APTA STANDARDS DEVELOPMENT PROGRAM

STANDARD

American Public Transportation Association
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Rail Transit Fixed Structures Inspection and Maintenance Working Group

Rail Transit Fixed Structures Inspection and Maintenance

Abstract: This *Rail Standard* establishes a standard for inspecting and maintaining rail transit system fixed structures.

Keywords: ancillary structures, barrier walls, bridges, catenary structures, communication towers, crash walls, culverts, inspection, maintenance, periodic inspection and maintenance, retaining walls, safety, structures, transit structures, tunnels.

Summary: This standard provides general requirements for the periodic inspection of safety-critical components of rail transit structures. This standard defines the minimum means, methods and frequency of inspection and maintenance activities, and the qualifications that rail transit employees or contractors must have to perform these procedures. This standard provides both a rating system for safety-critical components and record-keeping requirements.

Scope and purpose: This standard applies to all fixed facilities that support or carry loads. This includes bridges, tunnels and ancillary structures; retaining walls; barrier (crash) walls; communication towers; catenary structures; and culverts. This standard applies to rail transit systems that operate light rail or heavy rail systems. It does not apply to commuter railroads that operate on the general railroad system regulated by the Federal Railroad Administration (FRA). The purpose of this standard is to establish, through broad-based industry participation and consensus, minimum requirements for inspections and maintenance of rail transit system structures to ensure the safety of the traveling public and transit system employees and to ensure the continued performance of rail transit infrastructure. This standard includes a listing of structure types to be inspected, the frequencies of such inspections, and the qualifications of rail transit system employees or contractors who perform these inspection and maintenance activities.

Participants

The American Public Transportation Association greatly appreciates the contributions of **Travis Jones – SWG Chair, Clay Bunting, Rich Hovde, Joni Korte, Greg O'Hare, Dan Schiffer, and Bong Vang** who provided the primary effort in revising this *Rail Standard*.

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Introduction

This introduction is not a part of APTA RT-FS-S-001-02 First Revision October 6, 2016, *Standard for Rail Transit Fixed Structures Inspection and Maintenance*.

APTA rail transit safety standards represent an industry consensus on safety practices for rail transit systems to help achieve a high level of safety for passengers, employees and the general public. This document was created by and for those parties concerned with its provisions, namely, rail transit systems (operating agencies), manufacturers, consultants, engineers and general interest groups. This standard provides procedures for inspecting and maintaining rail transit structures.

APTA recommends this standard for the following:

- individuals or organizations that inspect, maintain and/or operate rail transit systems
- individuals or organizations that contract with others for the inspection, maintenance and/or operation of rail transit systems
- individuals or organizations that influence how rail transit systems are inspected, maintained and/or operated (including but not limited to consultants, designers and contractors)

This standard intends to meet the following objectives:

- to ensure that special life/safety equipment is operational and reliable
- to help rail transit systems incorporate safety considerations during the inspection and maintenance process
- to identify inspection criteria and maintenance standards that provide a high level of passenger and personnel safety.

Note on alternate practices

Individual rail transit systems may modify the practices in this standard to accommodate their specific equipment and mode of operation. APTA recognizes that some rail transit systems may have unique operating environments that make strict compliance with every provision of this standard impossible. As a result, certain rail transit systems may need to implement the standards and practices herein in ways that are more or less restrictive than this document prescribes. A rail transit system may develop alternates to APTA standards provided the alternates are based on a safe operating history and are described and documented in the system's safety program plan (or another document that is referenced in the system safety program plan).

Documentation of alternate practices shall:

- Identify the specific APTA rail transit safety standard requirements that cannot be met.
- Provide justification for each requirement that cannot be followed.
- Describe the alternate methods used.
- Describe and substantiate how the alternate methods do not compromise safety and provide a level of safety equivalent to the practices in the APTA safety standard (operating histories or hazard analysis findings may be used to substantiate this claim).

Rail Transit Structure Inspection and Maintenance

This APTA standard has been established to provide general minimum requirements for transit agencies for inspecting and maintaining all fixed facility structures supporting rail transit system loads. This standard covers general inspection practices, inspection staff qualifications, inspection types and frequencies, and maintenance practices.

1. Inspection practices

1.1 Inspection manual

Rail transit systems shall develop or formally adopt existing structural inspection manuals with the following sections:

a) Inspection and Maintenance Organization
   - Job descriptions
   - Qualifications
   - Responsibilities

b) Policies
   - Personnel
   - Inspection
   - Maintenance
   - Safety
   - Reports, plans and files

c) Coordination
   - Internal interfaces
   - External interfaces

d) Quality assurance/quality control

e) Inspection procedures

f) Planning and scheduling

g) Inventory

h) Inspection type

i) Documentation

COMMENT: Each rail transit system shall obtain inspection manuals used by the state(s) in which it operates. These are necessary for inspecting/documenting "highway" grade separations that the rail transit system may own or maintain. A rail transit system with bridges that are regulated by FRA shall also ensure that their Bridge Safety Management Program conforms in accordance with 49 CFR part 237.

Transit Authorities are encouraged to verify if owners of overhead structures are inspecting and maintaining their overhead structures in accordance with the applicable laws and regulations. This is necessary for rail transit owners to assure a safe operating environment.

1.2 Condition ratings

Each transit system shall establish or formally adopt, a rating system pertaining to its structures that is both compatible with its maintenance planning and scheduling and with any outside agencies it must coordinate

with. If it has a computerized maintenance system, then the rating system must be structured to input into that system.

The inspectors must be trained to uniformly apply the rating system when performing the inspections. The rating system, at a minimum, shall cover the structures and components listed in Section 1.2.1 through Section 1.2.5. Agencies are encouraged to augment the rating system as necessary to complement their infrastructure inventory.

1.2.1 Bridges

a) Substructure:
- Material:
  - Timber
  - Concrete (cast in place/precast)
  - Masonry
  - Steel
- Other:
  - Slope protection
  - Coating System

b) Superstructure
- Type:
  - Truss
  - Multi-girder
  - Box girder
  - Arches
  - Slab
  - Movable
  - Rigid frame
  - Suspension
  - Cable stayed
- Material:
  - Steel
  - Timber
  - Concrete (cast in place/precast)
  - Pre-stressed concrete
  - Masonry
- Other:
  - Bearings Coating system
  - Special connections (pin-hangers)

c) Decks
- Material:
  - Concrete (cast in place/precast)
  - Steel
  - Timber:
    - Parapets
    - Railings
    - Walkways
    - Appendages
- Other:

- Drainage
- Lighting
- Utilities (hangers and connections)
- Noise suppression systems
- Joints
- Pedestrian walkways

d) Waterway:
- Scour
- Channel protection

1.2.2 Tunnels and ancillary structures

a) Materials:
- Steel
- Concrete (cast in place/precast)
- Masonry
- Unlined
- Other

b) Special subsystems:
- Drainage
- Floating slab
- Wall penetrations (doors, pipe, etc.)
- Ventilation shafts
- Other (standpipe, electrical, lighting, ventilation, etc.)

