

Railroad Bridge Substructure Rehabilitations

Maine Northern Railway – Madawaska Subdivision
MaineDOT WIN 23488.00

PREPARED FOR



PREPARED BY



February 27, 2020

Executive Summary

This preliminary design memorandum presents the recommended substructure rehabilitation concepts and associated costs for the following bridges:

- Bridge No. 7785 (M.P. 224.51) over Fish River
- Bridge No. 7787 (M.P. 236.44) over Wallagrass Stream
- Bridge No. 7788 (M.P. 241.83) over Fish River
- Bridge No. 7792 (M.P. 253.87) over Dickey Brook

All four bridges carry the Madawaska subdivision of the Maine Northern Railway in various locations throughout Aroostook County. The proposed work will be performed under the Railroad Bridge Substructure Rehabilitations project and as part of the FASTLANE grant. At all locations, the decks and superstructures are either in "fair" or "satisfactory" condition. All the bridge superstructures either load rate about 1.0 or are being rehabilitated to load rate about 1.0 as part of other contracts. The work at all four bridges will focus specifically on the rehabilitation of the bridge substructures (abutments and piers) which are in either "poor" or worse condition.

The rehabilitation concepts present herein are intended to extend the service life and improve the condition rating of the substructure units. As such, the repairs shown focus on the areas of each bridge that are in imminent need of repair and are in the worst condition. Concepts were developed based review of existing plans and inspection notes, field visits, and consultation with industry experts. Repairs were selected for each bridge on a case-by-case basis with the primary goals being to maximize constructability while minimizing cost and shutdowns to railroad service.

Due to the unique nature of the proposed rehabilitation concepts, clarity and unambiguity will be critical in the development of plans and specifications. During final design, emphasis will be placed on the limits and extents of bridge removal and the work to be done at each bridge. Special provisions and plan details will be developed to mitigate risk, reduce quantity overruns, and provide contingencies for unforeseen issues during construction.

A description of the existing condition, proposed rehabilitation concepts, and their associated construction costs are presented for each bridge in the subsequent sections of this memorandum. Concept sketches showing the proposed repair concepts can be found at the end of each section. A summary of the anticipated construction cost for the project is shown below.

Summary of Anticipated Construction Costs (Year 2019 Costs):

Bridge No. 7785:	\$xxxxxxx
Bridge No. 7787:	\$ xxxxxxx
Bridge No. 7788:	\$ xxxxxxx
Bridge No. 7792:	\$ xxxxxxx
Subtotal:	\$ xxxxxxx
Mobilization:	\$ xxxxxxx
Contingency:	\$ xxxxxxx
Total Cost:	\$ xxxxxxx



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Bridge 7785 (M.P. 224.51)

Over Fish River

Bridge Description

Bridge 7785 is a 180-foot, two-span, steel deck-plate-girder bridge with open timber deck built in 1902. It carries the Madawaska subdivision of the Maine Northern Railway over the Fish River in Eagle Lake. The girders are supported on two unreinforced concrete abutments and one unreinforced concrete pier. According to the 2018 inspection report both the deck and superstructure elements are in “satisfactory” condition. The substructure and channel are in “poor” and “fair” condition, respectively.

Both abutments and the pier are approximately 40-feet tall and were previously covered with a superficial layer of shotcrete. This layer of shotcrete is in serious condition and is 50% to 90% spalled or delaminated with large areas of cracking and exposed welded-wire-fabric. Because the girders are in satisfactory condition and load rate above 1.0, the proposed work for this bridge will focus on rehabilitation of the substructure.



Elevation View of Bridge Looking West

Existing Condition and Proposed Repairs – North and South Abutments

Rehabilitate Backwalls

The Backwalls at both the North and South Abutments have several deficiencies that are recommended for repair.

At the North Abutment:

- A full-depth, full-height crack up to two inches wide directly behind the end of the east girder. As a result of the crack, ballast is spilling through and the backwall appears to be tipping forward.

