Montana Department of Transportation	**Bridge Memo Number:** 15-02
	Date Issued: June 9, 2015
	Date Effective: June 9, 2015
Bridge Design / Management Memo	**Date Revised:**
Subject: LRFD Bridge Deck Design	

To: Bridge Bureau
Consultant Design Bureau

From: Kent M. Barnes, P.E.
Bridge Engineer

☒ **In-House Design**	☒ **Consultant Design**
☒ **Bridge Management**	☐ **Condition Inspection**

Introduction

MDT has reviewed and updated our standards for LRFD Bridge Deck Design. The review included both design details such as concrete cover and the design calculations.

Policy / Guidelines

Use the following parameters for LRFD Deck Design for routine cases.

- Concrete Cover over Top Reinforcement, 2½ Inches
- Concrete Cover over Bottom Reinforcement, 1 Inch
- Assumed Concrete Strength, f_c' = 4 ksi
- Assumed Steel Yield Strength. f_y = 60 ksi

There may be special cases where alternate values should be used.

The attached "LRFD Deck Design Chart", and the associated spreadsheet that is available from the Bridge Bureau, may be used for LRFD bridge deck design.

These parameters apply to all projects that haven't been detailed at the date of this memo.

Closing

The changed concrete cover and updated Deck Design chart and spreadsheet should help promote consistency, ease of construction, and improved deck life.

KMB:BRIDGE MEMO 15-02

Attachment: LRFD Deck Design Chart

Copies Consultant Design
file

Cover Over Top Reinforcing	**2 1/2**	in
Assumed Integral Wearing Depth	**1/2**	in
Cover Over Bottom Reinforcing	**1**	in
f_y = **60** ksi	f_c' = **4**	ksi

LRFD Deck Design Chart
Normal Traffic Loading Based on Beam Spacing *

AASHTO 9.7.3 Traditional Design
AASHTO 4.6.2 Approximate Methods of Analysis
Using Table A4-1 Maximum Live Load Moments