1.2.3 Culverts

a) Materials:
- Concrete (cast in place/pre-cast)Steel
- Masonry
- Other

b) Waterway:
- Scour
- Channel protection

1.2.4 Retaining walls and barrier walls

a) Materials:
- Concrete (cast in place/pre-cast)
- Steel
- Masonry
- Mechanically stabilized earth (MSE)

b) Waterway:
- Scour
- Channel protection

1.2.5 Special structures

a) Catenary structures
b) Communication towers
c) Passenger Emergency Exit Systems and Appurtenances

d) Other

2. Inspection implementation

2.1 Inspection procedures

Before beginning the inspection, the inspection team shall study the structure file and as-built plans carefully to determine locations and level of criticality for the inspection. In addition, an assessment of the following shall be made:

- the potential for fatigue damage based upon the loading history
- the fatigue-prone details
- records of damage or deficiencies
- records of past repairs

The following procedures shall be performed routinely but may be adjusted based on special requirements:

a) Verify dimensions and member sizes using thickness gauges to determine if there is section loss due to corrosion. If a bridge has been repainted, then corrosion-related section loss may not be obvious. Document deviations, modifications or repairs with an estimate of their age.

b) Concrete elements shall be sounded and checked for cracks, scaling, spalling or other deterioration that might indicate a loss in strength.

c) Check steel members for corrosion, cracking or deformities with particular emphasis on locations prone to fatigue, brittle fracture or stress corrosion. Perform dye-penetrant tests at suspicious locations.

d) Concrete decks shall be inspected and sounded, top and bottom, to identify delamination and moisture penetration.

e) Check devices that facilitate movement to ensure that they are functioning properly.

f) Bearings and deck joints are also to be checked. Document opening or position relative to ambient temperature. This data shall be used to identify excessive movement or frozen bearings.

g) Substructure units shall be sounded and checked for settlement. Probe foundations for scour and undermining.

Inspection safety is an important consideration. Procedures shall be carefully planned for each project. Inspectors shall be familiar with, and follow, OSHA regulations related to fall protection, underwater safety, confined-space restrictions and exposure to toxic materials around bridges, such as creosote and bird droppings, as well as other applicable regulations.

2.2 In-depth and fracture critical inspections

The inspection intensity is based on the criticality of the structural element. An in-depth inspection is a close-up, hands on inspection of one or more structural members above or below water level to detect any deficiencies not readily visible using routine inspection procedures.

A fracture critical inspection applies to steel bridge components or any special structure with steel components that meet the definition of fracture critical members. Per the National Bridge Inspection

Standards (NBIS), a fracture critical member is a steel member in tension, or with a tension element, whose failure would probably cause a portion of or the entire bridge to collapse.

The objective of a fracture critical inspection is to mitigate the potential for fatigue-related failures. Fracture critical inspections shall include the identification of fracture critical members and the development of a plan for inspecting these members. Inspectors shall understand the importance of redundancy in a structure in order to identify these members, and also take into account the age of the bridge and material characteristics at the time it was constructed. In addition, the fracture critical inspection procedure shall include the following items:

a) Each rail transit system shall identify all fracture critical members, as defined by the NBIS, and maintain a fracture critical member file for each structure. If possible, this inventory shall establish which fracture critical members were fabricated in compliance with AASHTO's applicable requirements.

b) The rail transit system shall identify all the fatigue sensitive details throughout the transit guideway. The identified details shall be classified as fatigue sensitive based on AASHTO requirements, which include an evaluation based on the actual stress range and estimated number of cycles that each detail has been subjected to. This inventory and classification of fatigue sensitive details will require careful consideration, recognizing that some susceptible details may be excluded from the fatigue sensitive classification because they are subjected to low levels of stress or a small number of cycles. Also, the fatigue-sensitive determination is time-dependent, meaning that, as cycles accumulate, additional details may be reclassified as fatigue sensitive.

c) Using the compiled inventory of fracture critical members and fatigue sensitive details, a detailed, close visual inspection in the field shall be performed on these members. The inspection shall focus on tension zones of fracture critical members and fracture critical connections. All details identified as "prone to cracking," such as details with a potential for fatigue damage, shall be checked very closely. The inspector's view shall be clear, unobstructed, well illuminated and within an arm's length of the structural member. The member shall be viewed from all exposed sides and all angles. Additional light, magnification and nondestructive testing equipment shall be used when needed. If special equipment or testing procedures are called for, then the inspectors shall be trained to use this equipment, or the inspection program shall include provisions to retain the services of certified specialists to perform the work.

d) Welded girders, insert plates, cover plate ends and unground welds are susceptible to fatigue crack initiation. Reentrant corners and web gaps can also initiate fatigue cracks. Inspectors shall recognize problems caused by secondary stresses such as out-of-plane bending at diaphragm and floor beam connections, particularly on skewed bridges. Other points of localized stress concentration and potential crack initiation are tack welds, intermittent nicks, scars and holes with rough edges.

e) Special attention shall be given to truss spans. Inspectors shall safely position themselves on truss spans so that members and connections may be examined from all angles. If debris is present, then the surface must be cleaned and scraped if necessary. Compression members shall be checked for buckling. Deformations, twisting or eccentricity is also to be documented. Tension members shall be checked for flaws, welding, tears, cracks or "necking down" of section. Each member and connection shall be checked for loose or missing bolts or rivets, for corrosion and section loss, and for collision damage. Inspector's shall verify and record gusset plate thicknesses by using a combination of visual and ultrasonic testing during each inspection interval once corrosion is evident. It is important that all measurement locations be identified and located from reference points that are readily reestablished. If a suspicious problem is identified, but its significance cannot be determined with the equipment at

the disposal of the inspector, then appropriate follow-up testing and consultation with the rail transit system inspection program manager is required.

f) The inspection findings for fracture critical members and fatigue sensitive details shall be included in the corresponding inspection reports, which shall be distributed according to established documentation procedures.

g) AREMA fatigue standards may be utilized in lieu of AASHTO standards at the option of the transit system.

2.3 Inspection staff qualifications

2.3.1 Program Manager

The Program Manager shall administer the rail transit system's inspection standard and assign the responsibilities for structure inspection, reporting, and inventory.

a) Be a registered Professional Engineer in the state the structure is located in, or have 10 years of bridge (tunnel) and other structure inspection experience in a responsible capacity; and

b) Successfully complete a Federal Department of Transportation-approved comprehensive bridge (tunnel) inspection training course. For example, NHI Course 130055 -- Safety Inspection of In-Service Bridges qualifies as an acceptable comprehensive training course.

To remain qualified as a Program Manager, successful completion of a Federal Department of Transportation-approved "refresher bridge inspection training course" must be completed every 5 years.