- A diagonal shear crack approximately one-half inch wide propagating down from the top of the backwall. This crack is located at the upper west corner of the backwall, where several timbers bear directly on the backwall. See photo provided in the attached "Additional Photos" section.

At the South Abutment:

- A full-depth, full-height crack up to two inches wide directly behind the end of the west girder. Like the North Abutment, ballast is spilling through and the backwall appears to be tipping forward.
- Approximately 70% of the concrete on the face of the backwall is either delaminated or spalled with cracking throughout. See photo provided in the "Additional Photos".



Crack in North Abutment at End of the East Girder, Up to 2" Wide

The proposed work to each backwall consists of partial depth repairs at the cracked and delaminated locations. Partial depth repairs will allow the wingwall to stay in place and will not require excavation or extensive removal of existing bridge members. Conceptual details of these repairs are shown in the attached Preliminary Repair Concept Plans.

Anticipated Construction Cost: \$xxxxxx North Abutment and \$xxxxxx South Abutment

Rehabilitate Bridge Seats and Bearings

The primary function of the bridge seat and the bearings is to support the girders and transfer load down through the abutment. The primary concern is that these concrete bridge seats are unreinforced and support highly concentrated loads, and therefore the potential exists for non-ductile failure under the bearings. At both abutments, the concrete directly below the bridge seat is deteriorated and cracked with areas of delamination and exposed wire fabric. At the North Abutment, the original roller style” expansion bearings supporting the girders have failed and are falling apart. At the South Abutment, the existing fixed bearings are in satisfactory condition. See photo provided in the attached “Additional Photos” section.

The proposed work to the bridge seats includes:

- Removal of the existing concrete from the upper portion of the bridge seat and directly below the bearings.
- Installation of steel girder support bolsters.
- Encasement of the upper portion of the bridge seat with new concrete and reinforcing steel to improve ductility.
- Replacement of the existing bearings at the North Abutment with new fabric pad expansion bearings.

Conceptual details of these repairs are shown in the attached Preliminary Repair Concept Plans.

Anticipated Construction Cost: \$ xxxxxx North Abutment and \$ xxxxxx South Abutment



View of North Abutment and Northeast Wingwall

Rehabilitate Footing Apron (North Abutment Only)

The concrete at the base of the North Abutment is heavily deteriorated. The goal of the proposed work is to protect the base of the abutment and breastwall from further deterioration and scour. This will include rebuilding the existing concrete apron at and below the waterline and patch repairing the face of the abutment above the water line. Conceptual details of this repair are shown in the attached Preliminary Repair Concept Plans.

Anticipated Construction Cost: \$ xxxxxx



Deteriorated and Abraded Concrete at Base of North Abutment

Rehabilitate Wingwalls

The wingwalls at both the North and South Abutment have large areas of delamination, cracking, and spalling. Additionally, the southeast wingwall appears to be tipping outward slightly.

At both abutments, wingwalls a wingwall tie-back system will be installed. The wingwall tie-back system will consist of a horizontal strip of reinforced concrete attached to upper portion of both wingwalls. The wingwalls will be tied together using steel rods attached to the reinforced concrete strips on each wingwall. The tie-back system will prevent the wingwalls from future tipping and will introduce ductility in the wingwalls. Conceptual details of these repairs are shown in the attached Preliminary Repair Concept Plans.

Anticipated Construction Cost: \$ xxxxxx North Abutment and \$ xxxxxx South Abutment

Existing Condition and Proposed Repairs – Pier



View of South Face of Pier

Rehabilitate Top of Pier and Bearings

Like the abutments, the primary function of the bearings and top of pier is to support the girders and transfer load uniformly down into the pier stem. The concrete throughout the pier is unreinforced and is heavily cracked, delaminated and spalled. This includes the areas directly below the girders at the top of pier. The original “roller style” expansion bearings supporting the girders on the south span have failed and are falling apart. See photo provided in the attached “Additional Photos” section.

