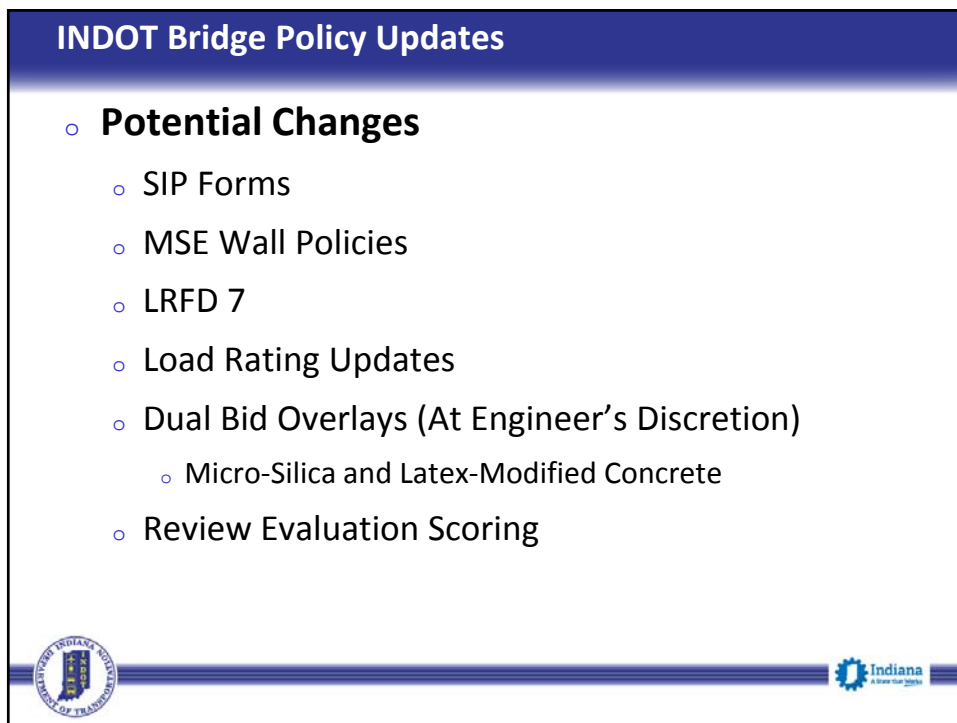






**Indiana Bridge  
Policy Updates**

Jeremy Hunter, P.E.  
Bridge Design and Load Rating Manager, INDOT  
February 16<sup>th</sup>, 2017





**INDOT Bridge Policy Updates**

- **Potential Changes**
  - SIP Forms
  - MSE Wall Policies
  - LRFD 7
  - Load Rating Updates
  - Dual Bid Overlays (At Engineer's Discretion)
    - Micro-Silica and Latex-Modified Concrete
  - Review Evaluation Scoring



### Load Rating For Deterioration

- **BrIM 3-6.01**
  - New Bridge and Superstructure Replacement Capacity Policy
  - *“New bridges and those with total superstructure replacement are to be rated using the LRFR methodology during the design load rating check.”*
  - *“The load rating factor for the design load rating shall be greater than 1.06.”*
    - Clarification on this policy is forthcoming

### Load Rating For Deterioration

- **BrIM 3-6.01 Interim Solution**
  - *“The load rating factor for the design load rating shall be greater than 1.06.”*
    - LRFD 1.3.5 – Operational Importance (Use 1.06)

**1.3.5—Operational Importance**

This Article shall apply to the strength and extreme event limit states only.

The Owner may declare a bridge or any structural component and connection thereof to be of operational priority.

For the strength limit state:



$\eta_r \geq 1.05$  for critical or essential bridges

$= 1.00$  for typical bridges

$\geq 0.95$  for relatively less important bridges.

