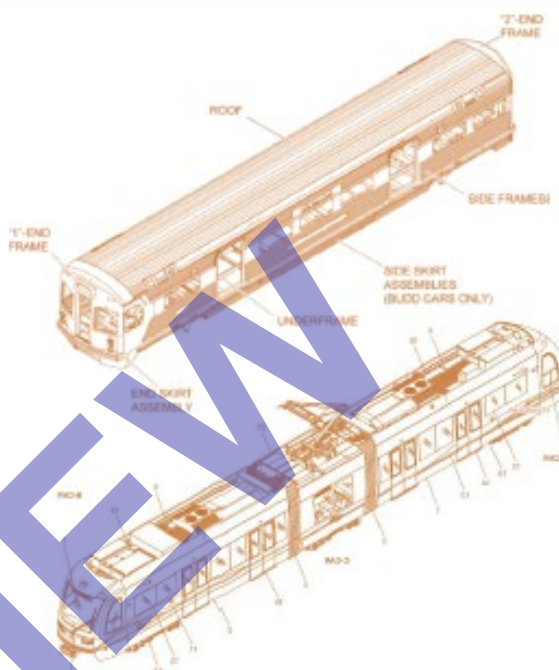


Introduction and Overview to Carbody

Course 108



PARTICIPANT GUIDE

 RAIL CAR TRAINING CONSORTIUM

PREVIEW

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REVISION INDEX

Any additions, deletions, or revisions are to be listed below.

Date	Description of Change	Revision Author
	Revise & Update PG	Brandon Liu

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MODULE 1

Overview

Outline

- 1-1 Safety Review
- 1-2 History of Rail Carbodies
- 1-3 Carbody Overview
- 1-4 Summary

Outcome and Objectives

This module is the introduction to the first of three Consortium courses on the carbody. This module starts with a safety review specific to working on and around the carbody, then it provides a description of the carbody structure. Finally, this module lists five maintainable areas of the carbody. Following the completion of this module, the participant should be able to complete the objectives with an accuracy of 75% or greater:

- Review safety guidelines.
- Describe the carbody structure.
- Identify various carbody configurations.
- List five maintainable areas of the carbody.

Key Terms

- Consist
- Married Pair

Abbreviations

APTA	American Public Transportation Association
LRV	Light Rail Vehicle
HRV	Heavy Rail Vehicle

1-1 SAFETY REVIEW

All work around rail vehicles is dangerous work. Thus the importance of safe operation and maintenance cannot be over-emphasized. Safety is an integral part of all maintenance programs and is strictly enforced by all Consortium rail transportation agencies. Here are some important points for technicians working on the carbody:



SAFETY PRECAUTIONS

- Wear proper-fitted and required PPE when working on the carbody. This may mean working under the vehicle.
- Follow lockout-tagout procedures.
- Never work on equipment while electrical power is applied unless it is absolutely necessary as part of the maintenance procedure. Verify that power is removed by checking with reliable equipment.
- Use proper lifting equipment to remove and replace heavy components. Also make sure the component is securely fastened to the lifting device.
- Never attempt to perform a two-person operation alone. Know and follow emergency procedures.
- Never take any short cuts that are not clearly defined and approved.
- Follow all agency safety guidelines and procedures.



1-2 HISTORY OF PASSENGER RAILCAR BODIES

The first passenger train can be traced to England in 1825. “Locomotion No. 1” was the first steam locomotive to carry passengers on a public railway. It hauled passengers seated on wooden planks from the mining town of Darlington to the town of Stockton. It did not take long for America to catch the railroad fever and in 1830, the Baltimore and Ohio Railroad operated the first scheduled railroad passenger service between Baltimore and Ellicott Mills (later known as Ellicott City), Maryland. A year later the Mohawk and Hudson Railroad operated its first passenger train between Albany and Schenectady, New York, a distance of 18 miles which took 45 minutes. The first passenger railcars were either wagons or stage coaches constructed of wood and mounted on four-wheels tethered by chains very much like the drawing shown in Figure 1.1



Figure 1.1 Source: Linda Hall Library for Science, Engineering, Technology. Kansas City, MO.

