Municipal Bridge Preservation Projects
MGL Chapter 85 Section 35 Review Process
Design Requirements and Submittals for Bridge Preservation Projects for both BRI (10 feet < span ≤ 20 feet) and NBI (20 feet < clear span) Structures

Note: If the Category of the Structure to be worked on is neither BRI nor NBI (i.e., span ≤ 10 feet), a Chapter 85 review is not required

Preservation Project Type	Hydraulic Design	Geotechnical Design	Structural Design	Construction Details	Design Review Submittals	Other Considerations
Cleaning and painting of Structural Steel (if performed without repairs)	Not required	Not required	Not required	Not required	Project Special Provisions	MGL and federal requirements for lead removal and air quality (see MassDOT specifications for Cleaning and Painting Structural Steel.
Concrete Deck Patching with or without applying waterproofing membranes and wearing surface	Not required	Not required	Not required. If reinforcing bars are deteriorated, provide additional reinforcing in kind and provide proper lap lengths with existing reinforcing. If changing wearing surface thickness from existing (either more OR less) perform a rating calculation to determine the change in load carrying capacity. Can use AASHTO Standard Specs.	Typical details showing limits of concrete deck chipping and forming deck repairs. If additional reinforcing steel is needed, show installation details along with lap lengths. Provide membrane details and wearing surface thickness.	Either a complete final set of Construction Plans (if used) or pages of typical details to be inserted into job Special Provisions (if "book job") as well as the job Special Provisions. If calculations are required, one set of design calculations checked by a second engineer. After MassDOT accepts the design, a complete final set of Construction Plan mylars or pages of typical details with the MassDOT Chapter 85 approval stamp printed on each sheet (page) for Bridge Engineer's signature.	Traffic control plan: close bridge during work or work in stages. If working in stages, provide barrier or other delineation of work zone. If more than 50% of deck area requires patching, consider a full deck replacement project instead.
Joint Sealing, Rehabilitation or Replacement	Not required	Not required	Not required if not reconstructing the end of deck. If reconstructing the end of deck, design any new deck configuration for wheel loads with Dynamic Allowance. Can use AASHTO Standard Specs.	Typical details showing all aspects of work, including limits of work, any demolition details and reconstruction details, new joint details.	Either a complete final set of Construction Plans (if used) or pages of typical details to be inserted into job Special Provisions (if "book job") as well as the job Special Provisions. If calculations are required, one set of design calculations checked by a second engineer. After MassDOT accepts the design, a complete final set of Construction Plan mylars or pages of typical details with the MassDOT Chapter 85 approval stamp printed on each sheet (page) for Bridge Engineer's signature.	Traffic control plan: close bridge during work or work in stages. If working in stages, provide barrier or other delineation of work zone or other temporary measures to allow work to be performed without impact to traffic.

