

Approved:12-11-2020

SUBJECT: BRIDGE AND TUNNEL MANAGEMENT

1. PURPOSE. Ensure the safety, function, and efficient management of all Department of Energy (DOE) bridges, culverts, and tunnels in support of DOE missions through regular, comprehensive inspections and evaluations using resources in an effective and efficient manner and in compliance with the governing laws and regulations.¹
2. CANCELS/SUPERSEDES. None.
3. APPLICABILITY.
 - a. Departmental Applicability.
 - (1) This Order applies to all DOE elements with responsibility for bridges, tunnels, or culverts where DOE has a legal interest or right to use such property except for the exemptions identified in paragraph 3.c. The requirements supplement those of DOE O 430.1, *Real Property Asset Management*, current version.
 - (2) The Administrator of the National Nuclear Security Administration (NNSA) must assure that NNSA employees comply with their responsibilities under this directive. Nothing in this directive will be construed to interfere with the NNSA Administrator's authority under Section 3212(d) of Public Law 106 – 65 to establish Administration-specific policies, unless disapproved by the Secretary.
 - b. DOE Contractors. Except for the equivalencies/exemptions in paragraph 3.c., the Contractor Requirements Document (CRD), Attachment 1, sets forth requirements of this Order that will apply to contracts that include the CRD. The CRD or its requirements must be included in contracts for the management or operation of DOE sites or facilities that include bridges, tunnels, or culverts in the real property asset inventory.
 - c. Equivalencies and Exemptions for DOE O 437.1. Equivalencies and exemptions to this Order are processed in accordance with DOE O 251.1, *Departmental Directives Program*, current version. Attachment 2 establishes the basis for equivalent requirements. The accountable Program Secretarial Officer must

¹ Code of Federal Regulations 23 CFR Part 650, *National Bridge Inspection Standards*; Code of Federal Regulations 23 CFR Part 650, Subpart E – *National Tunnel Inspection Standards*; Code of Federal Regulations 49 CFR Part 213, *Federal Railroad Administration Bridge Safety Standards*; and Code of Federal Regulations 49 CFR 237.71 Subpart D, *Determination of Bridge Load Capacities*.

approve any equivalency or exemption to the requirements delineated in this Order except those stipulated by Federal regulation or implementing Department of Transportation guidance.

- (1) Exemptions. The following are not subject to this Order:
 - (a) Federal Energy Regulatory Commission.
 - (b) Power Marketing Administrations. In accordance with Section 302 of the Department of Energy Organization Act of 1977, the Secretary operates and maintains the Power Marketing Administrations' (PMA) electric power transmission systems by and through the PMA administrators. The PMAs are uniquely established within the Department by nature of their administrators' obligations to meet statutory and public utility responsibilities for the safety, security, and reliability of electric power transmission. Administrators must determine the appropriate real property asset management program for their facilities, including consideration of appropriate parts of the criteria set forth in this Order and prudent utility industry practice. Except for assets subject to Federal regulation, the Power Marketing Administrations are exempt from the requirements in this Order.
 - (c) Accelerator facilities that are covered by DOE O 420.2, *Safety of Accelerator Facilities*, current version.
 - (d) Culverts not inventoried in the Facilities Information Management System with Usage Code 2629.
 - (2) Equivalency. In accordance with the responsibilities and authorities assigned by Executive Order 12344, codified at 50 U.S.C. sections 2406 and 2511 and to ensure consistency through the joint Navy/DOE Naval Nuclear Propulsion Program, the Deputy Administrator for Naval Reactors (Director) will implement and oversee requirements and practices pertaining to this Directive for activities under the Director's cognizance, as deemed appropriate. The notification requirements in section 5 do not apply.
4. REQUIREMENTS. The following paragraphs set forth the requirements for bridge and tunnel management including inspections, load rating and posting, scour evaluation, seismic vulnerability evaluation, vehicle traffic volume data collection, use of qualified personnel, quality management, records and reporting, and inventory and asset Management. Attachment 2 provides acceptable approaches for implementing Federal regulation and for meeting the requirements of this Order. It references Federal regulations, DOE directives, and industry best practices. It also provides criteria for

applying a graded approach to managing bridges, tunnels, or culverts, even those that are not subject to Department of Transportation regulations.

- a. Inspections. Ensure timely inspections, assessments, studies, and evaluations of each bridge, culvert, or tunnel as described in Attachment 2 are planned, conducted, and documented.
- b. Load Rating and Posting.
 - (1) Maintain a current load rating for each active bridge, tunnel, and culvert using the criteria and methods in Attachment 2. At-grade roadways in tunnels are exempt from load rating.
 - (2) When necessary, post a bridge, tunnel, or culvert for load restrictions or restrict access using the criteria in Attachment 2.
- c. Scour Evaluation. Ensure each active bridge and culvert that crosses a waterway is evaluated for vulnerability to scour or stream instability from floods using the criteria and methods in Attachment 2.
- d. Seismic Vulnerability Evaluation. Ensure each bridge is evaluated for vulnerability to seismic events and the need for seismic retrofitting using the criteria in Attachment 2.
- e. Vehicle Traffic Volume Data Collection.
 - (1) For each active vehicle bridge:
 - (a) Determine the Average Daily Traffic (ADT) and the percentage that is truck traffic. Do not include vans, pickup trucks, and other light delivery trucks in this percentage. Update every five (5) years.
 - (b) Maintain a forecasted average daily traffic for the route at least 17 years but no more than 22 years from the year in which the forecast is made. The intent is to provide a forecast of the ADT 20 years in the future.
 - (2) For each active vehicle tunnel, determine the Annual Average Daily Traffic (AADT) and the Annual Average Daily Truck Traffic (AADTT). Do not include vans, pickup trucks, and other light delivery trucks in this percentage. Update every five (5) years.
- f. Use of Qualified Personnel.
 - (1) Ensure each person performing an inspection or evaluation meets the qualification requirements specific to the inspection or evaluation

conducted and understands the duties of the role he or she is expected to perform as described in Attachment 2.

- (2) Document individual personnel qualifications including appropriate education, experience, licensure, and certifications, and current training. Individuals must complete refresher training at least every five years.

g. Quality Management.

- (1) Establish quality management procedures or requirements necessary to produce accurate and consistent bridge inspections conforming with inspection standards and criteria; inspection plans; quality control procedures; DOE policy; and Federal and State requirements.
- (2) Establish quality management procedures or requirements necessary to ensure that evaluation products such as calculations, reports, and studies are complete, accurate, and properly checked in accordance with applicable industry standards.
- (3) Establish quality management procedures or requirements necessary to ensure that information and data supporting the Department's external reporting or implementation of bridge and tunnel management requirements is validated and provided in a timely manner.

h. Records and Reporting. Ensure records, reports, and data are prepared, maintained, and submitted using the criteria in Attachment 2.

i. Inventory and Asset Management.

- (1) Integrate requirements for bridge and tunnel management with existing operating and management procedures for real property. Document any locally established policies, procedures, or inspection intervals for bridges, tunnels, or culverts.
- (2) When available resources are inadequate to maintain an acceptable level of bridge, culvert, or tunnel safety, act to impose lane or load restrictions, or closures.
- (3) Establish, document, and implement protocols for responding to a critical finding. Establish, document, and implement protocols for managing permit loads.
- (4) Establish, document, and implement bridge closure and re-opening procedures. Once closed, a bridge may not be reopened until repairs are complete and a qualified engineer determines that the bridge is safe and if necessary, posted for load restrictions.

- (5) For railroad bridges, establish, document, and implement procedures and issue instructions to personnel responsible for train operations to prevent operation of equipment that would exceed the capacity of the bridge.
5. RESPONSIBILITIES. DOE real property is operated and managed by qualified and experienced federal and contractor personnel at Headquarters and field locations. The paragraphs below describe the responsibilities and authorities for effective management of DOE bridges, culverts, and tunnels, and establish accountabilities for management of these assets.
 - a. Secretary. Establishes DOE policy for bridge and tunnel management.
 - b. Deputy Secretary. Exercises responsibility for implementation of this Order by DOE elements.
 - c. Under Secretaries.
 - (1) Implement the requirements of this Order through the Program Secretarial Offices or other DOE elements.
 - (2) Develop procedures for approving equivalencies or exemptions from bridge and tunnel management requirements, including notification to the Senior Real Property Officer.
 - d. Program Secretarial Officer/Program Office (PSO).
 - (1) Ensures validation and timely submission of information and data supporting the Department's requirements and external reporting.
 - (2) Determines which Management and Operating (M&O) and non-M&O contracts must include the CRD and notify Contracting Officers (COs) to incorporate the CRD. Determine which non-M&O contracts must include equivalent requirements to the CRD (in a contract clause or other contract provision, for example, in the Statement of Work) and notify COs to include the equivalent requirements in the contracts in a timely manner.
 - (3) Approves equivalencies or exemptions from bridge and tunnel management requirements as defined in Paragraph 3.c.
 - e. Associate Under Secretary, Office of Environment, Health, Safety and Security. Provides advice and assistance for environment, health, safety, and security implementation.

- f. Site and/or Field Office Manager. Integrates bridge and tunnel management requirements into existing quality assurance² and safety management systems,^{3,4} as well as site operations or emergency operations plans and procedures.
 - g. Contracting Officer. Once notified of contract applicability, insert the CRD of this order or equivalent requirements to the CRD into applicable M&O and non-M&O contracts.
 - h. Head of Contracting Activity.⁵ Issues direction to Contracting Officers to incorporate the CRD into contracts in a timely fashion upon notification of its applicability.
 - i. DOE Bridge and Tunnel Manager. Serves as the DOE official responsible for performing the duties of Bridge Program Manager and Load Rating Engineer as set forth in Code of Federal Regulations 23 CFR 650, Subpart C, and the duties of Tunnel Program Manager as set forth in Code of Federal Regulations 23 CFR 650.507 pertaining to agency-wide bridge inspection policies and procedures, quality control and quality assurance procedures, and preparation and maintenance of a bridge inventory.
6. INVOKED TECHNICAL STANDARDS. This Order does not invoke any DOE technical standards or industry standards as required methods. Any technical standard or industry standard mentioned in or referenced by this Order is not invoked by this Order. Note: DOE O 251.1D, Appendix J provides a definition for “invoked technical standard.”
 7. IMPLEMENTATION. For DOE elements, full compliance with this Order, including the attachments, must be accomplished within one (1) year of the issuance date. For covered contracts, full compliance shall be accomplished within one (1) year of the effective date of a new award or inclusion of the CRD or its requirements into an existing contract. Where less than one year of performance remains on a covered contract, the PSO shall define any requirements and the implementation date applicable within the remaining period of performance.
 8. DEFINITIONS. Federal requirements or industry standards establish definitions for many of the terms used in this Order. Attachment 3 lists the source of established definitions or establishes definitions for Departmental use. Find a current list of references at: https://powerpedia.energy.gov/wiki/Bridge_Management_Program.

² Department of Energy Order 414.1D, Quality Assurance, April 25, 2011.

³ Department of Energy Order 450.2, Integrated Safety Management, April 25, 2011.

⁴ Code of Federal Regulations, 48 CFR 970.5223-1, DEAR Clause: Department of Energy Acquisition Regulations, Integration of Environment, Safety and Health into Work Planning and Execution.

⁵ DOE O 361.1, *Acquisition Career Management Program*, current version.

9. CONTACT. Questions regarding the implementation of this Order should be directed to the Office of Asset Management at 202-586-4539.

