国家双高“铁道机车专业群”系列　多语种教材
——铁道车辆技术专业

Application and Management of Railway Vehicles

铁道车辆运用与管理

（中英对照版）

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PREFACE

This book is compiled in accordance with the latest version of *Railway Technical Management Regulations*, *Operation and Maintenance Regulations for Railway Passenger Cars*, *Operation and Maintenance Regulations for Railway Freight Cars*, *Rules for Investigation and Handling of Railway Traffic Accidents* and other relevant rules and regulations, and is compiled in accordance with the production organization mode and working content of the railway vehicle operation department.This book draws on the practical experience of experts and practitioners, and introduces the main work in the process of vehicle operation in detail, mainly including vehicle operation management, freight car operation and maintenance, passenger car operation and maintenance, railway production safety, etc. During the compilation process, the editors designed a series of professional skills and language learning tasks based on the application and maintenance of railway vehicles in the framework of task teaching. Using Chinese and English as the teaching media, the editors not only imparted professional knowledge and skills, but also focused on cultivating learners' ability to read English literature on railway vehicles, as well as their English communication ability in the work setting. By reading this book, readers can basically understand the basic situation of railway vehicle operation and maintenance. This book is suitable for the English teaching of vehicle majors in railway vocational colleges, and can also be used as a reference for on-site staff in countries along “The Belt and Road” that adopt Chinese railway standards.

This book is compiled by teachers of Zhengzhou Railway Vocational and Technical College, with Yu Jianyong, Xu Weihong and Ban Xiyi as chief editors, Yang Yang and Feng Hui as deputy chief editors, and Shang Yu as chief reviewer. Among them, Yu Jianyong is responsible for the first and second chapters of the Chinese part, Ban Xiyi is

responsible for the third chapter of the Chinese part, Feng Hui is responsible for the fourth chapter of the Chinese part, Xu Weihong is responsible for the first, second and fourth chapters of the English part, and Yang Yang is responsible for the third chapter of the English part.

We would like to express our heartfelt thanks for the support and help from the Locomotive and Vehicle Department of China National Railway Group Co., Ltd., Zhengzhou Bureau Group Corporation of China Railway, and Chengdu Bureau Group Corporation of China Railway and other relevant departments in the process of compiling the textbook.

Due to the limited level of editors, inaccuracies are inevitable, and we hope that readers who use this book could provide any constructive criticism and feedback.

Editor
March 2022

前　言

本书依据最新版《铁路技术管理规程》《铁路货车运用维修规程》《铁路客车运用维修规程》《铁路交通事故调查处理规则》等相关规章规程，按照铁路车辆运用部门生产组织方式及内容，借鉴专家及从业人员的实践经验，对车辆运用过程中的主要工作进行了详细介绍，主要包含车辆运用管理工作、货车运用维修、客车运用维修、铁路生产安全等内容。在编写过程中，编者以任务教学为框架设计了一系列基于铁路车辆运用维修的专业技能学习和语言学习任务，以中英双语为教学媒介，既传授专业知识和技能，又注重培养学习者阅读铁道车辆方面英文文献的能力，以及在工作场景中的英语交流能力。通过阅读本书，读者可基本了解铁道车辆运用维修工作基本情况。本书适合铁道类职业院校车辆专业英语教学使用，也可供采用中国铁路标准的“一带一路”沿线国家的现场工作人员参考。

本书由郑州铁路职业技术学院余建勇、许卫红、班希翼担任主编，杨阳、冯辉担任副主编，由郑州铁路职业技术学院尚宇主审。其中，余建勇负责编写中文部分第一、二篇，班希翼负责编写中文部分第三篇，冯辉负责编写中文部分第四篇，许卫红负责编写英文部分第一、二、四篇，杨阳负责编写英文部分第三篇。

在教材编写的过程中，编者得到了中国国家铁路集团有限公司机辆部，中国铁路郑州局、成都局集团公司等相关部门的支持和帮助，在此表示衷心感谢。

由于编者水平有限，不妥之处在所难免，希望使用本书的各位读者予以批评指正。

编　者

2022 年 3 月

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Chapter 1

Vehicle Management

As one of China's major infrastructures, railway is the main artery of national economy, as well as the backbone of transportation system. Railway transportation is featured by highly concentrated, closely connected and coordinated working links.

Railway transportation system consists of transport, maintenance, cars, public works, electrical and other departments. In order to ensure its safety, punctuality, convenience and efficiency, railway system must be operated by strictly following the transportation rules and the unified commands of China Railway Co., Ltd. (hereinafter referred to as China Railway Group), so as to transport passengers and goods to their destinations accurately, timely and safely. Railway employees must strictly abide by labor and operating disciplines, strictly implement the rules and regulations, keep in mind their own responsibilities, and ensure safe production with an extremely responsible attitude to the country and the people.