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Rehabilitation, patching or protection of concrete abutments and piers	Not required	Not required	Not required. If reinforcing bars are deteriorated, provide additional reinforcing in kind and provide proper lap lengths with existing reinforcing. If work will undermine existing beam bearings or if pier cap reinforcing will be exposed, design temporary shoring in accordance with the AASHTO Handbook for Temporary Works to carry all dead loads, and live loads if bridge is open to traffic, that the member under repair sees. AASHTO Standard Specifications can be used.	Typical details showing limits of work, limits of concrete chipping and forming of repairs. If additional reinforcing steel is needed, show installation details along with lap lengths. If shoring is required, provide details of shoring including locations, foundation and member sizes.	Either a complete final set of Construction Plans (if used) or pages of typical details to be inserted into job Special Provisions (if "book job") as well as the job Special Provisions. If calculations are required, one set of design calculations checked by a second engineer. After MassDOT accepts the design, a complete final set of Construction Plan mylars or pages of typical details with the MassDOT Chapter 85 approval stamp printed on each sheet (page) for Bridge Engineer's signature.	If temporary shoring is to be designed by the Contractor, the Designer should provide loads to be used, shoring material and that the design should be in accordance with the AASHTO Standard Specifications and the AASHTO Handbook for Temporary Work. Permits are required for temporary shoring in wetland resource areas.
Structural Repairs to Steel Beams (can be combined with cleaning and painting Structural Steel)	Not required	Not required	Can use AASHTO Standard Specifications for either the original design truck or H20, whichever is greater. Design all replacement member sizes and connections for the load that it will see (dead and/or live load). Consider fatigue loading if applicable. Bolting should also consider sealing of plates edges. If a beam needs to be unloaded, design temporary shoring and jacking in accordance with the AASHTO Specifications and the AASHTO Handbook for Temporary Works.	Develop specific details for each repair location or alternatively, typical details that can be used in multiple locations. Details should show all member sizes, bolt sizes and spacing.	Either a complete final set of Construction Plans (if used) or pages of typical details to be inserted into job Special Provisions (if "book job") as well as the job Special Provisions. One set of design calculations checked by a second engineer. After MassDOT accepts the design, a complete final set of Construction Plan mylars or pages of typical details with the MassDOT Chapter 85 approval stamp printed on each sheet (page) for Bridge Engineer's signature.	Field welding can be used, however the Designer must verify if the existing steel is weldable. Welds should be designed considering weld behavior and loads paths. Job Special Provisions should provide for field inspection of welds using Mag Particle or Ultrasonic Testing. If temporary shoring is to be designed by the Contractor, the Designer should provide loads to be used, shoring material and that the design should be in accordance with the AASHTO Specifications and the AASHTO Handbook for Temporary Works. Permits are required for temporary shoring in wetland resource areas.
Structural Repairs to Concrete Beams and Slabs	Not required	Not required	Can use AASHTO Standard Specifications for either the original design truck or H20, whichever is greater. Design all repairs so that in the repaired condition the beam or slab will carry all required loads. If reinforcing bars are deteriorated, provide additional reinforcing in kind and provide proper lap lengths with existing reinforcing. If a beam needs to be unloaded, design temporary shoring and jacking in accordance with the AASHTO Handbook for Temporary Works.	Typical details showing limits of work, limits of concrete chipping and forming of repairs. If additional steel if needed show how to install along with lap lengths. If shoring is required, provide details of shoring including locations, foundation and member sizes.	Either a complete final set of Construction Plans (if used) or pages of typical details to be inserted into job Special Provisions (if "book job") as well as the job Special Provisions. One set of design calculations checked by a second engineer. After MassDOT accepts the design, a complete final set of Construction Plan mylars or pages of typical details with the MassDOT Chapter 85 approval stamp printed on each sheet (page) for Bridge Engineer's signature.	If temporary shoring is to be designed by the Contractor, the Designer should provide loads to be used, shoring material and that the design should be in accordance with the AASHTO Specifications. If a prestressed concrete girder is being repaired, un-bonding of the prestressing strands will result in loss of prestress that should be taken into account in the design calculations. Permits are required for temporary shoring in wetland resource areas.

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Stone Masonry and Concrete Masonry Arch Repairs	Not required	Not required	Can use AASHTO Standard Specifications for either the original design truck or H20, whichever is greater. Design all repairs so that in the repaired condition the arch will carry all required loads. If reinforcing bars are deteriorated, provide additional reinforcing in kind and provide proper lap lengths with existing reinforcing. Design should ensure that the arch will still be stable after chipping of deteriorated concrete. If not, a shoring system needs to be provided.	Typical details showing limits of work, limits of concrete chipping and forming of repairs. If additional reinforcing steel is needed, show installation details along with lap lengths. If shoring is required, provide details of shoring including locations, foundation and member sizes. For stone masonry arch repairs, such as chinking gaps or mortaring voids and gaps, provide typical details.	Either a complete final set of Construction Plans (if used) or pages of typical details to be inserted into job Special Provisions (if "book job") as well as the job Special Provisions. If required, one set of design calculations checked by a second engineer. After MassDOT accepts the design, a complete final set of Construction Plan mylars or pages of typical details with the MassDOT Chapter 85 approval stamp printed on each sheet (page) for Bridge Engineer's signature.	Other preservation options: Consider lining the inside of the arch with a metal culvert structure and grouting the annular space between them. Metal culvert should be designed for full dead and live load as if masonry or concrete arch was not there. If there is sufficient backfill over the arch, consider casting a reinforced concrete moment slab over the entire arch so that live loads are distributed over a larger area and not as point loads.
Replacement or Jacketing of Timber or Other Piles	Not required	<u>For pile jacketing projects:</u> Geotechnical Report not required. <u>For pile replacement or installation of additional sister pile(s):</u> Geotechnical Report per Bridge Manual (except as noted below) At least one boring to refusal below bottom of pile tip at each pier where pile is to be installed. If rock is encountered, a 10 foot core is recommended.	<u>For pile jacketing projects:</u> Not required. <u>For pile replacement or installation of additional piles:</u> Design the new pile(s) to take all required loads. Design pile cap extension, modification, or sister pile cap to take all required DL and LL from superstructure that need to be removed from damaged pile. Can use AASHTO Standard Specifications for either the original design truck or H20, whichever is greater. If the superstructure needs to be unloaded as part of the work, design temporary shoring and jacking in accordance with the AASHTO Handbook for Temporary Works.	<u>For pile jacketing projects:</u> Show pile locations for jacketing, develop typical details showing pile jacket type and installation, grouting, and installation procedures. <u>For pile replacement or installation of additional piles:</u> Develop specific details for each repair location or alternatively, including pile details, pile driving notes, extension and modification of existing pile cap details, new sister pile cap details, method for transferring superstructure loads to the new pile, develop installation procedures consistent with design assumptions. If shoring is required, provide details of shoring including locations, foundation and member sizes.	<u>For pile jacketing projects:</u> Either a complete final set of Construction Plans (if used) or pages of typical details to be inserted into job Special Provisions (if "book "job) as well as the job Special Provisions. <u>For pile replacement or installation of additional piles:</u> Geotechnical Report and a Complete final set of Construction Plans, one set of design calculations checked by a second engineer and the job Special Provisions. After MassDOT accepts the design, a complete final set of Construction Plan mylars or pages of typical details with the MassDOT Chapter 85 approval stamp printed on each sheet (page) for Bridge Engineer's signature.	Work in water will require environmental permitting. Special Provisions should address pile driving specifications and testing (e.g. Wave Equation) to ensure that pile has reached capacity. If temporary shoring is to be designed by the Contractor, the Designer should provide loads to be used, shoring material and that the design should be in accordance with the AASHTO Specifications and the AASHTO Handbook for Temporary Works. Time of year restrictions must be considered for any work in water.

