



Bridge Inspection Program

**Road School
March 10, 2010**



Federal Highway
Administration



Indiana Department
Of Transportation



Purdue
University



Bridge Inspection Program





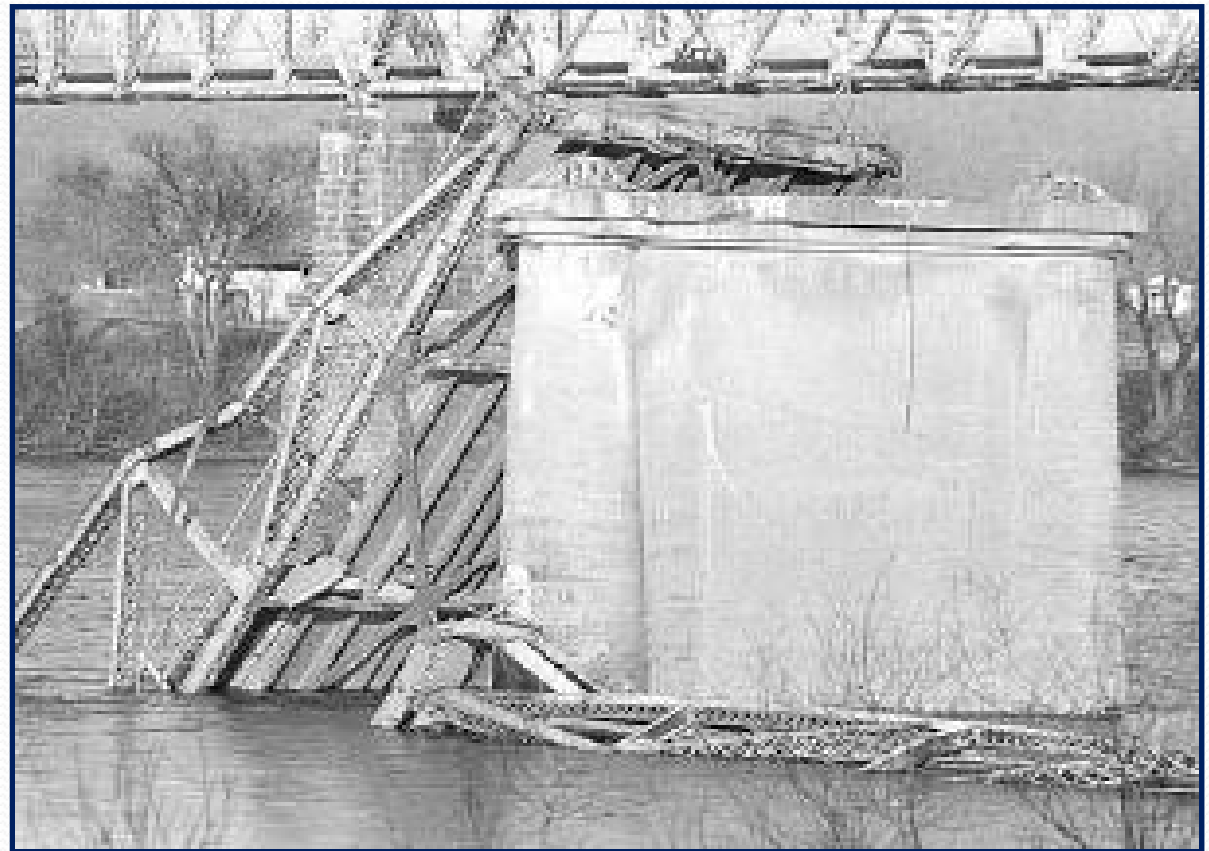
Bridge Inspection Program

- Originated in 1968 Federal Highway Bill
- Reaction to collapse of Silver Bridge over Ohio River
- Originally Targeted only Bridges on FA routes
- Later Extended to Cover all Public Bridges
- Federal Aid Funding Reimbursement of 80%



Bridge Inspection Program

December 15,
1967, Collapse of
the Silver Bridge
across the Ohio
River from Point
Pleasant, WV to
Gallipolis, Ohio.





