FHWA Bridge Program Initiatives - Bridge Design and Analysis

2016 RADBUG

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Outline

- Reauthorization
  - MAP-21
  - FAST Act
- Steel Bridge Initiatives
- Concrete Bridge Initiatives
- Load Rating Initiatives

MAP-21

- National Bridge Inspection Standards
- NHS Bridge Condition Penalty
- Bridge Performance Measures
- Risk-Based Prioritization

NBIS Update

- Establish and maintain risk-based, data-driven inspection standards
- Establish risk-based, data-driven frequency of inspections
- Establish procedures for reporting critical findings and monitoring corrective actions
- Requirement to conduct annual compliance reviews
- Maintain a bridge inspection training program
- Nationally Certified Bridge Inspectors

NHS Bridge Condition Penalty

- If deck area on structurally deficient NHS bridges exceeds 10 percent for 3 consecutive years,
- Then 50 percent of the State's Highway Bridge Program (HBP) apportionment in 2009 will be set aside from NHPP.
- First penalties will be “imposed” on October 1, 2016 (beginning of FY17)

MAP-21

- Bridge Performance Measures
  - The final rule is expected to be published by the end of the calendar year.
- Risk-Based Prioritization
  - Classify bridges according to serviceability, safety and essentiality.
  - Based on that classification, assign each a risk-based priority for preventative maintenance, replacement or rehabilitation.

Fixing America's Surface Transportation (FAST) Act

- Signed by President Obama on December 4, 2015 …retroactive to October 1, 2015
- First long-term authorization act in a decade
- Provides 5 years of funding certainty for infrastructure planning and investment
- Authorizes $305B (all modes) over FY 2016-2020
- $70B in transfers to keep the Highway Trust Fund solvent; fully "paid for" (offset) by unrelated savings

FAST Act Key Highway Facts

- $226.3B for highways over five years (FY 2016-2020)
- Builds on the program structure and reforms of MAP-21
- Continued focus on accelerating project delivery
- Adds a new freight formula and expands freight network
- Adds a new discretionary program for nationally significant freight and highway projects

Some FAST Act Bridge Related Provisions

- Sec. 1105 Nationally Significant Freight and Highway Projects
- Sec. 1106 National Highway Performance Program
- Sec. 1111 Bundling of Bridge Projects
- Sec. 1116 National Highway Freight Program
- Sec. 1303 Treatment of Certain Bridges Under Preservation Requirements
- Sec. 1409 Milk Products
- Sec. 1410 Interstate Weight Limits
- Sec. 1422 Study on Performance of Bridges
- Sec. 1439 Elimination of Barriers to Improve At-Risk Bridges

Sec. 1105 Nationally Significant Freight and Highway Projects

- New program: FASTLANE Grants
- $900 M/year (average) for competitive grants or TIFIA loans for projects >$100 M (reduced for States w/ small programs)
- Eligible activities:
  - Highway freight projects on National Highway Freight Network
  - NHS highway/bridge projects that increase capacity or are in National Scenic Areas
  - Freight rail/intermodal/port projects (≤$500 M over 5-year period)
  - Rail-highway grade crossing or grade separation projects
- States, large MPOs, Tribes, localities, and FLMAs may apply
- OST selects projects; Congress has 60 days to disapprove

Sec. 1409 Milk Products

- A vehicle carrying “fluid milk” products shall be considered a non-divisible load.

Sec. 1410 Interstate Weight Limits

- Covered Heavy-Duty Tow and Recovery Vehicles
- Vehicles on Certain Highways in TX
- Logging Vehicles in WI
- Vehicles on Certain Highways in AR
- Logging Vehicles in MN
- Emergency Vehicles
- Natural Gas Vehicles

Sec. 1410 Interstate Weight Limits

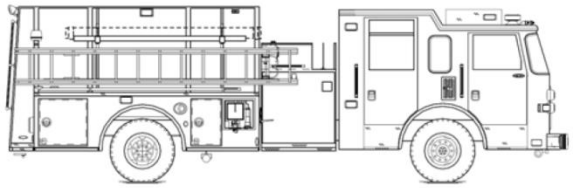
- Natural Gas Vehicles
  - If operated by natural gas, may exceed any vehicle weight limit (up to a maximum gross vehicle weight of 82,000 pounds) by the difference between the natural gas tank and fueling system and the weight of a comparable diesel tank and fueling system

