ASME RT-1–2020
(Revision of ASME RT-1–2015)

Safety Standard for Structural Requirements for Light Rail Vehicles and Streetcars

AN AMERICAN NATIONAL STANDARD

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Two Park Avenue • New York, NY • 10016 USA

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The next edition of this Standard is scheduled for publication in 2025. This Standard will become effective 6 months after the Date of Issuance.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. Interpretations are published on the ASME website under the Committee Pages at http://cstools.asme.org/ as they are issued.

Errata to codes and standards may be posted on the ASME website under the Committee Pages to provide corrections to incorrectly published items, or to correct typographical or grammatical errors in codes and standards. Such errata shall be used on the date posted.

The Committee Pages can be found at http://cstools.asme.org/. There is an option available to automatically receive an e-mail notification when errata are posted to a particular code or standard. This option can be found on the appropriate Committee Page after selecting “Errata” in the “Publication Information” section.

The American Society of Mechanical Engineers
Two Park Avenue, New York, NY 10016-5990

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FOREWORD

On March 18, 1998, The American Society of Mechanical Engineers (ASME) formed the Standards Committee on Rail Transit Vehicles.

The Standards Committee on Rail Transit Vehicles develops and maintains standards that cover safety, functionality, performance, and operability requirements, as well as mechanical systems, components, and structural requirements for rail transit vehicles. Rail transit includes heavy rail and light rail, and excludes freight, commuter, high-speed, or any other rail operations under the jurisdiction of the Federal Railroad Administration.

The Standards Committee is responsible for developing a series of safety standards within its charter under the designation of RT. The purpose of the RT standards is to provide the rail transit industry with safety standards that address vehicle mechanical systems, components, and structural requirements that enhance public safety. Principles, recommendations, and requirements included in these standards promote good engineering judgment as applied in designing rail transit vehicles for safety. The standards are subject to revisions that are the result of Committee consideration of factors such as technological advances, new data, and changing environmental and industry needs.

Both SI (metric) and U.S. Customary units are used in this Standard, with the latter placed in parentheses. These units are noninterchangeable and, depending on the country as well as industry preferences, the user of this Standard shall determine which units are to be applied. Parameters are derived from IEEE/ASTM SI 10-1997 or the latest revision, with U.S. Customary units noted in parentheses.

The 2015 edition was approved by the American National Standards Institute on September 9, 2015, and designated as ASME RT-1–2015.

The 2020 edition has been revised in its entirety in part to reflect industry adoption of performance-based acceptance criteria where possible; to provide new definitions for vehicle carbody structural elements that are subject to crashworthiness performance criteria; and to update performance criteria in consideration of changing conditions within the rail transit industry. This revision was approved as an American National Standard on May 8, 2020 and designated as ASME RT-1–2020.

ASME RTV COMMITTEE
Rail Transit Vehicle

(The following is the roster of the Committee at the time of approval of this Standard.)

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CORRESPONDENCE WITH THE RTV COMMITTEE

General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by requesting interpretations, proposing revisions or a case, and attending Committee meetings. Correspondence should be addressed to:

Secretary, RTV Standards Committee
The American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990
http://go.asme.org/Inquiry

Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Interpretations. Upon request, the RTV Standards Committee will render an interpretation of any requirement of the Standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the RTV Standards Committee.

Requests for interpretation should preferably be submitted through the online Interpretation Submittal Form. The form is accessible at http://go.asme.org/InterpretationRequest. Upon submittal of the form, the Inquirer will receive an automatic e-mail confirming receipt.

If the Inquirer is unable to use the online form, he/she may mail the request to the Secretary of the RTV Standards Committee at the above address. The request for an interpretation should be clear and unambiguous. It is further recommended that the Inquirer submit his/her request in the following format:

Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry in one or two words.
Edition:	Cite the applicable edition of the Standard for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. Please provide a condensed and precise question, composed in such a way that a "yes" or "no" reply is acceptable.
Proposed Reply(ies):	Provide a proposed reply(ies) in the form of "Yes" or "No," with explanation as needed. If entering replies to more than one question, please number the questions and replies.
Background Information:	Provide the Committee with any background information that will assist the Committee in understanding the inquiry. The Inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in the format described above may be rewritten in the appropriate format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

Moreover, ASME does not act as a consultant for specific engineering problems or for the general application or understanding of the Standard requirements. If, based on the inquiry information submitted, it is the opinion of the Committee that the Inquirer should seek assistance, the inquiry will be returned with the recommendation that such assistance be obtained.

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

Attending Committee Meetings. The RTV Standards Committee regularly holds meetings and/or telephone conferences that are open to the public. Persons wishing to attend any meeting and/or telephone conference should contact the Secretary of the RTV Standards Committee.

