Bridge Deficiency Evaluation and Repair Recommendations

Bridge Assessments
Charlemont, MA
March 31, 2016

Town of Charlemont

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1. BRIDGE CONDITIONS AND DEFICIENCY REVIEW

Bridge C-05-028, Maxwell Road over Maxwell Brook

Bridge Description: The bridge superstructure consists of a single 20'-8" long span between bearings of 6 steel beams that support a reinforced concrete deck. The roadway width is approximately 14 feet. The bridge substructure consists of concrete abutments and wingwalls that are supported on shallow foundation footings. The bridge was constructed circa 1939, and no original construction drawings are available.

Status: Bridge Closed.

Bridge Load Rating: The bridge was last load rated in 1985 when the bridge was in fair to satisfactory condition and did not require a posted weight limit. The bridge was closed to traffic due to severe deterioration in December of 2015.

Bridge Design Load: The bridge was designed for a H15 (15 ton 2 axle) truck.

Deck Condition: **Poor** per 12/28/2015 MassDOT Routine Inspection.

Superstructure Condition: **Serious** per 12/28/2015 MassDOT Routine Inspection.

Substructure Condition: Satisfactory per 12/28/2015 MassDOT Routine Inspection.

Severe Deficiencies include the deck, the steel beams, the paint system, and the traffic safety features. The bridge is closed due to severe deterioration of the steel beams. The bridge deck exhibits severe spalling (broken concrete) at numerous locations with a full depth hole at one location. The deck's reinforcing steel has heavy corrosion with section losses of up to 50%. The steel beams have severe corrosion with extensive holes through the bottom flanges and webs at numerous beam ends. The bottom flanges of the exterior beams have severe section losses running full length. The interior beams also have severe bottom flange corrosion extended up to 7' feet from the beam ends. The paint corrosion protection system has failed leaving most of the steel exposed and corroding. The bridge approach railing, transitions and terminations are in poor condition and do not comply with current standards.

Bridge C-05-028: Severe Corrosion of Steel

Minor Deficiencies include the bridge deck curbs, bridge railings, bearing devices, and steel beam alignment. The concrete curbs on the bridge have scaling (shallow broken concrete) that is about 1" deep. The east bridge railing is detached from the first post at the north end. The steel bearing plates are heavily corroded and many of the anchor bolts have severe corrosion. Pack rust has formed above the top flanges of the beams creating a gap between the flange and deck at the interior beams.

Bridge C-05-030, Maxwell Road over Maxwell Brook

Bridge Description: The bridge superstructure consists of a single 18'-3" long span between bearings of 6 steel beams that support a reinforced concrete deck and asphalt wearing surface. The bridge substructure consists of concrete abutments and wingwalls that are supported on shallow foundation footings. The bridge was constructed circa 1939 per the original construction drawings.

Status: Bridge Open – No Restrictions.

Bridge Load Rating: The bridge was last load rated in 1982 when the bridge was in fair to good condition and did not require a posted weight limit.

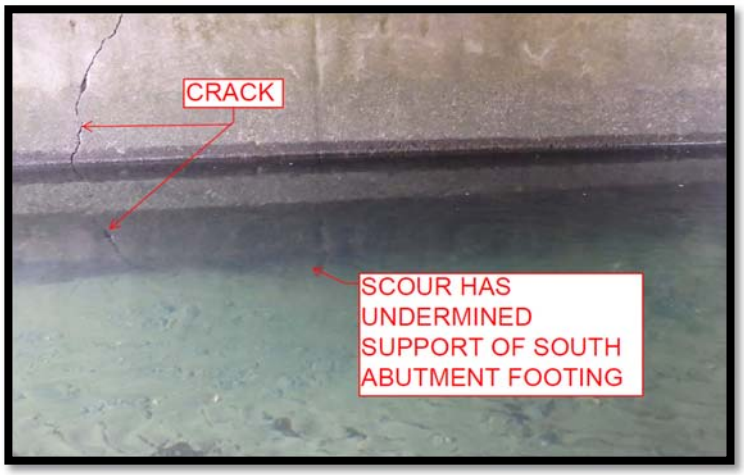
Bridge Design Load: The bridge was designed for a H15 (15 ton 2 axle) truck.

Deck Condition: Satisfactory per 12/28/2015 MassDOT Routine & Special Member Inspection

Superstructure Condition: **Serious** per 12/28/2015 MassDOT Routine & Special Member Inspection.

Substructure Condition: **Poor** per 12/28/2015 MassDOT Routine & Special Member Inspection.

Severe Deficiencies include severe corrosion of the steel beams, scour of the waterway channel and south abutment footing, cracking of the south abutment breastwall and through the footing due to undermining, severe corrosion of the steel bearing plates, the paint system is failing, and the bridge and approach railing system is missing the timber rails and some of concrete posts are either broken or tipped.



Bridge C-05-030: South Abutment Footing Scour

Bridge C-05-030: Severe Corrosion of Steel

Minor Deficiencies include cracking and patching of the asphalt wearing surface and aggradation (gravel buildup) in the northern half of the waterway channel.

