

МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
УКРАЇНСЬКИЙ ДЕРЖАВНИЙ УНІВЕРСИТЕТ НАУКИ І ТЕХНОЛОГІЙ

І. Г. МІРОШНИЧЕНКО, Т. С. ШУЛІЧЕНКО

Іноземна мова (англійська мова)
Англійська для інженерів-залізничників
English for Railway Engineers



НАВЧАЛЬНИЙ ПОСІБНИК

ДНІПРО
2026

МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
УКРАЇНСЬКИЙ ДЕРЖАВНИЙ УНІВЕРСИТЕТ НАУКИ І ТЕХНОЛОГІЙ

І. Г. Мірошніченко, Т. С. Шуліченко

Іноземна мова (англійська мова)
Англійська для інженерів-залізничників
English for Railway Engineers

НАВЧАЛЬНИЙ ПОСІБНИК

ДНІПРО
2026

УДК 811.111:656.2(075.8)
М 64

Авторський колектив:
Мірошніченко І. Г., Шуліченко Т. С.

Рекомендовано Радою якості освітньої діяльності УДУНТ
Протокол № 9 від 19.05.2026 р.

М 64 Мірошніченко, І. Г. Іноземна мова (англійська мова).
Англійська для інженерів-залізничників. English for Railway
Engineers : навч. посіб. / І. Г. Мірошніченко, Т. С. Шуліченко ;
Укр. держ. ун-т науки і технологій. – Електрон. вид. – Дніпро :
УДУНТ, 2026. – 118 с.

ISBN 978-617-8665-06-7 (PDF)

Навчальний посібник призначений для студентів технічних спеціальностей залізничної галузі закладів вищої освіти та спрямований на формування у них професійно-орієнтованої іншомовної комунікативної компетенції. Він охоплює тексти на фахову тематику, містить вправи на формування спеціалізованого термінологічного запасу, розвиток навичок усного та писемного мовлення.

Видання може бути використане для навчання та самостійної роботи студентів залізничних спеціальностей, а також буде корисним усім, хто прагне вивчати та удосконалювати уміння та навички у професійній комунікації на залізничну тематику.

Бібліогр. 12 назв.

УДК 811.111:656.2(075.8)



Цей твір ліцензовано на умовах Ліцензії Creative Commons
[«Attribution-NonCommercial-ShareAlike» 4.0 International \(CC BY-NC-SA 4.0\)](https://creativecommons.org/licenses/by-nc-sa/4.0/)
(«Із зазначенням авторства – Некомерційна – Поширення на тих самих
умовах» 4.0 Міжнародна)

ЗМІСТ

Передмова	5
Unit 1 History and Development of Railways	6
Unit 2 Railway Infrastructure	14
Unit 3 Construction of Railway Track	22
Unit 4 Railway Sleepers	31
Unit 5 Rails	40
Unit 6 Rail Fastening System	48
Unit 7 Freight and Passenger Railway Cars	57
Unit 8 Elements of Railway Car Construction	66
Unit 9 Wagon Bogies	75
Unit 10 Braking System on Wagon	84
Unit 11 Railway Electrification	94
Unit 12 Pantographs for Trains	103
Railway Engineering English. Термінологічний мінімум	113
Список використаної літератури	117

Передмова

В умовах глобалізації транспортних систем та стрімкого розвитку технологій залізнична галузь України активно розширює міжнародні зв'язки. Сучасний інженер-залізничник повинен не лише володіти глибокими професійними знаннями, але й бути готовим до ефективної взаємодії з закордонними колегами, працювати з технічною літературою іноземними мовами, брати участь у наукових та інженерних проєктах, а також слідкувати за новітніми досягненнями світової залізничної науки та техніки. У цьому контексті володіння англійською мовою стало однією із ключових професійних компетенцій спеціаліста.

Навчальний посібник «Іноземна мова (англійська мова). Англійська для інженерів-залізничників» призначений для студентів технічних спеціальностей залізничної галузі закладів вищої освіти та спрямований на формування у них професійно-орієнтованої іншомовної комунікативної компетенції. Основна мета видання – допомогти майбутнім інженерам опанувати англійську мову на комунікативному рівні як інструмент фахової діяльності, навчитися працювати з технічними текстами, використовувати іншомовну спеціалізовану лексику у професійному дискурсі.

Зміст посібника відображає основні напрями професійної підготовки інженерів-залізничників. Тематичні розділи присвячені таким важливим аспектам галузі, як будівництво залізничних колій, рухомий склад, електрифікація залізниць тощо. У текстах і завданнях використано автентичні та адаптовані матеріали, які дають змогу студентам познайомитися з професійною термінологією та актуальними інженерними технологіями.

Практичну спрямованість посібника зrealізовано через систему вправ, які забезпечують підготовку з різних видів мовленнєвої діяльності. Запропоновано завдання на формування запасу фахової термінології, вправи на читання та розуміння прочитаного, а також комунікативні, які охоплюють діалоги, рольові ігри та дискусії на інженерну тематику.

Особливу увагу приділено розвитку навиків пояснення технічних процесів, опису конструкцій, обговорення інженерних задач англійською мовою, написання есе, підготовку усних повідомлень на фахову тематику. Такий підхід сприяє формуванню у студентів здатності використовувати англійську мову в навчальній, науковій та майбутній професійній діяльності.

Отже, пропонований навчальний посібник покликаний не лише формувати розвиток мовленнєвих навичок студентів, але й розвивати їхнє професійне мислення, розширювати світогляд в галузі залізничної техніки та готувати до роботи у міжнародному професійному середовищі.

Unit 1

History and Development of Railways

Share your ideas:

Why are railways important to modern transportation?

How has technology shaped the way we travel?

Key Vocabulary:

steam /sti:m/ *n* пара

engine /'endʒɪn/ *n* двигун

locomotive /,ləʊkə'məʊtɪv/ *n* локомотив

coal /kəʊl/ *n* вугілля

passenger /'pæsɪndʒə/ *n* пасажир

freight /freɪt/ *n* вантаж

revolution /,revə'lu:ʃən/ *n* революція

load /ləʊd/ *n* вантаж, навантаження; *v* вантажити

invention /ɪn'venʃən/ *n* винахід

transport /'trænsپɔ:t/ *n* транспорт

/træn'sپɔ:t/ *v* транспортувати, перевозити

electric /ɪ'lektrɪk/ *adj* електричний

breakthrough /'breɪkθru:/ *n* прорив

industrial /ɪn'dʌstriəl/ *adj* промисловий

design /dɪ'zeɪn/ *v* проектувати

technology /tek'nɒlədʒi/ *n* технологія

development /dɪ'veləpmənt/ *n* розвиток

environment /ɪn'vaɪərənmənt/ *n* довкілля

high-speed /,haɪ'spi:d/ *adj* високошвидкісний

1. Match each word to its correct definition by writing the letter (A-G) next to the word.

- | | |
|---------------|--|
| 1 industrial | A the system or method used to move people or goods from one place to another |
| 2 technology | B goods or materials that are transported, especially by train, truck, or ship |
| 3 transport | C a machine or device that produces power to make a vehicle move |
| 4 engine | D related to factories, manufacturing, and production |
| 5 locomotive | E a railway vehicle with an engine that pulls trains |
| 6 environment | F the use of science and tools to solve problems or make tasks easier |
| 7 freight | G the natural world, including the air, water, and land, in which people, animals, and plants live |

2. Give the English equivalents to these words and word combinations using the key vocabulary.

ДОВКІЛЛЯ

промислова революція

технологія

проєктувати

ВАНТАЖ

транспортувати

паровий двигун

пассажир

ВИСОКОШВИДКІСНИЙ

розвиток технологій

Check your vocabulary! Say it in Ukrainian



Check your vocabulary! Say it in English



3. Make up collocations using the words and word combinations from the box.

successful	goods	pollution	the steam locomotive	train
	coal and iron	long distances		

design _____
produce _____
transport _____
high-speed _____
reduce _____
became _____
travel _____

4. Complete these sentences using the appropriate vocabulary word.

expansion sustainable revolutionising costs more reliable

1. Railways have been instrumental in shaping modern society, ... transportation and driving economic growth.
2. The inception of steam-powered locomotives in the early 19th century marked a significant turning point, enabling faster and ... movement of goods and people.
3. Railways not only facilitated industrial ... but also fostered urbanisation by connecting distant regions.
4. Railways have played a crucial role in reducing travel times and ... , making travel more accessible to the general public.
5. Railway systems continue to be a vital component of ... transport infrastructure, contributing to environmental conservation and economic development.

5. Read the text and answer the comprehension questions below.

The Evolution of Railways: from Steam Engines to High-Speed Trains

Railways have come a long way since they were first invented in the early 19th century. They have changed the way people travel and how goods are transported. From steam engines to modern high-speed trains, railways have played a key role in connecting the world.

The history of railways began with the steam engine. George Stephenson, known as the “Father of Railways,” designed the first successful steam locomotive in 1829. His locomotive, called the “Rocket,” was a big success. It showed that steam engines could pull heavy loads quickly and efficiently. This invention was a major step forward in transportation.

Railways became especially important during the Industrial Revolution. Factories produced more goods, and railways made it possible to move these

products to markets quickly. Coal, iron, and other materials needed for industries were also transported by train. This helped industries grow and made countries more connected. Railways didn't just transport goods – they also carried people. For the first time, people could travel long distances quickly and comfortably.

In the 20th century, railways continued to grow. Steam engines were replaced by diesel and electric trains, which were faster and easier to maintain. In 1964, Japan introduced the first high-speed train, the Shinkansen, or “bullet train.” It could travel at speeds of over 200 kilometres per hour. Today, countries like France, China, and Germany use high-speed trains that can reach even higher speeds.

Modern railways are not only fast but also environmentally friendly. High-speed trains are helping reduce pollution and traffic on the roads. The evolution of railways shows how technology has changed the way we travel and transport goods, making the world more connected than ever. [4]

1. What made George Stephenson's steam locomotive, the “Rocket,” a significant invention in railway history?

- A) It could carry passengers across countries
- B) It was the first machine to transport coal
- C) It proved that steam engines could pull heavy loads efficiently
- D) It was the fastest locomotive of its time

2. Why were railways important for the development of industries during the Industrial Revolution?

- A) They allowed factories to produce more goods
- B) They provided a faster way to transport goods and materials
- C) They replaced the need for coal in industries
- D) They helped industries become less dependent on markets

3. What transition occurred in the railway industry during the 20th century?

- A) High-speed trains replaced steam engines completely
- B) Diesel and electric trains became more common than steam engines
- C) Trains were no longer used for passenger transport
- D) The railway industry stopped developing altogether

4. How did the introduction of the Shinkansen train in Japan reflect innovation in railway technology?

- A) It was the first train to run on steam power
- B) It could transport both passengers and coal
- C) It reached speeds over 200 kilometers per hour
- D) It was the first train to operate underground

5. Why might modern high-speed trains be considered environmentally friendly compared to other forms of transportation?

- A) They require no maintenance
- B) They produce less pollution than cars or planes
- C) They only operate in cities
- D) They reduce the need for electricity

6. What connection can you make between the Industrial Revolution and the growth of passenger transport on railways?

- A) Factories relied on passengers for labour.
- B) Trains allowed workers to travel to factories in distant locations.
- C) Passengers provided funding for railway construction.
- D) Railways replaced factories as the main source of income.

7. What does the evolution of railways reveal about technological progress over time?

- A) Technology has focused only on speed
- B) Railways have adapted to meet the changing needs of society, from moving goods to providing fast, eco-friendly travel options
- C) Railways have stayed the same since the invention of steam engines
- D) Technological advancements in railways ended after the Industrial Revolution

6. Post-reading discussion.

1. What is the main purpose of railways?
2. Who designed the first successful steam locomotive?
3. What was the name of George Stephenson's famous locomotive?
4. Why were railways important during the Industrial Revolution?
5. What materials were commonly transported by trains during the Industrial Revolution?
6. What replaced steam engines in the 20th century?
7. Which country introduced the first high-speed train?
8. When was the first high-speed train introduced?
9. What is a key benefit of modern high-speed trains?
10. What does the development of railways show us about technology?
11. Which development in railway history do you find most interesting? Why?

7. Translate these sentences into Ukrainian.

1. The history of rail transport began before the beginning of the common era.
2. The first full-scale working railway steam locomotive was built in the United Kingdom in 1804 by Richard Trevithick.

3. Railways have played a significant role in the Industrial Revolution by enabling the efficient transport of goods and people.

4. The expansion of rail networks in the 19th century facilitated economic growth and urbanization.

5. Railways are a climate-smart and efficient way to move people and freight.

8. Translate these sentences into English.

1. Залізничний транспорт зменшує затори на дорогах та сприяє енергоефективності.

2. Залізниці сприяють економічному зростанню, одночасно зменшуючи викиди парникових газів.

3. Залізничний транспорт є необхідним для ефективного перевезення важких та об'ємних вантажів на великі відстані.

4. Сучасні залізничні системи продовжують розвиватися, упроваджуючи передові технології для підвищення швидкості та безпеки.

5. Залізниці є чистим та компактним способом перевезення мільйонів пасажирів та тонн вантажів через країни та континенти.

9. Read the text below. Choose from A-H the one which best fits each space 1-6. There two choices you do not need to use.

The Story of the Steam Engine

The steam engine is one of the most revolutionary inventions in human history. Its development transformed industries, transportation, and society itself, marking the beginning of the Industrial Revolution and paving the way for modern technology.

The story begins in the 17th century with the first attempts to harness steam power. One of the earliest models was created by Thomas Savery in 1698, designed to pump water out of mines. Although Savery's design was limited in its efficiency, it laid the foundation for future innovations. Later, in 1712, Thomas Newcomen built the first practical steam engine, which used 1) _____. His invention became widely used in mining operations and was an important step forward.

However, it was James Watt who made the steam engine truly effective. In the 1760s, Watt introduced several key improvements, such as the separate condenser, which made steam engines more powerful and energy-efficient. This breakthrough allowed steam engines to be used not just in mining but also in factories, mills, and transportation. Watt's partnership with Matthew Boulton turned the steam engine into a commercial success, 2) _____.

The steam engine's role in transportation became particularly significant in the 19th century. In 1804, Richard Trevithick built the first steam-powered locomotive, capable of pulling heavy loads on iron rails. Later, George Stephenson

revolutionized railway transportation with his steam locomotive, the “Rocket,” which won the Rainhill Trials in 1829. Stephenson’s design proved that 3)____and passengers quickly, efficiently, and on a large scale. Railways soon expanded across continents, connecting cities, industries, and people like never before.

Beyond railways, steam engines powered ships, factories, and even agricultural machinery. This technology enabled 4) _____, driving economic growth and urbanization. By the late 19th century, steam engines had become symbols of progress, powering the rise of industrial societies.

Though eventually replaced by more advanced technologies 5) _____, the steam engine remains a testament to human ingenuity. Its invention reshaped the world, demonstrating how innovation can revolutionize the way we live and work.

Today, the steam engine is remembered not only as a historic achievement but also 6) _____. Its legacy continues to inspire engineers, inventors, and dreamers as they look toward the future of technology and progress. [4]

- A a major step forward in transportation
- B steam-powered railways could move goods
- C as the driving force behind the industrial age
- D like diesel and electric engines
- E a piston to create mechanical motion
- F spreading its use across Europe and beyond
- G were replaced by diesel and electric trains
- H mass production and rapid transportation

10. Read the dialogue between two friends, then do the following tasks:

- **highlight the terms in the text, then some commonly used words;**
- **give the synonyms to the words in bold;**
- **find in the text the words and word combinations that express emotions.**

Alex: Hi, Sarah! I was reading about the history of railways, and it’s **fascinating** how they’ve changed over time.

Sarah: Oh, really? I know that railways **have played a big role** in transportation, but I don’t know much about their history.

Alex: Well, it all started in the early 19th century with steam engines. George Stephenson designed the first successful steam locomotive in 1829. It was called the “Rocket.”

Sarah: Oh, I’ve heard of George Stephenson! He’s often called the “Father of Railways,” right?

Alex: Exactly! His locomotive proved that steam engines could pull heavy loads efficiently, which was a major breakthrough in transportation.

Sarah: That must have been really important during the Industrial Revolution when factories needed to transport goods quickly.

Alex: Yes! Railways helped industries **grow** by moving coal, iron, and other materials much faster. Plus, for the first time, people could travel long distances comfortably.

Sarah: I see! But steam engines were eventually replaced, weren't they?

Alex: Yes, in the 20th century, diesel and electric trains became more common. They were faster, easier to maintain, and more efficient.

Sarah: And then came high-speed trains, like Japan's Shinkansen! I think it was introduced in 1964, right?

Alex: That's right! The Shinkansen was the first bullet train, reaching speeds of over 200 km/h. Today, countries like France, China, and Germany have even faster trains.

Sarah: Wow, that's **incredible**! And modern railways are also good for the environment, aren't they?

Alex: Indeed! High-speed trains **help** reduce pollution and road traffic, making them a great alternative for transportation. Railways really have come a long way!

Sarah: Absolutely! It's amazing how technology **has shaped** the way we travel. Thanks for sharing all this with me, Alex!

11. Role-play.

1) In pairs, practice the dialogue from the previous exercise. Then perform it in front of the class or in breakout groups.

2) Work in pairs. One plays the role of a historian presenting a railway milestone, and the other is a journalist asking questions.

Example:

Historian: "The first steam-powered train ran in 1804 in England."

Journalist: "What was its speed?"

Topics for an interview:

Early railways: George Stephenson and the steam engine.

Role of railways during the Industrial Revolution.

The growth of passenger and freight transport.

The emergence of modern high-speed trains.

12. Write an essay discussing the engineers' role in the evolution of the engines for railways. Organise your thoughts according to the following plan:

1. Introduction (say what railway engines are); **2. Early Steam Engines and Improvements to Steam Power** (write about Thomas Newcomen's early steam engine and its purpose; describe James Watt's work and explain how he made steam engines more efficient); **3. First Railway Locomotives** (write about Richard Trevithick and his high-pressure steam engine; mention George Stephenson and his role in building successful locomotives); **4. Conclusion** (summarize how engineers helped develop railway engines; explain why their work is important today).

Unit 2

Railway Infrastructure

Share your ideas:

What components of railway infrastructure do you know?

Can you name two famous railway structures?

Key Vocabulary:

infrastructure /'ɪnfəˌstrʌktʃə/ *n* інфраструктура

operation /ˌɒpə'reɪʃən/ *n* операція, функціонування

rail /reɪl/ *n* рейка, залізниця

sleeper /'sli:pər/ *n* шпала

smooth /smu:ð/ *adj* гладенький, рівний

stable /'steɪbəl/ *adj* стабільний, міцний

distribute /dɪ'strɪbjʊ:t/ *v* розподіляти, поширювати

prevent /prɪ'vent/ *v* запобігати, перешкоджати

collision /kə'liʒən/ *n* зіткнення

require /rɪ'kwaɪə/ *v* вимагати, потребувати

loop /lu:p/ *n* петля

simultaneously /ˌsɪməl'teɪniəsli/ одночасно

crucial /'kru:ʃəl/ *adj* вирішальний, ключовий

handle /'hændl/ *v* керувати, обробляти, справлятися

facilities /fə'sɪlətɪz/ *n, pl* споруди, зручності, обладнання

achieve /ə'tʃi:v/ *v* досягти

cargo /'kɑ:gəʊ/ *n* вантаж

trackside /'træksaɪd/ *n* узбіччя залізничної колії

enhance /ɪn'hɑ:ns/ *v* підсилювати, покращувати

1. Match each word to its correct definition by writing the letter (A-G) next to the word.

- | | |
|---------------------|--|
| 1 trackside | A a wooden or concrete beam that supports railway tracks |
| 2 cargo | B the goods or materials transported by a train, ship, or truck |
| 3 handle | C the area alongside a railway track |
| 4 facilities | D to manage or control something, especially a task or object |
| 5 smooth | E to need something for a specific purpose or to demand something, or to order someone to do something, esp. because of a rule or law |
| 6 sleeper | F having an even surface, without roughness or bumps |
| 7 require | G buildings, equipment, or services provided for a specific purpose |
| 8 stable | H firmly fixed, not likely to move or change; strong and reliable |

рейка
одночасно
вирішальний
вантаж
підсилювати

узбіччя залізничної колії
шпала
споруди
запобігати
стабільний

3. Make up collocations using the words from the box.

services	safety	terminal	system	transportation	part	damage
----------	--------	----------	--------	----------------	------	--------

transport _____
fundamental _____
prevent _____
railway _____
providing _____
cargo _____
enhance _____

4. Complete these sentences using the appropriate word.

deformation *comprises* *sophisticated* *efficiency* *facilitate*

1. Railway infrastructure encompasses the foundational elements that support and ... train operations, including tracks, bridges, tunnels, and signalling systems.

2. The track system ... rails, sleepers (ties), ballast, and subgrade, each playing a crucial role in maintaining stability and ensuring safe train movements.

