HIGHWAY CONSTRUCTION FACTORS GROUP
ATTACHMENT 17
STATE BRIDGE LOADING RESTRICTIONS DURING CONSTRUCTION FOR ALABAMA, CALIFORNIA, MASSACHUSETTS, AND MINNESOTA

ALABAMA CONSTRUCTION LOADING SPECIFICATIONS FOR BRIDGES

From: Conway, Fred [conwayf@dot.state.al.us]
Sent: Thursday, October 25, 2007 2:51 PM
To: Walsh Daniel
Subject: RE: Restriction of overweight loads and equipment (including stockpiling of raw materials) on structures

Dan:

I have attached some selected pages from the Alabama Department of Transportation Standard Specifications for Highway Construction - 2006 Edition that remotely relate to your inquiry concerning overweight loads and equipment (including stockpiling of raw material) on structures).

105.03(C)Working Drawings
Requires the Contractor to submit Drawings and Calculations for construction methods and materials proposed for use by the Contractor.

106.05 Handling and Storage of Materials
Requires the contractor to provide for transporting and storage of materials

510.03.6.k Placement of Cranes on Bridge Decks
Requires the contractor to submit Working Drawings and a complete stress analysis on all components affected by loads resulting from the use of crane the crane and/or equipment on the structure.

These may not be just what you are looking for but all except the Handling and Storage of Materials seem applicable to Bridge Loads and Construction.

Fred Conway, PE
ALDOT Bridge Engineer

-----Original Message-----
From: Walsh Daniel [mailto:daniel.walsh@ntsb.gov]
Sent: Thursday, October 25, 2007 2:08 PM
To: Conway, Fred
Subject: Restriction of overweight loads and equipment (including stockpiling of raw materials) on structures

Fred,

As we discussed on the telephone, can you please provide me Alabama DOT's policy on restriction of overweight loads and equipment (including stockpiling of raw material) on structures. Please call me at (817) 652-7844 if you have any questions. I would like to receive any information you have by Friday, November 2nd. Thank you.

Dan Walsh, P.E.
National Transportation Safety Board

4. DISTRIBUTION OF DRAWINGS FOR MEMBERS OTHER THAN STRUCTURAL STEEL.

After receiving the approved copy of the drawings, the Contractor shall submit ten copies of the approved drawings for distribution by the Department. Additional copies may be submitted for distribution if requested by the Contractor.

5. TIME ALLOWED FOR REVIEW.

Ten calendar days shall be allowed for each review of each set of drawings containing five sheets or less and two days shall be allowed for each sheet of each set of drawings containing more than five sheets.

If the review is not completed within the number of days allowed, and the delay is not the fault of the Contractor, the delay will be considered for an extension of contract time.

6. APPROVAL.

The approval of drawings will not release the Contractor from being solely and fully responsible for the accuracy of the drawings. Extra work that may result from errors in the shop drawings shall be done without additional compensation.

7. BEGINNING FABRICATION UPON APPROVAL.

Fabrication shall not begin until the drawings have been approved. There will be no compensation for, or acceptance of structural members and components that are fabricated prior to approval of the drawings.

(c) WORKING DRAWINGS.

1. PREPARATION OF DRAWINGS.

The Contractor shall submit working drawings to supplement the plans. Working drawings shall be submitted to provide a complete illustration of the construction methods and materials proposed for use by the Contractor. Design calculations shall be submitted with the drawings.

Working drawings, and design calculations, shall be submitted for the construction of sheeting and shoring, cofferdams, steel erection for continuous spans, falsework, stay-in-place forms and any other construction process where the Engineer determines that working drawings are required.

The drawings and calculations shall be submitted well in advance of the point in time when the work will be performed. The signature, seal, and date of signature shall be placed on all details and design calculations by a Professional Engineer that is licensed in the State of Alabama and not employed by the ALDOT.

2. SUBMITTAL.

Six copies of working drawings and one copy of design calculations shall be submitted by the Contractor to the ALDOT Construction Engineer.

3. DISTRIBUTION.

The drawings and design calculations will be checked for completeness. The drawings will be distributed to ALDOT construction personnel for inspection of the work. The distribution of the drawings will not release the Contractor and the Professional Engineer from being solely and fully responsible for the accuracy and adequacy of the drawings. Extra work that may result from errors in the working drawings and design calculations shall be done without additional compensation.

4. BEGINNING WORK SHOWN ON WORKING DRAWINGS.

The work shown on the working drawings shall not begin until the drawings have been received by the ALDOT field inspection personnel. There will be no compensation for work that is performed prior to the point in time that ALDOT personnel have the drawings for use in inspecting the construction work.

(d) COMPENSATION FOR DRAWINGS.

There will be no direct payment for the preparation and submittal of shop drawings, working drawings and design calculations. The cost of the drawings and calculations shall be included in the contract unit prices for the items of work.

105.03 Conformity with Plans and Specifications.

All work performed and all materials furnished shall be in reasonably close conformity with the lines, grades, cross sections, dimensions and material requirements, including tolerances shown on the plans or indicated in the Specifications.

In the event the Engineer finds the materials furnished, work performed, or the finished product not within reasonably close conformity with the plans and Specifications but that reasonably acceptable work has been produced, he shall then make a determination if the work shall be accepted

(d) ASPHALT PLANT LABORATORIES.

Asphalt plant laboratories shall contain not less than 450 square feet {41.8 square meters} of floor space and shall be of sufficient size to allow the required independent laboratory equipment to be used simultaneously by the contractor and the state. These laboratories shall have a minimum width of not less than 10 feet {3 m} with a 7 foot {2.1 m} (minimum) ceiling height and shall contain suitable work benches and drawers. A waiver of the 10 foot {3 m} width requirement may be granted for mobile, trailer type laboratories after an inspection of the lab's suitability has been made and approved. The laboratory may be a portable, a permanent, or a partitioned portion of a permanent structure provided it meets the requirements of these specifications. The unit shall be independent of plant storage, office space, etc., and shall have at least one private entrance door that can be secured. The laboratory shall be located as directed by the Engineer with window space suitable to the Engineer for periodic observation of plant operations. In addition each shall be provided with the following equipment:

1. Single sink with running water (minimum 100 gallon {375 liter} supply).
2. One laboratory burner or oven.
3. Lights.
4. Shelves and cabinets shall be provided as appropriate.
5. All asphalt plant laboratories shall be equipped with an exhaust fan, sufficiently sized and located to effectively clear the laboratory of smoke and fumes in a reasonable, in the judgment of the Engineer, amount of time. All asphalt laboratories shall also be equipped with all applicable equipment listed in ALDOT-349.

106.04 Contractor's Statement of Material Sources.

Before work on any contract is started, the Contractor may be required to furnish a complete statement of the origin, composition and manufacture of any or all materials proposed to be used in the construction of the work, together with samples which may be subjected to the tests provided in the contract to determine their quality and fitness for the work.

106.05 Handling and Storage of Materials.

(a) HANDLING MATERIALS.

All materials shall be handled in such a manner as to preserve their quality and fitness for the work. Aggregates shall be transported from the storage site to the work in tight vehicles so constructed as to prevent loss or segregation of materials after loading and measuring in order that there may be no inconsistencies in the quantities of materials, intended for incorporation in the work, as loaded and the quantities as actually received at the place of operations.

(b) STORAGE OF MATERIALS.

Materials shall be so stored as to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located so as to facilitate their prompt inspection. Approved portions of the right of way may be used for storage purposes and for the placing of the Contractor's plant and equipment, but any additional space required therefor must be provided by the Contractor at his expense. Private property shall not be used for storage purposes without written permission of the owner or lessee, and if requested by the Engineer copies of such written permission shall be furnished him. All storage sites shall be restored to their original condition by the Contractor at his expense. This shall not apply to the stripping and storing of topsoil, or to other materials salvaged from the work.

106.06 Unacceptable Materials.

All materials not conforming to the requirements of the Specifications shall be considered as unacceptable and all such materials will be rejected and shall be removed immediately from the site of the work unless otherwise instructed by the Engineer. No rejected material, the defects of which have been corrected, shall be used until approval has been given.

In case of failure by the Contractor to comply promptly with any order by the Engineer to remove rejected materials, the Engineer shall have authority to have such rejected materials removed by other means and to deduct the expense of such removal from any monies due or to become due the Contractor.

106.07 Department Furnished Material.

The Contractor shall furnish all materials required to complete the work, except those specified to be furnished by the Department.

The under surface of overhanging slabs shall be provided with a continuous "V" groove 3/4 of an inch {20 mm} in depth at a point not more than 6 inches {150 mm} from the outside face for the purpose of arresting the flow of water, and thus, preventing staining,

h. Expansion Joints.

Plates, channels, or other structural shapes shall be accurately shaped, in the shop, to conform to the section of the concrete floor. The fabrication and painting shall conform to the requirements of these specifications and/or the plans covering those items. Care shall be taken to insure that the surface in the finished plane is true and free from warp. Positive methods shall be employed in placing the joints to keep them in correct position during the placing of the concrete. Unless otherwise shown on the plans, the joint opening shown on the plans is the opening when the temperature of the structure is 70 °F {20 °C}. Special care shall be taken to insure that all expansion joint devices and expansion joint openings are correctly set prior to pouring the concrete adjacent to the joint.

Expansion joints shall be so constructed as to permit freedom of movement of the spans. Open joints shall be cleared of all mortar and other obstructions as soon as possible after pouring the spans.

Sealing of joints, if required, shall be in accordance with plan details.

i. Blank.

j. Barrier Rails Placed By Slip Forming.