Bridge No. C-05-047, Route 8A (North Heath Road) over Mill Brook

Bridge Description: The bridge superstructure consists of a single 54'-5" long span between bearings of 6 steel beams that support a reinforced concrete deck and asphalt wearing surface. The bridge substructure consists of concrete abutments and wingwalls that are supported on shallow foundation footings. The bridge was constructed circa 1939 per the original construction drawings.

Status: Bridge Open – Posted Weight & Width Restrictions.

Bridge Load Rating: The bridge was last load rated in 2014, which is the basis for the current posted weight limit of 13 tons, 16 tons, and 23 tons for the 2, 3, and 5 axle trucks, respectively. Concrete barriers have been placed near the curb lines in order to isolate the exterior beams from traffic, otherwise the posted weight limit would be much lower.

Bridge Design Load: The bridge was designed for a H15 (15 ton 2 axle) truck.

Deck Condition: Satisfactory per 4/6/2015 MassDOT Routine Inspection

Superstructure Condition: Satisfactory per 4/6/2015 MassDOT Routine Inspection.

Substructure Condition: Fair per 4/6/2015 MassDOT Routine Inspection.

Severe Deficiencies include the paint system failure below the deck drains and the remainder of the paint system is in the process of failing. The exterior beams have extensive corrosion in the vicinity of the deck drains. The posted weight limit is governed by the capacity of the interior steel beams 2 and 5.

Bridge C-05-047: Severe Corrosion Beam 6

Minor Deficiencies include the railing system, the bearing plates, and the abutments and wingwalls. Several of the railing system anchor bolt nuts are corroding or broken off and the east and west railings have sections of bent rails and posts. The north abutment bridge seat has heavy deterioration at Beam 1 with undermining of the bearing and 1 anchor bolt is missing. Other bearings have bent or broken off anchor bolts. Moderate to heavy concrete deterioration is also noted at all four of the wingwalls.

Bridge No. C-05-034, Route 8A (North Heath Road) over Maxwell Brook

Bridge Description: The bridge superstructure consists of a single 48' long span between bearings of 7 steel beams that support a reinforced concrete deck and asphalt wearing surface. The bridge substructure consists of concrete abutments and wingwalls that are supported on shallow foundation footings. The bridge was constructed circa 1939 per the original construction drawings.

Status: Bridge Open – No Weight Restrictions, but with Width Restrictions.

Bridge Load Rating: The bridge was last load rated in 2014 and there is currently no posted weight limit. Concrete barriers have been placed near the curb lines in order to isolate the exterior beams from traffic, otherwise a posted weight limit would have been implemented.

Bridge C-05-034: Corrosion of Beam 1

Bridge Design Load: The bridge was designed for a H20 (20 ton 2 axle) truck.

Deck Condition: Satisfactory per 4/6/2015 MassDOT Routine Inspection

Superstructure Condition: Fair per 4/6/2015 MassDOT Routine Inspection.

Substructure Condition: Satisfactory per 4/6/2015 MassDOT Routine Inspection.

Severe Deficiencies were not reported in the MassDOT inspection report.

Minor Deficiencies include the deck drainage system, the steel beams, the paint system, and the wingwalls. The deck drains allow direct discharge of water onto the exterior steel beams. The exterior steel beams have extensive corrosion due to water exposure. The paint system has failed below the deck drains. Heavy abutment seat and breast wall deterioration has occurred at the junction with the southwest wingwall, resulting in undermining of the bearing at Beam 6. Moderate to heavy concrete deterioration is also noted at all four of the wingwalls.

Bridge No. C-05-002, Zoar Road over Pelham Brook

Bridge Description: The bridge superstructure consists of a single 47'-1" long span between bearings of 6 steel beams that support a reinforced concrete deck and asphalt wearing surface. The bridge substructure consists of concrete abutments and wingwalls that are supported on shallow foundation footings. The bridge was constructed circa 1939 per the original construction drawings.

Status: Bridge Open – No Restrictions.

Bridge Load Rating: The bridge was last load rated in 1980, which is the basis for the bridge not having a posted weight limit.

Bridge Design Load: The bridge was designed for a H20 (20 ton 2 axle) truck.

Deck Condition: Satisfactory per 10/17/2014 MassDOT Routine Inspection

Superstructure Condition: Satisfactory per 10/17/2014 MassDOT Routine Inspection.

Substructure Condition: Satisfactory per 10/17/2014 MassDOT Routine Inspection.

Severe Deficiencies were not reported in the MassDOT inspection report.

Minor Deficiencies include the paint system, and the wingwalls. The paint system is failing along the bottom flange edges and where previous leakage of water through the now repaired deck in bays 2 through 4 caused steel corrosion. The abutment seats, breastwalls, and adjacent wingwalls have heavy deterioration at all four corners. Roadway water drains onto the bridge seats at each corner of the bridge leading to this deterioration. Moderate to heavy concrete deterioration is also noted at all four of the wingwalls.

