APTA STANDARDS DEVELOPMENT PROGRAM

STANDARD

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APTA Streetcar Subcommittee Working Group

Vintage and Heritage Trolley Vehicle Equipment

Abstract: This *Standard* establishes minimum requirements for equipping vintage and heritage trolley vehicles, also referred to as vintage trolleys or historic streetcars, for operation on urban heritage trolley systems.

Keywords: heritage trolley, historic streetcar, replica trolley, vintage trolley

Summary: This *Standard* includes programs and procedures that are to be established and documented in the vintage and heritage trolley system's System Safety Program Plan (SSPP), as well as equipment-related criteria that are to be documented as part of the vehicle safety certification process.

Scope and purpose: This *Standard* is applicable to all vintage and heritage trolleys operating in an urban public transit environment. It is not intended for application to railway museums/trolley museums, which may operate similar "heritage" or "vintage" equipment, unless they run in an urban public transit environment. Although a museum has the same obligation to conduct safe operations, there are also significant differences in the nature of a museum operating environment versus that of an urban public transit environment.

The purpose of this document is to provide APTA member transit systems and other vintage and heritage trolley operators with minimum standards for equipping and operating vintage and heritage trolley vehicles.

Participants

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This document was reviewed and revised by the Vintage & Heritage Trolley Working Group under the Streetcar Subcommittee. At the time of publication, the leadership team of the APTA Streetcar Subcommittee and the working group that revised the document are as follows:

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Introduction

This Introduction is not part of APTA RT-SCS-001-05 Rev 1, *Standard for Vintage & Heritage Trolley Vehicle Equipment.*

For purposes of brevity, the term heritage shall also mean vintage.

This *Standard* was the first major component of a larger set of documents covering streetcar technology, operation and maintenance. The reader will note the inclusion of both equipment and operational criteria in this *Standard*. In preparing this document, it was felt that this approach placed the appropriate emphasis on the critical importance of operating rules and procedures, as well as training, as part of overall vehicle safety.

The types of vehicles employed by various heritage trolley operations around the country are quite diverse; they range from restored original equipment dating to the early 1900s to newly built "replica" heritage cars. Although these vehicles operate on rails and utilize electric propulsion, there are also numerous and significant differences between heritage trolleys and the vehicles employed in other forms of rail transit. The service conditions under which heritage trolley vehicles are operated may also be quite different from those found on a typical light rail or other rail transit system.

While the rail transit industry has been steadily generating consensus standards covering many technical aspects of its present generation of equipment, these standards do not make provision for the unique vehicles found in heritage trolley operations. For this reason, the APTA Streetcar Subcommittee developed this document to establish appropriate standards for equipping and operating heritage trolley vehicles in an urban public transit environment.

This *Standard* is based on the "Historical Streetcar" section of the California Public Utilities Commission General Order 143-B, with many additional criteria added in order to create a more comprehensive standard.

This *Standard* represents a common viewpoint of those parties concerned with its provisions, namely agencies and other organizations operating or planning urban heritage trolley operations, manufacturers, consultants, engineers and general interest groups. The application of any standards, practices or guidelines contained herein is purely voluntary. In some cases, federal and/or state regulations govern portions of a rail transit system (or other heritage trolley operator's) operations. In those cases, the government regulations take precedence over this *Standard*. APTA recognizes that for certain applications, the standards or practices, as implemented by individual rail transit systems, may be either more or less restrictive than those given in this document.

Note on alternate practices

This *Standard* prescribes minimum requirements for equipping heritage trolley vehicles for operation in an urban public transit environment. APTA recommends the use of these practices by:

- individuals or organizations that design, restore, construct, operate and maintain heritage trolleys;
- individuals or organizations that contract with others for the design, restoration, construction, operation and maintenance of heritage trolleys; and
- individuals or organizations that influence how and heritage trolleys are designed, restored, constructed, operated and maintained.

The purpose of an APTA *Standard* is to ensure that each rail transit system achieves a high level of safety for passengers, employees and the public. APTA *Standards* represent an industry consensus of acceptable safety practices that should be used by a rail transit system. However, APTA recognizes that some rail transit systems (or other and heritage trolley operators) have unique aspects of their operating environment that, when combined with the levels of service that must be provided, may make strict compliance with every provision of an APTA *Standard* impossible.

A rail transit system (or other heritage trolley operator) that is faced with this dilemma may use its system safety program plan to specify an alternate means to achieve an equivalent level of safety as provided by the APTA *Standard*. The System Safety Program Plan (SSPP) should:

- identify the *Standard* requirements that cannot be met;
- state why each of these requirements cannot be met;
- describe the alternate means that ensures equivalent safety; and
- provide a reasonable basis (i.e., operating history or hazard analysis) for why safety is not compromised through the alternate means.

Document history

An initial version of this *Standard* was reviewed at a meeting of a task force of the Streetcar Subcommittee on June 6, 2003, in San Jose, California. Several additional drafts were subsequently developed, reviewed and approved using meetings of the task force held at various locations around the country, including face-to-face discussions with a large number of operators and other interested parties. This *Standard* was balloted by all agencies that have heritage trolleys or are planning for or considering their addition. This *Standard* was unanimously approved by balloted agencies and subsequently approved for publication by the APTA Rail Standards and Policy Committee on June 12, 2005.

Consistent with policies for review and revision of APTA Standards, this document was revised in 2016. The original authors were able to participate in the revision of the document.