Beam Spacing S	Deck t	Btm Trans Bar Size	Btm Trans Spacing	Top Trans Bar Size	Top Transverse Steel Spacing *						Distribution Steel	Number Required					
					MT-28	A	IV	M72	MTS-All	Steel	Dist Size	MT-28	A	IV	M72	MTS-All	Steel
4' - 0"	7 1/2	# 5	10	# 5	12	11	11 1/2	12	12	10 1/4	# 4	4	5	5	4	3	5
4' - 3"	7 1/2	# 5	10	# 5	12	10 1/4	10 3/4	11 1/2	12	9 3/4	# 4	4	5	5	5	4	6
4' - 6"	7 1/2	# 5	10	# 5	11 1/2	9 1/2	10	11	12	9	# 4	5	6	5	5	4	6
4' - 9"	7 1/2	# 5	10	# 5	11	9	9 1/4	10 1/4	12	8 1/4	# 4	5	6	6	5	4	6
5' - 0"	7 1/2	# 5	10	# 5	10 3/4	8 1/2	8 3/4	10	11 3/4	7 3/4	# 4	5	6	6	6	5	7
5' - 3"	7 1/2	# 5	10	# 5	10 1/4	8	8 1/2	9 1/2	11 1/4	7 1/4	# 4	6	7	6	6	5	7
5' - 6"	7 1/2	# 5	10	# 5	9 3/4	7 1/2	8	9	11	7	# 4	6	7	7	6	5	7
5' - 9"	7 1/2	# 5	9 3/4	# 5	9 1/2	7 1/4	7 3/4	8 3/4	10 1/2	6 3/4	# 4	6	7	7	7	6	8
6' - 0"	7 1/2	# 5	9 3/4	# 5	9	7	7 1/4	8 1/4	10 1/4	6 1/2	# 4	7	8	7	7	6	8
6' - 3"	7 1/2	# 5	9 1/2	# 5	8 3/4	6 3/4	7	8	10	6 1/4	# 4	7	8	8	7	6	9
6' - 6"	7 1/2	# 5	9 1/2	# 5	8 1/2	6 1/2	7	7 3/4	9 1/2	6	# 4	8	9	8	8	7	9
6' - 9"	7 1/2	# 5	9 1/4	# 5	8 1/4	6 1/4	6 3/4	7 1/2	9 1/4	5 3/4	# 4	8	9	9	8	7	10
7' - 0"	7 1/2	# 5	9	# 5	7 3/4	6	6 1/4	7 1/4	9	5 1/2	# 4	9	10	9	9	8	10
7' - 3"	7 3/4	# 5	9 1/4	# 5	8	6 1/4	6 1/2	7 1/4	9	5 3/4	# 4	9	10	10	9	8	10
7' - 6"	7 3/4	# 5	9	# 5	7 3/4	6	6 1/4	7 1/4	8 3/4	5 1/2	# 4	9	10	10	10	9	11
7' - 9"	7 3/4	# 5	8 3/4	# 5	7 1/2	6	6 1/4	7	8 1/4	5 1/2	# 4	10	11	11	10	9	12
8' - 0"	7 3/4	# 5	8 1/2	# 5	7 1/4	5 3/4	6	6 3/4	7 3/4	5 1/2	# 4	10	12	11	11	10	12
8' - 3"	7 3/4	# 5	8 1/4	# 5	7	5 3/4	6	6 3/4	7 1/2	5 1/4	# 4	11	12	12	12	10	13
8' - 6"	7 3/4	# 5	8	# 5	7	5 1/2	6	6 1/2	7 1/4	5 1/4	# 4	12	13	13	12	11	14
8' - 9"	8	# 5	8	# 5	7	5 3/4	6	6 3/4	7 1/2	5 1/2	# 4	12	13	13	12	11	14
9' - 0"	8	# 5	7 3/4	# 5	7	5 3/4	6	6 3/4	7 1/4	5 1/4	# 4	13	14	14	13	12	15
9' - 3"	8	# 5	7 3/4	# 5	6 3/4	5 3/4	6	6 1/2	7	5 1/4	# 4	13	15	14	14	13	16
9' - 6"	8	# 5	7 1/2	# 5	6 1/2	5 1/2	5 3/4	6 1/4	6 3/4	5	# 4	14	16	15	15	13	16
9' - 9"	8	# 5	7 1/4	# 5	6 1/2	5 1/4	5 1/2	6	6 1/2	5	# 4	15	16	16	15	14	17
10' - 0"	8 1/4	# 5	7 1/4	# 5	6 1/2	5 1/4	5 1/2	6	6 1/2	5	# 4	15	17	16	16	14	17
10' - 3"	8 1/4	# 5	7 1/4	# 5	6 1/4	5	5 1/4	5 3/4	6 1/4	4 3/4	# 4	16	17	17	16	15	18
10' - 6"	8 1/4	# 5	7	# 5	6	5	5	5 1/2	6 1/4	4 3/4	# 4	17	18	18	17	16	19
10' - 9"	8 1/4	# 6	9 1/2	# 6	7	6	6	6 3/4	7 1/4	5 1/2	# 5	12	13	13	12	11	14
11' - 0"	9	# 6	10	# 6	7 3/4	6 1/2	6 3/4	7 1/4	8	6 1/4	# 5	11	12	12	12	11	13
11' - 3"	9	# 6	9 3/4	# 6	7 1/2	6 1/4	6 1/2	7	7 3/4	6	# 5	12	13	13	12	11	13
11' - 6"	9	# 6	9 3/4	# 6	7 1/4	6 1/4	6 1/4	6 3/4	7 1/2	6	# 5	12	13	13	13	12	14
11' - 9"	9	# 6	9 1/2	# 6	7	6	6 1/4	6 3/4	7 1/4	5 3/4	# 5	13	14	14	13	12	14
12' - 0"	9	# 6	9 1/2	# 6	6 3/4	5 3/4	6	6 1/2	7	5 1/2	# 5	13	14	14	14	13	15
12' - 3"	9 1/2	# 6	9 3/4	# 6	7	6 1/4	6 1/4	6 3/4	7 1/2	6	# 5	13	14	14	14	13	14
12' - 6"	9 1/2	# 6	9 3/4	# 6	6 3/4	6	6 1/4	6 1/2	7 1/4	5 3/4	# 5	14	14	14	14	13	14
12' - 9"	9 1/2	# 6	9 1/2	# 6	6 3/4	6	6	6 1/2	7	5 3/4	# 5	14	15	15	14	14	15
13' - 0"	10	# 6	9 3/4	# 6	7	6 1/4	6 1/4	6 3/4	7 1/4	6	# 5	14	14	14	14	14	14
13' - 3"	10	# 6	9 3/4	# 6	6 3/4	6	6 1/4	6 1/2	7 1/4	5 3/4	# 5	14	15	15	14	14	15
13' - 6"	10	# 6	9 1/2	# 6	6 3/4	6	6	6 1/2	7	5 3/4	# 5	15	15	15	15	14	15
13' - 9"	10 1/2	# 6	9 3/4	# 6	7	6 1/4	6 1/4	6 3/4	7 1/4	6	# 5	14	15	15	14	14	15
14' - 0"	10 1/2	# 6	9 3/4	# 6	6 3/4	6	6 1/4	6 1/2	7	6	# 5	15	15	15	15	14	15
14' - 3"	10 1/2	# 6	9 1/2	# 6	6 3/4	6	6 1/4	6 1/2	7	5 3/4	# 5	15	15	15	15	15	16
14' - 6"	11	# 6	9 3/4	# 6	7	6 1/4	6 1/4	6 3/4	7 1/4	6	# 5	15	15	15	15	14	15
14' - 9"	11	# 6	9 3/4	# 6	6 3/4	6 1/4	6 1/4	6 1/2	7	6	# 5	15	15	15	15	15	16
15' - 0"	11	# 6	9 3/4	# 6	6 3/4	6	6 1/4	6 1/2	7	6	# 5	15	16	16	15	15	16

