



Unit

# 1

## Basic Knowledge of Railway Vehicles

### Learning Objectives

After learning this unit, you'll be able to:

1. use basic technical terms for railway vehicles;
2. describe the types, functions and characteristics of railway vehicles in English;
3. recognize various markings on railway vehicles and be familiar with their functions;
4. understand the principle of detaining railway vehicles and selecting color tickets for those with expired predetermined repair period.

## Part One : Lead-in

- Directions:** List different kinds of transportation available today and discuss their respective characteristics with your partner.
- Directions:** Please write down the English names of the following vehicles.



(a) \_\_\_\_\_

(b) \_\_\_\_\_

(c) \_\_\_\_\_

- Directions:** Have you seen the following trains? Please write down their English names and discuss their characteristics with your partner.



(a) \_\_\_\_\_

(b) \_\_\_\_\_

(c) \_\_\_\_\_

## Part Two : Reading Materials

### Material A

#### Characteristics and Classification of Railway Vehicles

Compared with the highway, air, water, and pipeline transportation, the rail transportation has plenty of advantages such as low energy consumption,

low transportation cost, little environmental pollution and a large capacity for carrying passengers or goods. Such a type of transportation plays an extremely important role in the national economy. In the rail transportation, the railway vehicle is an important tool for transporting passengers, loading and shipping goods or meeting other transportation needs. Usually, it is not equipped with a power device, therefore it cannot travel along the route unless it is coupled with and hauled by a locomotive. The railway vehicle is demanded to move along the dedicated track. Such a special relationship between the wheel and the rail is considered as the most prominent feature of the railway vehicle. And the following features of the railway vehicle result therefrom.

(1) Self-guided: Nearly all kinds of vehicles have the steering system except the railway vehicle. The railway vehicle can run along the track through its special wheels and rail structures, without the need for manual operation for movement.

(2) Low running resistance: In addition to the resistance incurred by the ramp, bend and air, the running resistance mainly arises from friction that exists between the axle and the bearing in the running gear, and between the wheel and the rail surface.

(3) Train operation in row: Railway vehicles can be grouped and coupled to form a train on the basis of the above two characteristics.

(4) Stringent limitation on the shape and dimensions: Railway vehicles are required to run on the specific line and hence it is impossible for them to change their routes like other types of vehicles to avoid collision with whatever comes close to them. Therefore, the shape and the vehicle's dimensions shall be strictly regulated to ensure the safety of train operation.

According to the usage, railway vehicles can be divided into freight cars, passenger cars and cars for special purposes. Freight cars are dedicated to freight transportation and generally grouped for the freight trains. Freight cars fall into two main categories based on their usage: general freight cars and special freight cars. Passenger cars can be classified into vehicles for

passenger transportation and passenger service. The table below shows different types of railway vehicles in detail.

	Classification	Characteristics	Example
Freight car	General freight car	Suitable for the transportation and delivery of various kinds of goods	Gondola car, box wagon, flat car
	Special freight car	Suitable for the consignment of certain regulated goods	Tank car, refrigerator wagon, mine car, gravel car, heavy-duty freight car, ventilated box car, stock car, cement truck, container truck, hopper car, poison car
Passenger car	Car for passenger transportation	To accommodate passengers	Hard seat carriage, soft seat class, hard sleeper carriage, soft sleeper class, jointly manufactured car
	Car for passenger service	To offer services to passengers	Dining car, baggage car
Car for special purposes		For railway enterprises' own transportation purposes	Rescue vehicle, scale test car, snow plow, rail car, test car, track inspection car, rail fault detection car, clearance detection car

## Exercise A

1. Directions: Discuss the differences between railway vehicles and other vehicles.

2. Directions: Classify the following vehicles and complete the table.

gondola car, tank car, dining car, cement truck, rail fault detection car, hard seat carriage, jointly manufactured car, mine car, flat car, refrigerator wagon, rescue vehicle, soft sleeper class, baggage car, stock car, heavy-duty freight car, test car, box wagon

Car for passenger transportation	Car for passenger service	General freight car	Special freight car	Car for special purposes

## Mini-project A

**1. Directions:** Please work in pairs to make up a conversation regarding the railway vehicle.

The conversation shall incorporate your basic knowledge of the railway vehicle and be carried out in a Q&A manner. Its content shall cover the shape, characteristics and functions of the selected type of railway vehicle (either passenger car or freight car).




**2. Directions:** Work in groups of 5 and search information about railway vehicles and talk about the differences between railway vehicles and other rail vehicles such as subways, light rails, and locomotives.

