American Association of State Highway and Transportation Officials
AASHTO

Guide Specifications for Bridges Carrying Light Rail Transit Loads

American Association of State Highway and Transportation Officials

AASHTO

Guide Specifications for Bridges Carrying Light Rail Transit Loads

FIRST EDITION 2018

© 2018 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.

AASHTO

American Association of State Highway and Transportation Officials
444 North Capitol Street, NW, Suite 249
Washington, DC 20001
202-624-5800 phone/202-624-5806 fax
www.transportation.org

Cover photo: Broadway Bridge in Denver, Colorado, carrying light rail trains. Courtesy Yail Jimmy Kim, University of Colorado Denver.

© 2018 by the American Association of State Highway and Transportation Officials. All rights reserved.
Duplication is a violation of applicable law.

ISBN: 978-1-56051-721-4

Pub Code: GSLR-1

© 2018 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.

AASHTO EXECUTIVE COMMITTEE

2018–2019

Voting Members

Officers:

PRESIDENT: Carlos Braceras, Utah*

VICE PRESIDENT: Patrick McKenna, Missouri*

SECRETARY–TREASURER: Scott Bennett, Arkansas*

EXECUTIVE DIRECTOR: Bud Wright, Washington, D.C.

Regional Representatives:

Jennifer Cohan, Delaware
Victoria Sheehan, New Hampshire
Russell McMurry, Georgia
Joe McGuinness, Indiana
Mark Lowe, Iowa
Roger Millar, Washington
Marc Luiken, Alaska

Nonvoting Members

Immediate Past President: John Schroer, Tennessee

* Elected at AASHTO's 2018 Annual Meeting in Atlanta, Georgia

© 2018 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.

AASHTO COMMITTEE ON BRIDGES AND STRUCTURES, 2018

GREGG FREDRICK, *Chair*
BRUCE V. JOHNSON, *Vice Chair*
JOSEPH L. HARTMANN, Federal Highway Administration, *Secretary*
PATRICIA J. BUSH, *AASHTO Liaison*

ALABAMA, Eric J. Christie, William "Tim" Colquett, Randall B. Mullins
ALASKA, Leslie Daughtery, Elmer E. Marx, Richard A. Pratt
ARIZONA, David B. Benton, David L. Eberhart, Pe-Shen Yang
ARKANSAS, Charles "Rick" Ellis, Mike Hill, Joe Santini
CALIFORNIA, Thomas A. Ostrom, Gedmund Setberg, Dolores Valls
COLORADO, Behrooz Far, Stephen Harelson, Jessica Martinez
CONNECTICUT, Mary E. Baker, Timothy D. Fields
DELAWARE, Jason Arndt, Jason Hastings, Craig A. Stevens
DISTRICT OF COLUMBIA, Donald L. Cooney, Konjit C. "Connie" Eskender, Richard Kenney
FLORIDA, Sam Fallaha, Dennis William Potter, Jeff Pouliotte
GEORGIA, Clayton Bennett, Bill DuVall, Steve Gaston
HAWAII, James Fu, Kevin Murata, John Williams
IDAHO, Matthew Farrar
ILLINOIS, Tim A. Armbrecht, Carl Puzey, Jayme Schiff
INDIANA, Andrew Fitzgerald, Jeremy Hunter, Anne M. Rearick
IOWA, Ahmad Abu-Hawash, James S. Nelson
KANSAS, Mark E. Hoppe, John P. Jones, Curt F. Niehaus
KENTUCKY, Bart Asher, Andy Barber, Marvin Wolfe
LOUISIANA, Arthur D'Andrea, Paul Fossier, Zhengzheng "Jenny" Fu
MAINE, Jeffrey S. Folsom, Wayne Frankhauser, Michael Wight
MARYLAND, Maurice Agostino, Jesse Creel, Jeffrey L. Robert
MASSACHUSETTS, Alexander K. Bardow, Thomas Donald, Joseph Rigney
MICHIGAN, Matthew Chynoweth, Rebecca Curtis, Richard E. Liptak
MINNESOTA, Arielle Ehrlich, Ed Lutgen, Kevin Western
MISSISSIPPI, Aaron Cagle, Justin Walker, Scott Westerfield
MISSOURI, Dennis Heckman, Greg E. Sanders, Scott Stotlemeyer
MONTANA, Amanda Jackson, Dustin E. Rouse
NEBRASKA, Mark Ahlman, Fouad Jaber, Mark J. Traynowicz
NEVADA, Troy Martin, Jessen Mortensen
NEW HAMPSHIRE, Robert Landry, David L. Scott
NEW JERSEY, Xiaohua "Hannah" Cheng, Eddy Germain, Dave D. Lambert
NEW MEXICO, Kathy Crowell, Jeff C. Vigil
NEW YORK, Brenda Crudele, Ernest Holmberg, Richard Marchione
NORTH CAROLINA, Brian Hanks, Scott Hidden, Girchuru Muchane
NORTH DAKOTA, Jon D. Ketterling, Jason R. Thorenson
OHIO, Alexander B.C. Dettloff, Timothy J. Keller, Jeffrey Syar
OKLAHOMA, Steven Jacobi, Walter Peters, Tim Tegeler
OREGON, Bruce V. Johnson, Albert Nako, Tanarat Potisuk
PENNSYLVANIA, James M. Long, Thomas P. Macioce, Lou Ruzzi
PUERTO RICO, (Vacant)
RHODE ISLAND, Georgette Chahine, Keith Gaulin
SOUTH CAROLINA, Terry B. Koon, Jeff Sizemore
SOUTH DAKOTA, Steve Johnson, Dave Madden, Todd S. Thompson
TENNESSEE, John S. Hastings, Ted A. Kniazewycz
TEXAS, Bernie Carrasco, Jamie F. Farris, Gregg A. Freeby
U.S. DOT, Joseph L. Hartmann
UTAH, Rebecca Nix, Carmen Swanwick, Cheryl Hersh Simmons
VERMONT, Kristin M. Higgins, Jim Lacroix
VIRGINIA, Prasad L. Nallapaneni, Kendal R. Walus, Andrew M. Zickler
WASHINGTON, Tony M. Allen, Mark A. Gaines, Bijan Khaleghi
WEST VIRGINIA, Ahmed Mongi, William Varney
WISCONSIN, Scot Becker, William C. Dreher
WYOMING, Jeff R. Booher, Paul G. Cortez, Gregg C. Frederick, Michael E. Menghini