*** Check Top Transverse Steel Spacing for Crash Loading on the Overhang. Use the controlling Spacing**

Version 1 Released 06/09/15

Minimum total overhang width of 21.0 in. measured from the center of the exterior beam.
Maximum total overhang width equal to the smaller of 0.625 times the beam spacing and 6.0 ft.
A railing system width of 21.0 in. was used to determine the clear overhang width.
Minimum three beams. Not less than 14.0 ft. between centerlines of exterior beams.

Dead Load assumed as $M = w l^2 / 10$ for M+ and M- in the bays.
Deck Dead Load $M = 0.150\ t\ l^2 / 120$ ft-k/ft LF = 1.25
Future Wearing Surface $M = 0.020\ l^2 / 10 = 0.002\ l^2$ ft-k/ft LF = 1.5
t = Deck thickness, in l = beam spacing, ft

LRFD Deck Overhang Design
Top Transverse Reinforcement for Barrier or Rail Impact Loads

		Concrete Barrier Systems						Rail Systems					
		Top Transverse Steel Spacing						**Top Transverse Steel Spacing**					
Overhang * Ft	**Top Trans Bar Size**	**MT-28**	**A**	**IV**	**M72**	**MTS-All**	**Steel**	**MT-28**	**A**	**IV**	**M72**	**MTS-All**	**Steel**
0' - 0"	# 5	8 3/4	8 3/4	8 3/4	8 3/4	8 3/4	8 3/4	5 1/4	5	5 1/4	5 1/4	5 1/2	5
1' - 9"	# 5	8 3/4	8 3/4	8 3/4	8 3/4	8 3/4	8 3/4	5 3/4	5 1/2	5 1/2	5 3/4	6	5 1/2
2' - 0"	# 5	8 3/4	8 1/2	8 1/2	8 3/4	8 3/4	8 1/4	6	5 3/4	5 3/4	6	6 1/4	5 3/4
2' - 3"	# 5	8 3/4	8 1/4	8 1/4	8 3/4	8 3/4	8	6 1/4	6	6	6 1/4	6 1/2	6
2' - 6"	# 5	8 1/2	8	8	8 1/4	8 3/4	7 3/4	6 1/2	6 1/4	6 1/4	6 1/2	6 1/2	6
2' - 9"	# 5	8 1/4	7 1/2	7 3/4	8	8 3/4	7 1/2	6 1/2	6 1/4	6 1/2	6 1/2	6 1/2	6 1/4
3' - 0"	# 5	8	7 1/4	7 1/2	7 3/4	8 1/4	7 1/4	6 1/2	6 1/2	6 1/2	6 1/2	6 1/2	6 1/4
3' - 3"	# 5	7 3/4	7	7 1/4	7 1/2	8	7	6 1/2	6 1/2	6 1/2	6 1/2	6 1/2	6 1/2
3' - 6"	# 5	7 1/2	6 3/4	7	7 1/4	7 3/4	6 3/4	6 1/2	6 1/2	6 1/2	6 1/2	6 1/2	6 1/2
3' - 9"	# 5	7 1/4	6 3/4	6 3/4	7	7 1/2	6 1/2	6 1/2	6 1/2	6 1/2	6 1/2	6 1/2	6 1/2
4' - 0"	# 5	7	6 1/2	6 1/2	6 3/4	7 1/4	6 1/4	6 1/2	6 1/4	6 1/2	6 1/2	6 1/2	6 1/4
4' - 3"	# 5	6 3/4	6 1/4	6 1/4	6 1/2	7	6 1/4	6 1/2	6 1/4	6 1/4	6 1/2	6 1/2	6
4' - 6"	# 5	6 1/2	6	6	6 1/4	6 3/4	6	6 1/2	6	6	6 1/4	6 1/2	6
4' - 9"	# 5	6 1/4	5 3/4	6	6 1/4	6 1/2	5 3/4	6 1/4	5 3/4	6	6	6 1/2	5 3/4