Learning Objectives

(1) Understand the tasks of vehicle operation.

(2) Master the requirements for marshalling and coupling of passenger trains and freight trains.

(3) Master the technical indicators of railway passenger cars and freight cars.

Learning Content

1. Vehicle management and maintenance

Vehicle operation includes management and maintenance. Freight trains are used throughout the country. Except for special cars and exclusive-used cars, we generally implement the responsibility system for maintenance by sections on national railways, rather than the allocation system.

1) Tasks of vehicle operation

The basic task of vehicle operation is to implement regulations and orders during maintenance, abide by operation disciplines, labor disciplines, and operation standardization, and find and deal with the faults of cars in operation to ensure driving safety.

(1) Correctly implement relevant regulations and orders.

(2) Correctly formulate production plans and technical measures, strengthen overall quality management, implement inspection and repair regulations, and improve car repair quality.

(3) On the basis of ensuring the quality of vehicle maintenance, strive to shorten the vehicle maintenance time and accelerate the cyclic utilization of vehicles.

(4) Repair the cars assigned to the depot and the cars within the jurisdiction to prevent accidents and ensure safety.

(5) Do well in labor protection, improve the working conditions of employees, and ensure safe production.

(6) Carry out technical training to improve the professional skills in train braking technology.

(7) Regularly investigate and analyze the technical status of vehicles in use, collect, process, and analyze the faults in operation and maintenance, so as to form a quality information feedback system to put forward suggestions for improvement in vehicle maintenance and operation management.

2) Vehicle maintenance work

Regular maintenance of railway vehicles is implemented, and gradually expanded to state repairs, replacement repairs, and professional centralized repairs of major parts.

(1) Operation and maintenance of railway passenger trains.

Passenger trains are inspected and repaired according to the traveled mileage. The repair for passenger trains with a maximum operating speed of 120 km/h are divided into overhaul, depot repair, and auxiliary repair. The maintenance quality of passenger trains is directly related to the safety of passengers' lives and property. The daily maintenance contents are as follows:

- Technical servicing station: comprehensively inspect, test and repair the passenger train entering the passenger train technical servicing station.
- Passenger train inspection and service point: carry out the technical inspection and maintenance for departure, arrival and passing-by trains.
- Passenger train technician crew: conduct technical inspection, maintenance and management on the passenger train on the way.

(2) Operation and maintenance of railway freight trains.

The repair of railway freight trains can be divided into overhaul, depot repair, and auxiliary repair. The overhaul of freight trains is once every 5-8 years, the depot repair is once every 1-2 years, and the auxiliary repair is once every 6 months. Freight trains have poor operating conditions and are subjected to frequent impacts during disassembly, marshalling, and mechanized loading and unloading operations. Perishable goods cause corrosion to parts. Trains with heavy-loaded goods and heavy haul trains collide during operation, causing great wear and tear, deformation, looseness, corrosion on train components. Therefore, the train must be inspected and repaired in time, which is divided into car detached repair and in-train repair.

a. Car detached repair.

Detach the cars with faults from the train, send them to the special repair line or repairing points. This is known as the car detached repair. Implementation of the car detached repair can make full use of fixed platform and mechanized repair equipment in accordance with technical standards to repair cars, eliminate failures, and to ensure quality. But this will increase the workload of shunting operations and car waiting time. This will effect transport efficiency. Cars with the faults that can be repaired in train must have the car detached repair.

b. In-train repair.

When doing the technical inspection after the arrival of the train, or before the departure of train, the car failures found in the parking line can be repaired in the dwell time, this is said in-train repair. The implementation of in-train repair can quickly eliminate the traffic safety failure, speed up car turnover and improve transport.

2. Operational indicators for vehicles

1) Present freight car

Present freight cars refer to all existing freight cars in the Railway Bureau jurisdiction at 18:00 every day. They can be divided into freight cars in operation and serviceable freight cars, as shown in Figure 1-1 and 1-2.

(1) Freight cars in operation refer to all the empty, loaded cars that are used in the railway transport operations, collectively referred to as the freight cars in operation. It is an important indicator of the transport capacity.

(2) Serviceable freight cars refers to freight cars that do not participate the railway transport operations. They include the non-production freight cars and empty freight cars provided and rented by enterprises.

A certain number of serviceable freight cars is necessary for transport production. But it cannot take up too many cars; otherwise it will affect the utilization rate of freight cars. Thus all

the vehicle-related departments should improve car maintenance efficiency, shorten the repair time, and make efforts to reduce the number of maintenance cars, increase the number of freight cars in operation and mine up transport potential.