Bridge C-05-002: Wingwall Deterioration

Bridge No. C-05-027, South River Road over Albee Brook

Bridge Description: The bridge superstructure consists of a single span 8 steel beams that support a reinforced concrete deck and asphalt wearing surface. The original portion of the bridge had 6 steel beams with a span length of 21' between bearings. The bridge was later widened on the south side by adding 2 additional beams with span lengths of 22'-4" and 28'-2" between bearings. The bridge substructure consists of concrete abutments and wingwalls that are supported on shallow foundation footings. The bridge was constructed circa 1939 and widened circa 1962 per the original construction drawings.

Status: Bridge Open – No Restrictions.

Bridge Load Rating: The bridge was last load rated in 1982 and the bridge does not have a posted weight limit.

Bridge Design Load: The bridge was designed for a H15 (15 ton 2 axle) truck.

Deck Condition: **Poor** per 11/25/2014 MassDOT Routine & Special Member Inspection

Superstructure Condition: Satisfactory per 11/25/2014 MassDOT Routine & Special Member Inspection.

Substructure Condition: Satisfactory per 11/25/2014 MassDOT Routine & Special Member Inspection.

Severe Deficiencies include the bridge deck and railing system. The deck has extensive spalling (cracked concrete) with exposed severely corroded reinforcing steel. The deck has been patched and the patches are delaminating from the surrounding concrete. The bridge railing is missing many sections of timber rails and the remaining timber rails are rotted and split.

Bridge C-05-027: Deck and Paint System Deterioration

Minor Deficiencies include the paint system, and the steel bearings. The paint system is peeling at numerous locations. The steel bearing plates are corroding and at least 1 anchor bolt has corroded away.

Bridge No. C-05-010, Route 8A (West Hawley Road) over Deerfield River

Bridge Description: The bridge superstructure consists of 4 continuous 75' long spans of 5 steel beams that support an exposed reinforced concrete deck. The bridge substructure consists of concrete abutments and wingwalls that are supported on shallow foundation footings. The bridge was constructed circa 1939 and widened circa 1962 per the original construction drawings.

Status: Bridge Open – No Restrictions.

Bridge Load Rating: The bridge was last load rated in 1984, which is the basis for the bridge not having a posted weight limit.

Bridge Design Load: The bridge was designed for a H15 (15 ton 2 axle) truck.

Deck Condition: Fair per 6/12/2015 MassDOT Routine Inspection.

Superstructure Condition: Satisfactory per 6/12/2015 MassDOT Routine Inspection.

Substructure Condition: Satisfactory per 6/12/2015 MassDOT Routine Inspection.

Severe Deficiencies include the bridge deck wearing surface and the bridge deck joints. At some point in the past, the bridge deck was given a thin epoxy wearing surface overlay that had fine aggregate embedded in it. The vast majority of this wearing surface has worn away leaving a bare deck. The bridge deck has areas of exposed reinforcing steel where potholes up to 3' in diameter and 2" deep have formed. Some potholes have been patched and cracking of the patches was observed. The underside of the deck where it overhangs the exterior beams has extensive spalling (cracked concrete) with exposed corroded reinforcing steel primarily where drainage scuppers are located. The deck joints are located at each abutment. The deck joint seals have torn and have pulled free from their supports, particularly at the south abutment. This has allowed a significant amount of sand and debris to accumulate on the bridge seat and steel beam ends.

Bridge C-05-010: Deck Deterioration and Failed Joint Seal

Minor Deficiencies include the bridge deck, steel beam bearings, approach roadway pavement, and debris (trees) that have lodged against Piers 1 and 2. The bridge deck has full width transverse cracking, delaminated patches, and spalling (broken concrete) up to 2" deep. The paint system is peeling at numerous locations. The steel bearing plates are corroding with numerous missing or bent anchor bolts at the abutments.

Bridge C-05-054, Legate Hill Road over Legate Hill Brook

Bridge Description: The bridge superstructure consists of a single 12'-10" long span between bearings of 9 steel beams that support an asphalt filled corrugated metal deck. The railing system consists of steel W beam guardrail that spans over the bridge without posts attached to the deck. The deck width is approximately 19 feet. The bridge substructure consists of concrete abutments and flared wingwalls that appear to be supported on shallow foundation footings. The bridge construction date is not documented as no original construction drawings are available. It appears that the steel beams may have been salvaged from another structure as the bridge seats are longer than required and have unused anchor bolts likely from a previous superstructure.

Status: Bridge Open – No Restrictions.

Bridge Load Rating: The bridge has not been load rated by MassDOT as the bridge was not listed within MassDOT's non-NBIS inventory until recently. MassDOT District 1 staff indicate that a load rating will be requested.

Bridge Design Load: The bridge design load is unknown.

Deck Condition: The MassDOT March 2016 Initial/Routine Inspection is not yet available.