Vintage and Heritage Trolley Vehicle Equipment

1. Programs and procedures applicable to all heritage trolley operations

The heritage trolley system's System Safety Program Plan (SSPP) shall include the programs and procedures outlined in Sections 1.1 through 1.3 below, as well as demonstrate that the minimum vehicle equipment / performance requirements of Section 2 (and where applicable, Section 3) are met. The items in Section 1 are intended to demonstrate that written rules and procedures, along with a program of instruction and system of maintaining auditable records, are in place.

Recognizing the diversity of heritage trolley vehicle technology (including control and braking systems), procedures and training shall be specific to each type of equipment in use on the system. Reference is made to "system standards", referring to operating and maintenance procedures developed specifically for the individual heritage trolley system, based on its specific combination of vehicles, operating environment and applicable regulations. Suitable courses should also be developed and provided for personnel seeking to broaden their technical skill level and whenever an additional vehicle type is added to the operating fleet.

1.1 Operating rules, procedures and program of instruction

The heritage trolley system shall establish a program of operating rules and procedures that cover each type of trolley being operated on the system, including the maximum authorized speeds for each section of right-of-way. These rules shall be checked for compliance with applicable federal, state and local safety rules and regulations. All personnel whose duties are governed by the operating rules shall be given a copy of the applicable rules. All work activities shall be performed in strict accordance with the operating rules.

The heritage trolley system shall adopt a written program of instruction for all personnel (employees and volunteers) engaged in the operation and maintenance of vehicles. All new personnel shall undergo appropriate training for their position before undertaking their duties.

Training shall include specific procedures for responding to emergency situations, including brake or propulsion system failure, as well as indications of fire or overheated equipment. These procedures shall include appropriate emphasis on the importance of prompt removal and securement of the trolley pole or other current collection apparatus from the overhead line in the event of fire.

Maintenance manuals, procedures and training shall clearly identify the presence of any hazardous materials and. as applicable, identify procedures for their proper handling, storage and disposal.

A system for defect reporting and related follow-up activities shall be established to ensure that an effective corrective action process is in place between the operations and maintenance functions within the organization.

Refresher courses and testing shall be provided at least every two years covering vehicle operation and the meaning and application of the operating rules for all personnel in safety sensitive positions. A policy and procedure shall be in place to maintain records showing compliance with this requirement, with records maintained for a period of not fewer than four calendar years.

1.2 Maintenance procedures and program of instruction

The heritage trolley system shall institute systematic inspection and maintenance practices for each type of trolley being operated on the system, using a mileage, hourly or other periodic basis. Written inspection and maintenance procedures shall be established, along with a system for maintaining records of inspection and the maintenance work performed.

A system (including written documentation) shall be in place to provide instruction to maintainers as to the requirements of their work. Maintenance procedures and related instruction shall emphasize the significance of the appropriate maintenance intervals required for the age of the technology used on the vehicle, particularly with regard to braking and electrical subsystems. These intervals are typically very different (shorter) than those associated with modern equipment.

1.3 Maintenance facility

The heritage trolley system shall establish an appropriate maintenance area to facilitate systematic vehicle inspection and record-keeping. At a minimum, the maintenance area shall provide a means for appropriate inspection and maintenance of vehicle underbody, including trucks, and rooftop apparatus.

> **NOTE:** An inspection pit is the most commonly used means to facilitate inspection and maintenance of trucks and underbody equipment, including brake adjustments. Permanent or portable jacks or overhead cranes are the most commonly used means of raising a carboy to allow removal of trucks.

2. Minimum vehicle equipment requirements

All heritage trolley vehicles shall comply with the requirements of this section. Compliance shall be documented as part of the vehicle safety certification process. See Annex B for a sample of auditors check list.

2.1 Service braking system

Each trolley shall be equipped with a documented, tested braking system adequate to control its movement and to stop and hold it stationary in a safe manner under all conditions of passenger weight loading between AW0 and AW3 inclusively, on any track grade or rail conditions experienced during operation. Written procedures shall be established for maintenance and inspection of the braking system, including system standards for maximum allowable wear of components, and the frequency of inspection and testing.

For trolleys equipped with airbrake systems, maintenance and inspection procedures shall include system standards for maximum allowable wear of braking rigging and brake shoes/pads, as well as maximum allowable brake cylinder piston travel, brake cylinder air leakage, and overall system air leakage. Also, all system air pressure settings shall be designated, including settings for compressor governor cut in/cut out, low air alarm, safety valve and, where applicable, brake pipe and feed valve settings and/or any other pressure switch settings. The system standards shall also cover frequency of air gauge testing and calibration, as well as overhaul and test of airbrake system valve portions.

> **NOTE:** APTA RT-VIM-S-007-02, Friction Brake Equipment Periodic Inspection and Maintenance is a good resource for the maintenance of braking systems. APTA RT-VIM-S-003-02, Air Supply and Air Storage Systems Periodic Inspection and Maintenance is a good reference for the maintenance of the air system. These documents are, however, generally based on the use of modern equipment, and as such some portions may not be directly applicable to all heritage trolleys. The wide variety of heritage trolley vehicles, including the varying ages of the mechanical and electrical technologies used, will typically mean that additional guidance, including original equipment manufacturer's data and maintenance procedures, will also be needed.

2.2 Redundant braking

Each trolley shall be equipped with a redundant form of braking that can be used to stop the trolley in the event the service braking system fails. Motor braking (specifically dynamic braking) combined with handbrake use is a common and effective form of redundant braking on heritage trolleys. The redundant form of braking shall be tested and the results documented.

