Federal Requirements for Inspection and Inventory of Bridges and Tunnels

Rodolfo F. Maruri, PE

Team Leader for Structures and Bridges

Federal Highway Administration – Virginia Division

Inspection and Inventory of Structures

- Bridge and Tunnel Inspection
- Highway Legislation
- Inspection of Assets
- Asset Management
- Other Discussion Topics

Inspection and Inventory of Structures

- **Definitions:**
  - **Bridge**
    - **Over depression, obstruction (water, highway, or railway)**
    - **Carrying traffic or other moving loads**
    - **20 feet 'between undercopings of abutments or ….'**
  - **Culvert**
    - **Structure designed hydraulically**
    - **Under roadway "covered with embankment"**

Bridge. A structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet between undercopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening.

Culvert. A structure designed hydraulically to take advantage of submergence to increase hydraulic capacity. Culverts, as distinguished from bridges, are usually covered with embankment and are composed of structural material around the entire perimeter, although some are supported on spread footings with the streambed serving as the bottom of the culvert. Culverts may qualify to be considered "bridge" length.

Inspection and Inventory of Structures

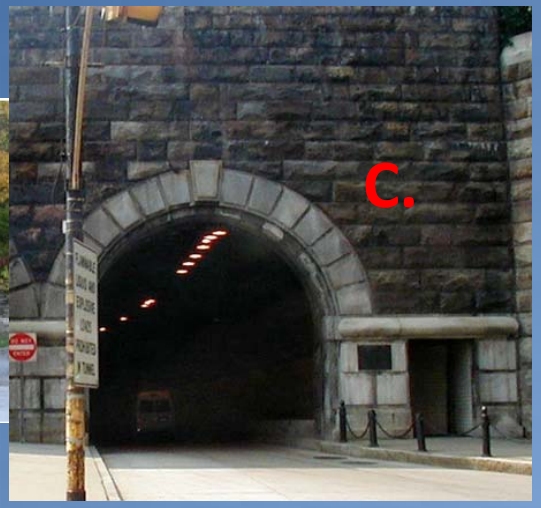
- **Tunnel Definitions**
  - Enclosed Roadway
  - For motor vehicle traffic
  - Access limited to Portals
  - Regardless of type of structure or construction
  - May include lighting, ventilation, emergency egress, and other special features
  - Does not include bridges or culverts inspected under the NBIS.

Tunnel. The term "tunnel" means an enclosed roadway for motor vehicle traffic with vehicle access limited to portals, regardless of type of structure or method of construction, that requires, based on the owner's determination, special design considerations that may include lighting, ventilation, fire protection systems, and emergency egress capacity. The terms "tunnel" does not include bridges or culverts inspected under the National Bridge Inspection Standards (subpart C of this part).

Portal. The term "portal" means the entrance and exit of the tunnel exposed to the environment; portals may include bare rock, constructed tunnel entrance structures, or buildings.

Inspection and Inventory of Structures

Pop Quiz – Select the tunnel(s)?



Inspection and Inventory of Structures

History of the National Bridge Inspection Program

The Silver Bridge Collapse

- Ohio River between WV & OH
- Eye-bar suspension design
- Collapsed evening of Dec. 15, 1967
- Cause: instantaneous fracture
- 46 fatalities

Inspection and Inventory of Structures

History of the National Bridge Inspection Program

1968 - Federal-Aid Highway Act – creation of the national bridge inspection standards (NBIS) and inventory of Federal-aid highway system bridges

1971 - The first National Bridge Inspection Standards (NBIS) were developed

1978 – NBIS was expanded to all highway bridges on public roads

Inspection and Inventory of Structures

- **History of Transportation Legislations**
  - Federal Aid Act → 1968
    - Other Transportation Legislation
  - ISTEA → 1991-1997
  - TEA-21 → 1998-2003
  - SAFETEA-LU → 2005-2009
  - MAP-21 → 2012-2014