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## Material B

### Lettering and Marking of Railway Vehicles

For convenience in use, management, and inspection and maintenance of railway vehicles, and according to the regulations in the rail sector, the signs marked on the designated parts of the vehicle are called vehicle markings, which are intended to identify the vehicle's property rights, model, serial number, basic performance and distributed jurisdiction of the railway bureau. Vehicle markings mainly include property rights markings, manufacturing markings, maintenance markings and operation markings.

	Type	Introduction	Illustration
	Railway emblem	The logo of a railway enterprise shall be painted on a railway vehicle to indicate its property rights.	
Property rights marking	Distribution marking	Distribution markings indicate the railway bureau that the vehicles are attached to.	
Manufacturing marking		Manufacturing markings indicate the name of the railway vehicle's manufacturing plant and manufacture date.	


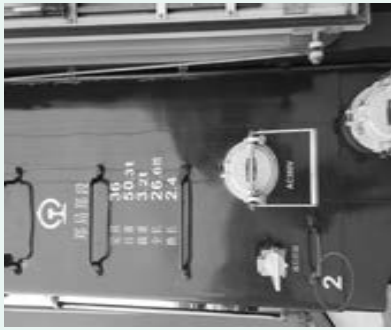

	Type	Introduction	Illustration
Maintenance marking	Regular maintenance marking	<p>It indicates the maintenance department and the date of the vehicle's regular maintenance, and marks for the next maintenance date.</p>	
		<p>Passenger car: Mainly divided into five classes, i.e. A1, A2, A3, A4, A5.</p>	

	Type	Introduction	Illustration
Maintenance marking	Marking of casual repair of vehicles detached from a train	When a freight car needs to be removed from a train and sent to the repair siding owing to its temporary malfunction, the car shall be painted on its end wall with the marking of casual repair of vehicles detached from a train to show the car's loading status, the detaching date and abbreviation for the name of the station repair yard when it is detached from the train.	For example: Detached empty car repair mark K15, 3, 6 Guangzhou North Railway Station; detached loaded car repair mark Z15, 4, 11 Guangzhou-Hengyang Railway
	Other maintenance markings	<p>The marking indicates that the vehicle is allowed for deferred maintenance, and the marking should be painted on the left side of the workshop repair mark.</p> <p>Along the outer side of the knuckle coupler and both sides of the coupler head, the horizontal straight line with width of 5 mm shall be painted with white paint at 1/2 height of the cross section of the coupler body, which is the coupler's center line.</p>	 





Type	Introduction	Illustration
Maintenance marking	<p>Marking for coupler's model</p> <p>The number of the coupler's model shall be painted in Arabic on the side of the coupler's head.</p>	
Other maintenance markings	<p>Marking for vehicle lifting</p> <p>It refers to the designated location for the passenger car to be jacked when it is in the lifting operation.</p>	

	Type	Introduction	Illustration
	Marking for vehicle model and number	The marking for vehicle model and number is composed of three parts: the basic model, the auxiliary model and its manufacturing sequence number.	
Operation marking	Marking for positioning	The marking for positioning is used for distinguishing the front and rear ends of a locomotive and for naming the same components.	
	Marking for basic data	The marking for basic data lists the capacity of a passenger car and a freight car and it is usually painted on both sides of the freight car's body and on two ends of the passenger car's body.	

## Exercise B

### 1. Directions: Discuss and answer the following questions.

(1) After reading the text, how many railway vehicle markings can you list?

(2) What are these markings used for?

(3) Where are these markings painted on the vehicle body?

### 2. Directions: Match the terms with the appropriate explanations.

(1) Dead weight	a. The weight of goods, or that of passengers and luggage shown in the markings on the railway vehicle
(2) Loading capacity	b. The distance between the inner sides of the two knuckle couplers when no longitudinal external force is acted on the vehicle and its couplers on two ends are at the locking position
(3) Volume	c. The weight of an empty car
(4) Length of car (full length)	d. The length calculated by dividing the vehicle length (m) by the standard length (m)
(5) Converted vehicle length	e. The rated number of passengers allowed to ride, stand or sleep on each vehicle
(6) Rated passenger number marking	f. The volume of goods that can be accommodated in the vehicle

## Mini-project B

1. **Directions:** Read the passage and mark the A end and B end of the vehicle, and the order of the vehicle components and parts in the picture.