Bridge Inspection Program

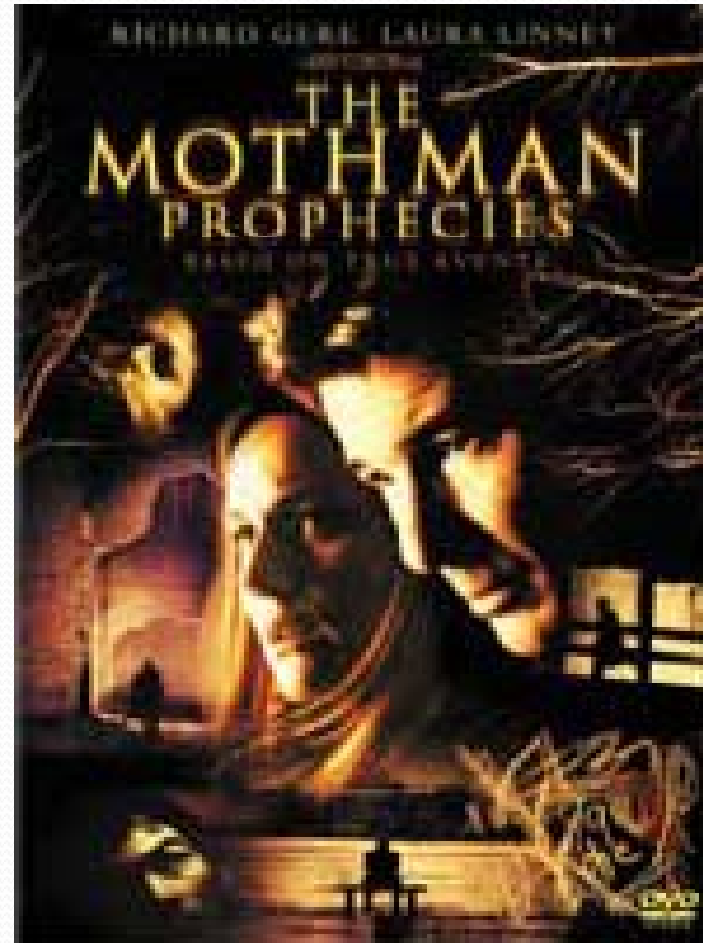
The Mothman Prophecies

Book by John Keel

2002 Movie Starring

-Richard Gere

-Laura Linney



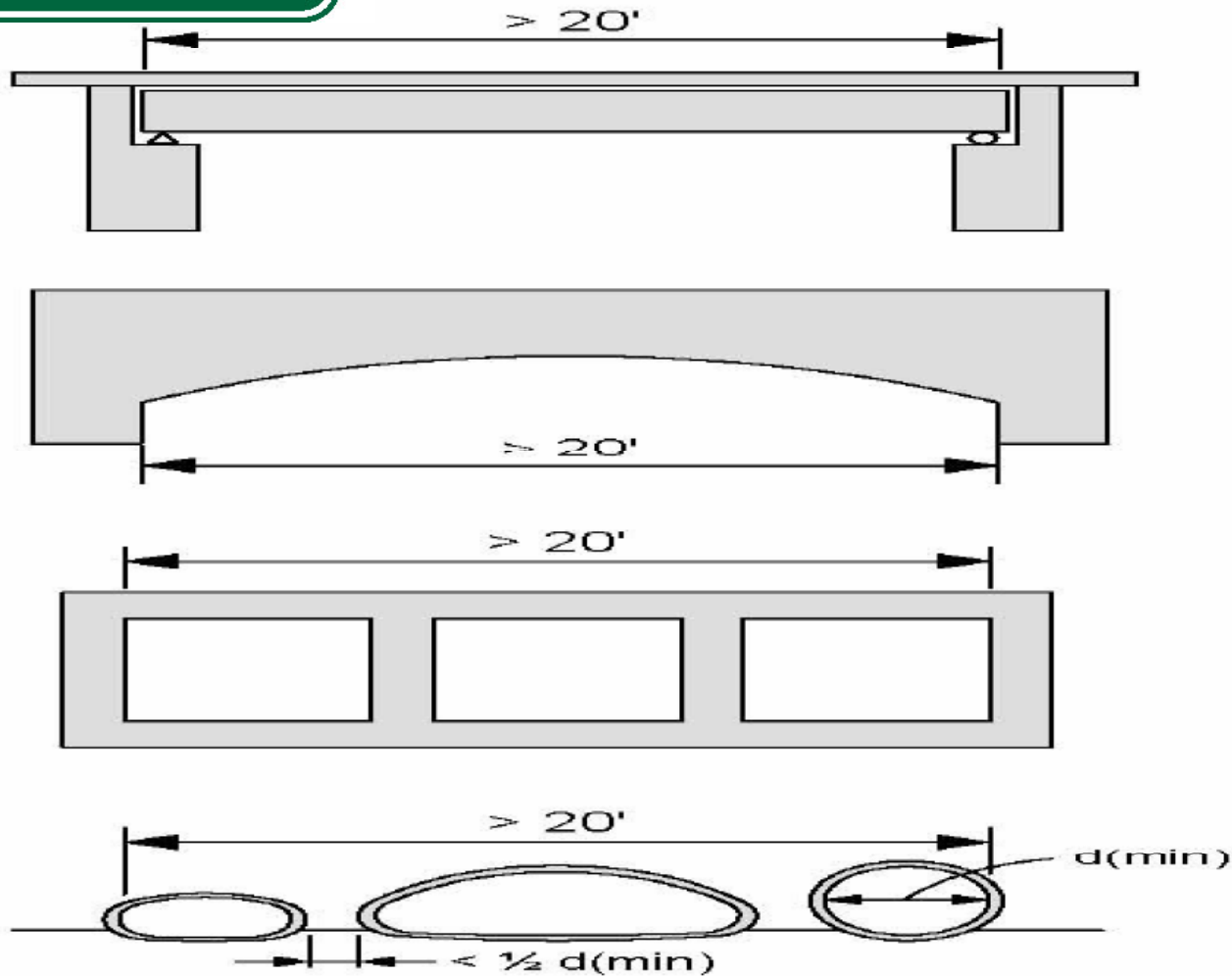


Bridge Defined...

- Carries Traffic or other Moving Loads
- Greater than 20 ft span (parallel to roadway)
- May include multiple pipes where separation is less than half the diameter
 - 2 - 8 ft diameter pipes, 4 ft apart would qualify as a bridge
- Railroad and pedestrian bridges currently are not inspected, but may be in the future



Bridge defined...





Consultant Selection

- Federal funding is involved, so LPA's must follow the Brookes Act (quality based selection)
- Must use INDOT's Consultant Selection Procedures:
<http://www.in.gov/dot/div/legal/rfp/LPASection/information/ConsultantSelection/Consultant%20Selection%20index.htm>
- Quality based selections are to be made based on Qualifications - Not Price!
- Fee's are Negotiated after the most qualified consultant is selected
- County forces may be used for the inspection and will be reimbursed at 80% (Must be Certified by INDOT)



Contracts

- Contracts are required between the LPA and the consultant and the LPA and INDOT
- Contracts are typically for a period of 4 years, requiring Phase I and Phase II inspections
- Sample Agreements are in the Administrative Guide



Qualifications of Inspection Personnel

- Program Manager - Engineer in Overall Charge
 - Must be Registered Professional Engineer
 - Must Sign and Stamp the Final Inspection Report