2.3 Parking brakes

Each trolley shall be equipped with a parking brake that is adequate to hold the trolley stationary under all conditions of loading for any grade on which the trolley is operated, through the full range of specified wheel and brake wear conditions. The parking brake shall be capable of holding the trolley stationary with line voltage removed and the primary braking system released. Wheel chocks, used in accordance with a documented procedure, may be used to supplement the parking brake, but not as a replacement for a parking brake. The parking brakes must meet all specifications herein described without the need for wheel chocks or any other braking system. The parking brake system shall be tested under actual operating conditions on the system's steepest track grade and the test results documented. System standards shall be established to cover inspection and testing of the parking brake, including frequency of inspection.

2.4 Air gauge and low-air alarm

If equipped with air brakes, each trolley shall be equipped with an air gauge that indicates, at a minimum, main reservoir pressure. The air gauge shall be mounted within the operator's immediate field of vision and shall be readable at all times during operation. As a secondary indicator, the vehicle shall also be equipped with a low-air alarm in the form of an audible and/or visual alarm that will automatically actuate if the main reservoir air supply drops below the preset minimum safe working pressure. Visual indicators for the low-air alarm shall be mounted within the operator's immediate field of vision and be of sufficient size or intensity to be always observable. Audible alarms shall be sufficiently loud to be heard over the noises associated with all car operation. The low-air alarm shall *not* be equipped with an operator-accessible means of disabling or muting the alarm function.

2.5 Braking rate / stopping distance

Each heritage trolley system shall establish and maintain a system standard for braking rate / stopping distance appropriate to the local operating environment and applicable state or local regulations. For example, the braking rate / stopping distance requirements may be different based on whether the operation is on exclusive right-of-way with restricted access, exclusive right-of-way with unrestricted access such as an urban street, or in a traffic lane with mixed vehicular traffic.

At a minimum, the stopping distance standard shall be that the trolley must be capable of being brought to a complete stop in less than 120 ft. from the point of first operation of the brake control at 20 mph on level, dry, tangent track under all conditions of loading. This equates to a minimum average braking rate of 2.5 mph/sec. As part of the safety certification process, each trolley shall be tested for stopping distance while loaded at AW0 and not less than AW3. A system standard shall be established for periodic re-testing.

2.6 Sanders

Each trolley shall be equipped with an operator-controlled device that directs a flow of sand onto the head of the rail in front of one or both leading wheels. Wherever the basic design of the car's equipment can be readily adapted to do so, sanders shall also apply automatically during emergency application of the braking system. Sander operation shall be tested and the results documented.

NOTE: Because the rails typically serve as the ground return in trolley systems, excessive use of sand could result in wheels losing electrical conductivity with the rails. For this reason, sanding apparatus on some trolleys is designed to sand only one rail. Sander operation, number of sanders and the rate and consistency of sand flow should be based on an operational hazard analysis of the particular heritage trolley operation.

2.7 Electrical systems

This section covers practices of critical importance in ensuring safe operation of electrical systems, including prevention of vehicle fires. This is particularly important where the propulsion system switches motor currents in the platform controller; such as in K-Type control. The safe operation of K and other "direct" type control systems is dependent upon the systematic application of proper design, proper maintenance and proper operating practices, the absence of any of which can lead to catastrophic equipment failure.

2.7.1 Documentation, inspection and testing

As part of the vehicle safety certification process, the basis of design for the electrical system shall be stated in the documentation. Where original designs are utilized, the omission or alteration of any component functions inherent in the original design shall be justified with an appropriate hazard analysis. All electrical systems on the trolley shall be documented in written form, and all controls on the vehicle clearly labeled including proper status indication such as "ON" and "OFF."

The wiring and electrical apparatus on each trolley shall be inspected and tested, and the results documented, to determine that they are in safe working order and are suitable for the intended operation.

System standards shall also be established for periodic inspection and testing of electrical apparatus and wiring, as well as updating of electrical schematics and other documentation as part of an overall vehicle configuration management process. This is particularly important on heritage trolleys where high voltage circuits are located in the operator or passenger areas. Replica trolleys and major overhauls of heritage trolleys shall be designed to eliminate, to the extent practical, high voltage in the passenger areas, other than for comfort heating.

NOTE: APTA PR-E-S-001-98, Standard for Insulation Integrity is a good reference for insulation testing. APTA RT-VIM-RP-010-02, Electric Motor Periodic Inspection and Maintenance is a good reference for any motor driven equipment. APTA RT-VIM-RP-018-03, Propulsion Controls Periodic Inspection and Maintenance is a resource for the maintenance of the propulsion system. These documents are, however, generally based on the use of modern equipment, and as such some portions may not be directly applicable to all heritage trolleys. The wide variety of heritage trolley vehicles, including the varying ages of the mechanical and electrical technologies used, will typically mean that additional guidance, including original equipment manufacturer's data and maintenance procedures, will also be needed.

2.7.2 Equipment arrangement

All wiring and electrical apparatus shall be installed on the car in such a manner that the danger of fire from heat, arcing or component failure is minimized. Components shall be mounted in such a manner that the heat produced by their operation does not damage themselves, other devices or the car structure. Appropriate heat shields are to be incorporated as required, with special care taken to isolate potential heat sources from wooden or other flammable portions of the car.

All wiring and electrical apparatus shall be installed on the car in such a manner that passengers and crew are protected from contacting energized components, with a special emphasis on high voltage circuits. Because many heritage trolleys do not have separate cabs, appropriate measures shall be taken to keep electrical control equipment sealed and provided with appropriate warning labels.

