Guide and / or I.M. Revision Notice

To: Cities, Counties, and Consultants **Date:** May 11, 2011

From: Office of Local Systems **Revision Notice Number:** 2011-02

The Federal-aid Project Development Guide (Guide) and / or Instructional Memorandums to Local Public Agencies (I.M.s) have been revised as indicated below. This revision notice identifies all new or revised documents and includes a summary of the significant changes. Where appropriate, it also references the existing Project Development Information Packet (Packet) or County Engineers I.M. documents that have been replaced or superseded.

The Iowa DOT does not provide paper copies of the Guide or I.M.s. Since these documents are updated frequently, we recommend using the on-line version of the Guide and I.M.s for reference. However, if you prefer using paper copies, all new or revised documents have been included in this file for convenient printing. If you maintain a paper copy of these documents, please remove the old documents and replace them with the new documents. Note: This file is designed for double-sided printing; therefore, all documents with an odd number of pages will be followed by a blank page.

For more information and additional download options, refer to the Guide and I.M.s web page. If you have any questions concerning these revisions, please contact Donna Buchwald Donna.Buchwald@dot.iowa.gov or 515-239-1051.

***** PLEASE NOTIFY ALL AFFECTED PERSONNEL OF THIS CHANGE *****

Document Title or I.M Number	Summary of Significant Revision(s)
I.M. Table of Contents May 11, 2011	The I.M. Table of Contents has been revised to reflect new or revised I.M.s, as indicated below.
I.M. 2.120 Bridge Inspection May 11, 2011	This I.M. has been revised. Substantive changes from the previous version include the following: • Attachment M, Routine Permit Truck Diagrams, was added. • "Grace Period" was changed to "Extended Inspection Cycle" throughout the document. • On page 3, new second and third paragraphs were added to the "Bridge Inspection Organization" section. The new paragraphs explain private bridges and other structures that do not carry vehicular traffic. • On page 4, two new paragraphs were added at the end of the "Qualifications of Personnel" section. The new paragraphs explain Professional Engineer requirements for those not licensed in Iowa. • On page 6, the last paragraph was replaced with two new paragraphs at the end of the "Inspection Procedures – Load Rating" section, "Procedures for Rating Standard Bridges" subsection. The new paragraphs explain the use of metric measurements; and Inventory, Operating, and Posting ratings. • On page 6, a sentence was added to item 3 in the first group of numbered items the "Inspection Procedures – Load Rating" section, "Load Factor Rating (LFR) Requirements" sub-section. This new sentence clarifies that bridges designed after Oct. 1, 2010, shall be rated LRFR. • On page 7, changes were made to item 3 the "Inspection Procedures – Load Rating" section, "Bridge Load Rating Report" sub-section. These changes clarify the rating calculations for standard bridges requirements. • On page 8, item 5 was added to the "Inspection Procedures – Load Rating" section, "overload or Superload Permitting" subsection. This new item explains the evaluation for Routine Permit Trucks (see new Attachment M).

Document Title or I.M Number	Summary of Significant Revision(s)
	• On page 10, changes were made to the paragraph under "Inspection Procedures – Records" section, "Load Rating Evaluation Form" sub-section. These changes alter the requirements for the Team Leader and Load Rating Engineer. • On page 10, changes were made to the first two paragraphs under "Inspection Procedures – Master List" section. The lists in both paragraphs are now all-inclusive. • On page 11, a new paragraph was added at the end of the "Inspection Procedures – Master List" section, "Scour Critical Bridges" sub-section. This paragraph was previously its own sub-section. • On page 12, the last sentence of the last paragraph of the "Inspection Procedures – Master List" section, "Unknown Foundations" sub-section, was deleted. • On pages 12, 13, and 14, a new section on "Inspection Procedures – Quality Control (QC) and Quality Assurance (QA)" was added. • On page 14, the last sentence of the paragraph was deleted and a new paragraph was added at the end of the "Inspection Procedures – Critical Findings" section, "Purpose" sub-section. The DOT will prepare a quarterly summary of Critical Findings to meet the requirements of NBIS. These changes make it the DOT's responsibility to notify FHWA.

Instructional Memorandums to Local Public Agencies
Table of Contents

Some I.M.s are written either to counties or cities; others are written to both counties and cities. The intended audience is indicated in the "To:" field of the I.M. as well as the Table of Contents below. Many of the I.M.s are referenced by the Federal-aid Project Development Guide (Guide). These I.M.s are marked with an asterisk (*). For more information about the relationship between the Guide and I.M.s, refer to the Guide and I.M.s web page.

Note: The I.M.s are currently in the process of being transitioned into a new format and numbering system. New or updated I.M.s will use the new format. Existing I.M.s will remain in the old format until they are revised or updated. Some of the I.M.s are not yet complete, as shown in light grey text. Some incomplete I.M.s will be based on an existing Project Development Information Packet document, some will be based on an existing County Engineers I.M. that will be renumbered, and some will include entirely new content. Where applicable, a reference and link to the existing Packet document or County Engineers I.M. is provided.

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INSTRUCTIONAL MEMORANDUMS
To Local Public Agencies

Iowa Department of Transportation

To:	Counties and Cities	Date: May 11, 2011
From:	Office of Local Systems	I.M. No. 2.120
Subject:	Bridge Inspections	

Contents: This Instructional Memorandum (I.M.) includes guidelines and procedures for a Local Public Agency (LPA) to assist them in complying with the National Bridge Inspection Standards (NBIS). This I.M. also includes the following attachments:

Attachment A - Bridge Scour Stability Worksheet – Level A Evaluation
Attachment B - Intermediate Scour Assessment Procedures Flowchart – Level B Evaluation
Attachment C - Scour Plan of Action (POA)
Attachment D - Scour Safe Foundations for Spread Footings or Steel Piles
Attachment E - Highly Erodible Soils
Attachment F - Berm Stability Criteria
Attachment G - Guidance for Developing and Implementing Plans of Actions (POA) for Bridges with Unknown Foundations, Flowcharts, and Worksheet
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Attachment I - Special Training, Equipment, and Access Requirements Checklist
Attachment J - Load Rating Evaluation Form
Attachment K - Iowa Legal Trucks Diagrams
Attachment L - Quality Assurance Field Review Worksheet
Attachment M - Routine Permit Trucks Diagrams

Introduction

According to Iowa Code Chapter 314.18, the counties, cities, and other public agencies are responsible for the safety inspection and evaluation of all highway bridges under their jurisdiction which are located on public roads, in accordance with the NBIS. These responsibilities include inspection policies and procedures, inspections, reports, load ratings, quality control (QC), quality assurance (QA), maintaining a bridge inventory, and other requirements of the NBIS.

The NBIS may be found in 23 CFR 650. The following are additions or clarifications to the indicated subsections of 23 CFR 650.

Definitions (23 CFR 650.305)

Armored Countermeasure (Armoring) - Material such as Class E Revetment, according to Section 4130 of the Standard Specifications, placed under and around a bridge structure for the purpose of protecting the embankment or berm from scour and/or erosion. Armoring is not a permanent countermeasure since the material is subject to displacement during a major flood event which is considered to be the lesser of the 500 year or roadway overtopping event.

Bridge Inspector Refresher Training Course – (FHWA-NHI-130053) – The major goals of this course are to refresh the skills of practicing bridge inspectors in fundamental visual inspection techniques, review the background knowledge necessary to understand how bridges function, communication issues of national significance relative to the nations' bridge infrastructures, re-establish proper condition and appraisal rating practices, and review the professional obligations of bridge inspectors.

Fracture Critical Inspection Techniques for Steel Bridges Training Course – (FHWA-NHI-130078) – The course curriculum for this training reflects current practices, while addressing new and emerging technologies available to bridge inspectors. In addition, the course features exemplary training, hands-on workshops for popular types of nondestructive evaluation (NDE) equipment, and a case study of an inspection plan for a fracture critical bridge.

Fracture Critical Member (FCM) - A steel member in tension, or with a tension element, whose failure would probably cause a portion of or the entire bridge to collapse. Floor beams are considered to be fracture critical members when the floor beam spacing is greater than 14 feet.

Extended Inspection Cycle - A period of time to allow for unforeseen circumstances such as severe weather, concern for bridge inspector safety, concern for inspection quality, the need to optimize scheduling with other bridges, or other unique situations may be cause to adjust the scheduled inspection date. The adjusted date should not extend more than 30 days beyond the scheduled inspection date.

Independent Party - An entity not influenced by or affiliated with the LPA or the LPA's Program Manager. An LPA or consulting firm with more than one Program Manager can utilize an alternate Program Manager from the same consulting firm or LPA to conduct the QA review.

Low Water - Water depth of less than 6 feet.

Monthly Notifications – automated notifications sent by e-mail to the LPA's by the Iowa DOT's Office of Bridges and Structures regarding inspections past due or bridges not in compliance with posting requirements on a monthly basis.

Permanent Countermeasure - Designed to account for all three major types of scour (i.e. long term degradation, general or contraction scour, and local pier or abutment scour). Properly designed and installed systems satisfy the requirements of a "Permanent" classification. Examples of permanent systems include:

- Fabric Formed Articulated Block Mattress (ABM)
- Stone Revetment
- Proprietary Articulated Concrete Block (ACB)
- Gabion Mattress

Stone revetment is subject to displacement during a major flood event which is considered to be the lesser of the 500 year or roadway overtopping event. Therefore, unless the revetment is designed in accordance with Hydraulic Engineering Circular (HEC) HEC 23 and contained, it cannot be considered to provide adequate protection to attain a "Permanent" classification. The following are some examples of permanent stone revetment:

- Burial below the contraction scour elevation.
- Installation of cut-off walls.
- Placing the revetment as launchable stone.

Safety Inspection of In-service Bridges – (FHWA-NHI-130055) – This course is based on the "Bridge Inspector's Reference Manual" and provides training on the safety inspection of in-service highway bridges. Satisfactory completion of this course will fulfill the training requirements of the National Bridge Inspection Standards (NBIS) for a comprehensive training course. This course does not address fracture critical, underwater, or complex structures.

Scour Plan of Action (POA) (see Attachment C to this IM) - A POA is a written procedure developed by the bridge owner or delegated Program Manager that outlines the monitoring plan for a specific bridge. The plan provides guidelines and practical information pertaining to each bridge for the purpose of monitoring foundation scour during flood events.

Standard bridge – a bridge constructed using the "Bridge Standards" developed by the Iowa DOT. See the Procedures for Rating Standard Bridges section below in this IM.

Structural Inventory and Inspection Management System (SIIMS)$^{(R)}$ - Bridge inspection data collection software.

Scour Evaluation - Scour evaluation is the process of determining the susceptibility of each bridge for scour. The depth, or level, of this process varies for each bridge. Some bridges may be determined scour safe after the first level of evaluation, Level A. Other bridges cannot be determined scour safe after Level A so they shall go to Level B using assessment procedures. Still others may need to go to the highest level of evaluation, Level C.

Level A - Bridge Scour Stability Worksheets (see Attachment A to this IM). Bridges that meet the required Stability Total of less than 35 points, do not need any further evaluation, and may be considered scour safe. Bridges with a Stability Total of 35 points or greater need further evaluation using the Level B Intermediate Scour Assessment Procedures Flowchart (see Attachment B to this IM).

Level B - Intermediate Scour Assessment Procedures Flowchart (see Attachment B to this IM). From this assessment, bridges are determined to be either stable, limited risk needing monitoring, scour susceptible needing monitoring, or scour susceptible needing a Level C Evaluation.

Level C - This is the most in-depth level of the evaluation process needed for those bridges that do not satisfy guidelines in the Level B Evaluation. A full computational analysis is completed using the Federal Highway Administration's HEC 18 procedures and a determination is made concerning the stability of the bridge. Bridge owners may decide to develop a Plan of Action (POA) for these structures in lieu of the Level C Evaluation.

Thalweg - The lowest point in the stream channel along the cross section.

Bridge Inspection Organization (23 CFR 650.307, d)

According to Iowa Code 314.18, the counties, cities, and other public agencies are responsible for the safety inspection and evaluation of all highway bridges under their jurisdiction, which are located on public roads, in accordance with the NBIS. These responsibilities include inspection policies and procedures, inspection reports, load ratings, QC, QA, maintaining a bridge inventory, and other requirements of the NBIS.

