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MEMORANDUM

TO: ALL CONSULTANTS
ALL BRIDGE DESIGNERS

FROM: HOSSEIN GHARA, P.E.
BRIDGE DESIGN ADMINISTRATOR

SUBJECT: BRIDGE DESIGN TECHNICAL MEMORANDUM NO. 28 REV. NO. 1 (BDTM.28.1)
LOUISIANA DESIGN VEHICLE LIVE LOAD 2011 (LADV-11)

DATE: AUGUST 26, 2011

Revision No. 1 Summary:

An additional magnification factor (MF) has been incorporated for the design of bearings. The bearing pads shown on the Miscellaneous Span and Girder Details are not designed for use with the LADV-11. Clarification concerning the use of the MFs has also been provided. All changes to the original content of BDTM.28 are shown in **bold**. The attached LADV-11 Magnification Factor Table and example hand calculations have been changed.

BDTM.28.1

Effective immediately for all projects prior to the 60% final plan stage **(as of April 5, 2011)**, the following provisions for the new Louisiana Design Vehicle Live Load 2011 (LADV-11) shall be implemented for the design of all bridges in Louisiana.

The LADV-11 was developed to provide a live load model that is representative of routine permit vehicles in Louisiana, which are not enveloped by the HL-93. Designs using the LADV-11 will meet the minimum service and strength requirements for these vehicles and satisfy load rating and evaluation criteria.

The LADV-11 is the product of the force effects produced by the HL-93 design live load, as specified in the AASHTO LRFD Bridge Design Specifications (Fifth Edition, 2010), and a magnification factor (MF). The MFs were developed through rigorous analysis of the load effects of the aforementioned permit vehicles and the HL-93 load on simple and continuous span bridges with varying span lengths.

For all simple and continuous spans, the MF for all **live load** force effects **at** all limit states shall be determined using the attached LADV-11 Magnification Factor Table. The value of the MF varies and is a function of the span length. Three example hand calculations have been attached to illustrate the use of the LADV-11 Magnification Factor Table.

The appropriate MF shall be applied to the HL-93 design load, including both the design truck or tandem, and the design lane load for the design of all bridge elements excluding the bridge deck. The design loading for bridge decks will remain unchanged with the advent of the LADV-11. **However, slab span bridge superstructures are not exempt from the MF. Braking forces (BR), being the directly correlated to the design live load vehicle, should also be multiplied by the appropriate MF. Dynamic Load Allowance (IM) will remain unchanged and should continue to be applied where appropriate.** Use of the LADV-11 shall be indicated on the General Notes plan sheet under "Design Criteria".

The "Louisiana Special Design Vehicles", as shown on pages 3(1) and 3(3) of the LADOTD LRFD Bridge Design Manual, Version 2008.1 (September 17, 2008), and all design requirements relating thereto shall be deleted. The LADV-11 will envelop the load effects from these special design vehicles. BDTM.2, which increased the Live Load Factor for the Service III Limit State to 1.0, remains in effect.

DOTD is in the process of revising all special details to incorporate these changes and will publish them as soon as possible. Published special details that are currently available shall not be used for projects that require the use of the LADV-11. **Please note that the bearing pads shown on the Miscellaneous Span and Girder Details are not designed to accommodate the LADV-11 and will be removed from the sheets. Any projects that require the use of the LADV-11 will also require bearings to be designed and detailed specific to the project.** Please contact the DOTD Bridge Standards Manager, Mr. Paul Vaught (225-379-1816, paul.vaughtiii@la.gov), for questions concerning the availability of the revised special details.

This technical memorandum will be posted on the Bridge Design Website: http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Bridge_Design/Pages/Technical-Memoranda.aspx

Please contact Ms. Zhengzheng "Jenny" Fu (225-379-1321, zhengzheng.fu@la.gov) if you have questions or comments.

