulder 7' crack along north side trail, 2'x1' efflorescence area on north side of 6th pier from north, west beam bay.

[2017] Intermittent transverse cracks with light efflorescence West Beam bay.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 62037

REINFORCING TYPE: Fiber

INSPECTION DATE: 7/31/2018

CURRENT DECK NBI RATING: 8

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Could not see condition of deck - inverted

MnDOT INSPECTION NOTES:

[2016] Minor scattered leeching between seams.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 62729

REINFORCING TYPE: Fiber

INSPECTION DATE: 7/31/2018

CURRENT DECK NBI RATING: 8

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

No visable damage

MnDOT INSPECTION NOTES:

Two lanes SB. 1,450 LB 60 KSI stainless rebar.
[2016] some forms still in place no cracks that can be seen

VISUAL INSPECTION FORM

BRIDGE NUMBER: 62730

REINFORCING TYPE: Fiber

INSPECTION DATE: 7/31/2018

CURRENT DECK NBI RATING: 8

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

No visible damage

MnDOT INSPECTION NOTES:

Two lanes NB. 227.5 x 57.62 = 13,109 SF
[2016] no cracks and some forms are still in place

VISUAL INSPECTION FORM

BRIDGE NUMBER: 62731

REINFORCING TYPE: Fiber

INSPECTION DATE: 7/31/2018

CURRENT DECK NBI RATING: 8

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

No visable damage

MnDOT INSPECTION NOTES:

2 Lanes WB. (3YHPC-M)

VISUAL INSPECTION FORM

BRIDGE NUMBER: 62732

REINFORCING TYPE: Fiber

INSPECTION DATE: 7/31/2018

CURRENT DECK NBI RATING: 8

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

No visible damage

MnDOT INSPECTION NOTES:

2 Lanes EB/WB. Roundabout each end. (3YHPC-S) Stainless steel rebar 60 KSI 830 LB
[2018] The deck had no deficiencies.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 62734

REINFORCING TYPE: Fiber

INSPECTION DATE: 7/31/2018

CURRENT DECK NBI RATING: 8

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		1
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: one transverse crack with efflorescence

UMD NOTES:

MnDOT INSPECTION NOTES:

2 Lanes EB. (3YHPC-M)

VISUAL INSPECTION FORM

BRIDGE NUMBER: 62925

REINFORCING TYPE: Fiber

INSPECTION DATE: 8/1/2018

CURRENT DECK NBI RATING: 8

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		7
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with very light leaching

UMD NOTES:

Could only look at approx. 1/4 of the bridge

MnDOT INSPECTION NOTES:

[2016] Under deck has 184 lf of leaching cracks.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69072

REINFORCING TYPE: Fiber

INSPECTION DATE: 7/18/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		1
	> 4'		4
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		1
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		1
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

4 transverse cracks with efflorescence (all on different bays)
one diagonal crack with efflorescence in corner

UMD NOTES:

Scaling on top at edge of shoulders next to barriers, exposing fibers about 1/2".
Bottom: small area of spalling with rust

MnDOT INSPECTION NOTES:

2018- N Abutment Area, Bay 1, Minor Transverse Crack with Efflorescence, 4 LF. 2017- 5 transverse cracks

VISUAL INSPECTION FORM

BRIDGE NUMBER: 71004

REINFORCING TYPE: Fiber

INSPECTION DATE: 8/9/2018

CURRENT DECK NBI RATING: 8

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		1
	> 4'		10
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: two transverse cracks with efflorescence in all bays at end span at 10 ft spacing

UMD NOTES:

Could only see approx. 1/4 of bridge due to river

Transverse cracks on the top appear to be directly above the cracks below

MnDOT INSPECTION NOTES:

11/27/17. 10,000 Linear feet of underdeck cracks with efflorescence.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 73047

REINFORCING TYPE: Fiber

INSPECTION DATE: 8/9/2018

CURRENT DECK NBI RATING: 8

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		4
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: three diagonal cracks with efflorescence in corner, one transverse crack with efflorescence in interior bay at end span

UMD NOTES:

MnDOT INSPECTION NOTES:

2017. The under deck is cracked with 100 linear feet of efflorescence and the corners are diagonal cracked with efflorescence.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 30001

REINFORCING TYPE: Control (Fiber)

INSPECTION DATE: 8/8/2018

CURRENT DECK NBI RATING: 9

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Built in 2014 - possibly was redecked

Bottom: no cracks, slight leaching at joints

MnDOT INSPECTION NOTES:

2016. Under deck cracks with eff. 200 lin ft of unsealed cracks.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 09017

REINFORCING TYPE: Control (Fiber)

INSPECTION DATE: 7/18/2018

CURRENT DECK NBI RATING: 8

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		1
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Bottom: 1 small area of spalling with no exposed rebar

MnDOT INSPECTION NOTES:

2017- N/C 2016/2015-No Change 2014/- New bridge

VISUAL INSPECTION FORM

BRIDGE NUMBER: 82023

REINFORCING TYPE: Control (Fiber)

INSPECTION DATE: 7/31/2018

CURRENT DECK NBI RATING: 8

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		49
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

- 2 interior bays: transverse cracks with efflorescence at approx. 5 to 8 ft spacing at East end
- 2 interior bays: transverse cracks with efflorescence at approx. 10 ft spacing at East end
- 1 interior bay: transverse cracks with efflorescence at approx. 20 ft spacing at East end
- 4 interior bays: transverse cracks with efflorescence at approx. 5 ft spacing at West end
- 2 exterior bays: transverse cracks with efflorescence at approx. 8 ft spacing at West end

UMD NOTES:

No cracks at midspan

MnDOT INSPECTION NOTES:

[2016] 336 lf of cracks with leaching.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 19009

REINFORCING TYPE: Control (Fiber)

INSPECTION DATE: 7/31/2018

CURRENT DECK NBI RATING: 8

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

No visable damage

MnDOT INSPECTION NOTES:

1 lane EastBound/WestBound. (3YHPC-S)
[2017] Underside of the deck has no cracks or spalls.

APPENDIX D: FIELD INSPECTION FORMS FOR MIXED REBAR DECKS

VISUAL INSPECTION FORM

BRIDGE NUMBER: 09011

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 7/17/2018

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat and Sai Wu

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		60+
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with efflorescence (some with rust staining) approx. 3 to 8 ft spacing

UMD NOTES:

MnDOT INSPECTION NOTES:

2017- 130 SF of under deck cracking 2013- Transverse cracks at 2 ft. to 6 ft. intervals some with rust staining and efflorescence.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 48031

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 8/22/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Sai Wu

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		2
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: two transverse cracks with efflorescence with very light efflorescence at approx. 3 ft spacing at end span in interior bay

UMD NOTES:

MnDOT INSPECTION NOTES:

Under deck / minor cracks with efflorescence. 2016.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 58818

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 8/22/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Sai Wu

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Bottom: possible patch on end span

No other visible damage

MnDOT INSPECTION NOTES:

2018- No new deficiencies

2016- No Change No Change.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69039

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 7/27/2018

CURRENT DECK NBI RATING: 8

INSPECTORS: Cori Treat and Jacque Promersberger

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		1
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: diagonal crack with efflorescence, minor map cracking at end spans

UMD NOTES:

MnDOT INSPECTION NOTES:

2016 - No Change

2014- No Change.

Superficial cracking throughout underside.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69046

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 7/17/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Sai Wu

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		1
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Bottom: one area of spalling near midspan, some efflorescence on joints

MnDOT INSPECTION NOTES:

2017, Small amount of efflorescence coming through poured joints.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69117

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 7/18/2018

CURRENT DECK NBI RATING: 8

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

No visable damage

MnDOT INSPECTION NOTES:

2013- Span 1 has 2 longitudinal leaching cracks 16 to 20 feet long and 1 light full width transverse crack at midspan. Span 2 has 2 - 16 ft. light transverse cracks .

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69118

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 7/18/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

No visible damage

MnDOT INSPECTION NOTES:

2013- Span 1 and 2 have a light transverse crack full width at mid span. Span 1 has a full length diagonal crack and a 5 ft. longitudinal crack with leaching. Hairline cracks with efflorescence perpendicular to pier on centerline, both north and south sides. Longitudinal hairline crack east side of pier wall.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 01005

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/17/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Sai Wu

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		2
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Top: transverse cracks that have been sealed at approx. 1 ft spacing

Bottom: two transverse cracks with efflorescence above the piers

UMD NOTES:

MnDOT INSPECTION NOTES:

Several areas leaching through cracks with efflorescent showing. 3"-5" spall along top flange #1 (fascia) beam over S end #2 pier. 2016- 14 LF minor cracks with leaching span 1. 17 LF minor cracks with leaching span 3.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 01006

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/17/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Sai Wu

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		1
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Top: transverse cracks on shoulder

Bottom: one diagonal crack with efflorescence

UMD NOTES:

MnDOT INSPECTION NOTES:

2016- 1- 3 LF minor diagonal crack with leaching NW corner, 72 LF minor cracks with leaching N. span, 2 SF delam span 2 bay 5.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 01007

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/17/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Sai Wu

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		1
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		2
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: one diagonal crack with efflorescence in corner

UMD NOTES:

Top: patches at joints

Bottom: delamination at the joints - one with efflorescence and rust

MnDOT INSPECTION NOTES:

2015- Pier 1: Efflorescence leaching& rust staining 9 lf. 1 Area C/L 3 SF spalled. Pier 2: 16 LF of efflorescence with rust staining. 2013 Pier 2 and 1 pourable under deck has rust staining efflorescence, minor spalling and delamination for 7 L.F. x 1 ft. 2013/ S.E.corner 1'x1' spall

VISUAL INSPECTION FORM

BRIDGE NUMBER: 02811

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 7/31/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		77
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		2
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

- 2 interior bays: transverse cracks with efflorescence at 3 to 5 ft spacing through entire length
- 2 interior bays: transverse cracks with efflorescence at 8 to 10 ft at both ends, none midspan
- 3 interior bays: transverse cracks with efflorescence at 10 ft spacing through entire length
- End span: transverse cracks with efflorescence at 30 ft spacing through entire length
- 2 interior bays with no cracks

UMD NOTES:

No cracks in two interior bays

MnDOT INSPECTION NOTES:

[2017] There were 135 SF of moderate leaching cracks.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 09006

REINFORCING TYPE: Mixed

INSPECTION DATE: 11/9/2017

CURRENT DECK NBI RATING: 5

INSPECTORS: Cori Treat, Scott Asperheim

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		12
	> 4'		42
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		2
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		2
	> 3 in ² and < 1 ft ²		5
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'	6	
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

The cracks with efflorescence seemed to be spaced at regular intervals perpendicular to the beams and most of them spanned from beam to beam.

MnDOT INSPECTION NOTES:

2015- 142 transverse cracks with efflorescence, rust staining and exposed rusted rebar.

2009 - There is rust staining on the piers and abutments from water running through cracks in deck.

Span 1 has 13 transverse cracks, 1 with rust staining. Span 2 has 35 transverse cracks, 2 with rust staining. Span 3 has 13 transverse cracks.

2011 - 4 areas of delamination in areas around cracks.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 09007

REINFORCING TYPE: Mixed

INSPECTION DATE: 11/9/2017

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat, Scott Asperheim

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		1
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'	1	

SPACING AND TYPES OF CRACKS:

UMD NOTES:

There was a patch at the midspan of the top of the deck that appeared to be directly above the spalling area on the bottom.

MnDOT INSPECTION NOTES:

2017-2' x 5' & 2' x 10' spalls with exposed rusted rebar between B2 & B3 center span at joint
2015/- 16 sq ft of delam with rust staining center span between beams 3 and 4

VISUAL INSPECTION FORM

BRIDGE NUMBER: 11006

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/17/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Sai Wu

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		1
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

1 diagonal crack with efflorescence

UMD NOTES:

MnDOT INSPECTION NOTES:

(2014) SE corner has a diagonal crack with leaching about 3' long. Delam over pier 1 at pourable, 3 SF in bay 2 and 3 SF in bay 3. 1 sf spall under side of deck NE corner

VISUAL INSPECTION FORM

BRIDGE NUMBER: 16001

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/18/2018

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		7
	> 6" and < 4'		6
	> 4'		9
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		7

SPACING AND TYPES OF CRACKS:

Mostly diagonal cracks with efflorescence, some transverse cracks

UMD NOTES:

MnDOT INSPECTION NOTES:

2017-130 LF of transverse cracking with efflorescence 2013/2015- No Change. 2008- The deck has short heavy leaching diagonal cracks on the underside at the corners. One crack is longitudinal and all leak water. One crack south bound lane has rust staining & water soaked 1 ft. each side.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 16002

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/18/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		1
	> 4'		6
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'	6	

SPACING AND TYPES OF CRACKS:

Bottom: 4 transverse cracks > 4ft long w/ efflorescence/leaching at end of span spaced approx 5ft

2 more transverse cracks > 4ft long w/ efflorescence/leaching in two other bays

Top: 6 transverse cracks > 4ft spaced approx. 4ft - 6ft

UMD NOTES:

MnDOT INSPECTION NOTES:

2017- 70ft of transverse cracking with efflorescence 2015- No Change. Scattered transverse leaching cracks through the slab are leaching and wet on the bottom. A total of 6 cracks mostly in the 2nd from west bay near the south end.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 18001

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/17/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Sai Wu

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Two 6' x 6' (approx.) patches on middle bay end span on underside

MnDOT INSPECTION NOTES:

(2014) Minor leakage over piers at cold joints with leaching. 5 SF delam over pier 2 at pourable in bay 2. 8 LF cracks with light leaching in bay 1. 12 LF cracks with light leaching in bay 2. 18 LF cracks with light leaching in bay 3. [Spalls repaired 2008]

VISUAL INSPECTION FORM

BRIDGE NUMBER: 19033

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/31/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		1
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		1
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		2
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: diagonal crack with efflorescence

UMD NOTES:

Bottom: efflorescence and rust staining at joints, delamination over joint (1 SF)

MnDOT INSPECTION NOTES:

[2016] There are approximately 6 SF of moderate width transverse leaching cracks and 30 SF of delam.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 19037

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 8/1/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		13
	> 4'		20
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		3
	> 1 ft ²		4
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		1
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: 2 areas with transverse cracks with efflorescence at approx. 5 ft spacing

UMD NOTES:

MnDOT INSPECTION NOTES:

[2017] Span 1 has 113 SF of moderate transverse cracks with leaching, 4 SF of delamination, 10 SF of 1-1/2" deep spalls with exposed rebar and 30 SF of map cracking with minor leaching. (CS2-147) (CS3-10)

Span 2 has 100 SF of moderate transverse cracks with leaching and 1 SF of 1-1/2" deep spall with exposed rebar.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 19038

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/1/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		7
	> 4'		9
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		4
	> 1 ft ²		4
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		3
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse efflorescence cracks at random spacing

UMD NOTES:

One spalling area 5 SF or greater (approx. 5 SF with exposed rebar)

MnDOT INSPECTION NOTES:

C-I-P concrete deck with uncoated/epoxy coated rebar,
 [2017] Approximately 80 SF of moderate transverse cracks with leaching between beams and 12 SF of 1" deep scattered
 spalls with rebar exposure, and 4 SF delamination (CS2-84) (CS3-12).

VISUAL INSPECTION FORM

BRIDGE NUMBER: 19075

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/31/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		6
	> 4'		3
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		2
	> 1 ft ²		1
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		6
	> 1 ft ²		5
Rust Staining	< 3 in ²		5
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with efflorescence and rust staining, map cracking above pier

UMD NOTES:

MnDOT INSPECTION NOTES:

[2016] Scattered leaching trans. cracks along construction joint w/minor spalling. 45 SF of spalls and delam. 4 SF delam between 1-8 over cap.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 19076

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/31/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		1
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Bottom: efflorescence and rust staining at joints
could only look at portion of bridge

MnDOT INSPECTION NOTES:

Span 1: [1997] Minor deck leaching at Pier joint (center bay).

[2000/2008] 10 sf of delamination at Pier 2.

[2014] 10 SF of delamination at pier 2 is now 10 SF of spall.

[2012] The underside of the deck at the poured joints is exhibiting minor leaching and rust staining with isolated areas of small delamination. Total distressed area is less than 2% of the total area of the deck.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 19811

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/30/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		10
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		10
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with efflorescence at approx. 5 ft spacing

UMD NOTES:

MnDOT INSPECTION NOTES:

[2013] Concrete repair, clean & paint rebar.

[2016] The underside of the deck has 100 SF of moderate width transverse leaching cracks, 228 SF of spall with exposed rebar.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 19812

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/30/2018

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		5
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		1
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		1
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with efflorescence

UMD NOTES:

MnDOT INSPECTION NOTES:

[2016] Span 1 has 6 SF of moderate width transverse leaching cracks. 2 SF (2' x 2' x 2") of spall with exposed rebar. 6 SF (6' x 1') of delam. Span 2 has 12 SF of moderate width transverse leaching cracks. 50 SF of spall with exposed rebar. 2 SF (2' x 1') of delam. Span 3 has 75 SF of moderate width transverse leaching cracks.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 19813

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/30/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		2
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		2
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: two small cracks with efflorescence and rust staining

UMD NOTES:

MnDOT INSPECTION NOTES:

[2016] There are approximately 2 SF of moderate width transverse leaching cracks.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 19814

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/30/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		1
	> 4'		6
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		2
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with efflorescence

UMD NOTES:

MnDOT INSPECTION NOTES:

[2016] There are 3 SF of moderate width transverse unsealed cracks.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 19891

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/31/2018

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		19
	> 4'		5
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		1
	> 1 ft ²		14
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		5
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with efflorescence at 4 to 10 ft spacing

UMD NOTES:

Five spalling areas with exposed rebar greater than 5 SF (approx. areas: 5 SF, 7 SF, 10 SF, 5 SF, 10 SF), delamination 1 SF with loose concrete

MnDOT INSPECTION NOTES:

[2017] Bay 1 has a 38 SF spall with exposed rebar with 2% section loss, 2 SF of delam over north slope and 100 LF of cracks with efflorescence. Bay 2 has 22 SF of spall with exposed rebar with up to 2% section loss and 120 LF of cracks with efflorescence. Bay 3 has 57 SF of spall with exposed rebar with up to 2% section loss and 100 LF of cracks with efflorescence.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 19892

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/31/2018

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		2
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		11
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		6
	> 3 in ² and < 1 ft ²		5
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with efflorescence and rust staining with delamination

UMD NOTES:

Two spalling areas with exposed rebar greater than 5 SF (approx. areas: 8 SF, 6 SF) span beam to beam, multiple rust staining spots from rebar chairs

MnDOT INSPECTION NOTES:

[2017] 70 SF of spalling and 10 SF of delamination, mainly in outside bays. 144 LF of leaching cracks.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 19893

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/31/2018

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		5
	> 4'		2
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		3
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		50+
	> 3 in ² and < 1 ft ²		20+
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with efflorescence

UMD NOTES:

Rust staining along the outside girders along the entire length of bridge

MnDOT INSPECTION NOTES:

[2016] There are approximately 10 SF of moderate width transverse leaching cracks and 30 SF of spall with exposed rebar with section loss.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 27044

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 7/25/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		20
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with efflorescence at approx. 5 ft spacing

UMD NOTES:

MnDOT INSPECTION NOTES:

Two lanes EB & WB (left turn lane). 2 Traffic loops WB span 1. Epoxy coated rebar.

[2009/2017] Underside of the deck has 1500 LF of moderate transverse leaching cracks, mostly in the median and EB bays.

[2017] Inspector feels 562 SF of CS 3 needs to be changed to 150 SF of CS 2 due to the amount of moderate size cracking and the light leaching (Photo 27).

VISUAL INSPECTION FORM

BRIDGE NUMBER: 27056

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 7/25/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		1
	> 4'		5
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: 6 transverse cracks with efflorescence

UMD NOTES:

MnDOT INSPECTION NOTES:

[2016] Underside of the deck has 24 SF of moderate width light leaching cracks with rust staining and staining on the deck behind the conduit.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 27058

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 7/25/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		2
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: two transverse cracks with efflorescence

UMD NOTES:

MnDOT INSPECTION NOTES:

[2016] 25 SF of leaching moderate width cracks with rust stains, water saturation, and efflorescent. Coping has moderate width cracking heavy saturation, rust staining and efflorescent.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 27068

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/24/2018

CURRENT DECK NBI RATING: 5

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		2
	> 1 ft ²		5
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Rust and efflorescence over piers at joints with loose delamination

MnDOT INSPECTION NOTES:

[2010] Loose delamination over Ped path at S end of 1st Bay.

[2012/2016] Loose concrete removed over walkway 3 sf of spall with rusted rebar. Delamination and leaching and rust stains above pier caps at construction joints 289 lf.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 27117

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 7/25/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		10
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: ten transverse cracks with efflorescence 3 to 5 ft spacing

UMD NOTES:

MnDOT INSPECTION NOTES:

[2017] There are approximately 22 SF of transverse moderate width unsealed leaching cracks on the underside of the deck.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 27134

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/24/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Could not get underneath due to railroad tracks

MnDOT INSPECTION NOTES:

C-I-P concrete deck with epoxy coated rebar,
[2017] Deck was in good condition

VISUAL INSPECTION FORM

BRIDGE NUMBER: 27237

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/24/2018

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Bottom: spalling with exposed rebar at center spanning entire the length of bridge approx. 1 to 3 ft wide, some delamination with loose concrete on edges over railroad tracks

MnDOT INSPECTION NOTES:

[2017] There were approximately 700 SF of spall with exposed rebar and section loss (Est. 3%) mainly at the center of bridge. (CS3)

500 SF of delamination mostly over center line of median opening. No delamination or spall over trail.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 27739

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/24/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		2
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: two transverse cracks with efflorescence

UMD NOTES:

MnDOT INSPECTION NOTES:

[2017] There were approximately 18 SF of moderate width transverse leaching cracks in the wear course.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 27740

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 7/24/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

No visable damage

MnDOT INSPECTION NOTES:

[2017] In Good Condition

VISUAL INSPECTION FORM

BRIDGE NUMBER: 27741

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 7/24/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

No visable damage

MnDOT INSPECTION NOTES:

[2017] In Good Condition.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 27749

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 7/24/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		1
	> 4'		9
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: one diagonal crack with light efflorescence, nine transverse cracks with light efflorescence

UMD NOTES:

MnDOT INSPECTION NOTES:

[2005] Leaching cracks bottom of deck.

[2010/2014] Checked, no loose concrete.

[2016] Delamination NE and NW corners at Gland, 2-1 sf. 73 lf cracks with efflorescence.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 27765

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/24/2018

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		4
	> 6" and < 4'		40
	> 4'		29
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		19
	> 1 ft ²		17
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		2
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		1
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with efflorescence - random spacing, center bay had transverse cracks with efflorescence at 2 ft spacing

UMD NOTES:

MnDOT INSPECTION NOTES:

[2015] North End 2 SF of delamination above column. 3 SF of delamination over left turn lane Northbound.