The NBIS regulations apply to all publicly owned highway bridges longer than 20 feet located on public roads. Railroad and pedestrian structures that do not carry vehicular traffic are not covered by the NBIS regulations. Similarly, the NBIS does not apply to inspection of sign support structures, high mast lighting, retaining walls, noise barrier structures, and overhead traffic signs. Tunnels, since they are not bridges, are not covered by the NBIS.

While NBIS is for all public highway bridges, the FHWA has no legal authority to require private bridge owners to inspect and maintain their bridges. However, the FHWA strongly encourages private bridge owners to follow the NBIS as the standard for inspecting their highway bridges. Where a privately owned bridge carries a public road, FHWA encourages the private bridge owner to inspect their bridge in accordance with the NBIS or reroute their public road.

The Bridge Owner shall have a Program Manager who is assigned the above responsibilities. The Bridge Owner may retain a consultant to perform the duties of Program Manager.

Qualifications of Personnel (23 CFR 650.309, b)

The Iowa DOT has developed the following procedure to determine if an individual with experience performing NBIS bridge inspections can qualify as a Team Leader in accordance with the 23 CFR 650.309(b) and guidance provided by FHWA Questions and Answers on NBIS.

Bridge inspection experience is defined as active participation in bridge inspections in accordance with NBIS, in either a field inspection, supervisory, or management role. A combination of bridge design, bridge maintenance, bridge construction, and bridge inspection experience is acceptable. At least 50% or more of the individual's experience must come from bridge inspection.

To determine an individual's bridge inspection experience, the number of years performing or supervising bridge inspections and the number of annual bridge inspections performed shall be provided. Office work associated with field inspection; such as, completing Structure Inventory & Appraisal (SI&A) forms, maintaining files of inspection data, performing load rating calculations, and other miscellaneous work, may be considered bridge inspection experience. One day a week is allotted for office work related to field inspection; therefore, the number of days calculated for field inspection time is divided by 4 to approximate average office time and then added to the field inspection time.

Example calculation of bridge inspection experience for a technician Team Leader:

Number of years performing or supervising bridge inspections: 25
Annual bridge inspections performed: 150
150 bridges/6 bridges per day = 25 days
25 days/4 = 6.25 days of office related work
Total days per year = 25+6.25= 31.25 days
Months per year: 31.25 days/22 working days per month = 1.42 months
Bridge inspection experience: (1.42 months) (25 years) = **35.5 months**

35.5 months is greater than the required 30 month minimum, therefore this person would be approved.

Bridge inspectors not qualified as Team Leaders may assist the Team Leader but may not inspect bridges independently. Education and experience requirements for bridge inspectors who are not Team Leaders should be determined by the Program Manager or Bridge Owner.

Program Managers and Team Leaders who perform field inspections on FCM's shall complete the Fracture Critical (FC) Inspection Techniques for Steel Bridges Training Course, by December 31, 2011. Any individual that meets the qualifications of Program Manager or Team Leader after December 31, 2011, that will be performing field inspections on FCM's shall complete the Fracture Critical (FC) Inspection Techniques for Steel Bridges Training Course.

The NBIS requires periodic bridge inspection refresher training for Program Managers and Team Leaders as part of QC and QA. The Iowa DOT has defined periodic as being every 5 years. Therefore, all bridge inspection personnel are required to complete the Bridge Inspection Refresher Training Course every 5 years following the completion of the Safety inspection of In-Service Bridges Training Course.

Professional Engineers that have successfully completed the Safety Inspection of In-Service Bridges have met the qualifications to be bridge inspection Program Managers as per the NBIS. The Iowa DOT provides access to bridge records authorized by the bridge owners in SIIMS bridge inspection software to these individuals once they have submitted the Bridge Inspector form provided on the SIIMS website to the Iowa DOT for review and approval.

Approved Program Managers are provided access to all forms and records for each bridge authorized by the bridge owner. Individuals approving the Load Rating form are required to be Professional Engineers licensed in the state of Iowa. Therefore, each person that is required to approve the load rating information must submit the Bridge Load Rating form provided in SIIMS. The Bridge Load Rating form must be reviewed and approved by the DOT, or by an approved Program Manger who has submitted the Bridge Inspector form including Professional License information. Editing of the Bridge Load Rating form by other users with authorized access to the bridge forms is permitted but approval can only be completed by a qualified Load Rater.

Inspection Frequency (23CFR 650.311)

Routine Inspections (23CFR 650.311, a)

The required inspection frequency for routine inspections may be extended by the extended inspection cycle to account for unforeseen circumstances as described in the definition of extended inspection cycle. Subsequent inspections should adhere to the previously established interval; that is the use of the extended inspection cycle should be an exception. The inspection date recorded for Items 90, Inspection Date, shall be the actual date the new inspection is initiated. The details of why the bridge inspection was late shall be documented and placed in the bridge file folder.

Bridges that have Item 58, Deck; Item 59, Superstructure; or Item 60, Substructure, with a condition rating of 3 or less, should have an inspection frequency less than 24 months, which may be a routine inspection on a more frequent basis or a special inspection in between routine inspections. Other factors that may impact frequency of inspections are Item 29, ADT; Item 70, Posting; Item 64, Operating Rating; and all items under Structure Type and Materials on the SI&A form.

Underwater Inspections (23CFR 650.311, b)

Underwater inspection requirements covered in this article pertain to the inspection of the structural elements such as abutments or piers to determine the structural integrity. If at any time during the 60 month underwater inspection interval there is low water, inspections may be performed with a method appropriate for the element and without the use of divers.

Bridges that have Item 60, Substructure, with a condition rating of 3 or less due to deficiencies below the waterline should have an underwater inspection frequency less than 60 months. Other factors that may impact frequency of inspections are Item 29, ADT; Item 70, Posting; Item 64, Operating Rating; all items under Structure Type and Materials; environment; age; and scour characteristics.

Fracture Critical Members (FCMs) (23CFR 650.311, c)

An Item 59, Superstructure, coding of 4 or less should have an inspection frequency less than 24 months. FCM inspection may be on a more frequent basis or a special inspection in between FCM inspections. Other factors that may impact frequency of inspections are Item 29, ADT; Item 70, Posting; Item 64, Operating Rating; and all items under Structure Type and Materials.

Inspection Procedures – Load Rating (23 CFR 650.313, c)

Bridges are to be load rated in accordance with the FHWA Policy Memorandum on Bridge Load Ratings for the National Bridge Inventory, dated November 5, 1993 and FHWA Policy Memorandum on Bridge Load Ratings for the National Bridge Inventory, dated October 30, 2006. Item 64, Operating Rating; and Item 66, Inventory Rating; will need to be updated accordingly upon completion of the new load rating capacity calculations. Computations shall be performed based on items found during the most recent field inspection. (See Attachment J to this IM)

At the discretion of the Program Manager, Team Leader, or Load Rater, the bridge may be re-rated to reflect changes in condition, method of analysis used, or changes in acceptable load rating methodologies. The re-rating may be justified without changes in the condition codes of Item 58, Deck; Item 59, Superstructure; or Item 60, Substructure. A new Bridge Load Rating Report form will need to be generated in SIIMS and the form certified by a Professional Engineer, licensed in the State of Iowa, when the controlling member changes or the controlling capacity is reduced.

Procedures for Rating Standard Bridges

The following procedure should be utilized for determining the load ratings of standard bridges that have been rated by the Iowa Highway Research Board Project, HR-239. There are currently 4 phases of the report available for different standard bridge designs (Load Rating for Standard Bridges (1982), Load Rating for Secondary Bridges (1991), Load Rating for Standard Bridges, Phase III (1998), and Load Rating for Standard Bridges, Phase IV (2008)).

1. Identify the standard bridge used. Refer to project plans, if available, in the bridge file to determine the version of the standard utilized. Some standards have multiple versions due to minor revisions.

2. Item 27, Year Built, is a good indicator of which standard version was used, if you are unable to locate the original plans. Some verification may be necessary in the field to determine exactly which version was utilized.

3. Review the applied dead load to determine if it matches the standard rating assumptions.

4. The operating and inventory ratings in the summary for each standard bridge are coded as an HS rating. This is NOT what should be coded on Items 64, Operating Rating, and Item 66, Inventory Rating, on the SI&A form. These numbers shall be converted to a tonnage based on a 36 ton truck.

   The HS number shall be multiplied by the ratio of 36 tons/20 tons = 1.8 and this number recorded on the SI&A in Items 64, Operating Rating, and Item 66, Inventory Rating. For example, if the operating and inventory ratings are listed as HS 32.0 and HS 23.3 respectively; then Item 64, Operating Rating,

should be coded 57.6 (32.0 tons x 1.8 = 57.6 tons) and Item 66, Inventory Rating, should be coded 41.9 (23.3 tons x 1.8 = 41.9 tons).

5. Some of the HR-239 reports include detailed computations for review of the critical and non-critical elements. These computations can be adjusted when changes to the dead load conditions are encountered or section loss in structural elements are noted.

6. Some of the standard bridges have restrictions to the number of vehicles that may be on the bridge at one time even if the roadway will accommodate more than one vehicle. If bridges are rated using one lane loading these bridges shall be posted accordingly and Item 41, Posting Status, on the SI&A coded based on the restriction.

The Federal Government instituted a policy to use only metric units for all measurement. Therefore, FHWA requires all National Bridge Inventory data to be in metric units. The Iowa DOT has chosen to use English units instead of metric. SIIMS was developed using English units for all measurements; including, but not exclusive to, vertical and horizontal clearances, deck widths, bridge length, and Inventory and Operating ratings. These English values will be converted to metric units by SIIMS for the annual National Bridge Inventory submittal.

The Inventory, Operating, and Posting ratings are typically governed by superstructure elements; and in some cases, deck elements. Further analysis may be necessary to determine the capacity if significant changes in condition or applied dead load are noted based on the current conditions. Substructures should be reviewed for deterioration and rated, if necessary. Section loss should be reviewed and losses considered in adjustments to the original ratings.

Load Factor Rating (LFR) Requirements

Bridges are to be load rated in accordance with the FHWA Policy Memorandum on Bridge Load Ratings for the National Bridge Inventory, dated November 5, 1993, for all bridges constructed, replaced, or rehabilitated since January 1, 1994. Bridges in this category shall be rated by load factor methods.

These ratings are required for the HS ratings Items 64, Operating Rating, and Item 66, Inventory Rating, on the SI&A. The bridge owner may elect to use Load Factor Rating (LFR), Allowable Stress Rating (ASR), or Load Resistance Factor Rating (LRFR) to establish load limits for purposes of load posting.

Bridges built or rehabilitated since January 1, 1994, falling into the following categories shall be rated by load factor methods:

1. Bridges constructed or replaced with the following materials:

   a. Steel produced in 1936 (33 ksi or better) or after.
   b. Prestressed concrete.
   c. Reinforced concrete.

2. Bridges that undergo major rehabilitation or repairs.

3. Bridges designed with the Load Resistance Factor Design (LRFD) method prior to October 1, 2010, shall be rated with LRFR or LFR method. Bridges designed after October 1, 2010, shall be rated LRFR.

The following material types do not require LFR analysis and may be analyzed using ASR:

1. Masonry including stone, concrete block, or clay brick.

2. Bridges constructed with timber and designed prior to October 1, 2010.

3. Rolled steel produced prior to 1936 (30 ksi or less).

Bridge Load Rating Report

A Bridge Load Rating Report has been developed to be included in each bridge file to help identify the critical elements for the capacity rating of the structure and for certification of the ratings by a Professional Engineer, licensed in the State of Iowa.

1. All rating calculations shall be certified by a Professional Engineer, licensed in the State of Iowa, and summarized on the Bridge Load Rating Report in SIIMS.

2. The Bridge Load Rating Report shall be reviewed by the Program Manager or Team Leader to ensure that it indicates the critical element, the operating and inventory ratings and the method of analysis used to determine the rating capacity of the bridge.

3. Rating calculations for standard bridges shall be reviewed using the Load Rating Evaluation form (see Attachment J) by a Professional Engineer, licensed in the State of Iowa, to verify the ratings are still applicable under the current condition ratings and applied loads of the bridge, and be summarized on the Bridge Load Rating Report. For standard bridges the Controlling Element and Location fields are not required to be completed.