Superstructure Condition: The MassDOT March 2016 Initial/Routine Inspection is not yet available.

Substructure Condition: The MassDOT March 2016 Initial/Routine Inspection is not yet available.

Severe Deficiencies include severe corrosion of the corrugated metal deck above both ends of Beam 5 and the severe corrosion of the ends of Beam 5 directly beneath. The top flange of Beam 5 is mostly corroded away and the web has advanced section loss with holes up to 10" long and 1" high. The bottom flange also has little remaining area for a length of about 4'. The corrosion protection system has failed leaving large areas of the steel with little or no remaining paint.

Bridge C-05-054: Beam 5 End Corrosion and Corrugated Deck Deterioration

Minor Deficiencies include the bridge railing as it is not attached to the bridge and does not comply with current standards. There is no curbing on the bridge that would prevent water from running onto the exterior beams. The steel bearing plates are heavily corroded. The corrugated metal decking is prone to corrosion as water becomes trapped at the troughs.

2. RECOMMENDED REPAIRS

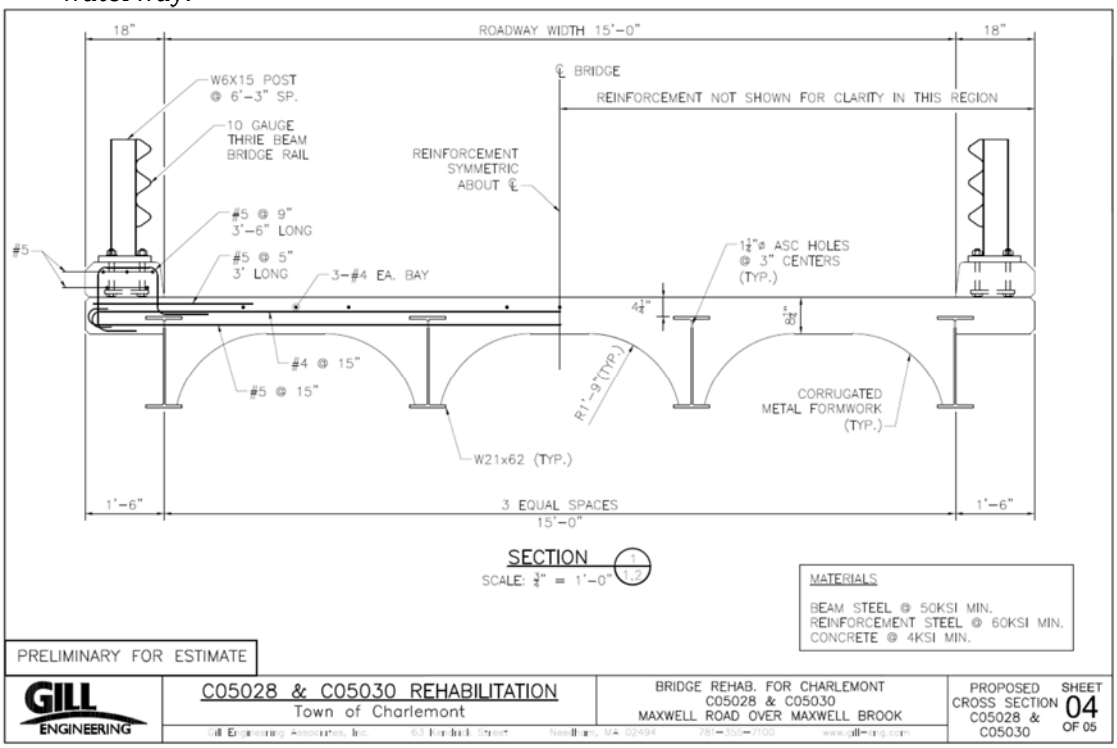
Bridge C-05-028, Maxwell Road over Maxwell Brook

Superstructure Replacement: The bridge's superstructure (steel beams and deck) is in serious condition as a result of severe corrosion of the steel beams and deterioration of the concrete deck. The extent of these deficiencies has rendered the existing superstructure unsuitable for rehabilitation. The existing substructure is in satisfactory condition and is considered suitable for reuse based upon its condition. Recommendation: Replace the existing superstructure with 4 steel beams and an arched concrete deck. The proposed railing system is metal thrie beam guardrail which will be carried through the approaches at all four corners and terminated. Analysis of the existing substructure will be required to verify its stability for the proposed superstructure replacement.

Estimated Construction Cost: $160,000.
Estimated Design Engineering Cost: $24,000.
Estimated Permitting Cost: $5,000.
Estimated Construction Engineering & Inspection Cost: $15,000.
Estimated Total Cost: $204,000.

Anticipated Permitting Requirements:

- File a Request for Determination of Applicability (RDA) with the Charlemont Conservation Commission. It is assumed that the Conservation Commission will make a negative determination stating the work is not subject to regulation under the Wetlands Protection Act. The proposed superstructure replacement will not require extensive work in the waterway.