BY ORDER OF THE SECRETARY OF ENERGY:



MARK W. MENEZES
Deputy Secretary

**CONTRACTOR REQUIREMENTS DOCUMENT
DOE O 437.1, BRIDGE AND TUNNEL MANAGEMENT**

This Contractor Requirements Document (CRD) sets forth requirements applicable to the contract to which this CRD is inserted. It establishes the requirements for Department of Energy (DOE) contractors, including National Nuclear Security Administration contractors, whose contracts involve the management or operation of DOE sites or facilities that include bridges, tunnels, or culverts. Contractors are expected to meet these functional requirements through tailoring of their business processes and management practices and through use of nationally recognized industry standards and practices and voluntary consensus standards.

Regardless of the performer of the work, the contractor is responsible for complying with the requirements of this CRD. The contractor is responsible for flowing down the requirements of this CRD to subcontractors at any tier to the extent necessary to ensure the contractor's compliance with the requirements.

In addition to the requirements set forth in this CRD, contractors are responsible for complying with Attachments 2, 3, and 4 to DOE O 437.1, referenced in and made a part of this CRD, which provide requirements and information applicable to contracts in which this CRD is inserted.

The contractor must establish and maintain a documented bridge and tunnel management approach satisfying Federal regulations, DOE directives, and industry standards and practices. Attachment 2 provides acceptable approaches for implementing Federal regulation and for meeting the requirements of this Order. It references Federal regulations, DOE directives, and industry best practices. It also provides criteria for applying a graded approach to managing bridges, tunnels, or culverts, even those not subject to Department of Transportation regulations.

The contractor's bridge and tunnel management approach must satisfy the following requirements for the following structures: public- and controlled-access vehicular bridges; public- and controlled-access railroad bridges; public- and controlled-access pedestrian bridges, including elevated walkways; public- and controlled-access vehicular tunnels; and culverts assigned Usage Code 2629 in the Facilities Information Management System. These include requirements specific to assets with fracture critical member bridges or complex features.

1. Inspections. Plan, conduct, and document timely inspections, assessments, studies, and evaluations of each bridge, culvert, or tunnel as described in Attachment 2.
2. Load Rating and Posting.
 - a. Maintain a current load rating for each active bridge, tunnel, and culvert using the criteria and methods in Attachment 2. At-grade roadways in tunnels are exempt from load rating.
 - b. When necessary, post a bridge, tunnel, or culvert for load restrictions or restrict access using the criteria in Attachment 2.

3. Scour Evaluation. Maintain a current scour evaluation of vulnerability to scour or stream instability from floods for each active bridge and culvert that crosses a waterway using the criteria and methods in Attachment 2.
4. Seismic Vulnerability Evaluation. Evaluate each bridge for vulnerability to seismic events and the need for seismic retrofitting using the criteria in Attachment 2.
5. Vehicle Traffic Volume Data Collection.
 - a. For each active vehicle bridge:
 - a. Determine the Average Daily Traffic (ADT) and the percentage that is truck traffic. Do not include vans, pickup trucks and other light delivery trucks in this percentage. Update every five (5) years.
 - b. Maintain a forecasted average daily traffic for the route at least 17 years but no more than 22 years from the year in which the forecast is made. The intent is to provide a forecast of the ADT 20 years in the future.
 - b. For each active vehicle tunnel, determine the Annual Average Daily Traffic (AADT) and the Annual Average Daily Truck Traffic (AADTT). Do not include vans, pickup trucks, and other light delivery trucks in this percentage. Update every five (5) years
6. Use of Qualified Personnel.
 - a. Ensure each person performing an inspection or evaluation meets the qualification requirements specific to the inspection or evaluation conducted and understands the duties of the role he or she is expected to perform as described in Attachment 2.
 - b. Document individual personnel qualifications including appropriate education, experience, licensure, and certifications, as applicable and current training. Individuals must complete refresher training at least every five (5) years.
7. Quality Management.
 - a. Establish and implement quality management procedures or requirements necessary to produce accurate and consistent bridge inspections conforming with inspection standards and criteria; inspection plans; quality control procedures; DOE policy; and Federal and State requirements.
 - b. Establish and implement quality management procedures or requirements necessary to ensure that evaluation products such as calculations, reports, and studies are complete, accurate, and properly checked in accordance with applicable industry standards.
 - c. Establish and implement quality management procedures or requirements necessary to ensure that information and data supporting the Department's

- d. external reporting and bridge and tunnel management is validated and provided in a timely manner.
8. Records and Reporting. Prepare, maintain, and provide records, reports, or data using the criteria in Attachment 2.
 9. Inventory and Asset Management.
 - a. Integrate requirements for bridge and tunnel management with existing operating and management procedures for real property. Document any locally established policies, procedures, or inspection frequencies for bridges, tunnels, or culverts.
 - b. When available resources are inadequate to maintain an acceptable level of bridge, culvert, or tunnel safety, act to impose lane or load restrictions, or closures.
 - c. Maintain protocols for responding to a critical finding.
 - d. Maintain bridge closure and re-opening procedures. Once closed, a bridge may not be reopened until repairs are complete and a qualified engineer determines that the bridge is safe and if necessary, posted for load restrictions.
 - e. For railroad bridges, maintain procedures and issue instructions to personnel responsible for train operations to prevent operation of equipment that would exceed the capacity of the bridge.

ATTACHMENT 2: BRIDGE AND TUNNEL MANAGEMENT

The following paragraphs set forth the requirements for bridge and tunnel management including conduct of inspections and evaluations, use of qualified personnel, quality management, records and reporting, and inventory and asset management. Requirements are applicable and specific to the following structures: public- and controlled- access vehicular bridges, public- and controlled-access railroad bridges, public- and controlled- access pedestrian bridges including elevated walkways, public- and controlled- access vehicular tunnels, and culverts assigned Usage Code 2629 in the Facilities Information Management System. It includes requirements specific to assets with fracture critical member bridges or complex features.

1. Inspections. The type and frequency of inspections performed may vary over the life of a bridge or tunnel to reflect the level of effort needed to document its condition.
 - a. Types of Inspection.
 - (1) DOE elements with a bridge, tunnel, or culvert structure among their real property holdings must plan, conduct, and document timely inspections^{1,2} in accordance with applicable national^{3,4,5,6,7} standards and the following requirements. Required inspections⁸ may include the following types: Initial, Routine, In-Depth, Fracture Critical Member, Underwater, Damage, or Special. Fracture Critical Member inspections and Underwater inspections are not applicable to tunnels.
 - (2) A graded approach is allowable for short span bridges, these are public- and controlled- access vehicular bridges with a structure length of less than 20 linear feet, public- and controlled- access pedestrian bridges including elevated walkways, and culverts assigned Usage Code 2629 in the Facilities Information Management System (FIMS) when considering complexity of the bridge, level of use, degree of structural redundancy, history of acceptable performance, and stable condition over time. Document such approaches in local procedures and bridge and tunnel management plans. A graded approach may not be used to obtain exemptions from requirements nor does it imply the omission of requirements.

¹ Code of Federal Regulations, 23 CFR Part 650, Subpart C, National Bridge Inspection Standards.

² Code of Federal Regulations, 49 CFR Part 237, Bridge Safety Standards, Subpart D, Capacity of Bridges.

³ Federal Highway Administration, Bridge Inspector's Reference Manual.

⁴ American Association of State Highway and Transportation Officials, Manual for Bridge Element Inspection.

⁵ American Railway Engineering and Maintenance-of-Way Association (AREMA), Manual for Railway Engineering.

⁶ American Railway Engineering and Maintenance-of-Way Association, Bridge Inspection Handbook.

⁷ Federal Highway Administration, Tunnel Operations, Maintenance, Inspection, and Evaluation Manual.

⁸ Federal regulations for railroad bridges and highway bridges include slightly different terminology and requirements for type of inspections. The Department of Energy maintains consistent terminology for the various types of inspections as defined in Attachment 3.

- (3) Identify bridges with Fracture Critical Members, complex bridges, and bridges with special features. Identify bridges with Critical Findings. Identify bridges requiring underwater inspections, bridges that are scour critical or have unknown foundations, and bridges where scour evaluations have not been conducted. Identify bridges on the National Highway System.
 - (4) Determine and document the risk classification for routine inspection and underwater inspection of each bridge.
 - (5) Determine and document seismic trigger events for prioritizing Damage Inspections after seismic events.
 - (6) Determine and document types of inspections required for each bridge, culvert, and tunnel.
- b. Inspection Interval. The frequency of inspection is specific to each bridge, tunnel, or culvert based on factors effecting safety, reliability, and consequences of failure.
- (1) Using Table 2.1, determine and document the inspection interval of each required inspection for each active asset.
 - (a) Establish a baseline month for Routine, Underwater, or Fracture Critical Inspections. Conduct all subsequent inspections in the baseline month unless granted a one-time exception in advance. Subsequent inspections must revert to the previous schedule.
 - (b) Identify those structures requiring variations from the established intervals and document rational for determination.

TABLE 2.1 ESTABLISHED INSPECTION INTERVALS					
Requirement	Vehicle Bridge	Short Span Bridge or Culvert	Pedestrian Bridge incl. Elevated Walkway	Railroad Bridge	Vehicular Tunnel
Initial	Within 60 days of: <ul style="list-style-type: none"> ▪ Date Placed in Service, or ▪ acquisition, or ▪ change in configuration, or ▪ construction due to repair or retrofit 				
Routine	Regular intervals not to exceed 24 months			One inspection per calendar year, with not more than 540 days between	Regular intervals not to exceed 24 months

TABLE 2.1 ESTABLISHED INSPECTION INTERVALS					
Requirement	Vehicle Bridge	Short Span Bridge or Culvert	Pedestrian Bridge incl. Elevated Walkway	Railroad Bridge	Vehicular Tunnel
				successive inspections	
In-Depth	As determined by the cognizant Responsible Engineer				
Fracture Critical Member	Regular intervals not to exceed 24 months				
Underwater	Regular intervals not to exceed 60 months				
Damage	<ul style="list-style-type: none"> ▪ As soon as practicable after damage occurs ▪ Before structure is re-opened to traffic, or ▪ Per the site’s emergency action plan following an established seismic trigger event 				
Special	As established				

- (2) Inspection Interval Variance. The inspection interval may be adjusted based on the condition of the bridge. The Routine Inspection interval may be increased up to 48 months for a public- or controlled- access vehicle bridge. Inspection intervals may be increased to up to 60 months for a short span bridge or a culvert in good condition and with low consequences of failure. Inspection intervals may be increased up to 60 months for a low risk pedestrian bridge in good condition. Use the following guidelines to determine if a bridge is a likely candidate for variance approval:
- (a) Increased Inspection Interval. The Routine Inspection interval may be increased (i.e. less frequent inspection) if all the following criteria are met:
- 1 All applicable Condition Ratings, NBI Data Items 58 through 60 or NBI Data Item 62 and NBI Data Item 61, are greater than 6.
 - 2 NBI Data Item 113 is coded 5, 8, 9, or N.
 - 3 The Condition Ratings have not changed (i.e. no deterioration) over the previous three (3) inspection cycles.
 - 4 The Inventory Rating Factor is greater than 1.0 for all American Association of State Highway and Transportation Officials (AASHTO) vehicles including Specialized Hauling Vehicles (SHVs) and State legal loads.