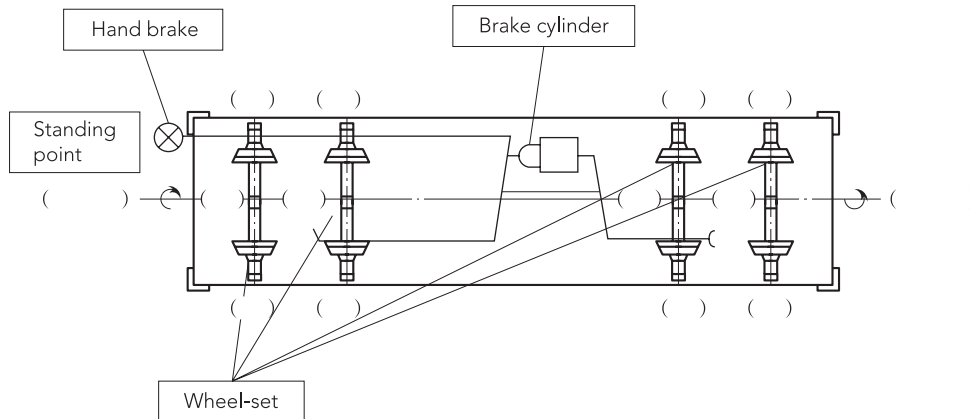
For the convenience of vehicle manufacturing, overhauls and operation, names are specified for vehicles' and their components' directions and positions.

When a vehicle is running on a straight route, the direction of connecting vehicle's front and rear is called the longitudinal direction. The transverse direction refers to the direction that is perpendicular to the vehicle's longitudinal direction.

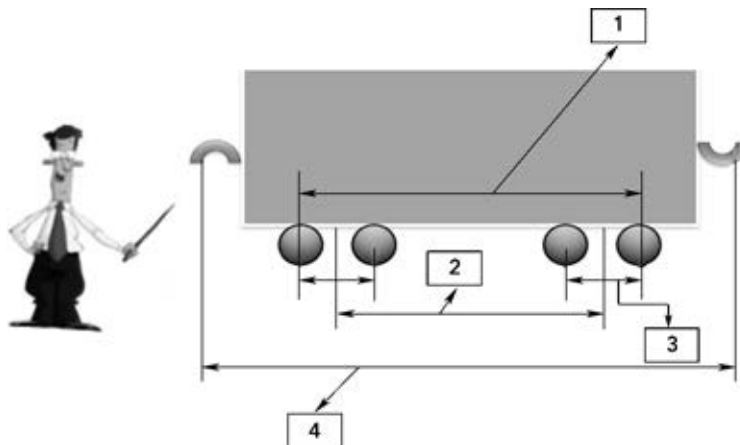


The vehicle's orientations are respectively defined as the A end of the vehicle and the opposite one, the B end of the vehicle. The latter refers to the end of the vehicle towards which the piston rod of the brake cylinder is pushed out. At the B end of the vehicle a hand brake gear is located. When a vehicle is mounted with multiple brake cylinders, the end of the vehicle where the hand brake is installed shall be considered as its B end. The determination of the sequence of a vehicle's components and parts is as follows: If the components and parts are longitudinally distributed, their sequence number shall be consecutively counted from the B end of the

vehicle to its A end; if the components and parts are distributed bilaterally and symmetrically, the sequence number of the parts shall be counted in the left-to-right order from the B end of the vehicle to the A end by a person who is required to stand at the B end of the vehicle and face the A end.



**2. Directions:** Look at the picture. Work in groups to search relevant information and explain what the length of car, the wheelbase of car, the length between truck pivot centers, and the rigid wheelbase are and what problems may arise if a rigid wheelbase is too large or too small.



Notes: 1. wheelbase of car 2. length between truck pivot centers 3. rigid wheelbase 4. length of car

## Part Three : Further Development

### Material C

#### Management of Railway Vehicles When Their Predetermined Repairs Expire

When a freight car's predetermined repair is due or expires during a train inspection outside the scope of the car's distributed jurisdiction of the railway bureau, the station that performs the inspection shall detain the car. Under such circumstances, the train inspector shall insert the prescribed color ticket into the ticket jack mounted on the detained vehicle and informs the on-duty train inspection staff to go through the detaining procedures.

(1) Programmed detainment: According to various overhaul, repair and maintenance instructions issued by the Ministry of Railways of the People's Republic of China, the railway vehicles shall be detained in light of their models and types in accordance with plans, so as to ensure that all vehicles of the railway system can be inspected and maintained as scheduled or according to the vehicles' conditions.

(2) Detainment based on the overhaul period: All classes of repairs must be carried out on a periodic basis. The station in charge of train inspection and maintenance shall detain and repair the vehicles within the predetermined repair period according to their markings for repairs and overhauls. Overhauls and depot repairs shall be performed on a monthly basis, and auxiliary repairs and axle inspections shall be performed on a predetermined date. The vehicle's auxiliary repairs can be postponed for 10 days after the date specified on the marking. Advanced repairs shall be carried out for the vehicle when its overhaul, depot repair, and auxiliary repair are due at the same time. If the auxiliary repair is due within 10 days after the empty car is detained, such a repair can be performed in advance.