Bridge C-05-028 & C-05-030 Proposed Superstructure Replacement Cross Section

Bridge C-05-030, Maxwell Road over Maxwell Brook

Superstructure Replacement and Replacement of South Abutment: The bridge's superstructure (steel beams and deck) is in serious condition as a result of severe corrosion of the steel beams and deterioration of the concrete deck. Extensive scour of the south abutment footing has occurred resulting in undermining of the footing and cracking of the abutment breastwall and footing above the undermining. The main flow of the channel is directed along the south abutment. The extent of these deficiencies has rendered the existing superstructure and south abutment unsuitable for rehabilitation. The existing north abutment is in satisfactory condition and is considered suitable for reuse based upon its condition. Recommendation: Replace the existing superstructure with 4 steel beams and an arched concrete deck. The proposed railing system is metal thrie beam guardrail which will be carried through the approaches at all four corners and terminated. Replace the south abutment roughly 10' south of the existing abutment and place riprap scour protection. Analysis of the existing north abutment will be required to verify its stability for the proposed loads from the new superstructure.

Estimated Construction Cost: $226,000.
Estimated Design Engineering Cost: $34,000.
Estimated Permitting Cost: $5,000.
Estimated Construction Engineering & Inspection Cost: $21,000.
Estimated Total Cost: $286,000.

Anticipated Permitting Requirements:

- File a Request for Determination of Applicability (RDA) with the Charlemont Conservation Commission. It is assumed that the Conservation Commission will make a negative determination stating the work is not subject to regulation under the Wetlands Protection Act. The proposed superstructure replacement will not require extensive work in the waterway.

Bridge C-05-047, Route 8A/North Heath Road over Mill Brook

Steel Repairs: The bridge's exterior steel beams have extensive corrosion and loss of steel section due to deck leakage and drainage from the scuppers directly discharging roadway water onto the steel. Recommendation: Strengthen the existing bottom flanges of the exterior beams. Implementation of this recommendation would allow for the removal of the existing temporary concrete barrier that is currently in place to limit loading of the exterior beams. The bridge would still require a posted weight limit of approximately 15, 17, and 25 tons for the 2 axle, 3 axle, and 5 axle trucks respectively. It would also be necessary to strengthen the interior beams (Beams 2 through 5) in order to be able to remove the posted weight limit as the bridge was designed to support 15 ton 2 axle truck loads. It is noted that strengthening the bottom flanges by adding bottom flange cover plates would be difficult as the extent of the corrosion would make effective attachment of the new cover plates difficult. For this reason, strengthening the beams using a system of anchored tension rods is preferred. The following preliminary cost estimate assumes that only the exterior beams will be repaired.

Estimated Construction Cost: $75,000.
Estimated Design Engineering Cost: $12,000.
Estimated Permitting Cost: $5,000.
Estimated Construction Engineering & Inspection Cost: $8,000.
Estimated Total Cost: $100,000.

Anticipated Permitting Requirements:

- File a Request for Determination of Applicability (RDA) with the Charlemont Conservation Commission. It is assumed that the Conservation Commission will make a negative determination stating the work is not subject to regulation under the Wetlands Protection Act. The proposed steel repairs will not require extensive work in the waterway.

Cleaning and Painting of the Structural Steel: Recommended as a preservation activity to extend the service life of the bridge and minimize the need for potential future steel repairs.

Estimated Construction Cost: $155,000.
Estimated Design Engineering Cost: $23,000.
Estimated Permitting Cost: $0 if filed concurrent with steel repair RDA, otherwise $3000.
Estimated Construction Engineering & Inspection Cost: $14,000.
Estimated Total Cost: $192,000.

Anticipated Permitting Requirements:

- File a Request for Determination of Applicability (RDA) with the Charlemont Conservation Commission. It is assumed that the Conservation Commission will make a negative determination stating the work is not subject to regulation under the Wetlands Protection Act. The cleaning and painting of the steel will not require extensive work in the waterway.

Repair Deteriorated Substructure Concrete: Moderate to heavy localized abutment and wingwall deterioration has occurred. Recommendation: Remove and replace deteriorated substructure concrete. Provide temporary shoring of Beam 1 at the north abutment in order to perform concrete repairs at the bridge seat where the bearing is partially undermined.

Estimated Construction Cost: $95,000.
Estimated Engineering Cost: $14,000.
Estimated Permitting Cost: $0 if filed concurrent with steel repair RDA, otherwise $3000.
Estimated Construction Engineering & Inspection Cost: $9,000.
Estimated Total Cost: $121,000.

Anticipated Permitting Requirements:

- File a Request for Determination of Applicability (RDA) with the Charlemont Conservation Commission. It is assumed that the Conservation Commission will make a negative determination stating the work is not subject to regulation under the Wetlands Protection Act.

Repair Deteriorated Deck Concrete & Eliminate Deck Drains: Although not urgent, moderate deterioration of the deck concrete has occurred in the vicinity of the deck drains. Elimination of the deck drains will prevent future roadway drainage from spilling onto the steel beams and causing corrosion. Recommendation: Remove and replace the deck concrete in order to eliminate the deck drains.