Sec. 1410 Interstate Weight Limits

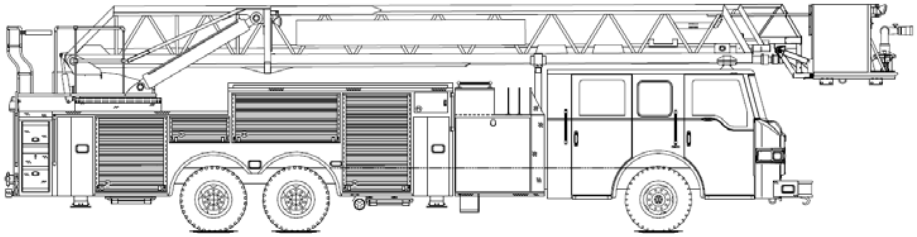
- Emergency Vehicles
  - Shall not enforce against an emergency vehicle up to a maximum of 86,000 pounds a limit less than –
    - 24,000 pounds on a single steering axle
    - 33,500 pounds on a single drive axle
    - 62,000 pounds on a tandem axle
    - 52,000 pounds on a tandem rear drive/steer axle

Sec. 1410 Interstate Weight Limits – Emergency Vehicles

- Single Rear Axle Emergency Vehicle
  - Front Single Axle: 24,000 pounds
  - Rear Single Axle: 33,500 pounds
  - Wheelbase: 15 ft.



- Tandem Rear Axle Emergency Vehicle
  - Front Single Axle: 24,000 pounds
  - Rear Tandem Axle: 62,000 pounds (two 31,000 pound axles spaced at 4 ft.)
  - Wheelbase: 17 ft. (distance from front axle to the centerline of rear tandem axle)



Sec. 1410 Interstate Weight Limits – Emergency Vehicles

System	NBI	CA	NY (State-Owned)	OR (State-Owned)	TN	VA (State-Owned)	WI (State-Owned)	WY
Interstate	10%	<14% (State)	3%	15%	14% (biased)	2%	<12%	4%
Non-Interstate	35%	<42% (Local)	17%	25%			<12%	8% (Non-IS NHS)
								25% (Non-NHS)

Concerns…

- Ubiquitous signs
- Freight

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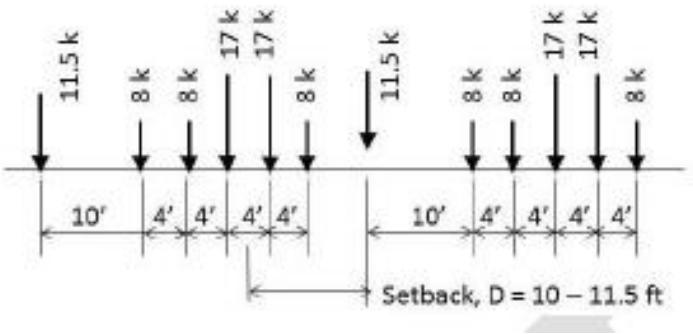
Sec. 1410 Interstate Weight Limits

- Covered Heavy-Duty Tow and Recovery Vehicles
  - Interstate vehicle weight limits to not apply
  - A vehicle that is transporting a disabled vehicle from the place where it became disabled to the nearest appropriate repair facility, and
  - Has a gross vehicle weight that is equal to or exceeds the gross vehicle weight of the disabled vehicle being transported

Covered Heavy-Duty Tow and Recovery Vehicles



Sec. 1410 Interstate Weight Limits

- Covered Heavy-Duty Tow and Recovery Vehicles
  - Assuming both the tow vehicle and the disabled vehicle individually meet the Bridge Formula

System	NBI	CA	NY (State-Owned)	OR (State-Owned)	TN	VA (State-Owned)	WI (State-Owned)	WY
Interstate	20%	14% (State)	6%	>15%	39% (biased)	4%	12%	16%
Non-Interstate	42%	42% (Local)	11%	>25%			12%	18% (Non-IS NHS)
								35% (Non-NHS)

National Tunnel Inspection Standards

- 07.14.2015, Enacted
- 08.13.2015, Effective
- 12.11.2015, Pre. Inventory Data Due
- 08.13.2017, Qualified PM Identified
- 08.13.2017, Initial Inspections Due
- 04.01.2018, Inspection Data Due

Much like NBIS, we are developing a metric based oversight process that will be implemented in 2018.