Bridge barrier rails constructed by the use of a slip form extrusion machine shall be well compacted dense concrete meeting all the requirements of Section 501, except for the requirement for fixed forms. The forming portion of the extrusion machine shall be readily adjustable vertically during the forward motion of the machine so that the top of the barrier can be maintained at the required grade.

Open joints shall be located as required on Standard Drawing No. I-131. Longitudinal bars shall be cut at joint locations to provide for 2 inch {50 mm} end cover. The Contractor shall be responsible for marking these locations in advance of placement of concrete so that sawed joints will be properly located.

The joints shall be sawed as soon as the concrete has hardened to the degree that tearing and raveling is not excessive, and before uncontrolled shrinkage cracking begins. This time may be as short as four hours or even less in extremely warm weather, but not over 12 hours unless authorized by the Engineer. If extreme conditions exist which make it impractical to prevent uncontrolled cracking by early sawing, the procedure shall be revised immediately to adjust the sequence of sawing.

A minimum saw cut width of 5/16 of an inch {8 mm} shall be maintained. On the inside of the barrier, the saw cut shall extend from the top to the bottom of the rail to the point of intersection with the bridge deck. On the outside of the barrier, the saw cut shall extend from the top to within 11 inches {280 mm} of the bottom of the rail.

k. Placement of Cranes on Bridge Decks.

A crane shall not be placed on a bridge deck until Working Drawings for the placement and operation of the crane are distributed by the Department. Working Drawing shall be submitted in accordance with the requirements given in Subarticle 105.02(d). The Working Drawing submittal shall include:

(1) Specifications of the crane and/or equipment to be placed on the structure.

(2) Mobilization (wheel location) diagram of the crane (with respect to centerline of structure) as it is being mobilized for final positioning on the structure.

(3) Final positioning/usage diagram once the crane is on the structure showing the location of the outriggers, and timber mat requirements (i.e. mat thickness, width, orientation of mats), maximum load to be lifted for a particular positioning of the boom, etc.

(4) A complete stress analysis (superstructure and substructure) on all components affected by loads resulting from the use of the crane and/or equipment on the structure. The analysis shall be provided in accordance with AASHTO Allowable Stress Design Method. Mobilization analysis (item 2) as well as final positioning/usage analysis (item 3) will be required. The results of the analysis shall be noted on the submittal by a written conclusion that the placement of the crane will not damage any part of the bridge.

7. CONCRETE RAILINGS, CURBS, SIDEWALKS, AND PARAPETS.

In no case shall concrete railings, sidewalks, and parapets be placed until the falsework for the span has been released, rendering the span self-supporting.

CALIFORNIA SPECIFICATIONS FOR BRIDGE LOADING

From: Kevin Thompson [kevin_thompson@dot.ca.gov]
Sent: Wednesday, October 31, 2007 6:02 PM
To: Walsh Daniel
Cc: Richard Land
Subject: Re: Fw: Restriction of overweight loads and equipment (including stockpiling of raw material) on structures

Dan,

The PDF attachments below provide policy guidance and specifications for weight overload on construction projects.

The first attachment, Memo to Designers 15-15, provides guidance for Material Hauling Equipment Loading. The second and third, attached below, are guidelines from the Bridge Construction Memo 150-1.0 and Standard Specifications Section 7-1.02.

(See attached file: 15-15.pdf)(See attached file: 150-1.0_BCM.pdf)(See attached file: Document.pdf)

Dan - Give me a call when you get a chance to review the attachments. I've contacted our Structures Maintenance folks and others for specific policy and specifications in this area.

Thanks

Kevin J. Thompson, P.E.
State Bridge Engineer
Deputy Division Chief
Structure Design
Division of Engineering Services, MS 9
(916) 227-8807

Richard Land/HQ/Caltrans/CAGov

10/31/2007 10:08 AM

To: kevin.thompson@dot.ca.gov

cc:

Subject: Fw: Restriction of overweight loads and equipment (including stockpiling of raw material) on structures

Can you pull together some info to send to Dan? I'd like to get it to him today or tomorrow, electronically.

Thanks.

- Rick

----- Forwarded by Richard Land/HQ/Caltrans/CAGov on 10/31/2007 10:05 AM -----

"Walsh Daniel" <daniel.walsh@ntsb.gov>

10/25/2007 09:27 AM

To <richard.land@dot.ca.gov>

cc

Subject Restriction of overweight loads and equipment (including stockpiling of raw material) on structures

Richard,

As we discussed on the telephone, can you please provide me Caltran's policy on restriction of overweight loads and equipment (including stockpiling of raw material) on structures. Please call me at (817) 652-7844 if you have any questions. Thank you.

Dan Walsh, P.E.
National Transportation Safety Board

be made and become effective at the time the awarding body tenders final payment to the contractor, without further acknowledgment by the parties.

"If an awarding body or public purchasing body receives, either through judgment or settlement, a monetary recovery for a cause of action assigned under this chapter, the assignor shall be entitled to receive reimbursement for actual legal costs incurred and may, upon demand, recover from the public body any portion of the recovery, including treble damages, attributable to overcharges that were paid by the assignor but were not paid by the public body as part of the bid price, less the expenses incurred in obtaining that portion of the recovery.

"Upon demand in writing by the assignor, the assignee shall, within one year from such demand, reassign the cause of action assigned under this part if the assignor has been or may have been injured by the violation of law for which the cause of action arose and (a) the assignee has not been injured thereby, or (b) the assignee declines to file a court action for the cause of action."

7-1.02 LOAD LIMITATIONS

Unless expressly permitted in the special provisions, construction equipment or vehicles of any kind which, laden or unladen, exceed the maximum weight limitations set forth in Division 15 of the Vehicle Code, shall not be operated over completed or existing treated bases, surfacing, pavement or structures in any areas within the limits of the project, whether or not the area is subject to weight limitations under Section 7-1.01D, "Vehicle Code," except as hereinafter provided in this Section 7-1.02.

After application of the curing seal, no traffic or Contractor's equipment will be permitted on cement treated base or lean concrete base for a period of 72 hours. After 72 hours, traffic and equipment operated on the base shall be limited to that used in paving operations and placing additional layers of cement treated base. No traffic or Contractor's equipment will be permitted on treated permeable base except for that equipment required to place the permeable base and the subsequent layer of pavement. Trucks used to haul treated base, portland cement concrete, or asphalt concrete shall enter onto the base to dump at the nearest practical entry point ahead of spreading equipment. Empty haul trucks shall exit from the base at the nearest practical exit point. Entry and exit points shall not be more than 1,000 feet ahead of spreading equipment except in locations where specifications prohibit operation of trucks outside the area occupied by the base or where steep slopes or other conditions preclude safe operation of hauling equipment. In those locations, entry and exit points shall be established at the nearest point ahead of spreading equipment permitted by specifications and allowing safe operation of hauling equipment. Damage to curing seal or base shall be repaired promptly by the Contractor, at the Contractor's expense, as directed by the Engineer.

Within the limits of the project and subject to the control of the Engineer, and provided that the Contractor, at the Contractor's expense, shall provide such protective measures as are deemed necessary by the Engineer and shall repair any damage caused by the operations, the Contractor will be permitted to:

(1) Make transverse crossings of those portions of an existing public road or street that are within the highway right of way, with construction equipment which exceeds the size or weight limitations set forth in Division 15 of the Vehicle Code.

(2) Make transverse crossings of treated bases, surfacing or pavement which are under construction or which have been completed, with construction equipment which exceeds the size or weight limitations set forth in Division 15 of the Vehicle Code.

(3) Cross bridge structures that are not open to public traffic and which are designed for HS20-44 Live Loading (culverts and pipes excluded), with construction equipment which exceeds the size or weight limitations set forth in Division 15 of the Vehicle Code, but not exceeding the load limitations hereinafter specified, provided that the Contractor furnishes to the Engineer the dimensions and maximum axle loadings of equipment proposed for use on bridge structures:

(a) The maximum loading on bridge structures due to pneumatic-tired truck and trailer combinations shall not exceed (1) 28,000 pounds for single axles, (2) 48,000 pounds for tandem axles, nor (3) 60,000 pounds total gross load for single vehicles or 110,000 pounds total gross load for truck and trailer or semi-trailer combinations.

(b) The loading on bridge structures due to 2 and 3 axle pneumatic-tired earthmovers shall not exceed that shown in the following table.

Allowable Construction Loading On Bridges
For 2 and 3 Axle Earthmovers

Spacing of Bridge Girders (center to center in feet)	Maximum Axle Loading (in pounds)
4	28,000
5	29,000
6	30,000
7	32,000
8	34,000
9	37,000
10 and over	40,000

Minimum axle spacing:
For 3-axle earthmovers
Axles 1 to 2 = 8 feet
Axles 2 to 3 = 20 feet
For 2-axle earthmovers
Axles 1 to 2 = 20 feet

(4) Move equipment within the limits of the project over completed or existing base, surfacing, pavement and structures, whether or not open to the public, in accordance with the limitations and conditions in the "Permit Policy" of the Department of Transportation.

Within the limits of the project and subject to the condition that the Contractor shall repair, at the Contractor's expense, any damage caused thereby, the Contractor will be permitted to cross culverts and pipes with construction equipment which exceeds the size or weight limitations set forth in Division 15 of the Vehicle Code in accordance with the conditions set forth on the plans. If the conditions are not set forth on the plans, the provisions in the first paragraph in this Section 7-1.02 will apply.