[2017] Deck had 281 SF of moderate transverse cracks with leaching, 126 SF of 1 1/2" deep spalls with rebar and 49 SF of loose delamination.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 31028

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/17/2018

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat and Sai Wu

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		3
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		1
	> 4'		3

SPACING AND TYPES OF CRACKS:

Top: map cracking on each corner, transverse cracks along shoulder with 3 to 6 ft spacing

Bottom: some map cracking on ends, two diagonal cracks and 1 transverse crack with efflorescence

UMD NOTES:

MnDOT INSPECTION NOTES:

2018-NW and SE Ends Below Deck: Moderate Density Map Cracking with light leaching and staining.

2014-Hairline diagonal cracks in bottom of slab at all 4 corners. There are a few new transverse cracks with light leaching throughout the slab.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 31030

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/17/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Sai Wu

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Some small cracks on underside - no leaching or efflorescence

MnDOT INSPECTION NOTES:

(2016) Minor leaking over the ends of piers 1 & 2 with efflorescence. Cold joints over both piers show some past leakage. 2016- 14FT efflorescence over P1 on pourable. 6" delam / spall bay 3 pourable. 2 moderate cracks over east side of P1 with leaching. 3 moderate cracks over P2 east end

VISUAL INSPECTION FORM

BRIDGE NUMBER: 33003

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 8/22/2018

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat and Sai Wu

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		3
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: diagonal cracks with efflorescence at ends

UMD NOTES:

MnDOT INSPECTION NOTES:

Cracks leaching thru with efflorescence all four corner of deck And cracked over pier. 2015. No changes. 2017.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 34021

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/9/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		5
	> 4'		1
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with efflorescence

UMD NOTES:

MnDOT INSPECTION NOTES:

underdeck cracks leaching thru with efflorescence.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 36007

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/27/2018

CURRENT DECK NBI RATING: 5

INSPECTORS: Cori Treat and Jacque Promersberger

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		10
	> 4'		40+
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with efflorescence spanning beam to beam approx. 4 to 10 ft spacing

UMD NOTES:

MnDOT INSPECTION NOTES:

2018/2016- 50 sq. ft. of transverse cracks w/ efflorescence 500 LF (220 span #1, 90 span#2, 190 span #3) Snooper: Agree with noted inspection. South end of deck face under strip seal has: 25' x 1' x 3" deep total spalling with exposed rebar, also 45' x 1' of loose delamination.

2014-2010 20 ft. of delamination

VISUAL INSPECTION FORM

BRIDGE NUMBER: 36011

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/27/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Jacque Promersberger

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		6
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		1
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: at barrier transverse cracks with efflorescence at 10 ft spacing with random spots of rust staining

UMD NOTES:

Bottom: delamination with efflorescence and rust staining

MnDOT INSPECTION NOTES:

2017 - 107 ft of leaching cracks in deck. 25 Sf of rust staining cracks in soffits
 2015- 3 in. X 2 in. spall & 12 in. x 8 in. delam between beam 6&7 north end - 2 ft. x 2 ft. delam between beam 1&2 on north end. The slab is leaching on the underside in a 4 sq. ft. area.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 36012

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/27/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Jacque Promersberger

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		4
	> 6" and < 4'		9
	> 4'		16
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with efflorescence and some with rust staining 5 to 10 ft spacing or > 20 ft spacing

UMD NOTES:

MnDOT INSPECTION NOTES:

2017 -543 ft of cracks with leaching through out deck and 1 crack with delam 8 in. wide X 6 ft long between beam 6 & 7

2015- No Change.

14 light trans. leaching cracks.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 36013

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/27/2018

CURRENT DECK NBI RATING: 5

INSPECTORS: Cori Treat and Jacque Promersberger

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		1
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Bottom: one 0.5' x 0.5' area of efflorescence, 3 patches approx. 4" x 4"

MnDOT INSPECTION NOTES:

2017 - There are many patched and unpatched honeycomb and light map cracked area through out deck for a total of 390 sq ft and leaching at joints over pier caps 236 ft or 23 sq ft

2015- No Change.

Span 3 has several areas under the deck which have been patched for a total of 10 sq. ft. Moderate leaching at joints under Piers. Rust stain minor delam over Pier 2 east end.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 38002

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/18/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: 3' x 6' map cracking

UMD NOTES:

MnDOT INSPECTION NOTES:

2017- 6' x 3' area of map cracking with watersoaked concrete NE corner due to leaking stripseal

VISUAL INSPECTION FORM

BRIDGE NUMBER: 48001

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/8/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		1
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Bottom: delamination at joint above pier

MnDOT INSPECTION NOTES:

None

VISUAL INSPECTION FORM

BRIDGE NUMBER: 48003

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/22/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Sai Wu

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		1
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Bottom: delamination above pier at joint approx. 1 SF

MnDOT INSPECTION NOTES:

Under deck rusting & delamination at deck joint over pier. 2016.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 48005

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/8/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Bottom: spalling above pier at midspan

MnDOT INSPECTION NOTES:

Spalled over center pier. delaminated with efflorescence under cold jnt. (8 sq. ft all pic on file 08)

VISUAL INSPECTION FORM

BRIDGE NUMBER: 48006

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/8/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

No visable damage

Bottom: could not see above pier

MnDOT INSPECTION NOTES:

rust stained and small spalls over pier, and under pour jnt. 4 sq. ft all 08 pic on file. 12 sq. ft. of spalls & delam under deck above pier below joint. 2016.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 48007

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/8/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

No visable damage

MnDOT INSPECTION NOTES:

Minor cracks with efflorescence. 2016.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 48008

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/8/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		3
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with very light efflorescence in 3 different bays

UMD NOTES:

MnDOT INSPECTION NOTES:

Cracks leaching thru underdeck 50 lin ft all. 2015. Exposed rebar above S. Pier with cracks, delam & efflorescence. 2016

VISUAL INSPECTION FORM

BRIDGE NUMBER: 48009

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/8/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		1
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Bottom: one area of spalling with exposed rebar above pier approx. 1' x 1'

MnDOT INSPECTION NOTES:

some underdeck cracks S. side 4th bay 1'x2' spall ex rebar.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 48010

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/8/2018

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

No visable damage

MnDOT INSPECTION NOTES:

None

VISUAL INSPECTION FORM

BRIDGE NUMBER: 48011

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/8/2018

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		9
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		2
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		4
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with efflorescence at 5 to 10 ft spacing

UMD NOTES:

Bottom: some delamination with loose concrete at midspan over the river

MnDOT INSPECTION NOTES:

Diagnol cracks at bridge corners, and minor cracks mid span with efflorescence.. Spalled underdeck, 8 sq. ft all and 1 sq. ft spalled rebar exposed.2010

VISUAL INSPECTION FORM

BRIDGE NUMBER: 48012

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/8/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		8
	> 4'		17
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		1
	> 1 ft ²		3
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with efflorescence (some spanning entire width of the bridge under the girders) at 5 to 10 ft spacing all at midspan

UMD NOTES:

Bottom: some delamination with loose concrete over the river at midspan, 2 delamination areas at cracks with efflorescence and rust staining

MnDOT INSPECTION NOTES:

some cracks midspan. Under deck cracked w/eff. N. pier and under bridge delamed 60 lin ft.2 spalls 1'x1' N. end.2016

VISUAL INSPECTION FORM

BRIDGE NUMBER: 48013

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/8/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		5
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		1
	> 1 ft ²		1
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: one bay at end span had 5 transverse cracks with efflorescence at 5 to 10 ft spacing

UMD NOTES:

Bottom: spalling and delamination above pier, some small circles of rust staining from rebar chairs

MnDOT INSPECTION NOTES:

Areas of deck that were replaced in 2004 are cracked with efflorescence. Two small spalls under center median where signs are in deck. Coping over 169 N.B. shoulder starting to spall 2010

VISUAL INSPECTION FORM

BRIDGE NUMBER: 48015

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/8/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		2
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Bottom: rust staining above both piers and one 1 SF area of delamination above the North pier, one 4 SF area of delamination with rust staining

MnDOT INSPECTION NOTES:

between e facia beam and 2nd beam north end 3sq ft spall

VISUAL INSPECTION FORM

BRIDGE NUMBER: 48016

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/8/2018

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		1
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		4
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Bottom: some delamination and rust staining above both piers, exposed rebar over one pier

MnDOT INSPECTION NOTES:

Above the S.pier 2 sq ft spall exposed rebar. 1'x3'sq delam over same pier between E. fascia and 2nd beam.2016.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 48019

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/8/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

No visable damage

MnDOT INSPECTION NOTES:

None

VISUAL INSPECTION FORM

BRIDGE NUMBER: 48020

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/8/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

No visable damage

MnDOT INSPECTION NOTES:

None

VISUAL INSPECTION FORM

BRIDGE NUMBER: 49023

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/22/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Sai Wu

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		2
	> 4'		1
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: diagonal cracks in corners with efflorescence

UMD NOTES:

MnDOT INSPECTION NOTES:

- 1 minor 4' diagonal crack in the NE corner with light efflorescence.
- S.E. Corner 2sf minor segregated concrete with light leaching and 8' of minor cracking

VISUAL INSPECTION FORM

BRIDGE NUMBER: 49024

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/22/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Sai Wu

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		2
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: diagonal cracks in corners outside bays at end spans

UMD NOTES:

MnDOT INSPECTION NOTES:

Gel sealed 2010. Light efflorescence is showing in diagonal cracks at E. end of outside bays. Cracking SE 4', NE 1'

VISUAL INSPECTION FORM

BRIDGE NUMBER: 49031

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/22/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Sai Wu

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		4
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		1
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		1
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: diagonal cracks with efflorescence in corners at East end span

UMD NOTES:

Bottom: one crack had approx. 1/2' x 1/2' spalling with exposed rebar and some rust staining

MnDOT INSPECTION NOTES:

Diagonal cracks in corners of east end of deck are showing some leaching and rust staining about 4". There is a small 1 sf spall with exposed rebar in the SE corner.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 49032

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/22/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Sai Wu

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		1
	> 1 ft ²		1
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		2
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Bottom: spalling and delamination at joint above pier

MnDOT INSPECTION NOTES:

Spalling along pourable joint above the Pier between the Beams Bay 1, 6'x1.5' with minor rust staining / Bay 2, 4'x1.5' spall with 2 exposed bars and 5'x1.5' delam / Bay 3, 4'x1.5' delam and rust staining and minor leaching all areas of delam and spalls.

Leaching with minor rust staining on both outside soffit at the pourable joints 5lf.

A few minor crack

VISUAL INSPECTION FORM

BRIDGE NUMBER: 58002

REINFORCING TYPE: Mixed

INSPECTION DATE: 11/9/2017

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat, Scott Asperheim

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		7
	> 6" and < 4'		2
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		1
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'	1	

SPACING AND TYPES OF CRACKS:

UMD NOTES:

MnDOT INSPECTION NOTES:

- 2015- Span 2 has light to moderate cracks with efflorescence at 4' to 8' intervals.
- 2013- Numerous transverse cracks in gutters which leach on underside of deck with rust.
- 2011- There are small areas of delamination developing at many of the cracks.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 62810

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 8/1/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		120
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with severe efflorescence at 6 to 10 ft spacing, approx. 10 cracks with rust staining

UMD NOTES:

Bottom: Severe leaching from cracks

MnDOT INSPECTION NOTES:

[91/2001] Underside of deck has 800 LF of leaching cracks.

[2006] Soffits have leaching cracks.

[2017] 121 SF of moderate transverse cracks with leaching.

2 SF spall (1" deep) with exposed rebar at north abutment, bay 5

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69076

REINFORCING TYPE: Mixed

INSPECTION DATE: 11/15/2017

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat, Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'	1	
	> 4'	1	

SPACING AND TYPES OF CRACKS:

UMD NOTES:

The only degradation observed on the bottom was leaching at the deck joints.

MnDOT INSPECTION NOTES:

2017-Pier #2, between Beams #3 & #4: 1' x 1' x 1" spall & Beam #3 on the west side has 1' x 1' delam with rust staining. Span #2, above pier #1, East side of Beam #3: 1' x 1' delam with rust staining. West soffit, over Pier #2: 2 minor 2' leaching cracks. 108 LF of CS 3

2015- Both Pier joints are leaching and rust stained at deck bottom.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69081

REINFORCING TYPE: Mixed

INSPECTION DATE: 11/15/2017

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat, Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		1
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"	1	
	> 6" and < 4'		
	> 4'	1	

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Very little visible degradation.

MnDOT INSPECTION NOTES:

(2016) all construction joints above pier 1 & 2 have delam , heavy leaching , significant water saturation , and rust stain. / center span 3 between beams 3 & 4 , 2 spalls 4in X 4in X 1in deep. / east soffit has 4 cracks with leaching west soffit has 2

2015- Delamination and rust beginning to show signs of unsealed construction joint. Moderate leaching at Pier joints. Pier 1 joint area Bay 2, 3, & 4 delam. & rust staining. Pier 2 joint over cap Bay 1, 2, & 3 delam starting. Bay 4, 2 sq. ft. delam.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69082

REINFORCING TYPE Mixed

INSPECTION DATE: 11/15/2017

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat, Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'	1	

SPACING AND TYPES OF CRACKS:

UMD NOTES:

The only visible degradation on the bottom was leaching at the deck joint.

MnDOT INSPECTION NOTES:

(2016) The Pier joints are leaking with rust staining efflorescence. Map cracking and delam starting . above pier 1 between beams,1 crack with delam 1ft. wide and 3 cracks .5ft wide and above pier 2, 3 cracks 1ft. wide and 1 crack .5ft. wide for a total of 54sq. ft. CS3 and 4 cracks in soffit 2ft long .8 sq ft CS2

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69083

REINFORCING TYPE: Mixed

INSPECTION DATE: 11/15/2017

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat, Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		1
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"	1	
	> 6" and < 4'	1	
	> 4'	1	

SPACING AND TYPES OF CRACKS:

UMD NOTES:

MnDOT INSPECTION NOTES:

2017- 1 transverse leaching crack 8' long

2015- SE End 2' x 1' Spall with exposed rusted rebar Edge of slab spalled at west end of south abutment, 1 ft. diameter x 4 in. deep. The overhangs are cracked diagonally. Small areas of the v-drip are filled with concrete. Some heavy leaching at coping near midspan at east coping.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69084

REINFORCING TYPE: Mixed

INSPECTION DATE: 11/15/2017

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat, Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		1
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'	2	
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Very little degradation visible on bottom of deck.

MnDOT INSPECTION NOTES:

2015- Small areas of the v-drip are filled with concrete. S.E. corner underdeck is spalled 2 ft. x 2 ft. x 1 1/2 in. with rusted rebar .

2009 - deck has random light map cracking

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69085

REINFORCING TYPE: Mixed

INSPECTION DATE: 11/15/2017

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat, Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'	4	

SPACING AND TYPES OF CRACKS:

UMD NOTES:

The bottom of the deck had no visible degradation.

MnDOT INSPECTION NOTES:

2017- 85 lf of transverse cracking with efflorescence

2016 - 8 cracks with leaching east soffit , 7 cracks with leaching west soffit

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69086

REINFORCING TYPE: Mixed

INSPECTION DATE: 11/15/2017

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat, Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		3
	> 4'		2
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		1
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'	2	
	> 4'	1	

SPACING AND TYPES OF CRACKS:

UMD NOTES:

MnDOT INSPECTION NOTES:

2017- 96 Lf of transverse cracking

2016 -40 minor light vertical cracks / 1 ft X 1.5 ft delam span 3 between beam 1 & 2 / 5 cracks with leaching west soffit 3 cracks with leaching east soffit

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69088

REINFORCING TYPE: Mixed

INSPECTION DATE: 11/15/2017

CURRENT DECK NBI RATING: 8

INSPECTORS: Cori Treat, Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		1
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Very little visible degradation.

MnDOT INSPECTION NOTES:

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69103

REINFORCING TYPE: Mixed

INSPECTION DATE: 11/15/2017

CURRENT DECK NBI RATING: 8

INSPECTORS: Cori Treat, Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

The top of the deck had multiple small cracks near the ends. There were a few cracks near the midspan. The bottom of the deck had no visible degradation.

MnDOT INSPECTION NOTES:

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69107

REINFORCING TYPE: Mixed

INSPECTION DATE: 11/15/2017

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat, Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		10
	> 6" and < 4'		7
	> 4'		5
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

MnDOT INSPECTION NOTES:

(2016)- 1720 LF of transverse cracking with efflorescence. Also observed was 41SF of CS3 water saturation.

Span 1 has 10 trans. cracks. Span 2 has trans. cracks at 3 ft. to 10 ft. intervals. Span 3 has 11 trans. cracks with moderate leaching. South soffit has 17 light cracks with leaching North has 16. Minor rust staining in some cracks. Midspan between Beam 1 & 2 delam 6 in. W along lateral leaching crack.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69108

REINFORCING TYPE: Mixed

INSPECTION DATE: 11/15/2017

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat, Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		3
	> 6" and < 4'		12
	> 4'		15
Spalling w/ Exposed Rebar	< 3 in ²		1
	> 3 in ² and < 1 ft ²		3
	> 1 ft ²		2
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		2
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

The majority of the degradation occurred at the midspan of the bridge.

MnDOT INSPECTION NOTES:

(2016)-Span 2 has 27sqft. of rust stain and is water soaked. Span 3 has 8sqft. of rust stain. Heavier transverse cracks at mid-span of Span 2
 East span has 2 cracks with light leaching CL 2 spalls 1 ft. sq. each delam starting of leaching cracks.
 Center has 24 8' transverse moderate cracks with heavy leaching and light rust stain, some starting to delam. West has 6 8' transverse cracks with light leaching CL delam 1 sq. ft. Minor cracking & map cracking under entire bridge.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69110

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 7/27/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Jacque Promersberger

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Bottom: delamination along both edges with some rust staining

MnDOT INSPECTION NOTES:

2017/2016-No Change 2015-Delamination along edge of soffit has increased for last inspection Span 3 has 16 L.F. of delam on East fascia edge, and 35 L.F. of delam on West fascia edge. 2014 no change) 2012 - Spans 1,2,3, have 1 longitudinal crack at C/L., Span 3 has 2. There are light diagonal cracks at the Pier on the West and East face of slab. 1 ft x 6 in. x 1 in. deep spall at Pier 1 West side. Leaching has begun at Span from abut. to 7 ft. out into slab in 2004/2012- Span 1 has 6 LF of delam at the east fascia edge and 3 at the west. Span 2 has 3 LF of delam at the west fascia edge and 1 LF at the east. Span 3 has 8 L.F. of delam on East fascia edge, and 8 L.F. of delam on West fascia edge.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69111

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/27/2018

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat and Jacque Promersberger

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Bottom: delamination and rust staining at joint
Top: patch at joint

MnDOT INSPECTION NOTES:

2016- 100 SF of pourable joints have up to 1' wide delamination with rust staining and efflorescence due to no sealant in joints
2014-.No Change
2010 - Cracks extend from railing joints into gutter areas with some leakage. Slight leakage at Pier joints. Pier 2 exp. joint has effervescence on underside rust stains with spalling approx. 6 sq. ft. and 1 ft. x 14 ft. of delam. SE corner soffit 1 ft. x 20 ft. delam

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69113

REINFORCING TYPE: Mixed

INSPECTION DATE: 11/28/2017

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat, Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		1
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		1
	> 3 in ² and < 1 ft ²		2
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

All spalling and delamination occurred near the deck joints. The joints had some areas on the top that had been patched.

MnDOT INSPECTION NOTES:

2015- Pier 1 at B 3 B 4 1'x2' delham.

2011- under pourable joints there is beginning to be Delamination, efflorescence and rust staining for a total of 6sf.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69114

REINFORCING TYPE: Mixed

INSPECTION DATE: 11/28/2017

CURRENT DECK NBI RATING: 8

INSPECTORS: Cori Treat, Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

All degradation observed on the bottom was at the deck joints. There were cracks with rust and efflorescence, and spalling and delamination directly under the joints. The remainder of the bridge deck was in very good condition and had no visible degradation. The deck joint had many patches and holes on the top. The degradation on the underside appeared to be caused by the deck joint, not by the rebar in the deck.

MnDOT INSPECTION NOTES:

2017 @ Pier 3 Beam 1&2 2 SF of delam with rusted bar. 2015- No Change.
 2013- All const. joints above piers have spalling with delam and rust staining there is a total of 15 sf. of delam. 2011- Deck under pourable joints have delamination, efflorescence with rust staining. There is 2 SF of delamination over pier 1.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69115

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 11/28/2017

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat, Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		1
	> 6" and < 4'		6
	> 4'		7
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

MnDOT INSPECTION NOTES:

2013- The S.E. & S.W. corner of the slab is spalled. Transverse leaching cracks from N. abut - 20 ft. back with Eff.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 69116

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 11/28/2017

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat, Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		9
	> 6" and < 4'		12
	> 4'		34
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		3
	> 1 ft ²		1
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

There were many cracks with efflorescence that were spaced at fairly equal intervals running perpendicular to the girders. Most of the cracks spanned the entire distance between the girders. Some of these cracks had delamination.

MnDOT INSPECTION NOTES:

2009 - Span 1 has 5 transverse cracks, Span 2 has 18.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 70027

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 7/24/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		30
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		1
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with efflorescence spanning beam to beam - one interior bay spaced at approx. 4 ft down entire span of bridge, other interior bay spaced at approx. 10 ft spacing, no cracking in two exterior bays

UMD NOTES:

MnDOT INSPECTION NOTES:

[2000/2005] One sf spall between fascia and second girder, 400 lf of efflorescence cracks.
 [2002] Efflorescence on underside of deck appears to be more pronounced, however no new spalls or rust staining.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 71007

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/8/2018

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		10
	> 4'		5
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: two diagonal cracks with efflorescence at ends, transverse cracks at midspan at 4 to 10 ft spacing

UMD NOTES:

MnDOT INSPECTION NOTES:

cracks with efflorescence., 30 lin ft all

VISUAL INSPECTION FORM

BRIDGE NUMBER: 71008

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 8/8/2018

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat and Ethan Herberg

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		1
	> 4'		2
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with efflorescence at midspan - all in different bays

UMD NOTES:

MnDOT INSPECTION NOTES:

cracks with efflorescence 30 lin ft all. 2016.150 lin ft of cracks w/eff

VISUAL INSPECTION FORM

BRIDGE NUMBER: 71012

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 8/9/2018

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		22
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: two interior bays with transverse cracks with efflorescence at 4 to 20 ft spacing in one bay and 3 to 5 ft spacing in the other bay

UMD NOTES:

Could see approx. 1/3 of bridge

MnDOT INSPECTION NOTES:

200 lf of cracks with efflorescence. 2017.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 73020

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/9/2018

CURRENT DECK NBI RATING: 6

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		1
	> 6" and < 4'		2
	> 4'		2
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Top: transverse cracks approx. 6 in to 4 ft spacing

Bottom: transverse cracks with efflorescence at random spacing

UMD NOTES:

MnDOT INSPECTION NOTES:

None for Element #12

VISUAL INSPECTION FORM

BRIDGE NUMBER: 73023

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/9/2018

CURRENT DECK NBI RATING: 8

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		20
	> 4'		5
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: transverse cracks with efflorescence at 5 to 10 ft spacing on three interior bays, other bays had 1 to 2 transverse efflorescence cracks

UMD NOTES:

MnDOT INSPECTION NOTES:

20 lin ft cracks with efflorescence, 07. 30 lin ft cracks with efflorescence 2015. 400 lf of cracks with efflorescence. 2017.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 73025

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 8/9/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Could not access because of railroad

MnDOT INSPECTION NOTES:

None for Element #12

VISUAL INSPECTION FORM

BRIDGE NUMBER: 73026

REINFORCING TYPE: Control (Mixed)

INSPECTION DATE: 8/9/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Connor Mills

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Could no access because of railroad

MnDOT INSPECTION NOTES:

Minor cracks with efflorescence. 2017.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 77013

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/22/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Sai Wu

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Bottom: some efflorescence at joint above pier
could not go under entire bridge because of the river

MnDOT INSPECTION NOTES:

Minor leakage showing at bottom of railing joints. Some leaking at cold joints over the pier (old) spall in soffit over south end with re-rod showing 1SF & 3' leaching.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 77014

REINFORCING TYPE: Mixed

INSPECTION DATE: 8/22/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Sai Wu

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Bottom: efflorescence and delamination at joint above pier

MnDOT INSPECTION NOTES:

Span 1, Bay 3- 11 SF minor map cracking next to S. abutment, Bay 4- 20 SF, Bay 5- 10 SF

Span 2, Bay 5- 2" x 1' delam on bottom of cold joint at mid span E. side of bridge.