3. Proper maintenance of these components is essential to prevent track ... and maintain alignment.

4. Advancements in technology have led to the development of more durable materials and ... monitoring systems, enhancing the efficiency and safety of railway networks.

5. Investments in modernizing railway infrastructure contribute significantly to economic growth by improving transportation ... and connectivity.

5. Read the text and answer the comprehension questions below.

Railway Infrastructure: The Backbone of Rail Transport

Railway infrastructure is the foundation of any rail transport system, ensuring safe, efficient, and reliable train operations. It consists of several key components, including tracks, stations, signalling systems, and power supply networks.

The most fundamental part of railway infrastructure is the track system, which includes rails, sleepers (also called ties), and ballast. Rails provide a smooth and stable surface for trains, while sleepers support the rails and keep them at the correct distance. Ballast, which consists of crushed stones, absorbs vibrations and distributes the weight of the train to prevent track damage. Railways can be classified into single-track and double-track systems. Single-track lines allow trains to travel in both directions on the same track, requiring passing loops, while

double-track lines enable trains to move in opposite directions simultaneously, improving efficiency.

Railway stations play a crucial role in rail transport, serving as points where passengers board and leave trains. Large railway terminals, such as Grand Central Terminal in New York or London's King's Cross Station, handle thousands of passengers daily, providing ticketing services, waiting areas, shops, and connections to other transport systems. Freight terminals, on the other hand, are designed for loading and unloading goods, often featuring cranes and storage facilities for cargo transportation.

To ensure safe operations, railways rely on signalling systems, which control train movements and prevent accidents. Traditional signals use coloured lights and trackside indicators, while modern systems, such as ETCS (European Train Control System), use digital communication and automation to improve efficiency. Automatic Train Control (ATC) and Positive Train Control (PTC) systems further enhance safety by preventing collisions and ensuring trains follow speed limits.

Many railways operate on electric power, which is more environmentally friendly and efficient than diesel. Electrified railways use overhead wires or third-rail systems to supply power to trains. High-speed trains and metro systems mainly rely on electrification to achieve high speeds and reduce pollution.

In challenging landscapes, such as mountains or rivers, railway engineers build bridges, tunnels, and viaducts to maintain smooth routes. Iconic structures like the Channel Tunnel between the UK and France or the Tsing Ma Bridge in Hong Kong demonstrate the importance of advanced engineering in railway infrastructure. These structures not only enhance connectivity but also improve travel times and reduce environmental impact.

1. What are the main components of railway infrastructure, and why are they important?

- A) Only tracks and stations, because they handle passengers
- B) Tracks, stations, signalling systems, and power supply, as they ensure efficient train operations
- C) Just signalling systems, since they prevent accidents
- D) Only electrification, as it makes trains faster

2. What is the function of ballast in a railway track system?

- A) It keeps rails clean and shiny
- B) It prevents passengers from slipping on the tracks
- C) It absorbs vibrations and distributes train weight to prevent damage
- D) It connects trains to the power supply

3. How do single-track and double-track railway systems differ?

- A) Single-track lines require passing loops, while double-track lines allow trains to travel in both directions at the same time

B) Single-track lines are used only for freight transport, while double-track lines are for passengers

C) Single-track lines are underground, while double-track lines are above ground

D) Single-track lines use diesel power, while double-track lines use electricity

4. Why are modern signalling systems like ETCS important for rail transport?

A) They help reduce pollution from train engines

B) They allow passengers to check train schedules more easily

C) They use digital communication to improve train safety and efficiency

D) They make railway stations more attractive to tourists

5. What is the main advantage of electrified railways compared to diesel-powered trains?

A) They allow trains to travel in tunnels more safely

B) They are more environmentally friendly and efficient

C) They are cheaper to maintain than tracks

D) They require no overhead wires or infrastructure upgrades

6. What role do bridges, tunnels, and viaducts play in railway infrastructure?

A) They are only used for metro systems

B) They allow high-speed trains to travel at full speed inside cities

C) They are built only to separate freight trains from passenger trains

D) They help maintain smooth routes in difficult landscapes, improving connectivity

7. Why are structures like the Channel Tunnel and Tsing Ma Bridge significant for rail transport?

A) They help reduce train ticket prices for passengers

B) They are used only for local train routes and not for international connections

C) They are examples of advanced engineering that improve travel times and reduce environmental impact

D) They were built to test new train designs but are no longer in use

6. Post-reading discussion.

1. What are the key components of railway infrastructure?

2. What is the purpose of ballast in the track system?

3. How do single-track and double-track railway systems differ?

4. What services do large railway terminals provide for passengers?

5. How do freight terminals support cargo transportation?
6. What are some modern signalling systems used in railways, and how do they improve safety?
7. Why are electrified railways considered more environmentally friendly than diesel-powered trains?
8. What is the function of bridges, tunnels, and viaducts in railway infrastructure?
9. Can you name two famous railway structures mentioned in the text? What is their significance?
10. How has technology improved railway operations over time?

7. Translate these sentences into Ukrainian.

1. The earliest railways were used in mines or to bypass waterfalls, and were pulled by horses or by people.
2. In 1811, John Blenkinsop designed the first successful and practical railway locomotive.
3. The Liverpool and Manchester Railway, considered to be the world's first intercity line, opened in 1826.
4. The construction of railways in Europe in the nineteenth and early twentieth century was mainly carried out by the private sector.
5. By 1950 nearly all the railways in Europe were state-owned and the vast majority of them still are.

8. Translate these sentences into English.

1. Промислова революція стала значним поворотним моментом в історії розвитку інфраструктури.
2. Із появою парової енергії та механізації будівництво доріг, мостів і каналів прискорилося, що дозволило швидко перевозити товари та людей.
3. Перший залізничний тунель, відомий як тунель Фрітчлі, був побудований у 1793 році для обслуговування кінних вагонів, що перевозили вапняк.
4. Інтеграція залізничних мереж відіграла вирішальну роль у територіальній інтеграції Європи з 1850 по 2020 рік.
5. Концепція інфраструктури виникла в законодавстві Франції про залізниці у XIX столітті і з того часу розширилася, охоплюючи різні громадські роботи.

9. Read the text and choose the correct answer (A, B, C or D).

Railway infrastructure is a key element of modern transportation, supporting economic growth, reducing traffic 1) _____, and promoting eco-friendly travel. As rail technology 2) _____, infrastructure will continue to play a crucial role in shaping the future of global transport.

With growing demand for faster and more 3) _____ transport, railway infrastructure continues to evolve. Countries are developing high-speed rail 4) _____, upgrading automated signalling systems, and integrating smart technologies to improve efficiency. The shift towards green railways, including hydrogen-powered trains and solar-powered stations, highlights the industry's 5) _____ to environmental sustainability.

Without well-developed infrastructure, railways cannot 6) _____ effectively, making investment in maintenance and modernization essential for a country's transportation network. Countries like Japan, Germany, and China have invested heavily in electric rail networks 7) _____ sustainable transport development.

1	A blocking	B obstruction	C congestion	D crowding
2	A arrivals	B approaches	C inventions	D advances
3	A supportable	B strong	C sustainable	D powerful
4	A corridors	B pathways	C roads	D pavements
5	A responsibility	B obligation	C undertaking	D commitment
6	A serve	B function	C perform	D operate
7	A to aid	B to assist	C to support	D to help

10. Read the dialogue between two friends, then do the following tasks:

- highlight the terms in the text, then explain their meanings;
- give the synonyms to the words in bold;
- find in the text the words and word combinations that express emotions.

Understanding Railway Infrastructure

Tom: Hi, Lisa! I've been reading about railway infrastructure. It's quite complex, isn't it?

Lisa: Yes, it is! Railway infrastructure includes many **components** like tracks, stations, and signalling systems to ensure smooth and safe train operations.

Tom: I read that the track system is the most **fundamental** part. What does it consist of?

Lisa: Well, tracks are made up of rails, sleepers, and ballast. The rails provide a stable surface, sleepers hold them in place, and ballast absorbs vibrations to protect the track.

Tom: That makes sense! I also learned that railways can be single-track or double-track. What's the difference?

Lisa: A single-track system **allows** trains to move in both directions on the same track, but passing loops are needed. Double-track systems are more **efficient** because trains can move in opposite directions simultaneously.

Tom: I see. And railway stations must be very important too, right?

Lisa: Absolutely! Stations are where passengers board and leave trains. Large railway terminals handle thousands of people daily and offer services like ticketing, shops, and connections to other transport.

Tom: That's interesting! What about signalling systems? How do they help with safety?

Lisa: Signalling systems **control** train movements. Traditional ones use coloured lights, while modern systems like ETCS and ATC use digital automation to prevent collisions and improve efficiency.

Tom: Oh, and many **modern** trains are electric now. How do electrified railways work?

Lisa: They use overhead wires or a third-rail system to supply power. This is more efficient and environmentally friendly compared to diesel-powered trains.

Tom: Wow, railway engineers must face many **challenges**, especially in difficult landscapes.

Lisa: Exactly! That's why they build tunnels, bridges, and viaducts. The Channel Tunnel and the Tsing Ma Bridge are great examples of **advanced** railway engineering.

Tom: Thanks, Lisa! Now I understand how crucial railway infrastructure is in modern transportation.

11. Role-play.

1) In pairs, practice the dialogue from the previous exercise. Then perform it in front of the class or in breakout groups.

2) After the role-play, each student in your pair should summarize the key points in his/her own words. Use the following questions to guide your partner.

What is railway infrastructure?

What are the main components of the track system?

How do modern trains ensure safety?

Do you have any railway stations near your home?

Have you ever travelled by high-speed train?

What are the advantages of electrified railways?

How can railway systems become more sustainable in the future?

12. Write an essay discussing the future of electric trains. Organise your thoughts according to the following plan: **1. Introduction** (mention that many countries are moving from diesel trains to electric trains); **2. Advantages of Electric Trains** (less pollution, quieter and more energy-efficient, run faster and require less maintenance); **3. Disadvantages and Challenges** (expensive to install; some regions have difficult terrain or low traffic, where electrification may not be practical); **4. Future Possibilities** (battery trains or hydrogen trains); **5. Conclusion** (give your opinion about whether most or all trains should be electric in the future).

Unit 3

Construction of Railway Track

Share your ideas:

What is the main purpose of railway track construction?

Which material is commonly used for sleepers due to its durability?

Key Vocabulary:

complex /'kɒmpleks/ *adj* складний

ballast /'bæləst/ *n* баласт

subgrade /'sʌbgreɪd/ *n* земляне полотно

site /saɪt/ *n* будівельний майданчик

level /'levəl/ *v* вирівнювати

solid /'sɒlɪd/ *adj* твердий, міцний

maintain /meɪn'teɪn/ *v* підтримувати

gravel /'grævəl/ *n* гравій

drain /dreɪn/ *v* осушувати, відводити воду

vibration /vaɪ'breɪʃən/ *n* вібрація

align /ə'laɪn/ *v* вирівнювати; узгоджувати

install /ɪn'stɔ:l/ *v* встановлювати

gauge /geɪdʒ/ *n* ширина колії, колія

concrete /'kɒŋkri:t/ *n* бетон

durability /,dʒʊərə'bɪləti/ *n* міцність, довговічність

fasten /'fɑ:sən/ *v* закріплювати, фіксувати

track bed баластна призма

1. Match each word to its correct definition by writing the letter (A-G) next to the word.

- | | |
|---------------------|---|
| 1 gauge | A to adjust or position something in a straight line or correct position |
| 2 maintain | B a strong, hard material used in construction, made of cement, sand, gravel, and water |
| 3 drain | C to make a surface flat and even |
| 4 align | D the ability of a material or structure to last a long time without breaking or deteriorating |
| 5 concrete | E the prepared foundation of a railway track that supports the rails and sleepers |
| 6 durability | F the width between the inner sides of the two rails on a railway track |
| 7 track bed | G to remove excess water from an area to keep it dry and prevent damage |
| 8 level | H to keep something in good condition by checking and repairing it regularly |

2. Give the English equivalents to these words and word combinations using the key vocabulary.

підтримувати
вирівнювати
осушувати
закріплювати
підтримувати

ширина колії
міцність
твердий
складний
баласт

Check your vocabulary! Say it in Ukrainian



Check your vocabulary! Say it in English



3. Make up collocations using the words from the box.

the ground	the sleepers	subgrade	movement	parameters	vibrations
------------	--------------	----------	----------	------------	------------

smooth _____
railway line _____
levelling _____
solid _____
reducing _____
install _____
technical _____

4. Complete these sentences using the appropriate word.

secured aligned levelling drainage compacted involves

1. Constructing a railway track ... several critical steps to ensure safety and efficiency.
2. Initially, the ground is prepared through excavation, ... , and compaction to create a stable foundation.
3. Subsequently, a layer of bottom ballast, typically medium-coarse sand, is laid to provide ... and distribute loads.
4. Railway sleepers are then evenly placed on this ballast, ... with the track's centreline.
5. Steel rails are positioned atop the sleepers and ... using appropriate fastenings.
6. Finally, top ballast is added and ... , followed by precise alignment and levelling to ensure the track meets required standards.

5. Read the text and answer the comprehension questions below.

Construction of Railway Track

The construction of a railway track is a complex process that involves careful planning, engineering, and skilled labour. It ensures a safe and efficient route for trains, allowing for the smooth movement of passengers and goods. The main components of a railway track include rails, sleepers (also known as ties), ballast, and the subgrade. Each part plays a crucial role in maintaining the stability and durability of the railway line.

The first step in railway track construction is site preparation. This involves clearing the land, levelling the ground, and building a solid subgrade. The subgrade is the foundation of the track, which must be stable and well-drained to support the heavy loads of passing trains. Engineers conduct soil tests to determine

the ground's strength and stability. If necessary, they enhance the subgrade with additional materials like gravel or sand.

After preparing the subgrade, the next step is to lay the ballast. Ballast consists of crushed stones that provide a stable base for the sleepers and rails. It helps in draining water, reducing vibrations, and distributing the load evenly across the track bed. Proper compaction of ballast is essential to prevent track deformation and maintain alignment.

Once the ballast is in place, workers install the sleepers, which support the rails and keep them at the correct distance, known as the gauge. Sleepers are typically made of wood, concrete, or steel, each with its own advantages. Concrete sleepers are popular due to their durability and low maintenance requirements.

Rails are then laid on the sleepers and fastened using clips or bolts. Engineers ensure the rails are perfectly aligned and levelled to provide a smooth and safe ride. In high-speed rail construction, special care is taken to maintain precision in track geometry to prevent derailments and improve passenger comfort. Finally, the track is tested for safety and stability. Engineers use advanced machines to check alignment, gauge, and other technical parameters. Once approved, the track is ready for use.

The construction of railway tracks is a vital part of transportation infrastructure. It requires detailed planning, precision engineering, and skilled labour to ensure safe and efficient train operations. With the advancement of technology, modern railway tracks are now more durable, safer, and faster than ever before. [4; 12]

1. What is the main purpose of railway track construction?

- A) To build roads for cars and buses
- B) To ensure a safe and efficient route for trains
- C) To create paths for pedestrians
- D) To develop underground tunnels

2. Why is subgrade preparation important in railway track construction?

- A) It gives passengers a comfortable ride
- B) It helps trains move faster
- C) It provides a stable and well-drained foundation for heavy loads
- D) It replaces the need for sleepers

3. What is the function of ballast in railway tracks?

- A) To provide a stable base and drain water
- B) To make trains move faster
- C) To act as a decorative element
- D) To replace sleepers

4. Which material is commonly used for sleepers due to its durability?

- A) Plastic
- B) Wood
- C) Rubber
- D) Concrete

5. How do engineers ensure the rails are properly aligned and levelled?

- A) By using a measuring tape
- B) By fastening them randomly to the sleepers
- C) By using precision engineering techniques and machines
- D) By laying them directly on the ground

6. What is the final step in railway track construction?

- A) Laying the ballast
- B) Installing the sleepers
- C) Fastening the rails
- D) Conducting safety tests and inspections

7. How has technology improved modern railway tracks?

- A) It has made them weaker but cheaper
- B) It has helped construct faster, safer, and more durable tracks
- C) It has eliminated the need for maintenance
- D) It has increased the number of railway stations

6. Post-reading discussion.

1. Why is railway track construction considered a complex process?
2. What is the function of the subgrade in railway track construction?
3. How do engineers ensure the subgrade is stable enough to support trains?
4. What are the main functions of ballast in railway construction?
5. Why are concrete sleepers commonly used in modern railway tracks?
6. How do engineers ensure that rails are properly aligned and levelled?
7. What role does technology play in modern railway track construction?
8. What is the initial step in the railway track construction process?
9. How do engineers enhance the subgrade if soil tests indicate insufficient strength?
10. What is the purpose of testing the track after construction?

7. Translate these sentences into Ukrainian.

1. Different methods, such as the telescopic method, are employed in track construction to enhance efficiency and accuracy.
2. The use of high-quality materials in track construction is essential to withstand the dynamic loads imposed by passing trains.

3. Advanced surveying techniques are utilized to design track alignments that minimize curves and gradients, ensuring efficient train operations.

4. The construction process must comply with stringent safety standards to protect workers and future passengers.

5. Environmental impact assessments are conducted prior to construction to mitigate potential ecological disruptions.

8. Translate these sentences into English.

1. Щоб запобігти накопиченню води та можливим пошкодженням колії, упроваджують належні дренажні системи.

2. Сучасна техніка, така як машини для укладання колії, підвищує ефективність та точність будівельного процесу.

3. Заходи контролю якості, включно з регулярними інспекціями, є необхідними для підтримки цілісності залізничної інфраструктури.

4. Екологічні аспекти, такі як мінімізація впливу на місцеві екосистеми, інтегрують в сучасні практики будівництва залізниць.

5. Постійні технологічні досягнення приводять до більш стійких та економічно ефективних практик будівництва залізничних колій.

9. Read the text and choose the correct answer (A, B, C or D).

Ballast

Railway track ballast is laid on the subgrade and under railway sleeper. Ballast is used to hold the railway sleeper. According to the laying of the position, ballast can 1) _____ into two types, top ballast and bottom ballast.

Ballast functions are as follows:

– bear the pressure from railroad tie, and 2) _____ them to the subgrade evenly;

– fix the position of the sleeper and 3) _____ the correct line and slope for the track;

– exclude the rain around the railway sleeper, and prevent subgrade soils deforming 4) _____ wet;

– increase the elasticity of the track, so that rail can be quickly returned to the original correct position after the rolling by the train;

– weed control in the railway track.

In order to ensure the safety of 5) _____ railway operation, and improve the strength of the roadbed, ballastless railway track is widely applied in the modern railway track. Ballastless track can reduce the ballast clean and maintenance, and use concrete 6) _____ to replace ballast, railway sleeper and subgrade. Ballast and ballastless railway track are the two typical railroad tracks.

As a reliable support for train, railroad track bears the 7) _____ from steel rails and keep them in right place. In a word, the railway track makes great contribution to the train safety. [3]

1	A be installed	B be built	C be crushed	D be divided
2	A arrive	B lift	C transfer	D advance
3	A maintain	B stable	C load	D drain
4	A despite of	B according to	C because of	D against
5	A well-drained	B high-speed	C solid	D additional
6	A site	B sleeper	C performance	D foundation
7	A durability	B load	C aid	D elasticity

10. Read the dialogue between two friends, then do the following tasks:

- highlight the terms in the text;
- give the synonyms to the words in bold;
- find in the text the connectors of sequence (words and word combinations that express sequence of actions or events).

Discussing Railway Track Construction

Alex: Hi Jamie, I've been reading about railway track construction. It seems like a **complex** process.

Jamie: It is indeed. The process involves several critical steps to ensure trains operate safely and efficiently.

Alex: What's the first step in building a railway track?

Jamie: The initial step is site preparation. This includes clearing the land, levelling the ground, and constructing a solid subgrade to support the track.

Alex: The subgrade acts as the foundation, right?

Jamie: Exactly. A stable and well-drained subgrade is essential to bear the heavy loads of passing trains.

Alex: After preparing the subgrade, what's next?

Jamie: The next step is **laying** the ballast, which consists of crushed stones. Ballast **provides** a stable base, aids in water drainage, reduces vibrations, and evenly distributes the load across the track bed.

Alex: And then the sleepers are installed on top of the ballast?

Jamie: Yes, sleepers are placed on the ballast to support the rails and maintain the correct gauge. They can be made of wood, concrete, or steel, with concrete being popular for its durability and low maintenance.

Alex: Once the sleepers are in place, the rails are laid and secured, correct?

Jamie: That's right. The rails are positioned on the sleepers and fastened using clips or bolts. Ensuring the rails are perfectly aligned and levelled is crucial for a smooth and safe ride.

Alex: Is there a final step before the track is ready for use?

Jamie: Yes, the final step involves **testing** the track for safety and stability. Engineers use advanced equipment to check alignment, gauge, and other technical parameters. Once everything meets the required standards, the track is approved for operation.

Alex: It's **fascinating** how much planning and precision go into constructing railway tracks.

Jamie: Absolutely. It's a meticulous process that ensures the safe and efficient movement of trains, benefiting both passengers and freight transport.