All wiring and electrical apparatus shall be installed on the car in a manner that provides adequate clearance for the normal movement of trucks, brake rigging and current collectors, and that protects against the entry or continued exposure to wheel splash or other sources of water.

2.7.3 Current Collectors

Trolley poles, bow trolleys or pantographs may be used for current collection, provided they are compatible with the overhead line design on the portion of the system on which the vehicle operates. The rope or other means used to raise / lower the current collector shall not be the sole means of retaining the current collector in the down position; a suitable hook or other mechanical latching means shall be provided to secure the collector in the down position when the raising/lowering mechanism is released.

System standards shall be established to cover inspection and maintenance of current collection equipment, including wear limits and contact force settings, as well as frequency of inspection. Written procedures shall also be developed for the emergency lowering and securement of the current collector.

> **NOTE:** APTA RT-VIM-S-002-02, Pantograph Current Collection Equipment Periodic Inspection and Maintenance is a useful reference for pantograph equipped vehicles. This document is, however, generally based on the use of modern equipment, and as such some portions may not be directly applicable to all heritage trolleys. The wide variety of heritage trolley vehicles, including the varying ages of the mechanical and electrical technologies used, will typically mean that additional guidance, including original equipment manufacturer's data and maintenance procedures, will also be needed.

2.7.4 Wiring

Conductor sizes shall be selected on the basis of current-carrying capacity, mechanical strength, temperature and flexibility requirements, and maximum allowable voltage drops. Conductors of all sizes shall be provided with appropriate mechanical and environmental protection. New wiring shall meet the smoke and flammability requirements of NFPA 130.

2.7.5 Control arrangement

The propulsion system shall be equipped, at each operating position, with an alternative means for the operator to shut off power in the event of a mechanical failure that may cause the primary control handle or pedal to jam.

2.7.6 Overload protection

All electrical systems on each trolley shall incorporate suitable overload protection devices.

2.7.6.1 Propulsion line breaker

Each trolley shall be equipped with a main automatic circuit line breaker or line switch and overload relay for the protection of the power circuits. In the case of K type and other "direct" control, the line breaker also serves the critical function of reducing arcing within the platform controller. The circuit breaker or line switch arc chute shall be vented directly to the outside air and suitably isolated from equipment or other potentially conductive car components (such as truss rods) that could lead to arcing.

2.7.6.2 Main fuse protection

In addition to the automatic circuit breaker, the main high voltage feed shall be equipped with an in-line fuse. Where cartridge-type fuses are used, they shall be installed in approved boxes or cabinets. Where railway-type ribbon fuses are used, they shall be in boxes designed specifically for this purpose and shall be equipped with arc blowout aids.

2.7.6.3 Auxiliary circuits

Circuits used for purposes other than propelling the vehicle shall be connected to the main cable at a point between the current collector and the protective device for the traction motors.

Each circuit or group of circuits shall be equipped with at least one circuit breaker, fused switch or fuse located as near as practicable to the point of connection to the auxiliary circuit.

2.7.6.4 Lightning protection

Each trolley that is supplied power from an overhead contact system shall be equipped with a suitable and effective lightning arrester for the protection of all electrical circuits.

2.8 Wheel/rail interface

The wheel profile used on each trolley shall be evaluated to ensure that it will provide a safe wheel-rail interface on all track work over which it is operated. Factors to be considered in evaluating wheel-rail interface include the details of both the track construction and the wheel profile, as well as operating conditions including operating speed and the maintenance/wear conditions of both the wheels and the tracks.

Specific wheelset elements to be examined include wheel tread width, wheel profile including tread taper and flange dimensions (including height, thickness, face angles and radii), and wheel gauge setting on the axles. Due to the difficulty in accurately measuring to a gauging point on the front face of the flange, the usual wheel gauging check is a measurement of the back-to-back wheel spacing.

Track work elements to be examined include rail profile, allowed gauge variation, characteristic elements of switch points and frogs, check gauge, groove width for street trackage and guardrail use and configuration.

Poorly matched wheel and track work elements, even if they initially appear adequate for operation, will lead to abnormal wear on both sides of the interface. Those "worn in" conditions rarely result in compatibility and have the potential to lead to unsafe conditions. Hence, the rolling stock that is routinely used on any heritage trolley system should be equipped with wheels that are matched to the track structure. Similarly, the track structure should present a consistent running surface to the wheels. Any rolling stock that is introduced to the system that does not have optimal wheel parameters for the track should be changed before entering revenue service. In the interim, it should be operated only with extreme care and supervision.

> **NOTE:** In general, trolleys equipped with narrow-tread/shallow flange streetcar profile wheels and/or wide wheel gauge settings are not compatible with track work used on railroad, heavy rail transit, and many light rail systems. Similarly, trolleys that are equipped with railroad profile wheels and/or railroad wheel gauge settings may not be compatible with certain elements of older streetcar-type track work. In either case, significant changes to the track work and/or vehicles may be necessary in order to achieve a safe wheel/rail interface.
>
> **NOTE:** TCRP Report 155, Track Design Handbook for Light Rail Transit, particularly Chapters 2 through 6, is a good reference for analysis of wheel/rail interface

2.9 Tamper-resistant controls

The operating and auxiliary controls on each trolley shall be arranged to prevent unauthorized operation.