Span 3, Bay 5- 2' minor diagonal crack with 1 SF delam and leaching under NE corner of deck.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 82003

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/31/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

UMD NOTES:

Efflorescence and rust staining at joint

MnDOT INSPECTION NOTES:

[2016] There are 4 SF of leaching cracks with rust staining at construction joint over pier 1.

VISUAL INSPECTION FORM

BRIDGE NUMBER: 82004

REINFORCING TYPE: Mixed

INSPECTION DATE: 7/31/2018

CURRENT DECK NBI RATING: 7

INSPECTORS: Cori Treat and Matt McDermott

NUMBER OBSERVED FOR EACH CONDITION			
CONDITION	APPROX. SIZE	TOP OF DECK	BOTTOM OF DECK
Cracks w/ Efflorescence (Leaching)	< 6"		
	> 6" and < 4'		
	> 4'		
Spalling w/ Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Delamination/ Spalling w/o Exposed Rebar	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Rust Staining	< 3 in ²		
	> 3 in ² and < 1 ft ²		
	> 1 ft ²		
Cracking	< 6"		
	> 6" and < 4'		
	> 4'		

SPACING AND TYPES OF CRACKS:

Bottom: small map cracking

UMD NOTES:

Efflorescence and rust staining at joint

MnDOT INSPECTION NOTES:

[2016] There are 4 SF of leaching cracks with rust staining at construction joint over pier 1.

Low Slump Overlay with Epoxy Rebar

[2016] There are approximately 21 SF of unsealed cracks in the wear course.

Scattered spalls along the stripe seal at the North and South ends.

APPENDIX E: EVALUATION OF INSPECTION DATA RESULTS

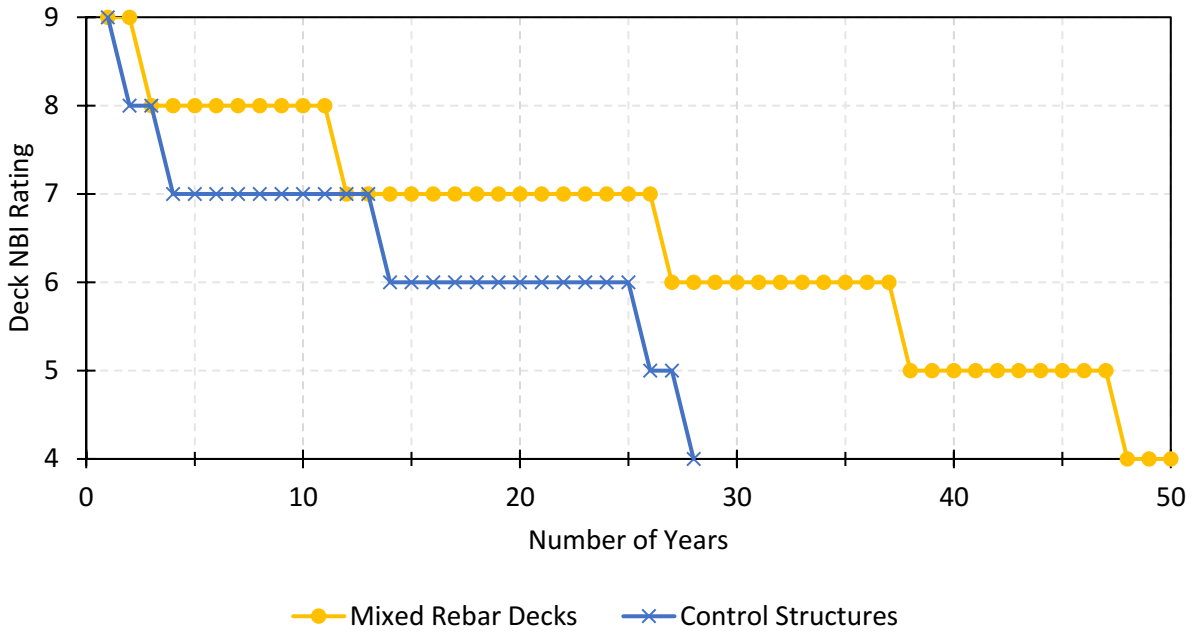


Figure E-1 Number of years at each Deck NBI rating for mixed rebar decks and the control structures for mixed rebar decks

Table E-1 Number of years and deck age at each Deck NBI rating for mixed rebar decks compared to the control structures

Deck NBI Rating	Mixed Rebar Decks			Control Structures			Comparison	
	Average Years at Deck NBI Rating	Average Deck Age at Last Cycle of NBI Rating	Number of Bridges	Average Years at Deck NBI Rating	Average Deck Age at Last Cycle of NBI Rating	Number of Bridges	Difference in Average Years at Deck NBI Rating	Difference in Average Deck Age at Last Cycle of NBI Rating
9	2	3	79	1	2	1	1	1
8	9	15	370	2	41	2	7	-26
7	15	27	543	10	25	4	5	2
6	11	32	175	12	36	5	-1	-4
5	10	32	26	2	49	1	8	-17
4	3	19	2	1	38	2	1	-19

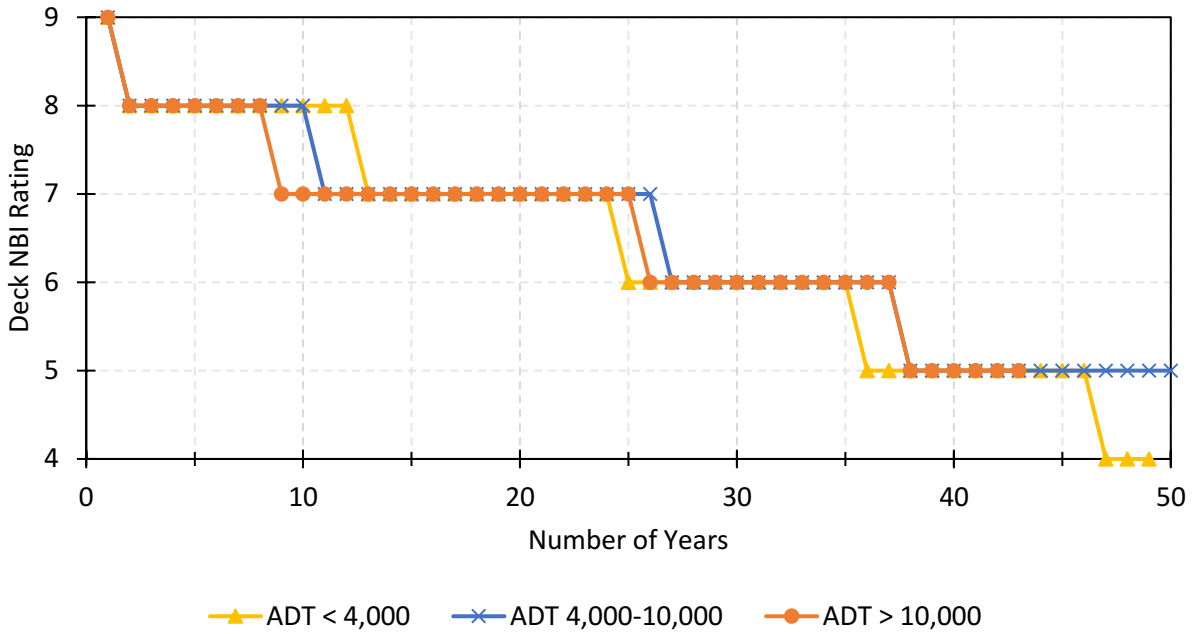


Figure E-2 Number of years at each Deck NBI rating for mixed rebar decks by ADT

Table E-2 Number of years and deck age at each Deck NBI rating for mixed rebar decks with an ADT less than 4,000

Deck NBI Rating	Years at Deck NBI Rating	Deck Age at Last Cycle of NBI Rating	Number of Bridges
9	1	4	22
8	11	17	162
7	12	27	237
6	11	30	70
5	11	30	13
4	3	19	2

Table E-3 Number of years and deck age at each Deck NBI rating for mixed rebar decks with an ADT between 4,000 and 10,000

Deck NBI Rating	Years at Deck NBI Rating	Deck Age at Last Cycle of NBI Rating	Number of Bridges
9	1	3	20
8	9	15	99
7	16	28	141
6	11	32	40
5	13	33	5
4			

Table E-4 Number of years and deck age at each Deck NBI rating for mixed rebar decks with an ADT greater than 10,000

Deck NBI Rating	Years at Deck NBI Rating	Deck Age at Last Cycle of NBI Rating	Number of Bridges
9	1	2	27
8	7	13	102
7	17	28	155
6	12	33	63
5	6	35	8
4			

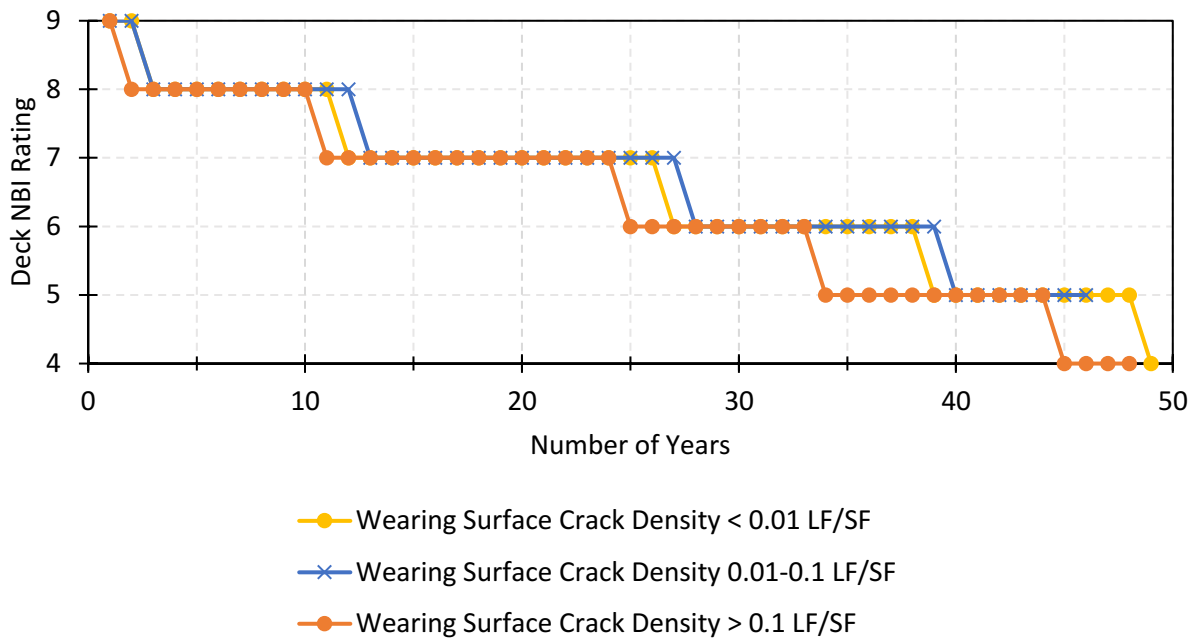


Figure E-3 Number of years at each Deck NBI rating for mixed rebar decks by amount of wearing surface crack density

Table E-5 Number of years and deck age at each Deck NBI rating for mixed rebar decks with a wearing surface crack density less than 0.01 LF/SF

Deck NBI Rating	Years at Deck NBI Rating	Deck Age at Last Cycle of NBI Rating	Number of Bridges
9	2	3	39
8	9	16	149
7	15	28	195
6	12	35	74
5	10	34	12
4	1	18	1

Table E-6 Number of years and deck age at each Deck NBI rating for mixed rebar decks with a wearing surface crack density between 0.01 and 0.1 LF/SF

Deck NBI Rating	Years at Deck NBI Rating	Deck Age at Last Cycle of NBI Rating	Number of Bridges
9	2	2	18
8	10	16	108
7	15	27	150
6	12	31	42
5	7	29	4
4			

Table E-7 Number of years and deck age at each Deck NBI rating for mixed rebar decks with a wearing surface crack density greater than 0.1 LF/SF

Deck NBI Rating	Years at Deck NBI Rating	Deck Age at Last Cycle of NBI Rating	Number of Bridges
9	1	3	21
8	9	14	107
7	14	26	191
6	9	27	56
5	11	31	10
4	4	20	1

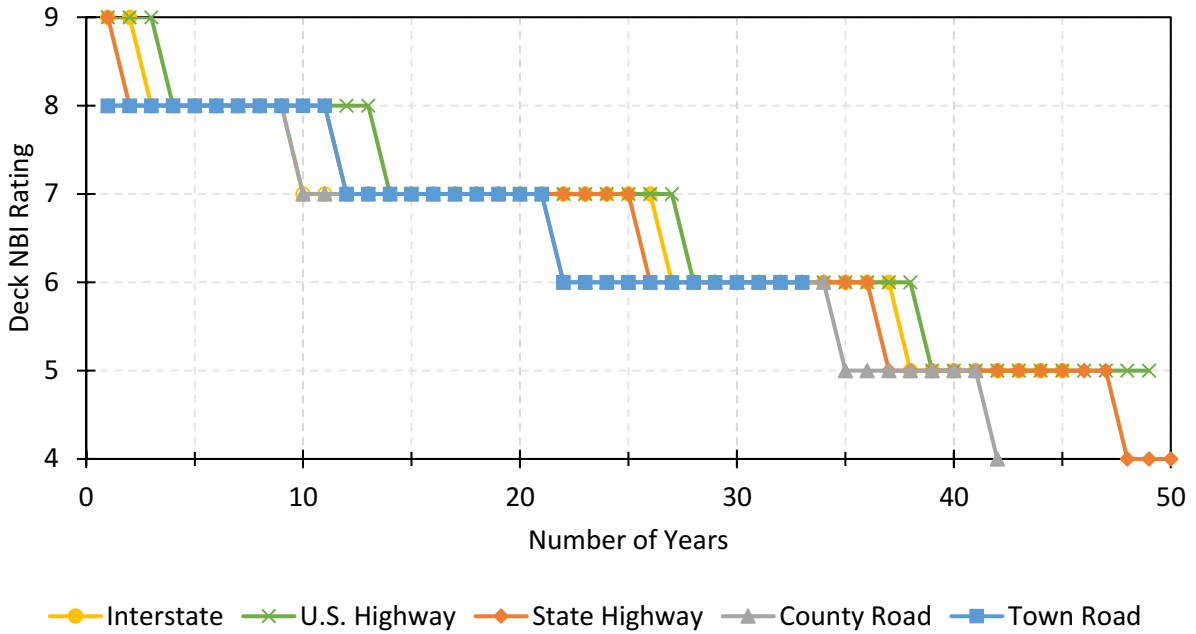


Figure E-4 Number of years at each Deck NBI rating for mixed rebar decks by route type

Table E-8 Number of years and deck age at each Deck NBI rating for mixed rebar decks that carry an Interstate

Deck NBI Rating	Years at Deck NBI Rating	Deck Age at Last Cycle of NBI Rating	Number of Bridges
9	2	3	18
8	7	15	58
7	17	29	130
6	11	36	39
5	8	37	4
4			

Table E-9 Number of years and deck age at each Deck NBI rating for mixed rebar decks that carry a U.S. Highway

Deck NBI Rating	Years at Deck NBI Rating	Deck Age at Last Cycle of NBI Rating	Number of Bridges
9	3	7	10
8	10	16	126
7	14	28	155
6	11	29	47
5	11	31	9
4			

Table E-10 Number of years and deck age at each Deck NBI rating for mixed rebar decks that carry a State Highway

Deck NBI Rating	Years at Deck NBI Rating	Deck Age at Last Cycle of NBI Rating	Number of Bridges
9	1	2	46
8	10	14	165
7	14	26	229
6	11	30	78
5	11	28	8
4	4	20	1

Table E-11 Number of years and deck age at each Deck NBI rating for mixed rebar decks that carry a County Road

Deck NBI Rating	Years at Deck NBI Rating	Deck Age at Last Cycle of NBI Rating	Number of Bridges
9			
8	9	25	16
7	12	27	16
6	13	41	6
5	7	36	5
4	1	18	1

Table E-12 Number of years and deck age at each Deck NBI rating for mixed rebar decks that carry a Town Road

Deck NBI Rating	Years at Deck NBI Rating	Deck Age at Last Cycle of NBI Rating	Number of Bridges
9			
8	11	23	2
7	10	29	3
6	12	45	1
5			
4			

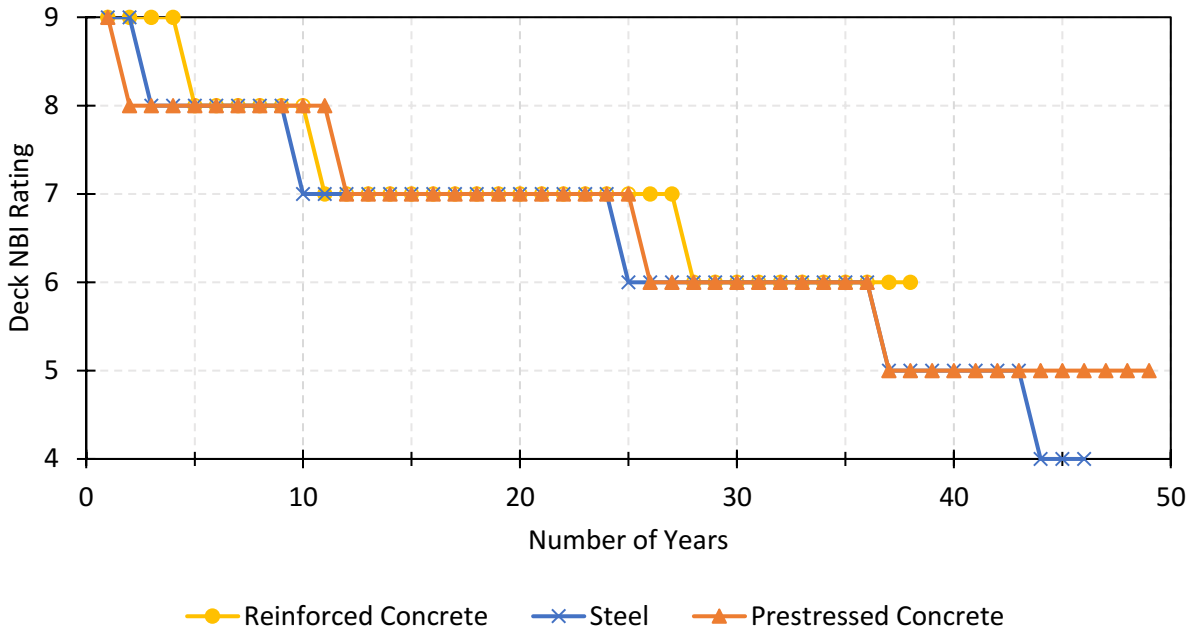


Figure E-5 Number of years at each Deck NBI rating for mixed rebar decks by superstructure type

Table E-13 Number of years and deck age at each Deck NBI rating for mixed rebar decks with a reinforced concrete superstructure

Deck NBI Rating	Years at Deck NBI Rating	Deck Age at Last Cycle of NBI Rating	Number of Bridges
9	4	5	6
8	6	10	18
7	17	26	32
6	11	27	7
5			
4			

Table E-14 Number of years and deck age at each Deck NBI rating for mixed rebar decks with a steel superstructure

Deck NBI Rating	Years at Deck NBI Rating	Deck Age at Last Cycle of NBI Rating	Number of Bridges
9	2	3	33
8	7	14	114
7	15	26	209
6	12	32	90
5	7	31	14
4	3	19	2

Table E-15 Number of years and deck age at each Deck NBI rating for mixed rebar decks with a prestressed concrete superstructure

Deck NBI Rating	Years at Deck NBI Rating	Deck Age at Last Cycle of NBI Rating	Number of Bridges
9	1	3	40
8	10	17	238
7	14	28	302
6	11	32	78
5	13	33	12
4			

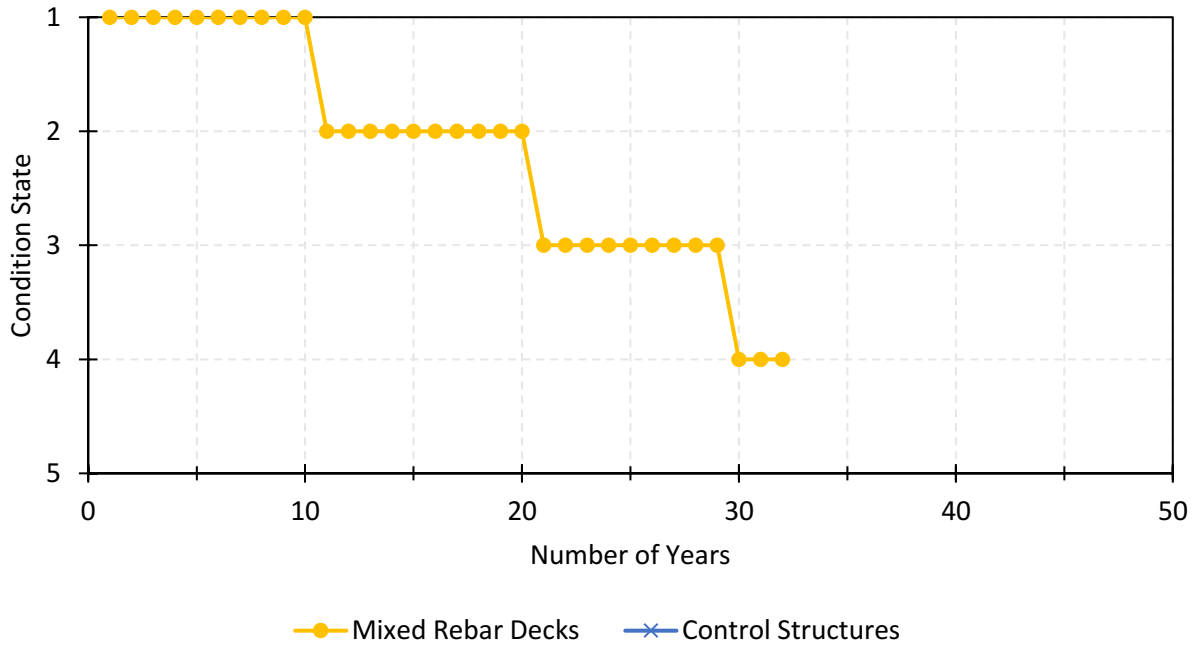


Figure E-6 Number of years at each CoRe Element #12 (underside of reinforced concrete deck) condition state for mixed rebar decks and the control structures for mixed rebar decks