(3) Detainment priority: If, pursuant to the detainment programs, vehicles whose repair periods are due or expire or those with different levels

of damage cannot be detained at the same time, the expired or more severely damaged shall have the priority of being detained for repairs.

(4) Detainment priority for higher level repairs: When a vehicle detained for predetermined repairs is required to undergo different repairs, in principle the higher level repairs shall be performed first.

(5) Detainment priority of the empty car: Generally, detainment for the vehicles whose predetermined repair periods are due shall be carried out first for the empty ones. The loaded cars shall not be detained unless it requires necessary repairs for failures that jeopardize the safety of train operation or it arrives or is about to arrive at the terminus. Otherwise, the loaded car whose predetermined repair periods are due shall be permitted to depart for the next station in charge of inspection and maintenance as long as safe operation of the train is ascertained after careful inspection.

Any vehicle that is detached for maintenance and repair owing to the due or the expired predetermined repairs, or the damage caused by a breakdown or an accident may be detained by the inspector by filling in the color ticket, and the vehicle shall be delivered in terms of the type of vehicle failures or the degree of damage to the designated places for repairs. The inspector shall verify the color ticket, carefully fill in it with the vehicle number, the major malfunction, the detaching time, the name of the station where the vehicle is detached and the inspector's name, and insert it into the ticket jacks on both sides of the vehicle.

<b>Functions of the color ticket</b>	The following color ticket shall be applied to freight cars that are detained on account of expired auxiliary repairs or required temporary repairs.	The following color ticket shall be employed to freight cars that are detained because of due or expired depot repairs, or workshop repairs at the depot or other reasons.	The color ticket below shall be used for the freight car when it is detained for being sent to the specific factory for repairs as a result of its expired workshop repairs or other reasons.
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Types of the color ticket

<p style="text-align: center;">Car sent to the line exclusively used by the railway company for repair</p> <p style="text-align: center;">Car number ____</p> <p>Malfunction part _____ inspected by ____ (inspector's name) in the ____ station on ____ (DD/MM/YY).</p> <p style="text-align: center;">Inspector for freight train</p> <p style="font-size: small;">This ticket shall only be inserted or removed by the assigned operator. (specifications: 132 mm × 210 mm)</p>	<p style="text-align: center;">Car sent for depot repair</p> <p style="text-align: center;">Car number ____</p> <p>Malfunction part _____ inspected by ____ (inspector's name) in the ____ station at ____ (Hour) on ____ (DD/MM/YY).</p> <p style="text-align: center;">Inspector for freight train</p> <p style="font-size: small;">This ticket shall only be inserted or removed by the assigned operator. (specifications: 132 mm × 210 mm)</p>	<p style="text-align: center;">Car sent for overhaul</p> <p style="text-align: center;">Car number ____</p> <p>Malfunction part _____ inspected by ____ (inspector's name) in the ____ station at ____ (Hour) on ____ (DD/MM/YY).</p> <p style="text-align: center;">Inspector for freight train</p> <p style="font-size: small;">This ticket shall only be inserted or removed by the assigned operator. (specifications: 132 mm × 210 mm)</p>
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## Exercise C

1. Directions: What are the principles of vehicle detainment for predetermined repairs?
  
2. Directions: Suppose you are a train inspector. Today is April 4, 2021 and you are inspecting the following vehicles (C70 gondola car) at the station. Please select the appropriate type of color tickets for the three vehicles in the following table and briefly explain the reason.

Note: Types of the color tickets—lines exclusively used by the railway company for repair, depot repair and overhaul

	Vehicle number	Mark for predetermined repair period	Remark
11	4811111	<u>18.04 16.04</u> 18.10 10.10	Empty car
22	4822222	<u>18.04 16.04</u> 18.04 10.04	Empty car
33	4833333	<u>18.09 16.09</u> 18.09 10.09	Defective empty car to be detached for repair



## Part Four : Workshop

Visit a passenger car depot and a freight car depot. Identify different types of vehicles, find out all kinds of markings on the vehicle, and determine the vehicle's orientation and the location of the components in the vehicle according to what you've learnt in this unit.



## Self-assessment

**Directions:** Check the box (😊, 😐 and 😞) given for each learning objective and tick the one that best matches your performance.

Learning Objectives	My Performance		
	😊	😐	😞
Be able to use basic technical terms for railway vehicles			
Be able to describe the types, functions and characteristics of railway vehicles in English			
Recognize various markings on railway vehicles and be familiar with their functions			
Understand the principle of detaining railway vehicles and selecting color tickets for those with expired predetermined repair period			