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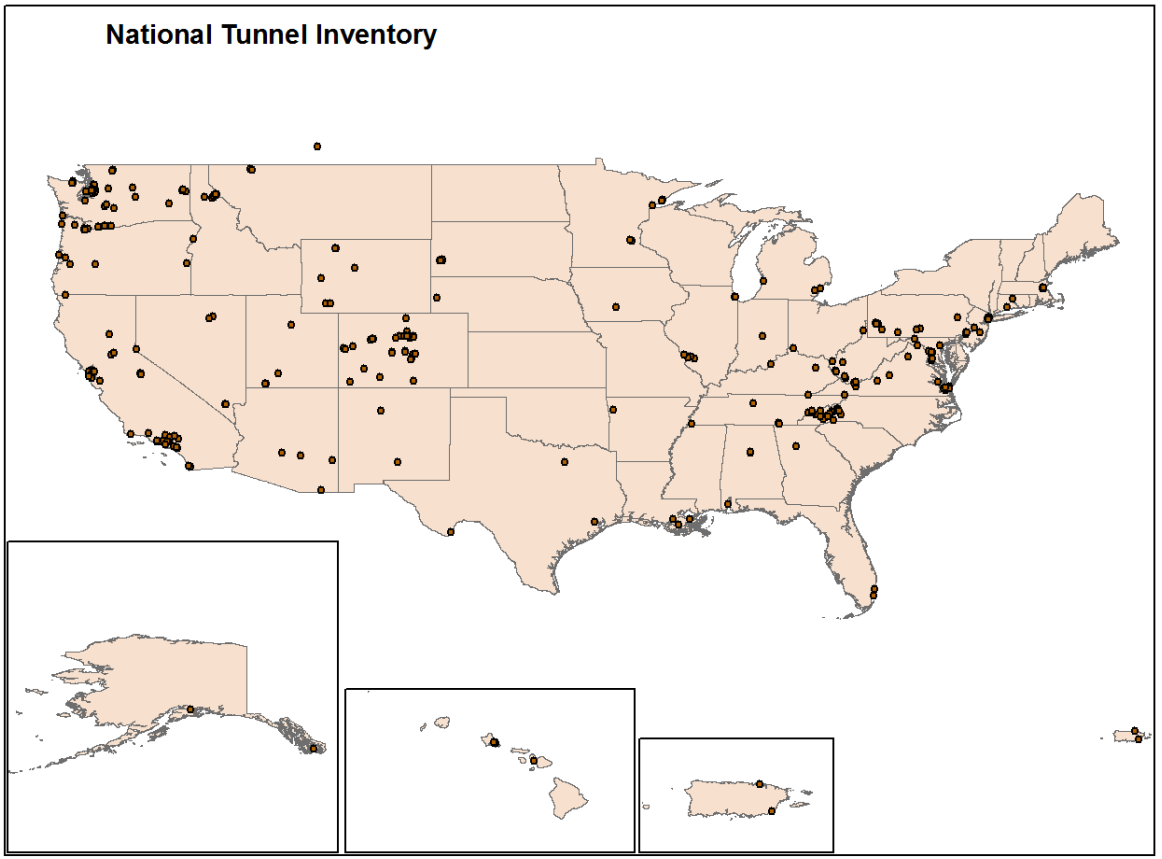
Highway Tunnel fun facts

- Number of highway tunnels = 473
- CA = 64
- WA = 56
- MA = 39
- NPS = 64



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Longest highway Tunnel

- Anton Anderson Tunnel (AK)
- 13,000 ft.