4. If a Bridge Load Rating Report has been previously completed, existing ratings shall be reviewed with the critical elements being determined from available file information and accepted by a Professional Engineer, licensed in the State of Iowa. Recertification is not required for existing computations included in the file that are deemed reasonable based on the present condition of the structure (see Attachment J to this IM).

5. Re-ratings needed due to reasons listed in the Load Rating Evaluation Form (see Attachment J to this IM) will need to be certified if the element re-rated becomes the critical element and controls the capacity of the structure.

6. Completing the Posting Table on the Bridge Load Rating Report is not required if posting is not required.

Culverts

This section is under construction and will be added at a later date.

Posting

All bridges shall be rated for the following vehicles:

1. Type 4
2. 3S3
3. 3-3

Note: if SU7 vehicles are using a bridge, the bridge should also be rated for the SU7 vehicle.

All bridges with continuous spans or simple span lengths of 100 feet or greater should also be rated for:

1. 3S3B
2. 4S3

Diagrams of the Iowa Legal Trucks are in Attachment K to this IM. The SU7 vehicle configuration can be found in the First Edition of the 2008 AASHTO Manual for Bridge Evaluation with the 2010 versions.

Posting signs should limit all vehicles as efficiently as possible. Posting for a single gross weight limit, maximum axle weight limit, or both are the most enforceable means of restricting vehicles. Any method described in the Manual for Uniform Traffic Control Devises (MUTCD) is appropriate. Using the signs in the MUTCD with pictorial images of vehicles is allowed as long as it is clearly understood that the number of axles shown on any one vehicle could be literally interpreted if/when a violation is taken to court.

Bridges that have adequate capacity of legal vehicles up to 40 tons, but do not have adequate capacity for legal vehicles over 40 tons should be posted for a maximum gross limit of 40 tons regardless of the allowable limit calculated. This eliminates confusion about any permit vehicles that are within the 40 to 48 ton range.

Bridges do not need to be posted for loads that are annual permit loads. Bridges that commonly carry vehicles that fall under the annual permit types should be documented in SIIMS so when a permit request is made these bridges can be included on the permit as embargoed for that vehicle.

Item 70, Posting, should be calculated using the most restrictive legal truck. The most restrictive truck will be the one with the lowest Rating Factor (RF). 1.0 – RF = % below legal load. Use this % to determine which coding, between 0 and 5, should be entered into Item 70, Posting. When Item 70, Posting, is equal to 4 or less, posting the bridge for the appropriate restriction is required. Item 41, Posting Status, shall be coded for the required restriction. The rating method for Item 70, Posting, does not have to be the same method used for Item 64, Operating Ratings, and Item 66, Inventory Rating. If a bridge is re-rated for Item 64, Operating Rating, and Item 66, Inventory Rating using the LFR or LRFR methods, the posting limits do not have to be re-calculated by these methods.

Advanced Posting

Bridges shall have advance load postings at the last available location to avoid crossing an embargoed structure by using an alternative route or turning around. The signs shall be readily visible and installed in accordance with the MUTCD.

When bridges are clearly visible and signs legible from the advance intersection, both advanced warning signs and signing at the bridge site are not required. The signing located at the bridge site will be sufficient to warn oncoming traffic.

Advance warning signs that restrict the bridge to one lane or limits the number of vehicles on the structure at one time shall also be located far enough in advance of the structure to allow the traffic to slow down prior to crossing the bridge along with oncoming traffic.

Overload or Superload Permitting

The bridge owner shall review requests for overload crossings of their bridges to minimize damage, ensure public safety, and protect the integrity of the local infrastructure.

1. The bridge files shall be reviewed and computations completed as required to determine if the specific overload will cause overstress to the structure.

2. Permit requests and approvals shall be kept on record for documentation. Special requirements such as reduction of speed, centering on the roadway, elimination of braking, and other restrictions should be noted on the permit.

3. The bridge owner has the right to be compensated for costs associated with the review for the overload permit by the individual/company requesting the permit as per Iowa Code 321E.14, Fees for Permits.

4. Any request can be denied if it is determined the overload will be detrimental to the public facility.

5. Bridges may be evaluated for Routine Permit Trucks (see Attachment M). If the bridge does not have the capacity to carry one or more of these trucks, when center-lined at 5 mph, the inadequacy can be recorded on the Load Rating Bridge Report (see Attachment J).

Inspection Procedures - Records (23 CFR 650.313, d)

Bridge owners are required to maintain a complete, accurate, and current record of each bridge under their jurisdiction, either electronically or hard copy, as per the American Association of State Highway and Transportation Officials Manual for Bridge Evaluation (AASHTO Manual). The components of a complete bridge

record are listed in the AASHTO Manual. Many of the items listed will be included in SIIMS for each bridge. Bridge owners are encouraged to include electronic copies of these items in SIIMS as soon as possible.

The following list of items shall not to be considered in lieu of the requirements in the AASHTO Manual. All of the items in the AASHTO Manual will not be available for every bridge structure; therefore, the items listed below should be included in each bridge file as a minimum. However, any and all items addressed in the AASHTO Manual should be included in the bridge files when available.

Bridge Plans

Plans for bridges are not required to be in the file folder; however, they are required to be readily available to the bridge owner, Program Manager, or Team Leader at all times. Plans for bridges let after January 1, 2011, shall be included in SIIMS. Bridge owners are encouraged to scan relevant plan sheets for bridges let prior to January 1, 2011, and include them in SIIMS.

Repair Plans

Plans for bridge repair are not required to be in the file folder; however, they are required to be readily available to the bridge owner, Program Manager, or Team Leader at all times. Plans for bridges let after January 1, 2011, shall be included in SIIMS. Bridge owners are encouraged to scan relevant plan sheets for bridges let prior to January 1, 2011, and include them in SIIMS.

Photographs

A road view and a side view of the bridge structure are the minimum requirement. Structures with Item 58, Deck; Item 59, Superstructure; Item 60, Substructure; Item 61, Channel / Channel Protection; and Item 61, Culvert coding of 4 or less are required to have photographs of the deficiency in the bridge folder or scanned into SIIMS. Structures that have had no changes from the previous inspection do not require updated photographs. Photographs will be required in SIIMS on January 1, 2013.

Scour Evaluation Data

Any scour evaluation documentation is required to be in the file folder or scanned into SIIMS, to include any Level A scour analysis worksheets (see Attachment A to this IM), Level B scour flowcharts (see Attachment B to this IM), or Level C HEC 18 calculations. Bridge owners or Program Managers are required to indicate the level of scour analysis completed using the check boxes on the Channel/Channel Protection tab in SIIMS. POAs (see Attachment C to this IM) are required to be in the file folder or scanned into SIIMS and indicated on the Channel & Channel Protection form. Scour analysis worksheets and POAs will be required in SIIMS on January 1, 2013.

Channel Cross Section

A channel cross section on the upstream side of the bridge is required to be a part of the bridge record. A standard Channel Cross Section form has been incorporated into SIIMS. Each bridge structure is required to have a data point at the top of bank, toe of bank, thalweg, and each substructure unit. The Channel Cross Sections are to be updated every 4 years for natural waterways and 10 years for drainage ditches controlled by a drainage district in SIIMS unless conditions at the bridge warrant more frequent monitoring. The Channel Cross Section will be required in SIIMS on January 1, 2013.

Local Agency Field Data Collection Form

The Local Agency Field Data Collection form will be completed and stored in SIIMS.

Structure Inventory and Appraisal Forms (SI&A)

The SI&A forms will be completed and stored in SIIMS.

Load Rating Calculations

The bridge record is required to include a complete record of the calculations of the bridges load carrying capacity. A standard Bridge Load Rating Report has been incorporated into SIIMS and is required to be

completed for each bridge structure by January 1, 2013. The load rating calculations are required to be signed by a Professional Engineer, licensed in the State of Iowa. Electronic signatures for the forms in SIIMS are not required, but a signed copy of the load rating calculations is required to be in the bridge file folder. Bridge owners are encouraged to have an electronic scanned copy of the signed Bridge Load Rating form included in SIIMS.

Load Rating Evaluation Form

The purpose of the Load Rating Evaluation Form (see Attachment J to this IM) is to provide the Program Manager with a checklist of items to determine if the condition of the bridge has changed since the most recent load rating calculations were completed. The Program Manager signing this form is not confirming that the load rating calculations are correct, only that the condition of the bridge has not changed. If any of the items on the form indicate that the condition of the bridge has changed since the most recent load rating calculations, then re-rating the structure for load carrying capacity is required. Any load rating evaluation documentation is required to be in the file folder or scanned into SIIMS, including the Load Rating Evaluation form.

Critical Findings

A standard Critical Finding report form has been incorporated into SIIMS. The completed report is to be filed in SIIMS.

Critical Features

FC and scour critical elements are addressed in SIIMS.

Special Inspection Equipment

The list of specialized equipment and any additional requirements to complete the bridge inspection is included in SIIMS.

QC Office Review Form

All bridge inspections will be required to have a QC Form completed by the Program Manager before the inspection is approved. There is a standard QC Form in SIIMS, which will be required to be completed in SIIMS for each inspection.

Inspection Procedures – Master Lists (23 CFR 650.313, e)

A master list shall be kept which identifies an agency's FC bridges, the bridges requiring underwater inspection, scour critical bridges, unknown foundations, and bridges that are load posted. Additionally, it is recommended that a map be prepared showing each of these bridges for easy reference.

The master list can be generated by selecting the Manager side of SIIMS and running the report for FC bridges, underwater inspections, scour critical bridges, unknown foundations, and bridges that are load posted.

Fracture Critical (FC) Bridges

The following information shall be kept as part of the inspection records for each FC bridge.

1. A drawing of the bridge showing the location of all FCMs.

2. The inspection frequency and procedures that are necessary to inspect each FCM within arm's reach. The procedure may include equipment required (i.e. climbing equipment, ladder, snooper truck) or access methods (i.e. ground access, walk on lower chord) used to inspect the member.

Underwater Inspections

The following information shall be kept as part of the inspection records for each bridge requiring underwater inspection.

1. The location of all elements requiring an underwater inspection.

2. The inspection frequency and procedures necessary to inspect each element. The procedure may include equipment required or access methods used to inspect the member.

Scour Critical Bridges

The following information shall be kept as part of the inspection records for each bridge determined to be scour critical or with unknown foundations. Item 113, Scour Critical, shall be coded as 2 or 3.

1. POA

   The POA includes a specific plan for monitoring, inspecting, or closure of scour critical bridges during and after a significant flood event. The level of flooding that triggers the POA is determined and listed within the POA document. A Team Leader or a Professional Engineer, licensed in the State of Iowa, shall inspect a bridge before it may be reopened. (See Attachment C to this IM for an example)

2. Scour Analysis Procedures

   The analysis used to determine the Item 113, Scour Critical, coding shall be included in the inspection file for each bridge as applicable. This may include a Level A, B, or C scour evaluation (see Attachment A and Attachment B to this IM).

   If a bridge has been designed for scour, a computed scour depth notation shall be shown on the plans or included in the inspection file.

3. Scour Inspection Frequency

   All bridges should be monitored for changes that may affect the scour rating at the routine inspection interval.

   Review Level A Bridge Scour Stability Worksheets (see Attachment A to this IM) and upstream channel cross section to determine scour rating.

New and reconstructed bridges shall be designed to resist scour in accordance with HEC 18, as required by AASHTO Bridge Design Specifications and FHWA Technical Advisory, Evaluating Bridges for Scour, dated October 28, 1991.

Unknown Foundations

The following information shall be kept as part of the inspection records for each bridge with unknown foundations.

1. A POA for monitoring bridges with unknown foundations should be developed and implemented to reduce the risk to users from a bridge failure during and immediately after a flood event (see HEC 23). Also, the use of risk assessment, standard design practices, and engineering judgment can be used to reduce the risk of scour induced failures.

2. Use Attachment G and Attachment H to this IM to evaluate the bridge according to the following procedures:

   A. Use the Procedural Flowchart (see Attachment G to this IM) to determine if the foundation type and depth can be determined. If not, then go to Step B.