Estimated Construction Cost: $35,000.
Estimated Engineering Cost: $5,000.
Estimated Permitting Cost: $$0 if filed concurrent with steel repair RDA, otherwise $3000.
Estimated Construction Engineering & Inspection Cost: $3,000.

Estimated Total Cost: $46,000.

Anticipated Permitting Requirements:

- File a Request for Determination of Applicability (RDA) with the Charlemont Conservation Commission. It is assumed that the Conservation Commission will make a negative determination stating the work is not subject to regulation under the Wetlands Protection Act.

Bridge C-05-034, Route 8A/North Heath Road over Maxwell Brook

Steel Repairs: The bridge's exterior steel beams have extensive corrosion and loss of steel section due to deck leakage and drainage from the scuppers directly discharging roadway water onto the steel. Recommendation: Strengthen the existing bottom flanges of the exterior beams. Implementation of this recommendation would allow for the removal of the existing temporary concrete barrier that is currently in place to limit loading of the exterior beams. If implemented, these repairs would allow the bridge to not require a posted weight limit as the bridge was designed to support 20 ton 2 axle truck loads. It is noted that strengthening the bottom flanges by adding bottom flange cover plates would be difficult as the extent of the corrosion would make effective attachment of the new cover plates difficult. For this reason, strengthening the beams using a system of anchored tension rods is preferred.

Estimated Construction Cost: $75,000.
Estimated Design Engineering Cost: $12,000.
Estimated Permitting Cost: $5,000.
Estimated Construction Engineering & Inspection Cost: $8,000.
Estimated Total Cost: $100,000.
Anticipated Permitting Requirements:

- File a Request for Determination of Applicability (RDA) with the Charlemont Conservation Commission. It is assumed that the Conservation Commission will make a negative determination stating the work is not subject to regulation under the Wetlands Protection Act. The proposed steel repairs will not require extensive work in the waterway.

Cleaning and Painting of the Structural Steel: Recommended as a preservation activity to extend the service life of the bridge and minimize the need for potential future steel repairs.

Estimated Construction Cost: $149,000.
Estimated Design Engineering Cost: $22,000.
Estimated Permitting Cost: $0 if filed concurrent with steel repair RDA, otherwise $3000.
Estimated Construction Engineering & Inspection Cost: $14,000.
Estimated Total Cost: $188,000.

Anticipated Permitting Requirements:

- File a Request for Determination of Applicability (RDA) with the Charlemont Conservation Commission. It is assumed that the Conservation Commission will make a negative determination stating the work is not subject to regulation under the Wetlands Protection Act. The cleaning and painting of the steel will not require extensive work in the waterway.

Repair Deteriorated Substructure Concrete: Moderate to heavy abutment and wingwall deterioration has occurred, particularly at the south end of the west abutment and the adjoining

southwest wingwall. Recommendation: Remove and replace deteriorated substructure concrete. Provide temporary shoring of Beam 6 at the west abutment in order to perform concrete repairs at the bridge seat where the bearing is partially undermined.

Estimated Construction Cost: $53,000.
Estimated Engineering Cost: $8,000.
Estimated Permitting Cost: $0 if filed concurrent with steel repair RDA, otherwise $3000.
Estimated Construction Engineering & Inspection Cost: $5,000.
Estimated Total Cost: $69,000.

Anticipated Permitting Requirements:

- File a Request for Determination of Applicability (RDA) with the Charlemont Conservation Commission. It is assumed that the Conservation Commission will make a negative determination stating the work is not subject to regulation under the Wetlands Protection Act.

Repair Deteriorated Deck Concrete & Eliminate Deck Drains: Moderate deterioration of the deck concrete has occurred in the vicinity of the deck drains. Elimination of the deck drains will prevent future roadway drainage from spilling onto the steel beams and causing corrosion. Recommendation: Remove and replace the deck concrete in order to eliminate the deck drains.

Estimated Construction Cost: $35,000.
Estimated Engineering Cost: $5,000.
Estimated Permitting Cost: $$0 if filed concurrent with steel repair RDA, otherwise $3000.
Estimated Construction Engineering & Inspection Cost: $3,000.
Estimated Total Cost: $46,000.

Anticipated Permitting Requirements:

- File a Request for Determination of Applicability (RDA) with the Charlemont Conservation Commission. It is assumed that the Conservation Commission will make a negative determination stating the work is not subject to regulation under the Wetlands Protection Act.

Bridge C-05-002, Zoar Road over Pelham Brook

Cleaning and Painting of the Structural Steel: Recommended as a preservation activity to extend the service life of the bridge and minimize the need for potential future steel repairs.

Estimated Construction Cost: $201,000.
Estimated Design Engineering Cost: $30,000.
Estimated Permitting Cost: $3000.
Estimated Construction Engineering & Inspection Cost: $18,000.
Estimated Total Cost: $252,000.