For all other limit states:

$\eta_r = 1.00$

## INDOT Bridge Policy Updates

- **Bridge Design and Load Rating Personnel**
  - Plan Review and Load Rating Supervisor
    - George Snyder
  - Bridge Design Supervisors
    - Stephanie Wagner
    - Ron McCaslin
    - Mahmoud Hailat





## INDOT Bridge Policy Updates

- **Bridge Design and Load Rating Personnel**
  - Plan Review and Load Rating Supervisor
    - Oversees plan review process
      - Ensures timely turnaround for bridge reviews
      - Ensures quality and consistency for each bridge review
      - Considers and implements recommendations for bridge review process improvements
    - Oversees load rating submittals and requests





**INDOT Bridge Policy Updates**

- **Bridge Design and Load Rating Personnel**
  - Bridge Design Supervisors
    - Design In-House Projects
    - Perform Plan Review as-needed
    - Perform Load Ratings as-needed
    - Provide District Support for Bridge Needs
      - Design, Maintenance, Construction
    - Provide Bridge Standards Support
      - Indiana Design Manual and Specifications

**INDOT Bridge Policy Updates**

- **Bridge Design and Load Rating Personnel**
  - Bridge Design Supervisors
    - District Support For Bridges
      - Fort Wayne / Greenfield: Stephanie Wagner
      - Vincennes / Seymour: Ron McCaslin
      - Laporte / Crawfordsville: Mahmoud Hailat



**INDOT Bridge Policy Updates**

- **Bridge Standards Subject Matter Owners**
  - **Mahmoud Hailat**
    - Std. Spec. 609: RC Bridge Approaches
    - Std. Spec. 701: Driven Piling
    - Std. Spec. 707: Prestressed Concrete Structural Members
    - Std. Spec. 714: Reinforced Concrete Box Structures
    - Std. Spec. 731: MSE Walls
    - Std. Spec. 732: Modular Concrete Block Walls
    - Std. Spec. 733: Steel Bin Retaining Walls
    - Std. Spec. 734: Cut-Walls
    - Std. Spec. 735: Temporary Wire-Faced MSE Walls
    - IDM 406: Prestressed-Concrete Structure
    - IDM 408: Foundation
    - IDM 410: Earth-Retaining System




**INDOT Bridge Policy Updates**

- **Bridge Standards Subject Matter Owners**
  - **Stephanie Wagner**
    - Std. Spec. 702: STRUCTURAL CONCRETE
    - Std. Spec. 704: CONCRETE FLOOR SLABS
    - Std. Spec. 708: PNEUMATICALLY PLACED MORTAR
    - Std. Spec. 710: PATCHING CONCRETE STRUCTURES AND REPOINTING MASONRY IN STRUCTURES
    - Std. Spec. 711: STEEL STRUCTURES
    - Std. Spec. 722: LATEX MODIFIED CONCRETE BRIDGE DECK OVERLAYS
    - Std. Spec. 724: STRUCTURAL EXPANSION JOINTS
    - IDM 404: Bridge Deck
    - IDM 407: Steel Structure
    - IDM 412: Bridge Rehabilitation

## INDOT Bridge Policy Updates

- **Bridge Standards Subject Matter Owners**
  - **Ron McCaslin**
    - Std. Spec. 703: REINFORCING BARS
    - Std. Spec. 705: SIDEWALKS ON STRUCTURES
    - Std. Spec. 706: BRIDGE RAILINGS
    - Std. Spec. 712: TIMBER STRUCTURES
    - Std. Spec. 723: REINFORCED CONCRETE THREE-SIDED STRUCTURES
    - Std. Spec. 726: BEARING ASSEMBLIES
    - IDM 402: Structure Size & Type
    - IDM 403: Load Analysis & Application
    - IDM 405: Reinforced-Concrete Structure
    - IDM 409: Abutment, Bent, Pier, & Bearing
    - IDM 411: Precast, Prefabricated Structure (in development)
    - IDM 413: Wood/Other Structures



## INDOT Bridge Policy Updates

- **Bridge Standards Subject Matter Owners**
  - Seeking your support
  - Contact one the subject matter owner if you would like to be an a reference when questions arise for a particular specification or design manual section



**INDOT Bridge Policy Updates**

## Work Zone Safety Awareness



**Work Zone Safety is Everyone's Responsibility**

We all are responsible for driving, walking and biking safely through roadway work zones.

Engineers, planners and workers are charged with ensuring the work zone is designed and operated with safety in mind.

Motorists and pedestrians have a responsibility to be alert, obey traffic laws and signs, and use common sense to safely navigate roadway work zones.

Everyone has a role in work zone safety.