2.3.2 Structures inspection team leader

The Inspection Team Leader is the individual in charge of the structural inspection team and is responsible for planning, preparing for, and performing field inspections:

1) Have the qualifications specified for a Program Manager listed above; or

2) Have five years bridge and other structure inspection experience and have successfully completed a FHWA-approved comprehensive bridge inspection course; or

3) Be certified as a Level III or IV Bridge Safety Inspector under the National Society of Professional Engineer's program for National Institute of Certification in Engineering Technologies (NICET) and have successfully completed a Federal Department of Transportation-approved comprehensive bridge inspection training course; or

4) Have all of the following:
   i. Bachelor's degree in engineering from a college or university accredited by or determined as substantially equivalent by the Accreditation Board for Engineering and Technology; and
   ii. Successfully passed the National Council of Examiners for Engineering and Surveying Fundamentals of Engineering examination; and
   iii. Two years of bridge and other structure inspection experience; and
   iv. Successfully completed a Federal Department of Transportation-approved comprehensive bridge inspection training course; or

5) Have all of the following:
   i. An associate's degree in engineering or engineering technology from a college or university accredited by or determined as substantially equivalent by the Accreditation Board for Engineering and Technology; and

ii. Four years of bridge and other structure inspection experience; and
iii. Successfully completed a Federal Department of Transportation-approved comprehensive bridge inspection training course.

6) The Team Leader for tunnel inspections must, at a minimum, be a registered professional engineer (P.E.). Additionally, the Team Leader must also meet the requirements as set forth in the National Tunnel Inspection Standards (NTIS).

A qualified Inspection Team Leader must be at the structure during each initial, routine, in-depth, fracture critical, and underwater inspection.

2.3.3 Inspection team

The inspection team shall have at a minimum, one person qualified as an Inspection Team Leader. All other inspectors must have successfully completed a Federal Department of Transportation- approved comprehensive bridge inspection training course.

2.3.4 Underwater inspector

Divers performing underwater inspections and evaluations shall be fully qualified by training and experience in evaluating the types of degenerative underwater structural and streambed conditions that can exist at given bridge locations.

Underwater bridge inspection diver must successfully complete a Federal Department of Transportation-approved comprehensive bridge inspection training course or other Federal Department of Transportation-approved underwater diver bridge inspection course.

Inspections made by divers not fully qualified as an Inspection Team Leader shall be limited to bridge situations where measurements, verbal descriptions, underwater photography, etc. can provide conclusive evidence of underwater conditions to an on-site fully qualified Inspection Team Leader.

2.4 Load rating/scour analysis

Load ratings and scour analysis are not required as part of a scheduled inspection for guide way structures. However, existing load ratings and scour analysis must be on file for each structure owned by the rail transit system. In addition, a structural load rating or scour analysis shall be performed if any of the following conditions exist:

a) Significant deterioration of the primary structural members or channel bottom is discovered during a visual inspection.

b) Current live loads (axle weight or configuration) are substantially different from the original design live load.

c) Undocumented structural modifications are discovered during inspection, which may potentially alter or inadvertently reduce the load-carrying capacity of a guide way.

The Program Manager will determine the need for, and will be in charge of any mandated load ratings or scour analysis. If a determination is made that load ratings or scour analysis are needed, then the analysis shall be prepared using the latest version of the rail transit system's design criteria, AASHTO and /or AREMA as required. The completed load rating and scour analysis shall be referenced in the corresponding inspection report and shall be disseminated according to established documentation procedures.

2.5 Seismic

The requirements for seismic inspection are presented using an incremental two-step approach that, based on a rational assessment of seismic risk, shall accommodate the needs of each rail transit system.

Under the direction of the Program Manager, each agency shall perform an inventory in accordance with AREMA Guidelines, to determine the degree to which all the transit guide way structures are susceptible to seismic loads.

This inventory shall be compiled in a report that is disseminated according to the established documentation procedures.

Following the determinations made during the existing structure inventory, each owner shall prepare "Post-Seismic Event Operation Guidelines" in accordance with AREMA Guidelines. Once completed, this self-contained manual shall be readily available to the Program Manager, as well as operations and maintenance personnel, to be used as an immediate source of reference information.

2.6 Structural damage diagnosis techniques

The rail transit system shall have on staff, or contract for the services of, qualified personnel who perform routine visual inspections of structural elements. In the event that structural damage or failures are found through visual examination, additional testing may be required.

2.6.1 Nondestructive testing

Inspection teams shall routinely use nondestructive testing such as thickness measurement instruments to help determine loss of section and dye penetrants to help locate and define cracks in steel. All testing shall be performed per industry standards.

Other types of specialized nondestructive tests include use of specialized equipment, such as for ultrasonic or X-ray examination of steel members and welds.

2.6.2 Destructive testing

Destructive material testing may be required once a problem has been identified, and further study may be needed to determine its severity and extent. The Program Manager may direct destructive testing of structural components to predict or determine failure modes. Removing a sample of steel for lab tests to determine fatigue vulnerability or material properties would be an example of destructive testing. For concrete structures, destructive testing may include such tests as petrographic analysis or Windsor Probe testing.

2.7 Underwater inspection

If applicable, each rail transit system shall perform underwater structural inspection at no more than 60-month intervals or more frequently as determined by a condition of the substructure elements or scour vulnerability analysis outlined by applicable FHWA publications. Underwater inspections involve visually or tactually inspecting all the exposed underwater components of each bridge, utilizing appropriate tools and methods. This includes but is not limited to abutments, piers, footings, piles, fender systems and channel scour problems. This work shall be performed in conformance with applicable OSHA Regulations and as described in the FHWA "Bridge Inspector's Reference Manual" and the "Underwater Bridge Inspection Manual".

Underwater inspections shall be performed on any qualifying structure where the water depth around any of the substructure units is normally greater than 1 m and inspection using hip boots is impossible or impractical because of water depth, current, soft bottom conditions, etc.

Underwater inspection reports shall contain pertinent information as required by the FHWA "Bridge Inspector's Reference Manual" and the "Underwater Bridge Inspection Manual".

3. Inspection controls

3.1 Frequency

Inspections shall be performed at intervals as indicated for the following structures. Additionally, special inspections shall be performed as directed by the Program Manager following extraordinary events such as major flooding, collisions, fire and seismic occurrences.

3.1.1 Bridges

Each bridge shall be routinely inspected at regular intervals at least once every 24 months.

Fracture critical members and fatigue sensitive details shall also be inspected at least once every 24 months following the detailed, close visual inspection procedure for a fracture critical inspection.

Certain types or groups of bridges will require inspection at an interval more frequent than once every 24 months. The intensity and frequency to which a bridge shall be inspected will be determined by factors such as age, state of maintenance and known deficiencies. The evaluation of these factors will be the responsibility of the Program Manager.