The proposed work to the top of pier includes:

- Removal of the existing concrete directly below the bearings.
- Installation of steel girder support bolsters.
- Encasement of bolsters with concrete and reinforcing steel.
- Replacement of failed expansions bearings with new fabric pad expansion bearings.

These repairs will improve the ductility of the top of pier and will ensure even distribution of loads into the pier stem. Conceptual details of this repair are shown in the attached Preliminary Repair Concept Plans.

Anticipated Construction Cost: \$ xxxxxx

Continued Next Page:

In addition to the proposed alternative stated above, a second alternative for rehabilitation of the top of pier was also evaluated.

The second alternative included:

- No removal of concrete from the top of pier or under the bearings.
- Limited removal of concrete from the sides of the pier.
- Installation of an external concrete encasement “band” or “donut” around the top of the pier.
- Installation of post tensioning rods through the top of pier and concrete encasement.

The proposed alternative was selected in lieu of the second alternative for the following reasons:

- By not removing the concrete under and around the bearings, concentrated loads are still being applied to the original concrete which is in poor condition. Applying concentrated loads or “punching” loads to poor/soft concrete could lead to a differential gaps or pockets under the bearings.
- Once encased the proposed alternative will make the entire cap work more as a unit, avoiding concentrated or “punching” loads. This will provide a more uniform distribution of loads into and through the pier.
- The proposed alternative encases the entire top of the pier, leaving no vertical joints for water and debris to get into. The “donut” encasement in the second alternative its more conducive to collecting debris, ponding of water, and will give water a path into the pier.
- The “donut” encasement in the second alternative will make future repairs, if necessary, more difficult.
- A significant portion of the cost for either alternative will just be in access and set up. Additionally, the expansion bearings need to be replaced so jacking and temporary support of the superstructure will be required for both alternative. The proposed alternative may have some addition up-front material and labor costs but provides a more sustainable and maintenance free solution. This will likely provide a long-term cost savings.



Heavily Deteriorated Concrete and Undermined Bearing at Top of Pier

Rehabilitate Footing Apron

The concrete at the base of the pier is heavily deteriorated. Undermining and loss of concrete at the base of the pier can lead to long-term serviceability concerns with the pier.

The goal of the proposed work is to protect the base of the pier by rebuilding the existing concrete footing apron. Conceptual details of this repair are shown in the attached Preliminary Repair Concept Plans.

Anticipated Construction Cost: \$ xxxxxx



Deteriorated Concrete at Base of Pier

Encase Pier

The shotcrete encasement surrounding the pier is heavily cracked and delaminated. There are large areas of spalling, exposed welded wire fabric, and vegetation growth. See photos on next page and provided in the attached "Additional Photos" section.

The proposed work includes the removal of the shotcrete encasement, unsound concrete, and encasement of the pier with new concrete and reinforcing steel. Conceptual details of this repair are shown in the attached Preliminary Repair Concept Plans.

Anticipated Construction Cost: \$ xxxxxx



Delamination and Cracking on the South Face of Pier

Summary of Anticipated Construction Costs (Year 2019 Costs):

North Abutment:

Rehabilitate Backwall:	\$xxxxxx
Rehabilitate Bridge Seat:	\$xxxxxx
Rehabilitate Footing Apron:	\$xxxxxx
Install Wingwall Tie-Back System:	\$xxxxxx

South Abutment:

Rehabilitate Backwall:	\$xxxxxx
Rehabilitate Bridge Seat:	\$xxxxxx
Install Wingwall Tie-Back System:	\$xxxxxx

Pier:

Rehabilitate Top of Pier:	\$xxxxxx
Rehabilitate Footing Apron:	\$xxxxxx
Encase Pier:	\$xxxxxx

Subtotal: \$xxxxxx

Mobilization: \$xxxxxx

10% Contingency: \$xxxxxx

Total Anticipated Construction Cost: \$xxxxxx

Additional Photos:



Diagonal Shear Crack in the Upper West Corner of the North Abutment Backwall Under Bridge Timber



View of South Abutment



Spalled and Deteriorated Concrete in the Backwall of the South Abutment



Failed Expansion Bearing at North Abutment



Failed Expansion Bearing on Southwest Side of Pier



North Face of Pier (Encased in Shotcrete)



Heavy Delamination on the South East Corner of Pier

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Bridge 7787 (M.P. 236.44)

Over Wallagrass Stream

Bridge Description

Bridge 7787 is a 75-foot, single span, through-plate-girder bridge with an open timber deck built in 1902. It carries the Madawaska subdivision of the Maine Northern Railway over the Wallagrass Stream in Wallagrass. The girders are supported on two unreinforced concrete abutments. According to the 2018 inspection report both the deck and superstructure elements are in “satisfactory” condition. The substructure and channel are in “poor” and “fair” condition, respectively.

Both abutments are approximately 16 to 20 feet tall and appear to have been previously covered with a superficial layer of shotcrete. This layer of shotcrete is in serious condition and is 90% to 100% spalled or delaminated with large areas of cracking and exposed welded-wire-fabric. Because the girders are in satisfactory condition, the proposed work for this bridge will focus on rehabilitation of the substructure. Additionally, the girders are being strengthened to load rate above 1.0 as part of a separate contract.



Elevation View of Bridge Looking West

Existing Condition and Proposed Repairs – North and South Abutments

Rehabilitate Backwalls

The backwalls at both abutments are cracked and delaminated throughout. There are several locations with full-depth cracks and full-depth spalls where ballast is spilling through. See photos on next page and provided in the attached “Additional Photos” section.

The proposed work to the backwalls consists of partial depth repairs along the entire face and top of both backwalls. Partial depth repairs will allow the backwall to stay in place and will not require excavation or extensive removal of existing bridge members. Conceptual details of these repairs are shown in the attached Preliminary Repair Concepts Plans.

Anticipated Construction Cost: \$xxxxxx North Abutment and \$xxxxxx South Abutment



Deteriorated and Crumbling Concrete Backwall at Northeast Bearing

Rehabilitate Bridge Seats and Breast Walls

The primary function of the bridge seat is to support the girders and transfer load down through the abutment. The primary concern is that these concrete bridge seats are unreinforced and support highly concentrated loads, and therefore the potential exists for non-ductile failure under the bearings. At both abutments, the concrete directly below the bridge seat is deteriorated and cracked with areas of delamination and exposed welded-wire-fabric. The existing "roller style" expansion bearings at the North Abutment are to be replaced as part of a separate superstructure rehabilitation contract (FASTLANE Contract 2). See photos on next page and provided in the attached "Additional Photos" section.

The proposed work to the bridge seats and breast walls includes:

- South Abutment – Removal of the existing concrete from the upper portion of the bridge seat and directly below the bearings.
- North Abutment – Removal of the existing concrete from the bridge seat directly below the bearings and partial depth removal for the remaining portions of the abutment breast wall.

Bridge 7787 (MP 236.44) – Wallagrass Stream

Preliminary Design Memorandum

FASTLANE Contract 4

- Both abutments – Installation of precast concrete or steel support bolsters.
- Both abutments – Encasement of the upper portion of the bridge seat with new concrete and reinforcing steel.
- North Abutment – Partial depth repairs to the lower portion of the abutment breast wall.

These repairs will improve the ductility of the bridge seats. Conceptual details of these repairs are shown in the attached Preliminary Repair Concepts Plans.

Anticipated Construction Cost: \$xxxxxx North Abutment and \$xxxxxx South Abutment



View of North Abutment Bridge Seat and Breast Wall

Rehabilitate Northeast Wingwall

In addition to the typical delamination, cracking and spalling, the northeast wingwall appears to be tipping outward, indicating a potential issue with the integrity of wingwall. See photo on next page.