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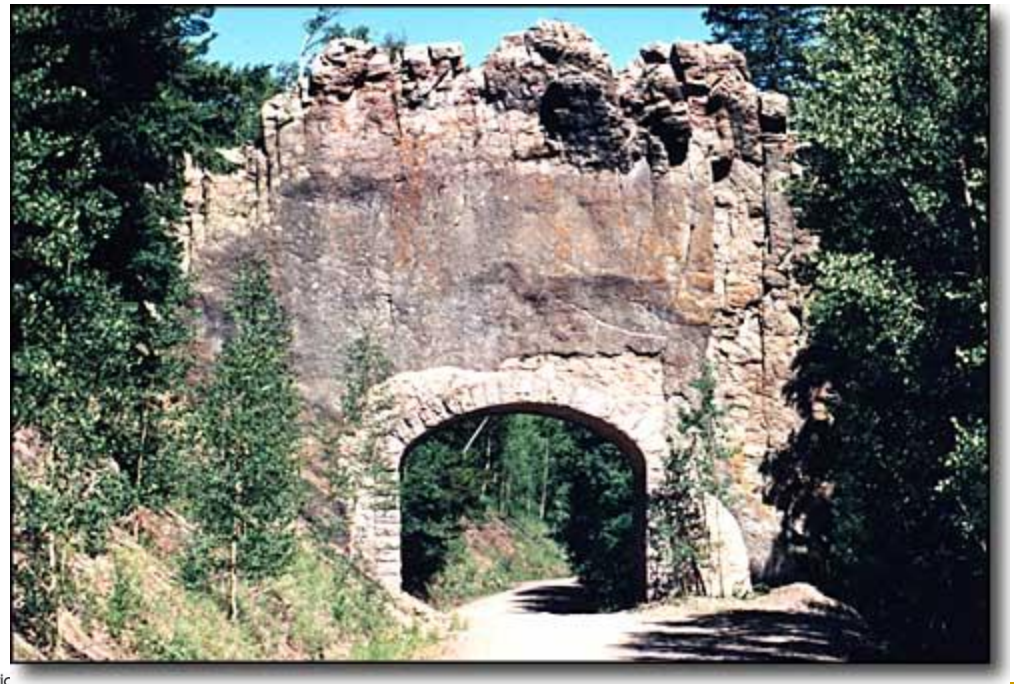
Shortest highway Tunnel

- Apishapa Arch (CO) = 11 ft.
- Also the oldest tunnel…built in 1882!



Changing the Language of the Federal-Aid Bridge Program

- Goal…Eliminate Federally instituted but (to the uninformed) sometimes confusing, unclear, misleading or alarming terms from the language of bridge engineers!
- This is language that has served us well and we have "owned" but recognize it does not translate well in a transparent world.
  - Functionally Obsolete
  - Sufficiency Rating
  - Structurally Deficient
  - Fracture Critical

Functionally Obsolete

- Legacy Term (MAP-21)
- Relies on 5 items from the NBI
- Used to incorporate some of the functional parameters of a bridge into the allocation and decisions on funding
- Still in some of our programs, guidance, etc. (SI&A) but the Federal-Aid program no longer uses it

Sufficiency Rating

- Legacy Term (MAP-21)
- Relies on 19 items from the NBI
- Used as a means to apportion Highway Bridge Program Funding to States
- An early attempt at bridge management
- Still in some of our programs, guidance, etc. (SI&A) but the Federal-Aid program no longer uses it

Structurally Deficient

- Condition and physical adequacy parameter for SR
- No longer needed for funding apportionment, but still in law (bridge penalty provision)
- Performance Measures Rule-Making…Good/Fair/Poor
- Poor
  - A condition rating of 4 or less for
    - Item 58, Deck; or
    - Item 59, Superstructures; or
    - Item 60, Substructures; or
    - Item 62, Culvert and Retaining Walls

    ~~OR~~
  - ~~An appraisal rating of 2 or less for~~
    - ~~Item 67, Structural Evaluation~~
    - ~~Item 71, Waterway Adequacy~~

Fracture Critical

- 23 CFR 650 (C): A steel member in tension, or with a tension element, whose failure would probably cause a portion of or the entire bridge to collapse.
- Rooted in two bridge failures
- FHWA, AASHTO, AWS
- System Redundant Member

Changing the Language of the Federal-Aid Bridge Program

- ~~Sufficiency Rating~~
- ~~Functionally Obsolete~~
- Structurally Deficient => Poor?
- Fracture Critical => need to retain in some form