Table E-16 Number of years and deck age at each CoRe Element #12 (underside of reinforced concrete deck) condition state for mixed rebar decks

CoRe Element 12 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	10	31	28
2	10	35	16
3	9	35	1
4	9	36	2
5			

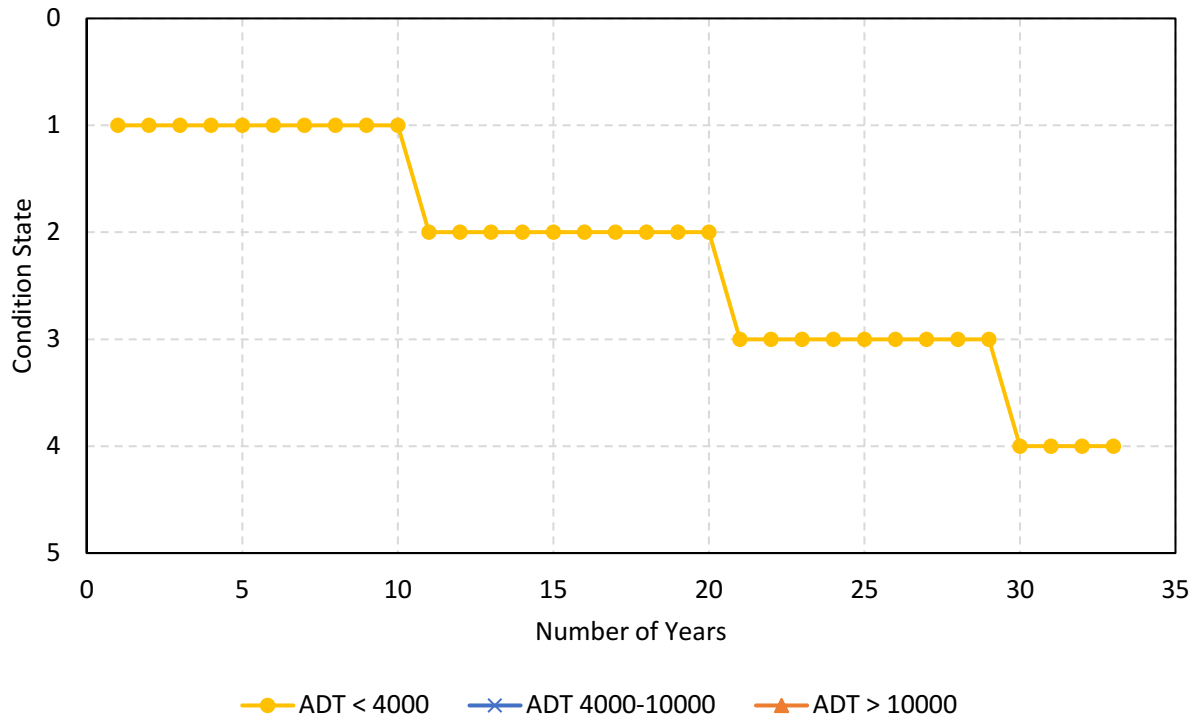


Figure E-7 Number of years at each CoRe Element #12 (underside of reinforced concrete deck) condition state for mixed rebar decks by ADT

Table E-17 Number of years and deck age at each CoRe Element #12 condition state for mixed rebar decks with an ADT less than 4,000

CoRe Element 12 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	10	31	28
2	10	35	16
3	9	35	1
4	9	36	2
5			

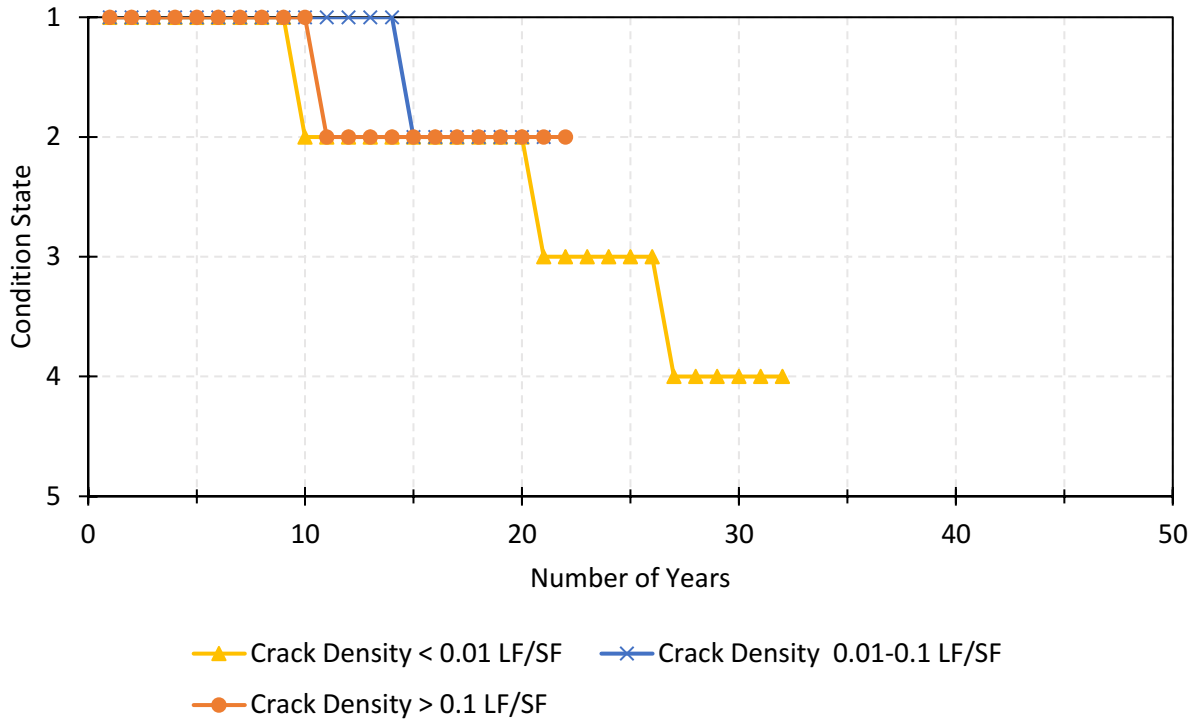


Figure E-8 Number of years at each CoRe Element #12 (underside of reinforced concrete deck) condition state for mixed rebar decks by wearing surface crack density

Table E-18 Number of years and deck age at each CoRe Element #12 (underside of reinforced concrete deck) condition state for mixed rebar decks with a wearing surface crack density less than 0.01 LF/SF

CoRe Element 12 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	9	32	17
2	11	39	7
3	6	29	2
4	9	36	2
5			

Table E-19 Number of years and deck age at each CoRe Element #12 (underside of reinforced concrete deck) condition state for mixed rebar decks with a wearing surface crack density between 0.01 and 0.1 LF/SF

CoRe Element 12 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	14	30	5
2	7	30	3
3			
4			
5			

Table E-20 Number of years and deck age at each CoRe Element #12 (underside of reinforced concrete deck) condition state for mixed rebar decks with a wearing surface crack density greater than 0.1 LF/SF

CoRe Element 12 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	10	28	8
2	12	35	5
3			
4			
5			

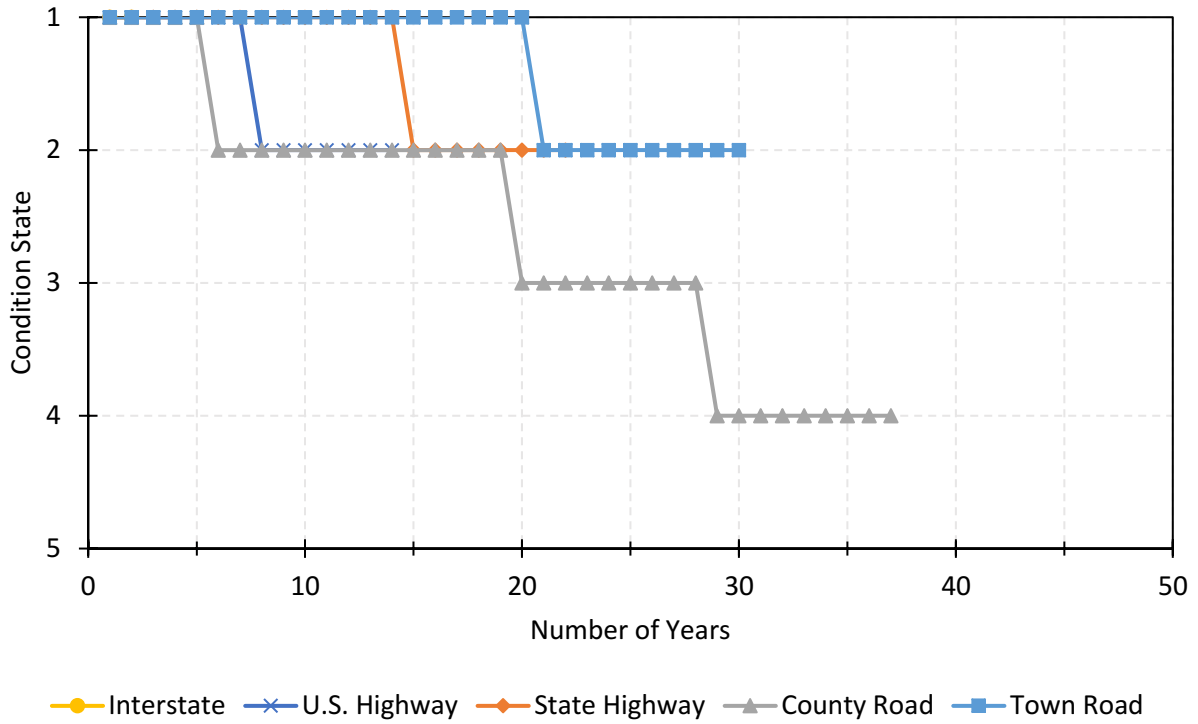


Figure E-9 Number of years at each CoRe Element #12 (underside of reinforced concrete deck) condition state for mixed rebar decks by route type

Table E-21 Number of years and deck age at each CoRe Element #12 (underside of reinforced concrete deck) condition state for mixed rebar decks that carry a U.S. Highway

CoRe Element 12 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	7	20	1
2	7	29	2
3			
4			
5			

Table E-22 Number of years and deck age at each CoRe Element #12 (underside of reinforced concrete deck) condition state for mixed rebar decks that carry a State Highway

CoRe Element 12 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	14	30	14
2	8	31	7
3			
4			
5			

Table E-23 Number of years and deck age at each CoRe Element #12 (underside of reinforced concrete deck) condition state for mixed rebar decks that carry a County Road

CoRe Element 12 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	5	31	12
2	14	41	6
3	9	35	1
4	9	36	2
5			

Table E-24 Number of years and deck age at each CoRe Element #12 (underside of reinforced concrete deck) condition state for mixed rebar decks that carry a Town Road

CoRe Element 12 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	20	40	1
2	10	41	1
3			
4			
5			

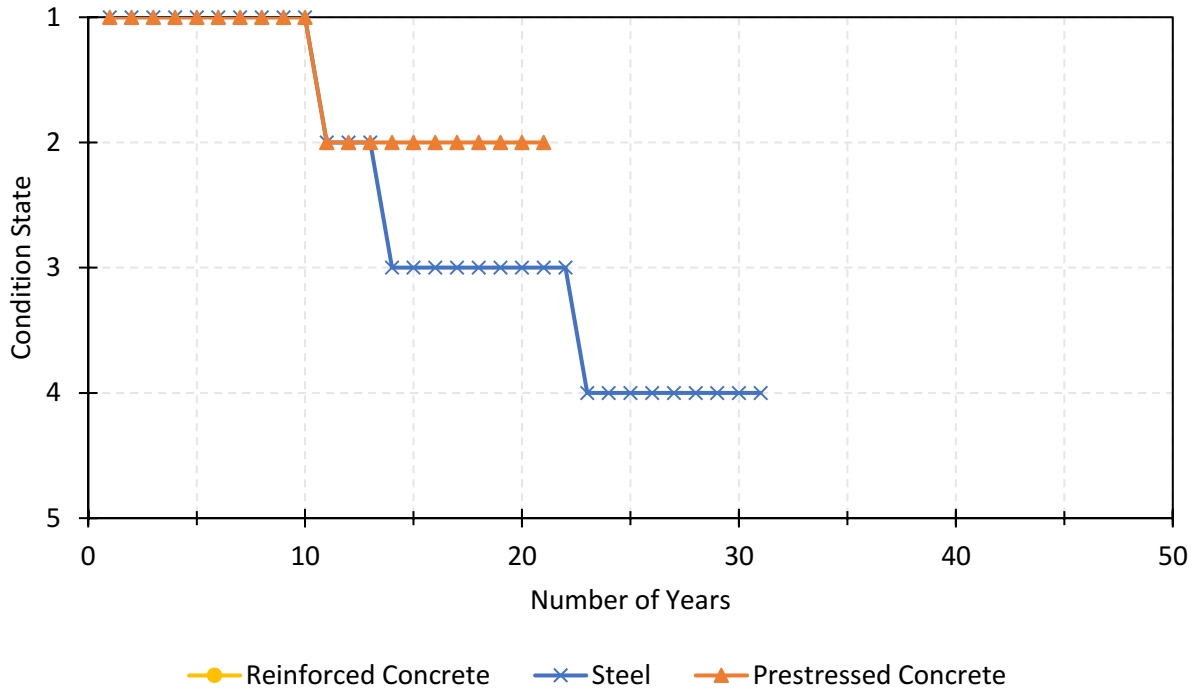


Figure E-10 Number of years at each CoRe Element #12 (underside of reinforced concrete deck) condition state for mixed rebar decks by superstructure type

Table E-25 Number of years and deck age at each CoRe Element #12 (underside of reinforced concrete deck) condition state for mixed rebar decks with a steel superstructure

CoRe Element 12 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	10	33	11
2	3	30	2
3	9	35	1
4	9	36	2
5			

Table E-26 Number of years and deck age at each CoRe Element #12 (underside of reinforced concrete deck) condition state for mixed rebar decks with a prestressed concrete superstructure

CoRe Element 12 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	10	29	17
2	11	36	14
3			
4			
5			

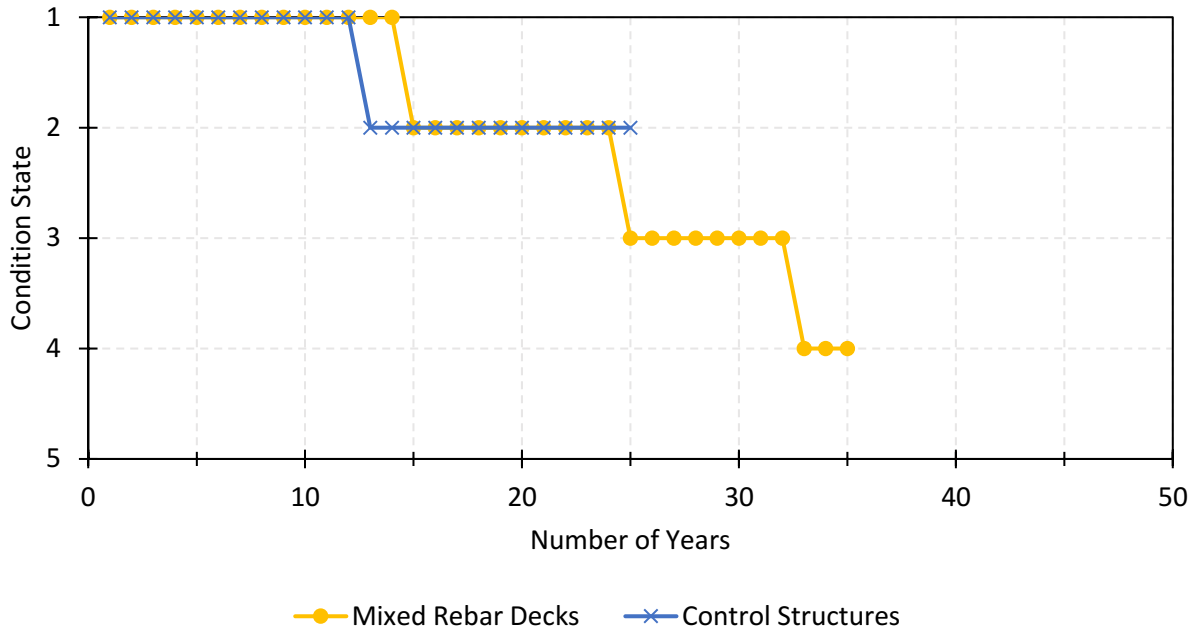


Figure E-11 Number of years at each Element #26 (top of deck with epoxy rebar and no overlay) condition state for mixed rebar decks and the control structures for mixed rebar decks

Table E-27 Number of years and deck age at each Element #26 (top of deck with epoxy rebar and no overlay) condition state for mixed rebar decks

Element 26 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	14	25	131
2	10	31	59
3	8	29	1
4	3	21	1
5			

Table E-28 Number of years and deck age at each Element #26 (top of deck with epoxy rebar and no overlay) condition state for control structures for mixed rebar decks

Element 26 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	12	28	10
2	13	27	4
3			
4			
5			

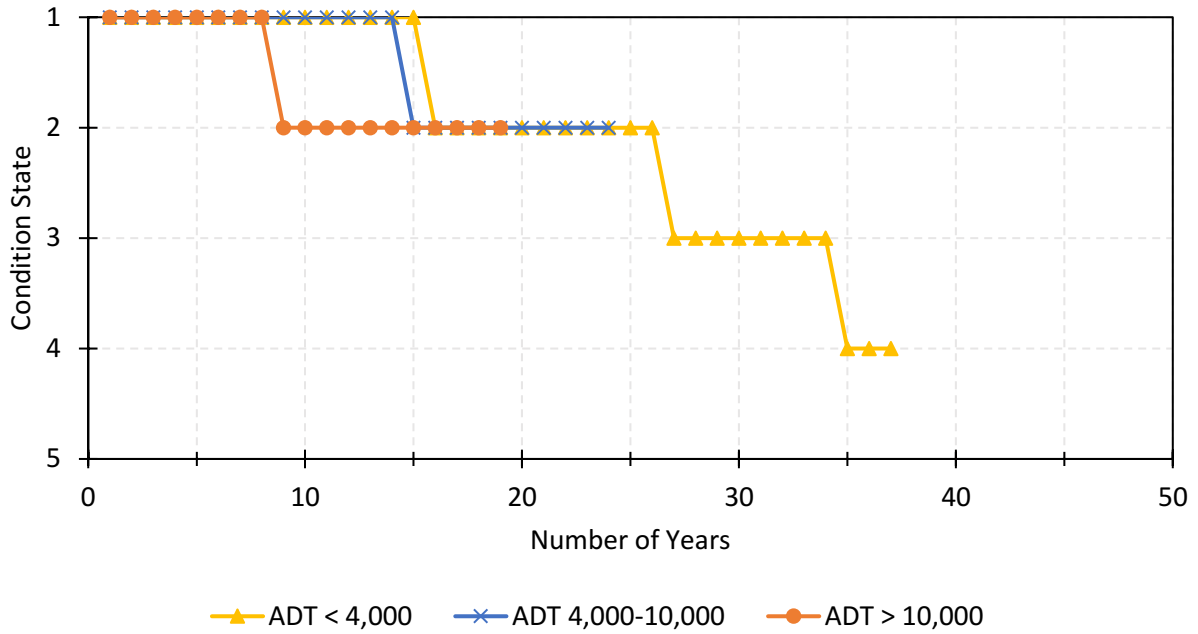


Figure E-12 Number of years at each Element #26 (top of deck with epoxy rebar and no overlay) condition state for mixed rebar decks by ADT

Table E-29 Number of years and deck age at each Element #26 (top of deck with epoxy rebar and no overlay) condition state for mixed rebar decks with an ADT less than 4,000

Element 26 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	15	26	94
2	11	31	34
3	8	29	1
4	3	21	1
5			

Table E-30 Number of years and deck age at each Element #26 (top of deck with epoxy rebar and no overlay) condition state for mixed rebar decks with an ADT between 4,000 and 10,000

Element 26 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	14	24	32
2	10	30	22
3			
4			
5			

Table E-31 Number of years and deck age at each Element #26 (top of deck with epoxy rebar and no overlay) condition state for mixed rebar decks with an ADT greater than 10,000

Element 26 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	8	15	5
2	11	32	3
3			
4			
5			

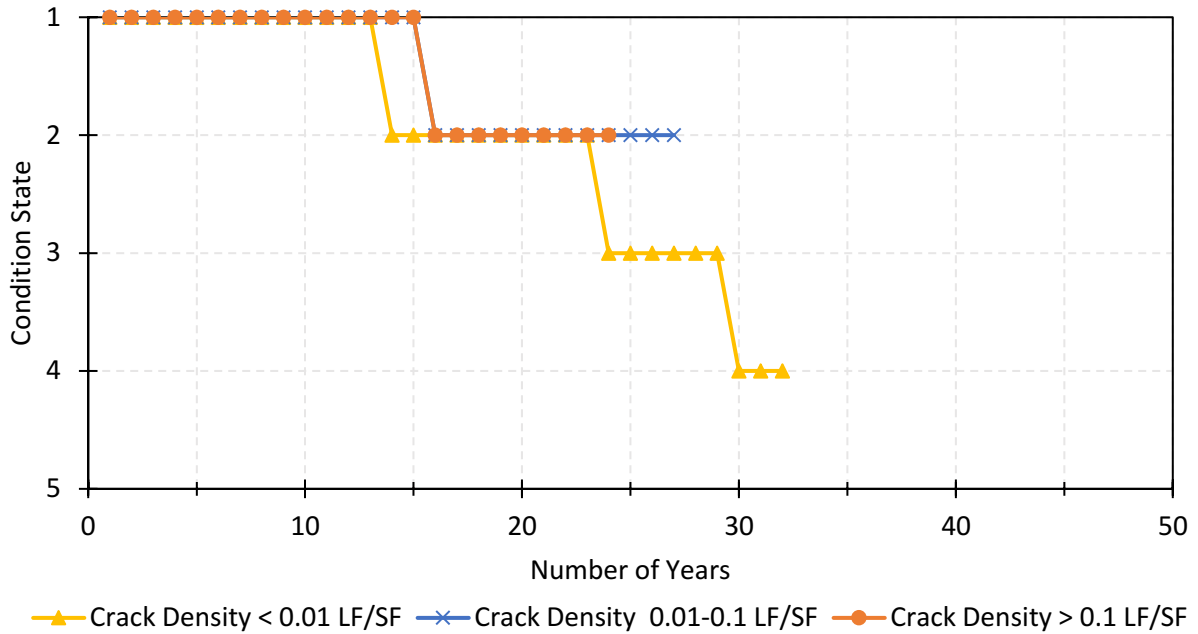


Figure E-13 Number of years at each Element #26 (top of deck with epoxy rebar and no overlay) condition state for mixed rebar decks by wearing surface crack density