Anticipated Permitting Requirements:

- File a Request for Determination of Applicability (RDA) with the Charlemont Conservation Commission. It is assumed that the Conservation Commission will make a negative

determination stating the work is not subject to regulation under the Wetlands Protection Act. The cleaning and painting of the steel will not require extensive work in the waterway.

Repair Deteriorated Substructure Concrete: Moderate to heavy abutment and wingwall deterioration has occurred, particularly where the exterior beams are supported at each abutment where they meet the wingwalls. Recommendation: Remove and replace deteriorated substructure concrete. Provide temporary shoring of each exterior beam end at each abutment in order to perform concrete repairs at the bridge seat where the bearings may become partially undermined.

Estimated Construction Cost: $125,000.
Estimated Engineering Cost: $19,000.
Estimated Permitting Cost: $0 if filed concurrent with steel painting RDA, otherwise $3000.
Estimated Construction Engineering & Inspection Cost: $11,000.
Estimated Total Cost: $158,000.

Anticipated Permitting Requirements:

- File a Request for Determination of Applicability (RDA) with the Charlemont Conservation Commission. It is assumed that the Conservation Commission will make a negative determination stating the work is not subject to regulation under the Wetlands Protection Act.

Bridge C-05-027, South River Road over Pelham Brook

Replace Bridge Deck: The existing bridge deck is in poor condition, with heavy spalling (cracked concrete), exposed reinforcing steel that is severely corroded at various locations, and concrete repair patches that have de-bonded from the surrounding concrete. The bridge railing is also severely deficient. Recommendation: Replace the existing reinforced concrete bridge deck and railing system. The proposed deck will conform to MassDOT standards and the proposed railing system is metal thrie beam guardrail which will be carried through the approaches at all four corners and terminated.

Estimated Construction Cost: $175,000.
Estimated Design Engineering Cost: $30,000.
Estimated Permitting Cost: $3000.
Estimated Construction Engineering & Inspection Cost: $20,000.
Estimated Total Cost: $228,000.

Anticipated Permitting Requirements:

- File a Request for Determination of Applicability (RDA) with the Charlemont Conservation Commission. It is assumed that the Conservation Commission will make a negative determination stating the work is not subject to regulation under the Wetlands Protection Act. The replacement of the existing bridge deck will not require extensive work in the waterway.

Cleaning and Painting of the Structural Steel: Recommended as a preservation activity to extend the service life of the bridge and minimize the need for potential future steel repairs.

Estimated Construction Cost: $62,000.
Estimated Design Engineering Cost: $9,000.

Estimated Permitting Cost: $0 if filed concurrent with deck replacement RDA, otherwise $3000.
Estimated Construction Engineering & Inspection Cost: $6,000.
Estimated Total Cost: $80,000.

Anticipated Permitting Requirements:

- File a Request for Determination of Applicability (RDA) with the Charlemont Conservation Commission. It is assumed that the Conservation Commission will make a negative determination stating the work is not subject to regulation under the Wetlands Protection Act.

Bridge No. C-05-010, Route 8A (West Hawley Road) over Deerfield River

Perform Bridge Deck Rehabilitation: The bridge deck has areas of exposed reinforcing steel where potholes up to 3' in diameter and 2" deep have formed. Some potholes have been patched and cracking of the patches was observed. The underside of the deck where it overhangs the exterior beams has extensive spalling (cracked concrete) with exposed corroded reinforcing steel primarily where drainage scuppers are located. Recommendation: Replace the reinforced concrete deck overhang and first interior deck bay on each side of the bridge. Perform hydro-excavation of the remainder of the deck to remove deteriorated concrete, followed by placement of rapid setting durable deck repair concrete that will also function as the riding surface. The proposed bridge cross section would consist of two 12' wide travel lanes and 18" wide safety curbs and thrie beam bridge railing on each side. Replace deck joints at each end of the bridge. It is proposed that this work be performed in 2 stages while maintaining a single reversible lane during construction using temporary traffic signals.

Estimated Construction Cost: $950,000.
Estimated Design Engineering Cost: $145,000.
Estimated Permitting Cost: $3000.
Estimated Construction Engineering & Inspection Cost: $90,000.
Estimated Total Cost: $1,188,000.

Anticipated Permitting Requirements:

- File a Request for Determination of Applicability (RDA) with the Charlemont Conservation Commission. It is assumed that the Conservation Commission will make a negative determination stating the work is not subject to regulation under the Wetlands Protection Act. The repair and partial replacement of the existing bridge deck will not require extensive work in the waterway.

Cleaning and Painting of the Structural Steel: Recommended as a preservation activity to extend the service life of the bridge and minimize the need for potential future steel repairs.

Estimated Construction Cost: $710,000.
Estimated Design Engineering Cost: $35,000.
Estimated Permitting Cost: $0 if filed concurrent with deck replacement RDA, otherwise $3000.
Estimated Construction Engineering & Inspection Cost: $65,000.
Estimated Total Cost: $813,000.