Bridge Conditions

	2016	2006	1972
Number of Bridges	614,288	597,561	563,500
Structurally Deficient Poor	56,017 48,565	75,422	88,900
Percent of total	9.1% 7.9%	12.6%	15.8%
Deck Area (million square meters)	334.0	371.2	
Percent of total	6.3% 5.9%	9.6%	

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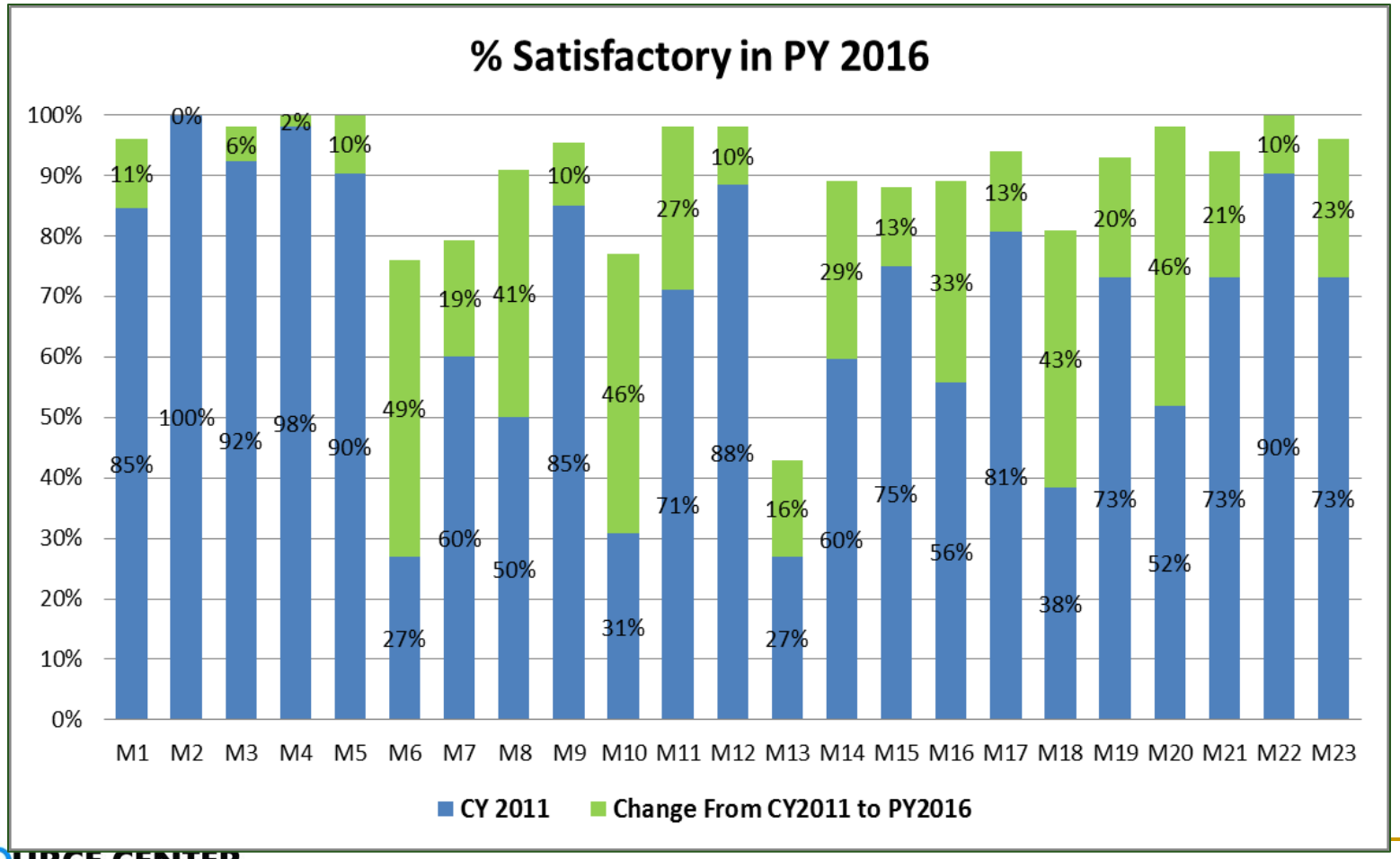
2016 NBIS Compliance