11. Role-play.

1) In pairs, practice the dialogue from the previous exercise. Then perform it in front of the class or in breakout groups.

2) After the role-play, each student in your pair should summarize the key points in his/her own words using connectors of sequence from the table below. Use questions to guide your partner to pay attention to the sequential steps involved in railway track construction:

What is the initial step in railway track construction?

After site preparation, which component is laid down next?

What is the purpose of installing sleepers during track construction?

Which step involves ensuring the rails are properly aligned and levelled?

What is the final step before a newly constructed railway track is ready for use?

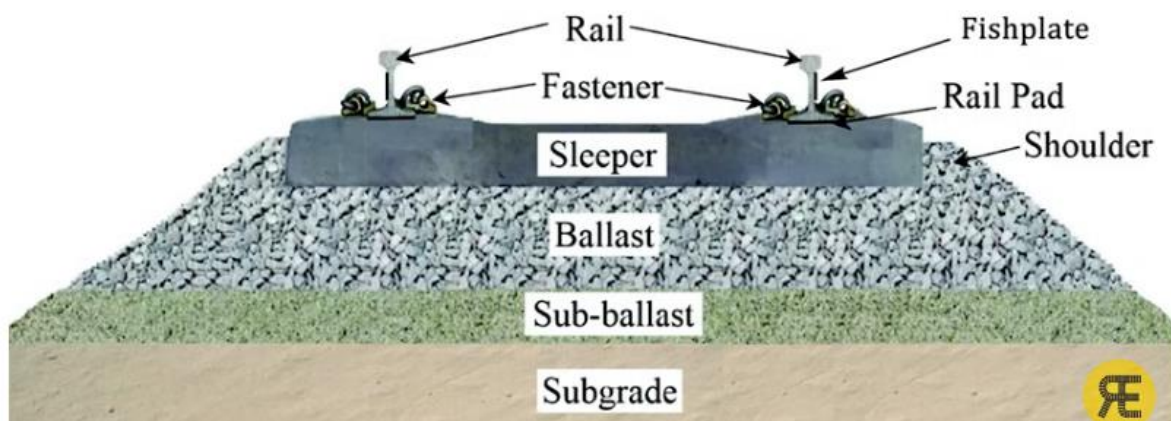
CONNECTORS OF SEQUENCE

First of all	First of all , we need to gather all the necessary materials before starting the project.
The second point is	The second point is that proper training is essential for all team members to ensure safety.
Next	Next , we should allocate specific tasks to each team member based on their expertise.
Then	Then , we'll establish a timeline to monitor the progress effectively.
After that	After that , we can begin the initial phase of the project, focusing on foundational work.
Before that	Before that , it's crucial to conduct a comprehensive risk assessment to identify potential challenges.
Finally	Finally , we'll review the completed work to ensure it meets all quality standards.
In the end	In the end , our goal is to deliver a project that exceeds client expectations.

12. Write a text describing the process of preparing the site and installing the railway track and sleepers.

When writing, follow a clear structure, organize the essay into three main parts: **Introduction** (introduce the topic and explain why track construction is important); **Main Body** (describe the process step by step); **Conclusion** (summarize the importance of proper track installation). Include important railway terms, for example: *trackbed*, *ballast*, *sleepers*, *rails*, *fasteners*, *alignment*, *tamping*. Try to describe the process step by step using linking phrases for describing technical processes. The phrases in the table below help organize explanations clearly and logically.

1. Phrases for Starting the Process • <i>First, the process begins with...</i> • <i>At the first stage, ...</i> • <i>The process starts with...</i> • <i>The first step is to...</i>	4. Phrases for Describing Simultaneous Actions • <i>At the same time, ...</i> • <i>Meanwhile, ...</i> • <i>During this stage, ...</i> • <i>In addition, ...</i>
2. Phrases for Adding the Next Step • <i>Next, .../ Then, ...</i> • <i>After that, ...</i> • <i>The next stage involves...</i> • <i>At this stage, ...</i> • <i>Following this, ...</i>	5. Phrases for Explaining Results • <i>As a result, ...</i> • <i>Consequently, ...</i> • <i>This leads to...</i> • <i>Therefore, ...</i>
3. Phrases for Explaining Purpose or Function • <i>This step helps to...</i> • <i>The purpose of this stage is ...</i> • <i>This allows the system to...</i> • <i>As a result, ...</i> • <i>This ensures that...</i>	6. Phrases for the Final Stage • <i>Finally, ...</i> • <i>In the final stage, ...</i> • <i>The process ends with...</i> • <i>After completion, ...</i>



<http://www.railway-fasteners.com/news/railway-track-parts.html>

Unit 4

Railway Sleepers

Share your ideas:

What is the main purpose of railway sleepers?

What materials used to make railway sleepers?

Key Vocabulary:

lifespan /'laɪfspæn/ *n* термін життя

longitudinal /lɒndʒɪ'tjuːdɪnəl/ *adj* поздовжній

lateral /'lætərəl/ *adj* бічний

timber /'tɪmbə/ *n* деревина

susceptibility /sə'septə'bɪləti/ *n* сприйнятливість

decay /di'keɪ/ *n* розкладання; *v* розкласти(ся)

pest /pezt/ *n* шкідник

infestation /,ɪnfə'steɪʃən/ *n* зараження

resist /rɪ'zɪst/ *v* протистояти

surpass /sə'pɑːs/ *v* перевершувати

longevity /lɒn'dʒevɪti/ *n* довговічність, довголіття

facilitate /fə'sɪlɪteɪt/ *v* полегшувати, сприяти

robust /rəʊ'bʌst/ *adj* міцний

rot /rɒt/ *n* гниття

corrosion /kə'rouʒən/ *n* корозія

rubber /'rʌbə/ *n* гума

ongoing /'ɒn,gəʊɪŋ/ *adj* триваючий

expenses /ɪk'spensɪz/ *n* витрати

1. Match each word to its correct definition by writing the letter (A-G) next to the word.

- | | |
|------------------|---|
| 1 corrosion | A to exceed or go beyond something in amount, degree, or quality |
| 2 facilitate | B chemical reaction causing material deterioration |
| 3 lifespan | C to make something easier or less difficult |
| 4 robust | D the period during which something exists or functions |
| 5 susceptibility | E to oppose or fight against something |
| 6 infestation | F the state or condition of being vulnerable or sensitive to something, especially to disease, influence, or attack |
| 7 resist | G the invasion or infection of a substance, object, or area by pests, parasites, or unwanted organisms |
| 8 surpass | H strength of resistance to decay or damage |

2. Give the English equivalents to these words and word combinations using the key vocabulary.

полегшувати
перевершувати
опиратися
довговічність
витрати
термін життя

корозія
розкладання
шкідник
бічний
гниття
деревина

Check your vocabulary! Say it in Ukrainian



Check your vocabulary! Say it in English



3. Make up collocations using the words from the box.

installation	stability	sleepers	the load	regular maintenance
	vibrations		requirements	

distribute _____
providing _____
absorb _____
necessitate _____
labour-intensive _____
concrete _____
maintenance _____

4. Complete these sentences using the appropriate vocabulary word.

lifespan surpass infestation facilitate robust

1. The ... nature of the metal made it prone to corrosion in humid environments.
2. The preservation techniques helped ... longer storage of the materials.
3. Regular maintenance helped extend the structure's ... beyond expectations.
4. The ... weakened the wood's natural resistance to decay.
5. The treatment helped ... previous durability records.

5. Read the text and answer the comprehension questions below.

Railway Sleeper Types and Their Properties

Railway sleepers (*Br En*), commonly referred to as ties (*Am En*), are fundamental to railway track systems. They perform several critical functions, such as maintaining the correct gauge by holding the rails at the appropriate distance, ensuring trains operate safely and smoothly. Additionally, sleepers distribute the load from the rails to the underlying ballast or ground, providing essential stability to the track structure. They also absorb vibrations generated by moving trains, which helps prolong the lifespan of track components, and offer both longitudinal and lateral stability, keeping the track properly aligned and secure.

Various materials are utilized in the manufacture of railway sleepers, each presenting distinct advantages and disadvantages. Wooden sleepers, traditionally crafted from timber, are relatively easy to install and handle. However, they have a shorter lifespan and necessitate regular maintenance due to their susceptibility to decay and pest infestations.

Concrete sleepers, on the other hand, are renowned for their durability and minimal maintenance requirements. They resist weathering effectively and offer a long service life, though their substantial weight can make installation more labour-intensive.

Steel sleepers provide strength and longevity surpassing that of wooden sleepers and are lighter than their concrete counterparts, facilitating easier installation. Nonetheless, they can be prone to corrosion if not adequately maintained.

Composite sleepers, made from recycled materials such as plastics and rubber, are environmentally friendly and resistant to rot and corrosion, but their higher initial cost compared to traditional materials can be a drawback.

The selection of sleeper material depends on several factors, including load requirements, environmental conditions, and budget constraints. Heavier loads may require more robust materials like concrete or steel to ensure structural integrity. In regions with high moisture levels, composite or concrete sleepers are advantageous due to their resistance to rot and corrosion. While wooden sleepers might offer a lower initial cost, their ongoing maintenance expenses can accumulate over time, making them less economical in the long term.

In conclusion, railway sleepers are vital for the safe and efficient operation of trains. A comprehensive understanding of the functions and characteristics of different types of sleepers is essential for making informed decisions regarding railway construction and maintenance. [10]

1. What are the primary functions of railway sleepers?

- A) To decorate the railway tracks
- B) To maintain the correct gauge, distribute load, absorb vibrations, and provide stability
- C) To signal approaching trains
- D) To connect different railway stations

2. Which material used for sleepers is noted for being environmentally friendly but has a higher initial cost?

- A) Wood
- B) Concrete
- C) Steel
- D) Composite

3. Why might concrete sleepers be considered less convenient despite their durability?

- A) They are prone to pest infestations
- B) They require frequent maintenance
- C) Their substantial weight makes installation more labour-intensive
- D) They are susceptible to corrosion

4. In regions with high moisture levels, which types of sleepers are advantageous due to their resistance to rot and corrosion?

- A) Wooden and steel sleepers

- B) Concrete and composite sleepers
- C) Steel and concrete sleepers
- D) Wooden and composite sleepers

5. What is a potential drawback of using steel sleepers?

- A) They are heavier than concrete sleepers
- B) They are difficult to install due to their weight
- C) They have a shorter lifespan than wooden sleepers
- D) They are prone to corrosion if not properly maintained

6. Which factor is NOT mentioned as influencing the choice of sleeper material?

- A) Aesthetic appeal
- B) Load requirements
- C) Environmental conditions
- D) Budget constraints

7. What is the main disadvantage of wooden sleepers compared to other types?

- A) They are more expensive initially
- B) They are too heavy, making installation difficult
- C) They are susceptible to decay and pests, requiring regular maintenance
- D) They are environmentally unfriendly

6. Post-reading discussion.

1. How do the materials used for railway sleepers impact the overall performance and maintenance of railway tracks?
2. What are the environmental considerations when selecting materials for railway sleepers, and how do composite sleepers address these concerns?
3. In what ways do regional climate and environmental conditions influence the choice of sleeper materials in railway construction?
4. How does the weight of different sleeper materials, such as concrete and steel, affect the installation process and labour requirements?
5. What are the economic trade-offs between the initial costs and long-term maintenance expenses of various types of sleepers?
6. How do advancements in technology contribute to the development of more durable and sustainable railway sleepers?
7. What role do railway sleepers play in ensuring passenger comfort and safety during train operations?
8. How does the choice of sleeper material influence the noise and vibration levels experienced in nearby communities?

9. What are the challenges associated with recycling or disposing of old railway sleepers made from different materials?

10. How do international standards and regulations affect the selection and design of railway sleepers in global railway projects?

7. Translate these sentences into Ukrainian.

1. Railway sleepers are essential components that support the rails on a track.

2. Traditionally, sleepers were made from wood, but now concrete and steel are also common materials.

3. Concrete sleepers offer greater durability and require less maintenance compared to wooden ones.

4. Steel sleepers are lightweight and resistant to decay, making them suitable for various environments.

5. The primary function of sleepers is to maintain the correct gauge between rails and distribute the load from trains.

8. Translate these sentences into English.

1. Сучасні композитні шпали виготовляють із перероблених матеріалів, щоб надати їм екологічних переваг.

2. Правильна установка шпал забезпечує стабільність та безпеку залізничної колії.

3. Регулярна інспекція шпал допомагає виявляти знос та запобігати можливим несправностям колії.

4. Вибір матеріалу шпал може впливати на рівень шуму, що створюють поїзди, які проходять.

5. Інновації в дизайні шпал сприяють розвитку більш ефективних та стійких залізничних систем.

9. Read the text below. Match choices (A-H) to (1-5). There are three choices you do not need to use.

Why Are There Crushed Stones Alongside Rail Tracks

1. _____

Travelling by train is an amazing experience in fast-paced city life nowadays. You get to witness the stunning views of nature, sprawling fields, cities teeming with people, or endless stretches of land with no sign of any life whatsoever. One more thing that you almost always see throughout your train-journey are those small stones lying alongside the track on which your train races. Have you ever given any thought as to why there are almost always stones alongside a rail track?

2. _____

To start with, the stones that you see lying close to the railway tracks are collectively called track ballast. It basically forms the trackbed on which the rail sleepers are kept. Track ballast is packed between the sleepers, in the areas below, and on the sides of railway tracks. I can already hear the question beginning to form in your head, what's a rail sleeper?

A rail sleeper is a rectangular support that is usually kept perpendicular to the tracks. Rail sleepers are known by a few other names too, like a railroad tie or a crosstie. These are usually made of wood or pre-stressed concrete, although the latter is more widely used today. The function of rail sleepers is to hold the rails upright and properly spaced.

3. _____

It's not like the construction crews put just any stone they find around the tracks. That wouldn't do the trick. For instance, if you put smooth, round pebbles in the ballast, then they might roll or slide over each other when a train passes over the tracks; therefore, they would fail at their main job – providing solidarity to the tracks. Given that fact, you need stones of a specific type that won't move around too much, except by kids chucking stones near the tracks, of course! In order to guarantee that the stones stay in place, they use sharp and edged stones in the ballast. Interesting, huh?

4. _____

In fact, the track ballast serves a number of purposes. First of all, it makes sure that tracks stay in place when super-heavy trains roll by on them. It also plays an instrumental role in keeping any vegetation in check that might grow around the tracks (and make the ground beneath the tracks weaker). Another important aspect of track ballast is that it seals out any water that may be around the tracks to actually reach the tracks on a regular basis. That doesn't mean the ballast completely insulates the tracks from water, which would be impossible, but it does facilitate water drainage around and beneath the tracks so that water doesn't stay near the tracks and compromise the solidarity of the ground.

5. _____

The excessive use of railway lines for transportation poses a threat to the buildings in the areas near the tracks due to the immense vibrations the tracks experience when a high speed locomotive moves over them. Also, the loud noise that is produced when a train moves rapidly also the tracks is also a nuisance to the surrounding areas.

In order to minimize these vibrations, a fairly simple clamping technique is employed using a dynamic vibration absorber. It consists of EPDM or Ethylene Propylene Diene Monomer rubber because of its high resistance to heat, water and other mechanical strains. As a result, the vibrations are reduced to a great extent and the noise is also diminished to a bare minimum.

<http://www.railroadfastenings.com/blog/functions-of-track-ballast.html>

- A Functions of Track Ballast
- B New Technique to Reduce Track Vibrations
- C Performance Materials
- D The Mystery of Tracksides Stones
- E Satisfy the Requirements for Trackbed Ballast
- F Why Specially Those Stones
- G What Is Track Ballast
- H Providing Water Drainage

10. Read the dialogue between two friends, then do the following tasks:

- highlight the connectors of opinion and reasoning in the text;
- give the synonyms to the words in bold;
- find in the text the words and word combinations that express emotions.

Debating the Optimal Material for Railway Sleepers: Concrete, Wood, Steel, or Composites?

Alex: In my opinion, concrete sleepers are the best **choice** for modern railways.

Jordan: I see your point; however, I believe that wooden sleepers have their own advantages, especially in terms of flexibility and cost.

Alex: That's true to some extent. Nevertheless, concrete sleepers offer greater durability and require less maintenance over time.

Jordan: I agree that durability is a **significant** factor. On the other hand, wooden sleepers are easier to install and handle due to their lighter weight.

Alex: While that's a valid point, it's important to consider that wooden sleepers are susceptible to decay and pest infestations, which can lead to higher long-term costs.

Jordan: That's a fair argument. Conversely, steel sleepers **provide** a good balance between strength and weight, don't you think?

Alex: Indeed, steel sleepers are strong and relatively lightweight. However, they can be prone to corrosion if not properly maintained, which might offset their benefits.

Jordan: That's a valid concern. In my view, composite sleepers might be the optimal solution, as they combine the strengths of various materials and are environmentally friendly.

Alex: I hadn't considered that. Composite sleepers do seem promising, especially since they resist rot and pests.

Jordan: Exactly. Moreover, they often utilize recycled materials, contributing to sustainability efforts.

Alex: That's a **compelling** point. Ultimately, the choice of sleeper material should depend on specific project requirements and environmental conditions.

Jordan: I couldn't agree more. Each material has its **pros and cons**, and the final decision should be based on a comprehensive assessment of all factors involved.

11. Role-play.

1) In pairs, practice the dialogue from the previous exercise. Then perform it in front of the class or in breakout groups.

2) After the role-play, each student in your pair should summarize the key points of the text in his/her own words using the connectors of opinion and reasoning, such as *in my opinion*, *however*, *nevertheless*, *on the other hand*, *while*, *conversely*, *indeed*, *in my view*, *exactly*, *moreover*, *ultimately*, and *I couldn't agree more* to articulate the perspectives and rationale of both speakers.

Use questions to guide your partner:

What is the main purpose of railway sleepers?

What materials are used to make railway sleepers?

Why are concrete sleepers often chosen for modern railways?

What is a disadvantage of using wooden sleepers?

How do steel sleepers help in maintaining track stability?

What is an advantage of composite sleepers over traditional materials?

How does the choice of sleeper material affect railway maintenance?

12. Describe the peculiarities of every types of sleepers using information from the read texts.



<http://www.railway-fasteners.com/railroad-sleeper.html>

Unit 5

Rails

Share your ideas:

What are the primary functions of railway rails in train operations?

What materials are used to make railway rails?

Key Vocabulary:

multiple /'mʌltɪpl/ *adj* численний; множинний

friction /'frɪkʃən/ *n* тертя

ensure /ɪn'ʃʊ:/ *v* забезпечувати

meet requirements /mi:t ri'kwaɪəmənts/ відповідати вимогам

double-headed rail /,dʌbl 'hedɪd reɪl/ двоголова рейка

feature /'fi:tʃə/ *v* включати (в себе); *n* особливість

wear out /weər aʊt/ *v* зношуватися

upper/lower table /'ʌpə/'ləʊə 'teɪbl/ верхня/нижня поверхня рейки

deteriorate /dɪ'tɪəriəreɪt/ *v* погіршуватися

chair /tʃeə/ *n* підкладка під рейку

bull-headed rail /,bʊl 'hedɪd reɪl/ рейка з масивною голівкою

flat-bottom rail /,flæt 'bɒtəm reɪl/ рейка з широкою подошвою [1]

rail foot /reɪl fʊt/ подошва рейки

web /web/ *n* шийка рейки

rest on /rest ɒn/ *v* спиратися на

resistance *n* /rɪ'zɪstəns/ *n* опір

alloy /'æləɪ/ *v* легувати

wear and tear /weər ən teə/ знос

withstand /wɪð'stænd/ *v* витримувати

rolling stock /'rəʊlɪŋ stɒk/ рухомий склад

continuous welded rail /kən'tɪnjuəs 'weldɪd reɪl/ суцільна зварна рейка

1. Match each word to its correct definition by writing the letter (A-G) next to the word.

- | | |
|-----------------|---|
| 1 rolling stock | A the force that opposes the relative motion or tendency of such motion of two surfaces in contact |
| 2 resistance | B to endure or remain unaffected by; to resist successfully |
| 3 requirement | C the vehicles that move on a railway, including both powered and unpowered vehicles such as locomotives, freight cars, and passenger cars |
| 4 withstand | D to become worse in quality or condition over time |
| 5 deteriorate | E a necessity or condition that must be met or complied with |
| 6 alloy | F a metal made by combining two or more metallic elements to enhance strength and resistance to corrosion |
| 7 friction | G the opposition that a substance offers to the flow of electric current or to other forces like motion |

2. Give the English equivalents to these words and word combinations using the key vocabulary.

рухомий склад	рейка з масивною голівкою
відповідати вимогам	нижня поверхня рейки
тертя	витримувати
погіршуватися	зношуватися
рейка з широкою підошвою	підкладка під рейку
шийка рейки	суцільна зварна рейка

Check your vocabulary! Say it in English



Check your vocabulary! Say it in Ukrainian



Pay attention to the terminology:

амортизація **amortization, wear and tear, damping**

знос **wear and tear, wearing out**

стотлення **fatigue, weariness, wear and tear**

3. Make up collocations using the words from the box.

process	the rail's lifespan	the rail's resistance	wear and tear
on the sleepers	train wheels	pathway	

smooth _____

guiding _____

extend _____

rests directly _____

enhancing _____

manufacturing _____

minimizing _____

4. Complete these sentences using the appropriate vocabulary word.

decades faster derailments functions stresses

1. Unlike some other uses of iron and steel, railway rails are subject to very high ... and are made of very high quality steel.