Figure 1-1 Freight cars in operation

Figure 1-2 Serviceable freight cars

2) Freight car kilometers

A freight car traveling one kilometer is called one car kilometer. Freight cars in operation kilometer is the total distance traveled by freight cars in operation; it is the indicator that reflects the running amount of the freight cars. To a certain extent, it reflects the degree of wear of the wheel sets.

3) Freight car kilometers per car per day

Freight car kilometers per car per day refers to the running mileage of one freight car in a day and night in a certain period of time for a railway bureau or the railway cooperation.

The number of kilometers for freight car per day = kilometer of freight cars in operation / number of freight cars in operation

= average car-kilometers in one complete turnround / car turnround time (km/d)

The freight car kilometers per car per day is the index to reflect the degree of freight car flow. Under the condition of a certain percentage of empty to loaded car kilometers, the greater the flow of freight car, the larger loading amount of freight car will accomplish.

4) Average car-kilometers in one complete turnround and turnround time of freight car

(1) Average car-kilometers in one complete turnround: refers to the average running distance of one complete turnround. It includes all the travelling distance of the freight car in the loaded and empty state. The average car-kilometers in one complete turnround of the freight car is positive to the turnaround time of the freight car. If the other factors remain unchanged, the longer the whole turnaround distance, the longer the turnaround time. Therefore, the average car-kilometers in one complete turnround should be shortened under the premise of ensuring normal work.

(2) Turnaround time of freight car: refers to the average time spent in turnover of freight cars in operation. It reflects the overall efficiency of the entire process of the car turnover, which is often used as a comprehensive indicator of the efficiency of the car operation.

5) Car loading capacity

The car loading capacity is an indicator of the degree of utilization of the car load capacity. It is divided into static load of car and dynamic load of car.

(1) Static load of freight car refers to the average tonnage of goods loaded by each car in the station, railway bureau or the whole railway in a certain period of time. It directly affects the number of loading cars and the number of operating cars required to complete a certain tonnage of goods.

(2) Dynamic load of freight car refers to the tonnage kilometers of goods completed by the whole railway and one Railway Bureau per car kilometer in a certain period of time.

The static load of freight car only reflects in the utilization of the load capacity of the goods under the static conditions of loading or loaded car. The dynamic load of freight car reflects the the average turnover of goods completed by each loaded car kilometer or operational freight car kilometer. It reflects the operational degree of the freight car in the whole process of transporting goods.

6) Present passenger cars

Present passenger cars include serviceable passenger cars and non-serviceable passenger cars, as shown in Figure 1-3 and 1-4.

(1) Serviceable passenger cars: all passenger cars dealing with transporting passengers collectively are referred to as serviceable passenger cars. Such as soft and hard seat cars for passengers, soft and hard sleeper cars, luggage cars and dining cars for passengers.

(2) Non-serviceable passenger cars: all passenger cars that do not handle passenger business and those that are in poor technical condition and cannot be coupled to the train for operation are non-serviceable passenger cars. Such as spare cars, official cars, welfare cars, special purpose cars and various maintenance cars, etc.

Figure 1-3 Serviceable passenger cars

Figure 1-4 Non-serviceable passenger cars

7) Number of passenger cars on hand

Railway passenger cars usually are respectively assigned to each unit, so the number of cars ownership for each unit is relatively stable, namely the number of all passenger cars each unit owns.

Number of passenger cars on hand can also be obtained by the formula:

$$P = (1+\alpha)\sum Lm$$

P—number of allocated passenger cars;

α—non-serviceable passenger cars retention factor, generally take 0.36 (of which spare car of 0.10, volatility of 0.20, maintenance rate of 0.06);

L—passenger train set number;

M—number of car sets.

Purpose of calculation of passenger cars ownership: one is to better grasp the distribution of passenger cars, to complete the railway transport task evenly; the other one is using the amount of car ownership multiplied by the repair cycle coefficient of various repair process, we can calculate the amount of maintenance tasks.

8) Passenger train kilometers and serviceable passenger car kilometers

(1) Passenger train kilometers refers to total kilometers the passenger train sets run attached to each unit of the bureau. The total kilometers of railway corporation passenger train is the sum of the national railway passenger train km. Passenger train kilometers is an important index of assessment and plan for passenger train related expenses.

(2) Serviceable passenger car kilometers refers to the total running kilometers of passenger cars allocated by each depot under the railway administration in each section.

Serviceable passenger car kilometers is an important part of passenger car kilometers and an important index for planning and assessment of passenger car maintenance costs and other technical expenses.

9) Turnround time of passenger train set

Turnround time of passenger train set refers to the total time from the first time when passenger train set is sent from the departure station to the next time when next passenger train set is sent from the departure station in order to operate the passenger train sets in the train diagram.