- 5 The Average Daily Traffic is less than 500.
 - 6 Structure Length is less than 100 feet.
 - 7 A steel bridge must have load path redundancy (NBI Data Item 92A = N).
 - 8 A new or newly rehabilitated structure must have had an initial inspection plus at least one cycle (24-month interval) routine inspection.
 - 9 Inspection interval may not extend beyond 24 months for:
 - a Bridges that have inventory ratings less than the State's legal load.
 - b Bridges with a Structure Length greater than 100 feet.
 - c Bridges with little performance history.
 - d Bridges susceptible to vehicular damage, for example those with vertical over or under clearances less than 14'-0", or those with restricted horizontal clearances on or under the structure.
 - e Bridges with Fracture Critical Members or Complex Bridges.
 - f Bridges constructed of timber or masonry.
 - g Bridges that carry heavy permit loads.
 - h Bridges known to experience overloaded trucks.
 - i Bridges with steel or timber decks.
 - j Bridges with rocker bearings.
 - k Bridges with no as-built drawings.
- (b) Decreased Inspection Interval. The Routine Inspection interval for bridges must be reduced (i.e. more frequent inspection) to 12 months or less when any Condition Rating (NBI Data Items 58 through 60 or NBI Data Item 62) is less than 4 or where the rate of deterioration is of a magnitude where safety may be impacted beyond that interval. Other considerations for reducing inspection intervals include:

- 1 State requires more frequent inspection of bridges on public roads.
 - 2 Bridge requires repair work.
 - 3 Bridge is subject to frequent overloads.
 - 4 Bridge has unique or unusual details, unique structure types, or unknown performance history.
 - 5 Large bridge carrying a significant amount of traffic.
 - 6 Bridge with temporary supports.
 - 7 Bridge is subject to significant substructure movement or settlement.
 - 8 Bridge with potential foundation or scour problems.
- (3) In-Depth Inspection. An In-Depth Inspection may be scheduled⁹ with or independently of a Routine Inspection or conducted as a follow-up to a Damage or other type of inspection. Schedule In-Depth Inspection of railroad bridges in consultation with the cognizant Railroad Bridge Engineer.
- (4) Fracture Critical Member Inspection. Inspection intervals will be reduced to 12 months or less where cracks are discovered in fracture critical members and the Inspection Team Leader has determined the function of these members will not be impacted over the inspection interval. The interval may be restored to up to 24 months if a fatigue/fracture analysis shows a safe life for the interval proposed.
- (5) Underwater Inspection. Underwater inspections may be performed as part of a Routine Inspection or as an independent inspection effort. An Underwater Inspection interval greater than 60 months (not to exceed 72 months) may be acceptable for a vehicle bridge on public roads in good condition with advance approval of the Federal Highway Administration (FHWA). An Underwater Inspection interval greater than 60 months (not to exceed 72 months) may be acceptable for controlled-access vehicle bridges, railroad bridges, short span bridges, culverts, or pedestrian

⁹ Conditions that may prompt an In-Depth Inspection of a bridge include: apparent cracks in steel members; apparent cracks, de-bonding or loss of tendon section in a prestressed concrete members; suspected frozen bearings or failed hold down devices; severe section loss from steel members; buckled or bent steel girders or beams; disconnected or loose members; or visual fretting rust on the pin of a pin and hanger connection.

bridges in good condition with advance approval of the DOE Bridge and Tunnel Manager.

- (a) Increased Inspection Interval. The Underwater Inspection interval may be increased (i.e. less frequent inspection) if all the following criteria are met.
 - 1 Condition Rating for NBI Data Items 60 or 62 is 6 or greater.
 - 2 Condition Rating for NBI Data Item 61 is 7 or greater.
 - 3 NBI Data Item 113 is coded 5, 8, 9, or N.
 - 4 The Condition Rating or Scour Ratings have not changed (i.e. no deterioration) over the previous inspection cycle.
 - 5 Pier protection is present and in good condition where a bridge crosses a navigable waterway.
 - 6 Bridge substructure elements are not constructed of steel or timber.
- (b) Decreased Inspection Interval. Underwater Inspection interval will be decreased to 24 months or less when the Condition Rating for NBI Data Item 60 or 62 is less than 4. If the deterioration causing the low Condition Rating is localized, then consider scheduling a Special Inspection focused on the localized area. Additional factors to consider when selecting underwater inspection interval include:
 - 1 NBI Data Item 113 is coded 0-4, 6, or 7.
 - 2 The bridge is on a waterway with rapid stream flows.
 - 3 Significant debris accumulates at structure.
 - 4 The bridge has constricted waterway openings.
 - 5 Erodible or unstable streambed or bank material present.
 - 6 Meandering channels exist.
- (6) Damage Inspection. Schedule immediately following an accident or trigger event involving the structure to determine if it should be closed. May be followed with an In-Depth Inspection to document the full extent of the damage as well as the urgency and scope of repairs.
- (7) Special Inspection. Scheduled at the discretion of the responsible DOE Element considering the severity of a known deficiency. Changes in

condition between inspections should be a factor in determining the frequency for conduct of Special Inspections. Conduct inspections more frequently as conditions deteriorate. Apply the following guidelines when determining the Special Inspection interval:

- (a) For a bridge not capable of carrying State legal loads, set inspection interval of no more than 12 months.
 - (b) For a bridge with an NBI Condition Rating of 4 for the deck, superstructure, substructure, or a primary load carrying member, set inspection interval of six to 12 months.
 - (c) For a bridge with an NBI Condition Rating of 3 or less for the deck, superstructure, substructure, or a primary load carrying member, set inspection interval of six months or less.
 - (d) For a bridge with known load-carrying deficiencies, inspection interval as determined in coordination with the DOE BTM.
 - (e) For a bridge with advanced deterioration, inspection interval as determined in coordination with the DOE BTM.
- (8) Complex and Special Feature Inspection. An inspection interval less than 24 months may be required for deficient members.
- (9) Vehicular Tunnels. Apply the following criteria for selecting a Routine Inspection interval of less than 24 months: poor condition, damage, change in condition between inspections, unknown capacity or history of performance, known problems, consequences of failure, and existence of temporary supports or necessary repairs.
- (10) Inspection Interval Variation Approval.
- (a) Any variation from the inspection intervals in Table 2.1 requires documentation. A less frequent inspection schedule requires advance approval. Any change to a more frequent inspection schedule requires notification.
 - (b) Less Frequent Inspections. Submit a request to the DOE BTM via Line Management prior to increasing the inspection interval. The DOE BTM will review the request and determine its merit, or when appropriate, submit to FHWA for review and approval. For bridges included in the National Bridge Inventory or tunnels included in the included in the National Tunnel Inventory, final determination is subject to FHWA approval. The request must include:
 - 1 the structure Real Property Unique ID Number,

- 2 the proposed inspection interval in months,
- 3 a list of criteria used to justify the request and how each criteria is met, and
- 4 any other explanation as to why the proposed inspection interval is suitable.

c. Risk Classification.

(1) Inspection Interval– Routine. Risk classification for routine inspection interval is based on the bridge’s super/substructure condition, load restrictions, and scour vulnerability.

(a) Bridge is Low Risk when:

- 1 NBI Data Item 59 AND 60 or 62 > 5
- 2 AND Either:
 - a NBI Data Item 70 = 5 AND NBI Data Item 63 ≠ 5
 - OR
 - b NBI Data Item 63 = 5 AND NBI Data Item 70 = 5 AND NBI Data Item 41 = A, D, or E
 - c AND NBI Data Item 113 = 4, 5, 7, 8, 9, N

(b) Bridge is High Risk when:

- 1 NBI Data Item 59 or 60 or 62 < 5
- 2 OR NBI Data Item 70 < 5
- 3 OR NBI Data Item 63=5 AND NBI Data Item 70=5 AND NBI Data Item 41= B, P, or R
- 4 OR NBI Data Item 113 = 0, 1, 2, 3, 6, T or U

(2) Inspection Interval – Underwater. Risk classification for underwater inspection interval is based on the bridge’s substructure/culvert condition and scour vulnerability.

(a) Bridge is Low Risk when:

- 1 NBI Data Item 92B = Y
- 2 NBI Data Item 60 or 62 > 4

3 AND NBI Data Item 113 = 4, 5, 7, 8, or 9

(b) Bridge is High Risk when:

1 NBI Data Item 92B = Y

2 AND NBI Data Item 60 or 62 < 5

3 AND NBI Data Item 113 = 0, 1, 2, 3, 4, 6, T or U.

d. Inspection Procedures.

- (1) Prepare a plan for each inspection specific to the intended inspection type and addressing each of the following phases of the inspection. Identify specialized procedures necessary to inspect bridges with Fracture Critical Members or all the features of each complex bridge. Inspect each bridge according to established procedures and structure-specific inspection plan addressing:
 - (a) pre-inspection – planning and coordination activities;
 - (b) on-site inspection – worker safety; public safety; traffic management; field inspection equipment, tools, and materials; inspection techniques including nondestructive tests and/or other physical and chemical tests; and documentation techniques; and
 - (c) post-inspection – recording, reporting, recommendations, archiving, and follow-up to critical findings.
- (2) Each Public or Controlled Access Vehicle Bridge, Railroad Bridge, or Tunnel inspection will be conducted under the full time, on-site supervision of an Inspection Team Leader or Railroad Bridge Inspector who is responsible for the accuracy of the results and is accompanied by at least one other inspector.
- (3) Conduct underwater inspections^{10,11} to determine member condition where conditions are such that the stream bottom elevation around the foundations cannot be accurately measured by use of rods, poles, weighted sounding lines or other means, or if any portion of a substructure is exposed to water deeper than 3 feet during periods of normal low water. A qualified diver must complete this inspection if the waterway cannot be waded safely.

¹⁰ American Society of Civil Engineers, Underwater Investigations: Standard Practice Manual, and FHWA-NHI-10-027, Underwater Bridge Inspection, June 2010.

¹¹ Among other factors used to determine type and extent of inspection, include structure type, materials of construction, foundation type, footing location relative to channel bottom, known or suspected problems, waterway characteristics, superstructure and substructure redundancy, and scour susceptibility.

- (4) Upon discovery of a Critical Finding, determine what action is required, how quickly that action needs to be implemented, the extent to which the bridge can be used (e.g., partial lane closures, load limits) or if it should be closed. Provide notifications and submit a Follow-up to Critical Findings Report detailing the intended recovery strategy with planned actions and milestone dates to ensure the safety of personnel and continuance of site operations.
 - (5) If a crack in a Fracture Critical Member is detected during an inspection, a Responsible Engineer will determine the necessity for a fatigue or fracture evaluation. When needed, complete the evaluation under the direction of a qualified engineer to determine the useful life and the critical crack size. Document and initiate monitoring procedures or necessary repairs.
 - (6) During each routine inspection, confirm conditions and assumptions used for existing load rating are still valid. If not, schedule a new load rating.
 - (7) Promptly following structural damage resulting from environmental factors or human action, conduct a Damage Inspection¹² sufficient to determine whether there is a need for emergency load restrictions or closure of part or all of the structure to traffic as well as the level of effort necessary to repair the damage.
2. Load Rating and Posting. The intent of load rating and posting is to ensure that bridges are appropriately evaluated to determine their safe live load carrying capacity and any load restrictions are appropriately posted.
- a. Rate each active vehicle bridge, railroad bridge, pedestrian bridge, culvert, and vehicular tunnel for its load carrying capacity. Load rate each newly acquired bridge within ninety (90) days of the date placed in service or acquired.
 - b. Review existing load rating at least once every five years to ensure conditions and assumptions are still valid, or when recommended by inspectors, or when concern for reduced structural capacity is caused by unexpected events.
 - c. Vehicle Bridges.
 - (1) Rate a vehicle bridge or short span bridge for its safe load carrying capacity of all unrestricted State legal loads, including State routine permits loads in accordance with Section 6A of the AASHTO Manual for Bridge Evaluation¹³.