Table E-32 Number of years and deck age at each Element #26 (top of deck with epoxy rebar and no overlay) condition state for mixed rebar decks with a wearing surface crack density less than 0.01 LF/SF

Element 26 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	13	23	39
2	10	30	26
3	6	26	2
4	3	21	1
5			

Table E-33 Number of years and deck age at each Element #26 (top of deck with epoxy rebar and no overlay) condition state for mixed rebar decks with a wearing surface crack density between 0.01 and 0.1 LF/SF

Element 26 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	15	26	48
2	12	34	15
3			
4			
5			

Table E-34 Number of years and deck age at each Element #26 (top of deck with epoxy rebar and no overlay) condition state for mixed rebar decks with a wearing surface crack density greater than 0.1 LF/SF

Element 26 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	15	26	41
2	9	29	16
3			
4			
5			

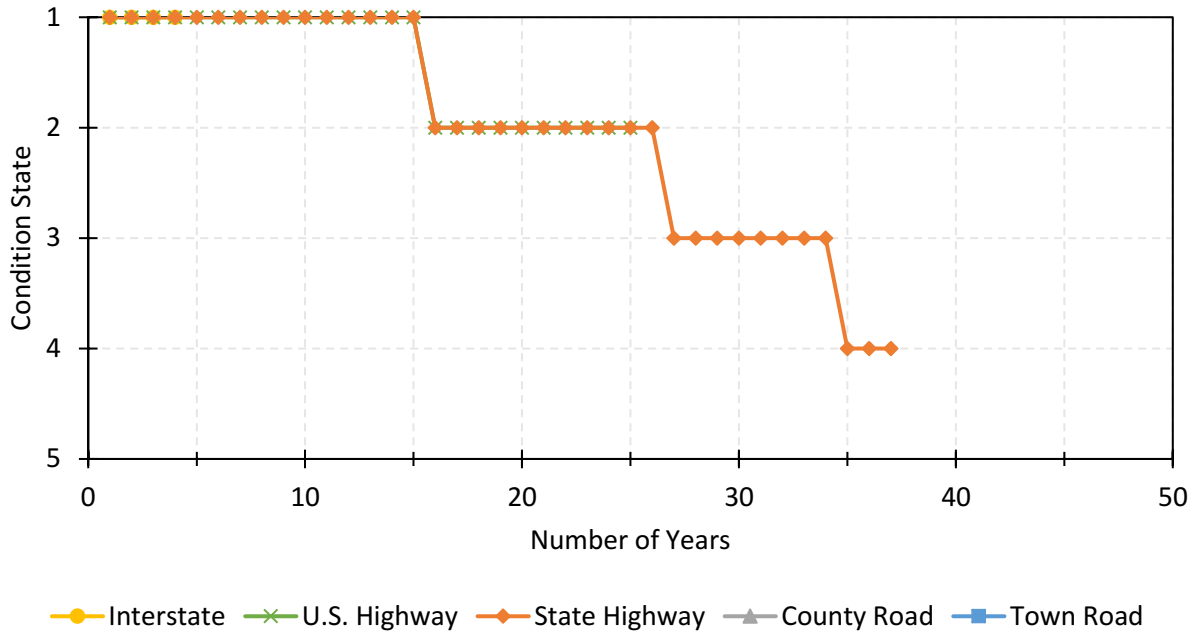


Figure E-14 Number of years at each Element #26 (top of deck with epoxy rebar and no overlay) condition state for mixed rebar decks by route type

Table E-35 Number of years and deck age at each Element #26 (top of deck with epoxy rebar and no overlay) condition state for mixed rebar decks that carry an Interstate

Element 26 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	4	13	6
2			
3			
4			

Table E-36 Number of years and deck age at each Element #26 (top of deck with epoxy rebar and no overlay) condition state for mixed rebar decks that carry a U.S. Highway

Element 26 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	15	25	50
2	10	31	31
3			
4			

Table E-37 Number of years and deck age at each Element #26 (top of deck with epoxy rebar and no overlay) condition state for mixed rebar decks that carry a State Highway

Element 26 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	15	25	75
2	11	31	28
3	8	29	1
4	3	21	1
5			

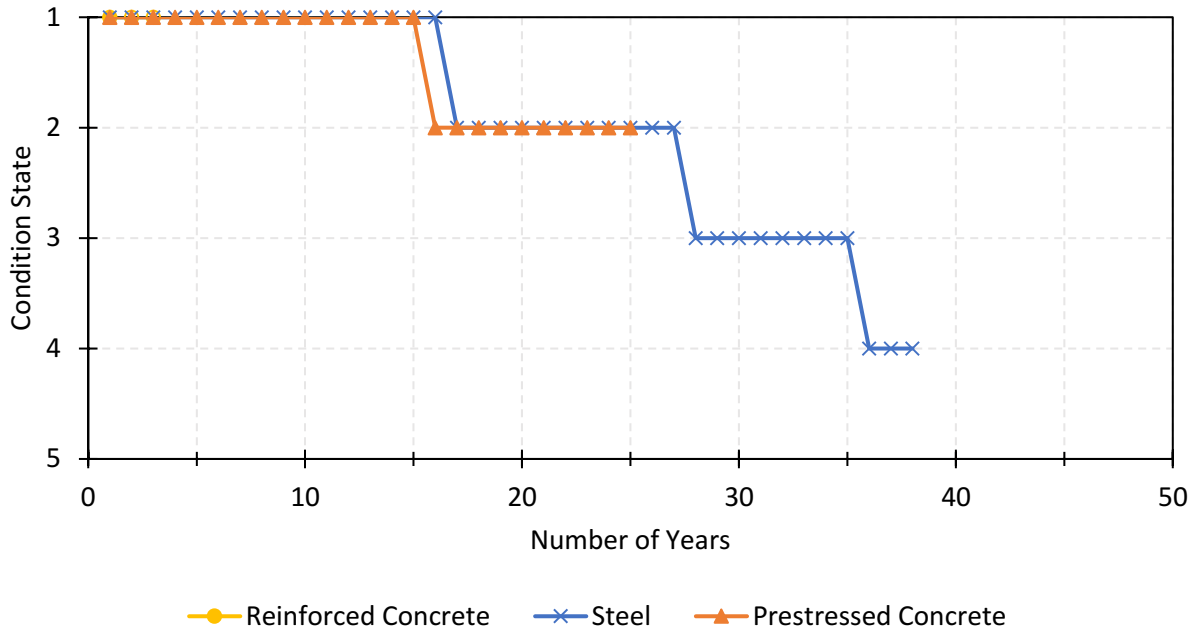


Figure E-15 Number of years at each Element #26 (top of deck with epoxy rebar and no overlay) condition state for mixed rebar decks by superstructure type

Table E-38 Number of years and deck age at each Element #26 (top of deck with epoxy rebar and no overlay) condition state for mixed rebar decks with a reinforced concrete superstructure

Element 26 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	3	11	5
2			
3			
4			
5			

Table E-39 Number of years and deck age at each Element #26 (top of deck with epoxy rebar and no overlay) condition state for mixed rebar decks with a steel superstructure

Element 26 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	16	27	39
2	11	33	14
3	8	29	1
4	3	21	1
5			

Table E-40 Number of years and deck age at each Element #26 (top of deck with epoxy rebar and no overlay) condition state for mixed rebar decks with a prestressed concrete superstructure

Element 26 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	15	25	87
2	10	30	45
3			
4			
5			

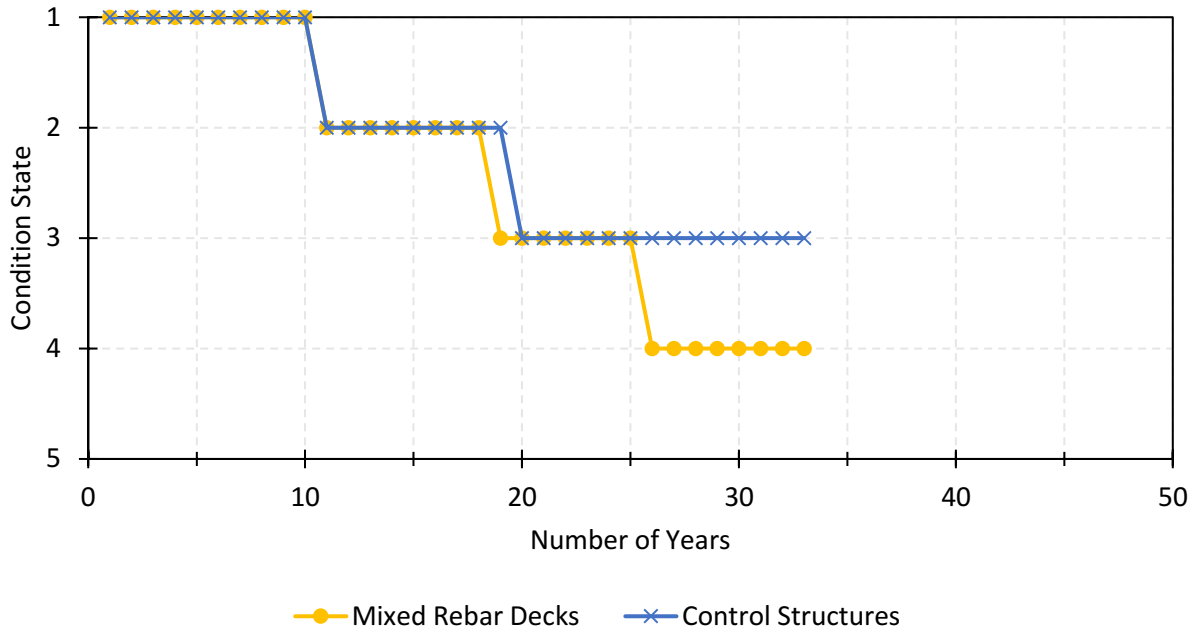


Figure E-16 Number of years at each Element #358 (cracking on the top of deck) condition state for mixed rebar decks and the control structures for mixed rebar decks

Table E-41 Number of years and deck age at each Element #358 (cracking on the top of deck) condition state for mixed rebar decks

Element 358 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	10	28	398
2	8	29	292
3	7	27	65
4	8	29	2
5			

Table E-42 Number of years and deck age at each Element #358 (cracking on the top of deck) condition state for the control structures for mixed rebar decks

Element 358 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	10	23	28
2	9	25	21
3	14	19	1
4			
5			

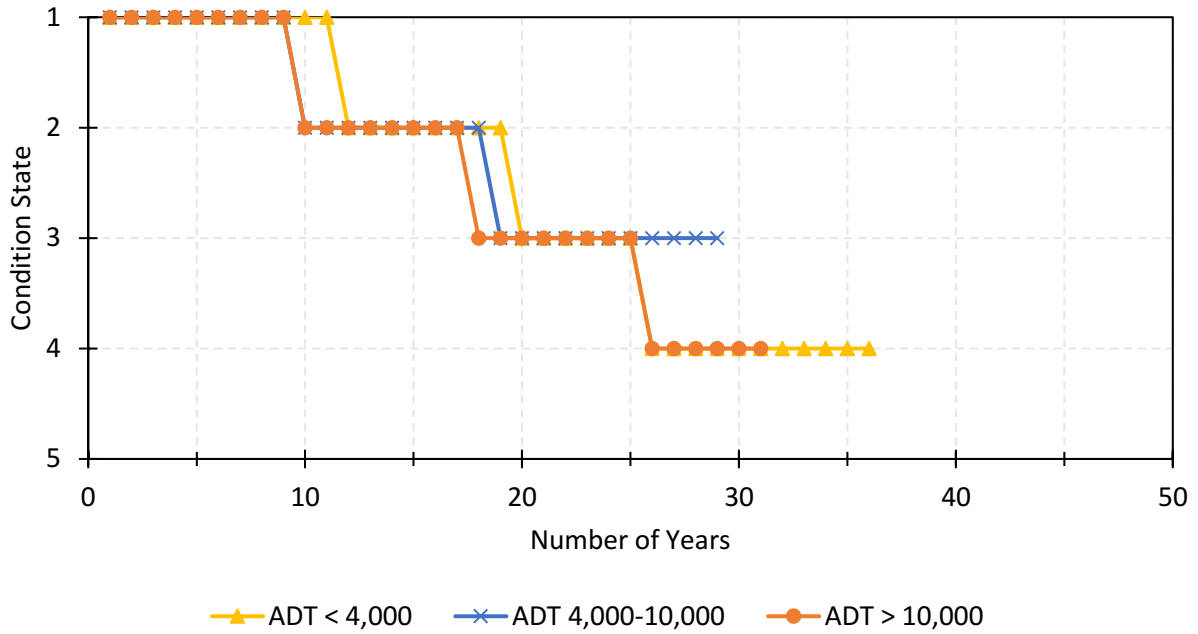


Figure E-17 Number of years at each Element #358 (cracking on the top of deck) condition state for mixed rebar decks by ADT

Table E-43 Number of years and deck age at each Element #358 (cracking on the top of deck) condition state for mixed rebar decks with an ADT less than 4,000

Element 358 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	11	29	181
2	8	28	115
3	6	24	30
4	11	24	1
5			

Table E-44 Number of years and deck age at each Element #358 (cracking on the top of deck) condition state for mixed rebar decks with an ADT between 4,000 and 10,000

Element 358 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	9	27	99
2	9	29	83
3	11	28	8
4			
5			

Table E-45 Number of years and deck age at each Element #358 (cracking on the top of deck) condition state for mixed rebar decks with an ADT greater than 10,000

Element 358 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	9	27	118
2	8	30	94
3	8	30	27
4	6	33	1
5			

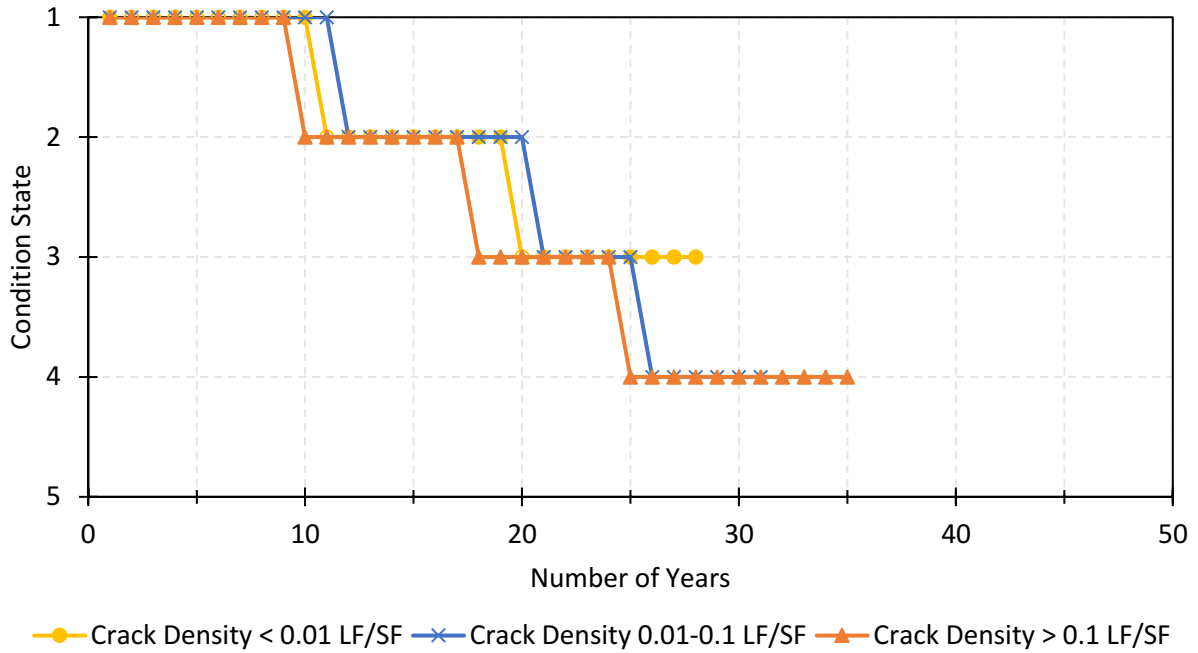


Figure E-18 Number of years at each Element #358 (cracking on the top of deck) condition state for mixed rebar decks by wearing surface crack density

Table E-46 Number of years and deck age at each Element #358 (cracking on the top of deck) condition state for mixed rebar decks with a wearing surface crack density less than 0.01 LF/SF

Element 358 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	10	30	148
2	9	31	100
3	9	29	26
4			
5			

Table E-47 Number of years and deck age at each Element #358 (cracking on the top of deck) condition state for mixed rebar decks with a wearing surface crack density between 0.01 and 0.1 LF/SF

Element 358 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	11	28	117
2	9	29	81
3	5	25	11
4	6	33	1
5			

Table E-48 Number of years and deck age at each Element #358 (cracking on the top of deck) condition state for mixed rebar decks with a wearing surface crack density greater than 0.1 LF/SF

Element 358 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	9	26	129
2	8	27	108
3	7	25	27
4	11	24	1
5			

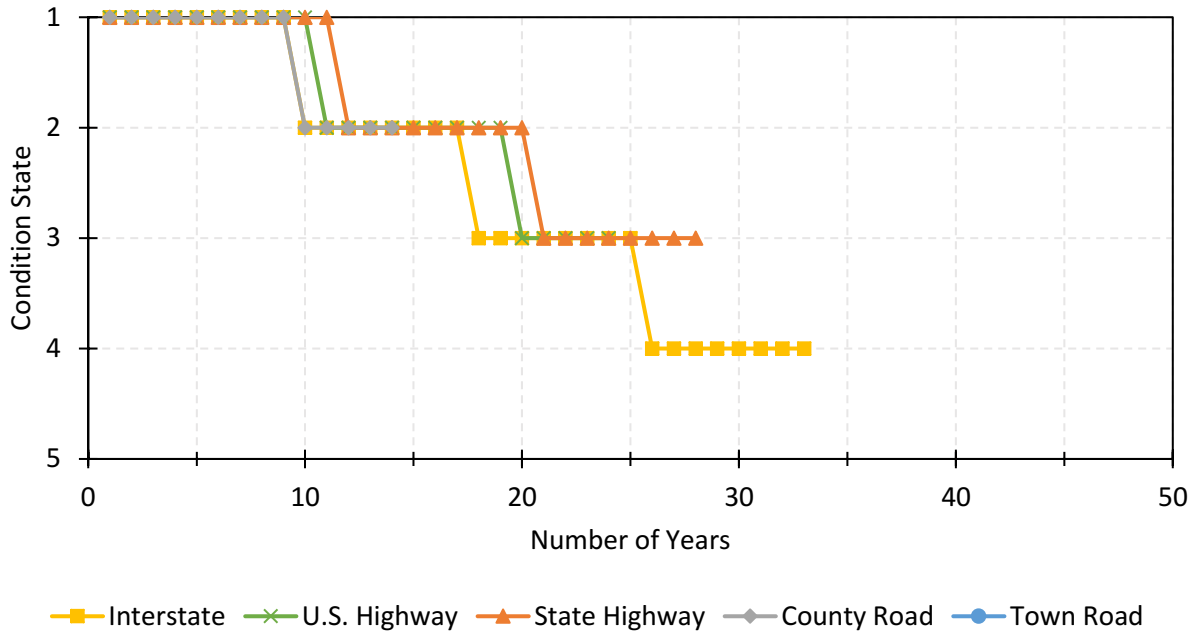


Figure E-19 Number of years at each Element #358 (cracking on the top of deck) condition state for mixed rebar decks by route type

Table E-49 Number of years and deck age at each Element #358 (cracking on the top of deck) condition state for mixed rebar decks that carry an Interstate

Element 358 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	9	28	99
2	8	30	90
3	8	26	15
4	8	29	2
5			

Table E-50 Number of years and deck age at each Element #358 (cracking on the top of deck) condition state for mixed rebar decks that carry a U.S. Highway

Element 358 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	10	30	129
2	9	30	81
3	5	25	11
4			
5			

Table E-51 Number of years and deck age at each Element #358 (cracking on the top of deck) condition state for mixed rebar decks that carry a State Highway

Element 358 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	11	26	153
2	9	27	106
3	8	27	36
4			
5			

Table E-52 Number of years and deck age at each Element #358 (cracking on the top of deck) condition state for mixed rebar decks that carry a County Road

Element 358 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	9	41	9
2	5	43	5
3			
4			
5			

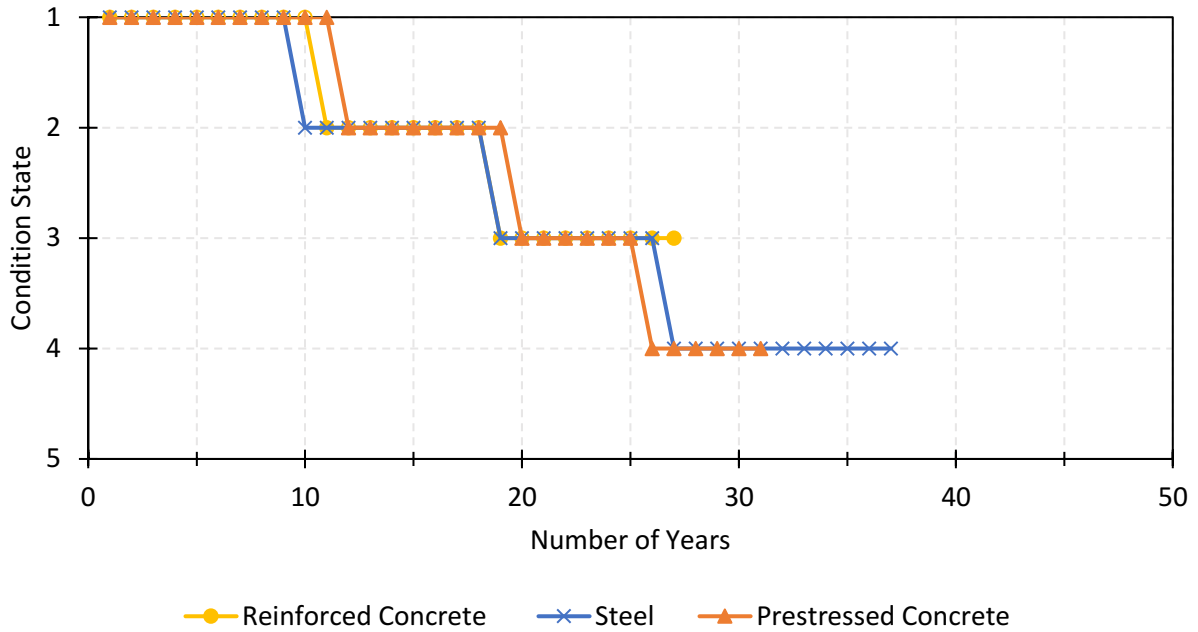


Figure E-20 Number of years at each Element #358 (cracking on the top of deck) condition state for mixed rebar decks by superstructure type

Table E-53 Number of years and deck age at each Element #358 (cracking on the top of deck) condition state for mixed rebar decks with a reinforced concrete superstructure

Element 358 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	10	24	20
2	8	27	19
3	9	20	5
4			
5			

Table E-54 Number of years and deck age at each Element #358 (cracking on the top of deck) condition state for mixed rebar decks with a steel superstructure