- Field Inspection Team Leader
 - Registered Professional Engineer and 2 week NHI Course, or
 - 5 years experience and completion of 2 week NHI Course, or
 - NICET level III or IV Bridge Safety Inspector Certification
 - Must lead the Field Inspection and sign the Inspection Report
 - Must be “Certified” by INDOT (Requires 2 week NHI Course)
- <http://www.fhwa.dot.gov/bridge/nbis/index.htm>
 - Course = Safety Inspections of In-Service Bridges



Types of Inspections

- Inventory – First Inspection after Construction
- Routine - all subsequent, 2 year interval
 - The Routine, Special Detail, and Fracture Critical Inspections should include all load rating work that may be needed based on the inspection findings.
- In Depth or Critical Feature Inspections
 - Fracture Critical
 - Tension Members of Non-Redundant Structures
 - Special Features
 - Hangers, Pin Connections, Hoan Details, Etc.
 - Underwater
 - “Visual” inspection by qualified diver/inspector



Types of Inspections

- Complex Bridges
 - Could be an additional Line Item Category
 - Includes Bridges that have a Special Inspection Cost
 - May be many times the cost of other Special Inspections
 - Access Equipment may be required
 - Traffic Control probably needed
 - Potentially NDT techniques required
- Emergency Inspections
 - Collision Damage, Scour Monitoring (After Major Flood Events)
 - Costs will vary widely based on specific requirements



Structure Inventory and Appraisal Sheet (SIA)

- Summary sheet of inspection results, including...