The proposed work includes:

- Partial depth removal of unsound concrete from the upper portion of the wingwall.
- Drilling and grouting vertical reinforcement into the existing concrete to “pin” the top of the wingwall.
- Partial depth repairs to the wingwall with new concrete and reinforcing.

Anticipated Construction Cost: \$xxxxxx



Northeast Wingwall Tilting Outward (Originally Battered)

North Abutment – Footing Apron

Previous inspection reports noted scour/undermining of the concrete encasement at the base of the North Abutment. During a 2019 site visit the base of the abutment was investigated to determine the extent of the undermining. A gap is present between the bottom of the encasement and the river bed. However, this is only undermining of the breast wall encasement, not undermining of the original footing. Based on comparisons of the field measurements to the existing plans, the footing is still embedded below the stream bed, and does not appear to be undermined. Additionally, the existing plans show the abutment is supported by timber piles, making the abutment not scour susceptible. See photo provided in the attached “Additional Photos” section.

No work is proposed at either of the abutment footings.

Bridge 7787 (MP 236.44) – Wallagrass Stream

Preliminary Design Memorandum

FASTLANE Contract 4

Summary of Anticipated Construction Costs (Year 2019 Costs):

North Abutment:

Rehabilitate Backwall: \$xxxxxx
Rehabilitate Bridge Seat: \$xxxxxx
Rehabilitate Northeast Wingwall: \$xxxxxx

South Abutment:

Rehabilitate Backwall: \$xxxxxx
Rehabilitate Bridge Seat: \$xxxxxx

Subtotal: \$xxxxxx

Mobilization: \$xxxxxx

25% Contingency: \$xxxxxx

Total Anticipated Construction Cost: \$xxxxxx



Additional Photos:



View of South Abutment



View of North Abutment



Heavy Deterioration in Shotcrete on North Abutment



Deterioration in Bridge Seat and Backwall at Northwest Bearing



Crack in Backwall at Southeast Bearing



Gap Between the Bottom of the Concrete Encasement and the River Bed, at North Abutment

Pages 29 Thru 31 Removed

Bridge 7788 (M.P. 241.83)

Over Fish River

Bridge Description

Bridge 7788 is a 270-foot, three-span, steel deck-plate-girder bridge with open timber deck built in 1902. It carries the Madawaska subdivision of the Maine Northern Railway over the Fish River in Fort Kent. The girders are supported on two unreinforced concrete abutments and two concrete piers. The piers were rehabilitated and encased in concrete in 2008 and are in “good” condition. According to the 2018 inspection report both the deck, superstructure, and channel elements are in “fair” condition. The substructure (abutments) is in “poor” condition.

Both abutments are approximately 25 to 30 feet tall and were previously covered with a superficial layer of shotcrete. This layer of shotcrete is in serious condition and is 80% to 90% spalled or delaminated with large areas of cracking. Because the piers have been recently rehabilitated, the girders are in fair condition, and load rate above 1.0, the proposed work for this bridge will focus on rehabilitation of the abutments.



Elevation View of Bridge Looking Southwest

Existing Condition and Proposed Repairs – North Abutment

North Abutment – Rehabilitate Backwall and Wingwalls

The North Abutment backwall and wingwalls have several deficiencies that are recommended for repair:

- A full-depth, full-height crack up to three inches wide in the backwall, directly behind the end of the west girder. As a result of the crack, ballast is spilling through and the backwall appears to be tipping forward.

- Approximately 75% of the concrete on the face of the backwall is either delaminated or spalled with heavy cracking throughout.
- The Northwest Wingwall appears to be tipping outward.
- Both wingwalls have large areas of delamination, cracking, and spalling throughout.

Due to the length and height of the wingwalls, and their close proximity to the tracks, the wingwalls are subject to high surcharge loading. The wingwalls and backwall are also unreinforced and therefore have limited flexural capacity. See additional photos in the attached "Additional Photos" section.