Element 358 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	9	27	147
2	9	30	143
3	8	28	39
4	11	24	1
5			

Table E-55: Number of years and deck age at each Element #358 (cracking on the top of deck) condition state for mixed rebar decks with a prestressed concrete superstructure

Element 358 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	11	29	231
2	8	29	130
3	6	27	21
4	6	33	1
5			

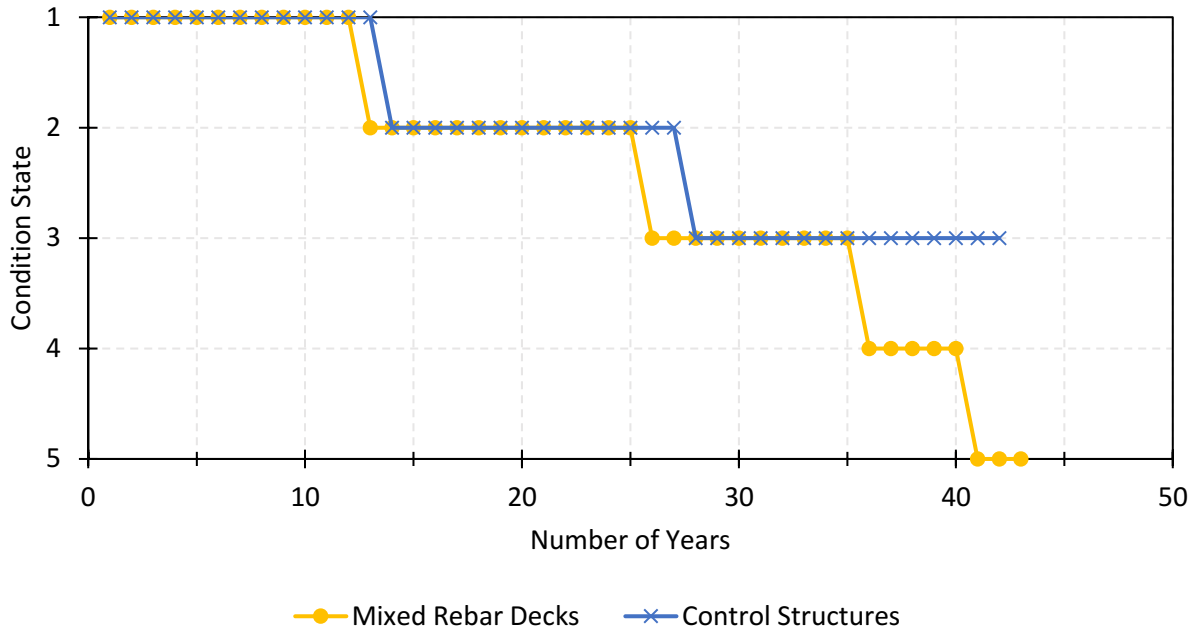


Figure E-21 Number of years at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks and the control structures for mixed rebar decks

Table E-56 Number of years and deck age at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks

Element 359 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	12	30	238
2	13	30	304
3	10	29	80
4	5	26	14
5	3	23	1

Table E-57 Number of years and deck age at each Element #359 (cracking on the underside of deck) condition state for the control structures for mixed rebar decks

Element 359 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	13	24	19
2	14	28	19
3	15	28	2
4			
5			

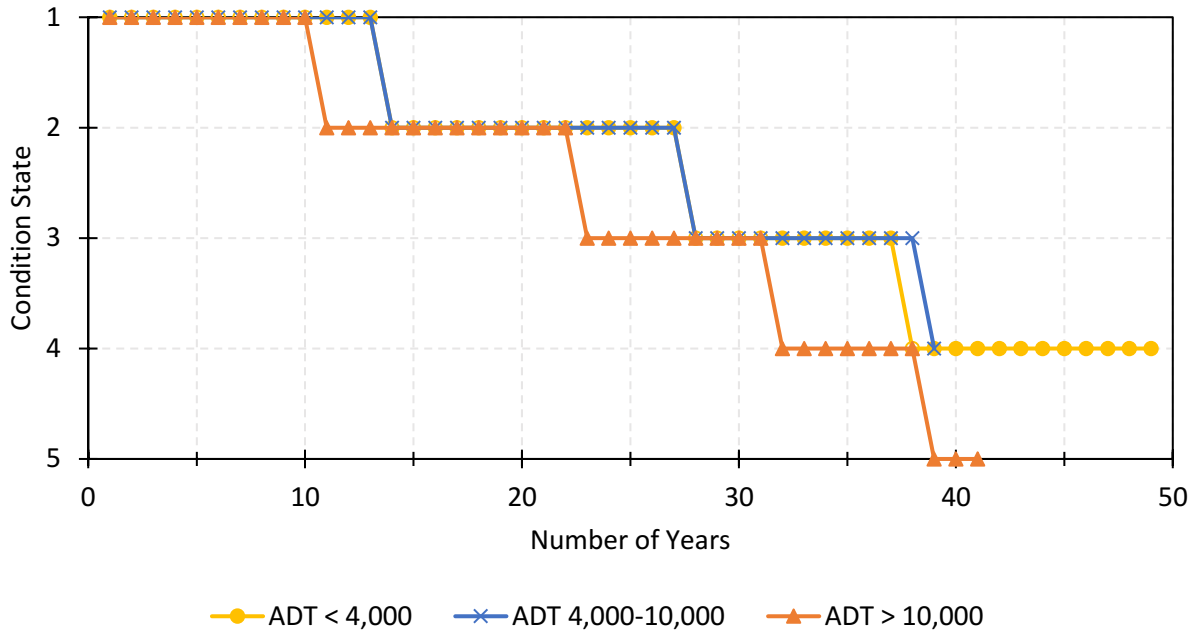


Figure E-22 Number of years at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks by ADT

Table E-58 Number of years and deck age at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks with an ADT less than 4,000

Element 359 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	13	31	118
2	14	31	117
3	10	25	17
4	12	30	3
5			

Table E-59 Number of years and deck age at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks with an ADT between 4,000 and 10,000

Element 359 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	13	30	57
2	14	30	81
3	11	29	18
4	1	20	7
5			

Table E-60 Number of years and deck age at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks with an ADT greater than 10,000

Element 359 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	10	28	63
2	12	29	106
3	9	31	45
4	7	34	4
5	3	23	1

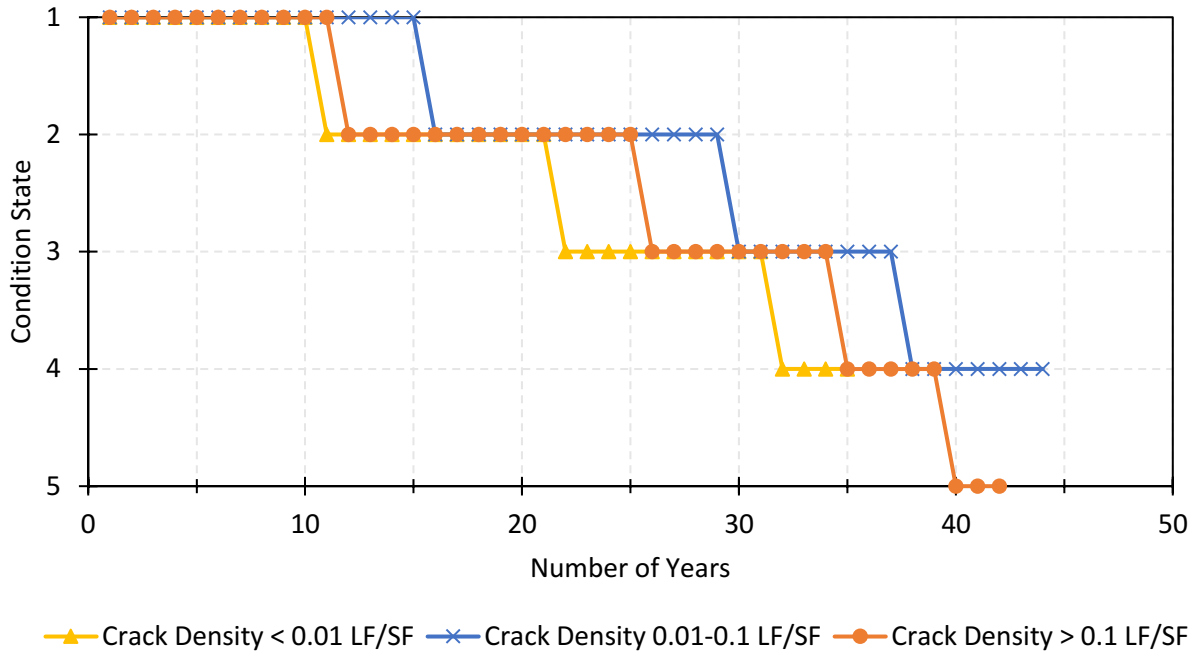


Figure E-23 Number of years at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks by wearing surface crack density

Table E-61 Number of years and deck age at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks with a wearing surface crack density less than 0.01 LF/SF

Element 359 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	10	31	103
2	11	29	115
3	10	30	37
4	4	28	5
5			

Table E-62 Number of years and deck age at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks with a wearing surface crack density between 0.01 and 0.1 LF/SF

Element 359 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	15	30	79
2	14	32	74
3	8	31	13
4	7	34	2
5			

Table E-63 Number of years and deck age at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks with a wearing surface crack density greater than 0.1 LF/SF

Element 359 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	11	28	54
2	14	30	112
3	9	26	31
4	5	22	7
5	3	23	1

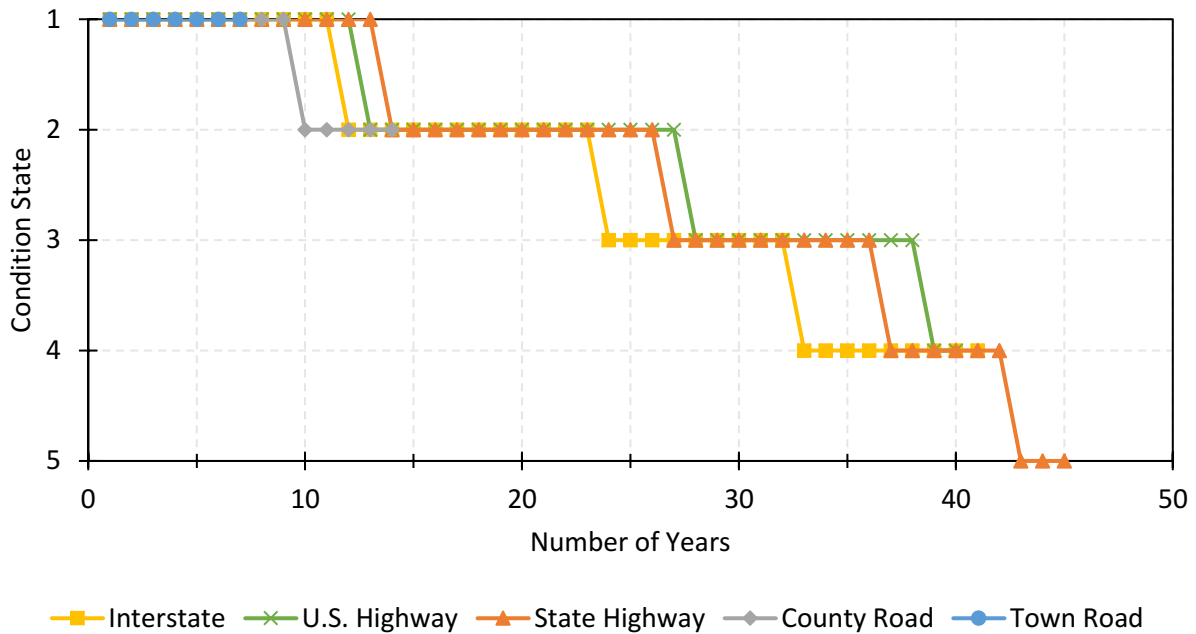


Figure E-24 Number of years at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks by route type

Table E-64 Number of years and deck age at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks that carry an Interstate

Element 359 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	11	29	59
2	12	29	78
3	9	30	23
4	9	30	3
5			

Table E-65 Number of years and deck age at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks that carry a U.S. Highway

Element 359 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	12	30	62
2	15	32	91
3	11	31	12
4	2	18	5
5			

Table E-66 Number of years and deck age at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks that carry a State Highway

Element 359 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	13	29	101
2	13	29	122
3	10	28	39
4	6	30	6
5	3	23	1

Table E-67 Number of years and deck age at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks that carry a County Road

Element 359 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	9	42	13
2	5	41	4
3			
4			
5			

Table E-68 Number of years and deck age at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks that carry a Town Road

Element 359 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	7	43	2
2			
3			
4			
5			

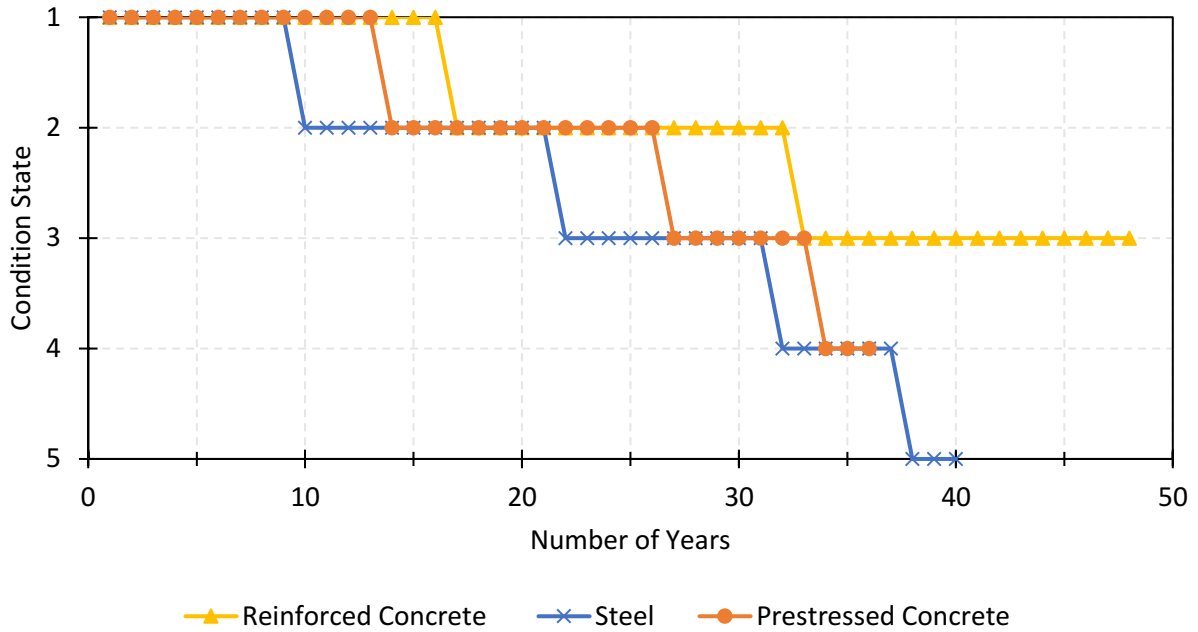


Figure E-25 Number of years at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks by superstructure type

Table E-69 Number of years and deck age at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks with a reinforced concrete superstructure

Element 359 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	16	30	5
2	16	28	18
3	16	32	2
4			
5			

Table E-70 Number of years and deck age at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks with a steel superstructure

Element 359 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	9	29	54
2	12	29	151
3	10	29	68
4	6	29	10
5	3	23	1

Table E-71 Number of years and deck age at each Element #359 (cracking on the underside of deck) condition state for mixed rebar decks with a prestressed concrete superstructure

Element 359 Condition State	Years at Condition State	Deck Age at Last Cycle of Condition State	Number of Bridges
1	13	30	179
2	13	32	135
3	7	30	10
4	3	19	4
5			

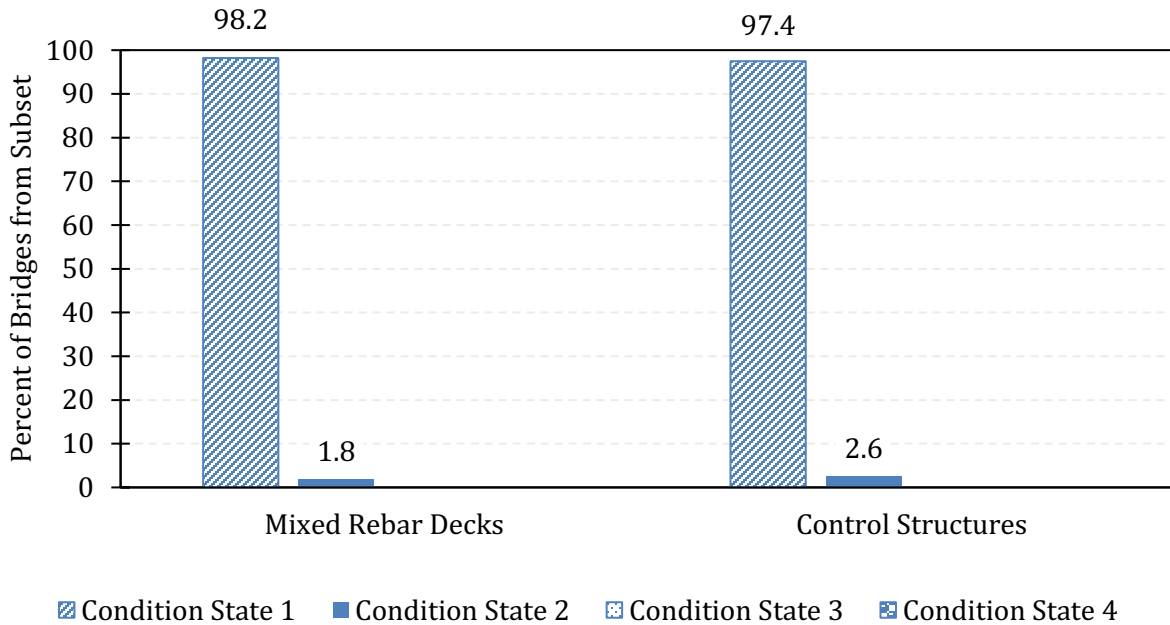


Figure E-26 Most recent Element #510 (deck wearing surface) condition states for mixed rebar decks and the control structures for mixed rebar decks

Table E-72 Number of bridges and percent of bridges at each Element #510 (deck wearing surface) condition state for mixed rebar decks

Element 510 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	490	98.2
2	9	1.8
3	0	0
4	0	0

Table E-73 Number of bridges and percent of bridges at each Element #510 (deck wearing surface) condition state for the control structures for mixed rebar decks

Element 510 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	38	97.4
2	1	2.6
3	0	0
4	0	0

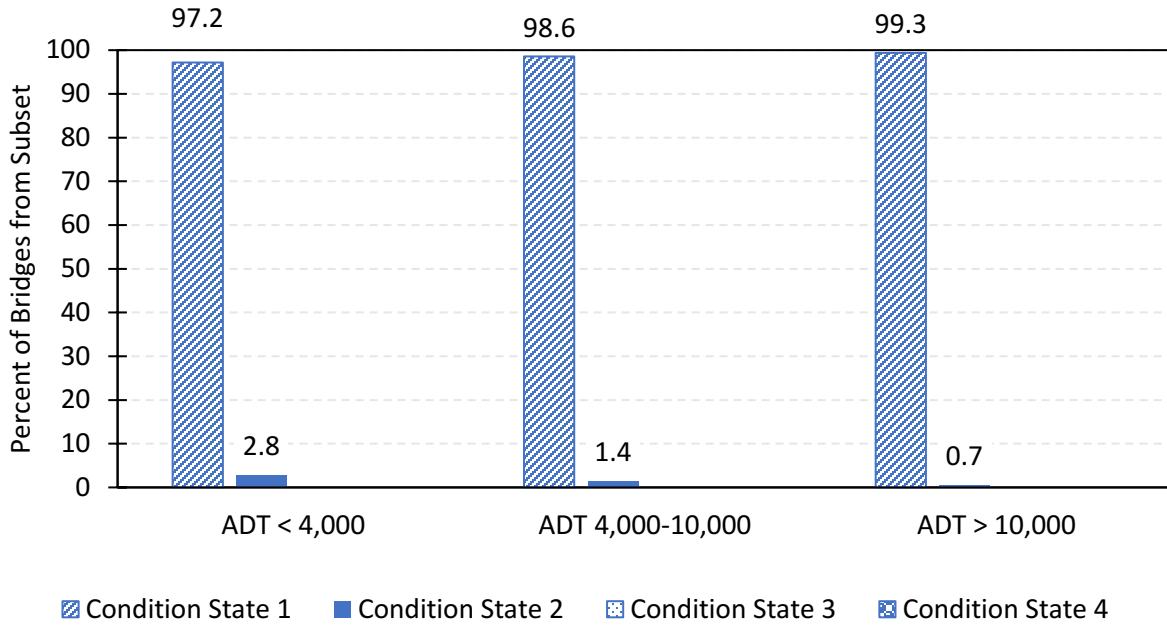


Figure E-27 Most recent Element #510 condition states for mixed rebar decks by ADT

Table E-74 Number of bridges and percent of bridges at each Element #510 (deck wearing surface) condition state for mixed rebar decks with an ADT less than 4,000

Element 510 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	205	97.2
2	6	2.8
3	0	0
4	0	0

Table E-75 Number of bridges and percent of bridges at each Element #510 (deck wearing surface) condition state for mixed rebar decks with an ADT between 4,000 and 10,000

Element 510 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	136	99
2	2	1
3	0	0
4	0	0

Table E-76 Number of bridges and percent of bridges at each Element #510 (deck wearing surface) condition state for mixed rebar decks with an ADT greater than 10,000

Element 510 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	149	99
2	1	1
3	0	0
4	0	0

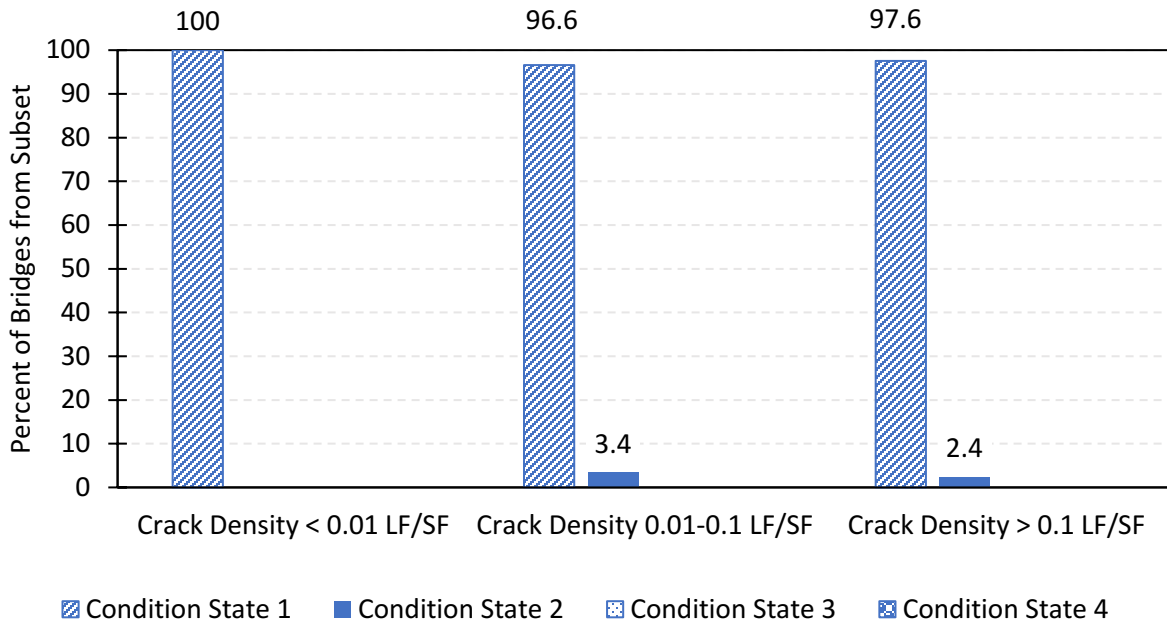


Figure E-28 Most recent Element #510 (deck wearing surface) condition states for mixed rebar decks by wearing surface crack density