¹² May require collection of detailed measurements and descriptions of damage necessary to assess the impacts to strength and function of the affected member as well as on-site calculations needed to establish emergency load restrictions. May be followed by a more refined analysis to establish or adjust interim load restrictions.

¹³ Code of Federal Regulations, 23 CFR 650.317, incorporates by reference the AASHTO Manual for Bridge Evaluation cited at 23 CFR 650.305 and 650.313.

- (2) The load rating must reflect the condition of the bridge as reported in the most recent bridge inspection report. Reflect any deficiencies that reduce member capacity in the load capacity determination. If the effects of condition on capacities is unknown or uncertain, conduct a Special Inspection¹⁴ to adequately quantify location and extent of deficiencies. Account for any modifications to the bridge that affect loading on (e.g., change in dead loads) or response of the member being rated.
- (3) Base load ratings on as-built drawings that have been verified by field measurements. When these drawings are not available, take field measurements and perform field-testing. When as-built drawings do not exist and field measurements cannot adequately quantify capacity (e.g., bridges with reinforced concrete members), base the load rating on a field evaluation and documented engineering judgment in accordance with FHWA guidance^{15,16}. Document basis of assumptions to include: some evidence that a search for design or as-built data has been attempted or other efforts to provide some background or history of the structure; a discussion of load history that confirms the load assumptions for normal traffic. Specifically identify the assumed normal traffic. Coordinate with State agencies to identify State legal loads and if they comply with federal weight limits and the Bridge Formula¹⁷ (also known as Formula B).
- (4) Load rating methodology must comply with FHWA memorandum¹⁸.
- (5) Evaluate bridge for the AASHTO HL 93 design vehicle for determining NBI Data Items 64-Operating Rating and 66-Inventory Rating and to determine the need for evaluating State legal loads.
 - (a) If the Inventory Rating Factor is less than 1.0 and the State does not comply with federal weight limits and the Bridge Formula, rate for State legal loads.
 - (b) In States that comply with federal weight limits and the Bridge Formula, rate for State legal loads when the Operating Rating Factor is less than 1.0.

¹⁴ Performed when a structure requires more frequent inspection than is given by the Routine Inspection cycle, typically for a known defect or condition severe enough to warrant extra scrutiny. The frequency of Special Inspections is determined on a case-by-case basis.

¹⁵ Federal Highway Administration Memorandum ACTION: Revisions to the Recording and Coding Guide for the Structure, Inventory and Appraisal of the Nation's Bridges - Item 31, Design Load, and Items 63 and 65, Method Used to Determine Operating and Inventory Rating, November 15, 2011.

¹⁶ Federal Highway Administration Memorandum, ACTION: Assigned Load Ratings, September 29, 2011.

¹⁷ Federal Highway Administration, FHWA-HOP-06-105, Bridge Formula Weights, August 2006.

¹⁸ Federal Highway Administration Memorandum, INFORMATION: Bridge Load Ratings for the National Bridge Inventory, October 30, 2006.

- (6) Determine load ratings and rating factors for Specialized Hauling Vehicles (SHVs) in accordance with FHWA memorandum¹⁹.
 - (7) If the Inventory Rating Factor for the AASHTO HL 93 design vehicle is less than 0.9 using the Load and Resistance Factor Design (LRFD) method²⁰, determine load ratings and rating factors for Emergency Vehicles (EV2 and EV3) in accordance with FHWA memorandums^{21,22}.
- d. Railroad Bridges.
- (1) Rate each railroad bridge for the applicable limit states defined in the AREMA Manual for Railway Engineering.
 - (2) Base load ratings on as-built drawings that have been verified by field measurements. When these drawings are not available, take field measurements and perform field-testing. When as-built drawings do not exist and where field measurements cannot adequately quantify required dimensional data, base the load capacity on a field evaluation and the documented engineering judgment of the Railroad Bridge Engineer. Determinations by judgment can be based on history and current use of the bridge. For example, the bridge could be rated based on known weight of passing loads if there is no evidence of distress.
 - (3) Evaluate each bridge for the Cooper E-80 Loading as defined in Figure 15-1-2 AREMA Manual for Railway Engineering. Consider other standard loading or loading consisting of specific equipment based on normal use of the bridge. The load rating must consider capacity of the superstructure as well as the substructure.
 - (4) Conduct a Fatigue Evaluation on each bridge with Fatigue Susceptible Details following the procedures in Chapter 15 of AREMA Manual for Railway Engineering. Live load stresses and traffic volumes must be known. A qualitative analysis may be completed for bridges with low traffic volumes and low stresses.
 - (5) Determine Normal Rating both with and without fatigue considerations. If there is a need to allow infrequent operation of loads greater than normal, determine Maximum Rating in accordance with AREMA Manual for Railway Engineering. Fatigue need not be considered for maximum rating.

¹⁹ Federal Highway Administration Memorandum, ACTION: Load Rating of Specialized Hauling Vehicles, November 15, 2013.

²⁰ American Association of State Highway and Transportation Officials, LRFD Bridge Design Specifications, 7th Edition with Interim Revisions, or current version.

²¹ Federal Highway Administration Memorandum, ACTION: Load Rating for the FAST Act's Emergency Vehicles, November 3, 2016.

²² Federal Highway Administration, Questions and Answers, Load Rating for the FAST Act's Emergency Vehicles, March 2017.

- e. Pedestrian Bridges.
- (1) Determine²³ the design strength of the bridge considering the existing condition, geometry, and materials.
 - (2) Determine required strength for loads prescribed in the LRFD Guide Specifications for the Design of Pedestrian Bridges or as required by the State within which the bridge is located or actual loads.
 - (a) When vehicular access is not prevented on the pedestrian bridge, use the design vehicle and limit state specified in 3.2 of LRFD Guide Specifications for the Design of Pedestrian Bridges.
 - (b) If vehicular access is prevented on the pedestrian bridge, do not consider the design vehicle.
 - (3) Where the design strength is determined to be less than the required strength, and where:
 - (a) Vehicular access is not prevented, conduct an iterative process to determine if the design strength is adequate with a lesser design vehicle load (using standard AASHTO H or known loading). If the design strength is acceptable for a lesser vehicle load, then the bridge must be posted. If it is determined that the design strength is less than required with no vehicle loading, develop a plan of action to prevent unsafe access.
 - (b) Vehicular access is prevented, develop a plan of action to prevent unsafe pedestrian access.
 - (c) A Fatigue Evaluation is required, evaluate for the AASHTO LRFD Fatigue I Limit State for applicable loads specified in 3.5 of LRFD Guide Specifications for the Design of Pedestrian Bridges.
 - (4) Alternatively, post each pedestrian bridge for the allowed vehicle load where vehicular access is not prevented or where vehicular access is prevented for the maximum number of people allowed on the bridge at one time.
- f. Culverts. Rate each culvert for its safe load carrying capacity. For a culvert with sufficient fill to minimize live load effects, showing no signs of distress, and the consequences of failure are low, rate in accordance with Section 6.1.4 of the

²³ American Association of State Highway and Transportation Officials LRFD Guide Specifications for the Design of Pedestrian Bridges, 2nd Edition with 2015 Interim Revisions, or current version.

AASHTO Manual for Bridge Evaluation²⁴. For a culvert with a depth of fill greater than either eight (8) feet or its span length whichever is greater, the live load is considered negligible so live load analysis is not required.

- g. Vehicular Tunnels. Rate each tunnel's safe vehicular load-carrying capacity in accordance with Sections 6 or 8 of the AASHTO Manual for Bridge Evaluation.
- h. Refined Analyses and Testing. When the load rating results in intolerable deficiencies and posting will result in severe impacts to site operations, consider conducting more refined analyses or testing. This analysis will typically consist of detailed three-dimensional finite element analyses of varying complexities. It may be conducted in conjunction with a load test or material testing to determine material properties, strength, or condition. The refined analyses or load testing may provide a more realistic distribution of loads to the various members and overall system response. See Section 5 of the AASHTO Manual for Bridge Evaluation for guidelines on testing. Alternatively, the bridge can be proof tested. See Chapter 8 of the AASHTO Manual for Bridge Evaluation for load and proof test procedures. These procedures are highly specialized and must be performed only by qualified individuals with documented experience in performing this type of analysis.
- i. Re-rate a bridge within in sixty (60) days when:
 - (1) There is a change in the condition of the bridge that would affect its load carrying capacity;
 - (2) There is a change in the configuration of the bridge through construction, alteration, or rehabilitation that would affect its load carrying capacity;
 - (3) Damage occurs to the bridge either through physical or environmental conditions, i.e. corrosion has resulted in significant section loss on load carrying steel members or components, cracking in primary members, losses at critical connections, or strength has changed due to damage from vessel or vehicular collision, fire, flood, or earthquake;
 - (4) There are changes to dead loads, for example from deck resurfacing or utility additions, changes in traffic loadings and/or traffic volume, or temporary construction loads exceed traffic loads;
 - (5) Soil and substructure settlement or slope instability has occurred; or
 - (6) Required by additional guidance.

²⁴ Section 6.1.4 of the AASHTO Manual for Bridge Evaluation is specifically for reinforced concrete bridges. It is acceptable for application to concrete culverts and to culverts constructed from other materials where the structure has carried normal traffic for an appreciable period of time and shows no distress.

j. Posting.

- (1) Post bridge load restrictions in accordance with the Manual for Uniform Traffic Control Devices²⁵ or State requirements.
- (2) Post a vehicle bridge for load restrictions where State legal loads exceed the calculated load capacity of the bridge.
- (3) Post bridges for speed to reduce impact loading where necessary.
- (4) Post a vehicle bridge for load restrictions when evaluated for emergency vehicles. Post appropriately for both the governing single axle weight limit and tandem axle weight limit derived for each emergency vehicle configuration.
- (5) For railroad bridges that have Normal Load Ratings less than normal load requirements, determine and document necessary operational restrictions. These may involve speed restrictions, coordination with track operation personnel, or other operational constraints. Issue instructions to the personnel who are responsible for the configuration and operation of trains to prevent the operation of cars, locomotives, or other equipment over a bridge that would exceed the capacity or dimensions of the bridge.
- (6) For each pedestrian bridge where the design strength is less than required strength, post for the allowed vehicle load where vehicular access is not prevented. For a pedestrian bridge where vehicular access is prevented and the design strength is less than 60 pounds per square foot or less than the required strength, determine a safe posting that limits the number of pedestrians on the bridge at one time. Select site-appropriate posting and enforcement procedures.
- (7) Post or restrict the highways in or over a tunnel when the maximum unrestricted legal loads or State routine permit loads exceed those allowed under the operating rating or equivalent rating factor.

k. Bridge Restrictions or Closure.

- (1) Immediately close to traffic any vehicle bridge with a load rating of 3 tons or less. Close to traffic any vehicle bridge when an imminent failure is possible. Bridge closure requires some combination of barrier, signage, and flagging or other means of controlling bridge access. The closure could be limited to specific lanes or it could be a complete closure to all traffic. Follow State guidelines for closure and detour traffic control requirements.
- (2) When the load rating evaluation reveals that a vehicle bridge requires posting, but is not, posting must be complete within thirty (30) days of load

²⁵ Federal Highway Administration, Manual on Uniform Traffic Control Devices, 2009 with revisions.

capacity determination.²⁶ Where posting is insufficient to ensure compliance with weight restrictions, engage law enforcement or install monitoring devices, including cameras, weigh-in-motion sensors, or radar stations.

- (3) For railroad bridges that have Normal Load Ratings less than normal load requirements, document necessary operational restrictions within ninety (90) days of load capacity determination.