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Deck Replacement	Not required	Not required	Design in accordance as follows: AASHTO LRFD for HL-93 Design Loading, or AASHTO Standard Specifications for preferably HS25 but not less than HS20. Follow Bridge Manual DL and LL load distribution procedures and deck design charts. Seismic design is not required. Check existing beams for load carrying capacity with the new deck loads. Check fatigue sensitive details (if any) for fatigue stress ranges. Design fatigue retrofits if needed to ensure 75 year fatigue life after deck replacement.	<u>For Rural Minor Collector, Rural Local Road, Urban Collector, and Urban Local Road:</u> Need not follow MassDOT Bridge Manual construction details. If not using standard MassDOT bridge railings or barriers and transitions, those used must be crash tested to either NCHRP 350 or MASH, Test Level 2 minimum if roadway speed ≤ 45 mph, minimum Test Level 3 if roadway speed > 45 mph. Provide 42" railing height if pedestrians are allowed on bridge. <u>For Rural Major Collector, Urban Minor Arterial, Rural Principal Arterial, Rural Minor Arterial, Urban Principal Arterial, Or Any structure on the National Highway System (NHS) (See Note 1 Below):</u> Follow MassDOT Bridge Manual construction details. Use MassDOT bridge railings and barriers and transitions.	Complete final set of Construction Plans and one set of design calculations checked by a second engineer. After MassDOT accepts the design, a complete final set of Construction Plan mylars with the MassDOT Chapter 85 approval stamp printed on each sheet for Bridge Engineer's signature.	Steel beams should also be painted as part of a deck replacement project. Structural repairs to beams may also be required. When considering a deck replacement, also consider the feasibility of doing a full superstructure replacement. This may be cheaper overall, especially if beam painting and structural repairs are required or if the existing beams cannot carry the required minimum loading and the bridge will require posting after completion of the work. Elimination of bridge joints by using Bridge Manual details is encouraged.
Bridge Superstructure Replacement	<u>For Rural Minor Collector, Rural Local Road, Urban Collector, and Urban Local Road:</u> Full hydraulic report is not required. The municipality's Designer of Record shall prepare an abbreviated Hydraulic Evaluation that shall evaluate current and past conditions and site specific critical hydraulic issues including past floods of record the bridge has withstood, local flooding issues, FEMA flood profiles, past and/or current scour of bridge substructure elements, and shall determine if the existing hydraulic opening is adequate to remain. <u>For Rural Major Collector, Urban Minor Arterial, Rural Principal Arterial, Rural Minor Arterial, Urban Principal Arterial, Or Any structure on the National Highway System (NHS) (See Note 1 Below):</u> Hydraulic report per Bridge Manual.	<u>For Rural Minor Collector, Rural Local Road, Urban Collector, and Urban Local Road:</u> Full geotechnical report is not required. The municipality's Designer of Record shall prepare a memo on the adequacy of the substructure to be re-used considering both a condition standpoint, including any demonstrated scour, and load carrying capacity. <u>For Rural Major Collector, Urban Minor Arterial:</u> Geotechnical report per Bridge Manual. <u>For Rural Principal Arterial, Rural Minor Arterial, Urban Principal Arterial, Or Any structure on the National Highway System (NHS) (See Note 1 Below):</u> Geotechnical report per Bridge Manual. Preliminary Structures Report per MassDOT Bridge Manual with material sampling.	Full Seismic design not required, except that restraint devices (anchor bolts, backwalls, cheek walls, or keeper blocks) shall be designed for SDC A loads. <u>For Rural Minor Collector, Rural Local Road, Urban Collector, and Urban Local Road:</u> Design in accordance as follows: AASHTO LRFD for HL-93 Design Loading, or AASHTO Standard Specifications for preferably HS25 but not less than HS20. Use Bridge Manual DL and LL load distribution procedure. <u>For Rural Major Collector, Urban Minor Arterial, Rural Principal Arterial, Rural Minor Arterial, Urban Principal Arterial, Or Any structure on the National Highway System (NHS) (See Note 1 Below):</u> Design in full accordance with AASHTO LRFD and MassDOT Bridge Manual for HL-93 Design Loading.	<u>For Rural Minor Collector, Rural Local Road, Urban Collector, and Urban Local Road:</u> Need not follow MassDOT Bridge Manual construction details. If not using standard MassDOT bridge railings or barriers and transitions, those used must be crash tested to either NCHRP 350 or MASH, Test Level 2 minimum if roadway speed ≤ 45 mph, minimum Test Level 3 if roadway speed > 45 mph. Provide 42" railing height if pedestrians are allowed on bridge (See Note 2). <u>For Rural Major Collector, Urban Minor Arterial, Rural Principal Arterial, Rural Minor Arterial, Urban Principal Arterial, Or Any structure on the National Highway System (NHS) (See Note 1 Below):</u> Use standard MassDOT Bridge Manual construction details. Use MassDOT bridge railings and barriers and transitions.	Hydraulic Evaluation; or Hydraulic Report (depending on Roadway Functional Class). Geotechnical Memo on adequacy of substructure re-use; or Geotechnical Report and Preliminary Structures Report (depending on Roadway Functional Class). Complete final set of Construction Plans and one set of design calculations checked by a second engineer. After MassDOT accepts the design, a complete final set of Construction Plan mylars with the MassDOT Chapter 85 approval stamp printed on each sheet for Bridge Engineer's signature.	Evaluation of structure from a Cultural Resources standpoint. Consider Complete Streets guidelines. Provide for utilities (water, gas, etc.) if it is expected that they will be installed in the future. If there is existing scour, scour repairs should also be performed. The need for scour countermeasures should also be evaluated. If scour remediation work will be required, environmental permitting may put restrictions on time of year when work can be done in the water.
Preservation Project Type	**Hydraulic Design**	**Geotechnical Design**	**Structural Design**	**Construction Details**	**Design Review Submittals**	**Other Considerations**