Table E-77 Number of bridges and percent of bridges at each Element #510 (deck wearing surface) condition state for mixed rebar decks with a wearing surface crack density less than 0.01 LF/SF

Element 510 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	181	100
2	0	0
3	0	0
4	0	0

Table E-78 Number of bridges and percent of bridges at each Element #510 (deck wearing surface) condition state for mixed rebar decks with a wearing surface crack density between 0.01 and 0.1 LF/SF

Element 510 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	142	97
2	5	3
3	0	0
4	0	0

Table E-79 Number of bridges and percent of bridges each Element #510 (deck wearing surface) condition state for mixed rebar decks with a wearing surface crack density greater than 0.1 LF/SF

Element 510 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	161	98
2	4	2
3	0	0
4	0	0

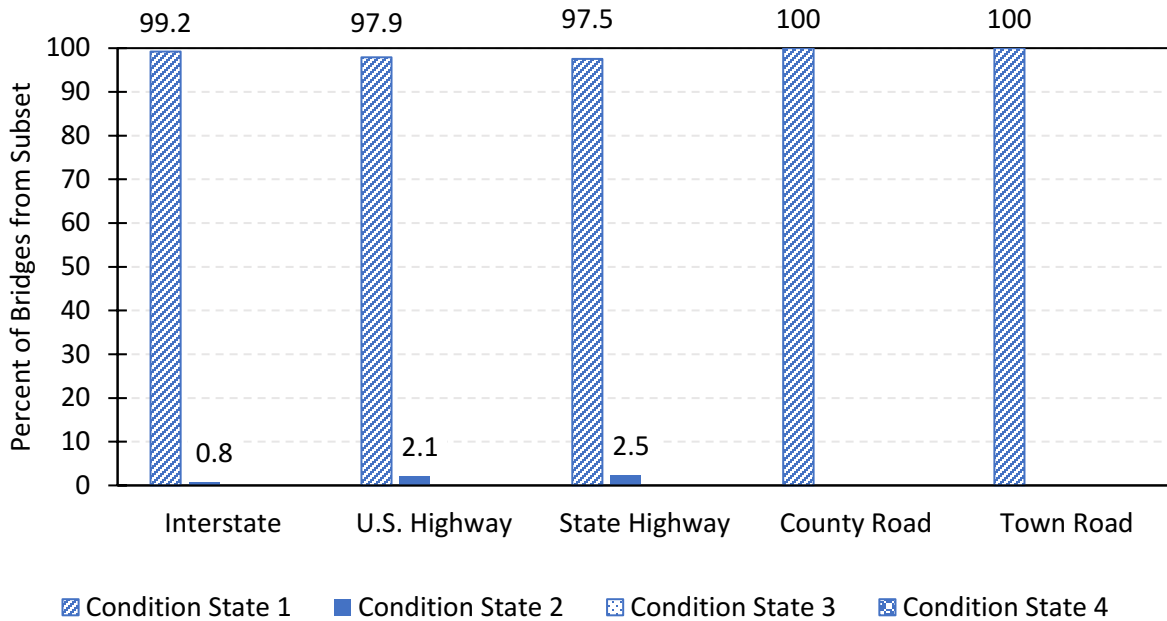


Figure E-29 Most recent Element #510 (deck wearing surface) condition states for mixed rebar decks by route type

Table E-80 Number of bridges and percent of bridges at each Element #510 (deck wearing surface) condition state for mixed rebar decks that carry an Interstate

Element 510 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	125	99
2	1	1
3	0	0
4	0	0

Table E-81 Number of bridges and percent of bridges at each Element #510 (deck wearing surface) condition state for mixed rebar decks that carry a U.S. Highway

Element 510 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	142	98
2	3	2
3	0	0
4	0	0

Table E-82 Number of bridges and percent of bridges at each Element #510 (deck wearing surface) condition state for mixed rebar decks that carry a State Highway

Element 510 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	199	98
2	5	2
3	0	0
4	0	0

Table E-83 Number of bridges and percent of bridges at each Element #510 (deck wearing surface) condition state for mixed rebar decks that carry a County Road

Element 510 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	12	100
2	0	0
3	0	0
4	0	0

Table E-84 Number of bridges and percent of bridges at each Element #510 (deck wearing surface) condition state for mixed rebar decks that carry a Town Road

Element 510 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	2	100
2	0	0
3	0	0
4	0	0

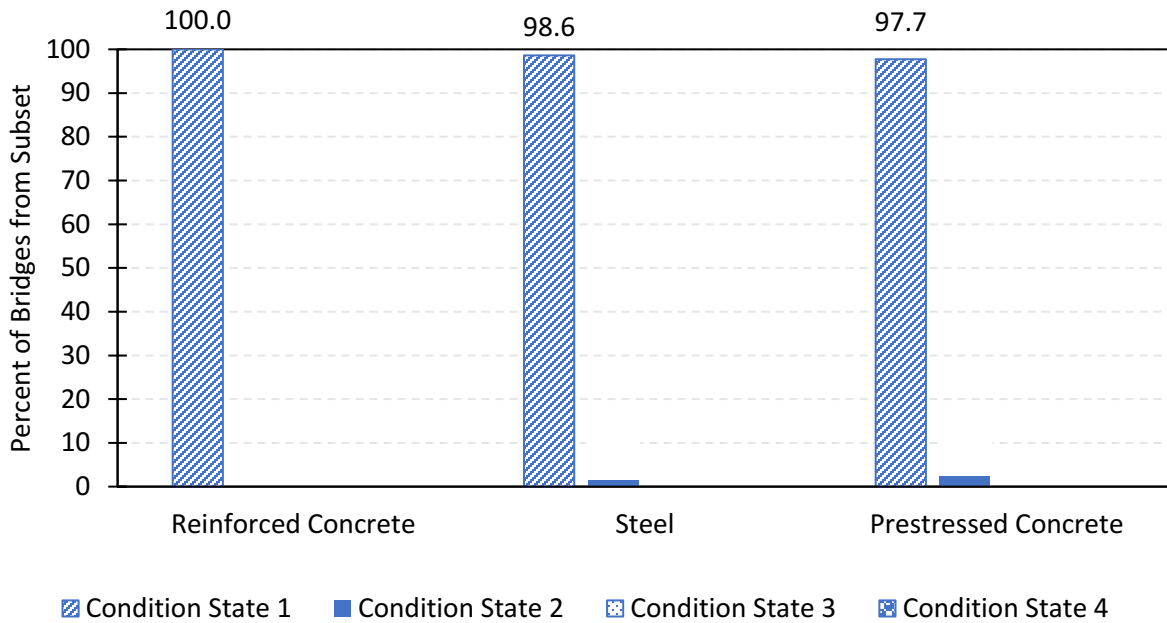


Figure E-30 Most recent Element #510 (deck wearing surface) condition states for mixed rebar decks by superstructure type

Table E-85 Number of bridges and percent of bridges at each Element #510 (deck wearing surface) condition state for mixed rebar decks with a reinforced concrete superstructure

Element 510 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	24	100
2	0	0
3	0	0
4	0	0

Table E-86 Number of bridges and percent of bridges at each Element #510 (deck wearing surface) condition state for mixed rebar decks with a steel superstructure

Element 510 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	209	99
2	3	1
3	0	0
4	0	0

Table E-87 Number of bridges and percent of bridges at each Element #510 (deck wearing surface) condition state for mixed rebar decks with a prestressed concrete superstructure

Element 510 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	257	98
2	6	2
3	0	0
4	0	0

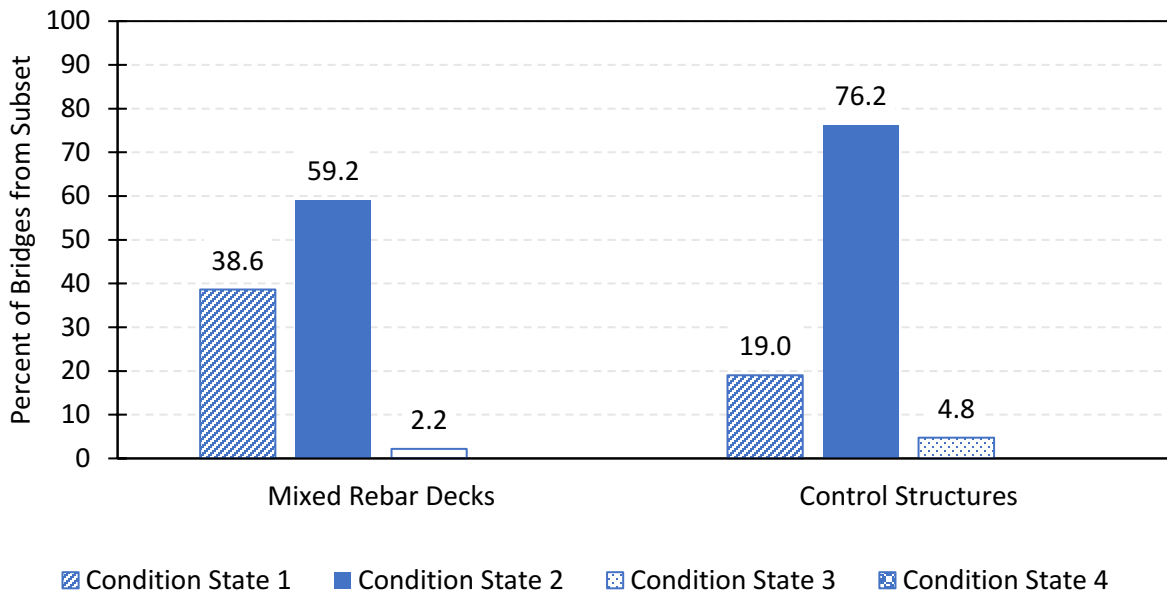


Figure E-31 Most recent Element #810 (concrete wearing surface cracking and sealing) condition states for mixed rebar decks and the control structures for mixed rebar decks

Table E-88 Number of bridges and percent of bridges at each Element #810 (concrete wearing surface cracking and sealing) condition state for mixed rebar decks

Element 810 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	143	38.6
2	219	59.2
3	8	2.2
4	0	0

Table E-89 Number of bridges and percent of bridges at each Element #810 (concrete wearing surface cracking and sealing) condition state for the control structures for mixed rebar decks

Element 810 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	4	19.0
2	16	76.2
3	1	4.8
4	0	0

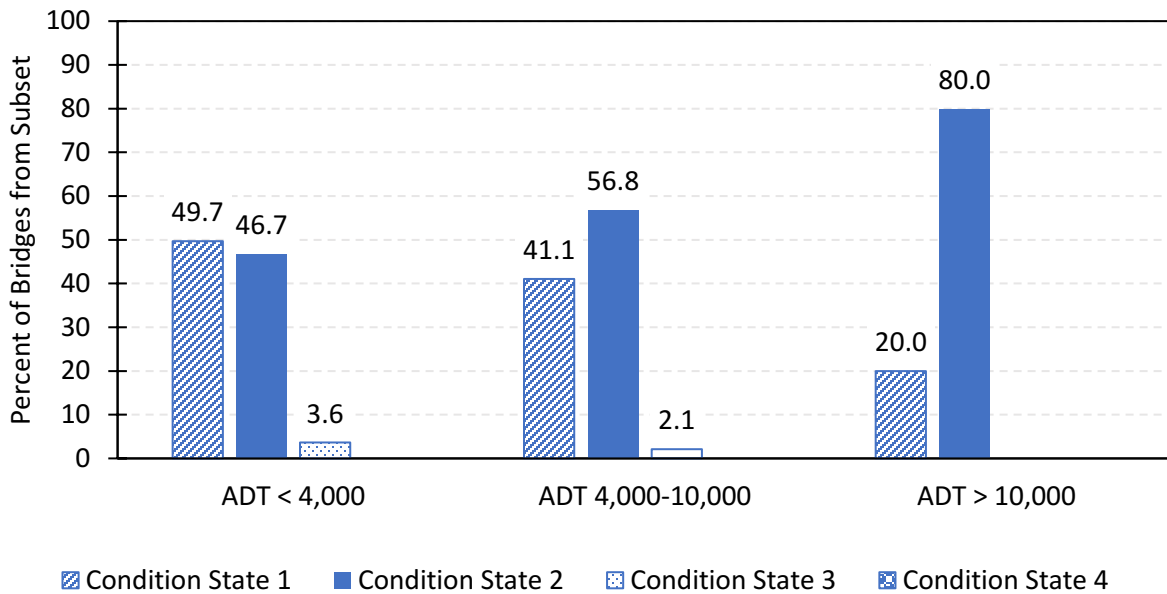


Figure E-32 Most recent Element #810 (concrete wearing surface cracking and sealing) condition states for mixed rebar decks by ADT

Table E-90 Number of bridges and percent of bridges at each Element #810 (concrete wearing surface cracking and sealing) condition state for mixed rebar decks with an ADT less than 4,000

Element 810 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	82	49.7
2	77	46.7
3	6	3.6
4	0	0

Table E-91 Number of bridges and percent of bridges at each Element #810 (concrete wearing surface cracking and sealing) condition state for mixed rebar decks with an ADT between 4,000 and 10,000

Element 810 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	39	41.1
2	54	56.8
3	2	2.1
4	0	0

Table E-92 Number of bridges and percent of bridges at each Element #810 (concrete wearing surface cracking and sealing) condition state for mixed rebar decks with an ADT greater than 10,000

Element 810 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	22	20.0
2	88	80.0
3	0	0
4	0	0

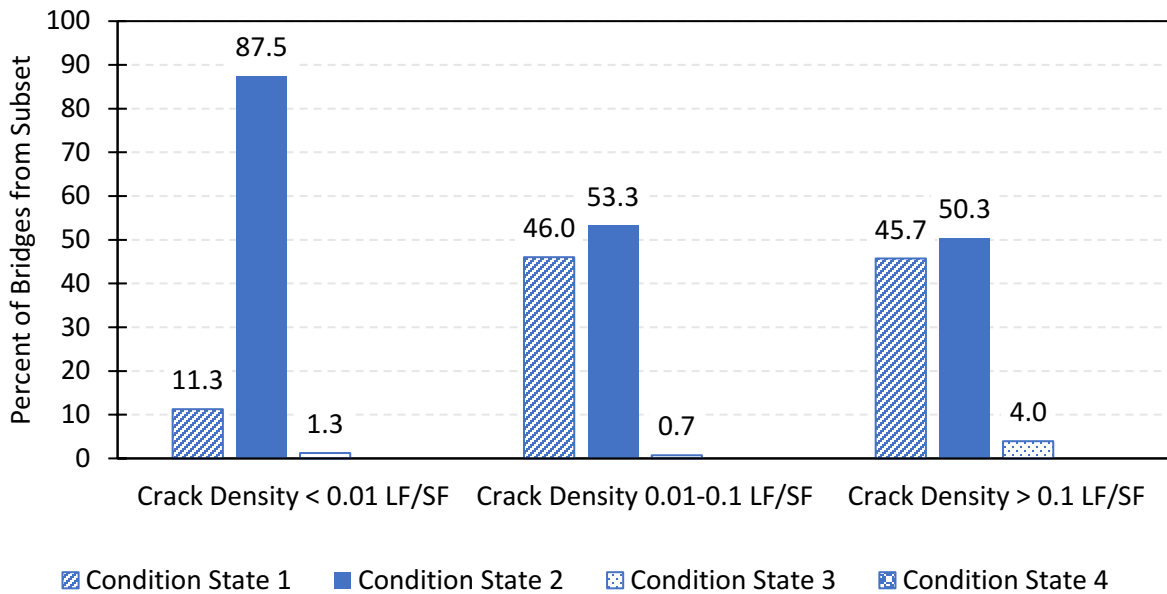


Figure E-33 Most recent Element #810 (concrete wearing surface cracking and sealing) condition states for mixed rebar decks by wearing surface crack density

Table E-93 Number of bridges and percent of bridges at each Element #810 (concrete wearing surface cracking and sealing) condition state for mixed rebar decks with a wearing surface crack density less than 0.01 LF/SF

Element 810 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	9	11.3
2	70	87.5
3	1	1.3
4	0	0

Table E-94 Number of bridges and percent of bridges at each Element #810 (concrete wearing surface cracking and sealing) condition state for mixed rebar decks with a wearing surface crack density between 0.01 and 0.1 LF/SF

Element 810 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	63	46.0
2	73	53.3
3	1	0.7
4	0	0

Table E-95 Number of bridges and percent of bridges at each Element #810 (concrete wearing surface cracking and sealing) condition state for mixed rebar decks with a wearing surface crack density greater than 0.1 LF/SF

Element 810 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	69	45.7
2	76	50.3
3	6	4.0
4	0	0

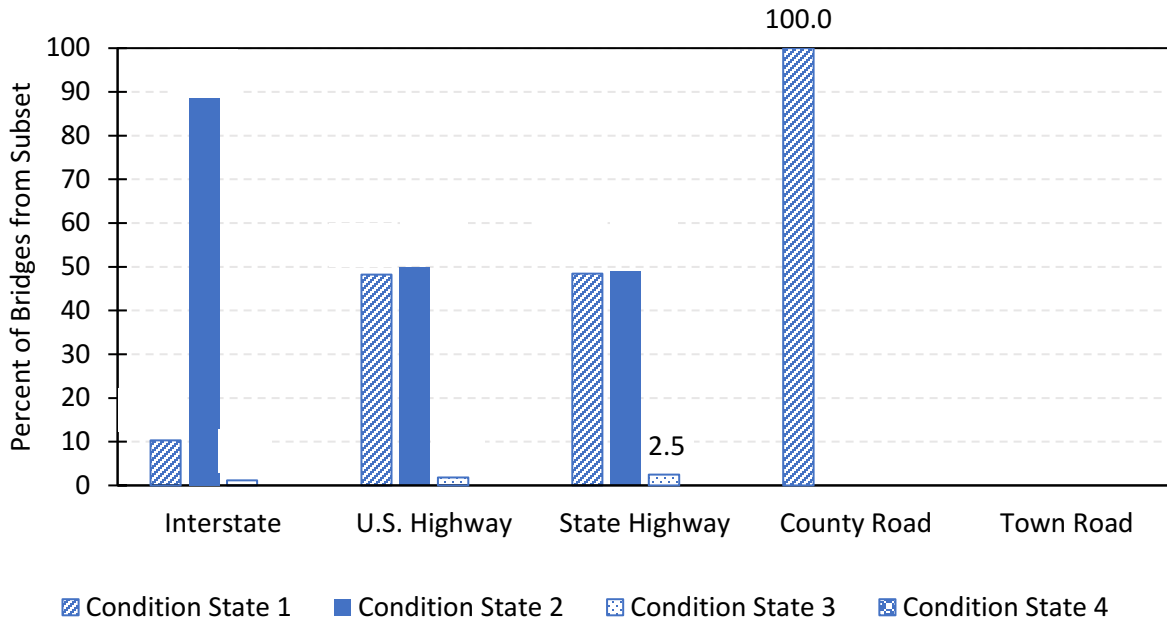


Figure E-34 Most recent Element #810 (concrete wearing surface cracking and sealing) condition states for mixed rebar decks by route type

Table E-96 Number of bridges and percent of bridges at each Element #810 (concrete wearing surface cracking and sealing) condition state for mixed rebar decks that carry an Interstate

Element 810 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	9	10.3
2	77	88.5
3	1	1
4	0	0

Table E-97 Number of bridges and percent of bridges at each Element #810 (concrete wearing surface cracking and sealing) condition state for mixed rebar decks that carry a U.S. Highway

Element 810 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	54	48.2
2	56	50.0
3	2	1.8
4	0	0

Table E-98 Number of bridges and percent of bridges at each Element #810 (concrete wearing surface cracking and sealing) condition state for mixed rebar decks that carry a State Highway

Element 810 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	78	48.4
2	79	49.1
3	4	2.5
4	0	0

Table E-99 Number of bridges and percent of bridges at each Element #810 (concrete wearing surface cracking and sealing) condition state for mixed rebar decks that carry a County Road

Element 810 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	1	100
2	0	0
3	0	0
4	0	0

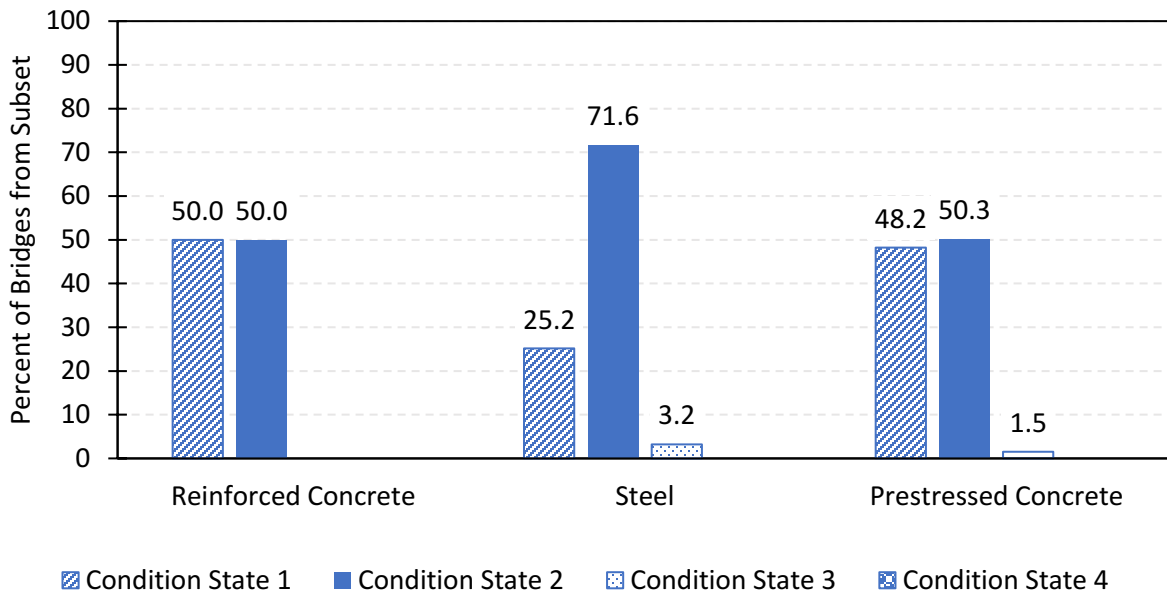


Figure E-35 Most recent Element #810 (concrete wearing surface cracking and sealing) condition states for mixed rebar decks by superstructure type