One passenger, a judge, recalled his first railcar journey in 1831 from Albany to Schenectady in New York:

The trucks were coupled together with chains or chain-links, leaving from two to three feet slack, and when the locomotive started it took up the slack by jerks, with sufficient force to jerk the passengers, who sat on seats across the top of the coaches, out from under their hats, and in stopping they came together with such force as to send them flying from their seats... There being no smoke or spark-catcher to the chimney or smoke-stack, a volume of black smoke, strongly impregnated with sparks, coals, and cinders, came pouring back the whole length of the train. Each of the outside passengers who had an umbrella raised it as a protection against the smoke and fire. They were found to be but a momentary protection... all having their covers burnt off from the frames... [and] the deck-passengers, each whipping his neighbor to put out the fire. [Quoted from: *The History of the First Locomotives in America from Original Documents and the Testimony of Living Witnesses*, by William H. Brown, 1871. Source:

<https://railroad.lindahall.org/essays/rail-cars.html>]

Not long after this, these rail carriages were replaced with rectangular cars and passengers sat on wood benches on either side of a center aisle.

1-3 CARBODY OVERVIEW

The rail vehicle's carbody is the area of the train where passengers ride the train. Among some railcar layouts, the carbody also includes the cab where the train operator sits.

Rail vehicles are configured in several ways depending on vehicle type such as whether it is light or heavy rail, power source (catenary or third rail), manufacturer, and other criteria. Typically, rail vehicles consist of two cars: the "A" car and the "B" car. Each car is further defined as whether it is a "1" or "2" ends (Figure 1.4) and "X" and "Y" ends (Figure 1.5). "F" and "R" designations for front and rear ends are also used (Figure 1.6).