DELAWARE RIVER AND BAY AUTHORITY, Shoukry Elnahal
MDTA, Dan Williams
MULTNOMAH COUNTY TRANSPORTATION DIVISION, Jon Henrichsen
N.Y. STATE BRIDGE AUTHORITY, William Moreau
U.S. ARMY CORPS OF ENGINEERS—DEPARTMENT OF THE ARMY, Phillip W. Sauser

© 2018 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.

U.S. COAST GUARD, Kamal Elnahal
U.S. DEPARTMENT OF AGRICULTURE—FOREST SERVICE, John R. Kattell

TRANSPORTATION RESEARCH BOARD,
Waseem Dekelbab

© 2018 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.

TABLE OF CONTENTS

© 2018 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.

© 2018 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.

Section 1
General

1.1—SCOPE

These guide specifications (LRT Guide Specifications) are a supplement to the *AASHTO LRFD Bridge Design Specifications* (LRFD Bridge Design) that address the design of bridges subjected to light rail transit (LRT) loadings, or both LRT and conventional highway traffic loadings. The LRT Guide Specifications state only the minimum requirements necessary to provide for public safety and are not intended to supplant proper training or the exercise of judgment by the Designer. The Owner or the Designer may require levels of sophistication for design and quality of materials and construction to be higher than the minimum requirements.

Except as superseded herein, LRFD Bridge Design and the *AASHTO LRFD Bridge Construction Specifications* shall govern the design and construction of bridges subjected to LRT loadings, or LRT and conventional highway loadings. Seismic design shall be in accordance with either the provisions in the appropriate sections of LRFD Bridge Design or the provisions in the *AASHTO Guide Specifications for LRFD Seismic Bridge Design*.

This document is largely dedicated to LRT load cases and load effects, and analysis of bridges subjected to LRT loadings. The following subjects are not covered: mechanical and electrical components of light rail trains, track materials and configurations, public utilities, transit signal work, and the maintenance of transit systems.

The commentary is not intended to provide a detailed summary of the studies and research data reviewed in formulating the provisions of the LRT Guide Specifications. However, technical discussions are provided as required.

C1.1

Light rail transit is defined as an electric railway system characterized by its ability to operate single or multiple cars along exclusive rights-of-way at ground level, on aerial structures, in subways, or on streets; able to board and discharge passengers at station platforms or at street, track, or car-floor level; and normally powered by overhead electrical wires.

Article 1.1 provides the scope of the LRT Guide Specifications, their applicability, and their limitations. The commentary directs attention to other documents when necessary, which provide guidance for carrying out the requirements and intent of these LRT Guide Specifications. However, the commentary and references herein are not part of the LRT Guide Specifications.

The design provisions of these LRT Guide Specifications employ the load and resistance factor design (LRFD) methodology. The load factors relevant to light rail transit loading have been developed from the theory of reliability based on current statistical knowledge of loads and structural performance.

1.2—NOTATION

A = cross-sectional area of rail (in.^{2}) (C3.3.4)
a_h = centrifugal acceleration (ft/sec^2) (C3.2.5)
C = centrifugal force multiplier for a curved bridge superstructure (3.2.5)
c_l = parameter for skewed supports (Table 4.4.4-1)
d = depth of member (ft) (4.4.3)
d_e = horizontal distance from the centerline of the exterior web of exterior beam at the deck level to the interior edge of curb or traffic barrier (ft) (4.4.3)
E = elastic modulus of rail (psi) (C3.3.4)
e = correction factor for distribution (Table 4.4.3-1)
f'_c = specified concrete strength in compression (ksi) (3.1.1)
G_{max} = rail break gap (in.) (C3.3.4)
g = gravitational acceleration (ft/sec^2) (3.2.5); live load distribution factor representing the number of lanes (Table 4.4.3-1)
H = height of the retarding surface above the ground surface (ft) (3.2.7.2)
K_g = longitudinal stiffness parameter (in.^{4}) (4.4.3)
L = bridge span length (ft) (4.4.3)
N_b = number of beams, stringers, or girders (4.4.3)
N_c = number of cells in a concrete box girder (4.4.3)
N_{clip} = number of rail clips on fastener (C3.3.4)
n = number of loaded tracks (3.2.5)

© 2018 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.