Should the Contractor desire to increase the load carrying capacity of a structure or structures which are to be constructed as a part of the contract, in order to facilitate the Contractor's own operations, the Contractor may request the Engineer to consider redesigning the structure or structures. Proposals by the Contractor to increase the load carrying capacity of structures above 130,000 pounds per single axle or pair of axles less than 8 feet apart, or above 330,000 pounds total gross vehicle weight, will not be approved. The request shall include a description of the structure or structures involved and a detailed description of the overloads to be carried, the date the revised plans would be required, and a statement that the Contractor agrees to pay all costs involved in the strengthening of the structure or structures, including the cost of revised plans, and further that the Contractor agrees that no extension of time will be allowed by reason of any delay to the work which may be due to the alteration of the structure or structures. If the Engineer determines that strengthening the structure or structures will be permitted, the Engineer will inform the Contractor of the estimated cost of the alterations, including engineering, and the date that revised plans could be furnished. If the cost and date are satisfactory to the Contractor, the Engineer will prepare a change order providing for the agreed upon alterations.

7-1.03 PAYMENT OF TAXES

The contract prices paid for the work shall include full compensation for all taxes which the Contractor is required to pay, whether imposed by Federal, State or local government, including, without being limited to, Federal excise tax. No tax exemption certificate nor any document designed to exempt the Contractor from payment of any tax will be furnished to the Contractor by the Department, as to any tax on labor, services, materials, transportation, or any other items furnished pursuant to the contract.

7-1.04 PERMITS AND LICENSES

The Contractor shall procure all permits and licenses, pay all charges and fees, and give all notices necessary and incident to the due and lawful prosecution of the work.

The Environmental Quality Act (Public Resources Code, Sections 21000 to 21176, inclusive) may be applicable to permits, licenses and other authorizations which the Contractor must obtain from local agencies in connection with performing the work of the contract. The Contractor shall comply with the provisions of those statutes in obtaining the permits, licenses and other authorizations and they shall be obtained in sufficient time to prevent delays to the work.

Volume II

WEIGHT OVERLOAD GUIDELINES FOR BRIDGES ON CONSTRUCTION PROJECTS

Introduction

This memo provides the Offices of Structure Construction guidelines on the administration of the "weight limitation" provisions of a construction contract. These guidelines are to ensure uniform review and proper allowance for movement of construction equipment over structures not open to public within the limits of the construction contract. Overload cases that vary from these guidelines need to be forwarded to the HQ Office of Structure Construction in Sacramento for further analysis per the following procedures.

Standard Specification Weight Limitations

Section 7-1.02, "Load Limitations," of the Standard Specifications sets forth weight limitations for earthmovers, truck, and truck and trailer combinations that will be permitted to cross-completed bridge structures, and in addition, provides that other construction equipment may be permitted to cross bridge structures subject to the weight limitations and conditions of the California Department of Transportation Permit Policy. The provisions of Section 7-1.02 apply only within the limits of highway construction contracts.

The California Vehicle Code governs operation of vehicles (including construction equipment) on State highways beyond the limits of a construction project.

Overloads

When analyzing overloads, consideration should be made for the potential reduced capacity of a partially completed or demolished structure. Overloads on bridge structures within construction contracts may be either repetitive or occasional, dynamic (moving) or stationary. Listed below are guidelines for evaluating common overloads.

A. Repetitive Overloads

Repetitive overloads usually occur in connection with an earthmoving operation, and thus usually involve earthmoving equipment.

1. Bridge Structures Designed for HS20-44, Alternative, and Permit Live Loading

Section 7-1.02, "Load Limitations" will apply and the use of earthmoving equipment that exceeds these limitations will not be permitted.

2. Structures Designed for Overloads

Under the provisions of Standard Specification Section 7-1.02, "Load Limitations" the Contractor may request the redesign of a structure to increase its load carrying capacity to accommodate heavy construction vehicles such as earthmoving equipment.

At the present time, the design vehicle used to represent the construction equipment loading is a three-axle vehicle having a maximum axle load of 130 kips and a total gross load of 330 kips for spans greater than 54 feet, and a two-axle vehicle having a maximum axle load of 130 kips and a total gross load of 200 kips for spans of 24 to 54 feet. For spans under 24 feet, the design is based on a single 130 kip axle.

If a structure is designed to accommodate the 330 kip construction equipment loading, no further increase in load-carrying capacity will be considered and the use of construction equipment that exceeds the 330 kip loading will not be allowed.

If the stresses produced by the Contractor's equipment do not exceed the stresses produced by the aforementioned construction equipment loading (design vehicle) and if the Contractor is willing to pay the cost of redesign and the increased cost of construction, the structure or structures will be redesigned. (Additional information relative to construction overload design is given in Memo to Designers 15-15.)

Following are the procedures to be followed when the Contractor requests a redesign of a structure, or structures, to increase the load carrying capacity.

(i) Contractor submits a letter to the Resident Engineer requesting that the structure be designed to increase its load carrying capacity. In this letter the Contractor must name the structure or structures to be redesigned, give specific details of the loads and the positioning of the loads on the structure. The contractor must also state that they are willing to pay the cost of redesign and the increased cost of construction.

(ii) Structure Representative submits a copy of the Contractor's letter to the Offices of Structure Construction subdivision Deputy along with a request that the structure be redesigned. The Structure Representative should also request that they be advised of the estimated cost of redesigning the structure. At this point, the contractor should be informed of the estimated cost and a formal agreement should be reached prior to proceeding.

(iii) After the redesign has been completed and upon receiving revised contract documents and the estimated maximum cost of redesigning the structure, the Structure Representative will prepare a Contract Change Order. The Contract Change order will authorize the structural alterations to accommodate the construction overloads. If the final cost to the Contractor for the redesign is known then the credit to the State should be included. Otherwise a supplemental Contract Change order should be written when the final costs are completed. (See page 6 of this Construction Memo for a sample of this type of Contract Change Order.)

B. Occasional Overloads

Occasional overloads will include the movement of construction equipment (concrete trucks, cranes, paving equipment, etc.) across completed or partially completed structures from one

work site to another. Also included for consideration are stationary overloads, such as cranes, winches, and concrete pumps operating from the bridge deck.

1. Concrete Trucks

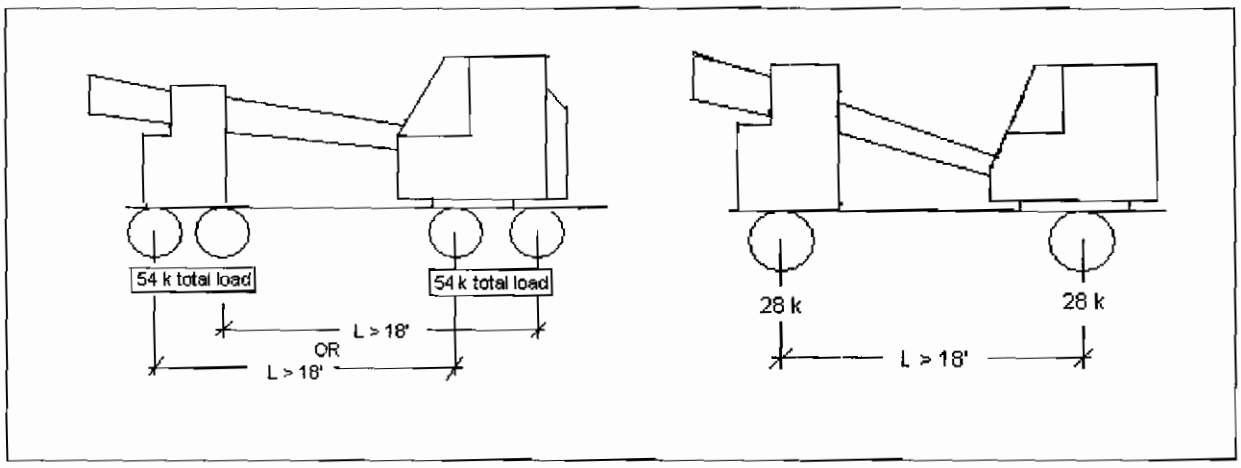
Concrete trucks traveling on the highway with full loads generally need to use booster axles to meet the axle weight requirements of the California Vehicle Code. When discharging concrete, the booster wheels need to be raised which increases the loads on the remaining axles resulting in axle loads that exceed the legal load allowed by the Permit Policy. Standard Specification Section 7-1.02 "Load Limitations," allows trucks over legal (exceeding CVC weight limitations) limit on bridges with up to 28,000 pounds for single axles and 48,000 pounds for the tandem axles. This limits most trucks to hauling a maximum 7 1/2 to 8 cubic yards. These trucks should be weighed to confirm allowable specification loading.

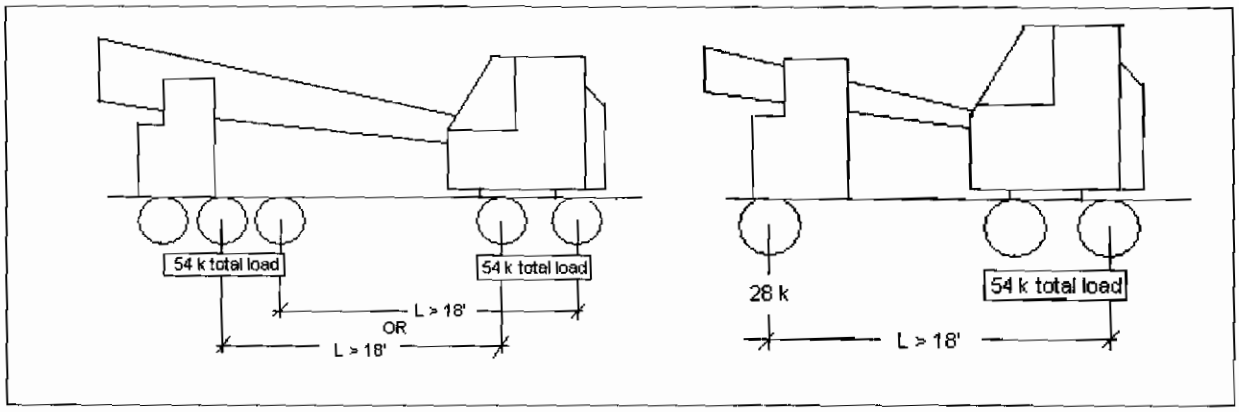
2 Cranes and Concrete Pumps

Fully equipped truck cranes are permitted to cross bridge structures on construction projects provided they conform to Permit Policy. The following general guidelines may be used to determine if truck crane or concrete pumper traveling on the bridge meets permit policy.

