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CHAPTER 8

SPECIAL PERMIT VEHICLE ANALYSIS GUIDELINES

8.1 POLICY

8.1.1 Purpose

This Chapter establishes procedures to be used by MassDOT and Consultant Rating Engineers in determining the structural adequacy of bridges that are to be crossed by escorted Special Permit (“Super Load”) permit vehicles, refer to Table 1 of 700 CMR 8.05 or Table 5 of 700 CMR 7.07.

Special Permit Vehicle Analysis for a bridge shall be performed using the same methodology that was used for its design. The majority of existing bridges in the Commonwealth of Massachusetts were designed using the Allowable Stress Design (ASD) method. In general, the Central Artery bridges were designed using the Load Factor Design (LFD) method and more recently all bridges have been designed using the Load and Resistance Factor Design (LRFD) method. It is the responsibility of the Rating Engineer to determine the methods that will be used for development of the Special Permit Vehicle Analysis.

8.1.2 Existing Inventoried Routes

In general, the Bridge Section performs the analysis of structures on the routes of travel listed below as a service to the Special Permit Vehicle Applicants. The routes contained in the Bridge Section inventory may change in the future. Consultant Rating Engineers are not required to analyze structures on these routes. However, the Consultant Rating Engineer should check with the Bridge Section for any exceptions or changes to this list.

The routes that are presently analyzed by the Bridge Section are as follows:

- Interstate I-495
- Interstate I-295
- Interstate I-290
- Interstate I-84
- Interstate I-395
- Interstate I-95
- Interstate I-91
- Interstate I-90 (Formerly the Massachusetts Turnpike)
- Interstate I-190
- Interstate I-195 (Wareham to New Bedford)
- Interstate I-93 (I-95/128 in Reading to Exit 30, Mystic Ave., in Medford)

The analysis performed by the Bridge Section attests only to the structural capacity of the bridges crossed. All other move essentials that are required for the successful passage of the Special Permit Vehicle, such as the vertical and horizontal clearances, the potential for any construction activities on the bridges crossed at the time of the move, the structural integrity of the pavement, slopes, utilities, as well as any other structures which are not specifically addressed in recommendations forwarded to the Permits Manager, will not be verified by the Bridge Section and thus, shall be examined and proved acceptable prior to the actual move by the Permit Applicant.

8.1.3 Definitions

For the purpose of this Chapter, the following definitions shall be used:

Rating Engineer is the engineer in Responsible Charge for the Special Permit Vehicle analysis. The Rating Engineer shall be the consultant engineer hired by the Permit Applicant to analyze bridge structure(s) crossed on routes not analyzed by the Bridge Section.

Special Permit Vehicles are vehicles with weights in excess of the legal limits that carry loads that are irreducible (non-divisible), with the following exception. Reducible loads may be permitted for delivering relief supplies during a Presidentially declared State of Emergency or Major Disaster under the Stafford Act, per Section 1511 of MAP-21.

Posting Vehicles are the vehicles whose load ratings are used when a bridge is posted. MassDOT currently uses the following posting vehicles: H20, Type 3, and Type 3S2.

8.1.4 Qualifications

Special Permit Vehicle Analysis Reports shall be prepared under the direction of a Professional Engineer in Responsible Charge of the work, who is registered in Massachusetts, or by the Bridge Section under the direction of the State Bridge Engineer. Rating Engineers performing Special Permit Vehicle Analyses shall be knowledgeable in bridge design and rating and shall be familiar with the relevant AASHTO and MassDOT requirements.

8.1.5 Field Inspection

The Rating Engineer will verify in the field what is contained on the latest Construction Drawings, latest inspection reports, and prior bridge rating reports available. If during the verification, the Rating Engineer finds an adverse condition that is not noted or documented sufficiently in the available information, the Rating Engineer shall notify the State Bridge Engineer. The Rating Engineer shall obtain documented measurements of the adverse condition prior to incorporating the findings into the Special Permit Vehicle Analysis Report. Section losses used to calculate the capacities shall be based on documented measurements and shall not be based on assumed conditions.

8.1.6 Undocumented Bridge Structures

The Rating Engineer shall obtain all pertinent information required to determine the capacity of all structures crossed to safely support the Special Permit Vehicle without damage. If a structure is encountered where no documentation exists that defines the structure's composition, then the Rating Engineer shall take all necessary steps to determine the physical characteristics of the structure so that the safe carrying capacity of the structure can be determined. The documentation shall include all necessary dimensions, non-destructive evaluations, sampling, and physical testing required to determine the safe carrying capacity. Upon gathering all relevant information, the Rating Engineer shall forward this information via a separate letter to the State Bridge Engineer, in addition to incorporating the information into the Special Permit Vehicle Analysis Report.

8.2 APPLICATION OF LIVE LOADS AND LOAD RATING INSTRUCTIONS

8.2.1 Objective

The object of the Special Permit Vehicle Analysis is to determine the appropriate rating factors for the given Special Permit Vehicle to ensure that all structures may be safely crossed without damage to the structure, consistent with sound engineering practice.