The proposed work to the North Abutment backwall and wingwalls includes:

- Full depth removal of the upper portion of the backwall and wingwalls.
- Installation of a new precast concrete backwall and bridge seat on the existing wingwalls, approximately 35-feet behind the existing backwall.
- Installation of a two girder "jump span" to span over the existing backwall and over the tipped portion of the Northwest Wingwall. The south end of the jump span will either be attached directly to the end of the existing girders or on new bolsters adjacent to the existing girders. The north end of the jump span will be placed on the new precast concrete bridge seat.



Northwest Wingwall Tilting Outward (Originally Battered Inward)

Spanning over the existing backwall and placing the new bridge seat on the existing wingwalls will alleviate horizontal live load surcharge loads on the wingwalls and backwalls and prevent further tipping. Although some excavation and modification to the existing structure is required, the work can be phased to reduce shut down lengths. Conceptual details of these repairs are shown in the attached Preliminary Repair Concept Plans.

Anticipated Construction Cost: \$xxxxxx



Crack in North Abutment at End of the West Girder, Up to 3" Wide

South Abutment – Rehabilitate Backwall and Wingwalls

The South Abutment backwall and wingwalls have several deficiencies that are recommended for repair:

- A full-height crack up to 3/4 inches wide directly behind the end of the east girder.
- Approximately 60% of the concrete along the face of the backwall is either delaminated or spalled with cracking throughout.
- Both wingwalls have large areas of delamination, cracking, and spalling throughout.

The proposed work at the South Abutment backwall consists of partial depth repairs at the cracked, delaminated, and spalled locations. Partial depth repairs will allow the wingwall to stay in place and will not require excavation or extensive removal of existing bridge members.

At the South Abutment wingwalls a wingwall tie-back system will be installed. The wingwall tie-back system will consist of a horizontal strip of reinforced concrete attached to upper portion of both wingwalls. The wingwalls will be tied together using steel rods attached to the reinforced concrete strips on each wingwall. The tie-back system will prevent the wingwalls from future tipping and will introduce ductility in the wingwalls. Conceptual details of these repairs are shown in the attached Preliminary Repair Concept Plans.

Anticipated Construction Cost: \$ xxxxxx for Backwall and \$ xxxxxx for Wingwalls

North and South Abutments – Rehabilitate Bridge Seats and Bearings

The primary function of the bridge seat and the bearings is to support the girders and transfer load down through the abutment. The primary concern is that these concrete bridge seats are unreinforced and support highly concentrated loads, and therefore the potential exists for non-ductile failure under the bearings. The acute corners of each abutment are of particular concern due to the significant skew of the bridge where the girder reactions are concentrated at the narrow nose of these unreinforced abutments). At both abutments, the concrete directly below the bridge seat is deteriorated and cracked with areas of delamination. At the North Abutment, the original “roller style” expansion bearings supporting the girders have failed and are falling apart. At the South Abutment, the existing fixed bearings are in satisfactory condition. See photos provided in the attached “Additional Photos” section.



View of South Abutment

The proposed work to the bridge seats includes:

- Removal of the existing concrete from the upper portion of the bridge seat and directly below the bearings.
- Installation of steel girder support bolsters.
- Encasement of the upper portion of the bridge seat with new concrete and reinforcing steel to improve ductility.
- Replacement of the existing bearings at the North Abutment with new fabric pad expansion bearings.

Conceptual details of these repairs are shown in the attached Preliminary Repair Concept Plans.

Anticipated Construction Cost: \$ xxxxxx North Abutment and \$ xxxxxx South Abutment

Existing Condition and Proposed Repairs – Piers

Replace Expansion Bearings

The original “roller style” expansion bearings supporting the girders at the north end of each span have failed and are falling apart.

The proposed work includes the replacement of the four failed expansions bearings with new fabric pad expansion bearings.