- Tandem axle weights less than 54,000 pounds
- Single axle weight less than 28,000 pounds
- No group of three axles within an 18 foot distance (see table diagrams below)

Any exception to the guidelines should be referred to the HQ Office of Structure Construction in Sacramento. The HQ Office of Structure Construction will forward the necessary information to Structures Maintenance and Investigations for decision. A letter requesting overloads analysis and a complete description of the vehicle should be included. (See Processing Requests to Move Overloads below for further details.)





Cranes are often stripped down (counterweights and other components removed) and sometimes the boom is supported on a trailer in order to achieve allowable permit weights. The Engineer should verify that the crane is configured in its traveling condition when moving on the bridge.

3. Stationary Cranes and Concrete Pumps

Cranes are also used in a stationary position to do work from bridges, including pile driving, lowering falsework, and lifting girders. Cranes lifting in a stationary position cause high outrigger loads. Outrigger loads greater than 40,000 pounds should be referred to the Sacramento Office of Structure Construction. The HQ Office of Structure Construction will forward the necessary information to Structure Maintenance and Investigations for decision. The engineer may review proposals for outrigger loads less than 40,000 pounds provided that the bridge is designed for permit loads or has full permit capacity (PPPPP). The Contractor should be required to provide calculations for outrigger loads. Outrigger loads may be distributed in one of three methods:

i. Outriggers that produce loads less than 25,000 pounds may be placed on timber mats. The mats should be 12 by 12 minimum and placed parallel to the girders. The minimum length of the mat is 5 feet.
ii. Outriggers that produce loads greater than 25,000 pound should be placed on a beam that distributes load fairly equally to two girders.
iii. Outriggers placed upon concrete bent caps of box girder bridges do not require mats or beams to distribute loads.

Submittals for stationary loading to be referred to Sacramento should include the following information:

i. Location of crane outriggers tied into reference locations (CL bent or abutment, CL bridge, or edge of deck etc.
ii. Calculations for outrigger loads.
iii. Manufacturers information for crane and a description of how the crane will be outfitted and configured (boom length and counterweights).
iv. Weight of what will be lifted and maximum extension of boom.
v. Proposed method for distribution of outrigger loads.
vi. How the configured crane will be moved into position while complying with Standard Specification Section 7-1.02, "Load Limitations".

4. Track Equipment

Equipment such as pavement grinders and excavators occasionally need to cross or work on a bridge. The engineer with bridges designed for HS-20 loading may approve this equipment, provided that it meets the following conditions:

i. maximum gross weight less than 60,000 pounds
ii. maximum load on track less than 5 kips per foot

All other requests should be referred to the HQ Office of Structure Construction in Sacramento.

Processing Requests to Move Overloads

As previously noted, requests from Contractors to utilize earthmoving equipment or to move overloads which do not exceed the limitations of Section 7-1.02, "Load Limitations" of the Standard Specifications may be approved at the job level. All other requests are to be forwarded by the Structure Representative to the Sacramento Office of Structure Construction. The Office of Structure Construction will forward the necessary information to Structures Maintenance and Investigations for decision.

The Contractor's request must be explicit as to the nature of the overload and the conditions under which it will be moved. A complete description of the vehicle is required. The information required includes the type, make and model of equipment, the axle spacing, axle width out to out of tires, the axle load (obtained by scale weight if possible), the width and number of tires, operating conditions, etc.

Permission to cross bridge structures with construction equipment (including earthmoving equipment) that does NOT exceed the limitations of Section 7-1.02 will also be granted by means of a letter to the Contractor from the Resident Engineer (see page 6 for and example letter). However, if special conditions or limitations are to be imposed, they should be incorporated into a letter similar to the example letter authorizing the use of earthmoving equipment.

Since construction overloads will often affect areas of responsibility of both the District and the Offices of Structure Construction it is important that both be fully informed. Particular care should be taken by the Structure Representative to ensure that copies of all correspondence related to overloads are furnished to interested District personnel.

EXAMPLE CHANGE ORDER TO AUTHORIZE BRIDGE REDESIGN

As provided in Section 7-1.02 of the Standard Specifications, modify substructure of the Van Koevering Avenue Undercrossing, Bridge 54-1001, as shown on Sheets 2 and 3 of this change order to accommodate construction overloads.

It is agreed that the contractor will furnish all labor, equipment and material and perform all work required to accomplish the structural alterations at no cost to the State.

It is further agreed that the State will be credited by means of a supplemental Contract cost change order the actual cost for redesigning the Van Koevering Avenue Undercrossing to accommodate construction overloads. The design costs shall be a maximum of $10,000.

EXAMPLE LETTER TO AUTHORIZE THE USE OF EARTHMOVING EQUIPMENT

To Contractor

Gentlemen:

Your request dated (date) for permission to cross the (name of bridge), Br. No. (xxx), with construction overloads is approved in accordance with the provisions of Section 7-1.02, "Load Limitations" of the Standard Specifications, subject to the following conditions:

1. The approaches at each end of the bridge shall be completed to the grade required to provide a smooth transition to the bridge roadway, and shall be maintained in a smooth and uniform condition at all times while construction equipment is in use, for a length of not less that 150 feet measured from the bridge ends. Local depressions in the approaches in the vicinity of the bridge ends will not be permitted.

2. Construction equipment, either loaded or unloaded, shall be operated at all times at a speed and in a manner so that or bouncing of the equipment will not occur while the equipment is crossing the bridge.

3. Construction equipment shall be confined to the construction equipment lane by means of substantial, temporary physical barriers.

4. Only one construction overload will be permitted on the bridge at any time.

5. On completion of the operation that requires the use of a construction overload, the bridge roadway shall be cleaned and physical barriers used in connection with the construction equipment lane shall be removed and disposed of away from the job site.

   Note: Other conditions or restrictions may be added as necessary to suit particular job circumstances.

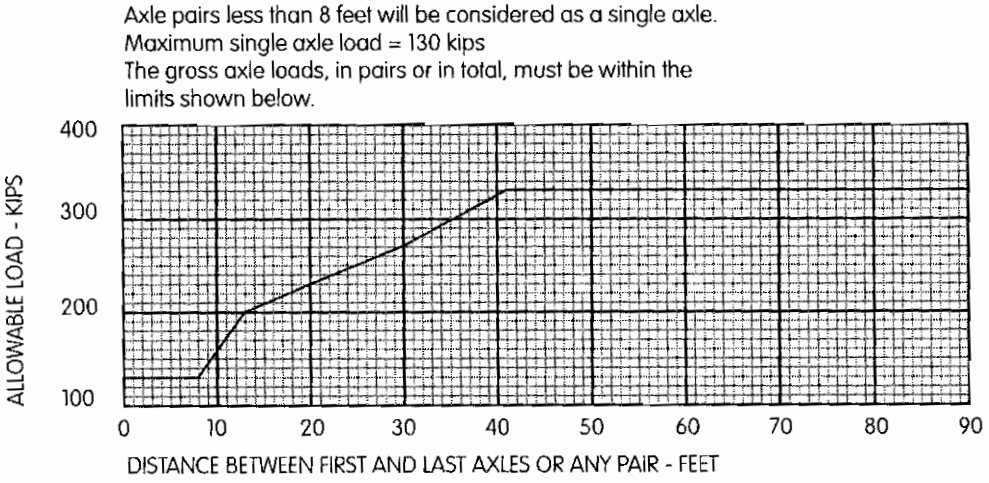
SUPERSEDES MEMO TO DESIGNERS 15-15 DATED OCTOBER 1989

15-15 MATERIAL HAULING EQUIPMENT LOADING

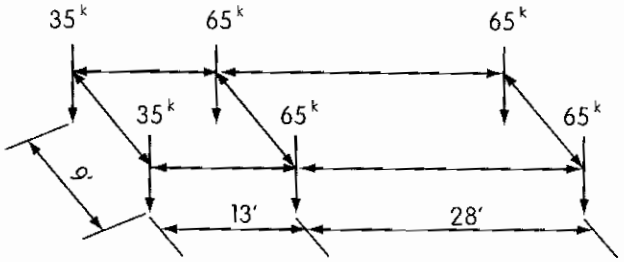
"Material Hauling Equipment" (MHE) is a general name for construction equipment such as dump trucks, trailers, earthmovers, and transit-mix trucks. The *Standard Specifications* conditionally allow for MHE that exceeds the size or weight limitations set forth in Division 15 of the California Vehicle Codes to cross bridge structures during construction. This Memo provides the design guidelines for MHE that exceeds the loading limitations set forth in the *Standard Specifications* but not exceeding 330 kips.