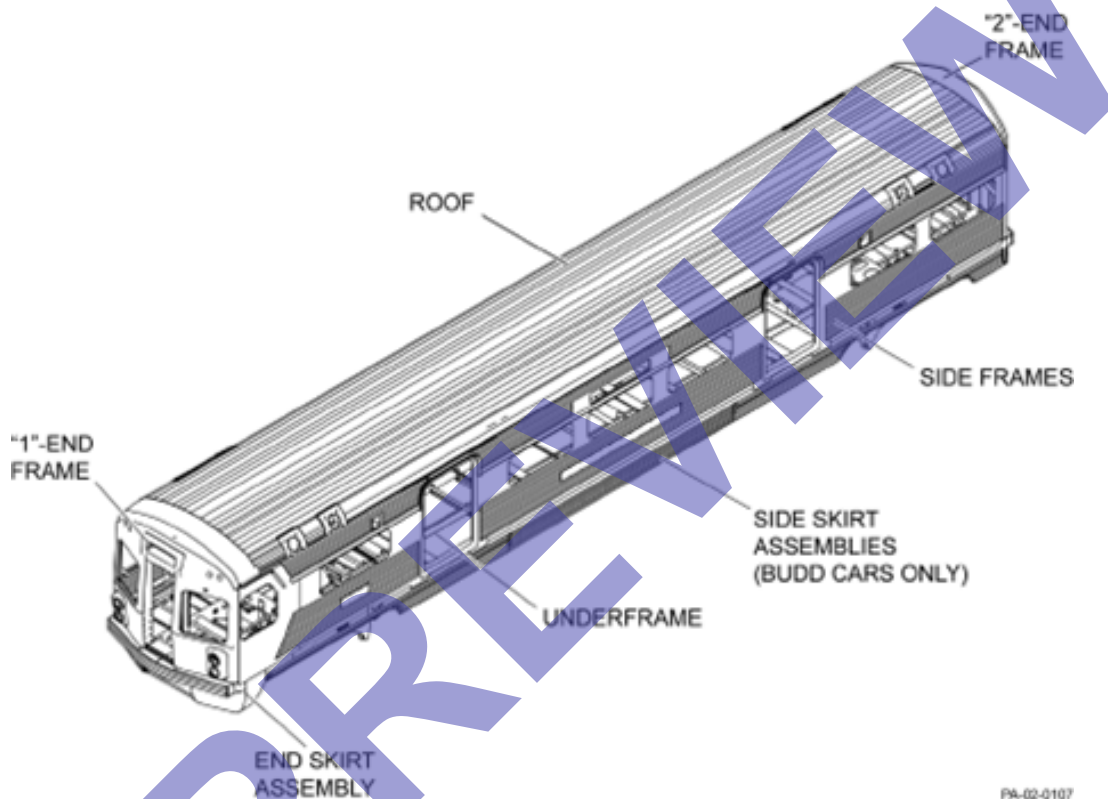


Figure 1.4 Carbody with Ends Designated as "1" and "2" –Courtesy PATCO

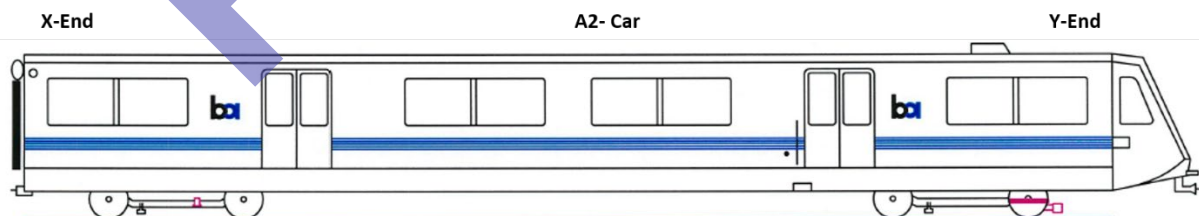


Figure 1.5 Carbody with Ends Designated as "X" and "Y" –Courtesy BART

The designation of numbered or letter car ends varies by manufacturer and rail transportation agency. For example, PATCO rail cars are assigned "1" for the cab end of a car and "2" for the non-cab end of a car.

Learning Application 1B: HRV Case Study



Read the following description from a manual for the 7000 Series cars manufactured by Kawasaki for WMATA. Participate in classroom discussion using the discussion questions that follow.

Note: The 7000-series cars do not have an operator's cab in every car: even-numbered "A" cars have operator's cabs, while odd-numbered "B" cars do not. The "B" cars can be operated however using smaller "hostler" controls instead. The married pairs are composed of one of each type.

There are two types of 7000 Series cars designated as the A Car, which has a full width cab at the front end ("F"-end) and the B Car, which has a Hostler Control Panel (HCP) at the front end. The exterior of the "F"-ends of both cars has red and white running lights, headlights, and taillights. At the rear end ("R"-end) of both cars is a semi-permanent coupler to join an A and B Car. The right and left sides of a car are always determined by facing the "F"-end of the car. The B Car has two configurations: B1 Car and B Car. The single difference is the inclusion of the Vehicle/Track Dynamic Monitoring (V/TDM) system on the B1 Car.

The 7000 Series creates a consist from car combinations called married pairs. A married pair is made up of an A Car and a B Car joined via a semi-permanent coupler at the "R"-ends (Figure 1.7). This configuration supports the electronics and networking technologies that have been integrated into the new cars and the shared mechanical and electrical systems such as the brake air compressor (only on the A Car) and the battery (only on the B Car).

Discuss:

1. In what ways does the 7000 Series compares to the rail vehicles in your transportation agency?
 2. How are multiple rail cars configured in your agency? How many rail cars make up the longest consist?
-

MODULE 2

Carbody Interior

Outline

- 2-1 Overview
- 2-2 Operator Cab
- 2-3 Flooring, Sides, and Ceilings
- 2-4 Seating and Other Installations
- 2-5 Windows and Windscreens
- 2-6 Interior Lighting
- 2-7 Summary

Outcome and Objectives

This module outlines the major areas of the carbody interior and their components. Following the completion of this module, the participant should be able to complete the objectives with an accuracy of 75% or greater:

- List the major components common to the carbody interior.
- Describe the functions of carbody interior components.

Key Terms

- Plymetal
- Windscreen

Abbreviations

ADA	Americans with Disabilities Act
HRV	Heavy Rail Vehicle
LRV	Light Rail Vehicle
WSMD	Wheeled and Seated Mobility Devices

2-1 OVERVIEW

The carbody interior varies in layout and configuration depending on age, type of vehicle, manufacturer and other criteria. In this module “interior” refers to those areas of the rail vehicle where the passengers ride.