B. Complete the Risk Assessment Worksheet (see Attachment G to this IM) utilizing the USGS Hydrologic Region (see Attachment H to this IM) information provided and the SI&A form. Determined the risk category based on the point totals and go to Step C3.

C. Utilize the appropriate Risk Category Flowchart to determine if the structure requires a plan of action. If so, refer to Attachment G to this IM for additional guidance on developing the appropriate plan of action.

Bridge owners are cautioned that simply developing a POA for each bridge with an unknown foundation without first making every effort to determine the foundation (by discovery or inference) may not be advisable. The personnel required to implement POA's for a large number of bridges during a widespread rainfall event may overwhelm staff.

Load Posting

Maintain a list of posted bridge with weight limits for each bridge. Additionally it is recommended that a map be prepared showing the locations of these bridges.

Inspection Procedures – Quality Control (QC) and Quality Assurance (QA) (23 CFR 650.313, g)

Quality Control (QC) Program

It is the Program Manager's responsibility to ensure the following:

1. The "Monthly Notifications" are reviewed to identify any bridges that have not been inspected within the specified frequency or are not in compliance with load posting requirements.

2. SIIMS is used to document each inspection, including but not limited to the following:

   a. Local Agency Field Data Collection Forms in SIIMS are completed.
   b. The QC Form in SIIMS is completed subsequent to each inspection.
   c. The Supplemental Inspection Information tab is completed in SIIMS for each bridge.

3. Master lists are maintained as required in the Inspection Procedures-Master List section of this IM.

4. Team Leaders maintain the education/experience/training requirements contained in the Qualifications of Personnel section of this IM.

5. The individual charged with the overall responsibility for load rating bridges is a Professional Engineer, licensed in the State of Iowa.

Quality Assurance (QA) Program

Bridge Record Reviews

A review of the bridge records for LPA's to determine if they contain the minimum items listed in Inspection Procedures – Records section of this IM, will be conducted by the Office of Bridges and Structures utilizing SIIMS on an annual basis for randomly selected LPAs. Additional reviews of the bridge records will be conducted during on site reviews in conjunction with the DOT's annual oversight of the LPAs.

Team Leader Reviews

It is the Program Manager's responsibility to ensure the following:

1. Team Leader Reviews are conducted every 4 years, beginning January 1, 2013.

    a. Independent party review by a Professional Engineer, licensed in the State of Iowa, and qualified as a Team Leader.
    b. Field review of inspection data for 10 bridges inspected during the past 12 months. The bridges selected shall include, but not limited to, predominant bridge types inspected and bridges with lower sufficiency ratings. The bridges selected shall include some bridges with Item 58, Deck; Item 59, Superstructure; Item 60, Substructure; Item 62, Culvert; or Item 70, Posting; rated 4 or less (if available for the bridges inspected by the Team Leader).
    c. Reviewer accompanies the Team Leader during the inspection of 2 of the 10 selected bridges.
    d. Quality Assurance Field Review Worksheet (Attachment L of this IM) completed for each bridge inspected.
    e. Verification of the validity of information provided by an individual to obtain approval to utilize SIIMS as a Team Leader.
    f. Documentation that the Team Leader has completed the Bridge Inspector Refresher Training Course and, if needed, Fracture Critical Inspection Techniques for Steel Bridges Training Course.

    The findings of the Team Leader Reviews shall be reported to the Iowa DOT's Office of Bridges and Structures. The report shall be stamped and signed by the reviewer. If there are negative findings regarding the Team Leader, the report shall include corrective recommendations, or actions taken, to resolve those findings.

2. Disqualification and re-instatement of Team Leaders

    The Program Manager shall disqualify a Team Leader if they have provided invalid information to obtain approval to utilize SIIMS as a Team Leader or have not completed the required training required by the Qualification of Personnel section of this IM. The disqualification shall be as follows:

    a. Invalid information willfully provided to obtain approval to utilize SIIMS as a Team Leader: Permanent disqualification as a Team Leader.

    b. Violation of the Qualification of Personnel section of this IM: Disqualification as a Team Leader for 1 year. After the disqualification period, an individual can be re-instated when they meet the requirements of Qualification of Personnel section of this IM.

Load Rating Reviews

A Load Rating Review of 10 bridges is conducted every 4 years, except as noted below:

1. Each bridge owner shall have the load rating calculations reviewed by a Professional Engineer, licensed in the State of Iowa. The reviewing Professional Engineer shall not review their own rating calculations.
2. If a load rating differs by more than 15%, the reviewing engineer and the engineer being reviewed must come to a consensus as to what the rating should be.
3. Bridge owners with less than 10 bridges shall have all load ratings reviewed every 8 years.

The findings of the Load Rating Review shall be reported to the bridge owner. The report shall be stamped and signed by the reviewing engineer.

If there are negative findings regarding the Load Rating Review, the report shall include corrective recommendations or actions taken to resolve these findings.

Inspection Procedures – Critical Findings (23 CFR 650.313, h)

Purpose

The purpose of the Critical Finding Bridge Report in SIIMS is to ensure that serious bridge damages or defects are reported, the necessary notifications are made to the bridge owner by the Program Manager or Team Leader, and that proper and timely action is taken to ensure the safety of the traveling public. This process alerts the bridge owner so damage or deterioration can be repaired in a proper and timely manner and that the damage and repairs are documented.

The Iowa DOT will perform a quarterly query in SIIMS for Critical Finding Reports and submit the summary report to FHWA; therefore, it is imperative that the LPA's complete the Critical Finding Report in SIIMS as per this I.M.

Criteria

Conditions that require the filing of a critical finding report shall include, but are not limited to one of the following:

1. a partial or complete bridge collapse,
2. structural or other defects posing a definite and immediate public safety hazard,
3. a condition rating of 2 or less for any of the following bridge items:

    a. Item 58, Deck,
    b. Item 59, Superstructure,
    c. Item 60, Substructure,
    d. Item 61, Channel/Channel Protection,
    e. Item 61, Culverts, or
    f. Item 113, Scour Critical.

In cases where it is determined that the bridge could be used safely at a lower posted load limit, the bridge may remain open if it is immediately posted at the reduced limit.

Procedure for County/City Bridges

1. The individual discovering the critical finding shall:

    a. Immediately report the finding to the responsible local official, who may notify law enforcement or maintenance personnel to close the bridge.

    b. Complete Part I of the critical finding report and submit a copy to the responsible local official within 48 hours of the finding.

2. The responsible local official shall

    a. Take action to ensure the safety of the traveling public.

    b. Complete Part II of the critical finding report within 5 days of the finding.

3. When final action is taken to resolve the critical finding issue, the responsible local official shall complete Parts III & IV of the critical finding report as necessary.

4. Before a closed bridge may be reopened to traffic, a Professional Engineer, licensed in State of Iowa, shall approve any structural repairs, the bridge shall be load rated, and the bridge shall be inspected by a Team Leader.

5. If final action is not taken within 6 months of the initial report of the critical finding, the responsible official shall complete Part III, indicating the current status of the bridge.

Inventory (23 CFR 650.315,

Iowa DOT maintains an inventory of all bridges subject to NBIS. This inventory is available for viewing and updating by local agencies in SIIMS. All local agencies shall enter their inventory data updates into the database using this access system. User names and passwords are available by request from the State of Iowa Enterprise A & A System. Access to SIIMS will be approved and granted by the Iowa DOT Office of Bridges and Structures, Bridge Maintenance and Inspection (BM&I) Unit.

For all types of bridge inspections, the inspection dates and condition codes shall be entered into SIIMS within 30 days of the field inspection.

Final approval of inspection reports, including load ratings if necessary, shall be completed in SIIMS within 90 days of the field inspection.

BRIDGE SCOUR STABILITY WORKSHEET
Level A Evaluation

Name: _____ Date: _____

Bridge ID: _____ County / City: _____

FHWA No.: _____ ADT: _____

Main Span Materials & Design (Item 43): _____

Location: _____

Bridges with observed major bridge threatening scour problems should be considered scour critical and SI&A item #113 should be coded 0, 1, 2, or 3. If bridge threatening scour is not observed then this form is intended to evaluate whether a bridge can be determined to be scour critical, stable, or whether more review is necessary. For each numbered question enter the number of points into the blank at the right. If more than one answer applies, use the answer with the highest number of points. Each question should be answered.

	POINTS	POINTS GIVEN
STRUCTURE		
1. Category:		
A. Single span, pile foundations, and spread footing.	4	
B. Multi-span, piers on piling, and continuous and non-continuous superstructure.	4	
C. Multi-span, piers on spread footings, and continuous and non-continuous superstructure.	8	
D. Structure is an over flow bridge.	8	_____
2. Number of piers in the main channel:		
A. No piers in main channel.	0	
B. One pier.	1	
C. Two to four piers.	2	
D. Five or more piers.	4	_____
3. Pier foundation:		
A. No piers or all piers above flood flows.	0	
B. Spread foundations:		
1) Spread on erosion resistant bedrock	0	
2) Spread on erodible rock (shale)	2	
3) Unknown foundation type	5	
4) Spread on soil or gravel	6	
C. Pile bents, footing/piling or caisson, depth below existing stream bed:		
1) Pile depth greater than 40’	0	
2) Pile depth 20’ to 40’	2	
3) Unknown pile depth	3	
4) Pile depth less than 20’	5	_____

4. Abutment foundation:

A. Abutments located above flood flows.	0	
B. Spread Foundations:		
1) Spread on erosion resistant bedrock	0	
2) Spread on erodible rock (shale)	2	
3) Unknown foundation type	4	
4) Spread on soil or gravel	6	
C. Pile Bents, footing/piling or caisson, depth below existing stream bed:		
1) Pile depth greater than 40’	0	
2) Pile depth 20’ to 40’	1	
3) Unknown pile depth	2	
4) Pile depth less than 20’	2	
D. High Timber Abutment.	6	_____

5. Road low point elevation vs. low member submergence:

A. Submergence of low member or overtopping of road low point is improbable.	0	
B. Low member elevation is above road low point, submergence possible.	1	
C. Low member elevation is below road low point, submergence possible.	4	_____

HISTORY

6. Observed scour at piers:

A. No piers or all piers above flood flows.	0	
B. Spread foundations:		
1) No scour hole	0	
2) Scour hole above top of footing	2	
3) Scour hole within limits of footing	8	
4) No measurement taken at piers	7	
C. Footing/piling foundations:		
1) No scour hole	0	
2) Scour hole above top of footing	2	
3) Scour hole within limits of footing	4	
4) Piling exposed	6	
5) No measurement taken at piers	5	
D. Pile bent foundations:		
1) No scour hole	0	
2) Less than 5’ scour	2	
3) More than 5’ scour	4	
4) No measurement taken at piers	3	_____

7. Abutment type and condition:

A. Stub/Integral abutments, effective berm slope:		
1) 2:1 or flatter	0	
2) Steeper than 2:1 but flatter than 1.5:1	3	
3) 1.5:1 or steeper	6	
B. High abutments, depth of footings or backwall planking below stream bed:		
1) More than 5 feet	0	
2) 0 to 5 feet	4	
3) Footing is above stream bed	8	
C. Abutment on bedrock – no deficiencies.	0	_____

8. Abutment protection:

A. No protection necessary.	0	
B. Wingdikes or revetment protection in good condition.	0	
C. Other protection in good condition.	1	
D. Protection condition poor or not provided, but needed.	3	_____

9. Location of abutments compared to top of bank:

A. More than 25 feet away.	0	
B. 5' to 25'.	2	
C. Less than 5'.	6	
D. Abutment within stream banks.	8	_____

10. Observed scour at abutments:

A. No problems.	0	
B. Minor scour problems.	4	
C. Major scour problems observed in past inspections.	8	_____

11. Observed debris (or ice) lodged against bridge:

A. Remote.	0	
B. Slight Amount of Occasional – every 3 years or more.	3	
C. Frequent – more than once every 3 years.	6	
D. No available information.	4	
E. Moderate to heavy debris or continually present.	8	_____

STREAM GEOMORPHICS

12. Average degradation of stream bed since construction, not including local scour:

A. Less than 4' or stream aggrading.	0	
B. 4' to 6'.	2	
C. Greater than 6'.	6	
D. No Comparative cross-sections.	4	_____

13. Observed lateral movement of stream:

A. Stable.	0	
B. Movement, no threats to bridge.	2	
C. Unstable, threatens bridge.	8	
D. No information available.	4	_____