Inspection and Inventory of Structures

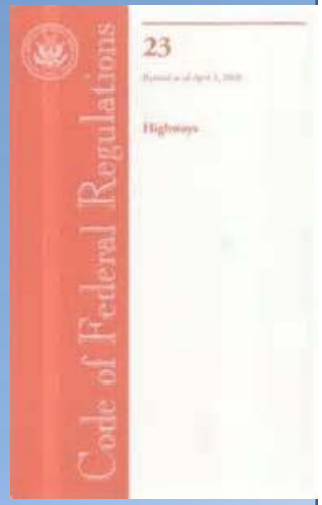
Transportation Legislation vs. Federal Regulations

- **Legislation**
- **Notice of Proposed Rulemaking**
  - Published in Federal Registry
  - Comment Period
  - Summarize comments and provide responses
    - Done by Federal Agency (FHWA)
  - Legal Review
  - OPM
  - Office of Secretary
- **Federal Regulation**

Inspection and Inventory of Structures

Law vs. Regulations

- **Law: 23 U.S.C. 144**
- **National Bridge Inspection Standard (NBIS)**
  - **23 CFR 650 (Part C)**
- **National Tunnel Inspection Standards (NTIS)**
  - **23 CFR 650 (Part E)**
- **CONSISTENCY !!!**



Inspection and Inventory of Structures

- 1983 -- I-95 over Mianus River Bridge Collapse in CT.

- 1987 -- I-90 over Schoharie Creek Bridge Collapsed in NY

- 1988 -- NBIS requirements for Fracture Critical members and Underwater Inspections were added

Inspection and Inventory of Structures

- **2004 – Updates to the NBIS**
  - Quality Control and Quality Assurance
  - Refresher Course
  - State responsible for the requirements of the NBIS
  - Team Leader Qualifications
  - Critical Findings
  - Complex Bridges
  - Training for Divers

Inspection and Inventory of Structures

- **Boston Artery Tunnel**
  - Ceiling Collapse on July 10, 2006
  - One (1) Person Dead

Inspection and Inventory of Structures

- **2007 Collapse**
  - **I-35 W over the Mississippi River**
  - **13 Fatalities**

Inspection and Inventory of Structures

2012 – MAP-21 Legislation

…(D) require each State, Federal agency, and tribal government to maintain and make available to the Secretary on request—

(i) written reports on the results of highway bridge and tunnel inspections and notations of any action taken pursuant to the findings of the inspections; and

(ii) current inventory data for all highway bridges and tunnels reflecting the findings of the most recent highway bridge and tunnel inspections conducted;

2015 – National Tunnel Inspection Standards

Inspection and Inventory of Structures

Key Sections of the NBIS & NTIS :

- 650.303 & 650.503: Applicability
- 650.307 & 650.507: Inspection Organization
- 650.309 & 650.509: Qualifications of Personnel
- 650.311 & 650.511: Inspection Frequency
- **650.313 & 650.513: Inspection Procedure**
- 650.315 & 650.515: Inventory

Inspection and Inventory of Structures

- **Inspection Procedures**
  - In accordance with AASHTO Manual
  - Visual and Hand-ON
    - Sight
      - Clean it
    - Sound
    - Touch

Inspection and Inventory of Structures

RABIT™ Bridge Deck Assessment Tool

Inspection and Inventory of Structures

- **Aerial Inspection**

Inspection and Inventory of Structures

- Importance of Inspections (GOALS)
  1. SAFETY
  2. Inventory
     - Mobility Limitations
       - Load Capacity, Vertical Clearance, Width
  3. Condition of Asset (Bridge, Tunnel, Other)
     - Change since last inspection