Bridge pier protection shall be inspected at regular intervals of at least once every 60 months.

3.1.2 Tunnels

Each tunnel, including penetrations such as doors and pipes, shall be inspected at regular intervals of 24 months or as defined in the NTIS. Certain tunnels may be inspected at regular intervals up to 48 months based on inspection findings and analysis that justify an increased inspection interval. At a minimum, the following criteria shall be used to determine the level and frequency of inspection based on an assessed lower risk, tunnel age, time from last major rehabilitation, tunnel complexity, traffic characteristics, geotechnical conditions, functional systems, and known deficiencies. Conversely, certain types of structures, such as old tunnels or underwater tunnels, may require more frequent inspection intervals. Such intervals shall be determined by the Program Manager but shall not exceed the duration specified in NTIS.

Ventilation shafts shall be inspected at intervals of at least once every 24 months. However, certain safety elements such as stairs, gratings at street level, spalled concrete areas, etc. shall be inspected more frequently, as determined by the Program Manager.

3.1.3 Culverts

Culverts, not otherwise classified as bridges or tunnels, shall be inspected at regular intervals of at least once every 60 months. The condition of the structure may require a more frequent inspection interval.

3.1.4 Retaining walls and barrier walls

Retaining and barrier walls shall be inspected at regular intervals of at least once every 60 months.

3.1.5 Special structures

Special structures, such as catenary structures and communication towers, etc., shall be inspected at intervals determined by the Program Manager.

3.2 Documentation

3.2.1 Structure and defect database

A computerized database consisting of the structural inventory and the inspection frequency, dates and condition rating of all structural elements that make up the various structures included in Sections 1.2 and 2.1 shall be maintained.

3.2.2 Inspection report format

A structural inspection report, which identifies the asset and documents the inspection, date, name of inspector and conditions of structural elements shall be maintained. See Appendix A, example of condition rating codes; and Annex B, for example of documentation forms. For sample tunnel inspection forms, see *FWHA Highway and Rail Transit Tunnel Inspection Manual – Chapter 3.D.3*

3.2.3 Engineering review

Inspection reports shall be reviewed by the Program Manager for final determination of condition and recommendation for mitigation as necessary. The Program Manager will be responsible to ensure that inspection reports are complete and consistent with good inspection practices.

3.2.4 Document control

Permanent files shall be established for all structures. Each file shall contain all pertinent drawings, inspection records, records of maintenance and repair work. Each Agency shall also have on file Master Lists of the following:

a) All Agency owned structures

b) Structures requiring fractural critical, underwater or special inspections

c) Scour critical or reduced load ratings

3.2.5 Quality assurance/Quality control Program

A quality assurance/quality control program shall be provided to ensure that all structures are being adequately inspected at the required frequency and that complete documentation is being provided according to proper procedures.

4. Maintenance

4.1 Qualifications

4.1.1 General Qualifications

The transit system shall hire, or contract for service, individuals who are trained and competent to maintain structural systems at a level consistent with agency guidelines and performance criteria.

4.1.2 Safety

Individuals involved in the maintenance of structures shall be trained and qualified per the system safety plan of the rail transit system - minimally, as necessary, including but not limited to: fall protection provisions, confined space requirements, PPE, and Roadway Worker protection..

4.1.3 Welding

Welders, welding operators and tack welders shall be qualified based upon the certification requirements of ANSI/AWS D1.1 and D1.5 as required by application. Each transit system or contractor shall be responsible for the qualification of welders.

4.2 Maintenance Items

4.2.1 Coatings

The person in charge of structure maintenance shall establish a maintenance schedule for each type of coating system (paint, elastomeric membrane, etc.) based upon the life expectancy of the coating.

4.2.2 Drainage

Drainage system maintenance shall be performed on a schedule to ensure compliance with original design considerations and in response to deficiencies noted in inspection reports.

4.2.3 Joint sealing

Joint seals shall be maintained periodically to perform as designed and in response to deficiencies noted in inspection reports.

4.2.4 Bearings

Bearings shall be maintained per manufacturers' recommendations and in response to deficiencies noted in inspection reports.

4.2.5 Sealing concrete

Sealing of concrete shall be scheduled to prevent corrosion or deterioration associated with water penetration and in response to deficiencies noted in inspection reports.

4.2.6 Cleaning

Structures shall be cleaned to prevent corrosion and drainage problems. This shall be done in accordance with a schedule established by the individual in charge of structure maintenance. Cleaning of structures for aesthetic purposes shall be determined by the rail transit system.

4.2.7 Vegetation

Vegetation shall be removed from structures in order to provide a clear view for the inspection of structural elements.

4.2.8 Stray current control

See APTA RT-S-FS-005-03, "Traction Electrification Stray Current/Corrosion Control Equipment Inspection and Maintenance."

4.3 Frequency

A plan shall be established by the rail transit system for frequency of maintenance.

4.4 Documentation

When deteriorated structural elements are repaired or replaced, an entry indicating the new element condition shall be made in the inspection records called for in Section 3.2.1.

Each rail transit system shall establish policies to address routine maintenance needs identified in the inspection process.

Each rail transit system shall establish procedures to respond to the finding of critical conditions during an inspection that require immediate correction or note a significant change in condition.

4.5 Inspection/maintenance record review

Inspection records shall be reviewed periodically by the person in charge of structure maintenance to ensure compliance with the program and, in particular, that all high-priority defects have been addressed. Where possible, all records shall be maintained in an electronic database.

Related APTA Standards

- APTA RT-FS-S-005-03 "*Traction Electrification Stray Current/Corrosion Control Equipment Inspection & Maintenance"* (This document was previously numbered as APTA RT-S-FS-005-03)

References

This standard shall be used in conjunction with the most recent versions of the following publications:

Code of Federal Regulations:

- *23 CFR 650, Subpart C, National Highway Bridge Inspection Standards.*
- *23 CFR 650, Subpart E, National Tunnel Inspection Standards.*
- *29 CFR, OSHA Standards.*
- *29 CFR, OSHA Standards, Subpart T.*
- *49 CFR Part 237 Bridge Safety Standards*
- *49 CFR Part 659, Rail Fixed Guideway Systems; State Safety Oversight*

American Association of State Highway and Transportation Officials

- *"AASHTO Manual for Maintenance Inspection of Bridges," prepared by the Highway Subcommittee on Bridges and Structures, 1970.*
- *AASHTO Manual for Bridge Evaluation*

American National Standards Institute and American Welding Society:

- *ANSI/AWS D1.1.*
- *ANSI/AWS D1.5.*

American Railway Engineering and Maintenance Association:

- *AREMA Fatigue Standards.*
- *AREMA Manual for Railway Engineering, Chapter 9, Part 1, Section 1.2.*
- *AREMA Manual for Railway Engineering, Chapter 9, Part 1, Section 1.5.*