**INDOT Bridge Policy Updates**

- **Work Zone Safety**
  - Opportunities
    - Worker Protection
      - Temporary Traffic Barrier (Concrete or Moveable depending on application)
      - Truck or Trailer Mounted Attenuators
    - Queue Mitigation
    - Driver Awareness



## INDOT Bridge Policy Updates

- **Work Zone Safety**
  - Engage with Industry
    - Ask questions
    - Have critical conversations
  - Seek Innovative Solutions
    - Concepts, Equipment
  - Collaboration
    - Standards and specifications



# INDOT Updates


Elizabeth Phillips, P.E.  
Standards and Policy, INDOT

INDOT Bridge Design Conference – February 16, 2017







## INDOT Updates






- *Doing Business with INDOT* → *Standards & Specifications*
- 2018 *SS* effective for lettings on or after September 1, 2017.
- Incorporates changes approved by the Standards Committee from Mar. 2016 – Feb. 2017
- Most changes are currently RSPs, some go into effect with the 2018 book.
- When published, full list of revisions is on-line.

## Coordination of Bridge Inspection

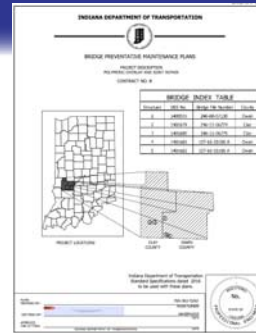
- Design Memo 16-05
  - issued March 2016,
  - effective September 2016 lettings
- Raise awareness of federal bridge inspection requirements.
- Completion of RSP 105-C-247 to identify bridges within the construction limits, due date for inspection, the type of inspection required, and frequency.
- For current District Bridge Inspectors, contact Bridge Inspection Office at [INbridgeshelp@indot.in.gov](mailto:INbridgeshelp@indot.in.gov)



## Plan Sheet Sizes

- Design Memo 16-07
  - issued March 2016, Rev. Nov. 2016
- Guidance on the use of letter-size (8½ x 11) and full-size (24 x 36 or 22 x 34) plans.
  - Signing and sealing
  - Review
  - Signing “Approved for Letting”
  - ERMS Document Type for small plans revised to “Final Tracings”



## Shop Drawing Review

- Design Memo 16-08
  - issued March 2016
- Updated IDM to reflect information from Construction Memo 13-13
- Reminder to forward a copy of approved LPA structural member shop drawings to George Snyder.
- Clarification that each sheet for structural member shop drawings must contain the signed and dated approval stamp



## Bridge Deck Drains



- Design Memo 16-09
  - issued March 2016
  - Effective September 2016 lettings
- Method of Measurement and Basis of Payment for “Grates, Basins, and Fittings” changed from LBS to EACH
- Pay item includes both the casting and the grate.



## Storm Water Management, E&SC

- Design Memo 16-11, Eff. September 2016 letting
  - Use of RSP 205-R-636, Storm Water Management
  - E&SC items rolled into a single (DOL) pay item.
    - Threshold of 1% of construction cost as check
  - SWQCP Preparation and Implementation pay item (LS)
    - Contractor must hold necessary Level 1 or Level 2 certification.
    - Level for project determined collaboratively among Environmental Services, designer, and Area Engineer.
- Design Memo 16-27, Eff. January 2017 letting
  - Clarifies language and principles of E&SC
  - Specifies additional plan detailing



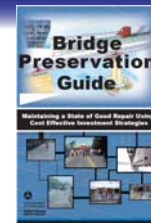
## Curb Ramps & Sidewalks

- Design Memos 16-12, Eff. September 2016 letting
  - 604-SWCR and 604-SWDK Standard Drawings updated to PROWAG
  - RSP 604-R-633, Curb Ramps, Landings and Detectable Warning Surfaces
    - Single pay item for Curb Ramp, Concrete
    - New pay items for Detectable Warning Surfaces and Detectable Warning Surfaces, Retrofit
  - Use of preferred slopes, ~.5% less than max. for design
  - Plan detailing guidelines
- Design Memos 16-33, Sidewalk Width on Bridge
  - 6-in. curb width must be assumed where sidewalk is poured monolithically