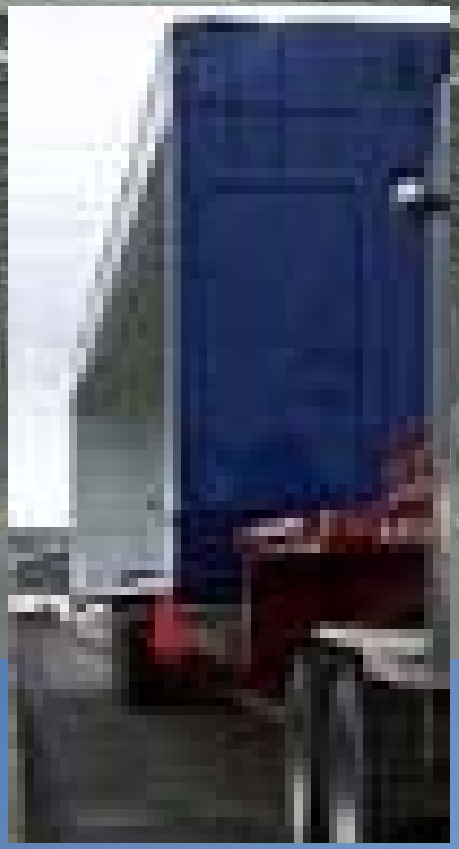
Inspection and Inventory of Structures

- **Shorten Commute to WORK**

Inspection and Inventory of Structures

Inspection and Inventory of Structures

Inspection and Inventory of Structures



Inspection and Inventory of Structures

Key Sections of the NBIS & NTIS :

- 650.303 & 650.503: Applicability
- 650.307 & 650.507: Inspection Organization
- 650.309 & 650.509: Qualifications of Personnel
- 650.311 & 650.511: Inspection Frequency
- 650.313 & 650.513: Inspection Procedure
- **650.315 & 650.515: Inventory**

Inspection and Inventory of Structures

- **Condition of Asset**
  - General Condition Ratings
    - DECK
    - Superstructure
    - Substructure
- According to the NBIS, condition ratings are used to describe an existing bridge component compared with its condition if it were new.
  - General condition ratings range from 0 (failed condition) to 9 (excellent). For detailed definitions, click here.

9 – Excellent …

8 – Very Good …

7 – Good …

6 – Satisfactory …

5 – Fair …

4 – Poor …

3 – Serious …

2 – Critical …

1 – Imminent Failure

0 – Failed …

Inspection and Inventory of Structures

- **QUIZ TIME**
  - **What is the General Condition Rating ?**

Inspection and Inventory of Structures

- **QUIZ TIME**
  - **What is the General Condition Rating ?**

Inspection and Inventory of Structures

- **Bridge Condition**
  - **Deficient Bridges**
    - **Structurally Deficient (SD)**
      - **What does this mean?**
    - **Functionally Obsolete (FO)**
      - **How about this?**
    - **Definitions:**
      - **http://www.virginiadot.org/info/resources/bridge_defs.pdf**

Inspection and Inventory of Structures

- **Structurally Deficient**
  - status used to describe a bridge that has one or more structural defects that require attention. This status does not indicate the severity of the defect but rather that a defect is present.

Inspection and Inventory of Structures

- Functionally Obsolete is a status used to describe a bridge that is no longer by design functionally adequate for its task. Reasons for this status include:
  - Capacity: doesn't have enough lanes to accommodate the traffic flow
  - Shoulders: may not have space for emergency shoulders.
  - Clearance: not have a high enough clearance to allow an oversized vehicle.

Inspection and Inventory of Structures

- **QUIZ TIME**
  - **Structurally Deficient or Functionally Obsolete?**

Inspection and Inventory of Structures

- ASCE – Vocal Organization about the Condition of America's Infrastructure
  - http://www.infrastructurereportcard.org/

- Grades assigns according to eight criteria:
  - capacity,
  - condition,
  - funding,
  - future need,
  - operation and maintenance,
  - public safety,
  - resilience, and
  - innovation.