Federal Highway Administration:

- *"Inspection of Fracture Critical Bridge Members"*
- *"Manual for Moveable Bridge Inspection"*
- *"Manual on Uniform Traffic Control Devices"*
- *"Bridge Inspector's Reference Manual"*
- *"Underwater Bridge Inspection Manual"*
- *"Highway and Rail Transit Tunnel Inspection Manual"*
- *"Tunnel Operations, Maintenance, Inspection, and Evaluation (TOMIE) Manual"*
- *"Specifications for the National Tunnel Inventory"*

Transit Cooperative Research Program

- "TCRP Synthesis 23, Transportation Research Board (TRB) *"Inspection Policy and Procedures for Rail Transit Tunnels and Underground Structures."*

Definitions

bridge: A structure built to span physical obstacles including, but not limited to a body of water, a valley, a road, or railway, for the purpose of providing passage over the obstacle.

culvert: A structure that typically allows water to flow under a road, railroad, trail, or similar obstruction. Typically embedded so as to be surrounded by soil, a culvert may be made from a pipe, reinforced concrete or other material.

fixed structure: A structure used by rail transit systems for the purpose of providing transit services.

owner: The legal entity that retains the right to construct and operate a transit system.

program manager: The individual in charge of the RTS program that has been assigned or delegated the duties and responsibilities for inspection, reporting and inventory of fixed structures. A licensed professional engineer who is authorized by the RTS to exercise engineering judgment; to make technical decisions with regard to the fixed transit guideway structures; and to direct qualified staff, engineering consultants or other qualified specialists to perform work. The Program Manager does not have to be a direct employee of the owner.

NOTE: The term program manager as referenced herein refers to a function title in accordance with 23 CFR 650 and not a position title.

rail transit system: The organization or portion of an organization that operates rail transit service and related activities. Synonyms: operating agency, operating authority, transit agency, transit authority, transit system.

rail transit system engineer: See Program Manager.

scour: Erosion of streambed or bank material due to flowing water; often considered as being localized around piers and abutments of bridges.

spall: An area of concrete that has broken, chipped or become pitted.

team leader: Individual in charge of an inspection team responsible for planning, preparing and performing field inspection of the fixed structure.

tunnel: An underground passageway for automobiles, trains, pedestrians, etc., completely enclosed except for openings for entrance and exit, commonly at each end.

Abbreviations and acronyms

AASHTO American Association of State Highway and Transportation Officials
ANSI American National Standards Institute
APTA American Public Transportation Association
AREMA American Railway Engineering and Maintenance Association
AWS American Welding Society
CFR Code of Federal Regulations
FCM fracture critical members
FHWA Federal Highway Administration

FRA	Federal Railroad Administration
FTA	Federal Transit Administration
NATSA	North American Transit Services Association
NBIS	National Bridge Inspection Standards
NICET	National Institute of Certification in Engineering Technologies
NTIS	National Tunnel Inspection Standards
OSHA	Occupational Safety and Health Administration
RTA	Regional Transit Authority
RTS	Rail Transit System
TCRP	Transit Cooperative Research Program
TRB	Transportation Research Board

Summary of document changes

1. Document formatted to the new APTA standard format.
2. Sections have been moved and renumbered.
3. Definitions, abbreviations and acronyms have been moved to the back of the document.
4. Two new sections added: "Summary of document changes" and "Document history."
5. Some global changes to section headings and numberings resulted when sections dealing with references and acronyms were moved to the end of the document and other cosmetic changes, such as capitalization, punctuation, spelling, grammar and general flow of text.
6. Document was previously numbered as *APTA RT-S-FS-001-02* and changed to *APTA RT-FS-S-001-02 Rev1*.
7. Added catenary structures to the scope of the standard to ensure these critical structures are inspected and maintained properly.
8. Section 1.1 Added language to FRA regulations for those bridges that may apply.
9. Section 1.2.5 Expanded special structures to include passenger emergency exit systems and appurtenances
10. Section 1.3 'Load Rating' to Section 2.4 as 'Load Rating/Scour Analyses'.
11. Section 1.4 on 'Fatigue' deleted as a section and added to Section 2.2.(b) also because the topic appears in various other places.
12. Section 1.5 'Seismic' moved to a new Section 2.5.
13. Added 2.0 'Inspection Implementation' Section that incorporates and reorganizes inspection procedures, ratings, techniques etc.
14. New Section 2.2 'In-depth and fracture critical inspections' added.
15. Reorganized Inspection Practices Section and subsections into two separate Sections (Inspection Practices & Inspection Implementation) in order to segregate the inspection practices/program from the inspection implementation.
16. Reworded section on 3.1.2 Tunnels to accommodate current inspection concerns for tunnels and allow for the inclusion of upcoming National Tunnel Inspection Standards.
17. Section 4.1.2 Safety qualifications expanded listing minimum, as necessary, safety related training/qualifications.
18. Revised various wording and sections to correspond with most current contents of the National Bridge Inspection Standards.
19. Modified the frequency duration from the number of years to number of months required between inspections.
20. Added the following new references: 23CFR 650, Subpart E National Tunnel Inspection Standards, 49 CFR Part 237, Bridge Safety Standards, 49 CFR Part 659, Rail Fixed Guideway Systems; State

Safety Oversight, AASHTO Manual for Bridge Evaluation, Bridge Inspector's Reference Manual, Underwater Bridge Inspection Manual, Highway and the Rail Transit Tunnel Inspection Manual.

21. Added in definitions for bridge, culvert, Program Manager, Scour, Spall, Team Leader and Tunnel to conform to regulations and standard industry practice.
22. Miscellaneous minor editorial modifications for clarity.
23. Added example inspection forms as attachments.
24. Added standardized rating codes in Appendix A for structural elements conforming to the Bridge Inspection Standards.

Document history

Document Version	Working Group Vote	Public Comment/ Technical Oversight	Rail CEO Approval	Rail Policy & Planning Approval	Publish Date
First published	June 25, 2002	—	—	Sept. 22, 2002	September 2002
First revision	Nov 4, 2014	April 1, 2016	May 19, 2016	July 20, 2016	October 6, 2016

Annex A: (informative) - Example of condition rating codes

Description:

In order to promote uniformity between inspectors, these guidelines can be used to rate and code the structural elements. The condition ratings are used to describe the existing in-place structure as compared to the as-built condition. Condition codes should provide an overall condition of the entire component being rated. Coding shall not attempt to describe localized or normally occurring instances of deterioration or dis-repair.

The load carrying capacity will not be used in evaluating condition items. The fact that a bridge was designed for less than the current legal loads and may be posted shall have no influence upon condition ratings. Portions of bridges that are being supported or strengthened by temporary members will be rated based on their actual condition; that is, the temporary members are not considered in the rating of the item.

Completed bridges not yet open to traffic, if rated, shall be coded as if open to traffic. Even if the bridge is closed, rate each item without being influenced to the fact that the bridge is closed.