2. It took many ... to improve the quality of the materials, including the change from iron to steel.

3. Minor flaws in the steel that may pose no problems in other applications can lead to broken rails and dangerous ... when used on railway tracks.

4. By and large, the heavier the rails and the rest of the track work, the heavier and ... the trains these tracks can carry.

5. Rail service life is the period during which a rail can safely and effectively perform its intended ... before requiring replacement.

5. Read the text and answer the comprehension questions below.

Rail Designs

Railway rails are fundamental components of railway infrastructure, providing a stable and smooth pathway for trains. They serve multiple essential functions, including supporting and guiding train wheels, distributing loads to the track foundation, and ensuring minimal friction between the wheels and the track.

Historically, various rail designs have been developed to meet specific requirements. Double-headed rails, used in the early stages of railroad development, featured identical upper and lower tables. This design aimed to

extend the rail's lifespan by allowing inversion when the upper surface wore out. However, it was discovered that the lower table also deteriorated due to contact with the chairs, making this design less effective over time.

Subsequently, bull-headed rails were introduced, characterized by a larger head and a narrower foot. This design required chairs to hold the rails in place, adding complexity to the track structure.

In modern railway systems, flat bottom rails (also flat-bottomed rails, flat-footed rails), also known as Vignoles rails, have become the standard. Designed by French engineer Charles Vignoles, these rails have a flat base that rests directly on the sleepers (ties), offering advantages such as ease of installation and maintenance. The flat base provides a stable platform, enhancing the rail's resistance to lateral forces.

Modern rails are typically made from high-quality steel alloys to withstand the substantial stresses imposed by heavy and fast-moving trains. The manufacturing process has evolved over time, transitioning from iron to steel to enhance durability and performance. The selection of rail type and material is crucial for the safety and efficiency of railway operations. Proper rail design and maintenance ensure that trains can travel smoothly at high speeds while minimizing wear and tear on both the rolling stock and the track infrastructure. [12]

1. What is one of the primary functions of railway rails?

- A) To increase the speed of trains
- B) To support and guide train wheels
- C) To reduce the weight of trains
- D) To decorate the railway tracks

2. Why was the design of double-headed rails eventually considered less effective?

- A) The upper surface wore out too quickly
- B) The lower table deteriorated due to contact with the chairs
- C) They were more expensive to produce
- D) They were difficult to install

3. What additional component did bull-headed rails require for proper installation?

- A) Nails
- B) Chairs
- C) Bolts
- D) Clips

4. Who designed the flat-bottomed (Vignoles) rails that are standard in modern railway systems?

- A) George Stephenson

- B) Isambard Kingdom Brunel
- C) Charles Vignoles
- D) Robert Stephenson

5. What is a notable advantage of flat-bottomed rails over previous designs?

- A) They are lighter in weight
- B) They require fewer maintenance checks
- C) They rest directly on the sleepers, simplifying installation
- D) They are more aesthetically pleasing

6. Why are modern railway rails made from high-quality steel alloys?

- A) To reduce manufacturing costs
- B) To withstand substantial stresses from heavy and fast-moving trains
- C) To make the rails more flexible
- D) To improve the appearance of the tracks

7. How does proper rail design and maintenance benefit railway operations?

- A) It allows trains to travel smoothly at high speeds while minimizing wear and tear
- B) It increases the weight capacity of trains
- C) It reduces the need for skilled labour
- D) It shortens the length of railway tracks

6. Post-reading discussion.

1. What are the primary functions of railway rails in modern train operations?
2. How did the design of double-headed rails aim to extend their lifespan, and why did this design prove less effective over time?
3. What were the characteristics of bull-headed rails, and how did their design impact the complexity of track structures?
4. Why have flat bottom (Vignoles) rails become the standard in modern railway systems, and what advantages do they offer over previous designs?
5. How has the material composition of railway rails evolved from the early days of rail transport to the present, and what factors have driven these changes?
6. In what ways does the selection of rail type and material influence the safety and efficiency of railway operations?
7. What role does proper rail maintenance play in ensuring smooth and safe train travel, and what are the potential consequences of neglecting rail upkeep?
8. How do modern steel alloys used in rail manufacturing contribute to the durability and performance of railway infrastructure?

9. What are the challenges associated with transitioning from older rail designs to modern standards, and how have railway systems addressed these challenges?

10. How do advancements in rail design and materials reflect broader technological progress in engineering and materials science?

7. Read the text and choose the correct answer (A, B, C or D).

Continuous Welded Rail

To enhance the 1) _____ and performance of railway tracks, modern systems often employ continuous welded rail (CWR). In CWR, standard rail 2) _____ are welded together to form seamless tracks that can extend for several kilometres. This approach reduces the number of 3) _____, leading to a smoother ride, decreased maintenance 4) _____, and the capability to support higher train speeds.

The manufacturing process of these rails has evolved significantly over time. Advancements in metallurgy and rolling techniques have enabled the production of 5) _____ rail sections, reducing the number of joints and further enhancing track stability. For instance, modern rolling mills can 6) _____ rails up to 130 meters in length, which are then welded together to create continuous tracks.

In summary, modern railway rails, characterized by their robust steel composition and advanced design features such as flat-bottom profiles and continuous welding, play a crucial role in supporting the efficiency, safety, and 7) _____ of contemporary rail transport systems [10].

1	A durability	B longevity	C ballast	D lifespan
2	A heights	B effects	C sections	D lengths
3	A joints	B tracks	C components	D foundations
4	A purposes	B surfaces	C requirements	D loads
5	A more powerful	B longer	C smoother	D safer
6	A assemble	B create	C process	D produce
7	A heavily	B represent	C reliability	D secondary

8. Translate these sentences into Ukrainian.

1. Rails are used in a wide range of industries, from transportation to construction, and made in many different shapes, sizes, and materials.

2. Modern rails are typically made from steel and come in a range of different shapes and sizes, depending on their intended use.

3. Modern railway rails are essential components of contemporary rail infrastructure, designed to support the substantial demands of today's high-speed and heavy-load train operations.

4. These rails are typically manufactured from high-quality steel, providing the necessary strength and durability to withstand significant stresses.

5. A prevalent type of rail in use today is the flat-bottomed rail, also known as the Vignoles rail.

6. This design features a broad base that rests directly on the sleepers, offering stability and simplifying the installation process by eliminating the need for additional support structures.

9. Translate these sentences into English.

1. Сталеві рейки є невід'ємною частиною залізничної інфраструктури.
2. Вони утворюють основу, по якій рухаються залізничні транспортні засоби, забезпечуючи безпечні та ефективні перевезення.
3. Існує кілька різних типів рейок, залежно від застосування та специфіки місцевості.
4. Транспортні рейки призначені для утримання вагонів або поїздів на правильному маршруті.
5. Їхня конструкція забезпечує достатню стабільність і міцність.
6. Транспортні рейки використовують як для пасажирських, так і для вантажних залізничних перевезень.

10. Read the dialogue between two friends, then do the following tasks:

- highlight the terms in the text, then some commonly used words;
- give the synonyms to the words in bold;
- find in the text the words and word combinations that express comparison.

Discussing the Evolution and Types of Railway Rails

Alex: I've been reading about the history of railway rails. Did you know that the earliest rails were **made** of wood?

Jordan: Really? I always thought they started with metal.

Alex: Initially, they were wooden but were later reinforced with iron straps to reduce wear and friction.

Jordan: Interesting. So, when did they **transition** to fully iron rails?

Alex: Around the mid-18th century. The Coalbrookdale Iron Works began producing cast iron rails in 1767, which marked a **significant** shift in rail design.

Jordan: I see. And what about the different rail designs over time?

Alex: One notable design was the double-headed rail, which had identical upper and lower surfaces. The idea was to invert the rail when the top wore out, but this wasn't very effective because the bottom also deteriorated.

Jordan: That makes sense. Were there other designs that followed?

Alex: Yes, the bullhead rail came next. It had a larger head and a narrower foot, requiring chairs **to hold** them in place.

Jordan: And what about modern rails?

Alex: Today, flat-bottomed rails, also known as Vignoles rails, are standard. Designed by Charles Vignoles, they rest directly on the sleepers, simplifying installation and maintenance.

Jordan: It's fascinating how rail design has evolved **to improve** durability and efficiency over time.

Alex: Absolutely. The advancements in materials and design have been crucial for the development of modern railways.

11. Role-play.

In pairs, practice the dialogue from the previous exercise. Then perform it in front of the class or in breakout groups.

Use questions to guide your partner:

How did the design of double-headed rails aim to extend their lifespan, and why was this approach eventually deemed ineffective?

What distinguishes bull-headed rails from double-headed rails, and what additional component did their design necessitate?

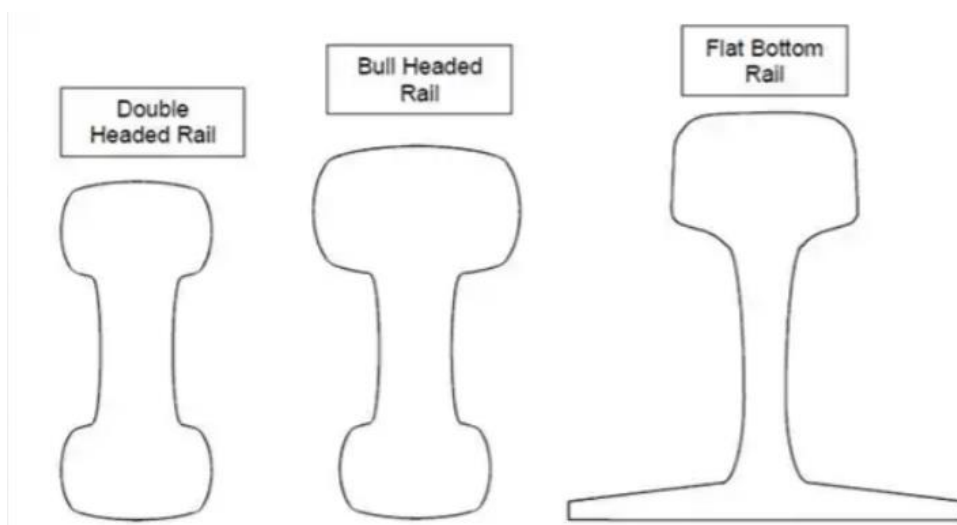
Why have flat-bottomed (Vignoles) rails become the standard in modern railway systems?

How has the material used in manufacturing railway rails evolved over time? What are the benefits of using high-quality steel alloys in modern rails?

Why is the selection of rail type and material crucial for railway operations? How does proper rail design and maintenance contribute to train performance?

12. Describe the peculiarities of every types of rails using information from the read texts. What are their advantages and disadvantages?

	Advantages	Disadvantages
Dubble-headed rail		
Bull-headed rail		
Flat bottom rail		



<https://www.world-of-railways.co.uk/techniques/what-is-flat-bottom-rail>

Unit 6

Rail Fastening System

Share your ideas:

How often do railway spikes need to be inspected and maintained?

What functions do fasteners have on railway?

Key Vocabulary:

fastener /'fɑ:sənə/ *n* скріплювальна деталь; кріплення

spike /spaɪk/ *n* костиль

screw /skru:/ *n* гвинт

rail anchor /reɪl 'æŋkə/ анкер рейки

tie plate /taɪ pleɪt/ стяжна пластина *syn* **baseplate** *n* /'beɪspleɪt/

single shoulder tie plate ['sɪŋɡl ʃouldə 'taɪ 'pleɪt] одноребордна підкладка

double shoulder tie plate ['dʌbl ʃouldə 'taɪ 'pleɪt] дворебордна підкладка

rail chair /reɪl tʃeə/ рейкова підкладка

rail clip /reɪl klɪp/ клема рейкова

rail clamp /reɪl klæmp/ затискач рейки

rail pad /reɪl pæd/ прокладка підрейкова

rail joint /reɪl dʒɔɪnt/ стикова накладка; стикове з'єднання рейок

integrity /ɪn'teɡrɪti/ *n* цілісність

buffering /'bʌfərɪŋ/ *n* амортизація

vibration /vaɪ'reɪʃən/ *n* вібрація

alleviate /ə'li:vɪeɪt/ *v* полегшувати

residual /rɪ'zɪdʒuəl/ *adj* залишковий

hot-pressed spring steel /hɒt prɛst sprɪŋ sti:l/ гарячепресована пружинна сталь

insert /ɪn'sɜ:t/ *v* вставляти

1. Match each word to its correct definition by writing the letter (A-G) next to the word.

- | | |
|--------------|---|
| 1 spike | A a metal or composite connecting plate used to join the ends of two rails, creating a continuous track |
| 2 screw | B to place or fit something into another thing, typically to fill a space or gap |
| 3 tie plate | C a fastening device, often made of metal, used to secure rails to railroad ties (sleepers), ensuring track stability |
| 4 rail clip | D a flat steel plate positioned between the rail and the sleeper (tie), distributing the load and securing the rail's position |
| 5 rail clamp | E the state of being whole, undivided, or in sound condition |
| 6 rail joint | F a metal fastening device that uses rotational force to secure materials together, often providing greater holding power |
| 7 integrity | G a resilient fastening component that holds the rail in place on the tie, allowing for slight movements and reducing vibrations |
| 8 to insert | H a device used to hold two components tightly together, often used in rail systems to maintain alignment and stability |

2. Give the English equivalents to these words and word combinations using the key vocabulary.

СТИКОВА НАКЛАДКА

ЗНИЖУВАТИ ВІБРАЦІЮ

одноребордна підкладка

скріплювальна деталь

ГВИНТ

затискач рейки

прокладка підрейкова

СТИКОВЕ З'ЄДНАННЯ РЕЙОК

полегшувати плавний рух

КОСТИЛЬ

Check your vocabulary! Say it in Ukrainian



Check your vocabulary! Say it in English



Pay attention to the terminology:

стикова накладка **rail joint, fishplate, joint bar, splice bar**

рейкова підкладка **tie plate, baseplate**

3. Make up collocations using the words from the box.

system	end-to-end	lifespan	reduction	rail and sleeper
		the gauge	the line	
connection between _____				
railway fastening _____				
vibration _____				
deformation of _____				
to maintain _____				
joint rails _____				
prolong the _____				

4. Complete these sentences using the appropriate vocabulary word.

holding consist of are placed to retain to bolt

1. Rail joint a metal or composites connecting plate used ... the ends of two rails into a continuous track.

2. Compression clip fastenings ... a spring steel clip provided with a projection which fits into the tie plate punching and a heat-treated hook which fastens the springs to the tie plates.

3. The bolts ... in the slots of standard single or double shoulder tie plates and the units may be tightened with a hand wrench or mechanical bolt tightener.

4. The screw spike is advantageously used for ... the tie plate securely to the track tie also in many instances to anchor the rail to track ties.

5. The principal points of divergence from standard track construction are the use of double-shoulder tie plates secured to the ties by independent spiking and the use of special fastenings ... the movement of the rail.

5. Read the text and answer the comprehension questions below.

Fastening the Rails and Sleepers

Fasteners are used for fixing rails to railway sleepers. It is also a very important component of railway track. Most commonly seen fasteners include spikes, screws, rail anchors, tie plates, chairs, etc. Various types of fasteners have been used over the years. Other track materials like rail clip, rail clamp, rail pad, rail joints also belong to railway fastening systems.

The main functions of the rail fastening system are as follow:

- effectively guarantee the reliable connection between rail and rail, rail and sleeper;
- maintain the continuity and integrity of the rail to the most;
- prevent the horizontal and vertical movement of the steel rail relative to the sleeper, ensure the normal gauge;

– fully exert the buffering and vibration reduction performance under the power of the locomotive and vehicle to delay the accumulation of residual deformation of the line. [9]

Tie plate

Tie plate, also calling baseplate, is an irreplaceable component in fastening the rails and sleepers, and it provides a solid foundation of the rails and reduces the abrasion damage of the sleepers. With the help of rail spikes and other fastening components, rail tie plates can fix the rail tracks properly and prolong the service life of rails and sleepers.



Rail clip

Rail clip is used to fix the railroad track to underlying baseplate and sleepers. The clamping force by rail clips helps to maintain the gauge and prevent the rail from moving in the vertical and horizontal direction relative to the sleeper. One extensively used type of rail clip is an elastic rail clip made of hot-pressed spring steel. Its energy produced at elastic deformation can alleviate the vibration and shock when trains moving.



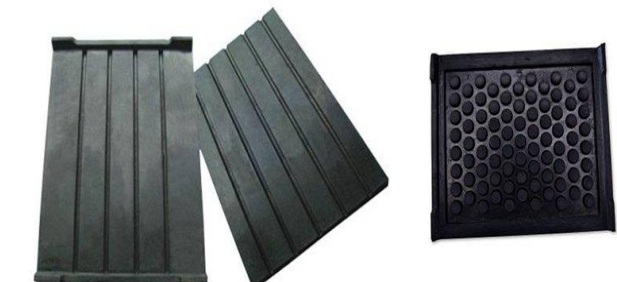
Rail clamp

The main application of rail clamps is for cranes. For the installation method, they can be divided into bolted rail clamps and welded rail clamps.



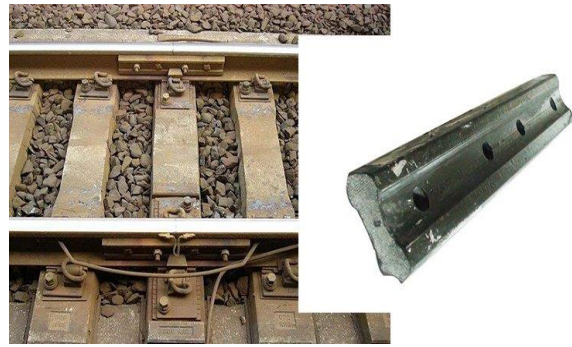
Rail pad

Rail pad or railway rubber pad, is a material available to decrease the vibration transmitted from the rails to the sleeper or subgrade. It is inserted in between the rail and baseplate or sleeper.



Rail joints

Rail joint is usually called fishplate, commonly known as the joint bar, is a component that joint rails end-to-end.



<https://railroadrails.com/knowledge/main-parts-of-railroad-track/>

- 1. What is the primary purpose of railway fasteners?**
 - A) To connect train cars together
 - B) To fix rails to railway sleepers
 - C) To signal train movements
 - D) To control train speed

- 2. Which of the following is NOT mentioned as a common type of railway fastener?**
 - A) Spikes
 - B) Screws
 - C) Rail anchors
 - D) Bolts

- 3. What is one of the main functions of the rail fastening system?**
 - A) To increase train speed
 - B) To signal approaching trains
 - C) To maintain the continuity and integrity of the rail
 - D) To monitor weather conditions

- 4. How does an elastic rail clip made of hot-pressed spring steel benefit railway tracks?**
 - A) It reduces noise pollution
 - B) It alleviates vibration and shock when trains are moving
 - C) It simplifies the installation process
 - D) It decreases the need for regular maintenance

- 5. In what context are rail clamps primarily used?**
 - A) For passenger trains
 - B) For high-speed railways
 - C) For cranes
 - D) For underground subways

- 6. Where is a rail pad typically inserted in the railway track structure?**
 - A) Between the rail and the sleeper

- B) Between two connected rails
- C) Between the sleeper and the ballast
- D) Between the rail and the train wheel

7. What is another term commonly used for a rail joint?

- A) Tie plate
- B) Rail pad
- C) Rail clip
- D) Fishplate

6. Post-reading discussion.

1. What are the primary functions of railway fasteners in maintaining track stability?
2. How do different types of fasteners, such as spikes and screws, contribute to the overall integrity of railway tracks?
3. In what ways do rail clips help maintain the correct gauge and prevent rail movement?
4. Why is hot-pressed spring steel commonly used in the manufacturing of elastic rail clips?
5. What role do rail clamps play in crane operations, and how do their installation methods differ?
6. How do rail pads contribute to reducing vibrations transmitted from rails to sleepers or the subgrade?
7. What is the purpose of rail joints (fishplates), and how do they ensure the continuity of the rail?
8. How does the design of a rail fastening system prevent horizontal and vertical movement of the rail relative to the sleeper?
9. In what ways does an effective rail fastening system enhance the safety and efficiency of railway operations?
10. How do advancements in rail fastening technology impact the maintenance requirements of railway infrastructure?