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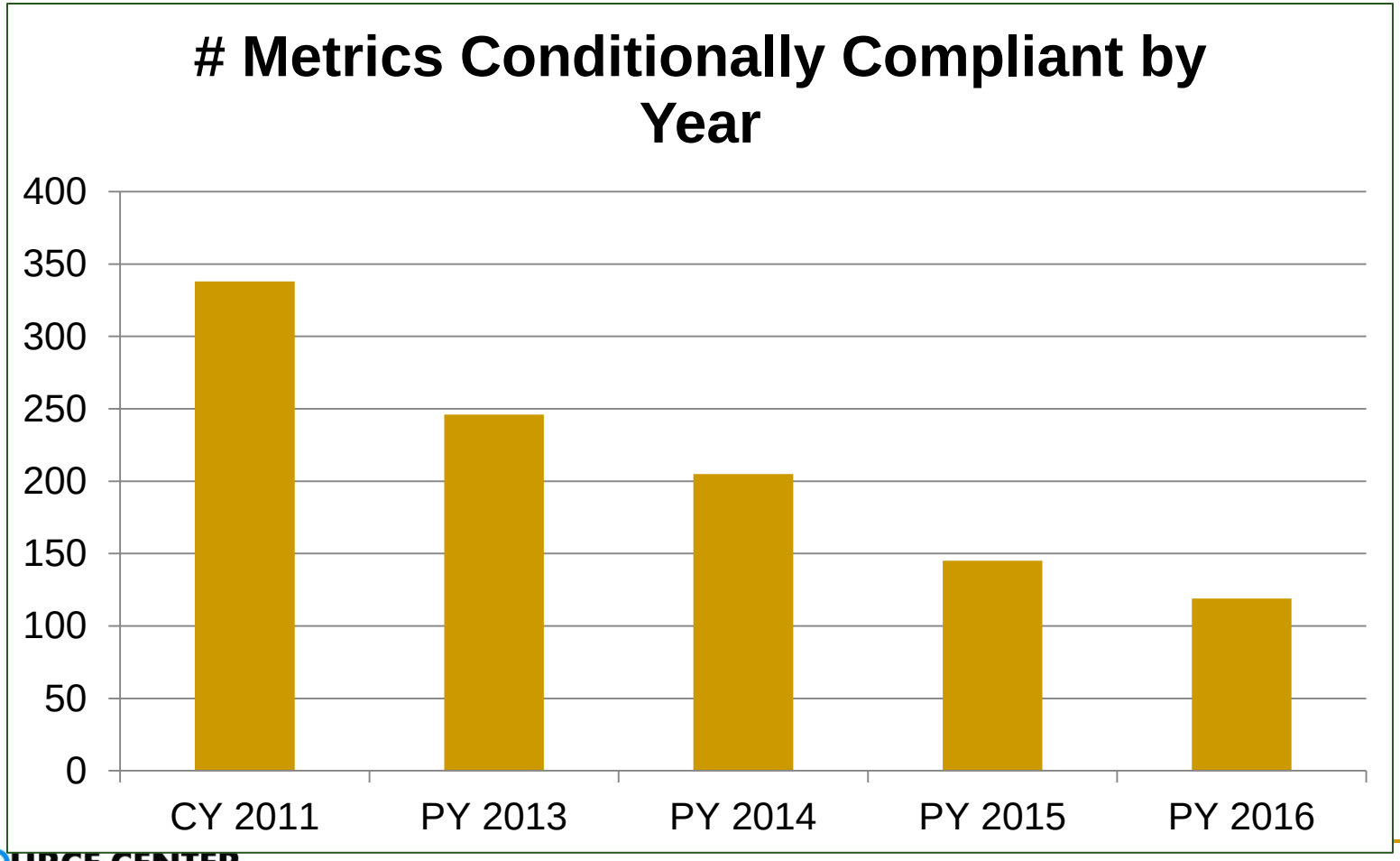
2016 NBIS Compliance



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Steel Bridge Technical Activities