INTRODUCTION

Safety of light rail transit operations is a system characteristic. As do all transportation options in a given corridor, this operation has certain risks, including collision with another vehicle. The risks are mitigated by the design of the signal system and other system elements, by operating and maintenance procedures, and by the design of the vehicle. Risks are further mitigated by the elimination of grade crossings and the provision of safety barriers. Active safety systems on the vehicle include train control, communication, and propulsion and braking subsystems. The carbody, if properly designed, may be considered a passive safety device, and this Standard is intended to address the performance of the carbody in collisions. This Standard draws from existing requirements and best practices for the design of the carbody of light rail vehicles. It also considers recent developments in the design of rail carbody structures intended to optimize the performance of the structure under the conditions of an overload, as may occur during a collision. This measure is commonly identified as crash energy management (CEM). The intent of CEM is to better manage the dissipation of the portion of the energy from a collision that can reasonably be expected to be absorbed by the deformation of the carbody. CEM design, when appropriately applied, may reduce risk of injuries to occupants of the light rail vehicle due to loss of survivable volume and due to secondary collisions of occupants with the car interior. Specific portions of the carbody are designed for controlled deformation and energy absorption, and are located in the structure so as to limit the damage to, and acceleration of, occupied volumes of the light rail cars. For multiple-unit operation, distributing structural energy absorption through the train has been shown to be beneficial. This Standard requires the incorporation of CEM principles in the design of light rail vehicles.

SAFETY STANDARD FOR STRUCTURAL REQUIREMENTS FOR LIGHT RAIL VEHICLES AND STREETCARS

1 SCOPE

The objective of the passive safety requirements in this Standard is to reduce the risk of passenger injury and damage to equipment resulting from collision accidents by providing a means of protection when other possibilities of preventing an accident have failed. In the event of a collision, application of this Standard provides protection for the occupants of new designs of crashworthy vehicles through the preservation of structural integrity and reducing the risk of overriding and limiting decelerations. This Standard does not extend to the design of the vehicle interior structures that may help reduce injury risk caused by impact between the occupants and the vehicle interior, beyond limiting vehicle acceleration and consequential secondary impact velocity of passengers colliding with interior surfaces. In addition, this Standard provides measures for design of light rail vehicles (LRVs) and streetcars with the goal of reducing risks to street vehicles and pedestrians when involved in collisions.

1.1 Subjects Not Addressed by This Standard

There are several design considerations related to safety that are not addressed in this Standard, such as the following:

(a) structural repairs
(b) fatigue
(c) corrosion
(d) fire protection
(e) interior vehicle design
(f) emergency egress from vehicle
(g) inspection and maintenance
(h) operator seat belt

1.2 Effective Date

This Standard applies to newly constructed light rail vehicles and streetcars for transit passenger service ordered 180 days following the date of issuance of this Standard that is issued by the Rail Transit Vehicle (RTV) Standards Committee and ASME.

2 DEFINITIONS

This Standard relies, where practical, on terms already in use by ASME, the American Public Transportation Association (APTA), and the Institute of Electrical and Electronics Engineers (IEEE). For the purposes of this Standard, the following definitions apply:

anticlimber: a structural member or mechanism located at each end of the vehicle used to engage an opposing vehicle, coupled or not, to resist relative vertical travel between the two carbodies during a collision.

articulation: a rotating connection at the intermediate ends of carbody sections to allow negotiation of tracks with various vertical and horizontal profiles.

average collision acceleration: the longitudinal acceleration of each car-module of the vehicle computed using a 100 ms simple moving average over the duration of the collision event and averaged over each car-module.

belt rail: a longitudinal structural member of the carbody located on each side of the carbody below the passenger side windows. The distance between opposite belt rails often establishes the overall width of the carbody, exclusive of the side door thresholds, side cameras, and mirrors.

carbody: the car-module body comprising its main load-carrying structure above all truck suspension units. It includes all components and structural articulation parts that contribute directly to its strength, stiffness, and stability.

car-module: a fully assembled vehicle section that spans between couplers, articulating joints, or a coupler and an articulation. A module may be supported by a truck or may be suspended between two articulations without a truck.

collision posts: a set of two structural posts located at each end of the carbody, extending from the bottom of the underframe structure up to the structural shelf. Collision posts may be made of several structural members assembled to each other, provided that the required performance is met. They are located at the approximate one-third points across the width of the vehicle and are forward of the seating position of any passenger or crew person. An alternative to collision posts is a collision wall.

collision wall: a structure at the leading end of the vehicle spanning the area between the structural shelf, corner posts, and top of the underframe.