1. Load Rating Report.

- (1) Report must include information about who performed the load rating, when the rating was performed, date of determination, assumptions and known information about the bridge used in rating the bridge, loading information, capacity calculations, load rating methodology, load rating calculations and any computer input and output used to calculate the loads and the capacities. Identify formulas used in the analysis and reference sources. Identify State legal loads as well as the State's compliance with federal weight limits and the Bridge Formula. Define terms and nomenclature used.
- (2) All calculations must be checked and initialed by the engineer who developed the calculations and by the engineer who checked them.
- (3) Document use of computer programs to include description of model (i.e. elements, boundary conditions, and load application) and comparison of differences between the model and actual behavior. Calculations developed by computer analysis must include a cover page explaining the analysis performed and must be initialed by the engineer who developed the input and the engineer who checked the input and results. State why the differences are acceptable and how the results might be affected. Results should include load effect diagrams and deflection plots, as applicable.
- (4) For vehicle bridges, include a summary of the calculation results including the inventory and operating ratings for the AASHTO Design vehicle, State legal loads if evaluated, and any required posting values for each vehicle type. Identify the controlling member(s).
- (5) For vehicle bridges, identify recommended data entries for NBI Data Items 31, 41, 63 through 66, and 70 in accordance with the FHWA Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's

²⁶ Federal Highway Administration Memorandum ACTION: Timeframe for Installing Load Posting Signs at Bridges, April 17, 2019.

Bridges including revisions, errata, and supplemental FHWA memorandum.²⁷

- (6) For railroad bridges, include a summary of the calculation methodology and results including the normal and maximum ratings for the Cooper E-80 loading, or any modified loading that is normal for the track. Identify the controlling member(s) for each load rating.
 - (7) A qualified load rating engineer must certify the rating as complete, accurate, and in accordance with applicable standards. Include the qualifications of Load Rater or Railroad Bridge Engineer and Load Rate Reviewer.
 - (8) Include quality control documentation.
- m. Bridge File.
- (1) Place all documents, including evaluator's qualifications, load rating calculations and reports in the Bridge File.
 - (2) When the bridge requires load limit posting, place evidence of bridge posting in the Bridge File.
 - (3) When operational restrictions are necessary, place evidence of such restrictions and enforcement procedures in the Bridge File.
3. Scour Evaluation. A scour evaluation identifies the susceptibility of streambed material to erosion and the degree of foundation element stability for bridges crossing a waterway. The evaluation relies on as-built foundation details, current conditions of the foundation, streambed cross section profiles, and stream flow rates. Scour evaluations are bridge site specific and additional information may be required to complete an accurate analysis. Scour evaluations are not static. As the bridge foundation condition changes and/or the stream bed characteristics change, the scour criticality must be reanalyzed.
- a. Evaluate^{28,29} each active bridge and culvert that crosses a waterway for vulnerability to scour and stream instability from floods. Evaluate each newly acquired bridge within ninety (90) days of the date placed in service or acquired.
 - (1) Approach. The extent of each scour evaluation depends upon existing site conditions. A complete evaluation may include a qualitative evaluation

²⁷ Federal Highway Administration Memorandum ACTION: Revisions to the Recording and Coding Guide for the Structure, Inventory and Appraisal of the Nation's Bridges - Item 31, Design Load, and Items 63 and 65, Method Used to Determine Operating and Inventory Rating, November 15, 2011.
<https://www.fhwa.dot.gov/bridge/110202.cfm>

²⁸ Federal Highways Administration, Publication No. FHWA-HIF-12-003, Hydraulic Engineering Circular No. 18 (HEC-18) Evaluating Scour at Bridges, April 2012.

²⁹ Federal Highways Administration, Publication No. FHWA-HIF-12-004, Hydraulic Engineering Circular No. 20 (HEC-20) Stream Stability at Highway Structures, April 2012.

(Level 1) only, a quantitative evaluation (Level 2 or Level 3), or a hydraulic engineering analysis.

- (2) Level 1 Evaluation. A Level 1 Field Assessment identifies the susceptibility of a bridge to scour and accurately records the present condition of the bridge foundations and stream stability. Each bridge is evaluated by viewing all available data including as-built plans, hydraulic studies, soundings and other underwater investigations, streambed and foundation soils, and historical use. If needed, HEC-18, Evaluating Scour at Bridges, and HEC-20, Stream Stability at Highway Structures, include guidance for collecting site data. The Level 1 Evaluation results in bridge classification for scour vulnerability as Low Risk, Scour Critical, or Scour Susceptible.
 - (a) Bridge with Low Risk for Scour. Low Risk bridges are monitored for scour during Routine Inspections and after significant events. They are re-evaluated for scour after significant flood events and when site conditions change. Bridge types and locations often considered Low Risk when there is no history of scour are:
 - 1 Single span bridge with protected abutments
 - 2 Bridge with foundations well above the flood plain
 - 3 Bridge over dams or pools with small flows
 - 4 Bridge over lined channels
 - 5 Bridge with spread footings on non-erodible bedrock
 - 6 Bridge length culvert with a floor.
 - (b) Level 2 or Level 3 Evaluation. Further analysis must be completed within ninety (90) days when a Level 1 Evaluation determines the bridge is Scour Susceptible, has unknown foundations, or is over tidal waters. Hydrologic data and streambed material properties must be obtained to conduct the Level 2 analysis. Level 3 analysis uses more detailed hydrologic and streambed material property data to complete mathematical or physical model studies.
 - (c) Bridge susceptibility to scour cannot be determined unless the construction details of the foundation are known. Make every attempt to determine the foundation type and depth, including a search for bridge records or conducting foundation testing. Once the foundation has been determined, perform a scour evaluation to determine potential scour depths and scour classification. Until the foundation is determined and the potential scour depths are known, implement a

Scour Critical Plan of Action with a monitoring plan and closure protocols.

- b. Scour Evaluation Results. Determine appropriate rating for NBI Data Item 113, Scour Critical Bridges in accordance with FHWA Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation’s Bridges including revisions, errata, and supplemental FHWA memorandum. Record the results of the scour evaluation in the Structure Inventory and Appraisal (SI&A) data. Until evaluation is completed, code NBI Data Item 113 as 6.
 - (1) Review scour evaluation concurrent with each routine inspection.
 - (2) Re-evaluate each bridge for changes in vulnerability to scour after any bridge-specific trigger event, following a flood event or when conditions affecting the flow change.
 - (3) Develop and execute a bridge-specific Scour Critical Plan of Action (Scour Critical POA) for each bridge where NBI Data Item 113 is coded 1, 2, 3, 4, 6, 7, T, or U, or where NBI Data Item 60 is coded 1 or 2 due to scour.
 - (4) Immediately close to traffic any bridge where the recommended rating code for NBI Data Item 113 is 1 or where the recommended rating code for NBI Data Item 60 is 1 based on scour.
 - (5) Where item 113 is coded 0, retain evidence of bridge closure.
 - (6) Bridge File. Place the completed scour evaluations, including qualifications for the responsible engineer and inspection team leaders, information required to do the evaluation, any Scour Critical POA, and evidence of any mitigation efforts in the Bridge File.
4. Seismic Vulnerability Evaluation.
 - a. Evaluate^{30,31} each bridge for vulnerability to seismic events and need for seismic retrofitting. Evaluate each newly acquired bridge within ninety (90) days of the date placed in service or acquired. A bridge is exempt from retrofitting for both levels of ground motion if it:
 - (1) has 15 years or less of Anticipated Service Life (ASL), or
 - (2) is temporary, or

³⁰ Federal Highway Administration, FHWA-HRT-06-032 Seismic Retrofitting Manual for Highway Structures: Part 1 – Bridges, January 2006.

³¹ Federal Highway Administration, FHWA-HRT-05-067, Seismic Retrofitting Manual for Highway Structures: Part 2 – Retaining Structures, Slopes, Tunnels, Culverts, and Roadways, August 2004.

- (3) is closed to traffic and does not cross an active highway, rail, or waterway.
 - b. Review existing seismic vulnerability evaluation at least once every five years to ensure conditions and assumptions used are still valid.
 - c. Re-evaluate a bridge within 60 days of a change in configuration or seismic retrofit.
 - d. Seismic Vulnerability Evaluation Results. Document the conduct and results of seismic vulnerability evaluations and reviews.
 - (1) Identify evaluation assumptions, methods and formulas, calculations, and terms or nomenclature used. Identify resultant seismic retrofit category for both upper and lower ground motion levels.
 - (2) If the bridge meets the criteria for Seismic Retrofit Category A for the upper level ground motion, document justification for retrofit exemption in the Bridge File.
 - (3) If the bridge meets the criteria for Seismic Retrofit Category B, C, or D, identify Bridge Rank and Priority Index. Where the need for retrofit is determined, document the retrofit strategy.
 - (4) Include qualifications for the responsible engineer.
 - e. Bridge File. Place the completed seismic evaluations, including qualifications for the responsible engineer and evidence of any retrofit efforts in the Bridge File.
5. Vehicle Traffic Volume Data Collection. Record the results in the SI&A or NTI data. Place data collection³² results and forecasts in the Bridge File or Tunnel File.
6. Use of Qualified Personnel. Required education, experience, licensure, certifications, and current training is specific to inspection type or evaluation and role. Acceptable training may consist of documented on-the-job training, classroom, web-based or any combination of these. Minimum qualifications include:
 - a. Inspection Team Leader or Railroad Bridge Inspector.
 - (1) Confirmation³³ of passing an eye examination, with or without corrective lenses, to prove near vision acuity of Jaeger³⁴ J-2 at 300 mm to 430 mm [12 in to 17 in] within the past three years.

³² Federal Highway Administration, Traffic Monitoring Guide presents methodology for gathering data on traffic volumes.

³³ Do not collect medical records.

³⁴ The results of visual acuity tests are used to prescribe eyeglasses or other corrective measures. The Grafco Jaeger Eye Chart has print samples of different sizes that are used to determine one's near vision. Eye examinations shall be administered by an Ophthalmologist, Optometrist, Medical Doctor, Registered Nurse or Certified Physician's Assistant or by other ophthalmic medical personnel and must include the state or province license number.

- (2) For Public- or Controlled-Access Vehicle Bridges, the Inspection Team Leader also must meet the requirements of Code of Federal Regulations 23 CFR 650.309(b) and complete refresher training³⁵ at least every five years.
- (3) For Railroad Bridges, the Railroad Bridge Inspector must also:
 - (a) Complete training from an accredited university or industry-related organization such as American Railway Engineering and Maintenance-of-Way Association (AREMA),
 - (b) Have at least 5 years of experience similar to that identified in Code of Federal Regulations 49 CFR 237.53, and
 - (c) Demonstrate familiarity with Code of Federal Regulations 49 CFR Part 214, *Railroad Workplace Safety*, through successful completion of an employer-provided or industry training course.
- (4) For Short Span Bridges, Culverts, and Pedestrian Bridges, the Inspection Team Leader must hold a current registration as a Professional Engineer (Civil or Structural) or meet the requirements of Code of Federal Regulations 23 CFR 650.309(b).
- (5) For structures with Fracture Critical Members (FCM), the Inspection Team Leader must have additional qualifications including:
 - (a) Completed National Highway Institute (NHI) Fracture Critical Member Inspection or equivalent training, and
 - (b) At least 5 years of experience in FCM inspection.
- (6) For Complex Bridges or Special Features Inspections, the Inspection Team Leader must have additional qualifications including:
 - (a) A current registration as a Professional Engineer (Civil or Structural),
 - (b) At least 5 years of experience in inspection of bridge type being inspected, and
 - (c) Completed training specific to type of bridge being inspected.
- (7) For Vehicular Tunnels, the Inspection Team Leader must meet Code of Federal Regulations 23 CFR 650.509(b) requirements. When the tunnel is

³⁵ National Highway Institute, state, local, or federally developed instruction aimed at improving the quality of inspections, introducing new techniques, and maintaining consistence within the inspection program.

complex or has distinctive features the Inspection Team Leader must hold a current registration as a Professional Engineer (Civil or Structural).