> **NOTE:** Common practice for heritage trolley vehicles is to use removable operating handles for the primary propulsion and braking controls and, in the case of double-ended cars, to carry only a single set of handles, which the operator moves from one control position to the other. Whenever the basic design of the car's equipment can be readily adapted to do so, removable handles should be arranged so that the handle can be removed only in the "OFF" position on propulsion controls, and only in the brakes-applied

position on braking controls. APTA recognizes that on many restored original trolleys, the brake valves on double-ended cars are designed to have the handle removable in a "LAP" position. In such instances, operating procedures should require making an appropriate service brake application before moving the handle to the "LAP" position and removing it. The handle should then be immediately carried to the other control position, put in place, and moved to "APPLY" to guard against brakes leaking off.

2.10 Emergency exits

Each trolley shall be equipped so that, in case of emergency, the doors or doorways can be easily opened by a passenger by a readily apparent or disclosed means. In case of operation on bridges, tunnels or elevated rights-of-way, the doors or doorways shall be arranged, or access otherwise controlled, so that passengers can not readily exit into an unsafe condition.

2.11 Door interlocks

Trolleys may be equipped with various devices, including doors, to protect car entranceways. Some trolleys use an open design with no passenger barriers on portions of the car. In all cases, the function of appropriate barriers and their impact on passenger safety shall be carefully evaluated as part of the safety certification process. An additional increase in safety may be obtained by interlocking the doors with the trolley propulsion and/or braking systems. The function of door interlocks and their impact on passenger safety shall be carefully evaluated using a hazard analysis process, especially where cars are operated with a single-person crew or have entranceways out of the operator's immediate view, mirror or video display.

2.12 Onboard safety equipment

Each trolley shall be equipped with an approved portable fire extinguisher at each control position, selected, inspected and maintained in compliance with NFPA 10. The extinguisher shall be readily accessible from the control position, taking into consideration any potential hazards that could impede access (such as a controller fire).

Each trolley shall also be equipped with appropriate emergency devices in compliance with applicable regulations.

NOTE: Examples of emergency devices typically carried include such warning devices as bidirectional emergency reflective triangles, red flags and flashlights.

2.13 Audible warning devices

Each trolley shall be equipped with one or more devices capable of producing a clearly audible warning that complies with applicable regulations and is appropriate to the local operating environment. Typical audible warning devices on a heritage trolley are gongs, horns and air whistles.

2.14 Lighting

2.14.1 Lighting Circuits

Heritage trolley systems operating restored original trolleys using lighting powered at overhead line potential (e.g. groups of five-bulbs-in-series circuits) shall provide training to operating and maintenance personnel on safe procedures associated with this style of lighting. Newly constructed replica trolleys shall not incorporate lighting circuits that are powered using overhead line potential, but instead use lighting circuits powered by low-voltage DC or an AC inverter.

2.14.2 Interior lighting

If operated during hours of darkness, each trolley shall be equipped with lights in the passenger compartment, arranged so as to illuminate the whole interior of the vehicle. Appropriate measures shall be taken to ensure that windshield reflection will be minimized so as not to impair the operator's ability to observe the right-of-way in front of him.

> **NOTE:** Common methods used to address windshield reflections include windshield slope, as well as the use of retractable curtains, switchable platform lighting (including both manual control of platform lights as well as automatic control in conjunction with door operation) and light shields.

2.14.3 Headlights

If operated during hours of darkness, each trolley shall be equipped with a headlight or headlights at each operating end that, in conjunction with ambient lighting, is capable of revealing a person or a motor vehicle at a specified distance in compliance with applicable regulations.

2.14.4 Tail lights

If operated during hours of darkness, each trolley shall be equipped with tail lighting (marker lights) that during hours of darkness are visible to the rear at a distance that is in compliance with applicable regulations.

2.14.5 Battery backup/emergency lighting

If operated during hours of darkness, each trolley shall be equipped with a battery for supplying automatic emergency lighting in the event that line voltage is lost. Emergency lighting shall provide illumination of the passenger compartment that is sufficient in intensity and duration to permit emergency evacuation of the car. The emergency lighting arrangement shall also provide for tail lighting to remain illuminated for a period compliant with applicable regulations.

2.15 Grab handles

Each trolley shall be equipped with grab handles, stanchions, bars or similar devices for the use of standing passengers and for the use of persons boarding or leaving.

2.16 Pilot or fender

Each trolley shall be equipped with a rigid pilot or a rigid or drop-type fender, installed full width in front of the leading wheels to deflect or trap foreign objects from the wheel’s immediate path. An operational hazard analysis of the particular heritage trolley operation shall be conducted to determine whether a fender or a rigid pilot is more appropriate.

> **NOTE:** A drop-action fender located under the carboy (commonly referred to as a “lifeguard”), arranged so that the fender tray drops to the rail head if an object strikes the leading trip bar, is the most commonly employed type of fender for heritage trolleys. This type of fender was designed for use on systems with primarily street-running or other rights-of-way with a paved surface to rail head. The hazard analysis process should be used in the evaluation of the type of fender to be used in a particular heritage trolley operation.

2.17 Windshields and windows

Each trolley shall be equipped with windshields installed using laminated safety glazing. Windows fitted to other portions of the car shall be installed with either laminated or tempered safety glazing.

2.18 Mirrors

Each trolley shall be equipped with rear-vision mirrors or other means of observation, located so as to allow the operator a view to the rear along both sides of the trolley, as well as a view of the trolley's interior including the rear stepwell.

3. Additional vehicle equipment, applicable where conditions warrant

The following list of features and equipment is based on best practice from the transit industry, both past and present. The necessity of equipping trolleys with these items shall be based upon an operational hazard analysis of the particular heritage trolley operation, conducted as part of the vehicle safety certification process. See Annex B for a sample auditor's checklist.