The District has the responsibility of identifying structures to accommodate Material Hauling Equipment loading. See Topic 110.1 of the *Highway Design Manual*. It is the Design Engineer's responsibility to contact the District in the early planning stages to discuss material hauling including the fact that MHE must weigh more than Vehicle Code limitations in order to be a consideration. If MHE loading is required, design and criteria will be as follows:

1. The Material Hauling Equipment design loading consists of the load represented by the chart and loading diagram shown below:



MATERIAL HAULING EQUIPMENT LOADING CHART

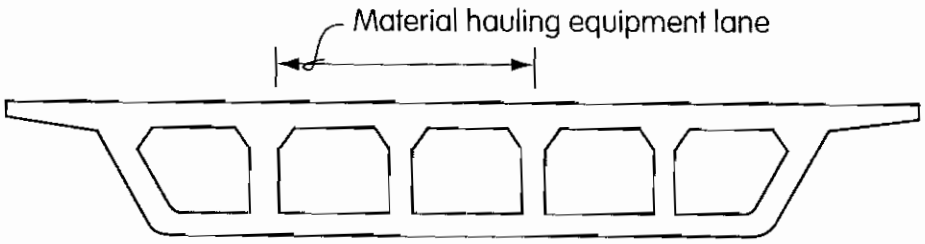


MATERIAL HAULING EQUIPMENT DESIGN LIVE LOADS DIAGRAM

2. Show this chart and loading diagram on the plans. CADD cells are available as are standard CADD Patterns.
3. Revise the live loading note on the General Plan thus:

   Live Loading: HL 93 and Permit Design Vehicle (LRFD)

   For Material Hauling Equipment loading, see chart and diagram on "___" sheet for permissible axle spacings and corresponding loadings.
4. For MHE design vehicle, use the axle configurations and loadings shown in the MHE Design Live Loads diagram. Use Strength II, Load and Resistance Factor Design (LRFD) for girders as well as slab design. Include Dynamic Load Allowance, IM = 33%.
5. Earth cover is normally not placed on deck.
6. Design for 200 feet minimum distance between Material Hauling Equipment loads.
7. Delineate the MHE lane as illustrated below in the Typical Section of the General Plan and on the Typical Section Sheet. If possible locate the lane away from the exterior girders. A MHE lane is normally 20 feet wide.



8. Obtain the factored DL+ADL+LL_{MHE} shear and moment demand envelopes in the individual girders or unit width (slab-type structure) using three dimensional modeling software tools with the loading anticipated at the time of construction in addition to the MHE truck configuration. For example, there will be no added dead load due to AC Overlay but the structure may be subjected to the weight of both permanent and temporary barriers. For prestressed concrete structures, add the average final prestressed secondary effects to the moment and shear demand envelopes. The individual girders or unit width shall be designed such that the ultimate capacity equals or exceeds the controlling maximum demand generated by the HL93 with "low-boy", Permit or the MHE design vehicle load. See *Memo to Designers* 15-20 "Using Refined Analysis of Live Loads with Two-Dimensional Design Tools" for additional design guidelines.

9. For prestressed concrete members determine the prestressing force from loads at the service level. Use normal stresses. Design for ultimate moment capacity and shear using the *AASHTO LRFD Bridge Design Specifications* as amended by Caltrans.

   The additional mild steel or prestressing steel (or P_j) shall be distributed equally within the girders considered as supporting the MHE loading. When defining P_j for MHE lane girders, also consider the variation in force allowed between girders by *Memo to Designers* 11-1.

10. The deck design shall be checked for resistance to the MHE wheel loads.

11. HL93 or Permit live load may govern part or all of design depending on configuration of structure.

12. All components of the structure must be designed to consider the effects of the MHE loads.

The *Standard Specifications* allow contractors to request redesign of proposed structures to carry overloads. If the Office of Structure Construction requests redesign, the procedures will be as stated in this memo. The maximum vehicle size allowed will be the MHE design load.

Kevin J. Thompson
State Bridge Engineer
Deputy Chief, Division of Engineering Services
Structure Design

MASSACHUSETTS SPECIFICATIONS FOR BRIDGE LOADING

U.S.Department
of Transportation
Federal Highway
Administration

Memorandum

Subject: Technical Advisory 5140.28 - Construction Loads on Bridges Date: August 8, 2007

From: Frederick G. Wright (Bud)
Executive Director (HOA-3)

To: Division Administrators
Directors of Field Services
Federal Land Highway Division
Engineers

PURPOSE

In the ongoing investigation of the collapse of the I-35W Bridge in Minneapolis, the National Transportation Safety Board has identified construction equipment and materials loading on the bridge as part of their review. While no conclusions have been reached, in an abundance of caution, we strongly advise the State Transportation Agencies and other bridge owners who are engaged in or contemplating any construction operation on their bridges to ensure that any construction loading and stockpiled raw materials placed on a structure do not overload its members.

For more discussion on this issue, please refer to the AASHTO Standard Specifications for Highway Bridges, 17th Edition, Division II, Section 8.15 or the AASHTO Load Resistance and Factor Design Bridge Design Specifications, 4th Edition, Section 3.

Please refer any questions to Benjamin Tang at 202-366-4592 or benjamin.tang@dot.gov.

MOVING THE
AMERICAN
ECONOMY

Contract #	Project No.	City/Town	Description
District 1	39036	Beckett/Middlefield	Bancroft Road over the west Bı
	42088	Colrain	Clorain - Lyonsville Road over t
	42097	District 1	Emergenct Deck Repair Contra
	42947	Ashfiled	Route 116 - 2 Bridges Over the
	44196	West Stockbridge	Route 102 over the Williams Riv
	44007	Monterey	River Road Bridge Over the Kor
	48168	New Marlborough	Hayes Hill Road Over the Konka
	49586	Route7	New Ashford Road - 2 Bridges C
	51216	Charlemont	Route 8A (North Heath Road) Bı
District 2			
	34067	Warren	Gilbert Rd Bridge over Quaboag
	34510	Chicopee	Route 141 over Chicopee River
	38132	Springfield	Parker Street under CSX RR
	38998	Palmer	Route 20 over CSX RR & Rte 67
	41067	Erving	Route 2 over Rte 63 and NECRR
	42616	Erving/Montague	Route 63 over Millers River
	43627	Barre	Route 32 over Ware River
	45687	Southwick	Route 168 Culvert@ Congamond
	45713	Winchendon	Route 202 over Millers River
	49428	Easthampton	I91 over East Street
	49437	Bernardston	Routes 5 & 10 over B&M RR
	49909	Westfield	Route 10 & 202 over Westfield Ri
District 3			
	34574	Millville	Central Street over P&W RR and
	636494	Worcester	I-290 at Rte. 146 (Brosnihan Squ
	34057	Worcester	Route 146 at Hurley Square
	33152	Leicester	McCarthy Avenue over Kettle Bro
	31172	Maynard, Stow	White Pond Rd over Assabet Rive
	36483	Southbridge	Eastford Road (Route 198)
	44385	Hudson	Route 62 (Main Street) / Assabet
	49421	Worcester	Exeter Street over CSX Railroad
	34485	Leominster	Route 13 (Main St.) over the Nort
	35657	Grafton	Depot St. over P&W RR
	45564	Framingham	Route 9 over the Sudbury River, I
	48023	Framingham	Main Street over Sudbury River
	39932	Bellingham	Pearl Street over Charles River
	38122	Natick	Route 9 over Lake Cochituate

	38930	Spencer	Brooks Pond Rd. over Five Mile
	45642	Sterling	Muddy Pond Road over the Stillv
	34661	District 3	Various Locations
	34025	Worcester	I-290 Viaduct over CSX and 4 Ci
	44828	Harvard, Shirley	Hospital Road over Nashua Rive
	33134	Auburn	I-290 over Auburn St. and I-290 c
	34612	Uxbridge	Mendon St. (Route 16) over the M
	44341	Clinton	Routes 62 & 70 / Nashua River
	38359	Grafton	Pleasant St. Brg (G-8-7) over Bla
	44339	Lunenburg	Leominster/Shirley Road over B&
	44137	Northborough	Allen Street over the Assabet Riv
	36127	District 3	District-wide
	34635	District 3	Various Locations in District 3
	41852	Northbridge	Rte 146 NB over Main Street
District 4			
	33126	Concord	Route 117 over the Sudbury Rive
	33205	Wellesley	Route 16 over Route 9
	34052	Boston	Congress Street over The Fort Pc
	34701	Peabody	North Central Street over the MB
	43300	Boston	Sprague Street over the MBTA, C
	48016	Lynn	Boston Street over the Saugus Ri
	33276	Haverhill	Upper County Bridge over the Me
	38549	Revere	Revere Street over the MBTA and
	39716	Dedham	Providence Highway over High St
	41586	Boston	Ipswich Street over the Muddy Ri
	41863	Andover	High Plain Road over Route I-93
	42760	Methuen	Riverwalk over the Spicket Falls I
	43701	Newbury	HAY STREET OVER THE LITTL
	44875	Concord	SUDBURY ROAD OVER SUDBU
	45142	Billerica	Route 4 (NASHUA ROAD) OVEF
	45304	Cambridge	WALDEN STREET OVER THE B
	48688	Chelmsford	Rt3A(Princeton Blvd) over B&M&
	49211	Newbury	ROUTE 1A (HIGH ROAD) OVEF
	36037	Waltham	Winter Street at Interstate 95
	34638	Canton	Interstate 95 (Route 128) and 93
	45533	Dedham	Interstate 95 and Route 1 and 1A
	39876	Wilmington	Section of Route 129 (Lowell Stre
District 5			
39689	601554	ATTLEBORO	ATTLEBORO - COUNTY STREE BRIDGES)