8.2.2 Live Loads

The live loads applied shall accurately represent the Special Permit Vehicle's wheel and axle loads, and wheel and axle spacing. In general, a sufficient number of axles shall be used such that the axle loads are limited to no more than 22,400 pounds, or 18,000 pounds if spaced at less than 6 feet apart, but higher axle loads may be allowed subject to the review and approval of the State Bridge Engineer. Any Special Permit Vehicle may be subject to additional restrictions, and it shall abide by these additional restrictions as identified by the Rating Engineer, MassDOT, or both. In the event of a conflict, or duplicate restrictions, the more conservative restriction shall govern. These restrictions may include, but not be limited to, spanning over the bridge with a temporary structure, increasing the number of wheel lines to improve the lateral and/or longitudinal distribution of the loads, reducing vehicle travel speed over the structure, limiting to specific lane or travelway locations, preventing other traffic from using the bridge at the same time as the Special Permit Vehicle, and rerouting to avoid specific bridges or other conflicts entirely.

8.2.3 Special Instructions for Special Permit Vehicle Analysis

8.2.3.1 Special Permit Vehicle Analysis rating calculations shall be performed in accordance with the following guidelines. Request for clarification of or deviation from these guidelines must be submitted via email. Responses will be provided via email.

8.2.3.2 Bridges shall be rated in accordance with the provisions of the current *AASHTO Manual for Bridge Evaluation* including all interims, except where modified by this Bridge Manual.

8.2.3.3 The computed stresses shall not exceed the Operating Stresses for structures where all of the main members are in fair or better overall condition.

8.2.3.4 Structures with main members in poor condition or worse shall be avoided, where possible. Computed stresses may be limited to values less than Operating Stresses, or other restrictions may be applied, at the discretion of the State Bridge Engineer.

8.2.3.5 Impact factors shall adhere to the requirements of the *AASHTO Manual for Bridge Evaluation* with the following exception. The impact factor may be reduced to no less than a minimum of 10% ($I = 0.10$) if the Special Permit Vehicle travels at a speed of 5 miles per hour or less over the structure and the bridge wearing surface has a condition rating of fair or better.

8.2.3.6 Rating factors for the Special Permit Vehicle(s) shall be calculated for each structure to be traversed. Live load comparison methods shall not be considered as a substitute for rating factor calculations, unless approved by the State Bridge Engineer.

8.2.3.7 Live load distribution factors in accordance with the *AASHTO Manual for Bridge Evaluation* and this Bridge Manual shall be used. The use of alternative distribution factors less than those provided in the *AASHTO Manual for Bridge Evaluation* and this Bridge Manual is not acceptable without calibrated load testing or refined methods of analysis.

8.3 SPECIAL PERMIT VEHICLE ANALYSIS REPORT

8.3.1 Format

The Special Permit Vehicle Analysis Report submitted by the consultant Rating Engineer shall be as an electronic file in PDF format. The cover of the report must contain the Permit Applicant's name as entered in their permit application, start and end points of the move, a description of the vehicle(s), the name and address of the consultant Rating Engineering firm that prepared the report, the date of the

report, and the Rating Engineer's professional engineering stamp along with an original signature and date. The Special Permit Vehicle Analysis Report shall consist of the following sections:

1. REPORT COVER

- 1.1 Formatted as shown in Figure 8.3.1-1
- 1.2 P.E. Stamp with date and signature of the Rating Engineer.

2. INDEX

- 2.1 Index of sections outlined with page numbers.

3. SPECIAL PERMIT VEHICLE ANALYSIS BREAKDOWN SUMMARY

- 3.1 Provide all pertinent information concerning every structure proposed to be crossed. Format the table with separate columns for mile marker, bridge number, structure number, BIN number, latitude, longitude, Operating rating factor values for the Special Permit Vehicle, method of analysis, Item 58, Item 59, Item 60 or Item 62, the date of the latest available inspection that was referenced by the Rating Engineer, and any restrictions required during the crossing of the structure. Each row in the table shall represent a particular structure to be crossed.
- 3.2 The rows shall be ordered in sequence from the start to the end of the move.

4. ROUTING MAPS

- 4.1 Provide an overall map(s) of the route identifying the start and end points, as well as detailed map(s) clearly identifying the locations of structures rated for the Special Permit Vehicle.

5. PURPOSE AND CRITERIA

- 5.1 Describe the purpose of the Special Permit Vehicle Analysis, including but not limited to identifying the hauling company, what aspects of the route the report covers (i.e., structures, geometry, clearances, etc.), the portion of the route anticipated to be analyzed by MassDOT if applicable, the anticipated move date, and requirements for escort, if applicable. Note that the name of the hauling company must agree exactly with what is submitted for the associated permit. Incorrect names, doing-business-as, etc. may result in either rejection of the analysis or the permit application. Provide confirmation that the Rating Engineer has reviewed and considered the findings of the latest available inspection reports listed in the Special Permit Vehicle Analysis Breakdown Summary.