The determination of which of the following ratings apply to each of the items will be based on an evaluation of all the relevant factors and information included in the detailed inspection reports. The rating chosen for each of these items will, in effect, be a composite of all of the relevant factors.

NA	**Not Applicable**
9	**Excellent Condition**
8	**Very Good Condition** - No problems noted.
7	**Good Condition** - Some minor problems.
6	**Satisfactory Condition** - Structural elements show some minor deterioration.
5	**Fair Condition** - All primary structural elements are sound but may have minor section loss. Cracking, spalling or scour.
4	**Poor Condition** - Advanced section loss, deterioration, spalling or scour.
3	**Serious Condition** - Loss of section, deterioration, spalling, or scour may have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
2	**Critical Condition** - Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear
1	**"Imminent" Failure Condition** - Major deterioration or section loss present in critical structural components or
0	**Failed Condition** - Out of service - beyond corrective action.

Annex B: (informative) - Example of documentation forms

The following forms were developed by the Pennsylvania Department of Transportation (Penn DOT) and later adopted by the rail transit agency of the Port Authority of Allegheny County. These forms contain the minimum elements and is intended to provide guidance to rail transit agencies when developing their own forms.

a. Site Data
b. Bridge 1 Data
c. Abutment Data
d. Pier Data
e. Bridge 2 Data
f. Maintenance Needs Data
g. Retaining Wall Inspection Report Sheet 1
h. Retaining Wall Inspection report Sheet 2
i. Scour/Underwater Inspection Report Sheet 1
j. Scour/Underwater Inspection Report Sheet 2

Site Data Form

PAT Form D-450A (2001) **Site Data** **BRIDGE MANAGEMENT SYSTEM** *Bridge Inspection Report* BMS Updated by _____ Date _____

A01 _____ E06 Inspection Date _____

A06 _____ over _____ E07 Inspection Type _____

E12 Name of Consultant _____ E08 Inspected by _____

C05 Structure Type _____ E13 Hired by _____

Bridge Signing Verification — Check boxes if Maintenance Activities are needed > x

BMS Item	Type of Sign	Required Sign	SIGNING IN FIELD Near Advance	Bridge Site Near	Bridge Site Far	Far Advance	Comments	
D15	Bridge Weight Limit	T						
D15	Except Combination	T						
D14	One Truck at a Time	Yes/No						
B22/B23	Vert. Clearance-On						See Sketch	
B22/B23	Vert. Clearance-Und						See Sketch	
	One Lane Bridge	Yes/No				(Opt)		
	Narrow Bridge	Yes/No				(Opt)		
	Hazard Clearance	Yes/No						
	Other							
(Opt)	Other							

Key > OK: Signs propoerly installed M: Signs Missing D: Signs damaged

Notes _____

Vertical Clearance Sign **On Feature:** < B01 = _____ B31 = _____ **Under Feature:** < B01 = _____ B31 = _____

E26 Underclearance Appraisal _____ Controlling: Lateral _____ Vertical _____

E28-A Traffic Safety Features (Subfields show n vertically) Posted Speed Limit _____ mph

_____ Bridge Railing _____

_____ Transition _____

_____ Approach Guiderail _____

_____ Approach Rail Ends _____

E28 Approach Alignment _____

E15 Approach Roadw ay _____

Pavement _____

Drainage _____

Shoulders _____

E14 Approach Slab _____

Bump at Bridge Yes _____ No _____ _____

C19 Pavement Relief Joint _____

Bridge 1 Data Form

PAT Form D-450B **Bridge 1 Data** A01 E06 Inspection Date
(2001)

For PAT Roadways B01 Ref B27 ADT B28 ADT Year B30A ADTT %

Deck

E25 Deck Geometry Table Controlling Values: B27/B34/B22 A31/B18
Design Exception granted?

E16 Deck Wearing Surface

E17 Deck Estimated Spall of Delamination % Est. Chloride Content
Top

Underside

Expansion Joints C22 Expansion Joint Types

Deck Drainage

Superstructure

E18 Superstructure See Sheet for Additional Details. Form 491-J attached for FCM details Yes/No

Girders/Beams

Floorbeams

Stringers

Diaphragms

Truss Members

Portals/Bracing

Bearings (Type/Condition)
Abutment No. 1
Abutment No. 2
Piers
Piers

Drainage System (Below Deck)

Abutment Data Form

PAT Form D-450C (2001) **Abutment Data** A01 E06 Inspection Date

E20 Substructure Details on Sheet

NAB - Near Abutment (Use same notation as W09)

Backwall

Bridge Seats

Cheekwalls

Stem

Wings

Footing

Piles

Scour/Undermine Yes No See Details on Form Sheet

Settlement

Embankment-Slope/Wall

Wall Drainage

FAB - Far Abutment (Use same notation as W09)

Backwall

Bridge Seats

Cheekwalls

Stem

Wings

Footing

Piles

Scour/Undermine Yes No See Details on Form Sheet

Settlement

Embankment-Slope/Wall

Wall Drainage

Pier Data Form

PAT Form D-450D **Pier Data** A01 E06 Inspection Date
(2001)

Substructure (Cont.)
Pier/Bent Number (Use same notation as W09)
Bridge Seats
Caps
Cheekwalls
Columns/Stems
Footings
Piles
Scour/Undermine Yes No See Details on Form Sheet
Settlement

Pier/Bent Number (Use same notation as W09)
Bridge Seats
Caps
Cheekwalls
Columns/Stems
Footings
Piles
Scour/Undermine Yes No See Details on Form Sheet
Settlement

Bridge 2 Data Form

PAT Form D-450K **Bridge 2 Data** A01 E05 Inspection Date
(2001)

E17 Paint Condition New Paint Y/N If Yes: Spot Zone Full
Revise item G01-G10

Interior Beam/Girder

Fascias

Splash Zone:Truss/Girder
Truss
Bearings
Other

E21 Estimated Remaining Life (Super + Sub + Deck)

Recaluate IR/OR: Yes Due to: Deterioration New Wearing Surface Other
No Previous Ratings Dated are still valid

E28 Inventory Rating								
E29 Operating Rating	H	HS	ML-80	TK527	COMP SNGL LRV	SD SNGL LRV	COMP DBL LRV	SD DBL LRV

E32 Rate Method E33 Type Member AASHTO E37 Spec E38 Manual

E30 Bridge Post Controlling: H HS ML80 Engineering Judgement

E22 Structural Condition Appraisal Based Upon Table 1 B27-ADT B30- IR
or E16-Super E18-Sub E20- Culvert

E01 Next Insp. Freq. E02 Equip. Next Insp.

E03 Spec. Insp. Type E07 By Insp.