14. Channel bottom material:

A. Bedrock.	0	
B. Boulders and cobbles.	2	
C. Gravel, Sand, Silt, and Clay.	4	_____

15. SI&A Item #61 Channel and Channel Protection:

A. Rated a 6 or more.	0	
B. Rated a 5 or less.	4	_____

SITE GEOMORPHICS

16. Bridge location:

A. Bridge over mainstream, tributary or spillway nearby:		
1) No tributary nearby	0	
2) Tributary downstream within 100 ft	1	
3) Tributary or spillway upstream within 1,000 ft	4	
B. Bridge over tributary, mainstream nearby:		
1) No mainstream within 1,000 feet	0	
2) Mainstream within 1,000 feet	2	
3) Mainstream within 500 feet	4	_____

17. Stream bend within 150 feet of bridge (deflection):

A. 0 to 15 degree bend.	1	
B. 15 to 45 degree bend.	3	
C. 45 to 90 degree bend.	6	_____

18. Alignment of piers to flood flows:

A. No piers or all piers above flood flows.	0	
B. 0 to 5 degrees skew.	1	
C. 5 to 15 degrees skew.	3	
D. 15 to 90 degrees skew.	6	_____

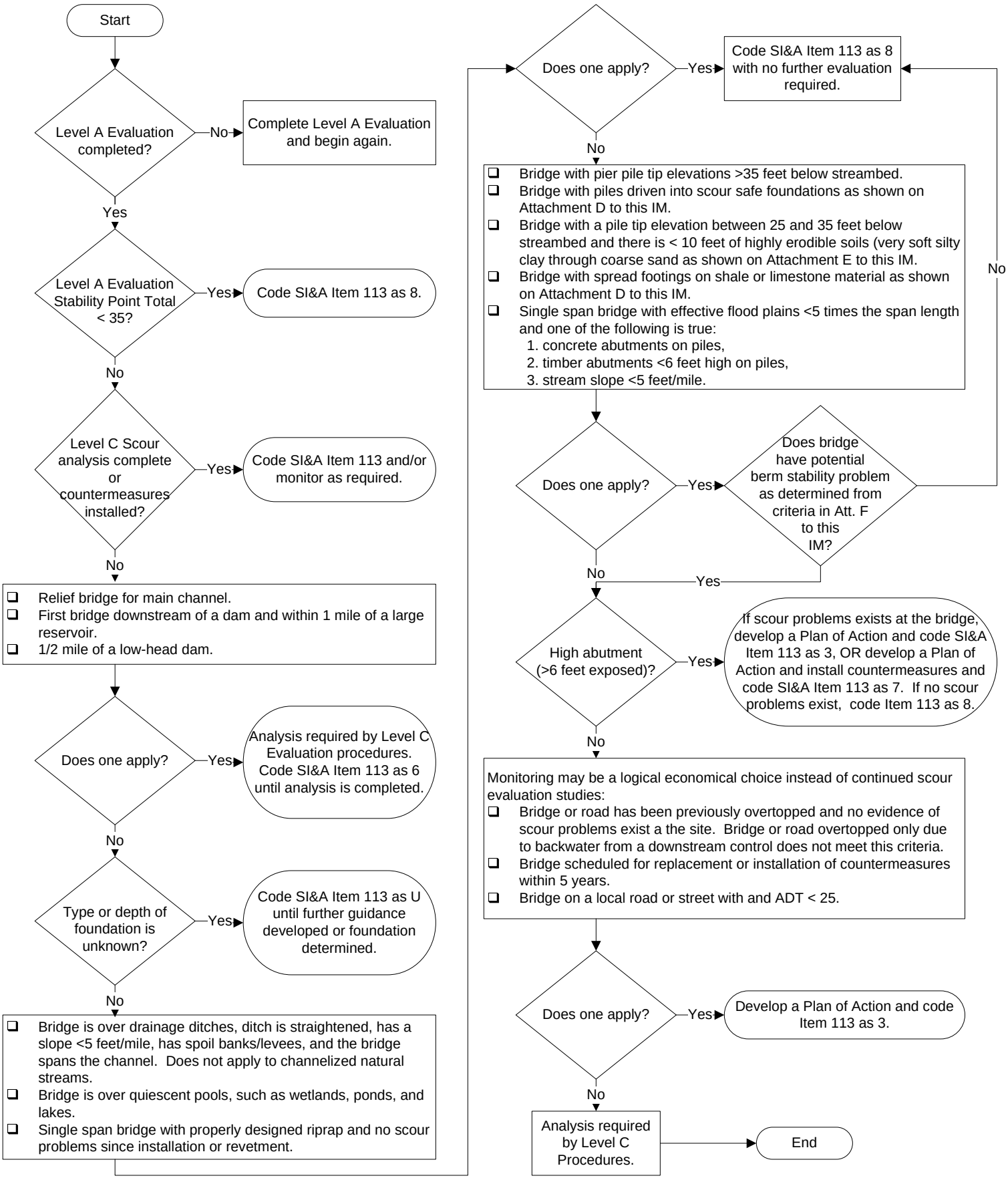
STABILITY TOTAL _____

Bridges with a stability total below 35 points could be considered stable and code SI&A Item 113 as 7 or 8 depending on the particular situation. Bridges with a total greater than 45 for a single span or 55 for a multi-span should be considered scour critical and code SI&A Item 113 as 2 or 3. Bridges coded as scour critical need to be considered for corrective counter measures or monitored closely.

Bridges with a stability total in the 35 to 45 range for single span and 35 to 55 range for multi-span require Intermediate Scour Assessment Procedures Flowchart (see Attachment B to this IM) to be completed.

INTERMEDIATE SCOUR ASSESSMENT PROCEDURES FLOWCHART

Level B Evaluation



Abbreviations / Acronyms:
SI&A = Structural Inventory and Appraisal

SCOUR PLAN OF ACTION (POA)

Name: _____ Date: _____

Bridge ID: _____ County / City: _____

FHWA No.: _____ ADT: _____

Main Span Materials & Design (Item 43): _____

Location: _____

Functional Groups

Functional groups which will be involved in the monitoring process during a flood event are defined as follows:

Local maintenance personnel: (Specify by job title)

This individual will be involved in the process of monitoring the development of flooding conditions, implementing bridge closure plans, general monitoring of bridge condition during floods, and advising the City/County Engineer of bridge closures. Guidelines need to be specified as to when this structure is required to be closed and or monitored during a flood event.

A critical water surface elevation should be determined for closure of the bridge. This could be a conservative elevation that can be calculated from the plans based on 25 or 50 year flood elevation. This elevation can be painted on a pier or abutment so the maintenance personnel can determine if they need to continue monitoring or initiate closure procedures.

Management:

The City/County Engineer or their representative (Specified). This individual will be involved in implementing bridge closure plans and the process of reopening of closed bridges. This individual is the ultimate authority for closing and re-opening bridge structures.

Initiation of Monitoring

Local maintenance personnel (specify by job title) shall initiate monitoring when one of the following events occurs: (these are just examples, list site specific requirements for each scour critical structure)

- A flood watch or warning is announced by the National Weather Service which includes the drainage area tributary to the bridge.
- Heavy rainfall occurs in the vicinity of the drainage area tributary to the bridge.

Reopening Procedures

Details of the criteria required to re-open the structure should be clearly stated. Following the flood event, these structures are required to be inspected by a Professional Engineer, licensed in the State of Iowa, or a Team Leader prior to opening the bridge, to determine if the structure has changed from its pre-flood condition and if any additional follow-up action is required. The POA should list the individual responsible for re-opening a bridge by job title.

Structures that are monitored during a flood event are required to be inspected to by the local maintenance personnel to provide findings to the City/County Engineer to determine if any follow up action is required, i.e. armoring.

SCOUR SAFE FOUNDATIONS FOR SPREAD FOOTINGS OR STEEL PILES

Foundation Material	Depth into Foundation Material
Weathered or broken limestone	>4 feet
Any limestone other than weathered or broken	Any depth
Any shale other than hard (or very firm) shale	>7 feet
Hard (or very firm) shale	Any depth
Very firm glacial clay	>10 feet

HIGHLY ERODIBLE SOILS

(Excerpt from "Driven Pile Foundation Soils Information Chart")

Soil Description	Blow count per foot (N Value)	
Alluvium or Loess	**Mean**	**Range**
Very Soft Silty Clay	1	0-1
Soft Silty Clay	3	2-4
Stiff Silty Clay	6	4-8
Firm Silty Clay	11	7-15
Stiff Silt	6	3-7
Stiff Sandy Silt	6	4-8
Stiff Sandy Clay	6	4-8
Silty Sand	8	3-13
Clayey Sand	13	6-20
Fine Sand	15	8-22
Course Sand	20	12-28

BERM STABILITY CRITERIA

Berm stability should be reviewed for any bridges that exceed the following values:

1) Any berm slope steeper than 1.5:1, or

2) When the road grade to normal stream bed is > 20’ and the effective berm slope (measured from road grade to the edge of stream) is steeper than 2:1, or

3) When the road grade to normal stream bed is < 30’ and the effective berm slope is steeper than 2.5:1.

Abutment berm slopes or high abutments protected by properly designed riprap are considered stable.

GUIDANCE FOR DEVELOPING AND IMPLEMENTING PLANS OF ACTION (POA) FOR BRIDGES WITH UNKNOWN FOUNDATIONS

The National Bridge Inspection Standards (NBIS) regulation, 23 CFR 650.313, requires that bridge owners identify bridges that have Item 113, Scour Critical, coded as 0, 1, 2, or 3; and to prepare a Plan of Action (POA) to monitor known and potential deficiencies. Bridge owners should be working on completing evaluations to determine which bridges over waterways are vulnerable to scour.

A bridge with Item 113, Scour Critical, coded as U represent a unique subset of bridges that were exempted from being evaluated for scour vulnerability due to the lack of a process and guidance that would have allowed bridge owners to determine the necessary foundation characteristics. The FHWA has provided several risk-based methods for assessing bridges with unknown foundations. However, there may still be an inventory of bridges coded U for which a scour evaluation cannot be completed.

Bridge owners should anticipate that any bridge reported with Item 113, Scour Critical, coded U after November 2010 will require development and implementation of a POA, until properly designed countermeasures are installed to protect the bridge foundations or until the bridge is replaced. The Coding Guide currently recommends development and implementation of a POA for existing bridges having a code "U."

FHWA has previously provided guidance for bridge owners on development and implementation of POA's for bridges determined to be scour critical. For bridges with unknown foundations, a bridge owner has two options for development of a POA:

1. A bridge with Item 113, Scour Critical, coded U can simply be changed to a scour critical code (e.g., 3) for the NBI and subjected to a POA as described for scour critical bridges.

2. A bridge with Item 113, Scour Critical, may remain coded U with a POA developed based on a risk assessment and bridge owner defined criteria considering known information about the bridge.

The POA for a bridge with Item 113, Scour Critical, that remains coded U may be different than for a bridge determined to be scour critical. The POA developed should be based on the known information of the bridge and the bridge owner determined risk from scour. The POA for a bridge over waterways with unknown foundations should contain minimum requirements commensurate to the consequences of loss of service of the structure to ensure a reasonable level of safety to the traveling public.

The steps below provide assistance to bridge owners in developing a POA for a bridge with Item 113, Scour Critical, coded U:

STEP 1:
Assess bridges with unknown foundations in accordance with guidance provided in this IM and examples provided on the Unknown Foundations website. For bridges with Item 113, Scour Critical that remains coded U after a risk-based assessment, FHWA recommends that a POA be developed based on the risk categories defined by bridge owners during initial categorization and grouping (e.g. A - High Risk, B - Moderate Risk, C - Low Risk).

STEP 2:
Develop a POA based upon the defined risk category that considers safety to the traveling public and the consequences of loss of service of the structure. The POA may be less detailed than for a scour critical bridge based on the defined risk categories, but it should contain elements that protect users during and after a scour event, and provide a proactive plan for addressing the bridge scour concerns in the future. Examples for lowest and highest risk categories are below.