7. Translate these sentences into Ukrainian.

1. When the train is running, rail joints (railway fish plates) play an important role in connecting and fastening rails as well as keeping the integrity of rails.
2. While the speed and load of rails are increasing, it requires a higher performance to the property of rail joints.
3. A rail joint can connect two rails with six bolts. Relying on the up and down shoulder slopes and the fastening with rails, it can support the large load during the train's runtime, the fretting wear and other complex stresses.
4. Rail baseplates are used not only to support the rails, but also to hold the entire rail fastening system.

5. Tie plate always works with anchor bolts or spikes by taking the load of the rail and transferring part of the load to the sleepers, with a flat smooth support surface to ensure vertical alignment and keep the rail on the correct rail gauge line system.

8. Read the text and choose the correct answers (A, B, C, D).

Keep the Correct Rail Gauge

Consider of the force caused by 1) _____ of passengers and the train, the rail may deviate from the original track slightly. It is tie plates together with sleepers which 2) _____ the rails tightly so that the trains can run safely on the tracks. It is also vital for the railway workers 3) _____ and repair the railroad regularly, especially for the 4) _____ of rail spikes, tie plates or other fastening accessories after using for a period of time.

Railroad tie plates can evenly 5) _____ the weight of the train, cargo or passengers. The use of tie plates helps to reduce the 6) _____ between the rails and ties, and makes the sleepers last longer. With tie plates, the rails can bear the pressure evenly so that they can maintain a smoother surface.

Rail tie plates play an important role in securing the safety of railway and passengers. It has the function of supporting the rails and protecting the sleepers. AGICO can provide you with high quality and 7) _____ rail tie plate and all of our products are inspected by a full set of inspection facilities in quality centre. Both standard and customized rail base plates are available according to your drawing and sample.

<http://www.railjoint.com/rail-fasteners/tie-plate.html>

1	A the kilogrammes	B the weight	C freight	D cargo
2	A facilitate	B invert	C fasten	D carry out
3	A to inspect	B to tighten	C to fit	D to fix
4	A aligning	B treatment	C compression	D replacement
5	A alleviate	B require	C distribute	D hold
6	A manufacture	B friction	C design	D application
7	A reliable	B quantifiable	C breakable	D winnable

9. Translate these sentences into English.

1. Кріплення рейок фіксують рейки до шпал, забезпечуючи стабільність колії.

2. Належні системи кріплення підтримують правильну ширину та вирівнювання колії.

3. Еластичні затискачі рейок допомагають поглинати вібрації, спричинені проходженням поїздів.

4. Поширені кріплення рейок включають костилі, затискачі та болти.

5. Прокладки під рейки розміщують між рейкою та шпалою для зменшення зносу та шуму.

6. Належне обслуговування кріплень рейок є необхідним для безпечної роботи залізниці.

7. Щоб забезпечити належне використання залізничного обладнання, нам потрібно час від часу проводити технічне обслуговування рейкових з'єднань, щоб покращити якість і уникнути аварій.

10. Read the dialogue between two friends, then do the following tasks:

- **highlight the verbs in the text and give the synonyms to them;**
- **find terms in the text and explain their meanings.**

Discussing the Railway Fastening System

Alex: I've been reading about railway infrastructure lately. Could you explain what a railway fastening system is?

Jordan: Sure! A railway fastening system secures the rails to the railroad sleepers, ensuring the tracks remain in place and maintain the correct gauge.

Alex: What components make up this system?

Jordan: It includes various parts such as rail spikes, screws, tie plates, rail clips, rail clamps, and rail joints. Each component plays a specific role in maintaining track stability.

Alex: I've heard of rail spikes. What exactly are they?

Jordan: Rail spikes are large nails with offset heads used to secure rails and base plates to wooden sleepers. They help keep the rail in gauge and prevent lateral movement.

Alex: And what about tie plates?

Jordan: Tie plates are steel plates placed between the rail and the tie. They distribute the load and hold the rail at the correct gauge, enhancing stability.

Alex: How do rail clips differ from rail clamps?

Jordan: Rail clips are resilient components that hold the rail in place on the sleeper, allowing slight movements and reducing vibrations. Rail clamps, on the other hand, are devices used to hold two components tightly together, often used to maintain alignment and stability in rail systems.

Alex: What role do rail joints play in the fastening system?

Jordan: Rail joints, also known as fishplates, are metal or composite connecting plates used to join the ends of two rails, creating a continuous track.

Alex: Are there different types of fastening systems used worldwide?

Jordan: Yes, various types have been developed over the years. For instance, the Pandrol clip is a commonly used heavy-duty clip that fastens rails to the underlying baseplate.

Alex: How have these systems evolved over time?

Jordan: Initially, railways used simple spikes and chairs to secure rails. Over time, more advanced systems like elastic rail clips and baseplates were developed to enhance durability and performance.

Alex: Why is it important to have a reliable fastening system?

Jordan: A reliable fastening system ensures track stability, maintains the correct gauge, reduces maintenance costs, and enhances the safety and efficiency of railway operations.

11. Role-play.

1) In pairs, practice the dialogue from the previous exercise. Then perform it in front of the class or in breakout groups.

2) After the role-play, summarize the key points in your own words using the texts from this unit.

3) Now work in pairs. One plays the role of an engineer presenting railway fasteners, and the other is a student asking questions to gather comprehensive information on railway fastening system. Use questions to guide your partner to pay attention to the function of every type of fastening involved in railway track construction:

What are the key components of a typical railway fastening system?

How does each element contribute to track stability?

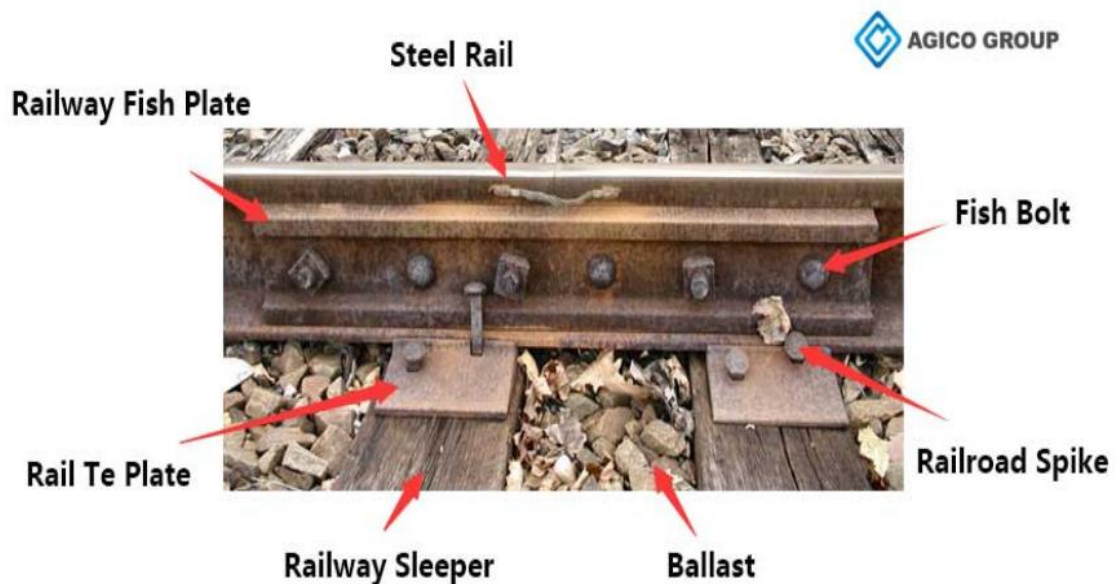
Could you explain the primary functions of a railway fastening system?

Why is fastening system crucial for rail infrastructure?

What specific types of rail fasteners are best suited for our railway infrastructure?

How do these fasteners perform under various environmental conditions?

12. Describe the process of railway joint using information from the texts.



<http://www.railway-fasteners.com/news/railway-track-parts.html>

Unit 7

Freight and Passenger Railway Cars

Share your ideas:

Why is rolling stock considered essential for modern economies?

In what ways do railway cars support sustainability and reduce road congestion?

Key Vocabulary:

rolling stock /'rəʊlɪŋ ,stɒk/ рухомий склад

car /kɑː/ *n* вагон; автомобіль

carry /'kæri/ *v* перевозити, нести

coach /kəʊtʃ/ *n* пасажирський вагон; міжміський автобус

carriage /'kæriɪdʒ/ *n* вагон; карета

arrangement /ə'reɪndʒmənt/ *n* розташування; домовленість

common /'kɒmən/ *adj* поширений, спільний

amenity /ə'mi:nəti/ *n* зручність, комфорт

seating coach /'si:tɪŋ kəʊtʃ/ пасажирський вагон із сидячими місцями

sleeping car /'sli:pɪŋ kɑː/ спальний вагон

dining car /'daɪnɪŋ kɑː/ вагон-ресторан

observation car /,ɒbzə'veɪʃən kɑː/ оглядовий вагон

freight car /'freɪt kɑː/ вантажний вагон

boxcar /'bɒks kɑː/ *n* критий вантажний вагон

flatcar /'flæt kɑː/ *n* платформний вагон

tank car /'tæŋk kɑː/ цистерна

hopper car /'hɒpə kɑː/ вагон-хопер

gondola car /'ɡɒndələ kɑː/ вагон-гондола

refrigerated car /rɪ'frɪdʒəreɪtɪd kɑː/, **reefer** /'ri:fə/ рефрижераторний вагон

elements /'elɪmənts/ *n* непогода

be designed /bi dɪ'zaɪnd/ бути спроектованим, призначатися (*for smth, to do*)

cylindrical /sɪ'lɪndrɪkəl/ *adj* циліндричний

sloped floor /sləʊpt flɔː/ похила підлога

discharge door /dɪs'tʃɑːdʒ dɔː/ розвантажувальні двері

perishable /'perɪʃəbəl/ *adj* швидкопсувний

versatility /,vɜːsə'tɪləti/ *n* універсальність, багатофункціональність

1. Give the English equivalents to these words and word combinations using the key vocabulary.

промисловий розвиток	перевезення пасажирів і товарів
економічне зростання і стабільність	управління залізничною системою
призначений для перевезення	рівень комфорту і зручностей
інноваційна роль	потребувати захисту
рухомий склад	похила підлога
спеціалізовані вагони	розвантажувальні двері

2. Match each word to its correct definition by writing the letter (A-G) next to the word.

- | | |
|---------------------------|--|
| 1 freight car | A a railcar with a flat, open platform used for carrying large or heavy loads. |
| 2 boxcar | B a type of freight car with a closed structure used for transporting general cargo. |
| 3 flatcar | C a specialized railcar equipped with refrigeration to transport perishable goods. |
| 4 tank car | D a freight car designed with an open-top and sloped floor for easy unloading of bulk materials like grain or coal. |
| 5 hopper car | E a railcar with large windows designed for passengers to enjoy scenic views. |
| 6 gondola car | F a freight car that is enclosed but has open-top sides, typically used for transporting bulk materials. |
| 7 refrigerated car | G a general term for any railcar used to transport goods and materials. |
| 8 observation car | H a cylindrical railcar designed to carry liquids such as chemicals, fuel, or milk. |

Check your vocabulary! Say it in Ukrainian



Pay attention to the terminology:

вагон car, couch, carriage, wagon
погана погода elements, unfavourable weather conditions, poor weather
railroad car, railcar (*American and Canadian English*)
railway wagon, railway carriage, railway truck, railwagon, railcarriage, railtruck (*British English and UIC*)
train car, train wagon, train carriage

from the elements	transportation needs	specialized cars	to transport people
by gravity	picturesque landscapes	meals and beverages	

4. Complete these sentences using the appropriate vocabulary word.

1. Freight cars are essential for transporting goods over including raw materials, consumer products, and industrial equipment.

2. A boxcar is one of the most common types of freight cars, used to carry packaged goods that need ... from weather conditions.

3. Tank cars are designed ... liquids such as oil, chemicals, and milk safely across rail networks.

4. Hopper cars have sloped floors and discharge doors, making them ideal for ... bulk materials like coal, grain, and sand.

5. Modern refrigerated cars help transport perishable goods, such as fruits, vegetables, and dairy products, by maintaining a controlled ... inside.

5. Read the text and answer the comprehension questions below.

Designation of Railway Cars

Rolling stock is a backbone of modern economies, enabling efficient transportation of goods and people while promoting sustainability and industrial development. Its continued innovation and expansion play a key role in shaping economic growth worldwide.

Rolling stock refers to all the vehicles that move on a railway track, including passenger cars, freight cars, locomotives, and specialized rail vehicles excluding the infrastructure like tracks, stations, and signalling systems.

Railway transportation utilizes a variety of specialized cars designed to efficiently carry passengers and freight. Understanding these different types is essential for appreciating how rail systems operate.

Passenger Cars

Passenger cars, also known as coaches or carriages, are designed to transport people comfortably and safely. Key types include:

Seating coaches are the most common passenger cars, providing seating arrangements for travellers. They are typically divided into classes, such as first and second class, offering varying levels of comfort and amenities.

Equipped with beds or berths, *sleeping cars* allow passengers to rest during overnight journeys, enhancing comfort on long-distance trips.

Dining cars function as onboard restaurants, offering meals and beverages to passengers during their journey.

Featuring large windows or open-air sections, *observation cars* provide scenic views, enhancing the travel experience, especially on routes through picturesque landscapes.

Freight Cars

Freight cars, or goods wagons, are designed to transport various types of cargo. Common types include:

Boxcars are enclosed cars used to transport general cargo that requires protection from the elements, such as packaged goods and machinery.

Flatcars are open-deck cars ideal for carrying heavy or oversized loads like machinery, vehicles, or construction materials that do not require enclosure.

Tank cars are cylindrical cars specifically designed to transport liquids, including chemicals, petroleum products, and food-grade liquids.

Hopper cars have sloped floors and discharge doors, making them suitable for transporting bulk commodities like coal, grain, or ore that can be unloaded easily by gravity.

Gondola cars are open-top cars with fixed sides, used for transporting bulk materials such as scrap metal, gravel, or sand.

Refrigerated cars (reefers) are insulated and temperature-controlled cars designed to transport perishable goods like fruits, vegetables, or dairy products, ensuring they remain fresh during transit.

Each type of rail car is engineered to meet specific transportation needs, contributing to the efficiency and versatility of rail systems worldwide. [11]

1. What is the primary purpose of railway transportation?

- A) To transport only passengers
- B) To efficiently carry both passengers and freight
- C) To provide luxury travel for tourists
- D) To replace road transportation

2. Which type of passenger car is best suited for long overnight journeys?

- A) Seating coach
- B) Observation car
- C) Sleeping car
- D) Dining car

3. What is a key feature of observation cars?

- A) They provide meals and beverages
- B) They offer sleeping accommodations
- C) They have large windows for scenic views
- D) They transport heavy machinery

4. Which type of freight car is used for transporting liquids?

- A) Hopper car
- B) Gondola car
- C) Tank car
- D) Flatcar

5. What distinguishes a boxcar from other freight cars?

- A) It has an open deck for large items
- B) It is enclosed to protect cargo from weather
- C) It is designed for transporting liquids
- D) It has large windows for scenic views

6. Which type of freight car is best for transporting bulk materials like coal or grain?

- A) Hopper car
- B) Observation car
- C) Dining car
- D) Tank car

7. What is the main function of refrigerated cars (reefers)?

- A) To transport machinery and vehicles

- B) To ensure perishable goods stay fresh during transit
- C) To provide comfortable seating for passengers
- D) To store extra cargo for long-distance trips

6. Post-reading discussion.

1. What does the term “rolling stock” include, and what does it exclude?
2. Why is rolling stock considered important for the economy?
3. What are the main types of passenger cars, and what are their functions?
4. How do seating coaches differ from sleeping cars?
5. What is the purpose of an observation car, and where is it used?
6. What are freight cars designed for, and what are some common types?
7. How do hopper cars help in unloading bulk materials more efficiently?
8. What type of freight car is used to transport perishable goods?
9. What distinguishes a boxcar from a flatcar in terms of design and usage?
10. How does the variety of rolling stock contribute to the efficiency of railway transportation?

7. Translate these sentences into Ukrainian.

1. Passenger cars are designed to transport people comfortably and safely, with different types such as seating coaches, sleeping cars, dining cars, and observation cars.
2. Boxcars are enclosed freight cars used for transporting general cargo that needs protection from weather conditions, such as packaged goods and machinery.
3. Tank cars have a cylindrical shape and are specifically designed to carry liquids like chemicals, petroleum, and food-grade substances.
4. Hopper cars feature sloped floors and discharge doors, making them ideal for transporting bulk materials such as coal, grain, or ore.
5. Flatcars are open-deck railcars without sides or a roof, used for carrying oversized loads like construction materials, vehicles, and heavy machinery.

8. Read the text and choose the correct answer (A, B, C or D).

What Is a Centerbeam Rail Car Used for?

A *centerbeam railcar* is specifically designed for 1) _____ bundled materials such as lumber, plywood, wallboard, fence posts, and other construction supplies. Structurally, it is a type of flatcar featuring a central I-beam running along its length, which helps 2) _____ the cargo and keeps it securely in place on both sides. This type of railcar can transport up to 200,000 pounds of 3) _____, making it an ideal choice for shipping large volumes over long distances.

To ensure 4) _____ and prevent tilting, a centerbeam railcar must be loaded and unloaded evenly on both sides. This process, often performed with

forklifts, maintains weight distribution and minimizes the risk of the car tipping over. A key advantage of this design is that 5) _____ loading and unloading improves efficiency, reducing 6) _____ time and enabling quicker reuse of the railcar.

Centerbeam railcars offer a cost-effective and efficient way to transport heavy freight. They are far more economical than trucks. In fact, a single train can replace up to 300 trucks, significantly easing traffic 7) _____ and reducing environmental impact and improving overall logistics efficiency. [11]

1	A during	B forcing	C designing	D transporting
2	A introduce	B stabilize	C optimize	D direct
3	A components	B materials	C freight	D wear parts
4	A balance	B surface	C condition	D load
5	A powerful	B perishable	C simultaneous	D common
6	A shipping	B delivery	C processing	D producing
7	A facilities	B signalling	C roundabout	D congestion

9. Translate these sentences into English.

1. Кожен тип вагона розроблений для певного виду вантажу, забезпечуючи оптимальні умови для його перевезення.

2. Проста конструкція гондол дозволяє легко завантажувати та розвантажувати їх – зазвичай за допомогою кранів.

3. Перші вагони-гондoli в Північній Америці були розроблені у 1830-х роках і використовувалися переважно для перевезення вугілля.

4. Криті вагони можуть перевозити широкий спектр вантажів у ящиках або на піддонах, зокрема папір, лісоматеріали, упаковані товари, напої та коробки.

5. Закриті хопери мають відкритий верх для завантаження продукції та похилу підлогу, що дозволяє розвантажувати вантаж через нижні люки за допомогою сили тяжіння.

10. Read the dialogue between two friends, then do the following tasks:

- highlight the terms in the text;
- give the synonyms to the words in bold;
- find in the text passive sentences. What is their role?

Discussing the Railway Cars

Alex: Hi, Emma! I've been reading about railway transportation, and I'm **amazed** by how important rolling stock is for the economy.

Emma: That's true! Rolling stock **includes** all railway vehicles, like passenger cars, freight cars, locomotives, and specialized rail vehicles.

Alex: I see! But what's the difference between passenger cars and freight cars?

Emma: Passenger cars are designed **to transport** people comfortably, while freight cars are used to carry goods and materials.

Alex: Interesting! What are the main types of passenger cars?

Emma: Well, there are seating coaches, which are the most common, **sleeping cars** for long-distance trips, dining cars that serve meals, and observation cars for scenic views.

Alex: I'd love **to travel** in an observation car! What about freight cars? What types are there?

Emma: There are several! Boxcars carry general cargo, flatcars transport oversized loads, tank cars are used for liquids, and hopper cars have sloped floors for easy unloading of bulk materials.

Alex: Oh, I've seen hopper cars before! What about gondola cars?

Emma: Gondola cars are open-top **wagons** with fixed sides, perfect for transporting materials like gravel, scrap metal, or sand.

Alex: That makes sense! And refrigerated cars – are they just for food transportation?

Emma: Mostly, yes! Refrigerated cars, or reefers, are insulated and temperature-controlled to transport perishable goods like fruits, vegetables, and dairy products.

Alex: Wow! It's impressive how railways use different cars for different needs. No wonder trains are so efficient!

Emma: Exactly! Rolling stock plays a key role in global trade and helps keep transportation sustainable and cost-effective.

11. Role-play.

1) In pairs, practice the dialogue from the previous exercise. Then perform it in front of the class or in breakout groups.

2) Make up your own dialogue with your partner about types of railway wagons, their functions, and their role for economy.

Use questions to guide your partner:

How do passenger cars differ from freight cars in terms of function and design?

What are the main types of passenger railway cars, and what purposes do they serve?

How do different types of freight cars contribute to efficient cargo transportation?

How do specialized railway cars, such as tank cars and hopper cars, enhance transportation efficiency?

What type of freight car is used to transport perishable goods?

12. Fill in the table about importance of rolling stock for the economy.

Efficient transportation of goods	Passenger mobility and connectivity	Environmental and cost benefits	Support for global trade and supply chains

13. Analyse the types of railway wagons in the picture below. Which of them are not mentioned in the text of this unit? Describe the peculiarities of every type of rail cars using information from the Internet. What are their functions?