The turnround time of passenger train set reflects the efficiency of the whole process of the train set turnover, which reflects the efficiency of all departments related to passenger transport. The length of the turnaround time directly affects the number of cars required for trains in operation, thus affecting the number of passenger cars required for the railway. Therefore, this

important indicator of car turnover time is used in the planning the number of passenger train sets.

3. Car maintenance index

1) Existing number of maintenance cars

Existing number of maintenance cars is also named as the number of cars in bad condition, or number of cars with defects. It refers to the number of all cars under repair and to be repaired that have been detained within the jurisdiction of the whole railway, a railway bureau, a vehicle repair factory or depot at 18:00 every day. It include subordinate cars (including corporate rental cars) that are detained for repair due to the expiration of regular inspection or temporary repair, the cars detained for repair, and cars to be scrapped and returned for maintenance. It also includes foreign and enterprise-owned cars with temporary failure that have been detained for repair.

Existing number of maintenance cars can be calculated according to the following formula:

Existing number of maintenance cars = number of remaining maintenance cars at the beginning of the day + number of cars detained for repair today − number of cars repaired today

Existing number of maintenancecars cars reflects the state of railway car reflects the status of vehicles of the whole railway or a railway bureau, as well as the progress of vehicle maintenance work of each vehicle maintenance unit, railway bureau or the whole railway. In order to ensure the factory and depot repair plan step by step and rhythmically, the Ministry of Railways stipulates that each Railway Bureau and repair factory has a certain amount of maintenance vehicles. Each depot and factory shall strive to reduce the number of maintenance cars under their jurisdiction and keep them below the specified quantity. Strengthen the planning of detaining cars and reducing the temporary repair of detached cars are one of the main ways to reduce the number of maintenance cars. Improve the efficiency of maintenance, shorten the maintenance time and improve the daily departure rate of maintenance cars are also important measures to reduce the number of maintenance cars.

2) Rate of cars under repair

Rate of cars under repair, also known as car defect rate, is the indicator to reflect the state of the car with relative figures.

Rate of freight cars under repair: it is the ratio of the number of defective freight cars of the whole railway or a railway bureau to the number of dominant freight cars. Freight cars are generally operated in the whole railway without fixed allocation. The freight car maintenance tasks of each bureau are allocated according to their maintenance capacity.

3) Down time for holding cars for repairing

Down time for holding cars for repairing refers to the average total dwell time of a car

repaired by the whole railway or a railway bureau, a vehicle repair factory, a depot or other vehicle repair unit within a certain period of time. Day is used to count the voerhaul and depot repair time. Hour is used to count the time of auxiliary repair and temporary repair.

Down time for holding cars for repairing is an important indicator of the progress of the car repair work. Under the premise of ensuring the quality of the car repair, if down time for holding cars for repairing is shorter, it means the higher of the efficiency of car repair; the longer the down time of car maintenance is, the lower of the efficiency of car repair.

To the depot repair, the total down time of car maintenance for each car includes the time of repair track maintenance, waiting time and repair time; For the vehicles handed over to the factory for maintenance, it is often necessary to add the whole time from the place confirmed to be sent to the factory for maintenance to the train until the factory procedures are completed, which can also be called the return time.

4) Responsibility delay

Responsibility delay is an important indicator to evaluate the quality of the inspection work. Inspection personnel should inspect and maintain the cars in the time specified in the train operation diagram, and ensure the car or train running to the next inspection field and the repaired parts will not have failure. Any delay caused by improper work organization affecting the train to leave according to the scheduled time and due to the maintenance of the train is called the train inspection responsibility delay.

5) Responsible accident

The car operation department shall eliminate the railway traffic accidents and ensure the safety of the train operation. The accident caused by the inspection field or depot should be listed as responsible accident in the railway bureau and depot assessment system in accordance with the provisions of the "Rules for Investigation and Handling of Railway Traffic Accidents". For general accidents, passenger cars are counted according to the number of cars per 100 allocated cars assigned to the depot. Freight cars are counted according to the number of pieces per million vehicle kilometers of freight trains in its jurisdiction.

4. Car marshalling

1) Marshalling of cars in freight trains

The marshalling of freight trains shall comply with the following provisions in addition to the marshalling plan and train operation diagram:

(1) Dangerous and flammable freight cars are required to take some isolation measures during transport to avoid accidents.

(2) In the freight train, it is allowed to close the cut-off cock (hereinafter referred to as the car with closed angle cock) for the cars whose braking effect is stopped due to the loaded goods

and the cars whose automatic brake temporarily fails. But the departure trains marshaled at the inspection field should not have cars with closed angle cock that have brake deformation. The number of cars with closed angle cock marshaled into the trains should not exceed 6% of the total number of cars. If exceeding the number, the force of brake shoe should be calculated, and we should fill the brake performance certificate to the locomotive driver.