A. Lowest Risk Categories:

Assumes that the bridge has performed well and has no history of scour related problems.

For bridges considered as low risk, the POA may be as simple as monitoring bridges for scour during routine biennial inspections and after major events.

If scour or a rainfall event has been observed in excess of predetermined monitoring triggers, then the bridge should be considered for an in-depth foundation investigation. Any information on observed or inspected conditions would be identified on the bridge inspection report so that inspectors could monitor the bridge for changes.

B. Moderate Risk Categories:

Assumes that the bridge has performed satisfactorily, but because of bridge owner defined criteria, it has been identified as moderate risk.

For bridges considered moderate risk, the POA may be similar to those for bridges determined to be scour critical. At a minimum, the bridge should be monitored on a more frequent basis than a bridge in a low risk category.

A bridge in this category should be considered for an in-depth foundation investigation if scour or a rainfall event has been observed for at least a magnitude equal to predetermined monitoring triggers. If significant changes in streambed continue to occur, countermeasures should be considered to make the bridge safe from scour and stream instability.

C. Highest Risk Categories:

Assumes that the bridge has performed satisfactorily, but because of bridge owner defined criteria, it has been identified as high risk.

POA may be similar to those for bridges determined to be scour critical. At a minimum, the bridge should be monitored on a more frequent basis than a bridge in a moderate to low risk category. Also, a bridge in this category should be considered for an in-depth foundation investigation if any significant changes in streambed occur, and scheduled for timely design and construction of a new bridge or countermeasures to make the bridge safe from scour and stream instability.

STEP 3:
Coordinate a global action plan for all bridges with Item 113, Scour Critical, coded U within a LPA, whether assessed through this guidance or not. The plan should:

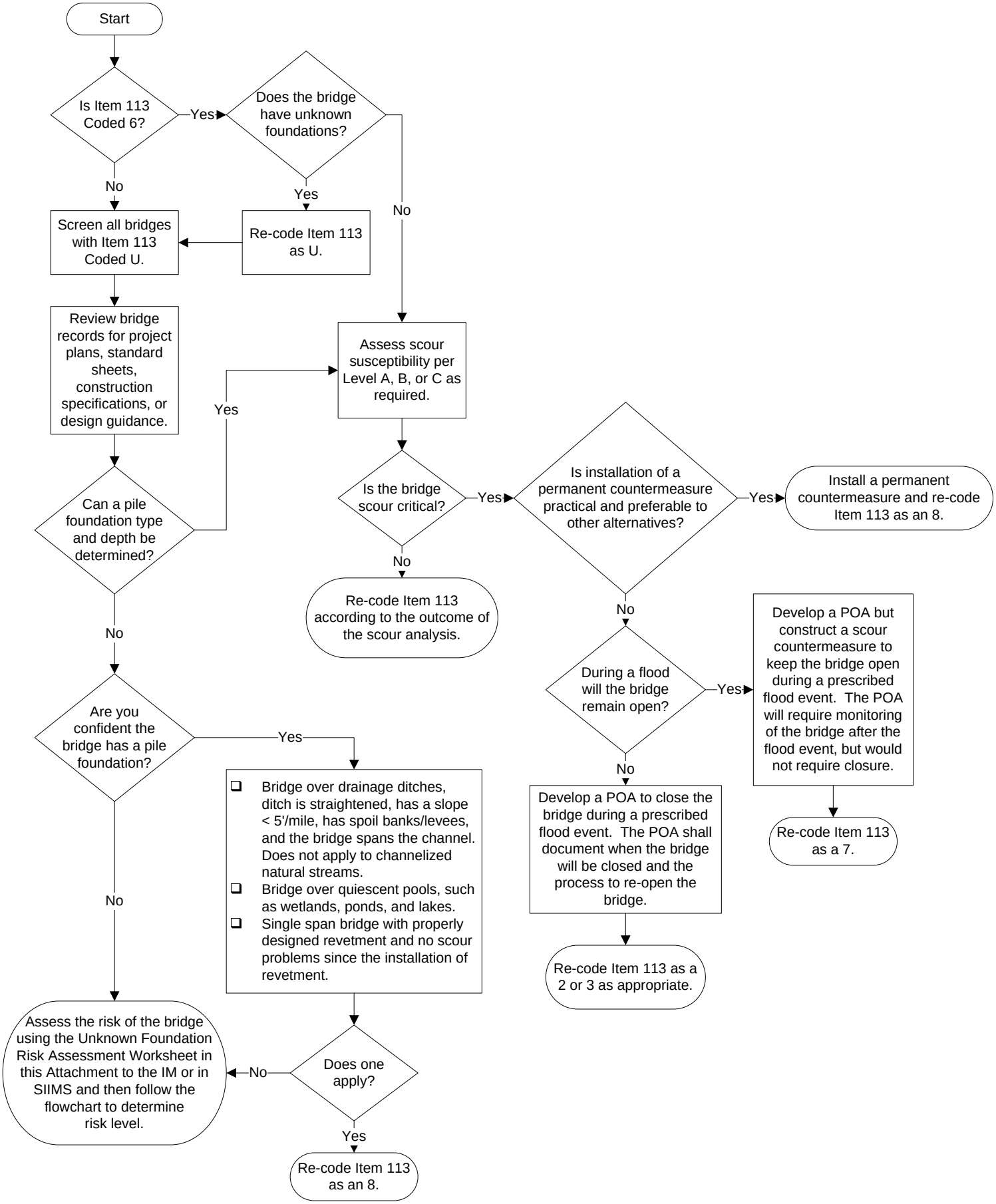
1. Identify the scour critical and unknown foundation bridges;

2. Define major events or monitoring trigger; and

3. Provide information for requesting technical assistance or conducting an in-depth foundation investigation.

Bridge owners should monitor and verify that the process of implementing POAs is working satisfactorily. The global action plan for developing and implementing POAs should be revisited and updated as necessary.

UNKNOWN FOUNDATIONS FLOWCHART



Abbreviations:
POA = Plan of Action

Intentionally left blank

UNKNOWN FOUNDATION RISK ASSESSMENT WORKSHEET

Name: _____ Date: _____

Bridge ID: _____ County / City: _____

FHWA No.: _____ ADT: _____

Main Span Materials & Design (Item 43): _____

Location: _____

For each numbered question enter the number of points into the blank at the right. If more than one answer applies, use the answer with the highest number of points. Each question should be answered. Structures with risk assessment totals equal to or less than 25 points can be considered low risk, 26 to 29 points can be considered medium risk, and greater than or equal to 30 points can be considered high risk.

	POINTS	POINTS GIVEN
1. Superstructure type:		
A. Continuous	2	
B. Multi-span	4	
C. Fracture critical	8	
D. Single span	8	
E. High concrete abutments	10	_____
2. Item 60, Substructure coding:		
A. 7 to 9	1	
B. 5 or 6	2	
C. 1 to 4	3	_____
3. Item 61, Channel/Channel Protection coding:		
A. 7 to 9	1	
B. 5 or 6	2	
C. 1 to 4	3	_____

4. Geomorphology/hydrology:

The USGS publication Water Resource Investigation Report 8704132 defines a Hydrologic Region based on the slope of the topography and has equations that estimate the flood discharge. Utilize the USGS Region map and the drainage for each structure in conjunction with the following guidelines to determine whether a bridge is low, medium, or high risk for this category.

Caution: Within each region there are small watersheds that have topography which produces runoff characteristics of another region. Utilize the region that best represents the area in which the watershed lies.

A. Hydrologic Region 1
   1) < 5 square miles 2
   2) 5 to 30 square miles 4
   3) > 30 square miles 6 _____

B. Hydrologic Region 2
   1) < 15 square miles 2
   2) 15 to 100 square miles 4
   3) > 100 square miles 6 _____

C. Hydrologic Region 3
   1) < 30 square miles 2
   2) 30 to 225 square miles 4
   3) > 225 square miles 6 _____

D. Hydrologic Region 4 and 5
   1) < 100 square miles 2
   2) 100 to 600 square miles 4
   3) > 600 square miles 6 _____

5. Topography:

   A. Hydrologic Region 4 and 5 2
   B. Hydrologic Region 3 4
   C. Hydrologic Region 1 and 2 6 _____

6. Item 26, Functional Class:

   A. Level B road 1
   B. Local road/minor arterial 2
   C. Farm to Market 3
   D. Urban Arterial 4 _____

7. Item 19, Detour Length:

   A. < 4 miles 1
   B. 4 to 10 miles 2
   C. >10 miles 3 _____

8. Item 29, Average Daily Traffic (ADT):

   A. < 26 2
   B. 26 to 50 4
   D. > 50 6 _____

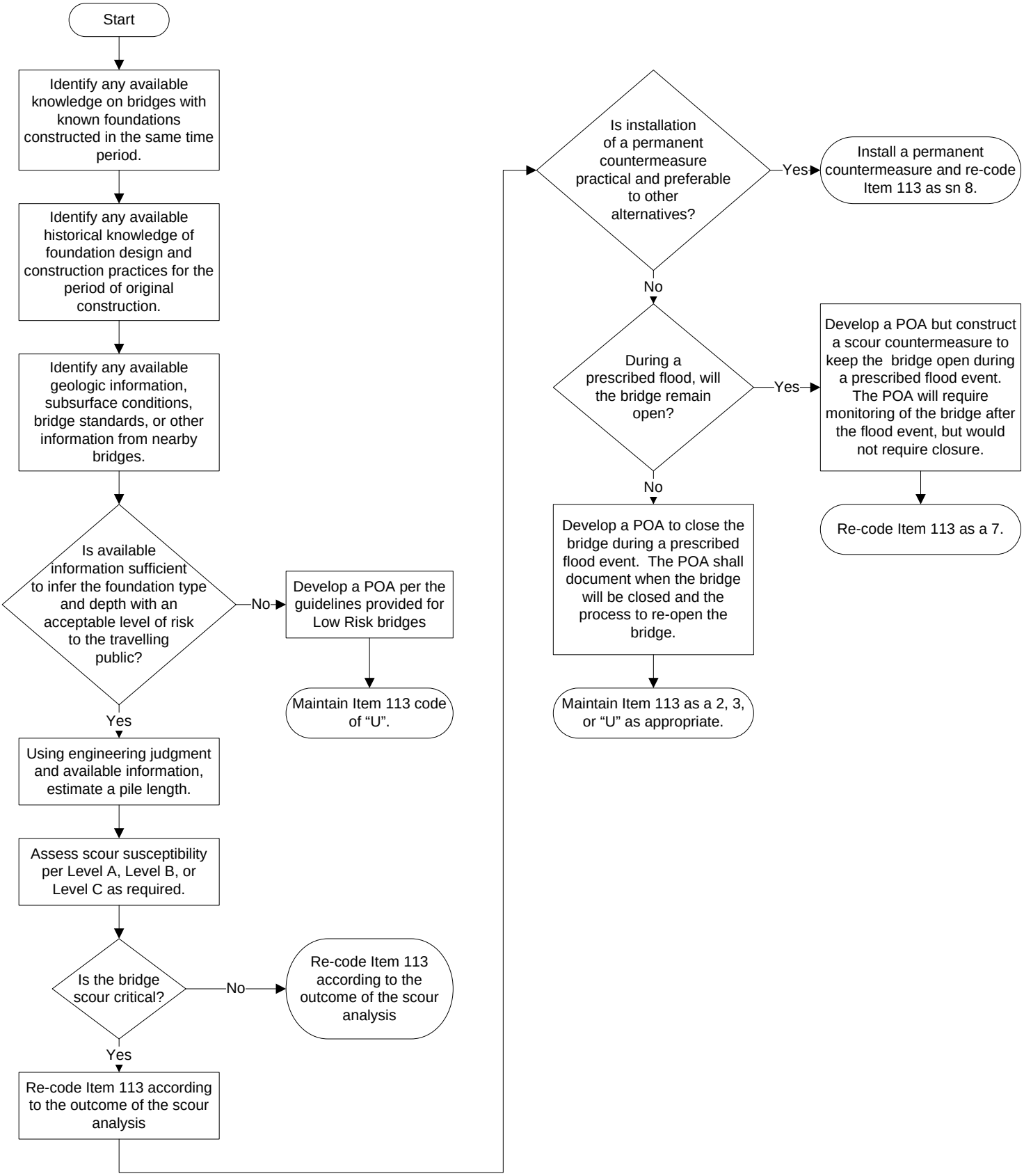
RISK ASSESSMENT TOTAL _____

Secondary Level of Assessment:

Bridge structures with an ADT greater than 50 cannot be considered low risk.