Identification	Condition
Structure Type/ Material	Load Rating and Posting
Age and Service	Appraisal
Geometric Data	Proposed Improvements
Navigational Data	Inspections
Classification	



SIA Sheet Highlights

- Pay special attention to...
 - Item 29 - Average Daily Traffic (ADT)
 - Item 37 - Historical Significance
 - Items 58 to 62 - Condition ratings
 - Items 64 and 66 - Inventory and Operating Ratings
 - Items 67 to 72 - Appraisal ratings
 - Item 75 - Type and Description of Improvements, including Maintenance Needs



Bridge Rating

- Component Ratings
 - Condition and Appraisal from SIA Sheet
- Sufficiency Rating
- Deficiency Status
- Load Rating



Component Ratings

- Items 58 thru 65 – Condition Ratings (Meat of Report!)
 - Deck
 - Superstructure
 - Substructure
 - Channel
 - Culvert / Retaining Walls
- Rated on a Scale of 0 to 9
 - 0 – Closed, Failed, or Beyond Repair
 - 4 – Poor Condition
 - 6 – Satisfactory
 - 9 – New Facility



Component Ratings

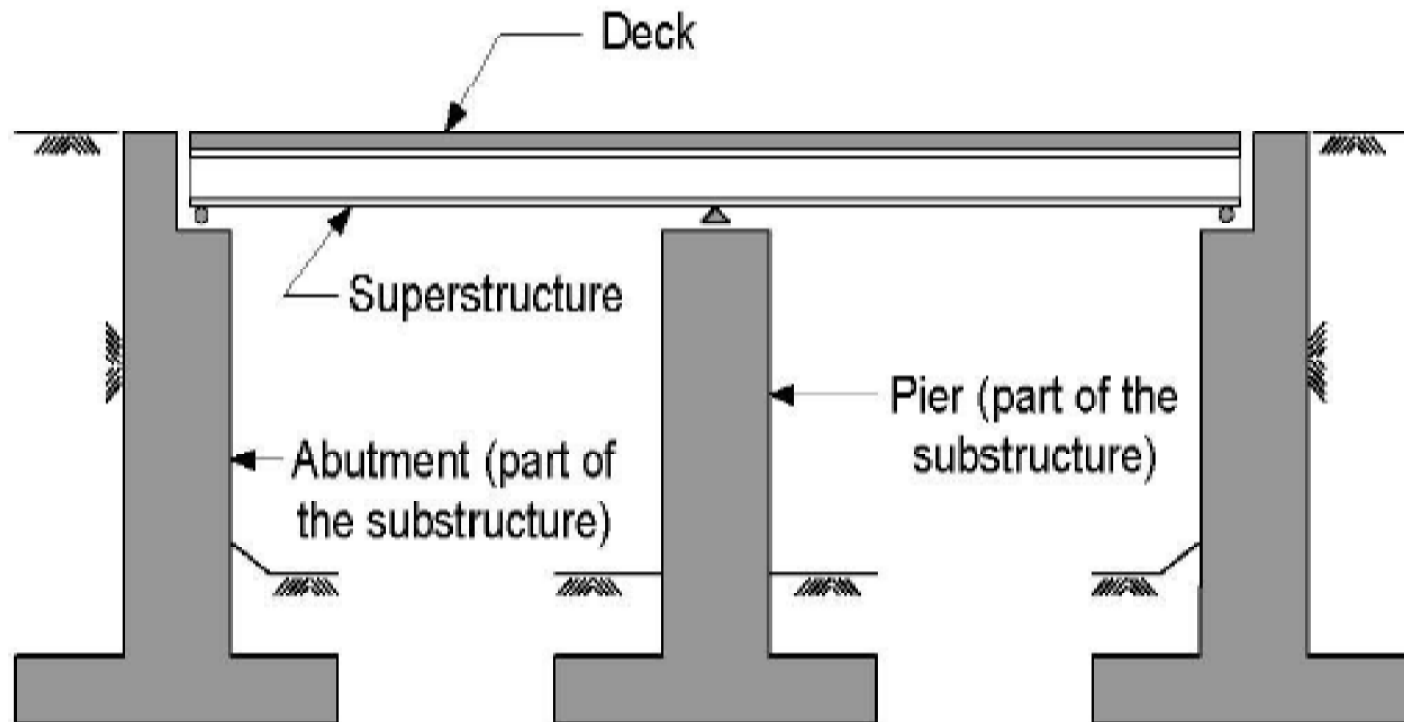


Figure P.2.1A Major Bridge Components



Sufficiency Rating

- Scale of 0 (poor) to 100 (excellent)
- Composite rating of:
 - Structural Adequacy and Safety 55%
 - Based on condition ratings and inventory load rating
 - Functionality 30%
 - Based on geometry, lane width, traffic volume, etc.
 - Essentiality for Public use 15%
 - Based on detour length, traffic volume



Sufficiency Rating

- Key factor in determining Funding Eligibility for Federal Aid Bridge Funds:
 - Must be less than 80 for FA Rehabilitation Funds
 - Must be less than 50 for FA Replacement Funds
- Other factors are also considered for Eligibility:
 - Structurally Deficient
 - or
 - Functionally Obsolete
 - and
 - > 10 Yrs since Construction/Rehab or used Federal \$



Structurally Deficient

- Rating of < 4
 - Deck (Item #58)
 - Superstructure (Item #59)
 - Substructure (Item #60)
 - Culvert (Item #62) – For Underfill Structures
- Rating = or < 2
 - Structural Evaluation (Item #67)
 - Waterway Adequacy (Item #71)



Structurally Deficient

- Structural Evaluation (Item #67)