<https://marline.ua/en/railway-platforms/>

Unit 8

Elements of Railway Car Construction

Share your ideas:

What construction elements of a railway car do you know?

What is the most important component of a railway car?

Key Vocabulary:

car body /'kɑ: ˌbɒdi/ кузов вагона

underframe /'ʌndəfreɪm/, **chassis** /'ʃæsi/ *n* рама вагона

support /sə'pɔ:t/ *v* підтримувати

bogie /'bəʊgi/ *n* візок (підвізок) вагона

wheelset /'wi:l set/ *n* колісна пара

axle /'æksl/ *n* вісь

suspension system /sə'spenʃn 'sɪstəm/ система підвіски

allow /ə'laʊ/ *v* дозволяти

curve /kɜ:v/ *n* крива, поворот

damage /'dæmɪdʒ/ *n* пошкодження

coupler /'kʌplə/ *n* зчеплення; автозчеп

buffer /'bʌfə/ *n* буфер

force /fɔ:s/ *n* сила

braking system /'breɪkɪŋ 'sɪstəm/ гальмівна система

air brakes /eə 'breɪks/ пневматичні гальма

electromagnetic /ɪˌlektɹəmæɡ'netɪk/ *adj* електромагнітний

hydraulic brakes /haɪ'drɔ:lɪk breɪks/ гідравлічні гальма

1. Match each word and word combination (1-8) to its correct definition by writing the letter (A-G) next to the word.

- | | |
|----------------------------|---|
| 1 coupler | A the main structure of a railway car that houses passengers or cargo |
| 2 car body | B a component that connects railway cars together to allow them to move as a single unit |
| 3 suspension system | C a mechanical system that absorbs shocks and ensures smooth movement of the train |
| 4 underframe | D a rigid bar that connects two wheels and allows them to rotate together |
| 5 support | E the lower structural part of a railway car that provides strength and stability |
| 6 bogie | F a framework that holds the wheels and axles, allowing the car to move along the track |
| 7 wheelset | G a set of two wheels connected by an axle |
| 8 axle | H a structure or mechanism that helps distribute weight and maintain balance |

2. Give the English equivalents to these words and word combinations using the key vocabulary.

колісна пара гальмівна система гідравлічні гальма рама вагона система підвіски пневматичні гальма	забезпечувати міцність головна конструкція зроблений зі сталі розподіляти вагу контролювати гальмівну силу механічний пристрій
--	---

Check your vocabulary! Say it in Ukrainian



Check your vocabulary! Say it in English



3. Make up collocations using the words from the box.

comfort	the foundation	damage	to move	a railway car
	passengers		together	

protects _____
main structure of _____
serves as _____
reducing _____
ensuring passenger _____
allowing cars _____
link cars _____

4. Complete these sentences using the appropriate vocabulary word.

to absorb axles attached smooth maintenance to support

1. The underframe of a freight car must be strong enough ... heavy cargo loads over long distances.
2. A damaged bogie can cause instability, making regular ... essential for safe railway operations.
3. Engineers inspected the wheelset to ensure that the wheels and ... were properly aligned.
4. The axle connects the wheels and allows them to rotate together, ensuring ... movement along the track.
5. The coupler mechanism allows train cars to be easily ... and detached when forming a new train composition.
6. Modern trains use hydraulic buffers ... shocks and prevent sudden jolts during braking.

5. Read the text and answer the comprehension questions below.

Main Elements of Railway Car Construction

Railway cars are designed to transport passengers and cargo efficiently while ensuring safety and durability. Their construction consists of several key elements that contribute to their strength, stability, and functionality.

The *car body* is the main structure of a railway car. It is usually made of steel or aluminium to provide strength while keeping the weight as low as possible. The body protects passengers and cargo from external conditions, such as weather and impacts.

The *underframe*, or *chassis*, serves as the foundation of the railway car. It supports the entire structure and distributes weight evenly. It must be strong enough to withstand heavy loads and resist stress during movement.

Beneath the car body, railway cars have *bogies* – movable wheel assemblies that allow smooth movement along the tracks. Each bogie consists of *wheelsets*, *axles*, and *suspension systems*, which help absorb shocks and ensure a stable ride. Bogies also allow railway cars to navigate curves safely.

To connect multiple railway cars, *couplers* are used. These mechanical devices link cars together, allowing them to move as a single unit. *Buffers*, placed at the ends of cars, help absorb impact forces when trains start or stop, reducing damage and ensuring passenger comfort.

A reliable braking system is essential for railway safety. Most modern trains use *air brakes*, where compressed air controls braking power. Some railway cars also have additional *electromagnetic or hydraulic brakes* to improve stopping efficiency.

Freight cars are designed with features that suit specific cargo types. For example, boxcars have enclosed walls to protect goods, hopper cars have sloped floors for easy unloading, and tank cars are designed to transport liquids safely.

The construction of railway cars combines strength, stability, and efficiency to ensure safe and effective transportation. Each component plays a crucial role in the overall performance, making rail transport one of the most reliable and sustainable modes of transportation in the world. [11]

1. What is the primary function of the car body in a railway car?

- A) To connect multiple railway cars together
- B) To provide strength and protection for passengers and cargo
- C) To absorb shocks during movement
- D) To control the braking system

2. What is the role of the underframe (chassis) in a railway car?

- A) To reduce the weight of the train
- B) To serve as the foundation and distribute weight evenly
- C) To improve braking efficiency
- D) To connect railway cars together

3. What components are included in a bogie?

- A) Couplers and buffers
- B) Wheelsets, axles, and suspension systems
- C) Braking system and air compressors
- D) Tank and hopper compartments

4. How do bogies help railway cars navigate curves?

- A) By controlling the braking system
- B) By absorbing impact forces
- C) By allowing wheels to move smoothly along the tracks
- D) By connecting multiple cars together

5. What is the purpose of couplers in railway cars?

- A) To absorb impact forces during braking
- B) To link railway cars together and allow them to move as a unit
- C) To improve the efficiency of air brakes
- D) To help with shock absorption during movement

6. Which braking system is most commonly used in modern trains?

- A) Hydraulic brakes
- B) Mechanical brakes
- C) Air brakes
- D) Magnetic brakes

7. Why do freight cars have different designs?

- A) To match the speed of passenger trains
- B) To improve the durability of railway tracks
- C) To transport different types of cargo efficiently
- D) To reduce the overall weight of the train

6. Post-reading discussion.

1. Why is the car body an essential part of a railway car, and what materials are commonly used to build it?
2. How does the underframe (chassis) contribute to the stability and durability of a railway car?
3. What are the main functions of bogies?
4. In what ways do couplers and buffers improve the efficiency and safety of railway transportation?
5. Why is a reliable braking system important for railway safety?
6. How do different types of freight cars (e.g., boxcars, hopper cars, tank cars) meet specific cargo transportation needs?
7. Why is the weight distribution of a railway car important for its performance and safety?
8. How does the design of railway cars contribute to the efficiency and sustainability of rail transport compared to other transportation modes?
9. What technological improvements could further enhance the safety and efficiency of railway cars?
10. In your opinion, what is the most important component of a railway car, and why?

7. Translate these sentences into Ukrainian.

1. The car body, which is typically made of steel or aluminium, serves as the outer shell of a railway car, protecting passengers or cargo from external conditions such as extreme weather, impacts, and vibrations during movement.

2. The underframe, also known as the chassis, plays a crucial role in the overall structure of a railway car by evenly distributing weight and withstanding the mechanical stress exerted during acceleration, braking, and turns.

3. Bogies, which are complex wheel assemblies positioned beneath railway cars, consist of multiple components, including wheelsets, axles, and a suspension system, all of which work together to ensure smooth movement and stability on the tracks.

4. Each wheelset, consisting of two wheels fixed to a common axle, plays a vital role in maintaining balance and ensuring that the railway car remains properly aligned with the tracks throughout the journey.

5. Couplers, which are mechanical devices located at the ends of railway cars, enable individual cars to be securely connected into a train, allowing for safe and coordinated movement across long distances.

8. Translate these sentences into English.

1. Буфери, розташовані спереду та ззаду залізничних вагонів, поглинають ударні навантаження, що виникають під час різкого гальмування або прискорення.

2. Гальмівна система, яка є однією з найважливіших систем безпеки залізничного транспорту, зазвичай використовує повітряні, електромагнітні або гідравлічні гальма для контролю швидкості поїзда та забезпечення плавної зупинки.

3. Вантажні вагони спеціально сконструйовані для перевезення різних типів вантажів: криті вагони забезпечують захист від зовнішніх умов, цистерни безпечно транспортують рідини, а хопери дозволяють легко розвантажувати сипучі матеріали, такі як зерно або вугілля.

4. Конструкція залізничних вагонів орієнтована не лише на міцність і довговічність, а й на підвищення ефективності, адже використання легких матеріалів та аеродинамічного дизайну допомагає зменшити споживання енергії та покращити загальні показники роботи.

5. Поєднання міцних матеріалів, передових інженерних рішень та інноваційних систем безпеки забезпечує залізничним вагонам статус одного з найбільш надійних і стійких видів транспорту у світі.

9. Read the text below. Match choices (A-G) to (1-5). There are two choices you do not need to use.

Suspension System

The suspension system in freight wagons is an essential part of the running gear, as it plays a crucial role in ensuring support, stability, and 1) _____. In terms of classification, its components are generally divided into primary and secondary suspension, depending on their position, connection, and function.

To begin with, the primary suspension is directly attached to the wheelsets and consists of springs and dampers that are placed 2) _____. As a

result, this setup guarantees stable movement, reduces track forces, minimizes wear, and enhances performance when navigating curves. Moreover, its primary function is 3) _____, thereby contributing to a smoother ride.

In contrast, the secondary suspension is not connected to the wheelset but is instead 4) _____. Traditionally referred to as bolster springs, these components are designed to absorb vibrations and minimize disturbances transmitted from the track through the wheelsets and bogie frame. Consequently, this helps to improve passenger comfort and cargo stability by reducing shock impact and oscillations.

When it comes to materials, springs remain the most common choice for suspension systems, with coil and flat springs being widely used. However, modern bogie designs are increasingly incorporating alternative solutions such as 5) _____. Particularly in passenger wagons, these advanced suspension technologies are employed to enhance ride comfort and optimize performance.

- A linked to both the car body and the bogie
- B to isolate the bogie from short-wavelength track irregularities
- C rubber elements, compressed airbags, or hybrid systems
- D is directly influenced by the specific axle load of the vehicle
- E smooth movement during rail transportation
- F to control of the entire train
- G between the bogie and the wheelset

10. Read the dialogue between two friends, then do the following tasks:

- highlight the phrases for agreement and disagreement in the text;
- find the terms in the text and explain their meanings.

Discussing the Construction of Railway Cars

Anna: I believe the most important part of a railway car is its car body because it protects passengers and cargo from external conditions. Would you agree?

Mark: I see your point, but I'd say the underframe is just as important. Without a strong chassis, the whole structure wouldn't be able to handle the weight properly.

Anna: That's a fair argument. However, the car body's material also affects the train's overall weight and durability.

James: I completely agree with you, Anna! If the body is too heavy, it could impact fuel efficiency and speed. That's why aluminium is often preferred over steel.

Emma: I'm not sure about that. While aluminium is lighter, steel is more durable and can withstand stronger impacts.

Mark: That's true, but let's not forget the role of bogies. Without them, railway cars wouldn't be able to move smoothly or handle curves properly.

Anna: Yes, I agree with that. The suspension system in bogies also plays a major role in ensuring a comfortable and stable ride.

James: Absolutely! And speaking of smooth movement, couplers are also essential. They allow railway cars to be connected securely, forming a single unit.

Emma: That makes sense. But don't you think buffers are just as important? They absorb impact forces, which improves safety when trains stop or start.

Mark: I completely agree! In fact, without buffers, there would be a higher risk of damage or discomfort for passengers.

Anna: And of course, we can't forget the braking system. Air brakes are the standard, but some trains use electromagnetic or hydraulic brakes for better efficiency.

James: Exactly! A well-functioning braking system is crucial for safety, which is why modern trains rely on advanced braking technologies.

11. Role-play.

1) In pairs, practice the dialogue from the previous exercise. Then perform it in front of the class or in breakout groups.

2) Below you have 5 false statements. With your partner, discuss them using the phrases of agreement and disagreement given in the table.

1. The car body of a railway car is usually made of wood to ensure flexibility and reduce costs.

2. The underframe of a railway car is not important for its stability and does not affect weight distribution.

3. Bogies are fixed structures that do not move, making railway cars rigid and difficult to navigate curves.

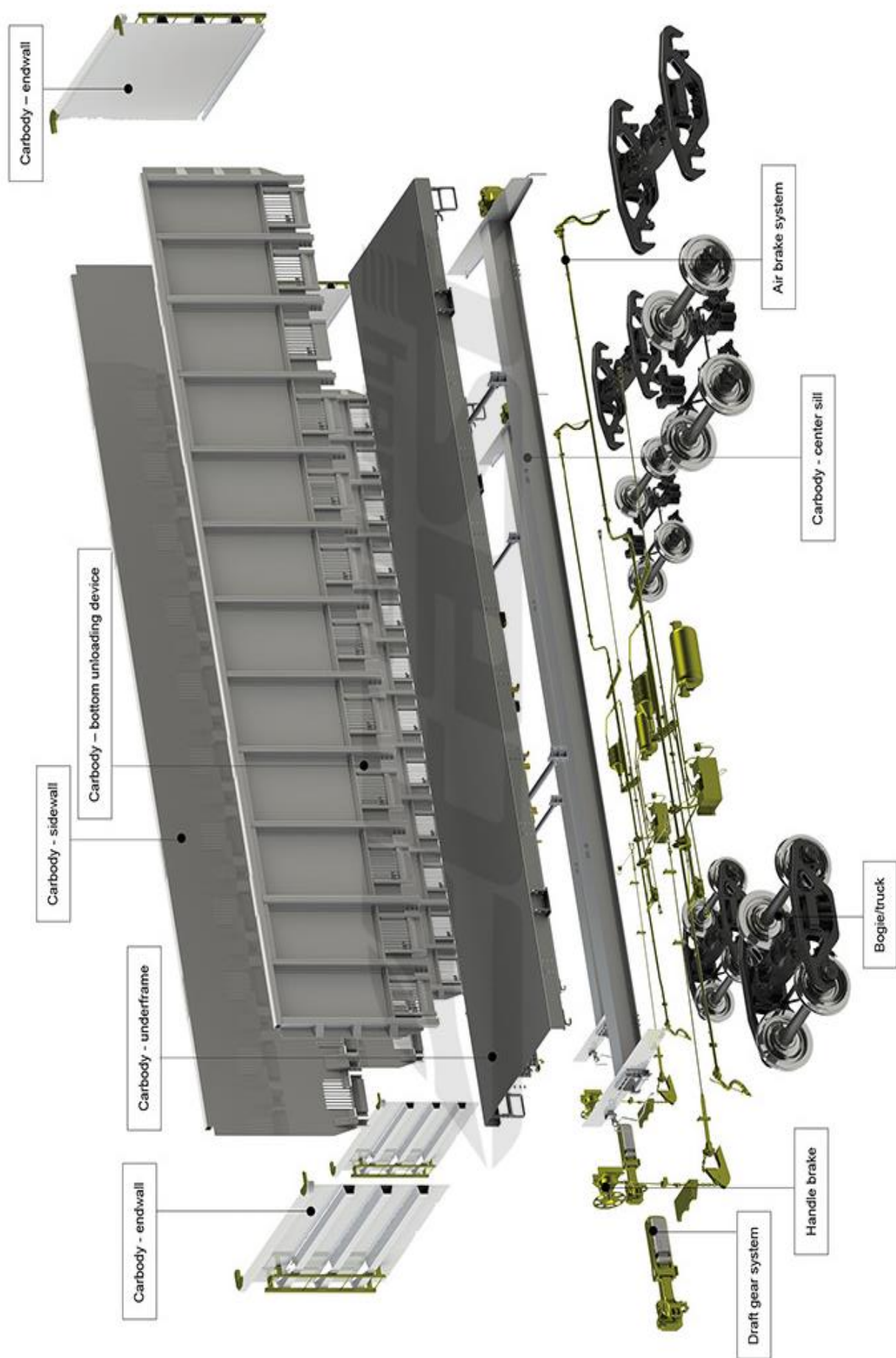
4. Couplers are not necessary for connecting railway cars, as they can move independently without them.

5. Buffers are used only for decoration and have no role in absorbing impact forces.

Agreeing with someone's opinion:	Disagreeing or expressing a different opinion:
<i>I completely agree with you!</i> <i>That's a fair argument.</i> <i>You're right about that.</i> <i>Absolutely!! Exactly!</i> <i>That makes sense.</i> <i>I couldn't agree more.</i>	<i>I see your point, but...</i> <i>However...</i> <i>I'm not sure about that.</i> <i>That's true, but...</i> <i>But don't you think...?</i> <i>That's one way to look at it, but...</i>

12. Describe the car body (see the picture on the next page) using information from the read texts.

Source of the picture: <http://www.eastrailway.com/plus/view.php?aid=213>



Unit 9

Wagon Bogies

Share your ideas:

What is the main function of a railway wagon bogie?

Why are wheelsets and axles considered essential parts of the bogie?

Key Vocabulary:

bogie /'bəʊgi/ *n* візок (підвізок) вагона (*Am En* truck)

bogie frame /'bəʊgi freɪm/ рама візка

side frame /saɪd freɪm/ бокова рама

overall performance /'əʊvəɹə:l pə'fɔ:məns/ загальна продуктивність

axle /'æksl/ *n* вісь

axlebox /'æksl bɒks/ *n* букса (корпус підшипника осі)

bear /beə/ *v* витримувати; нести

house /haʊz/ *v* вміщувати, розміщувати

bearing /'beərɪŋ/ *n* підшипник

rotate /rəʊ'teɪt/ *v* обертатися

load-carrying capacity /ləʊd 'kæərɪŋ kə'pæsəti/ вантажопідйомність

primary suspension /'praɪməri sə'spenʃn/ первинна підвіска

secondary suspension /'sekəndəri sə'spenʃn/ вторинна підвіска

coil spring /kɔɪl sprɪŋ/ гвинтова ресора

leaf spring /li:f sprɪŋ/ листовая ресора

damper /'dæmpə/ *n* амортизатор

uneven /ʌn'i:vən/ *adj* нерівний

bolster /'bəʊlstə/ *n* поперечна балка

beam /bi:m/ *n* балка

lubrication /,lu:bri'keɪʃn/ *n* змащення

grease equipment /gri:s ɪ'kwɪpmənt/ обладнання для змащення

rubber pad /'rʌbə pæd/ гумова подушка

cushion /'kʊʃn/ *n* амортизаційна прокладка, подушка

disc brake /disk breɪk/ дискове гальмо

air brake cylinder /eə breɪk 'sɪlɪndə/ пневматичний гальмівний циліндр

pivot pin /'pɪvət pɪn/, **centre pin** /'sentə pɪn/ шворінь візка

1. Give the English equivalents to these words and word combinations using the key vocabulary.

букса	висока вантажопідйомність
система змащення	поперечна балка
пневматичний гальмівний циліндр	шворінь візка
бічна рама	листова ресора
первинна підвіска	амортизаційна прокладка
вторинна підвіска	розміщувати підшипники

2. Match each word and word combination (1-8) to its correct definition by writing the letter (A-G) next to the word.

- | | |
|--------------------------|--|
| 1 primary suspension | A a device that absorbs shock and controls unwanted spring motion, improving ride quality |
| 2 coil spring | B the maximum weight or load that a component or system can safely support |
| 3 damper | C the system of springs and dampers located between the wheelset and the bogie frame |
| 4 secondary suspension | D a steel spring wound in a helical shape, commonly used to absorb and store energy |
| 5 bolster | E the system located between the bogie and the car body, reducing vibrations and improving comfort |
| 6 grease fitting | F a component in the air brake system that uses compressed air to apply braking force |
| 7 air brake cylinder | G a central cross beam in the bogie that helps support the car body and distribute loads |
| 8 load-carrying capacity | H a small metal fitting that allows grease to be added to lubricate moving parts |

3. Make up collocations using the words from the box.

the wagon	conditions	fitted	the vehicle	stopping power
		performance	the tracks	

movement along _____
 bogies are _____
 overall _____
 bear the load of _____
 supporting the weight of _____
 withstand operating _____
 braking components ensure _____

4. Complete these sentences using the appropriate vocabulary word.

buffer lubricant cylinder vibrations braking friction

1. Lubrication is essential to reduce ... between moving parts of the bogie.
2. The grease fitting allows maintenance workers to apply ... directly to the axlebox.
3. A rubber pad is used between the suspension elements to absorb ... during motion.
4. The cushion in the ... system helps to absorb shock during train coupling.

5. The disc brake provides efficient ... by applying force directly to the wheels.
6. The air brake ... activates the brake shoes when compressed air is applied.