The following operating conditions will significantly influence the application of these additional safety devices, and are to be considered in the hazard analysis process. These conditions include, but are not limited to, the following:

- single-person vs. two-person crew
- street running vs. private right-of-way operation
- the number of cars in operation simultaneously
- interaction between heritage trolleys and light-rail equipment/infrastructure in cases where heritage trolleys operate on a light-rail system
- highway grade crossings
- crossing of other rail systems at grade
- clearances
- grades
- operating speeds

3.1 Deadman interlock

Where local conditions warrant its application, each trolley should be equipped with a deadman system that requires the operator's continued presence at the controls in order for the car to remain in motion. The deadman system shall utilize a hand-operated or foot-operated control that must be continuously actuated by the operator while the braking system is in release. Any replica heritage trolleys shall incorporate a deadman system.

3.2 Low-air interlock

Where local conditions warrant its application, all trolleys with air brakes should be equipped with a low-air interlock that will prevent the propulsion circuit from operating if the main reservoir air drops below a minimum safe working pressure. Any replica heritage trolleys equipped with air brakes shall incorporate a low-air interlock.

3.3 Speedometer

Where local conditions warrant its application, each trolley should be equipped with a speedometer in clear view of the operator that is readable at all times during operation.

3.4 Turn and stop indicators

Where local conditions warrant their application, each trolley should be equipped with turn indicators that can be easily activated by the operator and that are clearly visible to motorists and pedestrians on the street. Where local conditions warrant their application, each trolley should also be equipped with rear-facing stop indicators,

clearly visible to motorists, pedestrians and any following trolleys, arranged to illuminate automatically when the vehicle's brakes are applied.

3.5 Windshield wipers/defrosters

Where local conditions are likely to cause ice, frost, fog or moisture to collect on the windshield, each trolley should be equipped with appropriate window wipers and an effective means to prevent or remove such collection of ice, frost, fog or moisture.

Related APTA standards

- APTA RT-S-VIM-002-02, Pantograph Current Collection Equipment Periodic Inspection and Maintenance
- APTA RT-S-VIM-003-02, Air Supply and Air Storage Systems Periodic Inspection and Maintenance
- APTA RT-S-VIM-007-02, Friction Brake Equipment Periodic Inspection and Maintenance
- APTA RT-RP-VIM-005-02, Door System Periodic Inspection and Maintenance
- APTA RT-RP-VIM-009-02, Battery Systems Periodic Inspection and Maintenance
- APTA RT-RP-VIM-010-02, Electric Motor Periodic Inspection and Maintenance
- APTA RT-RP-VIM-018-03, Propulsion Controls Periodic Inspection and Maintenance
- APTA PR-E-S-001-98, Standard for Insulation Integrity

References

This *Standard* shall be used in conjunction with the following publications. When the following publications are superseded by an approved revision, the revision shall apply. In the event of a conflict between the standard and a referenced document, this *Standard* shall take precedence, to the extent not preempted by law. Provisions of the referenced documents not in conflict with this *Standard* shall apply as referenced herein.

- 49 CFR 38, Americans With Disabilities Act (ADA) Accessibility Specifications for Transportation Vehicles
- FTA MA-26-5005-00-01, Hazard Analysis Guidelines for Transit Projects
- FTA MA-90-5006-02-01, Handbook for Transit Safety and Security Certification
- NFPA 10, Standard for Portable Fire Extinguishers
- NFPA 130, Standard for Fixed Guideway Transit and Passenger Rail Systems
- TCRP Report 155, Track Design Handbook for Light Rail Transit

Definitions

AC inverter: A device for converting direct current (DC) electricity into alternating current (AC) electricity using partial DC voltage rectification to simulate AC current at a specified frequency, usually 60 Hz in North America.

ADA (Americans with Disabilities Act): A civil rights law passed by Congress in 1990, which makes it illegal to discriminate against people with disabilities in employment, services provided by state and local governments, public and private transportation, public accommodations and telecommunications.

Average Braking Rate: The rate obtained by dividing the speed at which the brakes are initiated (brake entry speed) by the elapsed time until stopped. The average braking rate does not include operator reaction time.

AW passenger weight loadings:

- AW0: Empty car weight ready to run.
- AW1: Car weight with seated load. Weight based on 155 lbs. (70.3 kg) per passenger.
- AW2: Car weight with seated load plus standees at one person per 2.7 sq. ft. (four people per m^2). Weight based on 155 lbs. (70.3 kg) per passenger.

- AW3: Car weight with full load, which is seated load plus standees at one person per 1.35 sq. ft. (eight people per m^2. Weight based on 155 lbs. (70.3 kg) per passenger.

California Public Utilities Commission General Order 143-B: A set of rules and regulations issued to establish safety requirements governing the design, construction, operation and maintenance of light-rail transit systems in the state of California.

DC: Direct current; non-alternating in magnitude.

drop-action fender ("lifeguard"): A device mounted under the end of a trolley or light rail vehicle in front of the trucks, designed to trap foreign objects on the track and prevent them from becoming caught under the wheels. The most common form of drop-action fender (commonly referred to as a "lifeguard"), is arranged so that the fender tray drops to the rail head if an object strikes the leading trip bar.

elevated guideway: A guideway positioned above the normal street activity level (e.g., elevated over a street).

hazard analysis process: An analysis performed to identify hazardous conditions for the purpose of their elimination or control.

light rail: An electric railway system characterized by its ability to operate single or multiple car consists along exclusive rights-of-way at ground level, on aerial structures or in subways or in streets, able to board and discharge passengers at station platforms or at street, track or car-floor level. Normally powered by overhead electrical wires.

lightning arrester: A circuit protection device designed to protect trolley electrical circuits in the event that lightning strikes the overhead contact system. Functions by shunting the high-voltage lightning charge to earth ground.