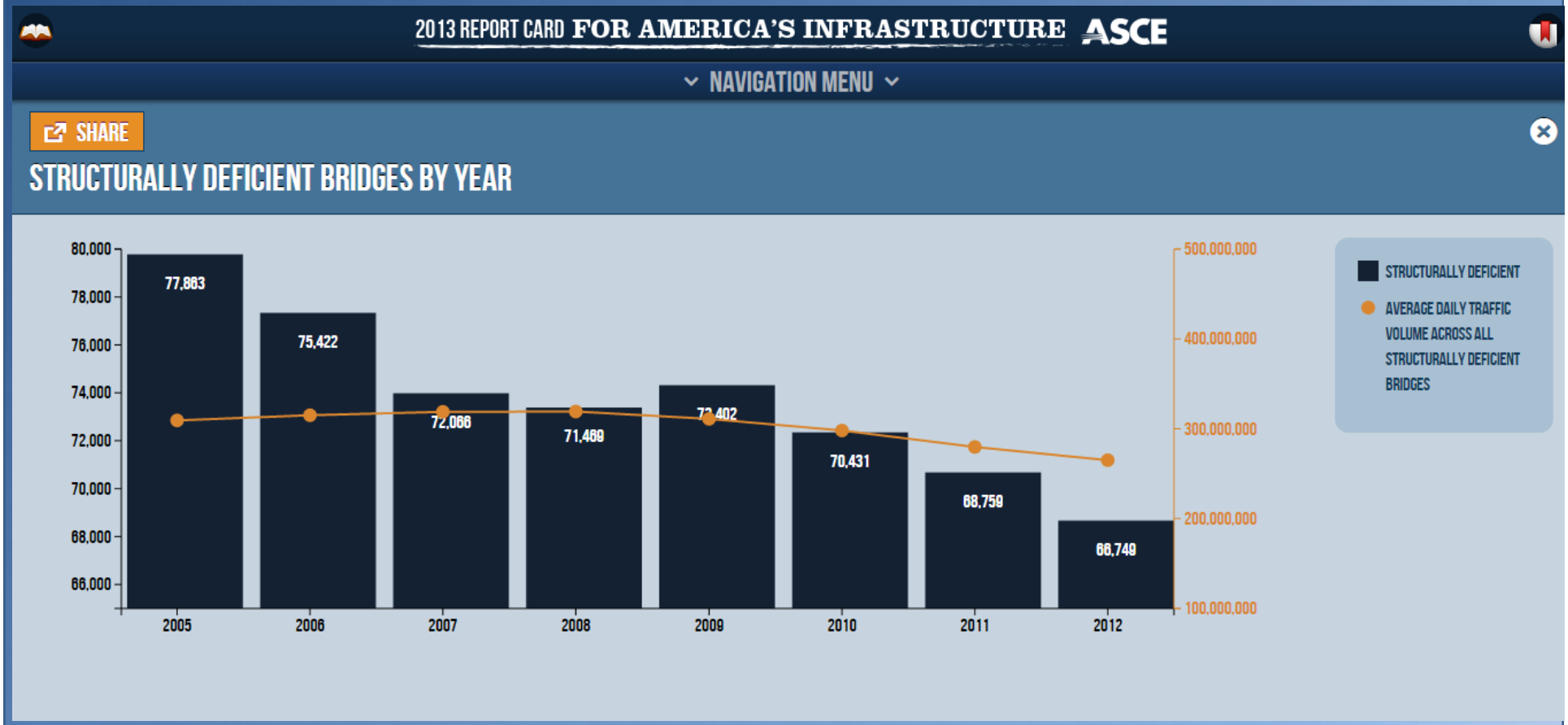
Inspection and Inventory of Structures

Inspection and Inventory of Structures

ASCE notes,

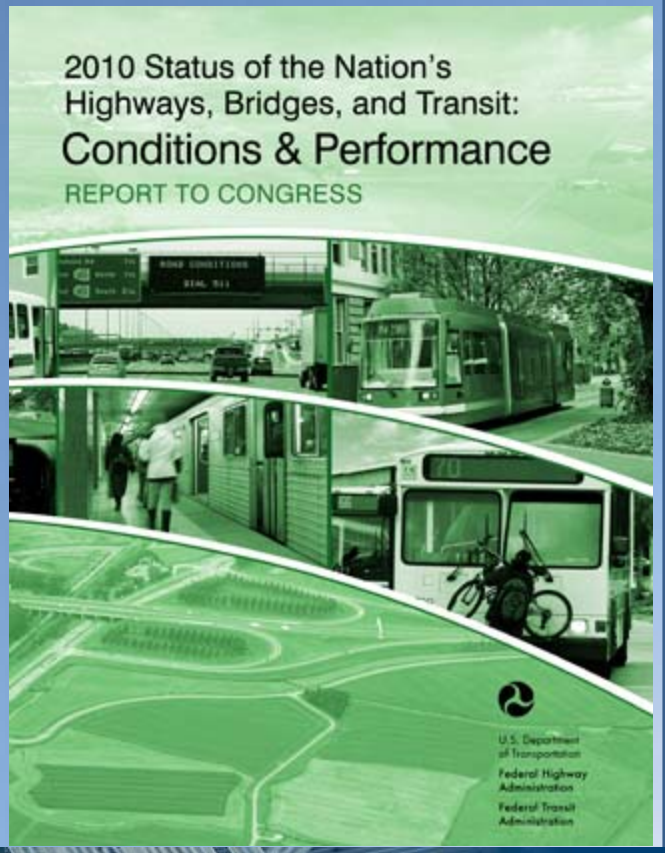
- **The percentage of bridges that are either functionally obsolete or structurally deficient has been declining slowly over the last decade as states and cities have increased efforts to prioritize repairs and replacements.**
  - **In 2012, one in nine, or just below 11%, of the nation's bridges were classified as structurally deficient.**
  - **The number of bridges defined as functionally obsolete has also declined, with**
  - **currently 24.9% of the nation's bridges defined in either deficiency category.**

Inspection and Inventory of Structures



Inspection and Inventory of Structures

- **ASCE Reporting**