43702	603385	BRIDGEWATER-MIDDLEBOROUGH	BRIDGEWATER-MIDDLEBOR(
37523	603733	DARTMOUTH	DARTMOUTH- NEW BEDFORD
42231	604386	DISTRICT 5	DISTRICT 5- EMERGENCY AN (BRIGHTMAN APPROACHES S
41856	604368	DISTRICT 5	DISTRICT 5- SCHEDULED & E OTHER RELATED WORK (BUL
36951	604180	DISTRICT 5	DISTRICT 5- SCHEDULED & E (WESTPORT DRAWBRIDGE &
38586	603388	FALL RIVER	FALL RIVER - CITY HALL PLAZ
50501	600792	FALL RIVER- SOMERSET	FALL RIVER- SOMERSET - BRI (MECHANICAL)
32279	601948	FALL RIVER- SOMERSET	FALL RIVER- SOMERSET- BRA
42274	601050	FALL RIVER- WESTPORT	FALL RIVER- WESTPORT - RO(
45509	603349	FALMOUTH	FALMOUTH - WATER STREET
43497	601932	FRANKLIN- MANSFIELD	FRANKLIN- MANSFIELD - ROUT BRIDGES)
45263	603376	FREETOWN	FREETOWN - ROUTE 24 OVER
34528	603378	HANOVER	HANOVER: ROUTE 53/3
49429	604481	MANSFIELD	MANSFIELD - ROUTE 140 (S. M
37551	600415	MANSFIELD	MANSFIELD - ROUTE 106
45675	604489	MARSHFIELD- SCITUATE	MARSHFIELD- SCITUATE - JUL THE SOUTH RIVER (2 BRIDGES
42308	603681	NORTH ATTLEBOROUGH	NORTH ATTLEBOROUGH - HUI
51231	4060	OAK BLUFFS- TISBURY	OAK BLUFFS- TISBURY- BEACH
43332	603021	ROCKLAND	ROCKLAND- ROUTE 3 NB and S
44232	603622	SHARON	SHARON - ROUTE 1/ROUTE I-9
34644	603519	SWANSEA	SWANSEA - ROUTE 6 OVER RO
38807	54140	SWANSEA	SWANSEA - OLD PROVIDENCE
43781	603007	SWANSEA	SWANSEA - ROUTE 136 OVER
33319	601473	TAUNTON	TAUNTON - WEST BRITTANIA S
43675	603253	TAUNTON	TAUNTON - WHITTENTON STR
40944	602555	TAUNTON	TAUNTON- EXTENSION OF AC(BRIDGES)
43326	601995	WESTPORT	WESTPORT - ROUTE 88 OVER

MINNESOTA SPECIFICATIONS FOR BRIDGE LOADING PRIOR TO COLLAPSE

Minnesota Department of Transportation

Office of Bridges & Structures
MS 610, 3485 Hadley Ave. No.
Oakdale, MN 55128

December 19, 2007

Daniel Walsh P.E.
Highway Accident Investigator
National Transportation Safety Board
Office of Highway Safety
624 Six Flags Drive, Suite 150
Arlington, TX 76011

Dear Mr. Walsh,

In response to your email inquiry dated November 27, 2007, we have reviewed the Minnesota Department of Transportation policies and procedures regarding construction loads, vehicle overload policy, bridge inspector certification, and additionally responded to your question regarding the fabricated openings in the main truss elements for Bridge 9340. We offer the following responses in the format you requested.

Construction Loads

Mn/DOT policies and procedures with respect for construction loading are as follows;

Since 1968 the Mn/DOT Standard Specifications for Construction manual contains language on limiting loads in Section 1513. Section 1513 in the current 2005 manual states that a contractor shall comply with the same load restrictions as normal legal traffic. The restrictions are for completed structures or those under construction. The legal limits are defined per Minnesota Statute of the Highway Traffic Regulation Act Chapter 169. Section 1513 from the 1968 and 2005 manuals are attached to this document as Figure A and B, respectively. Also per Section 2401.3G (Figure C) the contractor shall not prematurely load newly placed concrete elements until proper curing is completed.

The contractor can request to place larger than legal loads on a new or remodeled bridge with Mn/DOT Construction Project Engineers approval. Although not a written policy, when a contractor proposes a load that exceeds legal loads, it is a practice for the Mn/DOT Construction Project Engineer to consult with the Regional Construction Engineer in the Bridge Office. The construction loading information is provided to the Load Rating Unit or Design Unit for evaluation to determine if the loading is acceptable or if any special procedures such as use of the load distribution mats are required. Some examples of loads that exceed legal loads are mobile cranes or heavy earth moving equipment.

Per AASTHO design codes the construction loads shall not exceed the load carrying capacity of existing, new or partially completed portions of the structure. For typical bridges the policy per section 3.16 of Mn/DOT LRFD Bridge Design Manual is to assume a construction load of 10 psf dead load and 20 psf live load before the deck is cured

and not acting composite with main structural members. For specialty bridges such as segmental concrete box girders where the bridge must support erection equipment, the contract documents have specific limits on safe construction loads and locations. If the contractor's proposed erection equipment results in heavier loads than shown, the bridge designer is consulted.

Vehicle Overloads

All trucks over legal loads defined by Formula B are required to get a permit. Minnesota permits are issued by the Mn/DOT Office of Freight and Commercial Vehicle Operations (OFCVO) for state owned bridges. Some responsibilities of the OFCVO are to issue permits, collect fees, record information, and communicate with the Bridge Office for special loads. The OFCVO uses a computer program called "Routebuilder NT" to process all permits.

There are basically 3 kinds of permits issued for overweight trucks on state owned highways in Minnesota. The first is a self routing divisible annual permit for special commodities for loads up to 98 kips. The second is an annual permit for non divisible loads that do not exceed 145 kips. The last is a single trip permit for non divisible loads above the legal load.

The divisible annual permit is for certain commodities that have legislature approval to go above legal loads. Garbage haulers, raw forest products and some agricultural harvest products are examples of divisible annual permits. The maximum weights differ by the haul product but the maximum is 98k on 6 axles. The commodity haulers are allowed to travel on all non interstate bridges unless it is posted with a permit restricted sign. The legal loads as defined in Minnesota Statute 169 increase 10% in the winter. In the winter the damage done to the roads is minimal because the pavement is frozen. The bridge capacity does not increase but Mn/DOT accounts for the added load when calculating bridge postings for legal trucks. To allow the 10% increase on interstates they also need a separate annual divisible permit by Federal requirements.

The annual non divisible permit allows trucks an unlimited number of trips. Annual non divisible permits are allowed up to 92k on 5 axles and 145k on 8 axles. The trucks either call in for their route or use our website that provides the weight and bridge restrictions. If the truck is below 84k on 5 axles or 112k on 8 axles the truck may self route from bridge information given by Mn/DOT.

Lastly there were approximately 28,000 single trip permits issued last year for overweight trucks. There is no maximum weight for single trip permits other than bridge capacity. All single trip permits have a defined route determined by OFCVO along with any restrictions.

All permit types have weight limits for single axles and certain axle groups. Tandems are limited to 46k. Tridems are limited to 60k. Quads are limited to 72k and spread quads or first to last axle spacing greater than 14'1" are limited to 80k.

Routebuilder is able to process almost all the annual permits and the vast majority of single trip permits for overweight automatically. Based on axle weights and spacing Routebuilder attempts to classify the truck into a standard permit truck A, B, C or over C. The A truck is 104k at 46', the B is 136k at 49' and the C is combination of three trucks 59k at 57', 207k at 93' and 259k at 117'. All state owned bridges have their capacities related to the 3 standard permit trucks. If the truck is classified as an A, B or C the permit is compared to the predetermined standard truck capacity for each bridge it crosses. If the weight is over a C or Routebuilder and OFCVO permit technician can't accurately classify the truck due to concentrated axle groups, the information is sent to the Bridge Office for review. All trucks over legal weights are reviewed either directly by the Bridge Office or indirectly by the criteria the Bridge Office set for standard permit trucks used by Routebuilder.

Permit reviews are done by experienced bridge engineers in the Load Rating Unit at the Bridge Office. Permit reviews are typically processed within hours but could take several days or weeks depending on the complexity of permit. There are times when especially heavy permits take extensive coordination between the Bridge Office, OFCVO and the hauler to find a safe practical route.

For bridges that have rating factors above 1.0 for a permit there are no restrictions placed on the driver of the truck. If the rating factor is less than one, there are additional methods to decrease the trucks effect on the bridge. By occupying 2 lanes on a bridge the truck eliminates the possibility of a heavy adjacent truck. Also by limiting the speed, the truck reduces the dynamic forces of impact. If the rating factor is still below 1.0 with restrictions like eliminating an adjacent truck and/or reducing the speed, the permit is denied for that bridge and a new route must be chosen.

The Bridge Office maintains a database of all state owned bridges which includes postings and the standard permit truck restrictions if any. All state owned bridges have been analyzed for the standard permit trucks or posting trucks and these are updated as conditions change from deterioration to increased dead load. The Rating Unit is in the process of switching to a software program called Virtis from BARS which is being phased out. All the state owned bridges are being input in and analyzed by Virtis except the curved steel girders, concrete boxes, arches, tunnels, post tensioned boxes and trusses. Curved steel, concrete boxes and rigid frames are load rated either with BARS, another software package or by hand calculations.

Bridge Inspector Certifications

The Mn/DOT bridge inspector certification process meets the requirements of the National Bridge Inspection Standards (NBIS), as outlined in the Federal Code of Regulations Part 650.309, Minnesota Statute 165, and State of Minnesota Rule 8810.9300. Please see Figure D for the internal Mn/DOT bridge safety inspection certification policy which is based upon NBIS.

Mn/DOT offers 2 bridge inspection training courses developed by the National Highway Institute (NHI) and approved by FHWA. The 2 classes meet the NBIS standards for training classes.

There are five ways a bridge inspector can be certified as a team leader within Minnesota. The certification varies from having a professional engineering license to being an assistant inspector for five years. In accordance with NBIS all team leader inspectors must complete the FHWA comprehensive bridge inspection training course.