- b. Inspection Team Members.
 - (1) Passed an eye examination, with or without corrective lenses, to prove near vision acuity of Jaeger J-2 at 300 mm to 430 mm [12 in to 17 in] within the past three years.³⁶
 - (2) For Railroad Bridges, demonstrated familiarity with Code of Federal Regulations 49 CFR Part 214, Railroad Workplace Safety through successful completion of employer-provided training or course provided by an industry-related organization such as AREMA.
- c. Underwater Bridge Inspection Diver. Completed an FHWA approved comprehensive bridge inspection training course or other FHWA approved underwater diver bridge inspection training course and holds current dive qualifications (e.g., Association of Diving Contractors International (ADCI) or equivalent certificate) in addition to the inspection team member qualifications.
- d. Load Rating Engineer or Railroad Bridge Engineer.
 - (1) For Public- or Controlled-Access Vehicle Bridges, Short Span Bridges, Culverts, and Pedestrian Bridges:
 - (a) Current registration as a Professional Engineer,
 - (b) At least 5 years of experience similar to load rating being performed,
 - (c) Completed NHI Load Rating of Highway Bridges course or equivalent training, and
 - (d) Demonstrates working knowledge of the AASHTO Manual for Bridge Evaluation (MBE) and of rating methodology used in the given load rating through submission of a personnel qualifications statement identifying work on a similarly constructed and loaded structure.
 - (2) For railroad bridges:
 - (a) Current registration as a Professional Engineer,

³⁶ Do not collect medical records.

- (b) At least 10 years of experience similar to that identified in Code of Federal Regulations 49 CFR 237.51(a), and
 - (c) Demonstrates working knowledge of the AREMA Manual and of rating methodology used in the given load rating through submission of a personnel qualifications statement identifying work on a similarly constructed and loaded structure.
 - (3) For tunnels. A registered Professional Engineer must perform or directly supervise the conduct of tunnel load rating per Code of Federal Regulations 23 CFR Part 650.509(c).
 - e. Responsible Engineer.
 - (1) Current registration as a Professional Engineer,
 - (2) Demonstrates at least 5 years of experience similar to evaluation undertaken through submission of a personnel qualifications statement identifying similar work experience.
 - (3) Completed training specific to the evaluation type performed, such as –
 - (a) NHI Stream Stability and Scour at Highway Bridges course or equivalent training for conducting scour evaluations, or
 - (b) NHI Design and Evaluation of Bridges for Fatigue and Fracture course or equivalent training for conducting fatigue and fracture evaluations, or
 - (c) Multidisciplinary Center for Earthquake Engineering Research (MCEER) Seismic Retrofit of Highway Bridges course or equivalent training for conducting seismic screening evaluations.
 - f. Railroad Bridge Supervisor. Demonstrates at least 10 years of supervisory experience similar to that identified in Code of Federal Regulations 49 CFR 237.55 through submission of a personnel qualifications statement identifying similar work experience.
 - g. Quality Management Personnel. Individuals conducting quality control or quality assurance activities on inspection or evaluation products for service providers must meet the same qualification requirements as those responsible for conducting the inspections or evaluations.
- 7. Quality Management.
 - a. Establish and maintain quality management procedures or requirements necessary to ensure bridge inspections conform with inspection standards and criteria, inspection

plans, quality control procedures, DOE policy, and Federal^{37, 38} and State requirements.

- b. Establish and maintain quality management procedures or requirements necessary to ensure that evaluation products such as calculations, reports, and studies are complete, accurate, and properly checked in accordance with applicable standards³⁹. The individual conducting the quality control (QC) review must verify compliance with applicable references and criteria, that reasonable assumptions were used, and results were properly applied. The QC review of each load rating or each scour evaluation includes a review of calculations and methods applied.
 - c. Ensure service provider's inspection and evaluation activities include independent⁴⁰ quality assurance (QA) processes necessary to assure that QC activities are accomplished as planned and that those activities are effective in producing a product that meets the desired end quality.
 - d. Develop and execute a Plan of Corrective Actions (PCA) when quality management activities or an external review reveals that activities and systems do not comply with requirements.
 - e. Develop, document, and implement methods to determine that each member of the bridge and tunnel inspection organization holds current qualifications. Document the method by which each Team Leader qualified for the role.
 - f. Develop, document, and implement methods to determine when an inspection Team Leader's qualification must meet Code of Federal Regulations 23 CFR Part 650.509(b)(4) in order to adequately and appropriately lead an inspection of a complex tunnel or a tunnel with distinctive features or functions. At a minimum, the process must consider a tunnel's type of construction, functional systems, history of performance, and physical and operational conditions.
8. Records and Reporting.
- a. Document the education, experience, licensure, certifications, and training of each bridge and tunnel inspection organization member in the Bridge or Tunnel File.
 - b. Document inspection activities to include inspection planning, inspection field documentation, inspection report and recommendations, QC/QA documents and checklists, Follow-up to Critical Findings Report with status reports, and all other documents related to each inspection.

³⁷ Code of Federal Regulations, 23 CFR 650.313, Inspection Procedures.

³⁸ Code of Federal Regulations, 49 CFR 237.111, Review of bridge inspection reports.

³⁹ Code of Federal Regulations, 49 CFR 237.71, Determination of bridge load capacities.

⁴⁰ Independent means the reviewer did not participate or assist in any of the inspection activities.

- c. Prepare and submit SI&A data following each inspection in accordance with national standards^{41,42} and Departmental guidance. For all Reportable Bridges, including those on the National Highway System (NHS), collect^{43,44} inspection data at the element-level and submit corresponding XML data set.
- d. Prepare and submit National Tunnel Inventory data items following each inspection in accordance with national standards⁴⁵ and Departmental guidance.
- e. Document evaluations, including load ratings, scour evaluations, fatigue evaluations, fracture evaluations, seismic vulnerability evaluation, and any other evaluation used to assess the safety, functionality, or vulnerability of the structure.
 - (1) Each report will include a cover page; a title page; an executive summary stating the purpose of the evaluation, overall results, and recommendations such as additional analyses, repairs, monitoring, or load posting; a list of assumptions used; and all calculations and supporting documentation.
 - (2) Each report will specifically note recommended entries for NBI or NTI Data Items when related.
 - (3) The performing engineer will sign and seal any report. Additionally, the engineer who reviews load rating calculations in a load rating report will sign the report.
 - (4) Include personnel qualifications for each Inspection Team Leader, Railroad Bridge Inspector, Underwater Bridge Inspector, Load Rating Engineer, Responsible Engineer, Railroad Bridge Supervisor, Quality Control or Quality Assurance Reviewer responsible for or associated with the inspection or evaluation report.
- f. Prepare⁴⁶ and maintain a Bridge File or Tunnel File for each bridge, vehicular tunnel, and culvert in local records and in the Facilities Information Management System.

⁴¹ Federal Highway Administration Report No. FHWA-PD-96-001, Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges (NBI Coding Guide), December 1995, including revisions, errata, and supplemental FHWA memorandum.

⁴² Federal Highway Administration HIBS-30, Metrics for the Oversight of the National Bridge Inspection Program, May 2017 and revisions.

⁴³ Section 1111 of Public Law 112–141, Moving Ahead for Progress in the 21st Century Act (MAP-21) modified 23 U.S.C. 144 to require each State and appropriate Federal agency to report element level data.

⁴⁴ Federal Highway Administration, Specification for the National Bridge Inventory Bridge Elements (SNBIBE), October 2013.

⁴⁵ Federal Highway Administration Publication No. FHWA-HIF-15-006, Specifications for the National Tunnel Inventory, and revisions.

⁴⁶ See the Section 2 of the AASHTO Manual for Bridge Evaluation for specific information to include in the Bridge File.

- g. Submit documentation and complete notifications in a timely manner. Adhere to the following submission dates:
- (1) Initial SI&A data or NTI data within six (6) months of completing construction, rehabilitation, or repair.
 - (2) Inspection reports with SI&A or NTI data within thirty (30) days of the inspection.
 - (3) Load rating report or scour evaluation report within thirty (30) days of completing the evaluation. When load rating report includes determination to post, provide a sign installation schedule or photo of completed installation.
 - (4) Plan of Corrective Action within thirty (30) days of non-compliance notification. For each deficiency cited, the PCA must include-
 - (a) The deficiency and date of notification,
 - (b) A description of the action and schedule required to resolve the deficiency, and
 - (c) A procedure for periodically reporting status updates, milestone completions, and completion of corrective actions to cognizant line management and the DOE BTM.
 - (5) Notification within seven (7) days of the determination to close a bridge based on scour. Notification to include evidence of bridge closure and an initial plan of action to mitigate impact on site operations. Submit a Scour Critical Plan of Action within thirty (30) days of determination. Submit POA close-out report documenting completion of countermeasures and revised code for NBI Data Item 113 once complete.
 - (6) Initial Follow-up to Critical Findings Report within 24 hours of discovery. Submit a Follow-up to Critical Findings Report detailing the intended recovery strategy within thirty (30) days of initial report. Thereafter, provide status reports on Follow-up to Critical Findings Report quarterly through finding resolution.
 - (7) Notification no less than thirty (30) days in advance of the anticipated delay that an inspection will not occur within the established interval.
 - (8) Data to support FHWA Metrics Compliance assessments, as requested.
 - (9) Report within sixty (60) days of completing any seismic vulnerability evaluation, traffic volume data collection, or any other engineering studies or evaluations.

- h. Use Department of Energy standard document formats and reporting tools when available. Find standard reporting tools and templates as well as quality management checklists at:
https://powerpedia.energy.gov/wiki/Bridge_Management_Program
9. Inventory and Asset Management.
- a. Integrate requirements for bridge and tunnel management with existing operating and management procedures.
 - b. Record estimated costs for necessary improvements in SI&A data.
 - c. When available resources are inadequate to maintain an acceptable level of bridge, culvert, or tunnel safety, act to impose lane or load restrictions, or closures.
 - d. Establish, document, and implement protocols for responding to a critical finding. Establish, document, and implement protocols for managing permit loads.
 - e. Develop, document, and implement bridge closure and re-opening procedures. Once closed, a bridge may not be reopened until repairs are complete and a qualified engineer determines that the bridge is safe and if necessary, posted.
 - f. Develop, document, and implement procedures and issue instructions¹ to personnel responsible for train operations to prevent operation of equipment that would exceed the capacity of the bridge.

¹ Code of Federal Regulations, 49 CFR 237.73, Protection of bridges from over-weight and over-dimension loads.

ATTACHMENT 3: DEFINITIONS

This Attachment provides information associated with DOE O 437.1 as well as information applicable to contracts in which the associated Contractor Requirements Document (Attachment 1 to DOE O 437.1) is inserted.