Is bridge over water? Yes E20 = N Complete Forms D-450E through G
No E20 = N E19 = N E25 = N E31 = N

Notes:

Signature and Date:

Maintenance Needs Data Form

PAT Form D-450M **Maintenance Needs Data**
(2001) A01 _____ E06 Inspection Date _____

Approach Roadway Work	Item #	H01 Location		H05 Qty	H05 PR	H09 D/C
Pavement (Patch/Raise)	RDPAVMT	L N R L F R	SY			
Pavement Relief Jt (Rep/Repl)	RDRLFJT	L N R L F R	SY			
Shoulders (Repair/Reconstr)	RDSHLDR	L N R L F R	SY			
Drainage-Off Bridge (Improve)	RDDRAIN	L N R L F R	EA			
GR/Trans/End (Rep/Repl/Imp)	RDGDERL	L N R L F R	EA			
Load Limit Signs (Replace)	RDLDSGN	L N R L F R	EA			
Clearance Signs (Replace)	RDCLSGN	L N R L F R	EA			
Cut Brush to Clear Signs	RDBRUSH	L N R L F R	EA			
Approach Slab (Replace)	A744201	L N R L F R	SY			
Cleaning - Flushing						
Deck	A743101	- -	EB			
Scupper/Down Spouting	B743101	1 2 3 4 5 O	EB			
Bearing/Bearing Seat	C743102	1 2 3 4 5 O	EB			
Steel-Horizontal Surfaces	D743102	1 2 3 4 5 O	EB			
Deck						
Bitum Deck W Surf (Rep/Repl)	BITWRGS	1 2 3 4 5 O	SY			
Timber Deck (Rep/Repl)	B744301	1 2 3 4 5 O	SY			
Open Steel Grid (Rep/Repl)	C744302	1 2 3 4 5 O	SY			
Concrete Deck (Repair)	D744303	1 2 3 4 5 O	SY			
Concrete Sidewalk (Repair)	E744303	1 2 3 4 5 O	SY			
Concrete Curb/Parapet (Rep)	F744303	1 2 3 4 5 O	SY			
Deck Joints - Expansion Joints						
Reseal	A743301	N 1 2 3 O F	LF			
Repair/Reseal	A744101	N 1 2 3 O F	LF			
Compression Seal (Rep/Rehab)	B744102	N 1 2 3 O F	LF			
Modular Dam (Rep/Rehab)	C744102	N 1 2 3 O F	LF			
Steel Dams (Rep/Rehab)	D744102	N 1 2 3 O F	LF			
Other Types (Rep/Rehab)	E744102	N 1 2 3 O F	LF			
Bridge Railings - Parapets						
Bridge Parapet (rep/Repl)	RLGBRPR	N 1 2 3 O F	LF			
Struct Mount GR (Rep/Repl)	RLGSTRM	N 1 2 3 O F	LF			
Pedestrian (Rep/Repl)	RLGPEDN	N 1 2 3 O F	LF			
Median Barrier (Rep/Repl)	RLGMEDB	1 2 3 4 5 O	LF			
Deck Drainage						
Scupper Grate (Replace)	DRNGRAT	1 2 3 4 5 O	EA			
Drain/Scupper (Install)	B744401	1 2 3 4 5 O	EA			
Downspouting (Rep/Repl)	C744402	N 1 2 3 O F	EA			
Bearings						
Lubricate	A743501	N 1 2 3 O F	EA			
Steel (Rep/Repl)	A744501	N 1 2 3 O F	EA			
Steel (Replace)	B744501	N 1 2 3 O F	EA			
Expansion (Reset)	C744502	N 1 2 3 O F	EA			
Pedestal/Seat (Reconstruct)	D744503	N 1 2 3 O F	EA			
Timber						
Stringer (Rep/Repl)	A744601	1 2 3 4 5 O	EA			
Other Members (Rep/Repl)	B744601	1 2 3 4 5 O	EA			

Steel	Item #	H01 Location		H05 Qty	H05 PR	H09 D/C
Stringer (Rep/Repl)	A744602	1 2 3 4 5 O	EA			
Floorbeam (Rep/Repl)	B744602	1 2 3 4 5 O	EA			
Girder (Repair)	C744602	1 2 3 4 5 O	EA			
Diaph/Lat. Bracing (Rep/Repl)	D744602	1 2 3 4 5 O	EA			
Reinforced, PS, PC, and PT Concrete						
Stringer (Rep/Repl)	A744603	1 2 3 4 5 O	EA			
Diaphragm (Rep/Repl)	B744603	1 2 3 4 5 O	EA			
Other Members(Rep/Repl))	C744603	1 2 3 4 5 O	EA			
Truss						
Members (Strengthen/Rep/Repl)	A744701	1 2 3 4 5 O	EA			
Portal (Modify)	B744701	1 2 3 4 5 O	EA			
Members(Tighten/Flameshorten)	C744702	1 2 3 4 5 O	EA			
Painting						
Superstructure - Spot	A743201	1 2 3 4 5 O	EB			
Substructure - Spot	B743201	N 1 2 3 O F	EB			
Superstructure - Full	C743201	1 2 3 4 5 O	EB			
Substructure - Full	D743201	N 1 2 3 O F	EB			
Abutment - Wings - Piers						
Backwall (Rep/Repl)	A744801	L N R L F R	CY			
Abutments (Repair)	B744802	L N R L F R	CY			
Wing (Rep/Repl)	C744802	L N R L F R	CY			
Piers (Repair)	D744802	1 2 3 4 5 O	CY			
Footing (Underpin)	E744803	N 1 2 3 O F	CY			
Masonry (Repoint)	F744804	N 1 2 3 O F	LF			
Abut Slopewall (Rep/Repl)	A745101	L N R L F R	SY			
Abut Slopewall (Construct New)	B745102	L N R L F R	SY			
Pile Repair	A745901	N 1 2 3 O F	EA			
Scour - Erosion Control						
Streambed Paving (Rep/Constr)	A745301	UP UN DN	CY			
Rock Protection	B745301	UP UN DN	CY			
Scour Hole (Backfill)	C745301	UP UN DN	CY			
Stream Deflector (Rep/Constr)	D745302	UP UN DN	CY			
Vegetation/Debris	ECREMVG	UP UN DN	CY			
Deposition (Remove)	ECREMDP	UP UN DN	CY			
Culvert						
Headwall/Wings (Rep/Repl)	A745201	IN OUT	SY			
Apron/Cutoff Wall (Rep/Repl)	B745202	IN OUT	SY			
Barrel (Repair)	C745203	- -	SY			
FOR COMPLETION BY REVIEW ENGINEER						
Apply Protective Coating						
Deck/Parapet/Sidewalk	A743401	DK PARA SW	SY			
Substructure	B743401	N 1 2 3 O F	SY			
Construct Temporary						
Support Pier	A745401	N 1 2 3 O F	EA			
Pipe/Culvert Crossing	B745401	LT CL RT	EB			
Bridge	C745401	LT CL RT	EB			

REP… Repair REPL … Replace IMP ….. Improve
N …. Near UP ….. Upstream LNR …. Near Left/Right
F …. Far DN …… Downstream LFR ….. Far Left/Right
O … Other UN …… Under 1,2,3,etc.. Span/Pier No.
IN … Inlet OUT … Outlet EB…. Each Bridge (site)

PR-PRIORITY CODE
0 - Prompt action required. (Inform Bridge Engineer before updating BMS)
1 - High Priority, as soon as work can be scheduled.
2 - Priority, review work plan, adjust schedule if needed.
3 - Add to scheduled work.
4 - Routine structural, can be delayed until funds are available.
5 - Routine non-structural, can be delayed until proggrammed.