Anticipated Permitting Requirements:

- File a Request for Determination of Applicability (RDA) with the Charlemont Conservation Commission. It is assumed that the Conservation Commission will make a negative determination stating the work is not subject to regulation under the Wetlands Protection Act.

Add Shared Use Path: The existing bridge lacks a sidewalk to accommodate non-vehicular traffic. Gill Engineering staff were asked to consider ways in which a shared use path could be added to the bridge in order to accommodate pedestrian and bicycle traffic. The existing piers are not long enough to provide space where additional steel beams could be readily supported. Alternate support methods were considered, including the addition of steel columns attached to the existing pier walls or footings, or supported on extensions of the existing pier footings. Although feasible, these options are considered too vulnerable to damage from woody debris being transported by the river during high flows. In addition, the steel would be vulnerable to corrosion damage. A more appropriate solution would be to construct a reinforced concrete extension to each pier. These extensions would need to be about 13' in length in order to support a superstructure appropriate for a 10' wide shared use path. An additional alternate considered would be to build a cantilevered support beam at the top of each pier. This cantilevered beam would be attached to the existing bridge superstructure along the centerline of bearings atop each pier and could be constructed of reinforced concrete or structural steel. No detailed structural design of either support option has been performed at this point. The following order of magnitude costs have been estimated:

10' Wide Shared Use Path Bridge Supported on Pier Extensions: $1.5 Million
10' Wide Shared Use Path Bridge Supported on Cantilevered Beams at Each Pier: $1 Million

Each alternate would require modifications to the flared wingwalls located at each abutment. It was assumed that the shared use path bridge superstructure would consist of a reinforced concrete deck supported by two steel beams.

Bridge C-05-054, Legate Hill Road over Legate Hill Brook

Superstructure Replacement: The bridge's superstructure has areas of severe corrosion of the steel beams and corrugated metal deck. The corrugated metal decking is prone to corrosion that would require it to be replaced at regular intervals. The existing substructure is in satisfactory condition and is considered suitable for reuse based upon its condition. Recommendation: Replace the existing superstructure with 5 steel beams and an arched concrete deck. The proposed railing system is metal thrie beam guardrail which will be carried through the approaches at all four corners and terminated. Analysis of the existing substructure will be required to verify its stability for the proposed superstructure replacement.

Estimated Construction Cost: $124,000.
Estimated Design Engineering Cost: $19,000.
Estimated Permitting Cost: $5,000.
Estimated Construction Engineering & Inspection Cost: $12,000.
Estimated Total Cost: $160,000.

Anticipated Permitting Requirements:

- File a Request for Determination of Applicability (RDA) with the Charlemont Conservation Commission. It is assumed that the Conservation Commission will make a negative

determination stating the work is not subject to regulation under the Wetlands Protection Act. The proposed superstructure replacement will not require extensive work in the waterway.

It is possible that the Legate Hill Brook bridge could be closed as a result of the first inspection performed by MassDOT in March 2016, or as a result of load rating the bridge. In the interim, it is recommended that heavy timber blocking be installed on top of the bridge seats on each side of Beam 5. These temporary repairs should be designed to provide an alternate load path in case the ends of Beam 5 were to buckle or the corrugated metal decking were to fail where it bears upon the top flange of Beam 5 near the abutments.

3. REPAIR PRIORITIES AND COST ESTIMATES

Table 1 presents our prioritized listing of recommended deficiency repairs ranked from most to least urgent, the estimated total project cost of each repair, and the priority classification of each repair. The repairs classified as High Priority would upgrade the poor or serious condition rating for the bridge element in question and eliminate the Structurally Deficient designation for each bridge. The Median Priority repairs would increase the carrying capacity of the bridge to near legal capacity and substantially increase or potentially eliminate the current posted weight limit. The Low Priority repairs would preserve the bridge and prevent the bridge from becoming Structurally Deficient for many years.

Table 1 – Prioritized Recommended Repairs

Repair Description	Estimated Project Cost	Priority
Maxwell Road Bridge C-05-028: Perform Superstructure Replacement	$204,000	High
Maxwell Road Bridge C-05-030: Perform Superstructure and South Abutment Replacement	$286,000	High
Legate Hill Road Bridge C-05-054: Perform Superstructure Replacement	$160,000	High
South River Road Bridge C-05-027: Perform Deck Replacement and Clean and Paint Structural Steel	$308,000	High
North Heath Road Bridge C-05-047: Perform Steel, Substructure, and Deck Repairs, Clean and Paint Structural Steel	$459,000	Medium
North Heath Road Bridge C-05-034: Perform Steel, Substructure, and Deck Repairs, Clean and Paint Structural Steel	$403,000	Medium
West Hawley Road Bridge C-05-010: Perform Deck Rehabilitation and Clean and Paint Structural Steel	$2,000,001	Low
Zoar Road Bridge C-05-002: Perform Substructure Repairs and Clean and Paint Structural Steel	$410,000	Low