Scour Damage Repairs and Scour Mitigation/Countermeasures	Not required if only filling scour void with concrete. <u>For scour mitigation:</u> Prepare hydraulic report and calculate scour depth to be mitigated as follows: <u>For Rural Minor Collector, Rural Local Road, Urban Collector, and Urban Local Road:</u> Flood frequency: 10 year Design Scour freq.: 25 year Check Scour freq.: 50 year Must be scour stable after Design Scour Event but not necessarily available for use. <u>For Rural Major Collector, Urban Minor Arterial:</u> Flood frequency: 25 year Design Scour freq.: 50 year Check Scour freq.: 100 year Must be scour stable and available for limited use after the Design Scour Event. <u>Rural Principal Arterial, Rural Minor Arterial, Urban Principal Arterial, Or Any structure on the National Highway System (NHS) (See Note 1 Below)</u>: Flood frequency: 50 year Design Scour freq.: 100 year Check Scour freq.: 200 year Must be scour stable and available for limited use after the Check Scour Event.	Geotechnical Report not required. Design should consist of rip rap and keying of rip rap toe required or the use of other scour countermeasures (see Bridge Manual for acceptable countermeasures) to withstand the calculated scour depth and ensure that structure shall meet the required performance requirements.	Not required	<u>For filling of scour void with concrete:</u> Provide typical details of concrete bag berm and method of placing tremie concrete into void. If void extends under the substructure footing, provide typical details and method of placement to ensure that void is fully filled and bears up against the substructure. <u>For scour mitigation/countermeasures:</u> Provide details showing excavation, rip rap placement and keying (refer to Bridge Manual for typical details). If other types of countermeasures are used, such as concrete block mattresses, provide all relevant details of the countermeasure and its method of placement.	<u>For filling of scour void:</u> Either a complete final set of Construction Plans (if used) or pages of typical details to be inserted into job Special Provisions (if “book job”) as well as the project Special Provisions. If required, one set of design calculations checked by a second engineer. <u>For scour mitigation/countermeasures:</u> A Hydraulic Report and a complete final set of Construction Plans and the job Special Provisions. If required, one set of design calculations checked by a second engineer. After MassDOT accepts the design, a complete final set of Construction Plan mylars or pages of typical details with the MassDOT Chapter 85 approval stamp printed on each sheet (page) for Bridge Engineer’s signature.	Work in water will require environmental permitting. Installing scour countermeasures especially if altering the stream crossing’s bed, may complicate the environmental permitting process. Time of year restrictions must be considered for any work in water.

