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SUBJECT: LOAD RATING OF BRIDGES  
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Supersedes: E. V.  
Hourigan memo of  
11/20/80 "BRIDGE RATING"

## I BACKGROUND

The Federal Highway Administration requires bridge load rating in order to respond to various items which must be reported periodically to their central data files. These items are among those used to calculate the AASHTO Bridge Sufficiency Rating, which, in turn, is used to determine the allocation of funds to each State for the Highway Bridge Replacement and Rehabilitation Program. Thus, bridge ratings of poor quality may result in incorrect funding levels under the program. Bridge load ratings are also required for more accurate prioritizing of bridge projects, better routing of permit overloads and more reliable bridge postings.

The Federal Highway Administration data requirements are found in the "Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges". Those items which require load rating for response are 64 - Operating Rating, 66 - Inventory Rating, 67 - Structural Condition and 70 - Safe Load Capacity.

New York State has provided this information by use of two methods. The first was put into effect in 1973 and was intended to provide a quick response to the F.H.W.A. requirement cited above. It did not provide adequate ratings because it did not take into account bridge condition and used very generalized assumptions regarding bridge types and configurations.

Recognizing the deficiencies of the first method, plans were made for improvement. In 1976, the Department gained access to a computerized bridge load rating system developed by the Pennsylvania Department of Transportation and began testing and modifying the system to meet the Department's needs. This work was completed in early 1978, and resulted in a load rating program which allows the analysis of a number of specific bridge types and is condition dependent. This load rating program required additional information about each bridge, consisting of both inventory (fixed) information and inspection (variable) information. The required data was obtained for all local bridges as a part of the 1978-79 inventory and inspection program, and efforts are underway to obtain the information for State-owned bridges using State staff.

This load rating system is considered acceptable for use for the foreseeable future. However, it does have deficiencies because of approximations made in doing the analysis, and more important, because it can only be used to rate about 60-65% of the State's inventory of bridge types. No programs exist for the remaining types. Because of these deficiencies, it has been determined that

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bridges should be load rated individually at the time of design, whether original design or rehabilitation design. This load rating will be accomplished by analyzing the bridge in detail in order to produce a rating of the refinement which might be used for load posting. The rating will be computed for all bridges designed by the Department, and all bridges designed under the technical direction of the Department.

Implementation of this policy will result in having three bridge rating levels in use in New York State. They are as follows:

#### LEVEL #1 RATING - HIGHEST LEVEL (POSTING LEVEL)

This rating is based on an analysis done to the same level of accuracy and detail that would be used when a bridge is originally designed. A rating of this level is required to determine load posting values for bridges.

When done: A Level #1 Rating should be done when a bridge is: 1) newly designed, 2) being designed for rehabilitation, 3) being considered for overlay work (contract or maintenance), or, 4) being investigated for possible load posting.

Uses of Level #1 Rating: Once computed, a Level #1 Rating will go into the Inventory Files and will be used to report Inventory and Operating Ratings to FHWA. These ratings will also be used to determine posting values, and for overload permits, when appropriate. This is the rating level that goes on the front sheet of the Contract Plans. When plans are not prepared, but a Rating #1 Level analysis is performed, the rating values are sent to the Inventory and Inspection Unit, by memorandum.

#### LEVEL #2 RATING - MIDDLE LEVEL (STRUCTURAL RATING PROGRAM FOR BRIDGE RATINGS)

Ratings at this level come from the "Structural Rating Program for Bridges". By necessity, this program makes basic assumptions in analysis and the input to the program is not as detailed as would normally be required for a Level #1 Rating. For these reasons, ratings from the Rating Program (Level #2 Ratings) are approximations of load capacity and the degree of accuracy will vary from bridge to bridge, depending on how closely the program assumptions and the input to the program simulate a Rating #1 Level analysis.

When Done: Input for the Structural Rating Program for Bridges" will be updated as part of each General Inspection Cycle.