 - Rating = Lowest Value of Item #59 or #60
or
 - Per Table 1 (Following Slide)
 - Weight Restricted due to Deterioration of Structural Components
 - Not Necessarily Unsafe if Load Restrictions are:
 - Observed - Posting Signs in Place
 - Enforced – Work with Sherriff/Police Departments
 - Advertised – Article in Local Papers



Structurally Deficient

Table 1. Rating by Comparison of ADT - Item 29 and Inventory Rating - Item 66

Structural Evaluation Rating Code	Inventory Rating		
	Average Daily Traffic (ADT)		
	0-500	501-5000	>5000
9	>236* (HS20)**	>236 (HS20)	>236 (HS20)
8	236 (HS20)	236 (HS20)	236 (HS20)
7	231 (HS17)	231 (HS17)	231 (HS17)
6	223 (HS13)	225 (HS14)	227 (HS15)
5	218 (HS10)	220 (HS11)	222 (HS12)
4	212 (HS7)	214 (HS8)	218 (HS10)
3	Inventory rating less than value in rating code of 4 and requiring corrective action.		
2	Inventory rating less than value in rating code of 4 and requiring replacement.		
0	Bridge closed.		



Structurally Deficient

Waterway Adequacy (Item #71) ≤ 2

Per Coding Guide, ≤ 2 if:

- Occasional or Frequent Overtopping of Bridge Deck and Roadway Approaches with Significant to Severe Traffic Delays
- Better have Documentation (i.e.- Photos during Floods, Record of Road Closure Periods) to Justify a Rating of 2 or Less for this Item



Functionally Obsolete

- Rating of 3 or Less for Items:
 - Deck Geometry – Item #68 (Per Table 2 of Coding Guide)
 - Depends on ADT(Item #29) & Bridge Roadway Width (Item #51)



Functionally Obsolete

TABLE 2A							TABLE 2B	
Deck Geometry Rating Code	Bridge Roadway Width 2 Lanes; 2 Way Traffic						Bridge Roadway Width 1 Lane; 2-Way Traffic	
	ADT (Both Directions)						ADT (Both Directions)	
	0-100	101- 400	401- 1000	1001- 2000	2001- 5000	>5000	0-100	>100
9	>32	>36	>40	>44	>44	>44	-	-
8	32	36	40	44	44	44	15'-11"	-
7	28	32	36	40	44	44	15	-
6	24	28	30	34	40	44	14	-
5	20	24	26	28	34	38	13	-
4	18	20	22	24	28	32 (28*)	12	-
3	16	18	20	22	26	30 (26*)	11	15'-11"
2	Any width less than required for a rating code of 3 and structure is open.							
0	Bridge closed.							