Some of the major components of the carbody interior include:

- Operator cab
- Windows.
- Bike racks.
- Stanchions, grab rails, hanging straps.
- Stops for wheeled and seated mobility devices (WSMD) – mostly on older rail vehicles.
- Bulkhead doors (typically on heavy rail vehicles).
- Passenger seating.
- Signage, such as system maps, decals, ads.
- Rider alert panels.
- Fare collection or card equipment (typically on streetcars).

This introduction and overview course describes these major components to lay the foundation for the next level course which covers the inspection and maintenance of carbody components.

Generic interior components include flooring, stairs, windows, seats, stanchions, modesty panels, signage, exit path marking, fire extinguishers, doors, interior panels, threshold heaters, passenger hand rails, luggage racks and wheelchair restraints. The interior arrangement, for example, of a light rail vehicle manufactured by Siemens™ for the Charlotte Area Transportation System (CATS) is shown in Figure 2.1 on the next page.

COURSE 108: INTRODUCTION AND OVERVIEW TO CARBODY
MODULE 2: CARBODY INTERIOR

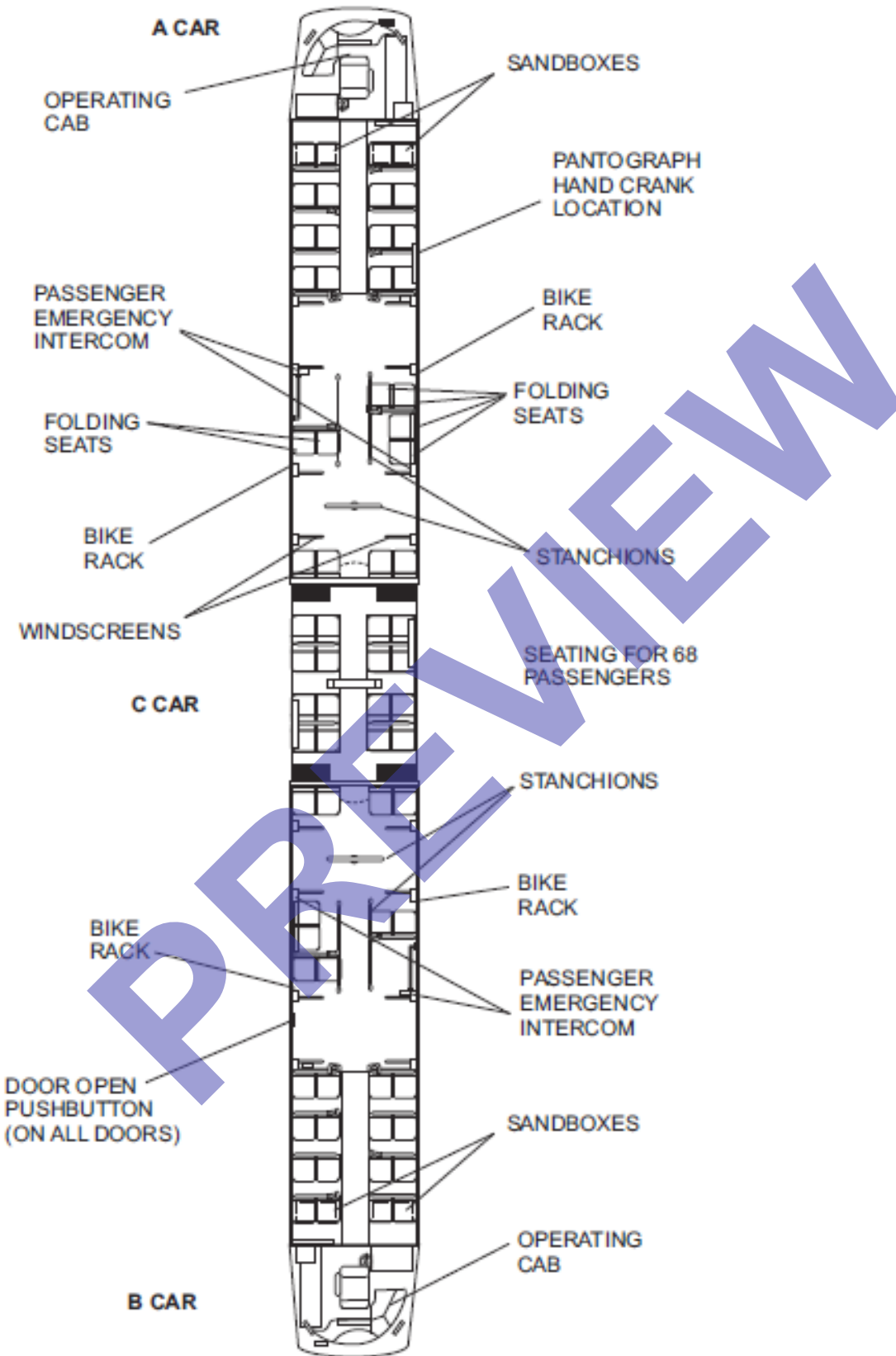


Figure 2.1 Interior Arrangement of Siemens S70 Light Rail Vehicle –courtesy CATS

2-2 OPERATOR CAB

The operator cab is an enclosed area of the rail vehicle from which the train operator works. It is closed off from the passenger seating area. Some rail vehicles are designed with operator cabs on both ends of the carbody. Other configurations have one cab. Not all rail cars have an operator cab – some rail cars are part of a married pair where one car has the operator cab and the other does not.

Though the operator cab layout varies by manufacturer, vehicle age, location requirement, and other criteria, it is comprised of these areas:

- Console.
- Operator seat.
- Cab door and windows. (Windshield is covered in Module 3, Exterior).
- Housing for specialized equipment including upper and side panels.
- Emergency equipment such as fire extinguisher and AED defibrillators.

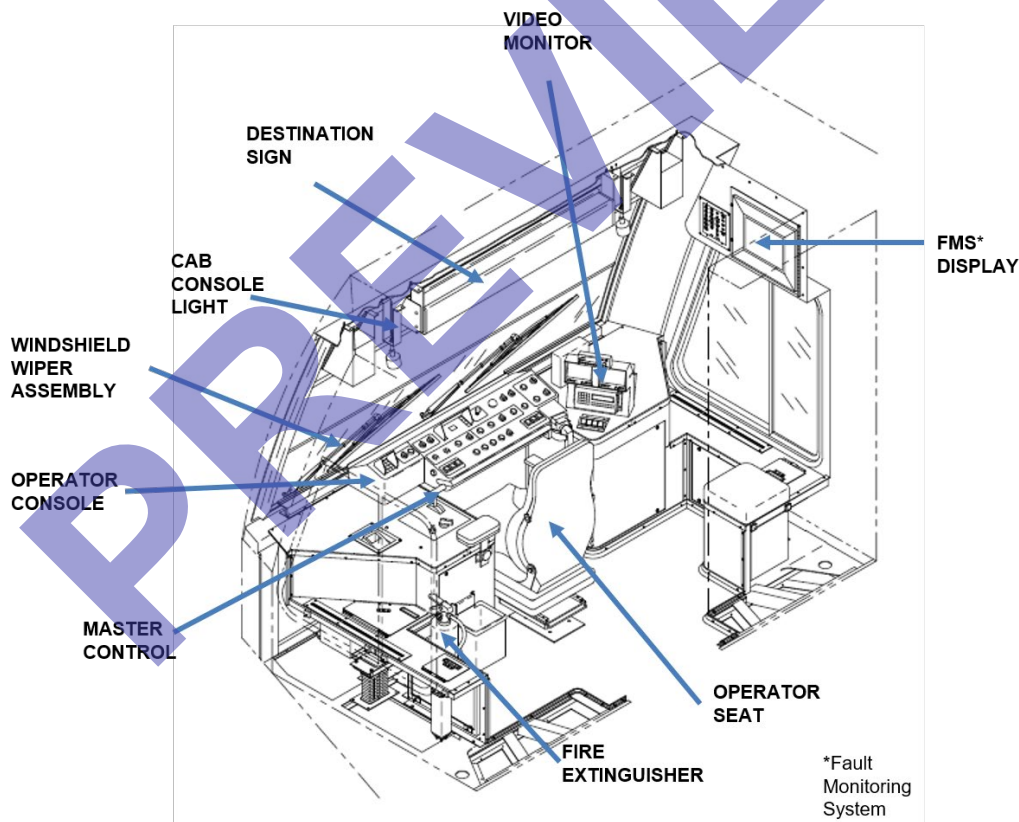


Figure 2.1 Operator Cab –Courtesy VTA

The operator cab is the center for communication between operator and passengers, operator and central control, and train and wayside equipment