The car with closed angle cock shall not be coupled within three cars at the rear of the locomotive; no more than two cars shall be coupled in a row; the last car of the train shall not be the car with closed angle cock; the last second and third trains shall not be the cars with closed angle cock continuously.

For cars that are not suitable for continuous coupling in the middle of the train but with good running part, they can be coupled at the rear of the train with the permission of the train dispatcher. If the automatic brake of the vehicle does not work, the vehicle personnel must take safety measures to ensure that they will not be decoupled.

(3) Mechanical refrigerated cars should be coupled in the middle or rear of the freight train.

2) Coupling requirements for passenger trains

Passenger trains should be coupled in accordance with the type, number and the linked location regulated by the provisions of passenger trains coupling table. The last car should have air gauge and emergency brake valve.

(1) The coupled cars should be coupled according the speed mark of the cars.

(2) The provisions of passenger train linked with freight cars.

Express passenger trains are not allowed to couple freight cars. Other passenger trains in principle are also not allowed to couple freight cars. However, in special circumstances (accident relief, rescue), when freight cars must be coupled to the passenger train, it is subject to the approval of the higher authorities, then freight cars can be coupled to the end of the train, but no more than two freight cars. The technical status and maximum operating speed of the coupled freight cars must conform to the speed requirements of the passenger train. In the passenger train, the end door of the passenger car connected with the freight car must be locked.

(3) Cars not allowed to be coupled into the passenger trains.

Cars that exceed the period of regular maintenance (except the passenger trains according to the provisions in the extension range or identified by vehicle department that are sent for plant repair and depot repair).

Cars that carry dangerous, stinking goods.

Passenger trains that do not have the axle alarm car installed.

(4) Requirements for linking the passenger train and traction locomotive.

Cars loaded with passengers should be isolated with the traction locomotive by the car with

no passengers. The luggage car, postal car, electric generator car and other non-passenger cars can be coupled next to the locomotive and at the end of the train as an isolated car. If the isolated car has faults and need to be taken off on the way, the train can continue to run without isolated car. In the absence of isolated car, in order to ensure the safety of passengers and the normal operation of traction locomotives, the front door of passenger car connected with the locomotive should be locked.

(5) Provisions for the car with closed angle cock in passenger train.

Passenger trains are not allowed to marshall cars with closed angle cock. In case of temporary failure of automatic brake during operation and can not be repaired within the parking time, it is allowed to close the angle cock of one car, but the last car of the train shall not be the car with closed angle cock.

3) Confirmation of coupler height difference

The height difference of the center horizontal lines of the couplers (simplified as coupler height difference) should be not more than 75 mm. This height difference is measured by the distances the two nearby coupler's center lines to the track surface. According to the operational restrictions, the maximum height between the coupler center lines to the top of the track surface is 890 mm. The minimum for empty freight car is 835 mm and for loaded freight car is 815 mm.

If the height difference of the coupler exceeds the operational restrictions, when the train runs on the track switches or on the soft foundation of the roadbed, the vehicles may vibrate up and down. Especially on the steep slope line, it is prone to happen decoupling and cause the vehicles to be uncoupled. When the coupler height difference is large, the contact surface of the coupler knuckle is also reduced, resulting in excessive bending moment, which is prone to happen coupler knuckle break accident.

Revision exercises

1. What is the car detached repair and in-train repair?

2. What is the danger if the height of two adjacent couplers exceeds the requirements in marshalling passenger trains?

3. What is the function of freight train's operation indicators and maintenance indicators?

第一篇　车辆运用管理工作

铁路是国家的重要基础设施之一，是国民经济的大动脉，是交通运输体系的骨干。铁路具有高度集中，各个工作环节紧密联系和协同动作的特点。

铁路运输系统由运输、机务、车辆、工务、电务等业务部门组成，为确保铁路安全正点、方便快捷、高速高效，铁路运输系统必须严格遵守运输纪律，服从运输指挥，在中国国家铁路集团有限公司（以下简称国铁集团）的统一指挥下联合行动，准确、及时、安全地把旅客、货物运输到达目的地。铁路职工必须严格遵守劳动纪律和作业纪律，严格执行各项规章制度，牢记自身职责，以对国家和人民极端负责的态度，保证安全生产。