Uses of Level #2 Rating: These ratings will be used to: 1) report ratings to the FHWA when no level #1 Rating is available, 2) screen for bridges requiring a Level #1 Rating to determine a need for posting, 3) routing overloads, and 4) estimating load capacity for programming purposes.

#### LEVEL #3 RATING - LOWEST LEVEL (BASED ON EXISTING POSTINGS, YEAR BUILT, CONDITION, ET

When no Level #1 or Level #2 Rating is available, the computer will assign a Level #3 Rating value based on existing general Inventory information on file, such as existing posting, year built, condition, etc. These ratings are not based on an analysis of the structure. These ratings are based on an estimate of the probable capacity of the bridge based on the parameters mentioned.

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When done: These ratings will only be computed when a Level #1 or Level #2 Rating is not available.

Uses of Level #3 Rating: These ratings are only used to report a rating value to the FHWA when no better information is available. These ratings should not be used to actually estimate the load capacity of a specific bridge.

## II ACTION

Information regarding procedures to be followed in determining bridge ratings is contained in the AASHTO "Manual for Maintenance Inspection of Bridges-1978".

The following actions will be taken to produce and document Level #1 Ratings.

- A. Level #1 Ratings, based on detailed analyses, shall be made for all new bridges including replacement bridges and all bridges being rehabilitated or overlaid. These ratings shall be computed from design computations and assumptions.
- B. The computation of the Level #1 Ratings will be the responsibility of the Engineer under whose direction the final plans for the project are prepared. The project may be a new bridge, a replacement bridge, a bridge rehabilitation or a bridge overlay. The plans may be prepared in the Structures Division, a Regional Office or by consulting engineers doing work under the direction of the Department. In addition, bridges to be overlaid by Maintenance Forces should receive a Level #1 Rating for the final condition prior to the work.
- C. A waiver of this requirement may be obtained from the Deputy Chief Engineer (Structures), if properly justified.
- D. Level #1 Ratings will generally be made using working stress analysis methods. Load factor analysis methods will be used for rating bridges designed using load factor analysis methods. In those cases where the use of working stress analysis for inventory rating results in a value of less than HS-20, load factor analysis will be used as a check, if available. This method of analysis will be limited to these cases because load factor analysis methods are limited in their application, take more time, take advantage of the dead load to live load ratio, and thus, are more rigorous and refined.
- E. All bridges will be rated for HS Loading.
- F. All bridges with an inventory rating less than HS-20 will also be rated for H Loading.
- G. The following Note shall be added to the General Notes of the Contract Plans:  

The Load Ratings are in accordance with the AASHTO "Manual for Maintenance Inspection of Bridges-1978".
- H. New York City owned bridges will be rated for the following Loadings:

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1. Type 3
2. Type 3 S2
3. Type 3-3
4. HS
5. H

For information on these loadings, see the AASHTO "Manual for Maintenance Inspection of Bridges-1978".

- I. The design method, either working stress or load factor, will be noted in brackets after the rating.
- J. Examples of typical ratings are as follows:

<u>LOADING</u>	<u>INVENTORY</u>	<u>OPERATING</u>
Type 3	1978 Type 3 (31T)(W.S.)	1978 Type 3 (40T)(W.S.)
Type 3 S2	1978 Type 3 S2 (39T)(W.S.)	1978 Type 3 S2 (54T)(W.S.)
Type 3-3	1978 Type 3-3 (40T)(W.S.)	1978 Type 3-3 (56T)(W.S.)
HS	HS 21 (37T)(W.S.)	HS 33 (59T)(W.S.)
H	H 20 (20T)(W.S.)	H 30 (30T)(W.S.)
HS	HS 21 (37T)(L.F.)	HS 33 (59T)(L.F.)

- K. Inventory and operating Level #1 Rating values will be shown on the front sheet of the plans for the work which resulted in the analysis being made. Those responsible for updating the bridge inventory file to reflect the work being done shall update inventory and operating ratings in accordance with current bridge inventory practice.
- L. Any questions on this issuance should be directed to the Inventory and Inspection Unit of the Structures Division.