1. Active Real Property Assets. See DOE O 430.1, *Real Property Asset Management*, current version.
2. Anticipated Service Life (ASL). Selection of the Anticipated Service Life is the responsibility of the Responsible Engineer in consultation with site management. See FHWA-HRT-06-032, *Seismic Retrofitting Manual for Highway Structures, Part 1- Bridges*, January 2006.
3. Assurance Systems. See DOE O 226.1, *Implementation of Department of Energy Oversight Policy*, current version.
4. Average Daily Traffic (ADT). See DOT/FHWA Traffic Monitoring Guide, October 2016.
5. Average Daily Truck Traffic (ADTT). See DOT/FHWA Traffic Monitoring Guide, October 2016.
6. Bankfull Discharge. See FHWA-HIF-16-018, HEC No. 17, *Highways in the River Environment: Extreme Events, Risk and Resilience*, June 2016.
7. Base Flow. See FHWA-HIF-16-018, HEC No. 17, *Highways in the River Environment: Extreme Events, Risk and Resilience*, June 2016.
8. Bridge Evaluation. See AASHTO, *Manual for Bridge Evaluation*.
9. Bridge or Tunnel File. A full history of the structure, including all design, construction, maintenance, repair, rehabilitation, use, and damage records. The Bridge File or Tunnel File contains inventory data, inspection, testing, and evaluation records, load rating and evaluation data and reports.
10. Bridge Importance. See Essential Bridge.
11. Bridge Inspection Experience. See Code of Federal Regulations 23 CFR 650.305, Subpart C.
12. Bridge Inspection Report. An inspection-specific summary including information pertinent to bridge inventory management. The report serves as a summary of the inspection, inspection findings, and recommendations; as a historical record for future reference; and, as a legal record that documents inspection activity.
13. Bridge and Tunnel Inspection Organization. Personnel assigned responsibility for implementing the Department of Energy bridge management requirements or who conduct inspections or evaluations.

14. Bridge or Tunnel Inspection. Determination of the physical and functional condition of a bridge, tunnel, or culvert by identifying, quantifying, and documenting existing defects. Performed by qualified technical personnel familiar with relevant methods and procedures, tools and equipment, safety requirements, and documentation practices.
15. Bridge or Tunnel Inspection Findings. Observations or measurements describing the overall condition of the bridge or tunnel and defects collected during an inspection. Specific defects typically include conditions that result in a condition rating of 5 or less or condition states of 3 or 4.
16. Bridge or Tunnel Inspection Report Recommendations. Corrective actions intended to ensure the safety and integrity of the bridge, culvert, or tunnel; to maintain it in good condition; and, to extend its service life. Actions may include additional inspection or evaluation, maintenance and repair, modernization, or operational activities.
17. Complex Bridge. A movable, suspension, cable stayed, segmental, bridge or any bridge with unusual characteristics. Unusual characteristics include the behaviors and details not inherent in other bridge types and include: movable bridge operating components and machinery, suspension cables and components, pins and hangers, segmental box post-tensioning details, cable-stayed components, or high-strength (70,000 pounds/square inch or greater) steel.
18. Controlled Access Vehicle Bridge. A structure including supports erected over a depression or an obstruction, such as water, a highway, or a railway, having a passageway for carrying traffic or other moving loads, and a Structure Length of more than 20 feet (6.1 meters). A traveler must pass through a staffed entry point and present identification to traverse this structure. These structures are not included in the National Bridge Inventory.
19. Countermeasures. Materials or systems intended to prevent, delay, or reduce the severity scour and stream instability.
20. Critical Findings. See Code of Federal Regulations 23 CFR 650.305. Levels of Critical Findings and corresponding response times follow:
 - a. **Emergency**: used to report the failure or imminent failure of a critical primary structural component. An Emergency Critical Finding means that a failure is likely within a short time period. A re-inspection or repair should be scheduled, and the structure may require a Prompt Interim Action (PIA), load posting, or closure. Immediate action required.
 - b. **Urgent**: used to report a potentially hazardous condition, which, if left unattended beyond the next anticipated inspection, would likely become dangerous to persons or property. Also used to report the actual or imminent failure of a non-critical structural component. Such failures may reduce the reserve capacity or redundancy of the structure but would not result in a structural collapse. A re-inspection or repair should be scheduled, and the structure may require load posting. Action required prior to next routine inspection.

- c. Rapid: used to report a potentially hazardous condition that is non-structural in nature but if left unattended beyond the next anticipated inspection would likely become dangerous to persons or property. Such failures would not affect the structure's load carrying capacity. Schedule required actions.
21. Critical Findings Protocols. A site-specific plan minimally identifying:
- a. members of the Critical Findings team and alternates,
 - b. team member contact information and responsibilities,
 - c. procedures for notifying team members upon discovery of a Critical Finding,
 - d. procedures for notifying:
 - (1) local agencies,
 - (2) local law enforcement agencies, and the Public Affairs Officer where local roads and traffic are affected,
 - (3) Site/Program leadership and the DOE BTM,
 - e. procedures for implementing temporary measures and,
 - f. guidelines on timeliness of actions, reporting requirements, and documentation procedures.
22. Culvert. A transverse structure, pipe, or series of multiple pipes, box(es), or arch(es) constructed to convey water or utilities under a road or railway.
- a. Culvert assets under a road with a Structure Length equal to or greater than 20 linear feet meet the FHWA definition of a bridge. These assets are inventoried in FIMS with Usage Code 1768 or 1769.
 - b. Culvert assets under railway with a Structure Length equal to or greater than 10 feet and located at such a depth that it is affected by live loads meet the Federal Railroad Administration (FRA) definition of a bridge. These assets are inventoried in FIMS with Usage Code 1468 or 1469.
 - c. Culvert assets with a Structure Length less than FHWA or FRA bridge length and an Opening Area of more than 20 square feet are inventoried in FIMS with Usage Code 2629. The FIMS Users Guide provides addition guidance for selecting real property asset Usage Codes.
 - d. Opening Area is the total cross-sectional area, measured in square feet. Consider a series of multiple pipes as a single unit when the clear distance between openings is less than half of the smaller contiguous opening.

- e. Culvert Length is measured longitudinally along the structure, pipe, or series of multiple pipes, box, or arch. The Culvert Length is generally perpendicular to the Structure Length.
23. Design Strength. The capacity of the structure or structural member being designed or analyzed (i.e. the Nominal strength) multiplied by the appropriate resistance factor.
 24. Elevated Walkway. See Pedestrian Bridge.
 25. Essential Bridge. An essential bridge satisfies one or more of the conditions identified in the reference or is designated as “Mission Critical” in the Department of Energy Facilities Information Management System. See FHWA-HRT-06-032, Seismic Retrofitting Manual for Highway Structures, Part 1-Bridges, Jan 2006.
 26. Exempt Bridge. See FHWA-HRT-06-032, Seismic Retrofitting Manual for Highway Structures, Part 1-Bridges, January 2006.
 27. Flood. See FHWA-HIF-16-018, HEC No. 17, Highways in the River Environment: Extreme Events, Risk and Resilience, June 2016.
 28. Follow-up to Critical Findings Report. Documents Critical Finding discovery and resolution.
 - a. Initial Report. The initial report includes the date and time of the Critical Finding discovery and notification, circumstances of the finding, severity and extent of finding, completed notifications, and closures or other limits imposed on the use of the bridge. The report includes supporting photos, sketches, and measurements.
 - b. Report of Recovery Strategy. This report updates the Initial Report and describes any temporary repairs and their inspection, other interim actions, and the intended recovery strategy with planned actions and milestone dates.
 29. Fracture Critical Member (FCM). See AASHTO, Manual for Bridge Evaluation, 2nd Edition.
 30. Graded Approach. See Code of Federal Regulations 10 CFR Part 830.3.
 31. Inspection – Damage. See Code of Federal Regulations 23 CFR 650.305. Analogous to a Special or Emergency Inspection for railroad bridges. See American Railway Engineering and Maintenance-of-Way Association, Manual for Railway Engineering.
 32. Inspection – Fracture Critical Member. A type of In-Depth Inspection conducted at regularly scheduled intervals specifically to inspect Fracture Critical Member(s) or member components. It requires close-up access, hands-on inspection, and may require non-destructive testing by qualified personnel to determine location and extent of cracking or other defects.
 33. Inspection – In-Depth. A hands-on, close-up inspection of one or more structure elements above or below the water level to identify any deficiencies not readily detectible using

Routine Inspection procedures. An In-Depth Inspection is also used to identify developing problems that impact present service requirements or to obtain detailed information needed to facilitate the preparation of structure rehabilitation plans. This inspection may result in a full investigation including structural analysis to determine member capacity that will be used in a revised load rating. It may be performed independently from a Routine Inspection at intervals other than 24 months. It can be at a longer interval or one time only. Analogous to a Special Inspection for railroad bridges.

34. Inspection – Hands-on. A visual or manual inspection technique made at a distance no greater than arm's length from the entire member or member component surface. Includes examination of all surfaces of the members and member components. May require use of specialized equipment to access members or member components.
35. Inspection – Initial. Inspection conducted after construction or rehabilitation of a bridge or when the configuration or geometry of the structure changes (examples include, widening, lengthening, and change in vertical clearance). It is the baseline inspection with which all future inspections will be compared. Performance may be coincident with the final construction inspection but must be done by a qualified inspection team.
36. Inspection – Routine. See Code of Federal Regulations 23 CFR 650.305. Analogous to a Periodic Inspection for railroad bridges. See American Railway Engineering and Maintenance-of-Way Association, Manual for Railway Engineering.
37. Inspection – Special. See Code of Federal Regulations 23 CFR 650.305. Analogous to an Interim Inspection for railroad bridges. See American Railway Engineering and Maintenance-of-Way Association, Manual for Railway Engineering.
38. Inspection – Underwater. See Code of Federal Regulations 23 CFR 650.305. There are three (3) levels of diving inspection, Levels I, II, and III, with increasing complexity from low to high:
 - a. Level I – Generally used to detect major damage, confirm drawings, or gain more information to plan a more in-depth inspection. This level is essentially a “swim-by” overview of 100% of underwater elements, which does not involve any structural elements cleaning.
 - b. Level II – Generally used to detect and identify damaged/deteriorated areas that may be hidden by biofouling or surface deterioration. The level requires detailed inspection of 10% of underwater elements and requires some cleaning. Elements are cleaned in 1-foot-high bands at near low waterline, at the mudline, and midway between.
 - c. Level III – Typically completed to investigate a deficiency detected under Level I or Level II inspections. This level often requires the use of non-destructive testing techniques and may also require the use of partially destructive techniques such as sample coring, material sampling or in-situ surface hardness testing.

39. Inspection Team Leader. See Code of Federal Regulations 23 CFR 650.305, Subpart C and Code of Federal Regulations 23 CFR 650.505, Subpart E.
40. Lateral Ground Movement. See FHWA-HRT-06-032, Seismic Retrofitting Manual for Highway Structures, Part 1-Bridges, January 2006.
41. Load and Resistance Factor (LRFD) Design. See FHWA NHI 12-049, Bridge Inspector's Reference Manual, February 2012.
42. Load Rating. See AASHTO, Manual for Bridge Evaluation. The capacity is commonly evaluated for the following load assumptions:
 - a. Inventory Rating. Represents the safe loading for application on a vehicle bridge on a day-to-day basis. It is the largest sustained live load that an existing structure can safely carry for an indefinite period of time without undergoing damage from repeated maximum loads. The rating is based on AASHTO design specifications and takes into account the current condition or deterioration of the bridge elements due to age and service. Applicable to vehicle bridges.
 - b. Legal Load Rating. Represents the maximum size or weight limits permissible on a specified portion of road by law for the State in which the bridge is located. The legal dimensions and weights vary between states. Applicable to vehicle bridges.
 - c. Maximum Rating. Represents the load level that can be supported on a railroad bridge at infrequent intervals with applicable speed restrictions. Applicable to railroad bridges.
 - d. Normal Rating. Represents that load which can be operated on a railroad bridge indefinitely without inducing damage. Normal ratings will be determined in accordance with the American Railway Engineering and Maintenance-of-Way Association with and without fatigue considerations. Applicable to railroad bridges.
 - e. Operating Rating. Represents the maximum permissible live load that can be placed on the vehicle bridge. Unlimited use by vehicles that subject the bridge to operating levels may shorten the useful life of the bridge. This rating also includes the same load in multiple lanes. Applicable to vehicle bridges.
43. Lower Level Earthquake Ground Motion. See FHWA-HRT-06-032, Seismic Retrofitting Manual for Highway Structures, Part 1-Bridges, January 2006.
44. Management. See 41 CFR 102-71.20.
45. National Bridge Inventory (NBI). A database of Structure Inventory and Appraisal data collected by each state or Federal bridge-owning agency to fulfill the requirements of the National Bridge Inspection Standards.