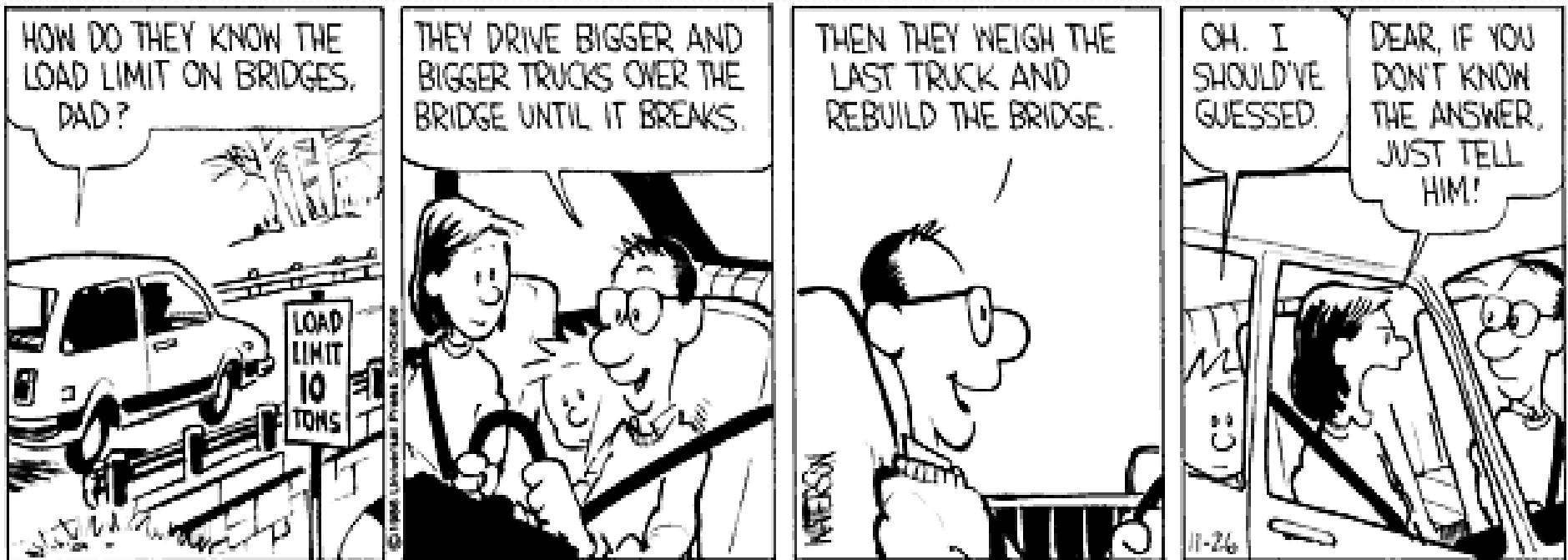


Functionally Obsolete

- Rating of 3 or Less for Items:
 - Deck Geometry – Item #68 (Per Table 2 of Coding Guide)
 - Depends on ADT (Item #29) & Bridge Roadway Width (Item #51)
 - Underclearance – Item #69 – Only applies if Bridge is over a Roadway (<16'-6") or Railroad (<23')
 - Approach Roadway Alignment
 - How does the Alignment of Approaches to the Bridge relate to the General Highway Alignment for the Section of Highway the Bridge is on.
 - Different than other Appraisal Evaluations
 - Not necessarily unsafe for all traffic or a function of Age
 - Also – Structural Evaluation (#67) or Waterway Adequacy (#71) = Rating of 3