Anticipated Construction Cost: \$ xxxxxx



Failed Expansion Bearing at North Pier

Summary of Anticipated Construction Costs (Year 2019 Costs):

North Abutment:

Install New Jump Span, Bridge Seat, and Backwall: \$xxxxxx
Rehabilitate Bridge Seat: \$xxxxxx

South Abutment:

Rehabilitate Backwall: \$xxxxxx
Rehabilitate Bridge Seat: \$xxxxxx
Install Wingwall Tie-Back System: \$xxxxxx

Piers:

Replace Expansion Bearings: \$xxxxxx

Subtotal: \$xxxxxx

Mobilization: \$xxxxxx

10% Contingency: \$xxxxxx

Total Anticipated Construction Cost: \$xxxxxx



Additional Photos:



View of North Abutment



North Elevation of North Pier, South Pier Similar (Encased in 2008)



Heavy Deterioration at the Interface of Northwest Wingwall and Backwall



Heavy Deterioration in Bridge Seat at South Abutment

Pages 41 Thru 45 Removed

Bridge 7792 (M.P. 253.87)

Over Dickey Brook

Bridge Description

Bridge 7792 is a 65-foot, single span, through-plate-girder bridge with open timber deck built in 1910. It carries the Madawaska subdivision of the Maine Northern Railway over the Dickey Brook in Frenchville. The girders are supported on two reinforced concrete abutments. According to the 2018 inspection report the deck, superstructure, and channel elements are in “satisfactory” condition. The substructure is in “fair” condition with the Northeast Wingwall being in “serious” condition.

Both abutments are approximately 10 to 15 feet tall and appear to be unmodified based on the original plans. Since the superstructure is in satisfactory condition and load rates above 1.0, the proposed work for this bridge will focus on rehabilitation of the substructure.



Elevation View of North Abutment

Existing Condition and Proposed Repairs – North and South Abutments

Rehabilitate Bridge Seats

At both abutments, the girders are supported on concrete-encased built-up steel grillages. At all four corners, the concrete encasement is cracked and deteriorated and at some locations the steel grillages are broken. Additionally, there are shear cracks in the bridge seat directly below the grillages. See photos on next page and provided in the attached “Additional Photos” section.

The proposed work to the bridge seats consists of:

- Both Abutments – Replacement of the existing bearing grillages with new precast concrete pedestals.
- Both Abutments – Drill and grout horizontal steel bars into the bridge seat directly below the bearing pedestals.
- North Abutment – Remove existing expansion bearings and install new fabric pad bearings.

These repairs will improve the serviceability and increase the life of the bridge seats. Conceptual details of these repairs are shown in the attached Preliminary Repair Concepts Plans.

Anticipated Construction Cost: \$ xxxxxx North Abutment and \$ xxxxxx South Abutment



Deteriorated Concrete Around Grillage at Southwest Bearing

Rehabilitate Wingwalls

The Northeast Wingwall has a large area of deteriorated, spalled, and cracked concrete with exposed reinforcing steel. Several of the cracks are full-height, full-depth, and up to an inch wide. As a result of the advanced deterioration, the wingwall concrete is crumbling, with sections of the wingwall and leaning forward approximately six inches. See photos on next page and provided in the attached "Additional Photos" section

The Northwest Wingwall has a full-height crack which is surrounded by a two-foot wide area of delaminated and spalled concrete with exposed reinforcing. See photos on next page and provided in the attached "Additional Photos" section.

The proposed work to the wingwalls includes:

- Northeast Wingwalls - Removal of the loose “cobble” and unsound concrete. Partial depth encasement of the face and top of the wingwall with new concrete and reinforcing steel.
- Northwest Wingwall – Removal of unsound concrete and partial depth encasement of the face and top of the wingwall with new concrete and reinforcing steel.

While the Northeast Wingwall is severely deteriorated, with sections of shifting concrete, the wingwall appears to be globally stable overall. The proposed repairs will restore connectivity along the wingwalls and will arrest further deterioration and movement without extensive excavation or reconstruction. The proposed repairs to the Northwest Wingwall will prevent the deterioration from advancing to a level similar to the existing Northeast Wingwall. Conceptual details of these repairs are shown in the attached Preliminary Repair Concepts Plans.