COURSE 108: INTRODUCTION AND OVERVIEW TO CARBODY
MODULE 2: CARBODY INTERIOR

Side and Ceiling Panels

The interior of many passenger rail cars are comprised of side and ceiling panels that hide and protect the electrical cables, fixtures, HVAC equipment, and other sensitive components. These panels are often hinged with locks so that, when necessary, qualified technicians can gain access to maintain, repair, or replace equipment and components.

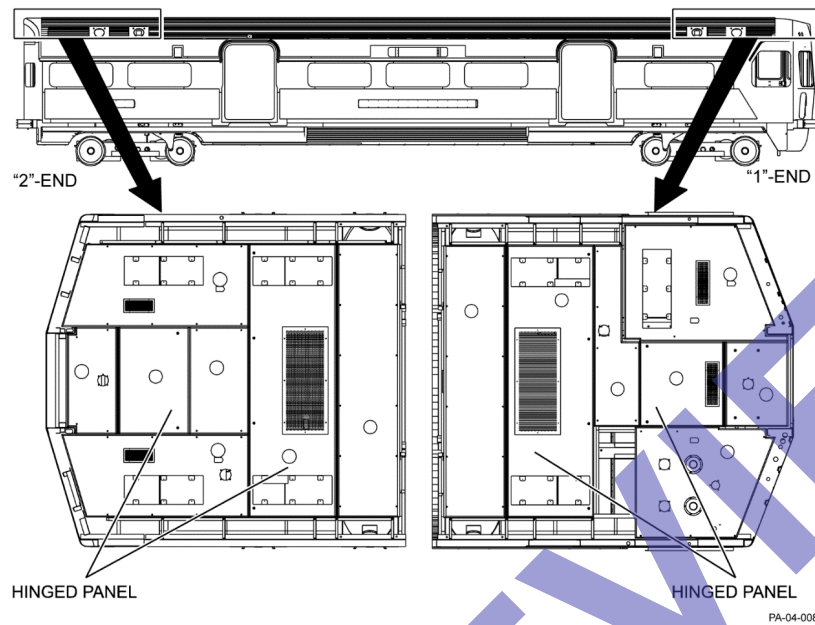


Figure 2.4 Hinged Ceiling Panels Layout on HRV –courtesy PATCO

The panels are often constructed of **plymetal** which is plywood material sheathed on both sides with aluminum or other metals.



Figure 2.5 Ceiling and Side Panels on GCRTA Tokuyū™ cars –photo by Amri Joyner

MODULE 3

Carbody Exterior

Outline

- 3-1 Overview
- 3-2 Carbody Roof
- 3-3 Carbody Ends
- 3-4 Carbody Sides
- 3-5 Exterior Lighting
- 3-6 Summary

Outcome and Objectives

This module outlines the major areas of the carbody exterior and their components. Following the completion of this module, the participant should be able to complete the objectives with an accuracy of 75% or greater:

- List the major components common to the carbody exterior.
- Describe functions of carbody exterior components.

Key Terms

- Hubometer
- Vehicle wrap

Abbreviations

APTA	American Public Transportation Association
HRV	Heavy Rail Vehicle
LRV	Light Rail Vehicle

3-2 CARBODY ROOF

Depending on the configuration of the rail vehicle, major components on the roof of the rail vehicle may include:

- Catenary equipment. These are covered in a series of Consortium courses on catenary systems for download at TransitTraining.net.
- Communication equipment. Similarly, these are covered in a series of Consortium courses available for download at TransitTraining.net.
- Roof shroud.



Learning Application 3A

List other components that are installed on the roof of the rail carbody that your agency operates. What are their major functions?