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Safety improvements to Bridge and Approach Railing	Not required	Not required (Assumes that approaches shall not be raised or approach walls, if any, shall not be modified).	If using MassDOT standard bridge railings and transitions, use predesigned reinforcing bars and standard details from Bridge Manual. If not using standard MassDOT bridge railings and transitions, provide the same details and reinforcing bars as used and shown in the crash test report. If any modification of the bridge is required to withstand the crash loads, use the AASHTO LRFD Section 13 TL loads and design methodology. DO NOT use the AASHTO Standard Specifications 10 kip force for these calculations.	<u>For Rural Minor Collector, Rural Local Road, Urban Collector, and Urban Local Road:</u> Need not use standard MassDOT bridge railings or transitions. Those used must be crash tested to either NCHRP 350 or MASH, minimum Test Level 2 if roadway speed ≤ 45 mph, minimum Test Level 3 if roadway speed > 45 mph. Provide 42" railing height if pedestrians are allowed on bridge. <u>For Rural Major Collector, Urban Minor Arterial, Rural Principal Arterial, Rural Minor Arterial, Urban Principal Arterial, Or Any structure on the National Highway System (NHS) (See Note 1 Below):</u> Use MassDOT bridge railings and barriers and transitions Show limits of existing bridge demolition, modifications to be made include reinforcing bars and their spacing, and show details of new bridge railing and transition.	Complete final set of Construction Plans and one set of design calculations checked by a second engineer. After MassDOT accepts the design, a complete final set of Construction Plan mylars with the MassDOT Chapter 85 approval stamp printed on each sheet for Bridge Engineer's signature.	Traffic control plan: can close bridge during work or work in stages. If working in stages, provide temporary barrier when existing railing has been removed and before the new one has been completely installed and is functional to maintain traffic safety. Existing railings and barriers can sometimes be retrofitted by running a Thrie Beam highway guardrail in front of the existing bridge railing. This eliminates the need for a transition element, since the Thrie Beam continues off the bridge and transitions to the W Beam guardrail off the bridge. For more bridge rail and bridge rail retrofit options, see Note 2 at end of this table.

<u>Note 1:</u> The following NHS routes: Eisenhower Interstate, Other NHS Routes and STRAHNET Routes and Connectors, are considered Critical/Essential in that they are the primary routes for emergency use during and after an emergency or natural event. Structures on NHS routes must be available for limited use after such an event. See MassDOT Bridge Manual for more information on these requirements. A map of NHS Routes in Massachusetts is available on the following website:
http://www.fhwa.dot.gov/planning/national_highway_system/nhs_maps/

<u>Note 2:</u> Bridge Railing and Transition and Bridge Railing Retrofit Resources:

Federal Highway Administration: http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/ctrmeasures/bridge_railings/

AASHTO | AGC | ARTBA Task Force 13: http://www.aashtotf13.org/Bridge-Rail.php

<u>Note 3:</u> AASHTO Handbook for Temporary Works = **Construction Handbook for Bridge Temporary Works, 1st Edition, with 2008 Interim Revisions**

<u>Note 4:</u> AASHTO Standard Specs = AASHTO **Standard Specifications for Highway Bridges, 17th Edition with current interims and errata**

<u>Note 5:</u> AASHTO LRFD = AASHTO **LRFD Bridge Design Specifications, Latest Edition with current interims and errata**