Anticipated Construction Cost: \$ xxxxxx Northeast Wingwall and \$ xxxxxx Northwest Wingwall



Heavy Deterioration and Cracking at the Northeast Wingwall

Summary of Anticipated Construction Costs (Year 2019 Costs):

North Abutment:

Rehabilitate Bridge Seat: \$xxxxxx
Rehabilitate Northeast Wingwall: \$xxxxxx
Rehabilitate Northwest Wingwall: \$xxxxxx

South Abutment:

Rehabilitate Bridge Seat: \$xxxxxx

Subtotal: \$xxxxxx

Mobilization: \$xxxxxx

25% Contingency: \$xxxxxx

Total Anticipated Construction Cost: \$xxxxxx



Additional Photos:



Elevation View of South Abutment



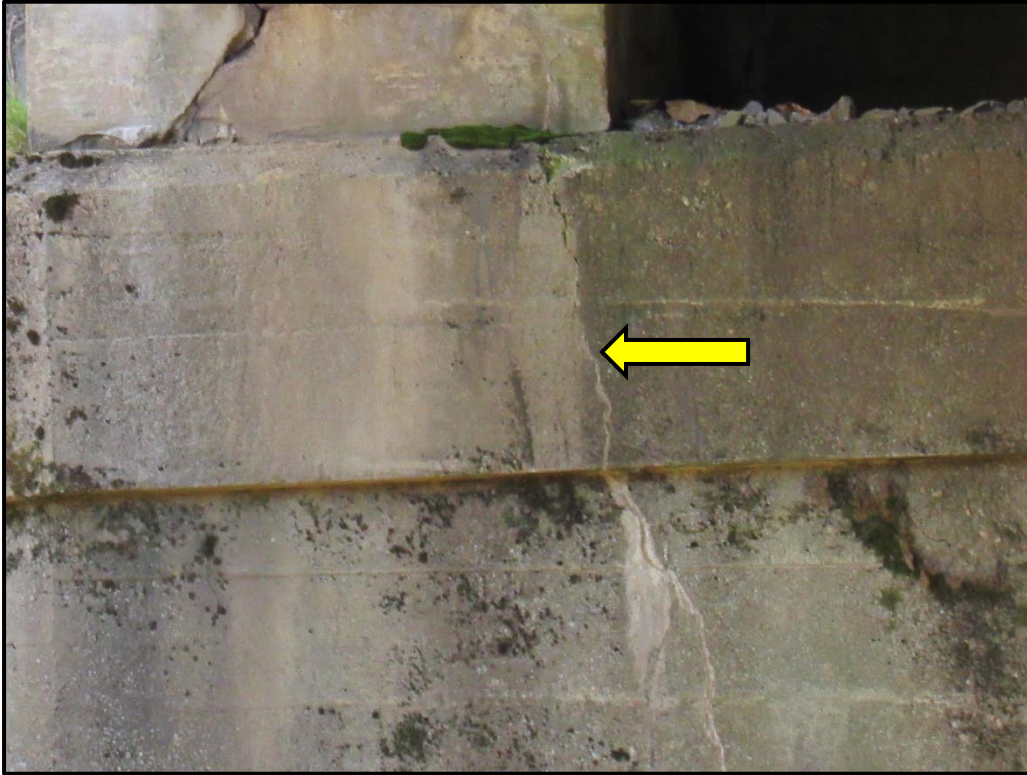
Heavy Deterioration and Cracks at the Northeast Wingwall



Spalled, Deteriorated, and Cracked Area at the Northwest Wingwall



Cracking in Bridge Seat Directly Under Southwest Bearing



Cracking in Bridge Seat Directly Under Northwest Bearing

Pages 54 Thru 55 Removed