## IDM Ch. 412, Bridge Preservation

- Design Memos 16-13
  - BCPI preventative maintenance (PM) treatments and associated bridge component condition ratings incorporated.
  - Discussion on distinction between Bridge PM and Bridge Rehabilitation projects.
  - An LPA may participate in bridge preventative maintenance activities with an INDOT-approved Bridge Asset Management Plan (BAMP).
    - Asset Management for LPA Bridges document is available from the Local Public Agency Programs website <http://www.in.gov/indot/2390.htm>, under New Items
  - Chapter 14 revised to include plan development information for Bridge Preventative Maintenance projects



## Fiber Wrap and Integral End Bents

- Design Memo 16-31, Fiber Wrap
  - Reiterated the Department's practice that externally bonded fiber reinforced polymer (FRP) materials, "fiber wrap".
    - Can be used for concrete repair
    - Cannot not be considered as having improved the load-carrying capacity of the bridge component
  - Chapter 412 revised accordingly.
- Design Memo 16-32, Integral End Bents
  - Maximum allowable integral end bent depth set to 6 ft.
  - Design assumptions and typical reinforcing details may not be appropriate for deeper end bents.
  - Exceptions require approval by Office of Bridge Design



## MASH Updates

### ■ NCHRP 350 to MASH 2016

- Manual for Assessing Safety Hardware (MASH) replaces NCHRP 350 as the current crash testing standard for safety hardware.
- Since 2011, all new products had to be tested under MASH. Hardware accepted under NCHRP 350 can still be installed. \*



### ■ Why did it change?

- Vehicles have increased in size and light truck bumper heights have risen since the NCHRP Report 350 criteria were adopted in 1993
- Updated crash test criteria was based primarily on changes in the vehicle fleet.

\* For right now



## MASH Updates





\* AASHTO-FHWA Implementation Agreement signed January 2016. "For contracts on the National Highway System with a letting date after the dates below, only safety hardware evaluated using the 2016 edition of MASH criteria will be allowed for new permanent installations and full replacements."

- December 31, 2017: w-beam barriers and cast-in-place concrete barrier
- June 30, 2018: w-beam terminals
- December 31, 2018: cable barriers, cable barrier terminals, and crash cushions
- December 31, 2019: bridge rails, transitions, all other longitudinal barriers (including portable barriers installed permanently), all other terminals, sign supports, and all other breakaway hardware
- Temporary work zone devices, including portable barriers, manufactured after December 31, 2019, must have been successfully tested to MASH.



## MASH Updates

### NCHRP 350 vs. MASH: Vehicles

Vehicle Class	NCHRP 350	MASH 2009
Small car 	820C Weight: 1,809 lb	1100C Weight: 2,420 lb
Pickup Truck 	2000P Weight: 4,409 lb	2270P Weight: 5,000 lb Min. c.g. height: 28 in.
Single Unit Truck 	8000S Weight: 17,636 lb	10000S Weight: 22,000 lb
Tractor Trailer 	36000V Weight: 79,366 lb	36000V Weight: 79,300 lb



Source: AASHTO Technical Committee on Roadside Safety



## MASH Updates

### Longitudinal Barrier Impact Conditions

Test Level	Test Vehicle	NCHRP 350	MASH 2009
TL-3	Small Car	Speed: 62 mph Angle: 20°	Speed: 62 mph Angle: 25°
TL-3	Pickup	Speed: 62 mph Angle: 25°	Speed: 62 mph Angle: 25°
TL-4	S.U.T.	Speed: 50 mph Angle: 15°	Speed: 56 mph Angle: 15°
TL-5	Tractor Trailer	Speed: 50 mph Angle: 15°	Speed: 50 mph Angle: 15°

Source: AASHTO Technical Committee on Roadside Safety

## AASHTO LRFD Specifications

### Table A13.2-1 Design Forces for Traffic Railing

Design Forces and Designations	TL-1	TL-2	TL-4	MASH TL-4
$P_t$ Transverse (kips)	13.5	27.0		
$F_L$ Longitudinal (kips)	4.5	9.0		
$F_v$ Vertical (kips) Down	4.5	4.5	54.0	67.2
$L_v$ and $L_d$ (ft)	4.0	4.0	18.0	21.6
$L_x$ (ft)	18.0	18.0	18.0	37.8
$H_r$ (min) (in.)	18.0	20.0	3.5	4.0
Minimum $H$ Height of Rail (in.)	27.0	27.0	18.0	
			32.0	25.1
			32.0	36.0