- NHI Engineering for Stability in Bridge Construction (3½ day course now available)
- LRFD Superstructure Design Course update (complete)
- Bridge Information Modeling (BrIM) Standards (ongoing)
- Cooperative Agreement with Lehigh (ongoing)
  - Manual for Refined Analysis of Bridges
  - Tubular Member Design for Bridges
  - Reliability in Special Bridge Systems
  - Strengthening of Bridge Members
  - Orthotropic deck testing

Steel Bridge Technical Activities

- Steel Bridge Design Handbook update (12/15)
- NHI Fatigue and Fracture Course (late 2016)
- Design Specs for Non-composite Box Sections (late 2017)

Concrete Bridge Technical Activities

- Post-Tensioning Guidance & Training
  - PT Installation and Grouting Manual (E-doc on HIBS)
  - PT Installation and Grouting WBT (Available through NHI)
  - PT Box Girder Design Manual (Final Draft under Review)
  - Advanced PT Design Guidance (electrically isolated PT, replaceable grouted external PT)
  - Designing PT Systems to Accommodate NDE
    - Literature search complete & electrically isolated PT testing just starting

Concrete Bridge Technical Activities

- Advanced Precast Element Design Guidance & Training
  - Awarded to AASHTO w/ subcontract to PCI as primary developer (August 2014)
    - PCC Girder Design WBT (8 hrs)
    - Full-Depth Precast Deck Panel WBT (4 hrs)
    - PCC Girder Stability WBT (4 hrs)
    - Curved U-Beam Design Guidance & Criteria

FHWA/NHI Bridge Design and Analysis Courses (www.nhi.fhwa.dot.gov)

- NHI Course 130081: LRFD for Bridge Superstructures (4 day)
- NHI Course 130092: LRFR for Highway Bridges (4 day)
- NHI Course 130093: LRFD Seismic Analysis and Design of Bridges (4 ½ day)
- NHI Course 130094: LRFD Seismic Analysis and Design of Tunnels, Walls and other Geotechnical Features (4 day)
- NHI Course 130095: LRFD Design and Analysis of Skewed and Horizontally Curved Steel Bridges (2 ½ or 4 ½ days)

Safety and Security

- AT Planner for Bridge
  - A DHS developed assessment and design tool for bridges now available at US Army Corps of Engineers Protective Design Center software portal.
- Bridge Security Design Manual
  - Draft final manual is under review. Publication expected in early 2017 (probably in electronic format).
  - Will incorporate state of the art security mitigation to show engineers how to plan and design.
  - Design examples utilize the AT Planner for Bridge Tool

Bridge Load Rating Initiatives

- Develop policies and guidance in bridge load rating that improve the safety of our nation's bridges
  - FAST Act's Vehicles
  - SHVs, Concrete Box Culverts
- Provide stewardship to advance the state of practice in bridge load rating, posting and overweight permitting
  - Bridge Load Rating Peer Exchange

FHWA Bridge Load Rating Webinar Series

To further support State's efforts in meeting the NBIS's requirements in load rating and FHWA's initiative of implementing the LRFR method, a series of webinars have been planned to provide continued awareness for local, regional, and State transportation agencies.

No. 16: Bridge Load Rating for Overweight Load Permitting – State's Practice (3) (5/19/2015)

No. 17: Federal Bridge Formula Weights and State-Specific Legal Loads (10/21/2015)

No. 18: Load Rating and Posting for State-Specific Legal Loads (1) (2/24/2016)

Recordings are available at

https://www.fhwa.dot.gov/bridge/loadrating/

Load Rating Program Peer Exchanges

- Northeast States
  - CT, MA, ME, NH, NJ, NY, PN, RI and VT
  - Aug. 4-6, 2014, Manchester, NH
- Southeast States
  - AL, FL, GA, KY, LA, MS, NC, SC and TN
  - Sept. 1-3, 2015, Atlanta, GA
- Midwest States
  - IA, IL, IN, MI, MN, MO, OH and WI
  - August 30 - September 1, 2016

QUESTIONS

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FHWA Load Rating Policy

http://www.fhwa.dot.gov/pgc/index.cfm?ddisc=110&dsub=1148

- Load Rating for Specialized Hauling Vehicles (SHVs)
- Oversight of Bridge Load Ratings and Postings
- Assigned Load Ratings
- Etc…