Roof Shroud

Roof shrouds are mounted on of the vehicle where the roof and side walls meet. The shrouds conceal the roof equipment to maintain the overall appearance of the vehicle. The VTA in Santa Clara, California, operates Kinki Sharyo low floor rail vehicles (LFLRV) which have ten roof shrouds on each car.

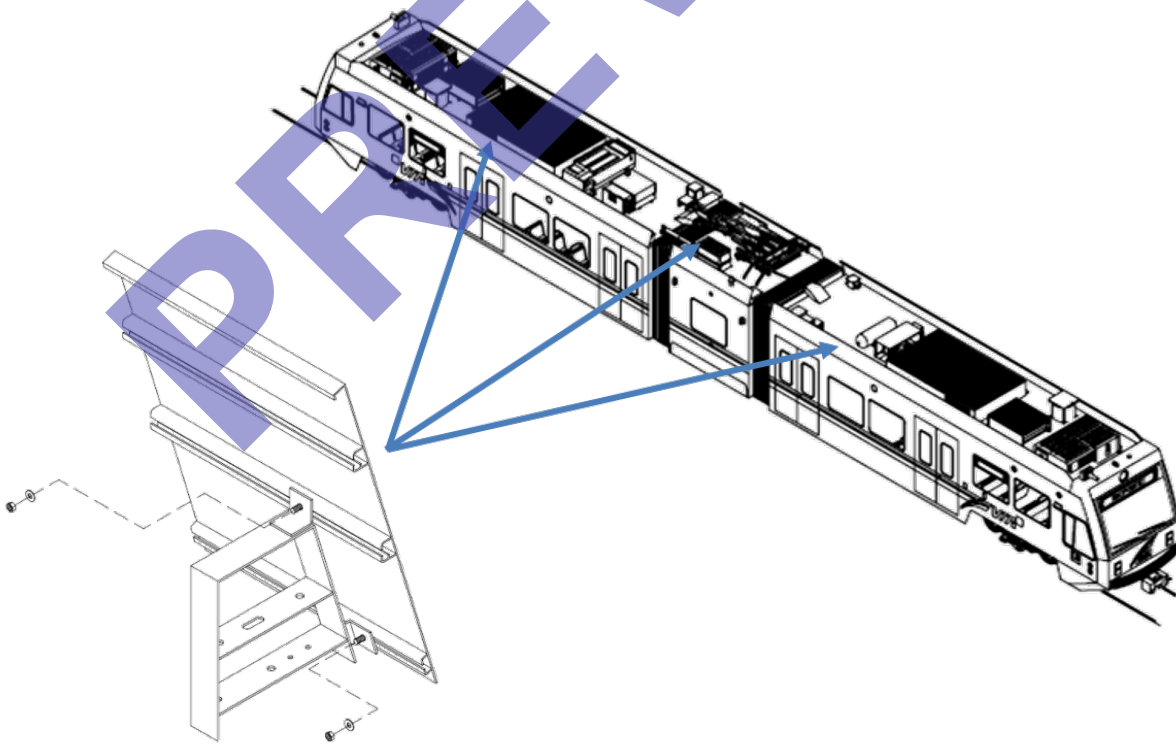


Figure 3.1 Roof Shroud Locations on LFLRV –courtesy VTA

Paint, Decals, Wraps

Carbody paint and decals are applied within specifications of the transportation system and according to requirements and standards by other authorities having jurisdiction. Samples of decals include emergency instructions and access; accessibility door; rail car number or identification; as well as labels for rail car equipment such as the sandbox and emergency door release.

Some rail transportation systems allow their vehicles to be wrapped for advertising or for promoting public interest. Known as **vehicle wraps**, these are generally applied to light rail vehicles and some marketing firms see these as rolling billboards. Vehicle wraps are a source of revenue for some transportation systems.



Figure 3.4 LRV Wrapped With Art Work –courtesy SacRT

Learning Application 3C

Read the article from Minnesota Public Radio’s website <https://www.mprnews.org/story/2014/10/09/metro-transit-ads>. Your instructor will have printed copies in class. Here are some questions for class discussion:



1. How much revenue does Metro Transit stand to gain from the advertising contract?
2. What is the estimated cost of a full wrap of a rail car?
3. What role, if any, would rail car maintainers have in the inspection and maintenance of vehicle wraps?