HG/zzf/pv
Attachments

Cc: Richard Savoie (Chief Engineer)
Janice Williams (Chief, Project Development Division)
Art Aguirre (FHWA)

LADV-11 Magnification Factor Table		
Load Effect	Range of Applicability	Magnification Factor (MF)*
M^+, V	$S \leq 240$	1.30
	$240 < S < 600$	1.30 - 0.00083(S - 240)
	$S \geq 600$	1.00
M^-	$S \leq 100$	1.30
	$100 < S < 240$	1.30 - 0.00214(S - 100)
	$S \geq 240$	1.00
R_B	**All Span Lengths**	**1.60**
R_F	$S_1 + S_2 \leq 100$	1.30
	$100 < S_1 + S_2 < 240$	$1.30 - 0.00214(S_1 + S_2 - 100)$
	$S_1 + S_2 \geq 240$	1.00
R_S	$S_1 + S_2 \leq 100$	1.55
	$100 < S_1 + S_2 < 600$	$1.55 - 0.00110(S_1 + S_2 - 100)$
	$S_1 + S_2 \geq 600$	1.00

* Equations are linear interpolations between the upper and lower values of the MFs

S = Span Length, feet (use the shortest span length for unequal continuous spans)

$S_1 + S_2$ = Sum of Span 1 Length and Span 2 Length on either side of the support, feet (for end bents use the approach slab length as S_1 and the span length as S_2)

M^+ = Positive Moment **(use for design of superstructure elements only)**

M^- = Negative Moment **(use for design of superstructure elements only)**

V = Shear **(use for design of superstructure elements only)**

R_B = Bearing Reaction (use for design of bearings only)

R_F = Factored Support Reaction **(use for design of all substructure elements and determination of factored pile / shaft loads)**

R_S = Service Support Reaction **(use for determination of service pile / shaft loads only)**

Example 1: Multiple simply supported slab spans (20 ft) with 40 ft approach slabs

Span

$S = 20$ ft

$MF(M^+, V) = 1.30$

$MF(M^-) = N/A$

$\mathbf{R_B = 1.60}$

End Bent

$S_1 = 40$ ft; $S_2 = 20$ ft → $S_1 + S_2 = 60$ ft

$MF(R_F) = 1.30$

$MF(R_S) = 1.55$

Intermediate Bent

$S_1 = 20$ ft; $S_2 = 20$ ft → $S_1 + S_2 = 40$ ft

$MF(R_F) = 1.30$

$MF(R_S) = 1.55$

Example 2: Two-span continuous girder unit (120 ft - 130 ft) adjacent to 75 ft spans on both sides

Span

$S = 120$ ft

$MF(M^+, V) = 1.30$

$MF(M^-) = 1.30 - 0.00214(S - 100) = 1.26$

$\mathbf{R_B = 1.60}$

Transition Bent 1

$S_1 = 75$ ft; $S_2 = 120$ ft → $S_1 + S_2 = 195$ ft

$MF(R_F)_1 = 1.30 - 0.00214(S_1 + S_2 - 100) = 1.10$

$MF(R_S)_1 = 1.55 - 0.00110(S_1 + S_2 - 100) = 1.45$

Intermediate Bent

$S_1 = 120$ ft; $S_2 = 130$ ft → $S_1 + S_2 = 250$ ft

$MF(R_F) = 1.00$

$MF(R_S) = 1.55 - 0.00110(S_1 + S_2 - 100) = 1.39$

Transition Bent 2

$S_1 = 130$ ft; $S_2 = 75$ ft → $S_1 + S_2 = 205$ ft

$MF(R_F)_2 = 1.30 - 0.00214(S_1 + S_2 - 100) = 1.08$

$MF(R_S)_2 = 1.55 - 0.00110(S_1 + S_2 - 100) = 1.43$

Example 3: Three-span continuous girder bridge (250 ft - 300 ft - 250 ft) with 40 ft approach slabs

Span

$S = 250$ ft

$MF(M^+, V) = 1.30 - 0.00083(S - 240) = 1.29$

$MF(M^-) = 1.00$

$\mathbf{R_B = 1.60}$

End Bent

$S_1 = 40$ ft; $S_2 = 250$ ft → $S_1 + S_2 = 290$ ft

$MF(R_F) = 1.00$

$MF(R_S) = 1.55 - 0.00110(S_1 + S_2 - 100) = 1.34$

Intermediate Bent

$S_1 = 250$ ft; $S_2 = 300$ ft → $S_1 + S_2 = 550$ ft

$MF(R_F) = 1.00$

$MF(R_S) = 1.55 - 0.00110(S_1 + S_2 - 100) = 1.06$