  - **Based on Data provided by FHWA**
    - **Interpretation**
    - **Conclusions**



U.S. Department of Transportation
Federal Highway Administration

Inspection and Inventory of Structures

- **QUIZ TIME – Deficient (Yes or No?)**

Inspection and Inventory of Structures

"SO WHAT DO I HAVE TO DO TO ENSURE THE SAFETY OF MY BRIDGES?"

Inspection and Inventory of Structures

Transportation Legislation (Under Construction)

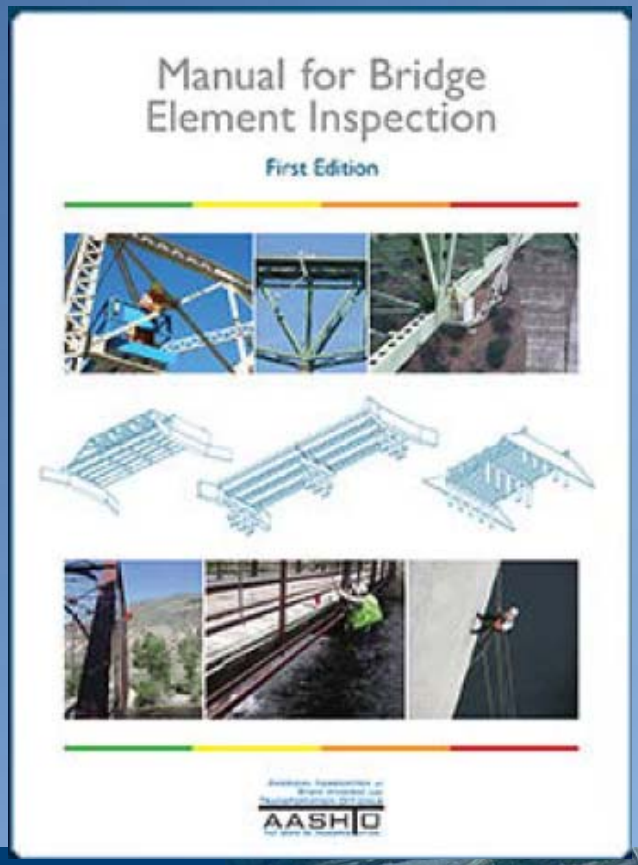
- GROW America – Executive Branch Proposal
- DRIVE Act – Senate
  - Section 1025 – change terminology of SD to "Poor Condition"
- STRR Act – House of Representatives
- MARURI ACT ➔ 2016-2022
  - **M**ove **A**head **R**ight-away and **U**nderstand the need to **R**estore (Rehabilitate, or Rebuild) our **I**nventory