46. National Bridge Inventory Bridge or Reportable Bridge. See Code of Federal Regulations 23 CFR Part 650.305, Subpart C.
47. National Bridge Inspection Standards (NBIS). See Code of Federal Regulations 23 CFR 650.305.
48. National Tunnel Inventory (NTI). A database maintained by the Federal Highway Administration containing inventory and inspection data for all highway tunnels located on public roads, on and off Federal-aid highways.
49. Non-Destructive Testing (NDT). Any of a variety of methods used to assess the strength and condition of materials or structural components of a real property asset that does not result in any damage or change to the material or part under examination.
50. Pedestrian Bridge. A structure that carries primarily pedestrian, bicycle, and equestrian traffic but may include light maintenance vehicles over a chasm, waterway, ditch, or other obstacle or convey pedestrian traffic from one building or structure to another including enclosed walkways. It does not include work or machinery platforms, stairways, platforms, boardwalks, or docks or similar type structures.
 - a. Low Risk Pedestrian Bridge – A low use, low height pedestrian bridge where vehicular access is prevented, and consequences of failure are not significant.
 - b. High Risk Pedestrian Bridge – A high use pedestrian bridge with a potential loss of life given collapse or one routinely by maintenance vehicles.
51. Performance Level (PL) or Performance Criteria. See FHWA-HRT-06-032, Seismic Retrofitting Manual for Highway Structures, Part 1-Bridges, January 2006.
52. Permit Load. A vehicle or load that exceeds the legal size or weight limits established by each state for operation on state roads. Each state has established procedures for reviewing the safety and serviceability of bridges along the planned route and for providing permission for transit.
53. Plan of Corrective Action (PCA). See FHWA memorandum HIBS-30, National Bridge Inspection Standards Plan of Corrective Action(s) Guidelines, January 3, 2017.
54. Prompt Interim Action (PIA). Any action, including repairs, load limits, or partial or full bridge closure that is enacted to alleviate a significant safety problem on the bridge. Prompt means as soon as possible or practical given the conditions and consequences of inaction. Interim means that the action may be temporary but is to the extent necessary to ensure safe use of the bridge.
55. Public Access Vehicle Bridge. A structure including supports erected over a depression or an obstruction, such as water, a highway, or a railway, and having a passageway for carrying traffic or other moving loads. A traveler could traverse the structure without ever passing through a staffed entry point or presenting identification. Public access vehicle

bridges with a Structure Length of more than 20 feet (6.1 meters) will be included in the National Bridge Inventory unless permanently closed.

56. Public Road. See 23 U.S.C. 101(a)(27).
57. Quality. See Code of Federal Regulations 10 CFR Part 830.3.
58. Quality Assurance (QA). See Code of Federal Regulations 10 CFR 830.3 and Code of Federal Regulations 23 CFR 650.305, Subpart C.
59. Quality Assurance Program. See Code of Federal Regulations 10 CFR Part 830.3.
60. Quality Control (QC). See Code of Federal Regulations 23 CFR 650.305.
61. Quality Management. See International Organization for Standardization (ISO) 9000, Quality Management Systems.
62. Railroad Bridge. See Code of Federal Regulations 49 CFR 237.5.
63. Required Strength. Structural capacity needed to meet or exceed the demands put on the structure by the loads.
64. Responsible Engineer. An engineer charged with the overall responsibility for conducting bridge evaluations other than load ratings. This may include scour evaluations, fatigue and fracture evaluations, or seismic evaluations.
65. Scour. See Code of Federal Regulations 23 CFR 650.305.
66. Scour Critical Bridge. See Scour Evaluation.
67. Scour Critical Plan of Action (Scour Critical POA). A written plan describing the appropriate measures necessary to make a bridge less vulnerable to damage or failure due to scour. The Scour Critical POA should explain why the preferred actions were selected, include a monitoring plan, possibly a plan for design and construction of countermeasures with a schedule, and a commitment to annual progress reporting until corrective actions are satisfied.
68. Scour Evaluation. Identifies the susceptibility of a bridge to scour and accurately records the present condition of bridge foundations and stream stability. The evaluation includes review of as-built foundation details; hydraulic studies, soundings, and other underwater investigations; knowledge of streambed and foundation soils; current condition of the foundation; streambed cross section profile measurement; stream flowrate measurements; and, similar historical and current data. A Level 1 Scour Evaluation results in the classification of each bridge as:
 - a. Scour Low Risk Bridge. Bridge with no history of scour problems and a low likelihood for scour problems in the future; or

- b. Scour Critical Bridge. Bridge with an unstable foundation element, abutment or pier foundation due to observed or to assessed or calculated scour as determined from a Level I Field Assessment or a Level 2 or 3 Scour Evaluation; or
 - c. Scour Susceptible Bridge. A bridge that based on a Level 1 Field Assessment is neither clearly scour critical or low risk. Further investigation is required to determine the status of the structure.
69. Seismic Hazard Level (SHL). See FHWA-HRT-06-032, Seismic Retrofitting Manual for Highway Structures, Part 1-Bridges, January 2006.
70. Seismic Hazard Rating (E). See FHWA-HRT-06-032, Seismic Retrofitting Manual for Highway Structures, Part 1-Bridges, January 2006.
71. Seismic Retrofitting Category (SRC). See FHWA-HRT-06-032, Seismic Retrofitting Manual for Highway Structures, Part 1-Bridges, January 2006.
72. Service Life. See FHWA-HIF-11042, Bridge Preservation Guide, Spring 2018.
73. Short Span Bridge. A vehicular bridge with a structure length less than 20 feet.
74. Site Class. See FHWA-HRT-06-032, Seismic Retrofitting Manual for Highway Structures, Part 1-Bridges, January 2006.
75. Site Factors. See FHWA-HRT-06-032, Seismic Retrofitting Manual for Highway Structures, Part 1-Bridges, Jan 2006.
- a. Fa is determined by the site class and the short-period spectral acceleration (Ss) for the upper level earthquake.
 - b. Fv is determined by the site class and the long-period spectral acceleration (S1) for the upper level earthquake.
76. Standard. See Public Law 104-113, National Technology Transfer and Advancement Act of 1995.
77. Strategic Highway Network (STRAHNET). The network of highways, including the Interstate System that provides connecting routes to military installations, industries and resources. It is a subset of the National Highway System and important to the United States' strategic defense policy by providing defense access, continuity and emergency capabilities for defense purposes.
[<https://www.sddc.army.mil/sites/TEA/Functions/SpecialAssistant/Pages/HighwaysNationalDefense.aspx>;
<https://www.fhwa.dot.gov/policy/2004cpr/chap18.cfm>]
78. Structure Inventory and Appraisal (SI&A) Data. Data recorded and stored for each bridge as standardized by the Federal Highway Administration to effectively monitor and manage a bridge inventory. Data submissions follow the current version of U. S. Department of Transportation, Federal Highway Administration, Report No. FHWA-PD-

- 96-001, Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges and associated guidance.
79. Structure Length. See Code of Federal Regulations 23 CFR 650.305, Subpart C.
 80. Structurally Deficient. See Code of Federal Regulations 23 CFR 490.405.
 81. Sufficiency Rating. See Code of Federal Regulations 23 CFR 650.403.
 82. Surface Runoff Event. See FHWA-HIF-16-018, HEC No. 17, Highways in the River Environment: Extreme Events, Risk and Resilience, June 2016.
 83. Tunnel – Pedestrian. An underground passageway, dug through the surrounding soil/earth/rock and enclosed except for entrance and exit, commonly at each end, and used exclusively for pedestrian or bicycle traffic. It does not include vehicular tunnels that have sidewalks. A tunnel used by both vehicles and pedestrians should be counted in one of the vehicular tunnel categories. A similar tunnel between two buildings may be inventoried with one of the buildings.
 84. Tunnel – Public Access Vehicular. Enclosed roadway for motor vehicle traffic with vehicle access limited to portals, regardless of type of structure or method of construction, and located on a public road. May include lighting, ventilation, fire protection systems, and emergency egress capacity.
 85. Tunnel – Train. Tunnel used exclusively by trains.
 86. Tunnel – Controlled Access Vehicular. Enclosed roadway for motor vehicle and pedestrian traffic with vehicle access limited to portals, regardless of type of structure or method of construction. May include lighting, ventilation, fire protection systems, and emergency egress capacity.
 87. Upper Level Earthquake Ground Motion. See FHWA-HRT-06-032, Seismic Retrofitting Manual for Highway Structures, Part 1-Bridges, January 2006.
 88. Validation. The process of establishing evidence that provides a high degree of assurance that a product, service, or system accomplishes its intended requirements.

ATTACHMENT 4: ACRONYMS

AADT	Annual Average Daily Traffic
AADTT	Annual Average Daily Truck Traffic
AASHTO	American Association of State Highway and Transportation Officials
ADCI	Association of Diving Contractors International
ADT	Average Daily Traffic
ADTT	Average Daily Truck Traffic
ANSI/EIA	American National Standards Institute/Electronic Industries Alliance
AREMA	American Railway Engineering and Maintenance-of-Way Association
ASL	Anticipated Service Life
CO	Contracting Officer
CFR	Code of Federal Regulations
CRD	Contractor Requirements Document
DED	Data Element Dictionary
DOE	Department of Energy
DOE BTM	Department of Energy Bridge and Tunnel Manager
E	Seismic Hazard Rating
EO	Executive Order
EV	Emergency Vehicles
FCM	Fracture Critical Member
FHWA	Federal Highway Administration
FIMS	Facilities Information Management System
FRA	Federal Railway Administration
HEC	Hydraulic Engineering Circular
LL	Lower Level
LRFD	Load and Resistance Factor Design
MA-50	Department of Energy, Office of Asset Management
MBE	AASHTO Manual for Bridge Evaluation
MCEER	Multidisciplinary Center for Earthquake Engineering Research
M&O	Management and Operating
NBI	National Bridge Inventory
NBIS	National Bridge Inspection Standards
NDT	Non-Destructive Testing
NHI	National Highway Institute
NHS	National Highway System
NNSA	National Nuclear Security Administration

NTI	National Tunnel Inventory
OMB	Office of Management and Budget
OSF	Other Structures and Facilities
PCA	Plan of Corrective Action
PL	Performance Level
POA	Plan of Action
PSO	Program Secretarial Officer
QA	Quality Assurance
QC	Quality Control
SHL	Seismic Hazard Level
SHV	Specialized Hauling Vehicles
SI&A	Structure Inventory and Appraisal
SNBIBE	Specification for the National Bridge Inventory Bridge Elements
SRC	Seismic Retrofit Category
TOMIE	Tunnel Operations, Maintenance, Inspection, and Evaluation
UL	Upper Level