In addition to meeting NBIS qualifications, Mn/DOT also requires a Bridge Inspection Team Leader to pass a field proficiency test administered by the Bridge Office. The purpose of test is to ensure compliance with NBIS standards, conform to Mn/DOT Recording and Coding practices, and to improve statewide consistency.

To maintain certification there is ongoing education and minimum inspection activity requirements. The education classes are done each year by the Bridge Office to share information, present new or changing requirements, rules, or policy, and to improve the quality and consistency of inspections.

The inspector is responsible to document change in condition from the previous report, to update the NBI and AASHTO elements, and to review and correct improperly coded inventory items. The inspectors will be looking for corrosion, cracking in concrete or steel, condition of concrete such as spalling, fatigue cracks, substructure movements, paint condition, unusual deflections, bearing alignments, impact damage from vehicle or stream as well as many non structural element conditions like joints, railings and approach slabs.

Main Truss Holes on Bridge 9340

There are oval holes on the ½" cover plates for the welded box sections of Bridge #9340. The holes are located on the bottom cover plate for the top chord and the top and bottom for the diagonals and bottom chord. In a 1998 contract clear PVC covers with vent holes were placed on the holes to keep pigeons from nesting inside the box sections. Inspectors could still remove the covers to get access inside.

The original reason for the providing holes is uncertain, but they are not unique to this bridge. Mn/DOT reviewed the Sverdrup design documentation and could not determine the designer's original reason for providing the holes. However, some of the holes are required for access during fabrication of the box and bridge erection to complete the riveted member to gusset plate connections. Note that an individual

had to obtain internal access in these box shaped members to install rivets along with the welded diaphragms. While it is speculation the designer may also have provided the holes for air circulation through the box sections to reduce moisture buildup or for reduction in weight.

Please contact me if there any further questions regarding these subjects.

Sincerely,

Daniel L. Dorgan
State Bridge Engineer

DLD/EL:lmg

Attachments

Figure A (1968)

1513

Restriction on Movement of Heavy Loads and Equipment

The hauling of materials and the movement of equipment to and from the Project and over the completed structures, base courses, and pavements within the Project, that are opened for use by traffic and which are to remain a part of the permanent improvement, shall comply with the regulations governing the operation of vehicles on the highways of Minnesota, as prescribed in the Highway Traffic Regulation Act.

The Contractor shall comply with the legal load restrictions, and with any special restrictions imposed by the Contract, in the hauling of materials and the movement of equipment over structures, base courses, and pavements within the Project which are under construction, or which have been completed but have not been accepted and opened for use by traffic.

Equipment mounted on crawler tracks or steel -tired wheels shall not be operated on or across concrete or bituminous surfaces without specific authorization from the Engineer. Special restrictions may be imposed by the Contract with respect to speed, load distribution, surface protection, and other precautions considered necessary.

Should construction operations necessitate the crossing of an existing pavement or completed portions of the pavement structure with equipment or loads which would otherwise be prohibited, approved methods of load distribution or bridging shall be provided by the Contractor at his expense.

Neither by issuance of a special permit, nor by adherence to any other restrictions imposed, shall the Contractor be relieved of his liability for any damages resulting from the operation and movement of his construction equipment.

Figure B (2005)

1513

Restrictions on Movement of Heavy Loads and Equipment

The hauling of materials and the movement of equipment to and from the Project and over completed structures, base courses, and pavements within the Project that are open for use by traffic and are to remain a part of the permanent improvement, shall comply with the regulations governing the operation of vehicles on the highways of Minnesota, as prescribed in the Highway Traffic Regulation Act.

The Contractor shall comply with legal load restrictions, and with any special restrictions imposed by the Contract, in hauling materials and moving equipment over structures, completed subgrades, base courses, and pavements within the Project that are under construction, or have been completed but have not been accepted and opened for use by traffic.

The Contractor shall have a completed Weight Information Card in each vehicle used for hauling bituminous mixture, aggregate, batch concrete, and grading material (including borrow and excess) prior to starting work. This card shall identify the truck or tractor and trailer by Minnesota or prorated license number and shall contain the tare, maximum allowable legal gross mass, supporting information, and the signature of the owner. The card shall be available to the Engineer upon request. All Contractor-related costs in providing, verifying, and spot checking the cab card information (including weighing trucks on certified commercial scales, both empty and loaded) will be incidental, and no compensation other than for Plan pay items will be made.

Equipment mounted on crawler tracks or steel-tired wheels shall not be operated on or across concrete or bituminous surfaces without specific authorization from the Engineer. Special restrictions may be imposed by the Contract with respect to speed, load distribution, surface protection, and other precautions considered necessary.

Should construction operations necessitate the crossing of an existing pavement or completed portions of the pavement structure with equipment or loads that would otherwise be prohibited, approved methods of load distribution or bridging shall be provided by the Contractor at no expense to the Department.

Neither by issuance of a special permit, nor by adherence to any other restrictions imposed, shall the Contractor be relieved of liability for damages resulting from the operation and movement of construction equipment.

Figure C

2401.3G

G Concrete Curing and Protection

Newly placed concrete shall be properly cured by providing protection against rapid loss of moisture, freezing temperatures, high temperatures, abrupt temperature changes, vibrations, shock waves, and prematurely applied loads. This protection shall be provided when directed by the Engineer and for a period of time not less than that specified hereinafter, except as may be otherwise determined and permitted by the Engineer.

The curing time shall be that period of time starting with the completion of concrete placement for a specific section or unit and continuing without interruption until the Engineer has determined that the curing has been satisfactorily completed. For cast-in-place concrete the curing shall continue until the Engineer has determined that the concrete has attained a strength based upon a percentage of anticipated compressive strength given in 2461.3B2. This percentage shall not be less than that shown below for the specified sections or units to which it corresponds:

Section or Unit	Percent
Bridge superstructures, except as otherwise specified	65
Diaphragms and end webs that are not a part of box girders and are cast in advance of the bridge slab	45
Railing	45

When a permissible construction joint is shown, subsequent concrete placement may begin before the curing period has been completed, unless otherwise specified in the Plans.

Railing concrete shall not be subjected to loading (supporting screed rails, light standards, etc.) until the Engineer has determined that the concrete has attained strength not less than 60 percent of the anticipated compressive strength.

Heavy equipment (such as ready-mix trucks) will not be permitted on the bridge slab until after completion of the curing period. Then the equipment operation shall be in a manner that will minimize shock waves. Mixer revolution shall be restricted to agitation speed. Equipment with gross mass exceeding 14 metric tons (**15 tons**) will not be permitted on the bridge slab for box girder and slab span bridges until one week after completion of the curing period.

Some modification of the requirement for continuous curing without interruption may be permitted by the Engineer for the purpose of setting wall or column forms on footings, but only when adequate provisions are made to protect the concrete from freezing or excessive drying during the interruption period. Curing shall be resumed at the earliest opportunity, and shall then be continuous until completion. When heated enclosures are used during the curing period, heaters and other equipment operated within the enclosure shall be vented to prevent the buildup of carbon dioxide.

In the event the curing period terminates during a time of the year when low temperatures will prevent additional strength gain before opening a bridge to traffic, the curing time for bridge superstructure concrete shall be extended to provide for strength gain equal to 70 percent of its anticipated compressive strength.

Strength gain percentages shall be computed from the Strength Gain Chart in Table 2401-1, except that during freezing or anticipated freezing temperatures, the Engineer may require that the computed strength gain be verified by casting and breaking control cylinders in accordance with 2461.4A5. In the event of discrepancy between these two methods, the Concrete Engineer may be called upon for determination of curing adequacy.

TABLE 2401-1
DETERMINATION OF STRENGTH GAIN OF STRUCTURAL CONCRETE *(A)*
Percent per 24 HOURS

Concrete Surface Temp. *(B)* °C (°F)	Previously Accumulated Strength Gain *(C)* % of 28 Day Value													
	5	10	15	20	25	30	35	40	45	50	55	60	65	70
24 (75)	15	15	15	15	14	13	12	11	10	9	8	7	6	6
21 (70)	15	15	15	15	14	13	12	11	10	9	8	7	6	6
18 (65)	14	14	14	14	13	12	11	10	9	8	7	6	6	5
16 (60)	12	12	12	12	11	10	9	9	9	8	7	6	6	4
13 (55)	10	11	11	10	9	8	8	8	8	7	6	5	5	3
10 (50)	8	9	9	8	7	7	7	7	7	6	5	4	4	3
7 (45)	6	8	7	6	6	6	6	5	5	4	4	3	3	2
4 (40)	5	6	6	6	5	5	5	4	4	3	3	3	2	2

(A) Table values indicate incremental strength gain for 24-hour periods at temperatures ranging from 4°C (40°F) to 24°C (75°F) when the concrete has previously accumulated a specific strength gain (percent).
(B) Represents temperature at the surface of the concrete for the section (or part section) being cured.
(C) Represents accumulative strength gain of structural grade concrete made with type I cement as a percentage of its compressive strength if cured 28 days at 24°C (75°F). Table 2401-1 may also be used for concrete mixtures containing up to 15% Class C fly ash as a cement substitution. Strength gain for concrete containing ground granulated blast furnace slag or cement substitutions except as noted above shall be determined by control cylinders.

EXAMPLE --- Average surface temperature for 24-hour period = 16°C (60°F). Previously recorded strength gain = 36 percent. Therefore, incremental strength gain = 9 percent; new accumulative total = 45 percent.

When control cylinders are used to determine if the minimum strength has been attained, in no case shall curing for cast-in-place concrete be considered completed in less than 96 hours for sections or units requiring a minimum of 65 percent of anticipated compressive strength or in less than 72 hours for sections or units requiring a minimum of 45 percent of anticipated compressive strength.