MODULE 4

Articulation

Outline

- 4-1 Overview
- 4-2 Major Components
- 4-3 Summary

Outcome and Objectives

This module identifies the primary components of the articulation section of a rail vehicle. Following the completion of this module, the participant should be able to complete the objectives with an accuracy of 75% or greater:

- List the major components common to the articulation section.
- Describe the functions of articulation.

Key Terms

- Articulation section

Abbreviations

APTA	American Public Transportation Association
FTA	Federal Transit Administration
LRV	Light Rail Vehicle
HRV	Heavy Rail Vehicle

4-1 OVERVIEW

As was described in Module 1, light rail vehicles generally consist of two or three sections (A and B cars and sometimes A, B, and C cars). Between these cars is the **articulation section** which serves as a flexible connection between cars and which enables the vehicle to bend horizontally for curves and vertically for track irregularities.

4-2 MAJOR COMPONENTS

An articulation consists of:

- Articulation panels
- Articulation floor
- Rub plates
- Bellows assembly
- Rubber bearing and bearing support

These components are shown in Figure 4.1 below.

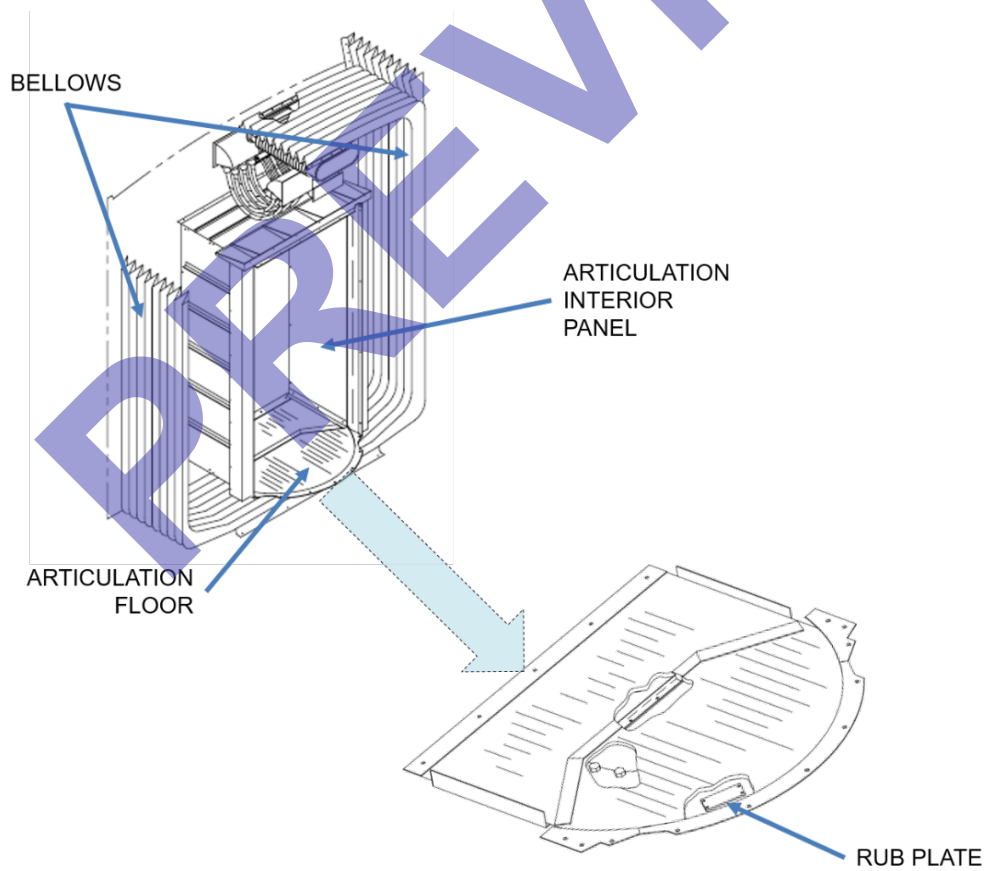


Figure 4.1 Articulation Panels Between A and B Cars –courtesy VTA