Check your vocabulary! Say it in Ukrainian



Check your vocabulary! Say it in English



5. Read the text and answer the comprehension questions below.

Railway Wagon Bogies

A railway wagon *bogie* (or *railcar truck*, or *trucks* in American English) is a complex structure that supports the wagon and ensures smooth, stable movement along the tracks. A bogie may remain normally attached or be quickly detachable (as in railway bogie exchange). Usually, two bogies are fitted to each carriage, wagon or locomotive, one at each end. It combines several interconnected components, each playing a specific role in the bogie's function and overall performance.

At the base of the bogie are the *wheelsets*, which include two wheels fixed to a single element. These wheelsets are the direct contact point with the rails and bear the load of the wagon. The *axles* are housed within the *side frames* of the bogie, which provide structural support and keep everything aligned. The *axlebox* (also known as a *journal box* or *bearing housing* in *Am En*) is the part that houses the *bearing*, connecting the axle to the side frame of the bogie and allowing the wheelset to rotate freely while supporting the weight of the vehicle. The axlebox includes *lubrication systems* or *grease equipment* to maintain bearing performance. Bearings in the railway sector are required to have exceptional load-carrying capacity, superior safety performance, and high reliability to withstand demanding operating conditions.

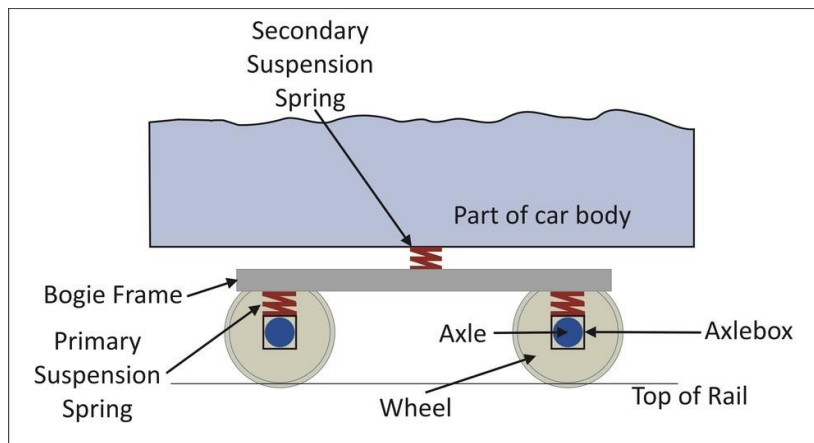
To connect the wheelsets to the bogie frame, a *primary suspension system* is used. This usually consists of *coil springs* or *leaf springs*, often combined with shock absorbers (*dampers*). This system reduces the impact of uneven tracks and prevents excessive vibrations from reaching the wagon.

Above the side frames, a central beam called *the bolster* spans across the bogie and connects to the wagon's underframe through the *secondary suspension*. This secondary suspension can include additional springs, rubber pads, or air cushions, which help further reduce movement and increase ride comfort – especially at higher speeds.

Pivot pin (also *bogie pin* or *centre pin/pivot*) is located at the centre of the bogie, connecting it to the railway wagon body through a central point called the *pivot point* or *centre plate*. When a train goes around a curve, the pivot pin allows the bogie to turn slightly so the wheels can follow the curve smoothly without derailling.

The braking components, such as *air brake cylinders* or *disc brakes*, are usually mounted on or near the bogie frame. They work in coordination with the wheelsets to ensure reliable stopping power.

All of these elements – wheelsets, axles, suspensions, frames, and brakes – are combined in a carefully engineered design to ensure that the bogie provides strength, flexibility, and safety. By working together, these components allow the wagon to navigate curves, carry heavy loads, and maintain stability on various types of tracks. [11]



Passenger car suspension system showing the general arrangement and location of the primary suspension springs on the axleboxes and the secondary suspension upon which the car body rests. <https://en.wikipedia.org/wiki/Bogie>

1. What is the main purpose of a railway wagon bogie?

- A) To improve the design of the car body
- B) To support the wagon and ensure stable movement
- C) To increase the speed of the train
- D) To connect the locomotive to the freight car

2. What is included in the wheelset?

- A) Two wheels attached to separate axles
- B) A wheel and a spring
- C) Two wheels fixed to a single element
- D) A single wheel with a rubber pad

3. Which part allows the wheelset to rotate while bearing the vehicle's weight?

- A) Side frame
- B) Axle
- C) Pivot pin
- D) Axlebox

4. What is the function of the primary suspension system?

- A) To connect the bogie to the car body
- B) To stop the train during emergencies
- C) To reduce impact and vibrations from the track
- D) To house the axle and bearings

5. What role does the bolster play in the bogie construction?

- A) It connects the wheelset to the axlebox
- B) It links the bogie to the car through the pivot point
- C) It supports the side frames from below

D) It spans across the bogie and connects to the underframe via secondary suspension

6. What does the pivot pin allow the bogie to do?

- A) Stop the wagon quickly
- B) Rotate freely inside the axlebox
- C) Turn slightly to follow curves smoothly
- D) Disconnect from the car during bogie exchange

7. Which of the following is NOT part of the secondary suspension?

- A) Rubber pads
- B) Coil springs
- C) Air cushions
- D) Additional springs

6. Post-reading discussion.

1. What is the main function of a railway wagon bogie?
2. How many bogies are typically used for one railway wagon or locomotive?
3. What role do wheelsets play in the bogie's construction and performance?
4. Where are the axles located, and what supports them structurally?
5. What is the purpose of the axlebox, and what does it contain?
6. Why are lubrication systems important in axleboxes?
7. What does the primary suspension system consist of, and what is its function?
8. How does the secondary suspension contribute to ride comfort?
9. What is the pivot pin, and how does it help a train navigate curves?
10. Which braking components are commonly found on or near the bogie, and what is their purpose?

7. Translate these sentences into Ukrainian.

1. A railway wagon bogie is a framework that carries the wheels and is mounted under the wagon.
2. Each bogie typically includes two wheelsets connected by axles.
3. The axlebox houses the bearing and ensures smooth rotation of the wheels.
4. Primary suspension with coil or leaf springs helps absorb shocks from the track.
5. Secondary suspension, often made with rubber pads or air cushions, improves ride comfort.

8. Translate these sentences into English.

1. Поперечна балка — це центральна балка, яка з'єднує візок із рамою вагона.
2. Центральний шворінь у центрі візка дозволяє йому повертатися, коли поїзд проходить повороти.
3. Змащувальне обладнання використовують для змащування підшипників і зменшення тертя.
4. На візках установлюють гідравлічні або пневматичні гальма для безпечного та ефективного гальмування.
5. Усі компоненти візка працюють разом, щоб забезпечити стабільність, гнучкість і безпеку під час залізничної експлуатації.

9. Read the text below. Match choices (A-G) to (1-5). There are two choices you do not need to use.

Functions, Design, and Variations of Railway Bogies

1. _____

Bogies serve a number of purposes:

- supporting the body of the rail vehicle
- running in a stable manner on both straight and curved track
- improving ride quality by absorbing vibration and minimizing the impact of centrifugal forces when the train runs on curves at high speed
- minimizing generation of track irregularities and rail abrasion.

2. _____

Instability can occur when a combination of bogie design, springing, vehicle and bogie wheelbase, and track dynamics, cause the bogie to oscillate at high speed – a phenomenon known as "hunting". If unchecked, derailment can occur. Cars experiencing hunting are removed immediately once the defect is discovered. A tendency for more than one vehicle to hunt will result in investigations with a view to re-designing.

3. _____

Usually, two bogies are fitted to each carriage, wagon or locomotive, one at each end. Another configuration is often used in articulated vehicles, which places the bogies (often Jacobs bogies) under the connection between the carriages or wagons.

4. _____

Most bogies have two axles, but some cars designed for superior riding qualities or heavy loads have more axles per bogie. Heavy-duty cars may have more than two bogies using span bolsters to equalize the load and connect the bogies to the cars.

5. _____

Usually, the train floor is at a level above the bogies, but the floor of the area between the bogies may be lowered to increase interior space while staying within height restrictions. Examples are container well cars, bi-level passenger cars or stepless-entry, low-floor cars on railways with near-ground-level platforms.

<https://en.wikipedia.org/wiki/Bogie>

A Potential Benefits of Carbon Fibre

B Common Bogie Configurations

C Floor Design and Space Optimization

D Bogie Instability and Hunting Phenomenon

E Improving the Ability to Navigate Curves

F Functions and Purposes of Bogies

G Number of Axles and Load Considerations

10. Read the dialogue between two friends, then do the following tasks:

- **highlight the verbs in the text, think about their functions;**
- **find the terms in the dialogue and explain their meanings.**

Anna: Have you read about how important wagon bogies are in railway systems?

Mark: Yes, I have! I didn't realize how many components are involved in just one bogie.

Anna: Exactly! The wheelsets and axles are the base, and they carry the entire load of the wagon.

Mark: I agree. And I was surprised to learn how the axlebox supports the wheelset while allowing rotation.

Anna: That's right. Plus, the primary suspension system with springs really helps reduce shocks from the track.

Mark: True, but I think the secondary suspension plays an even more important role in ride comfort, especially at high speeds.

Anna: I see your point, but without the primary suspension, the bogie couldn't absorb the initial impact from the rails.

Mark: Fair enough. And don't forget the bolster – it connects the bogie to the wagon body through the secondary suspension.

Anna: Yes! And the pivot pin is crucial too – it lets the bogie turn when the train goes around curves.

Mark: Absolutely. Without it, trains wouldn't be able to navigate curves safely.

Anna: And the braking system – disc brakes or air brake cylinders – really ensures safety during operation.

Mark: Totally agree. All these elements work together to keep the train stable, flexible, and safe on the tracks.

11. Role-play.

1) In pairs, practice the dialogue from the previous exercise. Then perform it in front of the class or in breakout groups.

2) After the role-play, each student in your pair should summarize the key points of the topic *Wagon Bogies* in his/her own words. Use the following questions to guide your partner.

How does the axlebox help ensure smooth movement of the wagon?

In what ways do primary and secondary suspension systems differ in function?

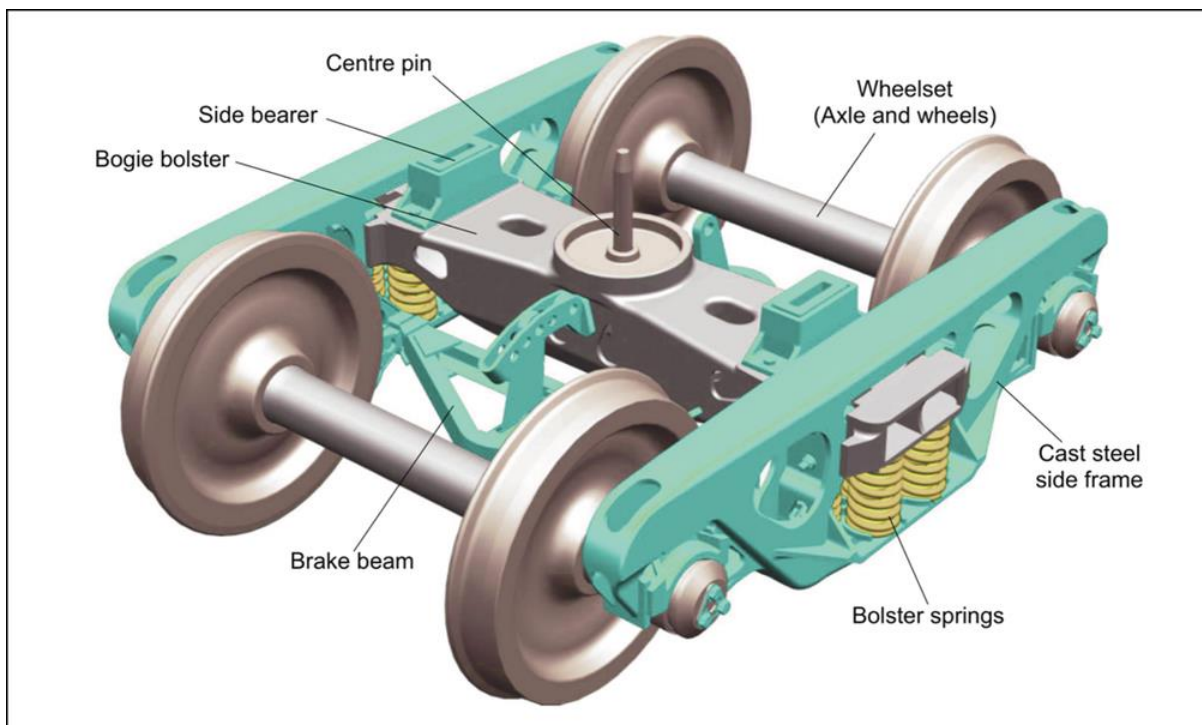
What role does the bolster play in the construction of a bogie?

How does the pivot pin help the train navigate curves safely?

Why is a reliable braking system important in the bogie structure?

How do all the components of the bogie work together to improve safety and comfort?

12. Describe the wagon bogie (see the picture) using information from the read texts.



<http://www.railway-technical.com/trains/rolling-stock-index-1/bogies.html>

Picture: A standard American bogie used on freight cars in which the bolster sits on a pair of twin coil springs to provide some level of damping for the vehicle resting on the two side bearers. The bogie rotates around the centre pin to allow the bogie to negotiate curves.

Unit 10

Braking System on Wagon

Share your ideas:

What types of braking systems on transport do you know?

Why is braking system so important?

Key Vocabulary:

braking system /'breɪkɪŋ ,sɪstəm/ гальмівна система

incorporate /ɪn'kɔ:pəreɪt/ *v* включати, поєднувати

represent /,repri'zent/ *v* представляти

advanced /əd'vɑ:nst/ *adj* передовий, сучасний

apply /ə'plai/ *v* застосовувати

pressure brake shoe /'presə breɪk ʃu:/ гальмівна колодка під тиском

brake cylinder /breɪk 'sɪlɪndə/ гальмівний циліндр

release /rɪ'li:s/ *v* звільняти, відпускати

disc brakes /dɪsk breɪks/ дискові гальма

mount /'maʊnt/ *v* встановлювати, монтувати

electro-pneumatic /ɪ,lektroʊ nju:'mætɪk / *adj* електропневматичний

precise /pri'saɪs/ *adj* точний

electromagnetic /ɪ,lektroʊmæg'netɪk / *adj* електромагнітний

electricity /ɪ,lek'trɪsəti/ *n* електроенергія

conventional /kən'venʃənl/ *adj* звичайний, традиційний

coil /kɔɪl/ *n* котушка

magnetic flux /mæg'netɪk flʌks/ магнітний потік

armature /'ɑ:mətʃʊə/ *n* якор (в електромагніті); арматура

squeeze /skwi:z/ *v* стискати

friction disk /'frɪkʃən dɪsk/ фрикційний диск

shaft /ʃɑ:ft/ *n* вал

inner /'ɪnə/ *adj* внутрішній

outer /'aʊtə/ *adj* зовнішній

brake monitoring system /breɪk 'mɒnɪtərɪŋ ,sɪstəm/ система контролю гальм

detect /dɪ'tekt/ *v* виявляти

fault /fɔ:lt/ *n* несправність

leak /li:k/ *n* витік

1. Give the English equivalents to these words and word combinations using the key vocabulary.

гальмівний циліндр	механізм контролю
електромагнітні рейкові гальма	традиційна надійність
фрикційний диск	технології автоматизації
система контролю гальм	стиснене повітря
продуктивність	котушка електромагніту
контролювати повітряні гальма	встановлювати на валу

2. Match each word and word combination (1-8) to its correct definition by writing the letter (A-G) next to the word.

- | | |
|-----------------|--|
| 1 electricity | A a traditional or commonly used method or device |
| 2 conventional | B the flow of electric power or charge, used to power systems and devices |
| 3 coil | C a twisted or wound wire that generates a magnetic field when electricity passes through it |
| 4 magnetic flux | D a rotating rod or bar that transmits motion or power |
| 5 armature | E to press something firmly, especially from opposite sides |
| 6 squeeze | F the total magnetic field passing through a surface |
| 7 shaft | G the moving part of an electric machine where current is induced |
| 8 detect | H to discover or identify the presence of something (like a problem or signal) |

3. Make up collocations using the words from the box.

an electromagnet	leaks	released	brake cylinders	the brake
		the wheels	flux	

activates _____
 to apply pressure to _____
 air pressure is _____
 brakes are mounted near _____
 the coil of _____
 magnetic _____
 to detect faults and _____

4. Complete these sentences using the appropriate vocabulary word.

emergency detect efficiency reduce precise

1. Modern braking systems on goods wagons use advanced technologies like electro-pneumatic control to ensure faster and more ... braking.
2. Disc brakes are increasingly used on freight wagons because they offer consistent braking performance and ... wear on wheels.
3. Electromagnetic rail brakes are applied directly to the rail using magnetic force, which improves braking power, especially in ... situations.
4. Modern brake monitoring systems can ... faults, air leaks, or performance issues in real time and alert maintenance teams immediately.

5. The integration of electronic components in braking systems enhances safety, reduces stopping distances, and increases overall ... in freight transport.

Check your vocabulary! Say it in Ukrainian



Check your vocabulary! Say it in English



5. Read the text and answer the comprehension questions below.

Modern Braking Systems on Goods Wagons

Modern goods wagons utilize sophisticated braking systems that combine traditional reliability with advanced technology to ensure safe and efficient cargo transportation. These systems represent a significant evolution from earlier

designs, incorporating multiple layers of safety and control mechanisms. They have developed significantly from traditional manual brakes to more advanced and automatic technologies.

The most commonly used braking system on goods wagons today is the *pneumatic air brake*. This system works by using compressed air to apply pressure to brake cylinders, which then push brake shoes against the wheels. When the train driver activates the brake, air pressure is released, and the brakes are applied along the entire train. This system allows for simultaneous braking of all wagons, improving safety and reducing stopping distances.

In addition to air brakes, many modern wagons are equipped with *disc brakes*, which offer better performance at high speeds and in difficult weather conditions. These brakes are mounted near the wheels and provide smoother and quieter braking, which also reduces wear on the wheels and rails.

Some wagons also use *electro-pneumatic braking systems*, where electrical signals are used to control the air brakes. This technology allows for faster response times and more precise control, which is especially important on long and heavy freight trains.

Electromagnetic rail brakes are a type of braking system used on some railway vehicles to provide strong and quick braking power in addition to conventional air or disc brakes. When electricity is applied to the coil of an electromagnet, the magnetic flux attracts the armature to the face of the brake. As it does so, it squeezes the inner and outer friction disks together. The hub is normally mounted on the shaft that is rotating. The brake housing is mounted solidly to the machine frame.

Modern goods wagons are also designed with *brake monitoring systems* that help detect faults, leaks, or brake wear. These systems improve maintenance and reduce the risk of accidents caused by brake failure.

In summary, today's braking systems in goods wagons combine traditional air braking with modern technologies such as disc brakes, electronic control, and monitoring devices. These improvements play a vital role in making rail transport safer, more efficient, and more reliable. [6; 7]

1. What is the main purpose of modern braking systems on goods wagons?

- A) To reduce the number of wagons needed
- B) To make trains faster
- C) To ensure safe and efficient cargo transportation
- D) To reduce the size of the train

2. How does the pneumatic air brake system work?

- A) By using oil pressure to stop the train
- B) By applying compressed air to brake cylinders that push brake shoes against the wheels

- C) By releasing steam to slow down the engine
- D) By using electricity to stop the wheels

3. What is one main advantage of disc brakes over traditional brakes?

- A) They are cheaper to produce
- B) They require more manual effort
- C) They are only used on passenger trains
- D) They work better at high speeds and in bad weather

4. Why are electro-pneumatic braking systems considered an improvement?

- A) They are completely automatic and need no human control
- B) They respond faster and allow for more precise braking control
- C) They use less air than other systems
- D) They work only with electric locomotives

5. What is the function of electromagnetic rail brakes?

- A) To reduce fuel consumption
- B) To keep the wagon on the rails during curves
- C) To provide additional strong and quick braking
- D) To connect the wagons together

6. What happens when electricity is applied to the coil in electromagnetic brakes?

- A) The magnetic flux attracts the armature, squeezing friction disks
- B) The train slows using steam
- C) The wheels stop turning immediately
- D) The coil disconnects from the brake system

7. What is the purpose of brake monitoring systems in modern wagons?

- A) To help the driver control speed
- B) To detect issues like faults or leaks and improve maintenance
- C) To increase train speed
- D) To balance the wagon loads

6. Post-reading discussion.

1. What is the main reason for using advanced braking systems in modern goods wagons?
2. How does the pneumatic air brake system function?
3. What benefits do disc brakes offer compared to traditional braking systems?
4. Why are electro-pneumatic brakes considered more effective on long and heavy freight trains?