MAJOR IMPROVEMENT NEEDS
[ ] Year Needed _____ F04 Improvement Length _____
F02 Type Work _____ F06 Bridge Width _____
F10 Future ADT _____ F11 Future ADT Year _____

Retaining Wall Inspection Report Sheet 1

PAT Form D-488T1 (2001)

BRIDGE MANAGEMENT SYSTEM
RETAINING WALL INSPECTION REPORT

BMS Updated by _____ Date _____

Retaining Wall Inspection Form D-488T1	Structure Identification Number A01	Structure Type T08
Inspection By:	Weather Conditions:	

T10 **Wall Use** _____ T09 **Insp Man Hours** _____

T13 **Backfill - Condition Rating** _____ Details on pages _____

Slope Stability/Settlement _____

Surface Drainage/Erosion _____

Vegetative Cover/Erosion Control _____

T14 **Wall Condition Rating** _____ Details on pages _____

Structural Wall, Soldier Beams, etc.: _____

Facing Panels, cribbing, etc.: _____

Bulging or Horizontal Displacement: _____

Wall Joints _____

Stub Abutment _____

T15 **Drainage - Condition Rating** _____ Details on pages _____

Weep Holes: Number _____ Condition _____

Roadway Drainage Control: Adequate _____ Inadequate _____

(Comment on Inlets/Outlets) _____

T16 **Foundation - Condition Rating** _____ Details on pages _____

Wall Base/Footing: _____

Wall Settlement/Stability/Tilting: _____

Tie Backs/Anchors: _____

T17 **Overall Condition** _____

Retaining Wall Inspection Report Sheet 2

PAT Form D-488T2 (2001)

BRIDGE MANAGEMENT SYSTEM
RETAINING WALL INSPECTION REPORT

BMS Updated by _____ Date _____

Retaining Wall Inspection Form D-488T2	Structure Identification Number A01 _____	Inspected By: _____ Date: _____

MAINTENANCE ITEMS

	H02	H04		H06	H08	H09
Maintenance Items	Item No.	Location	Unit	Est. Quantity	PR	D/C
Retaining Wall (REP/REPL)	RTWALLR		L.F.			
Facing (REP/REPL)	RTFACNG		S.Y			
Regrading	RTGRADE	L FW BW R	C.Y.			
Drainage (REP/REPL)	RTDRAIN	RW WH	E.A.			
Tie Back Conn. (REP/REPL)	RTTIEBK		E.A.			

NOTES:

Scour/Underwater Inspection Report Sheet 1

PAT Form D-488W1 (2001)

BRIDGE MANAGEMENT SYSTEM
Scour/Underwater Inspection Report

BMS Updated by _____ Date ______

Scour/Underwater Inspection Report Form D-488W1	Structure Identification Number A01	W01 Insp. Date / A01-A UW Insp. Date
Inspection By:	Weather Conditions:	

W02 Insp. Type | W02-A U.W. Insp. Type | W03 Reg. Freq. | W04 Int. Freq.

W07 Stream Bed Material | Description

W06 Scour Crit. Br. Ind. | W14 No. of Units Insp. | W15 Insp. Cost $.

W16 Name of Consultant | W17 Hired by

Substructure Units Inspection Findings (Use Additional Sheets as Required)

W09	W10	W11	W11-A	W11-B	W11-C	W11-F
Sub Unit	Found. Type	Water Depth	Observed Rating	U.I. Req.	Observed Depth	Counter-Measures

W12 Inspection Findings ____________________

W09	W10	W11	W11-A	W11-B	W11-C	W11-F
Sub Unit	Found. Type	Water Depth	Observed Rating	U.I. Req.	Observed Depth	Counter-Measures

W12 Inspection Findings ____________________

W09	W10	W11	W11-A	W11-B	W11-C	W11-F
Sub Unit	Found. Type	Water Depth	Observed Rating	U.I. Req.	Observed Depth	Counter-Measures

W12 Inspection Findings ____________________

W09	W10	W11	W11-A	W11-B	W11-C	W11-F
Sub Unit	Found. Type	Water Depth	Observed Rating	U.I. Req.	Observed Depth	Counter-Measures

W12 Inspection Findings ____________________

Scour/Underwater Inspection Report Sheet 2

PAT Form D-488W2 (2001) | **BRIDGE MANAGEMENT SYSTEM** *Scour/Underwater Inspection Report* | BMS Updated by _____ Date _____

Scour/Underwater Inspection Report Form D-488W2	Structure Identification Number A01 _____	W01 Insp. Date
		A01-A UW Insp. Date

OBSERVED SCOUR RATING GUIDE

Rating	Item Number 1 Change Since Last Insp.	2 Scour Hole	3 Debris Potential	4 Scourability	5 Opening Adequacy/ Channel	6 Sediment	7 Alignment	8 Velocity/ Stream Slope	Rating
9	None	None	None	Rock/P	Good	None	Good	Low	9
8	None	Minor	None	Rock/P/C	Good	Minor	Good	Low	8
7	Minor	Minor	Minor	Rock/C	Fair	Minor	Good	Medium	7
6	Minor	Advanced	Medium*	Stable	Fair	Medium	Medium	Medium	6
5	Medium*	Advanced	High*	Stable	Fair	High	Medium	High	5
4	Medium*	Serious	High*	Alluvium*	Poor*	High	Poor*+	High	4
3	High	Serious	Present*	Alluvium	Overtop*	High	Poor*	High	3
2	Bridge is scour critical, IMMEDIATE action is required*								2
1	Bridge is scour critical, bridge is CLOSED*								1
0	Bridge has failed due to scour*								0

NOTES:

Rating considerations given in highest to lowest level of importance from left to right.

* If an item is so marked, it cannot be given a higher ranking.

+ A higher ranking may be given if the unit is founded on component rock and no problems

DETERMINATION OF RATING FOR BMS ITEM W11-A

Substructure Unit	1 Change Since Last Insp.	2 Scour Hole	3 Debris Potential	4 Scourability	5 Opening Adequacy/ Channel	6 Sediment	7 Alignment	8 Velocity/ Stream Slope	W11-A Overall Observed Scour Rating