Load Rating



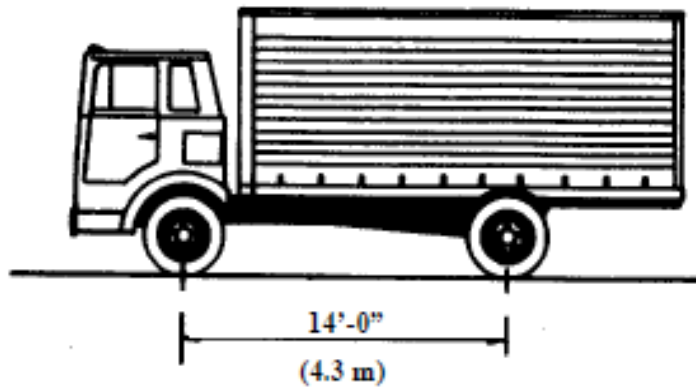


Load Rating

- Load rating is the responsibility of the consultant performing the most recent inspection
- State Policy is to Post Anything Less than 16 Tons
- Posted Load Rating – H-Truck Loading
- Inventory/Operating Ratings:
 - HS-20 Truck – LFD Analysis
 - HL-93 Truck - Current Design Vehicle for LRFD Analysis
- Ratings can also be done for other Vehicles upon Request:
 - School Buses
 - Overload Vehicles



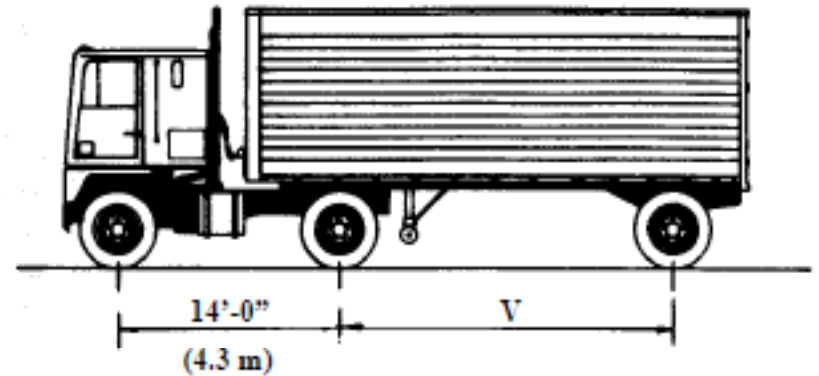
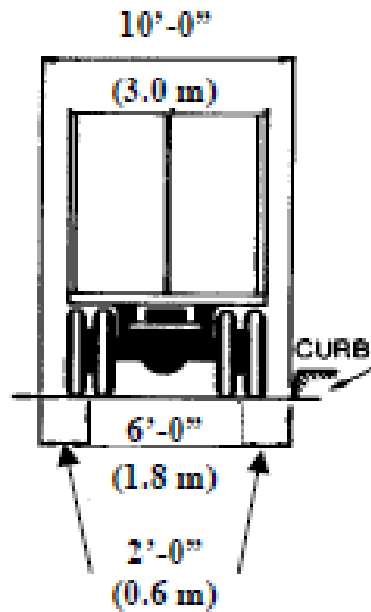
Load Rating



8,000 lbs (35 kN) 32,000 lbs (145 kN)

AASHTO H20 Truck

CLEARANCE AND LOAD LANE WIDTH



8,000 lbs (35 kN) 32,000 lbs (145 kN) 32,000 lbs (145 kN)

AASHTO HS20 Truck



Load Rating

- Bridge will be rated for both Inventory and Operating Stress Levels:
 - **Inventory** – Load that can safely use the bridge over an extended period of time (~55% of Capacity)
 - **Operating** – Absolute Maximum Permissible Load the bridge may be subjected to under controlled conditions
 - Bridge still has additional capacity (i.e.- won't fall down!)
 - Only 75% of Ultimate Capacity Allowed
- Calculations shall be maintained by the Consultant and stored in new Software



How much should it cost?

- Routine inspections (4 Year Contract, 2 Cycles)
 - \$800 – \$1,200+ per Bridge (Current Averages)
 - Approx. 8-12 Man-Hours per Bridge
 - Can vary widely based on # of Bridges, Size, Proximity, Condition of Bridges, Previous Load Ratings-Good?, Etc.
- Underwater inspections
 - \$2,500-\$10,000+ per bridge (Can Vary Widely)
 - Typically between \$1,400 - \$3,000 per Substructure Unit
 - Amount of Diving Required, # of Piers in Water, Depth, Current, Etc.
 - # of Bridges Inspected and Proximity – Mob/Demob Costs
 - 3 Person Dive Team Required by OSHA Code (Lead Certified PE)



How much should it cost?