5' - 0"	# 5	6	5 3/4	5 3/4	6	6 1/4	5 1/2	6	5 3/4	5 3/4	6	6 1/4	5 1/2
5' - 3"	# 5	6	5 1/2	5 1/2	5 3/4	6 1/4	5 1/2	6	5 1/2	5 1/2	5 3/4	6	5 1/2
5' - 6"	# 5	5 3/4	5 1/4	5 1/4	5 1/2	6	5 1/4	5 3/4	5 1/4	5 1/2	5 1/2	6	5 1/4
5' - 9"	# 5	5 1/2	5 1/4	5 1/4	5 1/2	5 3/4	5	5 1/2	5 1/4	5 1/4	5 1/2	5 3/4	5 1/4
6' - 0"	# 5	5 1/4	5	5	5 1/4	5 1/2	5	5 1/2	5	5	5 1/4	5 1/2	5
0' - 0"	# 6	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	7 3/4	7 1/4	7 1/2	7 1/2	7 3/4	7 1/4
1' - 9"	# 6	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/4	8 1/4	7 3/4	8	8	8 1/2	7 3/4
2' - 0"	# 6	12 1/2	12	12 1/4	12 1/2	12 1/2	11 3/4	8 3/4	8 1/4	8 1/4	8 1/2	8 3/4	8 1/4
2' - 3"	# 6	12 1/2	11 3/4	11 3/4	12 1/4	12 1/2	11 1/2	9	8 1/2	8 3/4	8 3/4	9 1/4	8 1/2
2' - 6"	# 6	12 1/4	11 1/4	11 1/2	11 3/4	12 1/2	11	9 1/4	8 3/4	9	9 1/4	9 1/4	8 3/4
2' - 9"	# 6	11 3/4	10 3/4	11	11 1/2	12 1/4	10 3/4	9 1/4	9	9 1/4	9 1/4	9 1/4	9
3' - 0"	# 6	11 1/4	10 1/2	10 3/4	11	11 3/4	10 1/4	9 1/4	9 1/4	9 1/4	9 1/4	9 1/4	9
3' - 3"	# 6	11	10 1/4	10 1/4	10 3/4	11 1/2	10	9 1/4	9 1/4	9 1/4	9 1/4	9 1/4	9 1/4
3' - 6"	# 6	10 1/2	9 3/4	10	10 1/4	11	9 3/4	9 1/4	9 1/4	9 1/4	9 1/4	9 1/4	9 1/4
3' - 9"	# 6	10 1/4	9 1/2	9 1/2	10	10 3/4	9 1/4	9 1/4	9 1/4	9 1/4	9 1/4	9 1/4	9 1/4
4' - 0"	# 6	10	9 1/4	9 1/4	9 3/4	10 1/4	9	9 1/4	9	9 1/4	9 1/4	9 1/4	9
4' - 3"	# 6	9 1/2	8 3/4	9	9 1/4	10	8 3/4	9 1/4	8 3/4	9	9 1/4	9 1/4	8 3/4
4' - 6"	# 6	9 1/4	8 1/2	8 3/4	9	9 3/4	8 1/2	9 1/4	8 1/2	8 3/4	9	9 1/4	8 1/2
4' - 9"	# 6	9	8 1/4	8 1/2	8 3/4	9 1/4	8 1/4	9	8 1/4	8 1/2	8 3/4	9 1/4	8 1/4
5' - 0"	# 6	8 3/4	8	8 1/4	8 1/2	9	8	8 3/4	8	8 1/4	8 1/2	9	8
5' - 3"	# 6	8 1/2	7 3/4	8	8 1/4	8 3/4	7 3/4	8 1/2	7 3/4	8	8 1/4	8 3/4	7 3/4
5' - 6"	# 6	8 1/4	7 1/2	7 3/4	8	8 1/2	7 1/2	8 1/4	7 3/4	7 3/4	8	8 1/2	7 1/2
5' - 9"	# 6	8	7 1/4	7 1/2	7 3/4	8 1/4	7 1/4	8	7 1/2	7 1/2	7 3/4	8 1/4	7 1/4
6' - 0"	# 6	7 3/4	7	7 1/4	7 1/2	8	7	7 3/4	7 1/4	7 1/4	7 1/2	8	7 1/4

Version 1 Released 6/9/2015

* Overhang is the distance from the Centerline of the Exterior Beam to the Face of the Rail or Barrier.
Check the overhang for compliance with the assumptions in the Normal Traffic Loading chart.

8" Minimum Edge of Deck Thickness
f_c' = 4 ksi f_y = 60 ksi