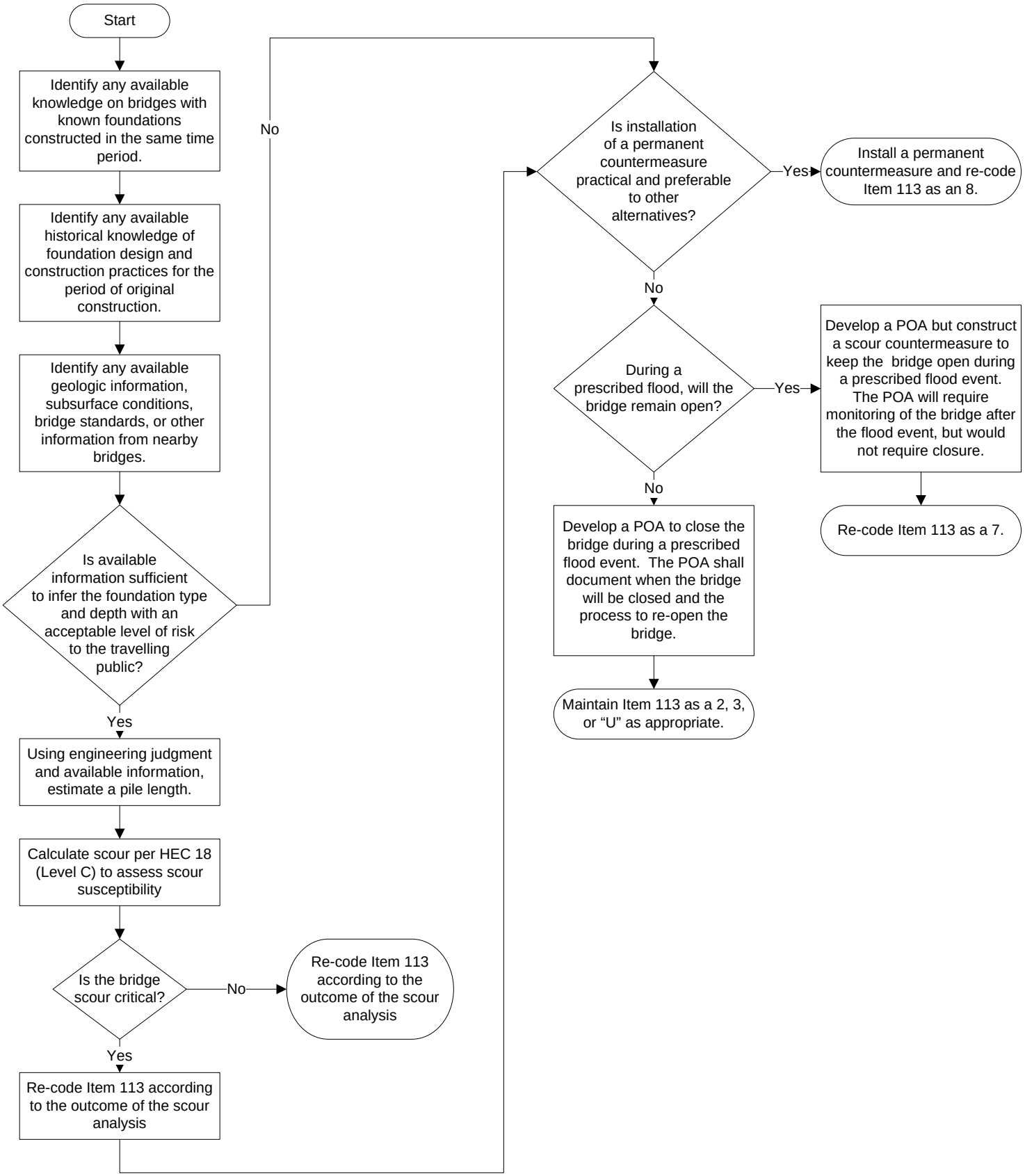
Bridge structures that historically experience roadway overtopping during flood events and have shown no signs of scour may be considered low risk.

UNKNOWN FOUNDATIONS LOW RISK FLOWCHART



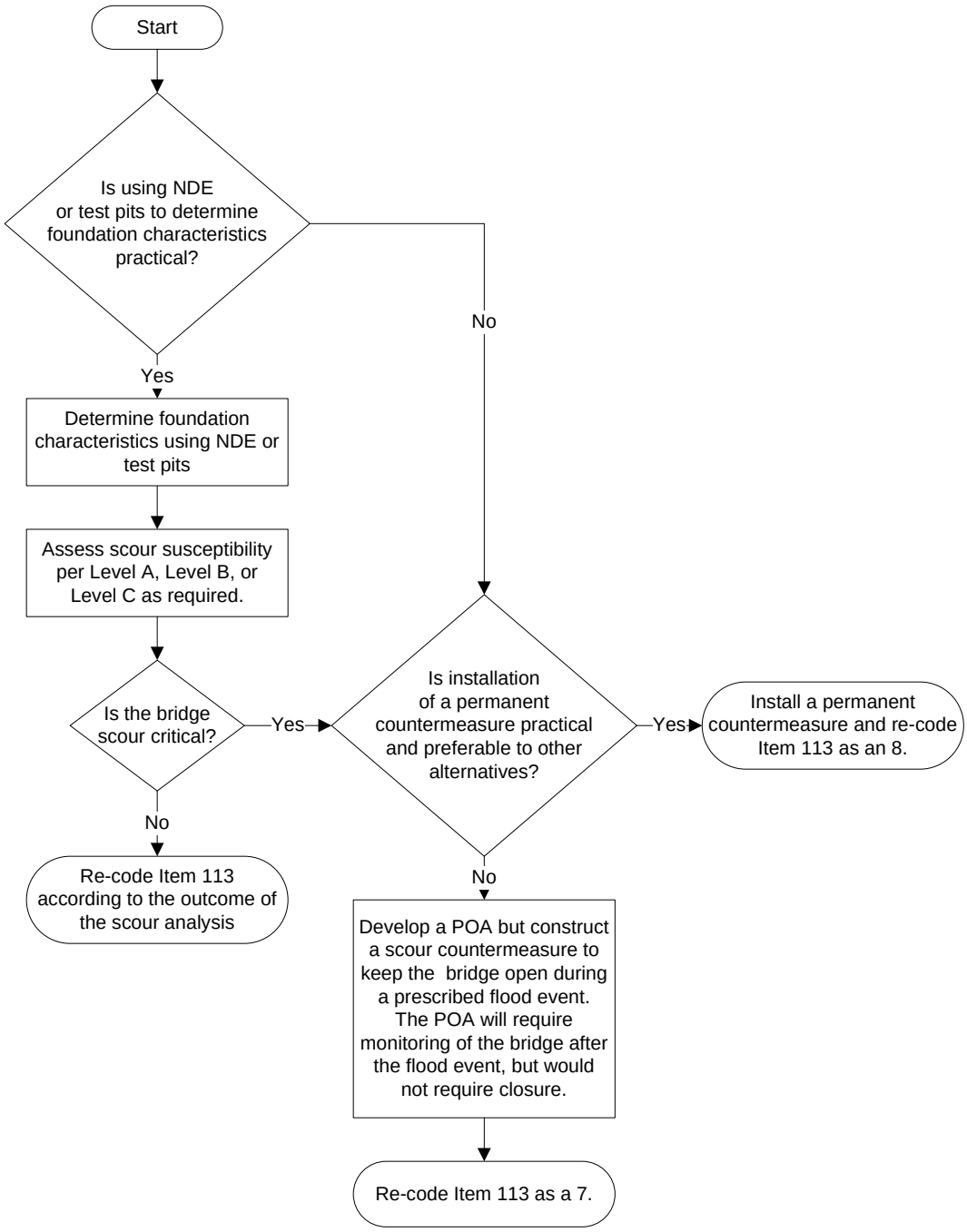
Abbreviations:
POA = Plan of Action

UNKNOWN FOUNDATIONS MODERATE RISK FLOWCHART



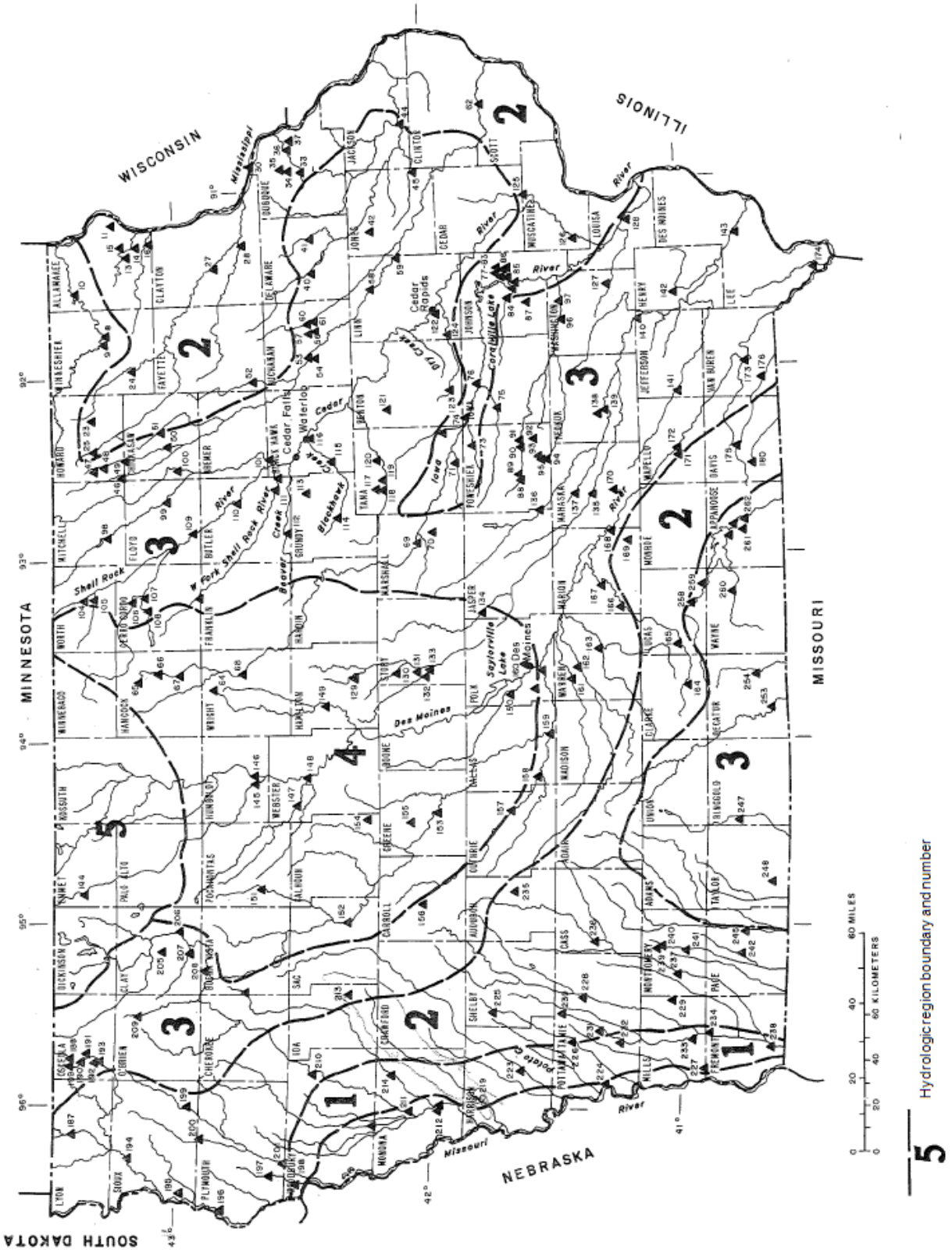
Abbreviations:
POA = Plan of Action

UNKNOWN FOUNDATIONS HIGH RISK FLOWCHART



Abbreviations:
POA = Plan of Action
NDE = Non-distructive Evaluation

USGS Hydrologic Region Map with Region Descriptions



Hydrologic Region 1

Hydrologic region 1 extends north and south along the bluffs that border the Missouri River valley, with limits approximating those of the physiographic area known as the Western Loess Hills (Prior, 1976). The landscape has a corrugated appearance of alternating waves and troughs. Hills are sharp-featured, with narrow broken ridge-crests, intersecting spurs, and steep-sided slopes; the landscape is conducive to rapid runoff. The western border of the region is well defined and easily distinguished on topographic maps and in the field. The eastern border is more difficult to define and merges gradually with the landscape of hydrologic region 2.