【学习目标】

（1）了解车辆运用工作的任务。

（2）掌握铁路客、货物列车编挂要求。

（3）掌握铁路客车、货车车辆运用技术指标。

【学习内容】

1. 车辆管理与检修

车辆运用工作包括管理和检修两方面的内容。货车通行全国，除特种车辆和专用车列外，一般不实行配属制，而是实行在全国铁路上按区段维修负责制。

1）车辆运用工作任务

车辆运用工作的基本任务是在检修中执行规章命令；遵守作业纪律、劳动纪律，作业标准化；发现和处理车辆在运用中发生的故障，保证行车安全。

（1）正确执行有关规章命令。

（2）正确编制生产计划及技术措施，加强全面质量管理，落实检修规定，提高修车质量。

（3）在保证车辆检修质量的基础上，努力缩短车辆修车时间，加速车辆周转。

（4）维修好本段配属车辆和管辖范围内的运用车辆，防止事故，保证安全。

（5）做好劳动保护工作，改善职工劳动条件，保证安全生产。

（6）开展技术培训，提高制动技术业务素质。

（7）定期调查分析运用车辆技术状态，对运用维修中的故障进行信息收集、处理、分

析，形成质量信息反馈系统，对车辆维修和运用管理提出改进意见。

2）车辆检修工作

铁路车辆实行定期检修，并逐步扩大实施状态修、换件修和主要零部件的专业化集中修。

（1）铁路客车运用维修。

客车按走行公里进行检修，最高运行速度不超过 120 km/h 的客车分为厂修、段修、辅修。客车的维修质量直接关系到旅客生命财产的安全，其日常维修内容为：

- 库列检：对于进入客车技术整备所的旅客列车进行全面检查、试验和修理。
- 客列检：对始发、到达及通过的旅客列车进行技术检查和维修。
- 客车乘务：车辆包乘组对值乘的旅客列车进行途中技术检查、维修和管理工作。

（2）铁路货车运用维修。

铁路货车通常分为厂修、段修、辅修。货车厂修 5～8 年一次，段修 1～2 年一次，辅修为 6 个月一次。货车运用条件较差，在解体、编组及机械化装卸作业中承受频繁冲击，易腐货物对配件造成腐蚀，重载货物、长大列车在运行途中冲撞等，使货车零部件产生较大的磨耗、变形、松动、腐蚀等故障。因此必须对货车进行及时的检查维修，分为摘车修和不摘车修。

a. 摘车修：

把有故障的车辆从列车中摘下，送到专用修车线或站修作业场内维修，称为摘车修。实施摘车修可充分利用固定台位和机械化修车设备，按照技术标准修复车辆，消除故障，保证质量。但会增加调车作业的工作量和车辆停留时间，对运输效率有所影响。在列车内无法修复的故障必须施行摘车修。

b. 不摘车修：

在列车到达后、始发前进行技术检查时，对发现的车辆故障，能在停车线上利用站停时间修复的，称不摘车修。实行不摘车修，能较快地消除危及行车安全的故障，加速车辆周转，提高运输效率。

2. 车辆运营指标

1）现在货车

现在货车，是指每日 18:00 现有的全部货车，可分为运用货车和非运用货车。

（1）运用货车：指参加铁路营业运输生产的一切空、重货车，统称运用货车，如图 1-1 所示。它是表明运输生产能力的一项重要指标。

（2）非运用货车：不参加铁路营业运输的非生产性的货车和企业自备、租用的空货车，

如图 1-2 所示。

一定数量的非运用货车是运输生产必须的。但不能占用过多，否则会影响货车利用率。为此，车辆相关部门要提高修车效率，缩短停修时间，努力压缩检修车数，增加运用货车数，挖掘运输潜力。

图 1-1　运用货车

图 1-2　非运用货车

2）货车车辆公里

一辆货车走行一公里叫一车辆公里。运用货车车辆公里是运用货车总走行的公里，它是反映货车走行工作量的数量指标，在一定程度上反映了轮对的磨耗程度。

3）货车日车公里

货车日车公里，指在一定时期内铁路局或全路平均每一运用货车在一昼夜内的走行里数。

货车日车公里数=运用货车车辆公里/运用货车数（km/d）

=货车全周转距离/货车周转时间（km/d）

货车日车公里是反映货车流动程度的指标。货车流动程度越大，在空车走行率一定条件下，货车所完成的货运量越大。

4）货车全周转距离及周转时间

（1）货车全周转距离（简称全周距）：货车每周转一次的平均运行距离。它包括货车在重车状态下和空车状态下的全部行程。货车全周转距离与货车周转时间成正比。若其他因素不变，全周距越长，货车周转时间越长。因此，全周距应保证正常工作的前提下力求缩短。