6. DESCRIPTION OF ROUTE

- 6.1 Include a detailed, turn-by-turn description of the route identifying street names, state route numbers, interstate numbers, directionality (i.e., east, west, NB, SB, etc.) from start to finish of the proposed route.

7. LIST OF STRUCTURES

- 7.1 Provide a list of structures included in the Special Vehicle Analysis Report. For each structure provide the facility carried and intersected, the MassDOT District number, the bridge number, BIN, number of spans, whether continuous or simple span, maximum span, year built, type (steel girder, reinforced concrete t-beams, truss, etc.), and the original design load, if known.

8. SUMMARY AND RECOMMENDATIONS

- 8.1 Provide a summary of the Special Vehicle Analysis, confirmation that the structures will not be subjected to stresses or loads exceeding Operating capacity, and any other related

recommendations. Confirm that no posted structures are present along the route. Identify any restrictions required per bridge to be imposed on the load, refer to Subsection 8.2.2 Live Loads.

9. CONSTRUCTION PROJECTS

- 9.1 Include a detailed description of all construction projects along the proposed route. Indicate what, if any, restrictions must be imposed to allow the Special Permit Vehicle to safely travel through the construction project(s).

10. SPECIAL PERMIT VEHICLE DATA

- 10.1 Provide a silhouette (preferred), or a table (minimum) indicating the Special Permit Vehicle axle loads, distance between axles, vehicle width, vehicle height, and overall vehicle length. Note this information, especially overall length, must agree exactly with what is submitted for the associated permit. Incorrect or conflicting information may result in either rejection of the analysis or the permit application.
- 10.2 Provide a cross section indicating the Special Permit Vehicle wheel lines and spacing between each wheel line.

11. APPENDIX A - COMPUTATIONS

- 11.1 At a minimum, a general plan, framing plan(s), and cross section(s) for each structure, identifying all members that have been rated, shall be included.
- 11.2 Tabular summary of all non-composite dead loads, composite dead loads, and live load distribution factors, etc. per member that has been rated, shall be included.
- 11.3 All hand and computer aided calculations, spreadsheets, etc. along with an index. Calculations shall include at a minimum the initials of the individuals performing and checking the work.
- 11.4 Input and output summaries from AASHTOWare Bridge Rating (BrR) and/or other software. Other software must be approved by the State Bridge Engineer prior to analysis and submission. Input and output shall include initials of the individuals performing and checking the work.

8.3.2 Submission and Processing Protocol

Electronic Submissions: Submissions larger than 25 MB in size shall be made through MassDOT's Bridge Inspections and Ratings SharePoint site. The site address starts as follows: <https://masgov.sharepoint.com/sites/DOT-Highway-Bridge/>.

Since each consultant will have a folder with access restricted to that consultant, MassDOT, and FHWA, the remainder of the address will be unique to each consultant. Access to the Bridge Inspection and Ratings SharePoint will be established for a consultant group staff by the Site Owner, currently the Bridge Load Ratings and Overloads Engineer. Requests for individual access will be rejected.

Submissions shall be made by creating a .zip file of the entire contents of the submittal, and then dragging and dropping it into the Submission folder under the consultant folder, then notifying the Site Owner.

Smaller submissions, roughly under 25 MB, may be made by creating a .zip file of the entire contents or a portion of the submittal and emailing that .zip file directly to the Bridge Load Ratings and Overloads Engineer.

An email copy of the cover letter shall also be sent to the MassDOT Deputy Chief Engineer for Operations and Maintenance, attention to the Permits Manager, and to the State Bridge Engineer for review.

Sufficient lead time must be provided to allow MassDOT to review the Special Permit Vehicle Analysis. Reports will be reviewed and processed in the order that they are received.

Recommendations will be forwarded to the Permits Manager; these recommendations are not the permit. The purpose of the recommendations is to assist the Permits Manager in determining the eligibility of a permit request based on all applicable permit regulations. The Permits Manager will make the final decision whether or not to issue a permit based on these recommendations.

Consultant Rating Engineers shall advise the Permit Applicant(s) accordingly.

8.4 PRIVATELY OWNED AND OTHER AGENCY OWNED STRUCTURES

The Bridge Section does not perform structural analysis, nor does it review structural analysis performed by consulting Rating Engineers, for bridges not owned by either MassDOT or the various cities and towns of Massachusetts.

SPECIAL PERMIT VEHICLE ANALYSIS REPORT

SUBMITTED TO

**MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION**

ROUTE

FROM:

POINT A (RI STATE LINE)

TO:

POINT B (BOSTON, MA)

SPECIAL HAULING, LTD

VEHICLES:

TRUCK 1 (200,000 LBS, 10-AXLES)

TRUCK 2 (175,000 LBS, 8-AXLES)

PREPARED BY

P.E. Stamp with Signature and Date

Consultant Logo

Consultant Name

Consultant Address

Figure 8.3.1-1: Format of Cover for Special Permit Vehicle Analysis Report