NFPA 10 (Standard for Portable Fire Extinguishers): Standard issued by the National Fire Protection Association (NFPA) covering the selection, installation, inspection, maintenance and testing of portable extinguishing equipment.

NFPA 130 (Standard for Fixed Guideway Transit and Passenger Rail Systems): Standard issued by NFPA covering fire protection requirements for underground, surface and elevated fixed guideway transit systems including train ways, vehicles, transit stations, vehicle maintenance and storage areas, and for life safety from fire in transit stations, train ways, vehicles and outdoor vehicles maintenance and storage areas.

overhead contact system: One or more overhead wires situated over rail tracks for the purpose of transmitting electrical energy to railcars. The wires are energized to a high electrical potential by connection to feeder stations at regular intervals.

PCC-type streetcars: A streetcar design introduced in North America in the 1930s by the Presidents' Conference Committee of U.S. streetcar operators. More than 5000 were built from 1936 to 1952 for U.S. and Canadian cities.

pilot: A rigid device mounted under the end of a trolley or other rail vehicle in front of the trucks, designed to deflect foreign objects on the track and to prevent them from becoming caught under the wheels.

replica heritage trolley: a new vehicle built to replicate the appearance and function of a heritage trolley (which see). For purposes of this standard, a major rebuild of a heritage trolley in which running gear and key subsystems are replaced with new equipment (i.e. only the car body is re-used), shall also be considered a replica.

subway: Underground rail alignment.

system safety program plan (SSPP): A document adopted by a transit agency or other transit provider detailing its safety policies, objectives, responsibilities and procedures.

vehicle safety certification: The vehicle component of the overall system safety certification program. The objective of the safety certification program is to produce a formal document that ensures that, at the time of operation, the system and all its components is safe for passengers, employees, emergency responders and the general public. Safety certification is the process of verifying that certifiable elements comply with a formal list of safety requirements. The requirements are defined by design criteria, contract specifications, applicable codes and industry safety standards.

heritage trolley (or "vintage trolley" or "historic streetcar"): An electrically propelled rail vehicle for the conveyance of passengers, originally manufactured prior to Jan. 1, 1956, or a new vehicle designed to replicate the appearance and function of such vehicles. The term is also used to describe similar rail vehicles that are not electrically propelled but have the same appearance and function.

wheel chock: A removable device that is manually applied to the railhead on either side of one wheel to deter a standing railcar wheel from rolling.

Abbreviations and acronyms

AC	alternating current
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
DC	direct current
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
LRV	light-rail vehicle
NATSA	North American Transit Services Association
NFPA	National Fire Protection Association
PCC	Presidents' Conference Committee
SSPP	System Safety Program Plan

Summary of document changes

a) Document formatted to a new APTA standard.
b) Scope and summary.
c) Document was changed from *APTA SS-HT-001-05* to *APTA RT-SCS-S-001-05 Rev1*.
d) Document name changed from *APTA Standard for Vintage/Heritage Trolley Vehicle Equipment* to *Vintage and Heritage Trolley Vehicle Equipment.*
e) Sections have been renumbered and moved around.
f) Deleted Section on Foreword.
g) Sections on Scope *Abstract, Keyword, Summary, and Scope and Purpose* moved to the front page.
h) Under Abstract and Key words, added words such as *historic streetcars* and *replica trolley.*
i) Deleted Section on Document Numbering Nomenclature.

j) Deleted Section on Standard vs. Recommended Practices.
k) Deleted Section on Requests for Revisions.
l) Deleted Section on Disclaimer.
m) Section on References moved to the rear of the document.
n) Definitions and Abbreviations moved to the rear of the document.
o) Section 2.7.5 *Lighting Circuits* – moved to Section 2.4.1
p) Section 4 is new Section 1– Added a new 2nd paragraph starting with *'Recognizing the diversity ……..*
q) Section 4.1 is new Section 1.1– Existing title *Operating rules changed* to a new title *Operating rules, procedures and program instruction.*
r) Section heading for 4.2 deleted and contents incorporated into 1.1.
s) Section 4.3 is new Section 1.2 – section heading amended to read from *Maintenance procedures* to *Maintenance procedures and program of instruction* and a new 2nd paragraph added.
t) Section 5.1 is a new Section 2.1 – Added a new 2nd paragraph and a new Note.
u) Section 5.5 is new Section 2.5 – Title changed from *Stopping* to *Braking rate/stopping distance.*
v) Section 5.7 is new Section 2.7 – New paragraph added.
w) Section 5.71 is new Section 2.7.1 – New 2nd paragraph and a new Note added.
x) New Section 2.7. *Current collectors* added.
y) Section 5.7.9 –*Lighting circuits* deleted.
z) Section 5.7.11 – *Portable fire extinguishers* deleted.
aa) Section 5.7.12 –*Periodic Inspection and Training* deleted
bb) Section 5.8 is new Section 2.8 – New 4th paragraph added starting with *Poorly matched wheel ……..*
cc) New Section 2.14 added – *Lighting*
dd) New Section 2.14.1 added – *Lighting Circuits,*
ee) Annex A under Fire Safety – Additional text added in the first paragraph related to K-Type control.
ff) Annex A – Section on *ADA issues* revised to *Accessibility*. Existing text deleted and a new text added starting with *As federal law ….*
gg) New Appendix B added *Sample auditor's checklist*
hh) Additional items added to the References Section.
ii) Under Definitions Section, two new definitions added relating to *Average Braking Rate* and *Replica Heritage Trolley*
jj) Under Abbreviations and Acronyms Sections, the following were added: ADA, FTA, and NATSA.