Inspection and Inventory of Structures

- Condition of Asset <Bridge or Tunnel>
  - Element Level (Bridges)
    - AASHTO Commonly Recognized Elements (CoRe)
    - National Bridge Elements (NBE)
    - Bridge Management Elements (BME)
  - Element Level (Tunnels)
    - Tunnel Element
      - Inspection needs to be completed in 2017

Inspection and Inventory of Structures

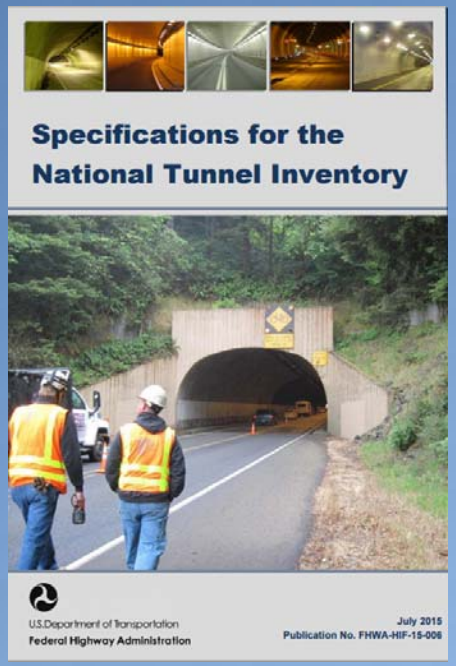
- **AASHTO's Manual for Bridge Element Inspection**
  - https://bookstore.transportation.org/item_details.aspx?id=2182

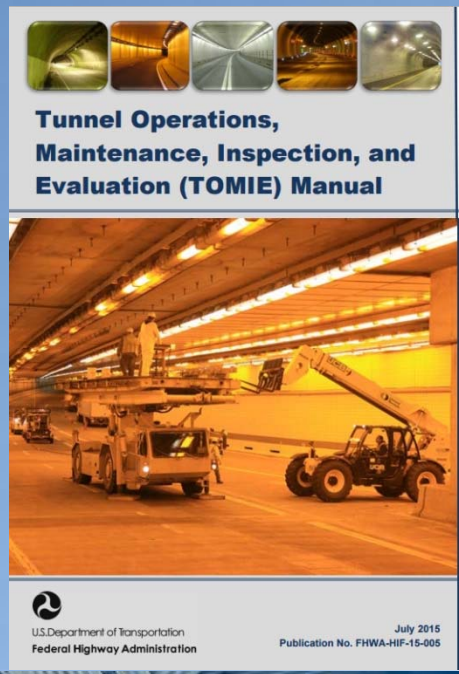


Inspection and Inventory of Structures

- **NTIS Documents:**
  - Specifications for the National Tunnel Inventory
  - Tunnel Operations, Maintenance, Inspection, and Evaluation (TOMIE) Manual