Hydrologic Region 2

The bluff area that borders the Mississippi River valley is typical of the landscape in hydrologic region 2. The landscape can vary from rugged to rolling topography, where runoff may be rapid, commonly causing flash flooding. Bluff-like areas are not only located in the vicinity of the Mississippi River, they also are present along the divide between the Mississippi River and Missouri River basins; in parts of the Iowa and Cedar River basins, in areas that border the Western Loess Hills, and in the headwater parts of basins of streams in south-central Iowa.

Hydrologic Region 3

Hydrologic region 3 is the largest hydrologic region. Most of the area in this region is typical of landscapes in Iowa. The topography of this region can be described as steeply to gently rolling hills interspersed with areas of more subdued topography. The area has a well-established drainage system. Physiographically, it covers most of the Iowa Surface, a large part of the Southern Iowa Drift Plain, and the Northwest Iowa Plains (Prior, 1976).

Hydrologic Region 4

This hydrologic region, which is located in west-central Iowa, is characterized by level terrain and a poorly developed drainage system. The region coincides approximately with the southern two-thirds of the Des Moines Lobe. Many clusters of ponds and marshes with no drainage outlets are present in this region. Small streams in level areas are shallow and sluggish.

Hydrologic Region 5

This hydrologic region in north-central Iowa coincides approximately with the northern part of the Des Moines Lobe (Prior, 1976). The magnitude of floods in this region are the smallest per unit area in the State. This is due to the flat topography and flood-attenuating effect of abundant bogs, swales, and circular depressions.

SPECIAL TRAINING, EQUIPMENT, AND ACCESS REQUIREMENTS CHECKLIST

Reviewer: _____ Review Date: _____

Agency: _____

Program Manager: _____ Team Leader: _____

Team Members: _____

Bridge No.:_____ County / City: _____

FHWA No.: _____ Stream: _____

Main Span Materials & Design (Item 43): _____

Location: _____

Special Training	Check if required
Fracture Critical Course	
Underwater Inspection Course	
Climbing / Rigging Training	

Special Equipment	
Survey equipment	
Non-destructive testing equipment	
Underwater inspection equipment	
Air-water jet equipment	
Sand / shot blasting equipment	
Burning / drilling / grinding equipment	
Timber coring drill	

Access	
Ladders / hook ladders	
Special rigging / platforms	
Scaffolding	
Climbers	
Floats	
Bosun chair / repelling	
Catwalk	
Personnel lift	
Bucket truck	
Under bridge inspection vehicle	
Platform truck	

LOAD RATING EVALUATION FORM

Name: _____ Date: _____

Bridge ID: _____ County / City: _____

FHWA No.: _____ ADT: _____

Main Span Materials & Design (Item 43): _____

Location: _____

The purpose of this evaluation form is to determine if the condition and configuration of the structure is still consistent with the load rating calculations that were completed during a previous bridge inspection. If the answer to all of these evaluation items is "No" then recalculation is not required. IF the answer to any of these evaluation items is "Yes", a Professional Engineer, licensed in the State of Iowa, must evaluate if re-calculation of the load ratings for this structure is required. Answer "No" or "Yes" to the following.

	No	Yes
Was the bridge re-rated following this inspection?	_____	_____
If no, answer the following questions. If yes, skip to signature.		
If any of the following criteria are "Yes", the bridge shall be load rated:		
1. The bridge is a new bridge.	_____	_____
2. The bridge has undergone a major rehabilitation that affects the controlling structural element. This may include the deck, superstructure, or substructure elements.	_____	_____
3. If Item 58, Deck; Item 59, Superstructure; Item 60, Substructure; or Item 62, Culvert; coding decreased to 3 or less.	_____	_____
4. If moderate to significant changes to the superstructure dead load has occurred, such as the addition of an overlay or changes of 2 or more inches of overburden such as earth or rock since the previous rating.	_____	_____
5. Changes to lateral support of the beams.	_____	_____
6. If 5 feet or more of scour/erosion has occurred at the foundations due to flooding events or progressive down cutting, the bridge shall be evaluated for structural capacity of the foundations.	_____	_____
If any of the following criteria are "Yes", the bridge shall be considered for re-load rating:		
1. If 58, Deck; Item 59, Superstructure; Item 60, Substructure; or Item 62, Culvert; coding decreased to 4.	_____	_____
2. New information found during the most recent field inspection affects load capacity.	_____	_____
3. New information is determined by additional investigation, testing, or analysis affects load capacity.	_____	_____
4. Item 63 and 65, Rating Method, is coded 5.	_____	_____
Does the bridge need to be re-rated?	_____	_____
If no, sign. If yes, sign this form, then re-rate the bridge and update the Bridge Load Rating Report.		

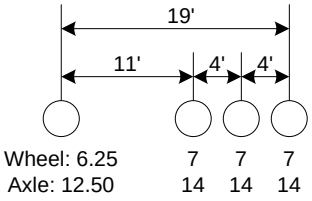
Program Manager signature

Printed name of Program Manager

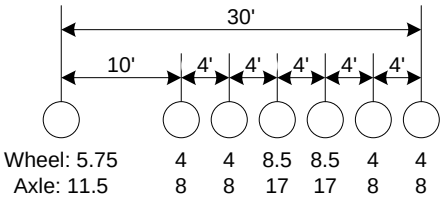
IOWA LEGAL TRUCKS DIAGRAMS

Typical Iowa Legal Truck Types
(Wheel and axle loads are shown in Kips)

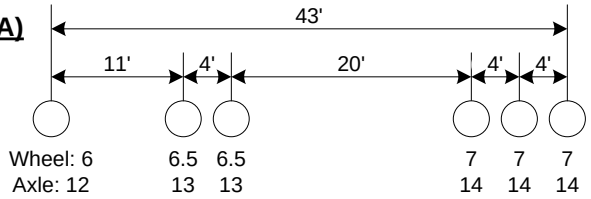
Straight Truck (Type 4)
Total Weight = 54.5 Kips (27.25 Tons)



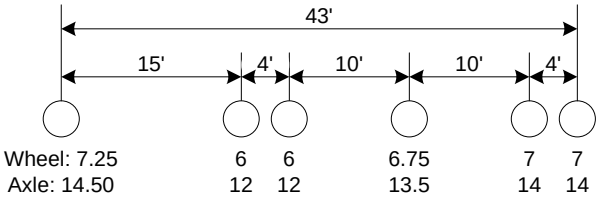
Truck (SU7)
Total Weight = 77.5 Kips (38.75 Tons)



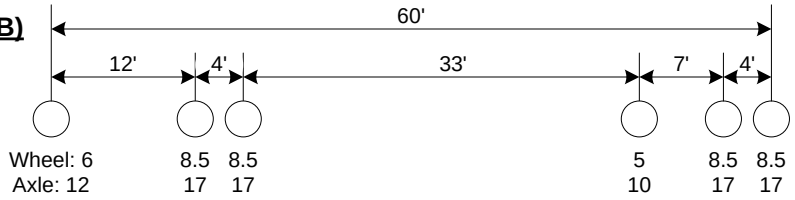
Truck + Semi-trailer (Type 3S3A)
Total Weight = 80 Kips (40 Tons)



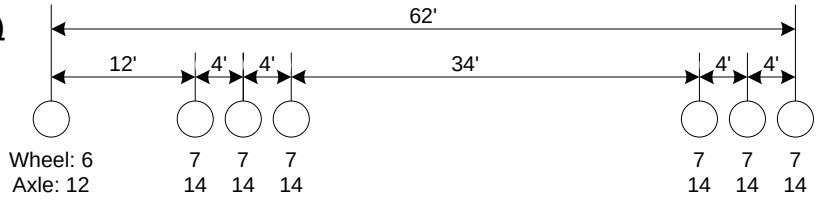
Truck + Trailer (Type 3-3)
Total Weight = 80 Kips (40 Tons)



Truck + Semi-trailer (Type 3S3B)
Total Weight = 90 Kips (45 Tons)



Truck + Semi-trailer (Type 4S3)
Total Weight = 96 Kips (48 Tons)



QUALITY ASSURANCE FIELD REVIEW WORKSHEET

Reviewer: _____ Review Date: _____

Agency: _____

Program Manager: _____ *Team Leader: _____

**Team Members: _____

Bridge ID: _____ County / City: _____

FHWA No.: _____ Stream: _____

Main Span Materials & Design (Item 43): _____

Location: _____

* (Required to be present at 2 reviews)
** (Not required to be present)

	No	Yes
1. Is this a Fracture Critical Bridge?	_____	_____
If "Yes", are the Fracture Critical Elements identified in the inspection documentation?	_____	_____
2. Are all necessary inspection forms completed fully and accurately in SIMMS?	_____	_____
3. Are the condition ratings, comparable between the inspector and reviewer (+/- 1 condition rating)? "Y" for Yes, "N" for No.	_____	_____

Item 58, Deck: Previous rating: ____ Inspector: ____ Reviewer: ____
Item 59, Superstructure: Previous rating: ____ Inspector: ____ Reviewer: ____
Item 60, Substructure: Previous rating: ____ Inspector: ____ Reviewer: ____
Item 61, Channel and Channel Protection: Previous rating: ____ Inspector: ____ Reviewer: ____
Item 62, Culvert: Previous rating: ____ Inspector: ____ Reviewer: ____

4. Does the bridge posting condition at the bridge match the condition coding in Item 41, Posting Status?	_____	_____
5. Were appropriate sketches, notes, and photos from previous inspections used for preparing the inspection documentation?	_____	_____
6. Was an underwater inspection required during this inspection?	_____	_____
If "Yes", was the underwater inspection properly documented?	_____	_____

Review comments: _____

_____

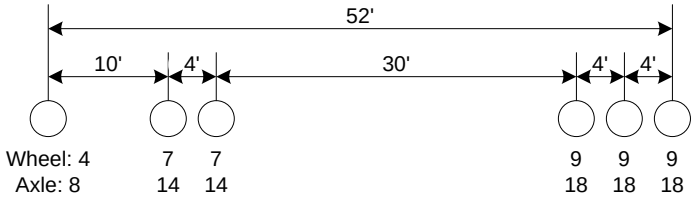
_____

_____

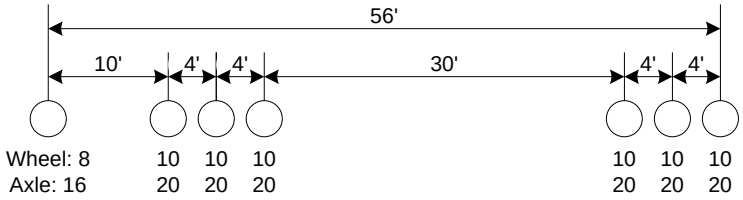
ROUTINE PERMIT TRUCKS DIAGRAMS

(Wheel and axle loads are shown in Kips)

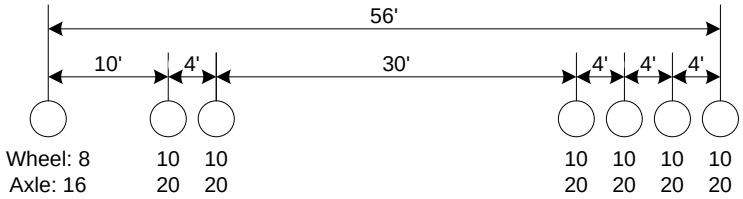
Truck (3 axle)
Total Weight = 90 Kips (45 Tons)



Truck (3 axle)
Total Weight = 136 Kips (68 Tons)



Truck (4 axle)
Total Weight = 136 Kips (68 Tons)



Truck (4 axle)
Total Weight = 156 Kips (78 Tons)