Document history

Document Version	Working Group Vote	Public Comment/ Technical Oversight	Rail CEO Approval	Rail Policy & Planning Approval	Published Date
First published	April 15, 2005	-	-	June 12, 2005	June 20, 2005
First revision	June 19, 2016	November 22, 2016	February 22, 2017	March 15, 2017	April 7, 2017

Annex A (informative): Other factors affecting heritage trolley design and operation

Vehicle structural requirements

APTA recognizes that structural design and integrity are significant issues facing potential operators of heritage equipment and/or "replica" heritage trolleys. However, owing to the wide variation in the types and ages of heritage vehicles, as well as the varying conditions of service, it is not practical to provide a universal standard.

In considering the design of new "replica" heritage trolley vehicles, structural integrity and any applicable regulations must be carefully considered. Heritage trolley operators are strongly encouraged to develop a system standard for their particular operation based on a hazard-analysis process. The operational factors detailed in Section 3 of this *Standard* provide a starting point for factors to be considered in the hazard analysis process.

For operators considering the use of restored original equipment, APTA recommends that whenever replacements or repairs are made to structural elements of the vehicle, care should be taken to ensure that the strength and integrity of the original construction is not reduced.

Fire safety

APTA recognizes the importance of fire safety countermeasures for all rail transit operations, including heritage trolleys. Section 2.7, "Electrical systems," of this *Standard* covers practices of critical importance in preventing vehicle fires. This is particularly important where the propulsion system switches high voltage motor currents in the platform controller; such as in K-Type control. The safe operation of K and other "direct" type control systems is dependent upon the systematic application of proper design, proper maintenance and proper operating practices, the absence of any of which can lead to catastrophic equipment failure. Heritage trolley operators should carefully review the criteria in Section 2.7 and establish appropriate fire safety countermeasures based on an system-level hazard analysis of their operations, taking into account the types of rights-of-way over which the vehicles are operated.

Additionally, NFPA 130, "Standard for Fixed Guideway Transit and Passenger Rail Systems," is an accepted standard in the rail transit industry and includes a comprehensive section on vehicles. NFPA 130, and other similar documents are, however, based on certain assumptions regarding the vehicles being utilized, particularly with regard to the types of materials incorporated in their construction. By their nature, heritage trolley vehicles typically incorporate large amounts of wood, obsolete upholstery materials, canvas roof coverings and other traditional car construction and finishing materials that are no longer found in the current generation of rail transit equipment. Because of this inherent difference in their construction, many heritage trolley vehicles will fall outside the scope of NFPA 130. NFPA-130 includes requirements for the same electrical elements covered in Section 2.7 of this *Standard*, emphasizing the critical importance of proper design, maintenance and operation of electrical equipment.

> **NOTE:** Section 1.1 Scope, subsection 1.1.3, of NFPA 130 specifically excludes "tourist, scenic, historic, or excursion operations."

Accessibility

Federal law requires compliance with ADA is required. While APTA recognizes that meeting the accessibility requirements of the Americans with Disabilities Act using heritage trolleys may present additional challenges, operators are encouraged to embrace this challenge and find the solutions that are appropriate to their local

operating environment. New heritage trolley projects in particular have ample opportunity to design their system with ADA compliance in mind. There are now many different onboard and wayside accessibility solutions available to heritage trolley systems, but because of the wide variation in the types and ages of heritage vehicles, APTA is not able to offer detailed guidance in this document.

Annex B (informative): Sample auditor's checklist

2	**Minimum Vehicle Equipment Requirements**		
2.1	Service Braking System		
2.2	Redundant Braking		
2.3	Parking Brakes		
2.4	Air Gauge & Low-Air Alarm		
2.5	Stopping Distance		
2.6	Sanders		
2.7	Electrical Systems		
2.7.1	Documentation, Inspection & Testing		
2.7.2	Equipment Arrangement		
2.7.3	Wiring		
2.7.4	Control Arrangement		
2.7.5	Overload Protection		
2.7.6	Propulsion Line Breaker		
2.7.7	Main Fuse Protection		
2.7.8	Auxiliary Circuits		
2.7.9	Lighting Circuits		
2.7.10	Lightning Protection		
2.7.11	Portable Fire Extinguishers		
2.7.12	Periodic Inspection & Training		
2.8	Wheel-Rail Interface		
2.9	Tamper-Resistant Controls		
2.10	Emergency Exits		
2.11	Door Interlocks		
2.12	On Board Safety Equipment		
2.13	Audible Warning Devices		
2.14	Interior Lighting		
2.15	Headlights		
2.16	Taillights		
2.17	Battery Backup / Emergency Lighting		
2.18	Grab Handles		
2.19	Pilot or Fender		
2.20	Windshields and Windows		
2.21	Mirrors		
3	**Additional Vehicle Equipment, applicable where conditions warrant**		
3.1	Deadman interlock		
3.2	Low-air interlock		
3.3	Speedometer		
3.4	Turn and stop indicators		
3.5	Windshield wipers/defrosters		