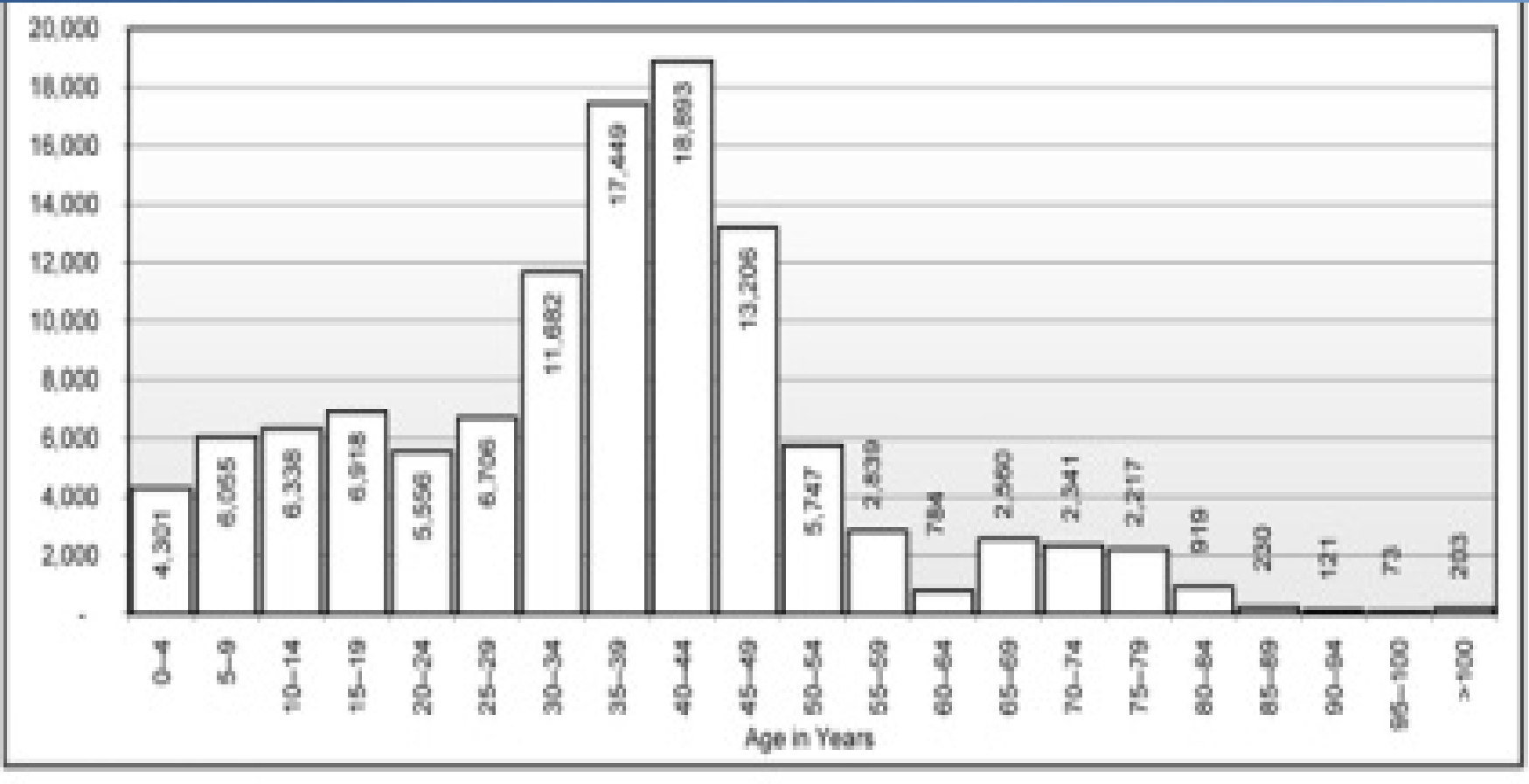
    http://www.fhwa.dot.gov/bridge/inspection/tunnel/