（2）货车周转时间：运用货车在一次周转中平均花费的时间。它反映着整个货车周转过程的总效率，通常把它作为货车运用效率的综合性指标。

5）货车载重量

货车载重量是反映货车载重能力利用程度的指标。分货车静载重和货车动载重两种。

（1）货车静载重：在一定时期内，车站、路局或全路平均每装车一辆所装载的货物吨数。它直接影响到装车数，影响到为完成一定货物发送吨数所需的运用车数。

（2）货物动载重：指在一定时期内，全路、一个路局平均每一货车公里所完成的货物吨公里数。

货车静载重仅反映在装车时或重车状态的静止条件下货车载重能力的利用程度。货车动载重反映的是平均每一重车公里或运用货车公里所完成的货物周转量，表现出货车在运送货物全过程中的利用程度。

6）现在客车

现在客车包括运用客车和非运用客车两种。

（1）运用客车：凡是办理旅客营业的客车统称为运用客车。如供旅客乘坐的软、硬座车，软、硬卧车及为旅客服务的行李车、餐车等，如图 1-3 所示。

（2）非运用客车：凡不办理旅客营业的客车以及技术状态不良，不能编挂于列车中运行的客车，均为非运用客车。如备用车、公务车、福利车、特种用途客车及各种检修客车等，如图 1-4 所示。

图 1-3　运用客车

图 1-4　非运用客车

7）客车保有量

铁路客车一般会分别配属给各单位，所以各单位的客车保有量是相对稳定的数值，即全部配属的客车辆数。

客车保有量也可由下式求得：

$$P = (1+\alpha)\sum Lm$$

式中　P——客车配属辆数；

α——非运用车保有系数，一般取 0.36(其中备用车 0.10，波动率 0.20，检修率 0.06)；

L——旅客列车车底列数；

m——车底组成辆数。

计算客车保有量的目的：一方面是为了更好地掌握车辆的分布情况，以均衡地完成铁路运输任务；另一方面，用保有量乘以各种修程的修理循环系数，可以计算出检修任务量。

8）旅客列车公里及运用客车车辆公里

（1）旅客列车公里：是指由铁路局所属各段配属车底开行的旅客列车公里总数，是计划和考核与旅客列车有关支出的一项重要指标。全路旅客列车公里是全国各铁路局旅客列车公里的总和。

（2）运用客车车辆公里：是指由铁路局所属各段配属客车在各区段走行公里的总和。旅客列车公里，是客车车辆公里的重要组成部分，是计划和考核客车检修费用等有关客运支出的一项重要指标。

9）旅客列车车底周转时间

旅客列车车底周转时间，是指为了开行运行图中某一对旅客列车的车底，从第一次由车底始发站发出之时起，至下一次再由该始发站发出时止，所经过的全部时间。

车底周转时间反映着车底周转全过程的效率，反映着所有与客运有关各部门的工作效率。车底周转时间的长短，直接影响到为开行某对列车所需要的车底数，从而也就影响到铁路所需要的运用客车数。因此，在计划旅客列车车底需要数时，都要使用车底周转时间这一重要指标。

3. 车辆检修指标

1）检修车辆现有数

检修车辆现有数，也叫不良车数、残车数或检修车数，是指每日 l8:00 全路、一个铁路局、一个车辆修理工厂或车辆段的管辖范围内所具有的全部已扣修的在修和待修的车辆数。其中包括部属车辆(包括企业租用车)中因定检到期或临修而扣修的车辆；因事故破损和待报废及回送中的检修车辆；也包括在铁路营业线运用中，因临时发生故障而摘车临修的外国车及企业自备车。

检修车辆现有数可按下列公式计算：

检修车辆现有数=日初残存检修车数+本日扣修车数－本日修竣车数（辆）

检修车辆现有数可以反映全路或一个铁路局车辆的状况，也可以反映各个车辆检修单位、路局或全路修车工作的进展。为了保证工厂和车辆段修车计划有步骤、有节奏地均衡完成，国铁集团规定了各铁路局和修理工厂有一定的检修车定量。各段、厂要努力减少管内的检修车数，使之经常保持在规定量以下。加强扣车的计划性和减少摘车临修，是减少检修车数的一个主要途径，而提高修车效率、缩短检修时间及提高修车的当日出车率，也是减少检修车辆的重要措施。

2）车辆检修率

车辆检修率，又称车辆不良率，是以相对数字反映车辆状态的指标。

货车检修率：是全路或一个铁路局不良货车数与支配货车数之比。货车通常是全路通用，不固定配属，各局货车检修任务根据各自检修能力分配。

3）车辆检修停留时间

车辆检修停留时间是指在一定时期内，全路或一个铁路局、一个车辆修理工厂、一个车辆段或其他修车单位，平均检修一辆车的全部停留时间。厂、段修的休车时间以天为单位，辅修、临修以小时为单位。