- Fracture critical inspections
 - \$1,400 - \$10,000+ per Bridge
 - Average of 17 Man-Hours (+/-) per Bridge
 - For Prep, Inspection, Drawings, Rating, Reporting
 - Varies Widely based on the Bridge Size & Type
 - Small Pony Truss ~ \$1,400/Bridge
 - Large Multi-Span Truss – Cost Can Vary Widely
 - Costs also depend on need for Special Equipment – Traffic Control, Climbing Gear, Snooper Truck, Etc.
 - Typically Multi-Member Inspection Team



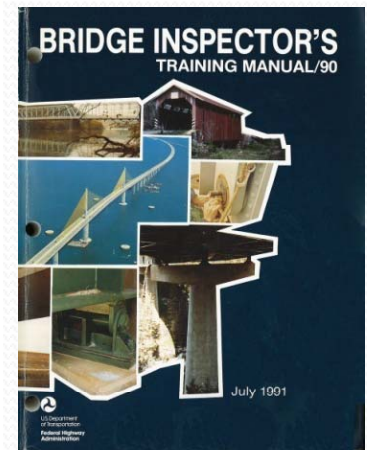
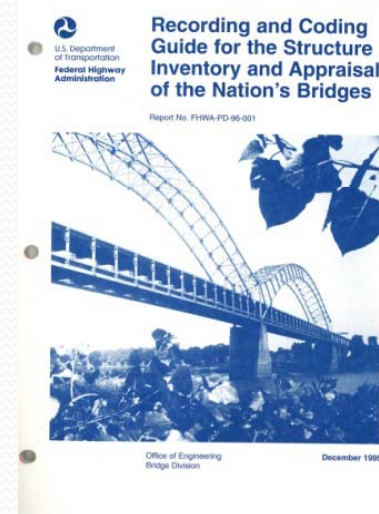
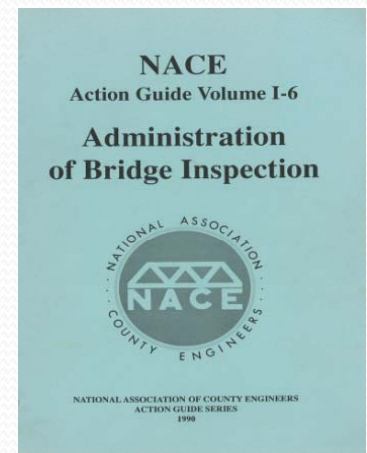
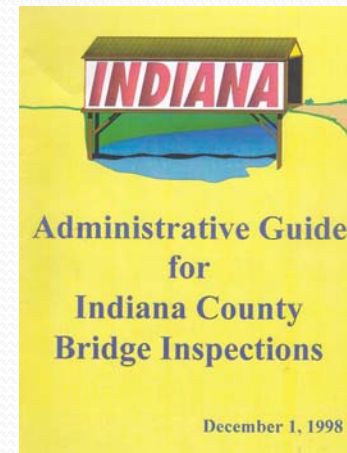
Who You Gonna Call?

- In the 2006 to 2008 time period, there were...
 - 20 Different Consultants performing County Bridge Inspections
 - Six Consultants perform over 60% of Counties
 - No Counties used their own Forces
- Indiana LTAP – Contact for a complete listing of current County Consultants



Resources

- Administrative Guide for Indiana County Bridge Inspections
- Administration of Bridge Inspection
 - NACE Action Guide I-6
- Recording and Coding Guide
- Bridge Inspectors Training Manual
- Bridge Inspector's Reference Manual (on line)
- INDOT Bridge Inspection Manual (Draft to be Completed in March)





The rest of the story...

- New Bridge Inspection Software – BIAS (Bridge Inspection Application System)
 - Developed by InspectTech (www.inbridges.com)
 - Went On-line February 2010 (must have password from INDOT)
 - New Data Collection Fields/Requirements
- Benefits
 - Data History/Report History
 - Web Application – Can be accessed from anywhere!
 - Bridge File – Store Scanned Bridge Plans, Drawings, Photos, Other Documents in one database for easy access
 - Manager Software – Will eventually lead to bridge management uses for LPA's
 - Discuss with your Consultant
- <http://www.fhwa.dot.gov/bridge/nbis.htm>