Strength gain shall not be credited for any period of time during which the concrete does not indicate the presence of a surface-moist condition, nor for any period of time when the temperature at the concrete surface is less than 5°C (40°F). In the event of exposure of the concrete to freezing temperatures or excessive drying during the curing
period, the Engineer will declare the affected section, or partial section, to be defective. Depending on the extent of the damage caused by
exposure, as determined by the Engineer, the affected section shall be:

(1) Removed and replaced,

(2) Removed to a depth specified by the Engineer and be replaced as directed,

(3) Sandblasted and overlaid with epoxy mortar or epoxy with sand broadcast,

(4) Covered by an epoxy seal coat,

(5) Subject to a reduction in payment as determined equitable by the Engineer, or

(6) Subjected to any combination of these remedies.

Anchor bolt holes and other depressions that may collect water shall, during periods of freezing temperature, be sealed or temporarily filled with closed cell polystyrene or other satisfactory material.

After completion of tine texturing for bridge deck slabs and after free water has disappeared from the surface, the Contractor shall apply a white pigmented linseed oil listed in the Special Provisions. The rate of application shall be approximately 4 m2/l (**150 square feet per gallon**) unless otherwise directed by the Engineer. The curing compound or emulsion shall be applied with approved power-operated spray equipment. The curing compound or emulsion is not a substitute for the cure specified below, but is required for moisture retention until the conventional curing material can be placed.

Bridge structural slabs shall have the conventional wet curing (wet burlap or curing blankets) applied as soon as the concrete can be walked on with insignificant damage.

Concrete exposed to a condition causing surface drying during the curing period shall be protected by a wet covering as soon as the set of the concrete will permit. Membrane curing compound will not be considered as an acceptable alternative for wet curing, except for such items as slope paving, footings and other sections that are to be covered with backfill material. Membrane curing compound shall not be used on an area that is to be covered by and bonded to subsequent concrete construction. The preferred method of

wet curing is with commercially available blankets of burlap and plastic bonded together.

Regardless of the method used, a moist surface condition must be maintained. Plywood forms left in place during the curing period shall not be permitted to become excessively dry.

Materials used as an aid to the retention of moisture on the surface of the concrete shall conform to the appropriate material requirements of these Specifications. However, when two or more materials (such as Burlene® over curing compound) are used in combination, some deviation from the material requirements may be allowed, subject to approval of the Engineer. (In no event shall the use of an approved curing system relieve the Contractor of the responsibility for maintaining a moist surface condition throughout the curing period.

Only when all requirements specified herein have been fulfilled, as determined by the Engineer, shall the curing period be considered as having been completed.

Figure D
Mn/DOT Bridge Inspection Certification Policy (April 2007)

The requirements listed below have been developed by the Mn/DOT Bridge Office to comply with the National Bridge Inspection Standards (NBIS), as outlined in the Federal Code of Regulations Part 650.309, Minnesota Statute 165, and State of Minnesota Rule 8810.9300. These new rules are effective as of January, 2006. *Note: the certification levels defined below refer to the inspection of in-service bridges and culverts (this should not be confused with bridge construction inspection certification).*

Mn/DOT Bridge Inspection Certification Levels

Assistant Bridge Inspector: This inspection level is automatically assigned to anyone who has successfully completed the 1-week training course ("Engineering Concepts for Bridge Inspectors"). A Mn/DOT BSI certification number is assigned along with this inspection level. *Note: an Assistant Bridge Inspector can only assist in bridge inspections - a certified Bridge Inspection Team Leader must be present at the bridge site at all times during a bridge inspection.*

Bridge Inspection Team Leader: A Bridge Inspection Team Leader can conduct inspections of in-service bridges & culverts on the state, county, and local highway system throughout the state of Minnesota. A certified Bridge Inspection Team Leader must be present at the bridge site at all times during a bridge inspection. There are five ways to qualify as a Bridge Inspection Team Leader...

1. Be a registered professional engineer in the state of Minnesota, successfully complete a FHWA approved comprehensive bridge inspection training course, **and pass a field proficiency test** (administered by the Mn/DOT Bridge Office).

2. Have five years of bridge inspection experience, successfully complete a FHWA approved comprehensive bridge inspection training course, **and pass a field proficiency test** (administered by the Mn/DOT Bridge Office).

3. Be certified by NICET (National Institute for Certification in Engineering Technologies) as a Level III or IV Bridge Safety Inspector, successfully complete a FHWA approved comprehensive bridge inspection training course, **and pass a field proficiency test** (administered by the Mn/DOT Bridge Office).

4. Have a bachelor's degree in engineering from an accredited college or university, successfully pass the National Council of Examiners for Engineering and Surveying Fundamentals of Engineering examination, have two years of bridge inspection experience, successfully complete a FHWA approved comprehensive bridge inspection training course, **and pass a field proficiency test** (administered by the Mn/DOT Bridge Office).

5. Have an associate's degree in engineering or engineering technology from an accredited college or university, have four years of bridge inspection experience, successfully complete a FHWA approved comprehensive bridge inspection training course, **and pass a field proficiency test** (administered by the Mn/DOT Bridge Office).

Bridge Inspection Training Courses

Mn/DOT offers two Bridge Inspection training courses each year (typically in February or March at the Mn/DOT Arden Hills Training Center). These courses were developed by the National Highway Institute (NHI), and are based upon the "Bridge Inspectors Reference Manual" (BIRM). Together, these two courses meet the definition of a "comprehensive training program in bridge inspection" as defined in the National Bridge Inspection Standards (NBIS).

- The one-week course "Bridge Safety I - Engineering Concepts for Bridge Inspectors" provides instruction on elementary concepts in engineering for use by bridge inspectors - it is intended to prepare technicians (and other personnel) with little or no background in bridge engineering for the more intensive two-week course. The current cost (2007) of this course is $350.

- The two-week course "Bridge Safety II - Safety Inspection of In-Service Bridges" provides detailed instruction on the inspection, evaluation, and condition rating of in-service bridges. The current cost (2007) of this course is $1,400.

Enrollment and scheduling information for these two courses is available on the Mn/DOT Technical Certification website or by contacting Sandy Servatius at (651) 296-3124.

Field Proficiency Test

If the above requirements have been met, an application form should be submitted to Mn/DOT Bridge Office to Schedule a field proficiency test. The purpose of this test is to ensure the compliance with the NBIS standards, to improve of bridge inspections and to increase the statewide consistency of bridge condition ratings.

The test consists of a routine inspection of an in-service bridge (based upon the Mn/DOT Bridge Inspection Manual and Inspection Report Format). The inspector is given 2 hours to examine a bridge, take notes, and determine the NBI & PONTIS condition ratings.

Grading of the field proficiency test is determined by comparing the candidate's inspection report to a reference inspection report. Emphasis is placed on the overall completeness and accuracy of the report, and on the proper documentation of any critical structural or safety conditions. Scoring is based on a scale of 0-100, with a passing score being 70 or more. The score is weighted using the following criteria:

- NBI condition ratings 30%
- Pontis element condition ratings 30%
- Pontis "smart flags" & other items 10%
- Inspection Notes 30%

Applicants who fail the field proficiency test may apply again after 6 months.

Expiration & Recertification Policy

Certification as a Bridge Inspection Team Leader must be renewed every 4 years (re-certification forms will be mailed out prior to the expiration date). To maintain certification, Bridge Inspection Team Leaders must meet the following two criteria...

- The inspector must have attended a minimum of two refresher seminars during the four preceding years. These one-day seminars are conducted annually by the Mn/DOT Bridge Office (schedules will be mailed to all Inspection Team Leaders) - the current seminar fee (2007) is $50.

- The inspector must have been actively engaged in bridge inspection during at least two of the four preceding years (the supervising engineer must verify this activity).

Mn/DOT Bridge Office Contacts (Bridge Inspection Certification)

Todd Niemann	(651) 366-4567	todd.niemann@dot.state.mn.us
Pete Wilson	(651) 366-4574	pete.wilson@dot.state.mn.us
Ken Rand	(651) 366-4576	ken.rand@dot.state.mn.us

Mn/DOT Bridge Inspection Team Leader - Field Proficiency Test Application Form

Personal Information

Name:

Mailing Address:

Employer:

_____
Minnesota Engineering Registration Number (leave blank if not applicable)

(_____) _____ - _____
Daytime Phone Number

Educational Background

List the date that the one-week training course "Engineering Concepts for Bridge Inspectors" was successfully completed (this course is optional for applicants with an adequate background in bridge engineering concepts). Date:

List the date that the two-week training course "Safety Inspection of In-Service Bridges" was successfully completed (this class is required for all applicants). Date:

Optional: List any degrees in engineering, associate degrees in engineering, or degrees in engineering technology, as well as any NICAD certification.

Inspection Experience

Total years of bridge inspection experience:
Number of bridges inspected each year (average):
Name of "Lead" Inspector(s) during these inspections:

Supervisor's Approval

I hereby certify that all above information is correct:

_____ Supervisor/Inspection Program Administrator

_____ Date

****Area below this line to will be completed by the Mn/DOT Bridge Office****

Field Proficiency

The inspector named above has successfully passed the Mn/DOT field proficiency test for Bridge Safety Inspection:

_____ Field Proficiency Evaluator

_____ Date of test

Mn/DOT Certification

The inspector named above has met all requirements necessary for certification as a Mn/DOT Bridge Inspection Team Leader:

_____ State Bridge Inspection Engineer

_____ Date

Applications must be submitted (by mail or fax) to Pete Wilson: (651) 366-4574 - phone
(651) 366-4566 - fax
Mn/DOT Bridge Office - Bridge Inspection
3485 Hadley Avenue North
Oakdale, MN 55128