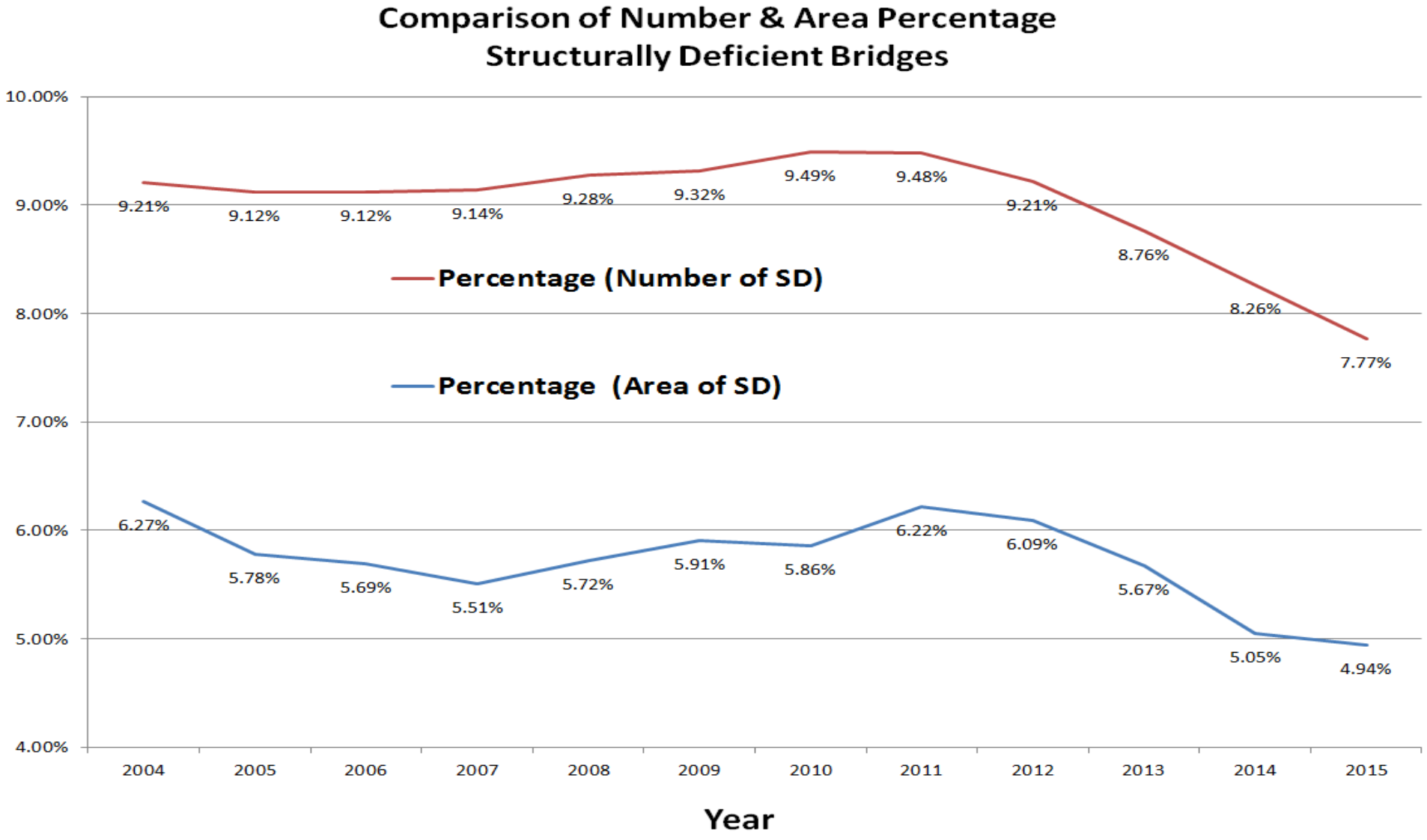
Inspection and Inventory of Structures

INVENTORY – AGE



Inspection and Inventory of Structures

- **Virginia's Bridge Condition (2004 – Present)**



Inspection and Inventory of Structures

- **Condition of Bridges (Why?)**
  - **Environment**
  - **Maintenance Practices**
  - **Engineering (Detailing of Bridges)**
  - **Construction**

Inspection and Inventory of Structures

CHALLENGE - New & Rehabilitated Structures

- **Design**
  - Does it make sense to do it & Is it an efficient use of funds?
  - Does it utilize the best materials?
- **Constructability,**
  - Can I build it, safely?
- **Inspectability**
  - Can I inspect the elements of the bridge?
- **Serviceability & Maintainability**
  - Preventive Maintenance
  - Can I rehabilitate the structure after XX years ➔ Design Life

Inspection and Inventory of Structures

MAP-21 Requirement for Asset Management

- **National Highway Performance Program.**
  - **State Program Must Include,**
    - **Objectives and Measures**
    - **Investment Strategies**
    - **Risk Analysis**
    - **Listing of all NHS Bridge Assets and their description**
- Additional Information:
  - https://www.fhwa.dot.gov/map21/docs/11sep_perf_mgt.pdf

Inspection and Inventory of Structures

Notice of Proposed Rulemaking (NPRM)

- **Performance Measures**
  - Bridges and Pavements
    - Requirement of MAP-21 Legislation
    - 10% of Deck Area SD on the National Highway System
- **NPRM for Design Exceptions**
  - Changes to the 13 Controlling Criteria

Inspection and Inventory of Structures

QUESTIONS?

Contact Information:
Rodolfo Maruri
(804) 775-3353
Rodolfo.maruri@dot.gov
FHWA Virginia Division
www.fhwa.dot.gov/vadiv

THANK YOU

?