休车时间是表示修车工作进度的重要指标。在保证修车质量的前提下，休车时间 fha 短，则表明修车效率越高；休车时间越长，则表示修车效率越低。

每一检修车辆的全部休车时间，对于交由车辆段修理的车辆来说，大致包括站休时间、待修时间和修理时间；对于交由工厂检修的车辆来说，往往还要加上由确认需要送交工厂检修的地点编入列车，直至送到工厂所在地办理完成入厂手续为止的全部时间，也可称之为回送时间。

4）责任晚点

责任晚点是考核列检工作质量的重要指标。检车人员应在列车运行图规定的时间内检修好车，并确保运行到下一个列检所而该所检修范围的部位不发生故障。凡由于工作组织不当影响列车按图定时间开出的和由于检修列车造成的晚点叫列检责任晚点。

5）责任事故

车辆运用部门应消灭行车事故，确保列车运行安全。由于本列检作业场或段责任造成事故的应按“铁路交通事故调查处理规则”规定，列入责任事故，铁路局、车辆段按件数考核。对一般事故，客车按每百辆配属车发生件数统计；货车按管内货物列车运行量每百万辆公里发生的件数统计。

4. 车辆编组

1）货物列车中车辆的编挂

货物列车编组，除应按照编组计划和列车运行图规定编组外，还应符合下列规定：

（1）装载危险及易燃货物车辆在运输途中须采取隔离措施，以免发生意外。

（2）货物列车中因装载的货物规定停止制动作用的车辆，自动制动机临时发生故障的车辆，准许关闭截断塞门（简称关门车），但列检场所在站编组始发的列车中，不得有制动故障关门车。编入列车的关门车数量不得超过现车总辆数的 6%，超过时，须计算闸瓦压力，并填发制动效能证明书交予司机。

关门车不得挂于机车后部三辆之内；在列车中连续连挂关门车不得超过两辆；列车最

后一辆不得为关门车；列车最后第二、三辆不得连续关门。

对于不适于连续连挂在列车中部但走行部良好的车辆，经列车调度员准许，可挂于列车尾部，以一辆为限，如该车辆的自动制动机不起作用，须由车辆人员采取安全措施，保证不致脱钩。

（3）机械冷藏车组应尽量挂于货物列车中部或后部。

2）旅客列车编挂要求

旅客列车应按客车编组表规定的车种、辆数、编挂位置编组，列车最后一辆车后端应有风表、紧急制动阀。

（1）编入的客车应按其标记速度编挂列。

（2）旅客列车加挂货车的规定。

特快旅客列车不准编挂货车，其他旅客列车原则上不准编挂货车。但在特殊情况下（事故救援、抢险），必须由旅客列车挂运时，需经上级主管部门批准，方可在列车后部加挂，但不得超过 2 辆。加挂货车的技术状态和最高运行速度，须符合该列车规定速度要求。旅客列车中乘坐旅客的车辆，与货车相连接的客车端门须加锁。

（3）禁止编入旅客列车的车辆：

a. 超过定期检修期限的车辆(按规定在延期范围内和经车辆部门鉴定送厂、段施修的客车除外)。

b. 装载危险、恶臭货物的车辆。

c. 未安装客车轴温报警装置的客车。

（4）乘坐旅客车辆与牵引机车连挂要求。

旅客列车中乘坐旅客的车辆，应以未搭乘旅客的车辆与机车隔离，可采用行李车、邮政车、发电车等非乘坐旅客的车辆分别挂于机车后第一位和列车尾部作为隔离车，如隔离车在途中发生故障摘下时，可无隔离车继续运行。无隔离车时，为保证乘客安全及牵引机车的正常工作，与机车相连接的客车，前部端门要加锁。

（5）旅客列车中关门车的规定。

旅客列车不准编挂制动关门车。在运行途中如遇自动制动机临时故障，在停车时间内不能修复时，准许关闭一辆，但列车最后一辆不得为关门车。

3）车钩高度差确认

列车中相互连挂的车钩中心水平线的高度差（简称车钩高度差）不超过 75 mm。这个高度差是由相邻两车的车钩中心线分别至轨面的高度差而来。运用限度规定车钩中心线距轨面最高 890 mm；最低限度：空货车 835 mm、重货车 815 mm。

若车钩高度差超过规定，当列车运行至道岔或路基松软地段时，车辆上下振动，尤其在陡坡线路上，容易发生脱钩而造成列车分离。车钩高度差较大时，还使车钩钩舌牵引接触面减少，产生过大的弯矩，容易发生断钩事故。

【复习题】

1. 什么是摘车修和不摘车修？
2. 货物列车编组时对相邻两车钩高有何要求？若超过限度有何危害？
3. 货车车辆运营指标和检修指标的作用有哪些？