Table E-100 Number of bridges and percent of bridges at each Element #810 (concrete wearing surface cracking and sealing) condition state for mixed rebar decks with a reinforced concrete superstructure

Element 810 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	9	50
2	9	50
3	0	0
5	0	0

Table E-101 Number of bridges and percent of bridges at each Element #810 (concrete wearing surface cracking and sealing) condition state for mixed rebar decks with a steel superstructure

Element 810 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	39	25.2
2	111	71.6
3	5	3.2
4	0	0

Table E-102 Number of bridges and percent of bridges at each Element #810 (concrete wearing surface cracking and sealing) condition state for mixed rebar decks with a prestressed concrete superstructure

Element 810 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	95	48.2
2	99	50.3
3	3	1.5
4	0	0

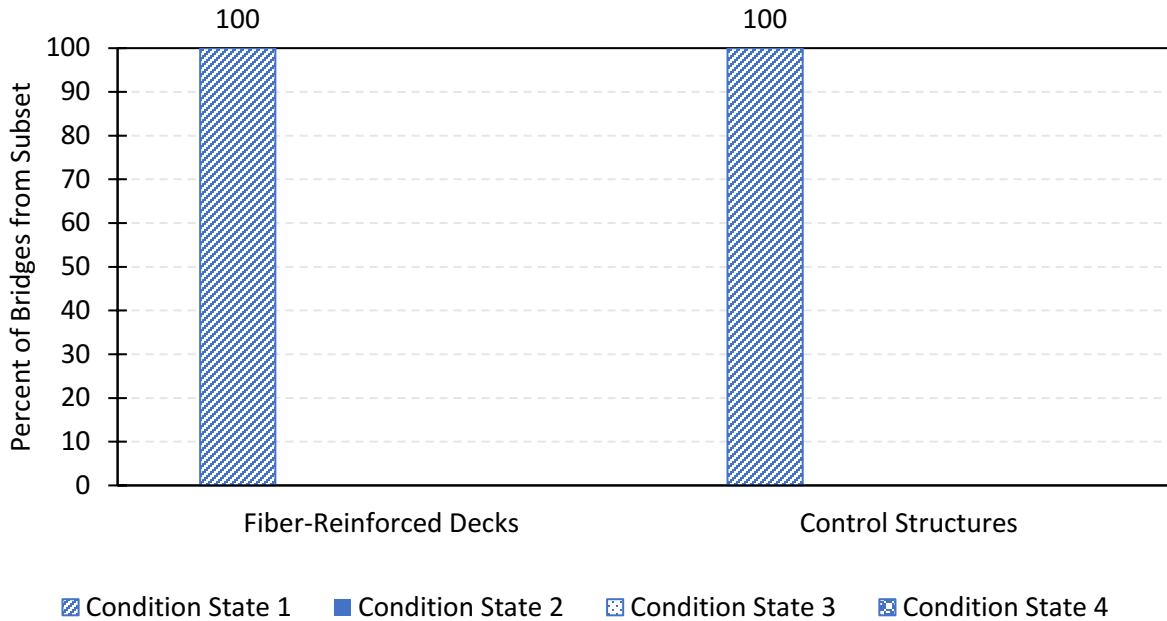


Figure E-36 Most recent Element #12 (underside of reinforced concrete deck) condition states for fiber-reinforced decks and the control structures for fiber-reinforced decks

Table E-103 Number of bridges and percent of bridges at each Element #12 (underside of reinforced concrete deck) condition state for fiber-reinforced decks

Element 12 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	19	100
2	0	0
3	0	0
4	0	0

Table E-104 Number of bridges and percent of bridges at each Element #12 (underside of reinforced concrete deck) condition state for the control structures for fiber-reinforced decks

Element 12 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	6	100
2	0	0
3	0	0
4	0	0

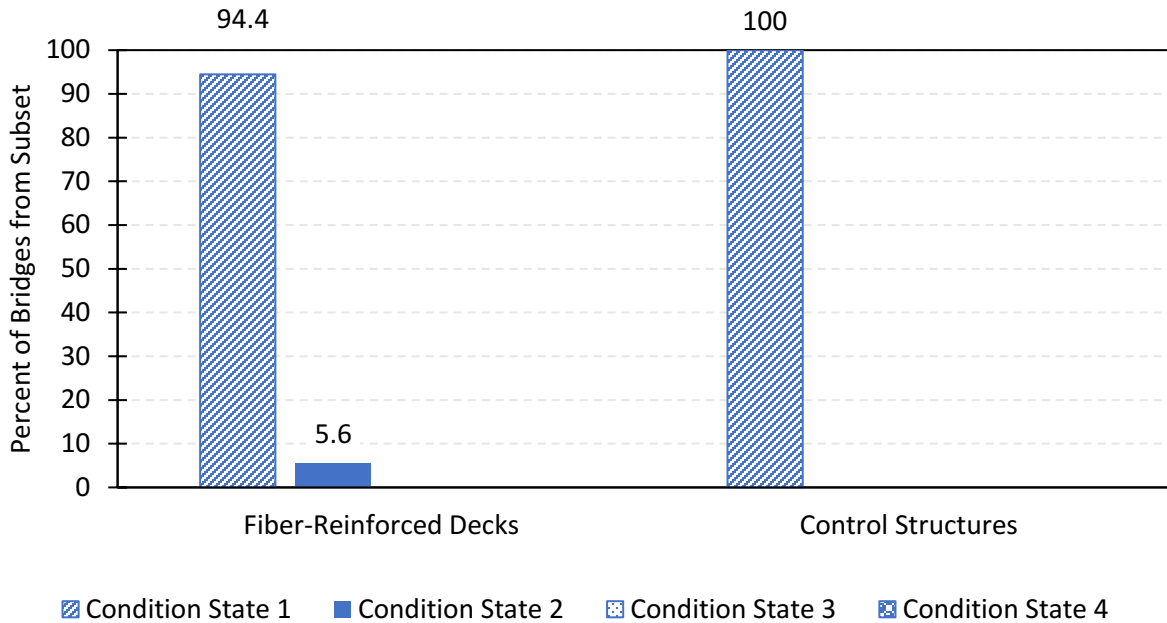


Figure E-37 Most recent Element #510 (deck wearing surface) condition states for fiber-reinforced decks and the control structures for fiber-reinforced decks

Table E-105 Number of bridges and percent of bridges at each Element #510 (deck wearing surface) condition state for fiber-reinforced decks

Element 510 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	17	94.4
2	1	5.6
3	0	0
4	0	0

Table E-106 Number of bridges and percent of bridges at each Element #510 (deck wearing surface) condition state for the control structures for fiber-reinforced decks

Element 510 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	4	100
2	0	0
3	0	0
4	0	0

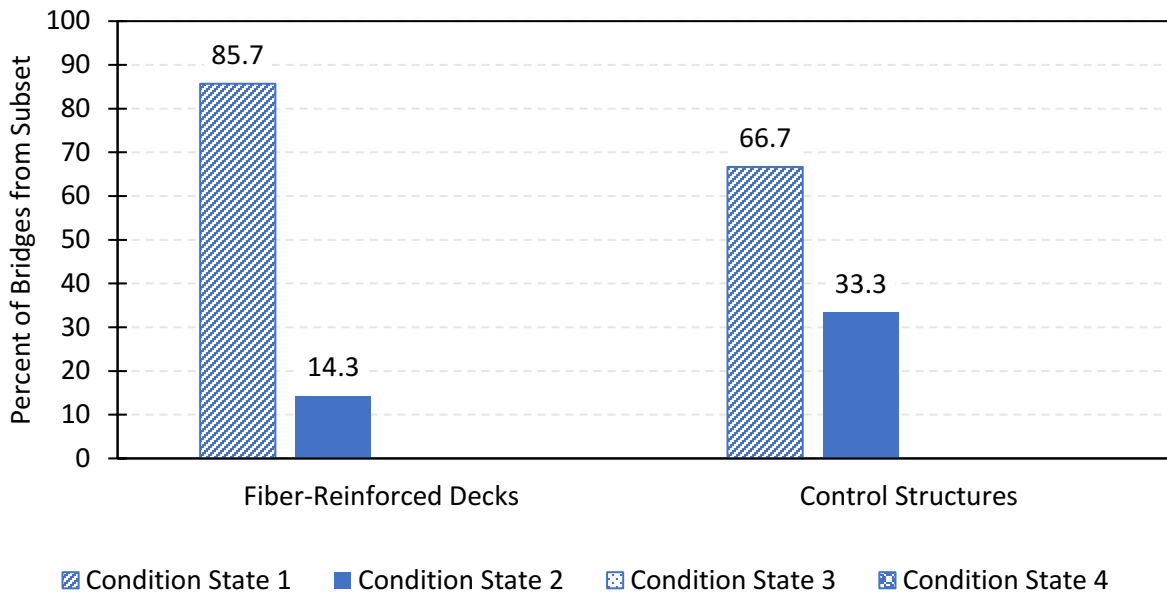


Figure E-38 Most recent Element #810 (concrete wearing surface cracking and sealing) condition states for fiber-reinforced decks and the control structures for fiber-reinforced decks

Table E-107 Number of bridges and percent of bridges at each Element #810 (concrete wearing surface cracking and sealing) condition state for fiber-reinforced decks

Element 810 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	6	85.7
2	1	14.3
3	0	0
4	0	0

Table E-108 Number of bridges and percent of bridges at each Element #810 (concrete wearing surface cracking and sealing) condition state for the control structures for fiber-reinforced decks

Element 810 Condition State	Number of Bridges Currently at Condition State	Percent of Bridges Currently at Condition State
1	2	67
2	1	33
3	0	0
4	0	0

APPENDIX F: EVALUATION OF NBE ELEMENT #12 INSPECTION DATA RESULTS

Table F-1 Average percent of the deck in condition states 3 and 4 for NBE Element 12 and the percent of the bridges in each subset that reached condition states 3 or 4 for mixed rebar decks and the control structures

Deck Type	Average % of Deck in CS3 and CS4	% of Bridges that Reached CS3 or CS4	Total Number of Bridges in Each Subset
Mixed Rebar	1.56	48	433
Control for Mixed	1.90	30	30

Table F-2 Average percent of the deck in condition states 3 and 4 for NBE Element 12 and the percent of the bridges in each subset that reached condition states 3 or 4 for mixed rebar decks by ADT

ADT	Average % of Deck in CS3 and CS4	% of Bridges that Reached CS3 or CS4	Total Number of Bridges in Each Subset
<4,000	1.92	37	180
4,000-10,000	1.31	44	124
>10,000	1.43	67	129

Table F-3 Average percent of the deck in condition states 3 and 4 for NBE Element 12 and the percent of the bridges in each subset that reached condition states 3 or 4 for mixed rebar decks by current wearing surface crack density

Wearing Surface Crack Density (LF/SF)	Average % of Deck in CS3 and CS4	% of Bridges that Reached CS3 or CS4	Total Number of Bridges in Each Subset
< 0.01	1.31	53	163
0.01-0.1	1.13	42	128
> 0.1	2.25	46	138

Table F-4 Average percent of the deck in condition states 3 and 4 for NBE Element 12 and the percent of the bridges in each subset that reached condition states 3 or 4 for mixed rebar decks by route type

Route Type	Average % of Deck in CS3 and CS4	% of Bridges that Reached CS3 or CS4	Total Number of Bridges in Each Subset
Interstate	1.58	54	98
U.S. Highway	1.03	45	133
State Highway	1.92	46	179
County Road	2.00	17	12
Town Road	0	0	2

Table F-5 Average percent of the deck in condition states 3 and 4 for NBE Element 12 and the percent of the bridges in each subset that reached condition states 3 or 4 for mixed rebar decks by skew

Superstructure Type	Average % of Deck in CS3 and CS4	% of Bridges that Reached CS3 or CS4	Total Number of Bridges in Each Subset
Reinforced Concrete	N/A	N/A	0
Steel	1.83	66	186
Prestressed Concrete	1.15	34	247

Table F-6 Average percent of the deck in condition states 3 and 4 for NBE Element 12 and the percent of the bridges in each subset that reached condition states 3 or 4 for mixed rebar decks by skew

Skew	Average % of Deck in CS3 and CS4	% of Bridges that Reached CS3 or CS4	Total Number of Bridges in Each Subset
Skewed	1.43	52	127
Not Skewed	1.64	45	304

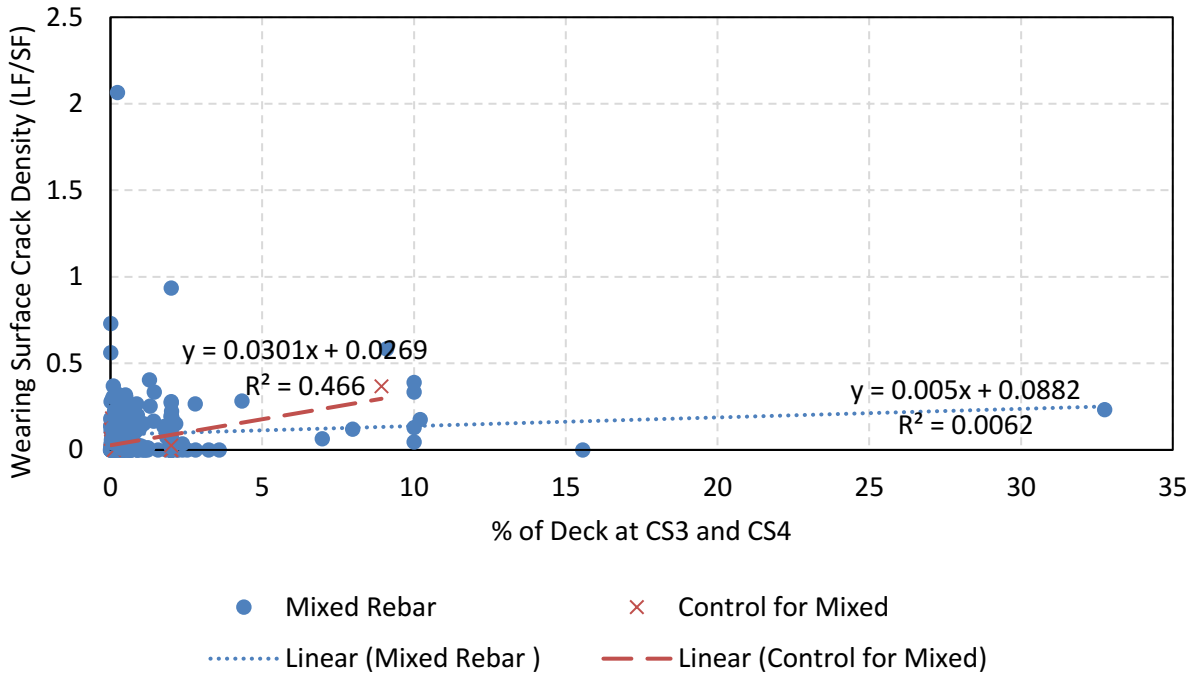


Figure F-1 Current wearing surface crack density versus percent of the deck in condition states 3 and 4 for NBE Element 12 for mixed rebar decks and the control structures

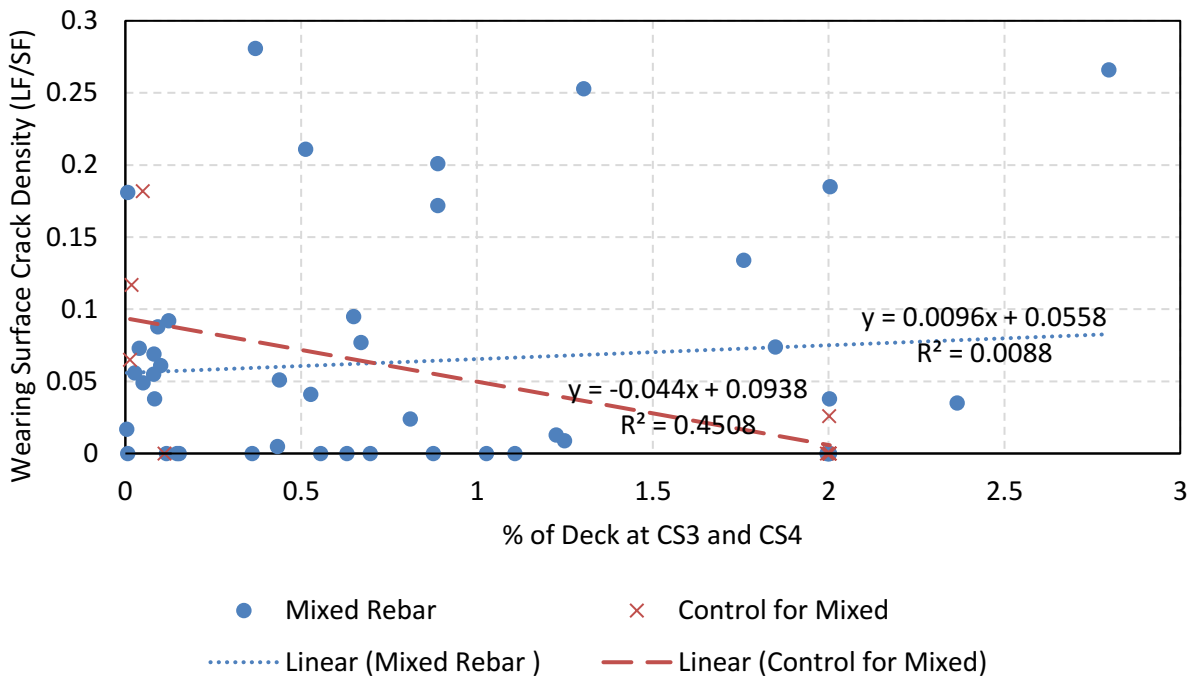


Figure F-2 Current wearing surface crack density versus percent of the deck in condition states 3 and 4 for NBE Element 12 for mixed rebar decks and the control structures with outliers removed

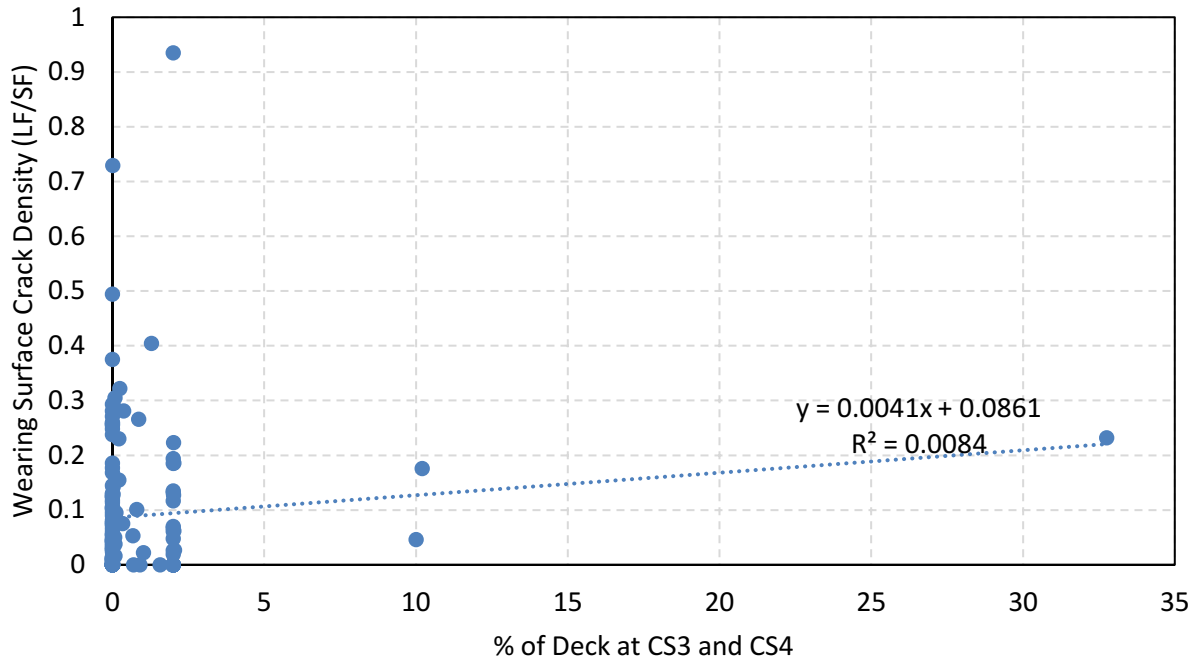


Figure F-3 Current wearing surface crack density versus percent of the deck in condition states 3 and 4 for NBE Element 12 for bridges with monolithic decks

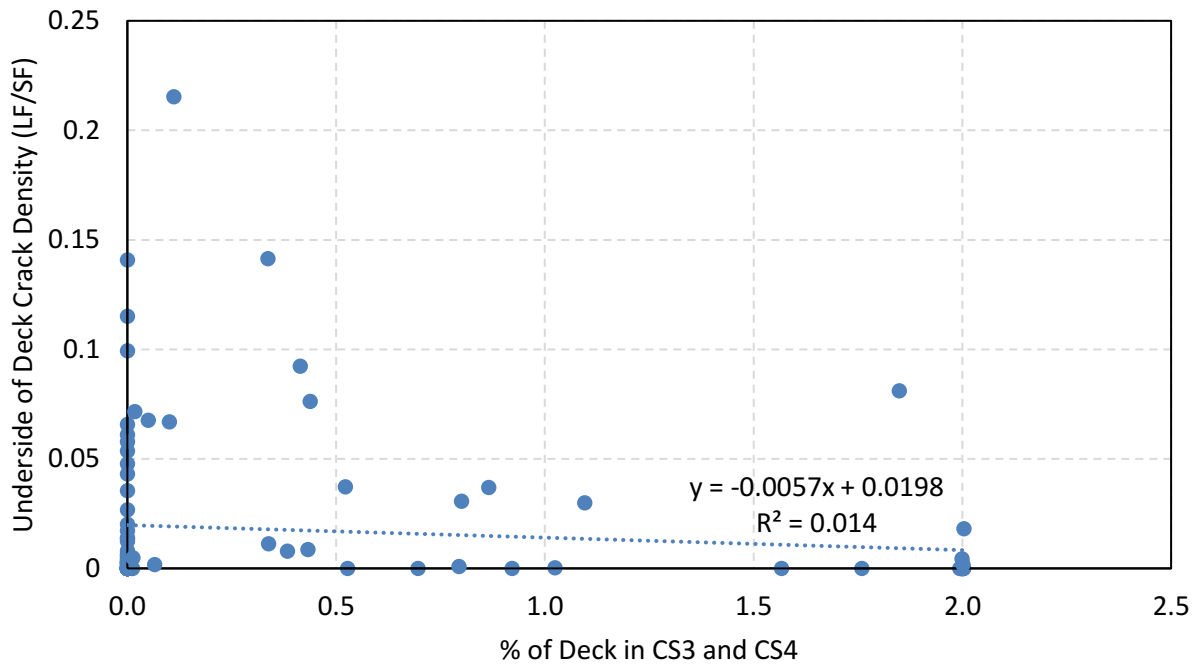


Figure F-4 Underside of the deck crack density from the most recent MnDOT inspection notes versus the percent of the deck in condition states 3 and 4 for NBE Element #12