Figure A13.2-1—Metal Bridge Railing Design Forces, Vertical Location, and Horizontal Distribution Length

NOTE: The MASH design forces shown are preliminary. Final values will be those published in future editions of the LRFD Bridge Design Specifications

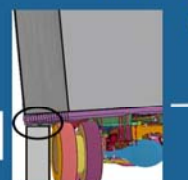
## MASH Updates

### INFLUENCE OF BARRIER HEIGHT ON IMPACT LOAD

Lateral force increases as barrier height increases  
 Vehicle contact area changes (box structure engaged)  
 Less vehicle roll (more mass engaged)




Floor of the box is not engaged in the impact

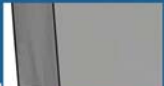


Floor of the box is engaged in the impact


Comparison of contact area




36 in. Tall Barrier



42 in. Tall Barrier



Source: Texas Transportation Institute




## MASH Updates


### SUMMARY OF MASH TL-4 LOADS ON RIGID BARRIERS

Design Forces and Designations	Barrier Height (in.)			
	36	39	42	Tall
$F_L$ Lateral (kip)	67.2	72.3	79.1	93.3
$F_L$ Long. (kip)	21.6	23.6	26.8	27.5
$F_V$ Vertical (kip)	37.8	32.7	22	NA
$L_l$ and $L_l$ (ft)	4	5	5	14
$H_e$ (in.)	25.1	28.7	30.2	45.5

$L_l$  = longitudinal distribution of  $F_l$   
 $H_e$  = vertical resultant height of  $F_l$



Source: Texas Transportation Institute





## MASH Updates

### CONCLUSIONS FOR MASH TL-4 LOADS


Minimum barrier height for truck stability = 36 inches.

Magnitude and resultant height of lateral impact force ( $F_t$ ) varies with barrier height.


For 36-inch tall barrier:  $F_t = 67.2$  kips and  $H_e = 25.1$  in.  
 For 42-inch tall barrier:  $F_t = 79.1$  kips and  $H_e = 30.2$  in.

Although  $F_t$  has 24% increase for 36-inch tall MASH TL-4 barrier compared to Table A13.2-1 *Design Forces for Traffic Railings*, associated moment for deck cantilever design does not change.

Table A13.2-1 → 54 kips x 32 in. = 1,728 in-kips  
 MASH 36-inch barrier → 67.2 kips x 25.1 in. = 1,687 in-kips





Source: Texas Transportation Institute



## MASH Updates

### How is INDOT responding the new requirements for Guardrail?

- INDOT is moving from strong-post w-beam guardrail to the Midwest Guardrail System (MGS) in anticipation of the Dec. 2017 deadline.
  - top rail height of 31 in., 8 in. blockout, mid-span splice.
  - uses a 6-ft post with an embedment depth of 3'-4".  
Requires a 2-ft offset from the back of post to the slope break (hinge point)
- Remaining 600-series standard drawings will be revised, eliminated, or designated as For Maintenance Only.
- Review of policy for existing non-MASH systems on-going.
- MASH-Compliant Guardrail End Treatments are being evaluated for inclusion on the Approved Material List.

## MASH Updates

### How is INDOT responding the new requirements for Bridge Railing?

- Updating the Type FC bridge railing to 39 in.
  - FT railing will remain unchanged and acceptable as TL-5
- Reviewing the Bridge Railing Test Level policy.
- Reviewing test level selection charts.
  - NCHRP 22-12(03), Bridge Railing Test Level Selection was proposed to updated for MASH
- Monitoring the progress of NCHRP 20-7 (Task 395)
  - Prioritizing bridge railing for full scale crash testing
  - Completing crash testing as funding allows.



## MASH Resources

- FHWA Roadside Hardware Policy and Guidance webpage  
[https://safety.fhwa.dot.gov/roadway\\_dept/policy\\_guide/road\\_hardware/#crashworthy](https://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/#crashworthy)
- FHWA Roadway Departure Research and Resources webpage  
[https://safety.fhwa.dot.gov/roadway\\_dept/research/](https://safety.fhwa.dot.gov/roadway_dept/research/)
- Roadside Safety Research Program Pooled Fund Study  
<https://www.roadsidepooledfund.org/>



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