5. Describe the working principle of electromagnetic rail brakes.
6. What components are involved in the electromagnetic rail braking process?
7. How do brake monitoring systems contribute to railway safety and maintenance?
8. What are the advantages of combining multiple braking technologies in one system?
9. Why is precise control of braking important for modern freight trains?
10. How do modern braking systems improve the efficiency and reliability of rail transport?

7. Translate these sentences into Ukrainian.

1. The braking system is essential for the safe operation of all railway vehicles.
2. Modern trains usually use pneumatic air brakes controlled by compressed air.
3. When the driver applies the brake, air pressure activates the brake cylinder.
4. Disc brakes provide smoother and more efficient braking at high speeds.
5. Electro-pneumatic brakes use electrical signals for quicker response.

8. Translate these sentences into English.

1. Електромагнітні рейкові гальма створюють сильне тертя за допомогою магнітної сили.
2. Гальмівні колодки притискаються до коліс, щоб сповільнити поїзд.
3. Система моніторингу гальм виявляє несправності або витoki в системі.
4. Правильне обслуговування гальмівної системи зменшує ризик аварій.
5. Поєднання традиційних і сучасних технологій робить гальмування безпечнішим і надійнішим.

9. Read the text and choose the correct answer (A, B, C or D).

What Is the Principle of Electromagnetic Braking?

Electromagnetic braking is based on the principle of electromagnetic induction, which 1) _____ an opposing magnetic field.

When an electric current flows through a conductor, a magnetic field is produced around it. Similarly, when a conductor moves through a magnetic field, an electric current is induced in the conductor. This is the principle of electromagnetic 2) _____, discovered by Michael Faraday in 1831.

In electromagnetic braking, the brake system uses a magnetic field 3) _____ or stop a moving object. When the brakes are applied, an electric

current is passed 4) _____ a coil of wire in the brake assembly, creating a magnetic field. This magnetic field interacts with the metal disc or rotor attached to 5) _____, generating a force that opposes the motion of the wheel. This force slows down the wheel and brings the vehicle to a stop.

Electromagnetic braking is commonly used in trains, where it is known as regenerative braking. In this system, the kinetic energy of the moving train is converted into 6) _____ energy, which is stored in a battery or used to power other systems on the train. This reduces the amount of energy wasted as heat, making the train more efficient and environmentally 7) _____. [6; 7]

1	A incorporate	B generates	C originates	D spans
2	A coil	B current	C flux	D induction
3	A to slow down	B cut up	C break down	D put out
4	A upon	B while	C through	D across
5	A flux	B shaft	C brake cylinder	D the wheel
6	A gravitational	B electrical	C mechanical	D thermal
7	A functional	B fruitful	C friendly	D beneficial

10. Read the dialogue between two friends, then do the following tasks:

- learn the terminology below the dialogue;
- in pairs, practice the dialogue, then perform it in front of the learner group or in breakout groups.

Discussing Braking Systems on Railway Vehicles

Alex: Have you ever thought about how important braking systems are for trains?

Maria: Absolutely! Without reliable brakes, trains wouldn't be safe at all, especially at high speeds.

Alex: I read that most freight wagons still use pneumatic air brakes. They've been around for decades.

Maria: Yes, and they work quite simply. Compressed air is stored in reservoirs, and when the driver applies the brake, the air flows into the brake cylinders.

Alex: And then the brake cylinders push the brake shoes against the wheels, creating the friction needed to slow the train?

Maria: Exactly! What's clever is that when the air pressure is released, the brakes are applied. That way, a loss of pressure means the train automatically stops – a great safety feature.

Alex: I agree. That's a smart fail-safe. But I guess modern wagons also use disc brakes for better efficiency?

Maria: Yes, disc brakes are smoother, quieter, and cause less wear on the wheels and rails.

Alex: I also heard electro-pneumatic brakes are becoming more common, especially on high-speed trains.

Maria: Right! They combine electric signals with air brakes to give faster response and more precise control.

Alex: And then there's the electromagnetic rail brake, which uses magnetic force to quickly stop the train in emergencies.

Maria: Plus, modern trains are equipped with brake monitoring systems that detect faults, leaks, or wear to ensure everything functions properly.

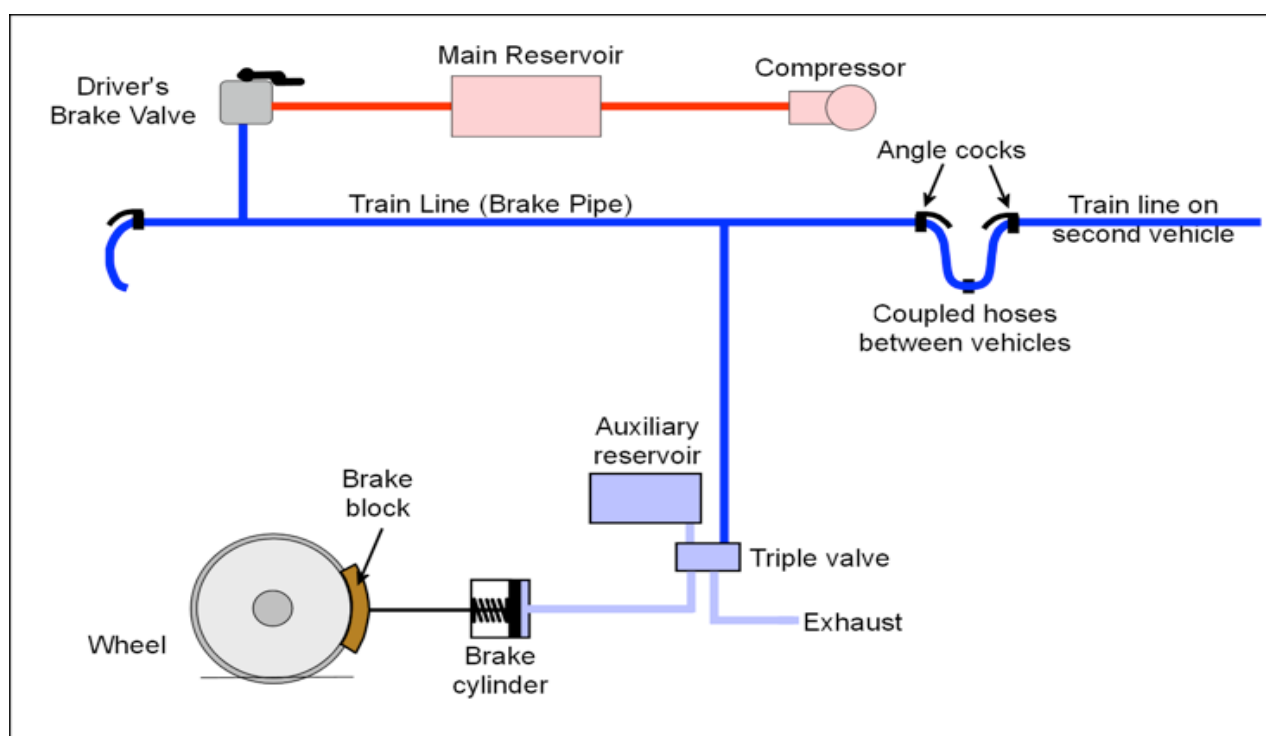
11. Role-play.

Work in pairs. One plays the role of a railway engineer presenting an air brake system for railway, and the other is a journalist asking questions. Using the picture *The Principal Parts of the Air Brake System* and learnt terminology, describe how the pneumatic air brakes function. Begin as the follows:

Journalist: *"What is the pneumatic air brakes on railway vehicle?"*

Railway engineer: *"The pneumatic air brake is the standard, fail-safe, train brake used by railways all over the world. In spite of what you might think, there is no mystery to it. It is based on the simple physical properties of compressed air. The air is drawn into a compressor and stored in a main reservoir"*

The Principal Parts of the Air Brake System



<http://www.railway-technical.com/trains/rolling-stock-index-1/train-equipment/brakes/>

driver's brake valve /'draɪvəz breɪk vælv/ гальмівний клапан машиніста

main reservoir /meɪn 'rezəvwaː/ головний резервуар

auxiliary reservoir /ɔːgˈzɪliəri ˈrezəvwaː/ допоміжний резервуар
compressor /kəmˈpresə/ компресор
train line /treɪn laɪn/ поїздна магістраль
brake pipe /breɪk paɪp/ гальмівна трубка
angle cocks /ˈæŋɡl kɒks/ кутові крани
coupled hose /ˈkʌpld həʊz/ з'єднаний шланг
brake block /breɪk blɒk/ гальмівний башмак
triple valve /ˈtripl vælʊ/ потрійний клапан
exhaust /ɪɡˈzɔːst/ п вихлоп, випуск повітря

Here are phrases that help you organize the information logically.

1. Description of the process step-by-step:

Initially, the compressor supplies compressed air to the main reservoir.

Air from the main reservoir is then sent through...

Under normal conditions, the pressure in the brake pipe keeps the brakes released.

When the driver moves the brake valve to apply the brakes, ...

The triple valve detects the drop in pressure and directs air...

The air pressure in the brake cylinder pushes the brake blocks against ...

2. Explaining release and safety features:

To release the brakes, the driver increases the brake pipe pressure, causing the triple valve to vent air from the brake cylinder to the atmosphere.

Angle cocks and hoses ensure the continuity of...

If a break in the train line occurs, the sudden loss of air pressure causes...

3. Final notes:

This system allows for simultaneous braking of all wagons and provides a high level of reliability.

Modern improvements include automatic leakage detection and...

12. Write a report about classification of brake types on modern railway vehicles using information from table *Brakes in Railway Vehicles*. Before writing, analyse the table and make up a plan. Use clear and structured phrases that help you organize the information logically.

Here are phrases and clichés you can use to introduce, classify, and explain different types of braking systems:

Phrases to Introduce Classification:

Braking systems on modern railway vehicles can be classified into several main types.

There are three/four primary types of braking systems used in rail transport today.

Modern railway braking technology falls into the following categories:

Brakes used in today's trains can be broadly divided into...

The classification of braking systems is based on their operating principle

Phrases to List or Group Items:

The main types include...

These are typically divided into...

Among the most common types are...

Each of these systems serves a specific function: ...

They can be grouped as follows:...

Phrases to Introduce Specific Types:

Firstly, the pneumatic (air) brake is...

Another widely used type is the disc brake, which...

Electro-pneumatic brakes combine...

In addition, modern trains may also be equipped with...

Phrases to Compare or Contrast:

Unlike traditional systems, this type offers...

In comparison with air brakes, disc brakes provide...

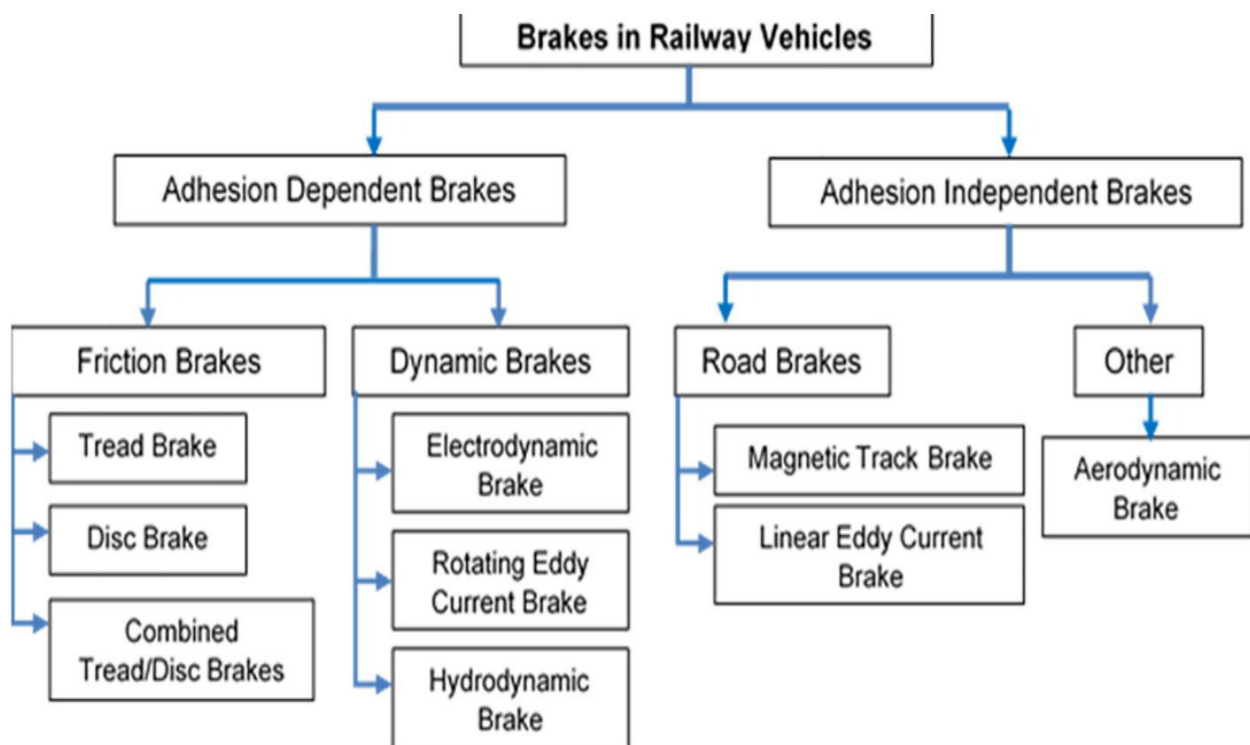
While both systems aim to slow the train, they operate differently.

Compared to conventional methods, this system allows...

Phrases to Conclude or Summarize:

To sum up, modern railway vehicles use a combination of braking technologies.

By integrating traditional and advanced systems, modern rail transport ensures reliable braking.



https://www.researchgate.net/publication/339036207_An_investigation_on_braking_systems_used_in_railway_vehicles

Unit 11

Railway Electrification

Share your ideas:

Why are modern railways electrified?

Which regions of the world are leading in railway electrification?

Key Vocabulary:

power /'paʊə/ *v* жити (електроенергією), приводити в рух

electrify /ɪ'lektrɪfaɪ/ *v* електрифікувати

instead of /ɪn'sted əv/ *prep* замість

overhead wire /,əʊvəhed 'waɪə/ повітряна контактна лінія

pantograph /'pæntəgrɑ:f/ *n* пантограф

draw /drɔ:/ *v* тягнути

slide /slaɪd/ *v* ковзати

alternating current /,ɔ:ltəneɪtɪŋ 'klərənt/ змінний струм

direct current /daɪ'rekt 'klərənt/ постійний струм

high-voltage /,haɪ 'vəʊltɪdʒ/ *adj* високовольтний

suburban train /sə'bʌ:bən treɪn/ приміський потяг

long-distance route /,lɒŋ 'dɪstəns ru:t/ маршрут дальнього сполучення

emission /ɪ'mɪʃən/ *n* викид

maintenance costs /'meɪntənəns kɒsts/ витрати на обслуговування

terrain /tə'reɪn/ *n* місцевість

switch /swɪtʃ/ *v* перемикає

linear motor /'lɪniə 'məʊtə/ лінійний двигун

extensive /ɪk'stensɪv/ *adj* обширний, масштабний

catch up /kætʃ ʌp/ *v* наздоганяти, надолужувати

1. Match each word to its correct definition by writing the letter (A-G) next to the word.

- | | |
|-----------------------|---|
| 1 electrify | A a wire suspended above the tracks to supply electrical power to trains |
| 2 overhead wire | B a device mounted on trains to collect current from overhead lines |
| 3 electricity | C gases or particles released into the air, often by vehicles or machines |
| 4 emission | D a current that changes direction periodically |
| 5 maintenance costs | E to provide a railway or area with electric power. |
| 6 alternating current | F a source of energy used to power electrical devices and systems |
| 7 direct current | G the ongoing expenses for keeping equipment in good working condition |
| 8 pantograph | H a flow of electric charge in one constant direction |

1. Give the English equivalents to these words and word combinations using the key vocabulary.

живити поїзд	електрифікація залізниць
повітряна контактна лінія	зменшувати викиди
змінний струм	маршрут дальнього сполучення
постійний струм	витрати на обслуговування
приміський потяг	обширна мережа
лінійний двигун	відновлювальна енергія

Check your vocabulary! Say it in Ukrainian



Check your vocabulary! Say it in English



Pay attention to the terminology:

повітряна контактна лінія **overhead wire, catenary system**

3. Make up collocations using the words from the box.

costs	benefits	operating costs	overhead wires	transport system
		route	infrastructure	

receive electricity through _____

brings many _____

installation of electrification _____

maintenance _____

modernize _____

reduce _____

long-distance _____

4. Complete these sentences using the appropriate vocabulary word.

mechanical disrupting topographical disrupting implementation

1. The successful ... of railway electrification requires precise coordination between civil engineering, electrical planning, and environmental assessment teams.

2. Before any physical installation begins, detailed surveys and ... analyses are conducted to determine the most efficient layout of the infrastructure.

3. One of the main challenges lies in integrating new electrification systems into existing railway lines without ... ongoing services.

4. Modern electrification projects often involve the use of computer-aided design (CAD) software to simulate voltage ... and ensure system stability.

5. The placement and tensioning of overhead catenary systems must adhere to strict standards to withstand weather conditions and ... stress.

5. Read the text and answer the comprehension questions below.

Railway Electrification: Powering Trains

Railway electrification is the process of powering trains by electricity instead of using traditional diesel engines. This method is becoming more common around the world because it offers many advantages, including greater energy efficiency, lower emissions, and better performance.

In an electrified railway system, trains receive electricity through overhead wires or a third rail. Overhead wires, also known as catenary systems, are the most widely used. A device called a pantograph, which is mounted on top of the train, makes contact with the overhead wire and draws electricity to power the train's

motors. In a third rail system, the electricity is supplied through an additional rail placed beside or between the regular rails, and the train collects power through a shoe that slides along this rail.

There are two main types of electrical systems used in railways: *alternating current* (AC) and *direct current* (DC). High-speed trains and long-distance routes usually use high-voltage AC because it is more efficient over long distances. DC systems are often found in metro systems and suburban trains where the distances are shorter.

Electrification brings many benefits. Electric trains are faster, quieter, and more reliable than diesel trains. They are also better for the environment because they produce no emissions at the point of use. Maintenance costs for electric trains and tracks are usually lower compared to diesel systems. However, the installation of electrification infrastructure can be very expensive, especially in areas with difficult terrain.

Many countries are investing heavily in railway electrification as part of their plans to reduce carbon emissions and modernize their transport systems. For example, much of Europe and parts of Asia already have extensive electrified railway networks, and other regions are quickly catching up.

In the UK, the modern push for electrification is centred more on the need to reduce operating costs and the carbon footprint of the rail network by switching to more renewable and efficient energy sources. For Network Rail (*Network Rail Limited* is the owner and infrastructure manager of most of the railway network in Great Britain), their preferred method is to install overhead line equipment (OHL), although other methods include the third rail. Other less conventional methods include linear motors and fourth rail systems.

In conclusion, railway electrification is an important step towards making transport greener, faster, and more efficient. As technology improves and costs decrease, more railways will likely switch to electric power in the future. [5; 7]

Reading Comprehension Questions

1. What is the main reason railway electrification is becoming more common?

- A) It is easier to install than diesel engines
- B) It reduces travel time between stations
- C) It offers efficiency, lower emissions, and better performance
- D) It eliminates the need for maintenance

2. How do trains collect electricity in a catenary system?

- A) Through batteries on board
- B) Through a sliding shoe on the track
- C) Through solar panels
- D) Through a pantograph that touches the overhead wire

3. Which system is most commonly used for long-distance and high-speed trains?

- A) Direct current (DC)
- B) Alternating current (AC)
- C) Diesel engines
- D) Fourth rail systems

4. Why are electric trains considered better for the environment?

- A) They are made from recycled materials
- B) They require less electricity
- C) They produce no emissions at the point of use
- D) They use solar power exclusively

5. What is one major disadvantage of railway electrification mentioned in the text?

- A) Trains are slower
- B) It is very expensive to install
- C) Diesel engines are more powerful
- D) It causes more noise pollution

6. What is Network Rail's preferred method for electrifying railways in the UK?

- A) Overhead line equipment (OHL)
- B) Battery-powered trains
- C) Third rail systems
- D) Linear motors

7. What does the author suggest about the future of railway electrification?

- A) It will be replaced by newer diesel technology
- B) It will likely decline due to high costs
- C) It is already complete worldwide
- D) It will likely increase as technology improves and costs decrease

6. Post-reading discussion.

1. What is railway electrification, and why is it becoming more popular?
2. How does a train receive electricity from overhead wires?
3. What is the function of a pantograph in an electrified railway system?
4. Describe the difference between a catenary system and a third rail system.
5. Why is alternating current (AC) preferred for high-speed and long-distance routes?
6. List at least three advantages of electric trains compared to diesel trains.

7. What is one major disadvantage of installing railway electrification infrastructure?

8. Which regions of the world are leading in the development of electrified railways?

9. What reasons does the UK have for investing in railway electrification?

10. Name two unconventional electrification methods mentioned in the text.

7. Translate these sentences into Ukrainian.

1. The electrification of railway lines requires extensive installation of overhead line equipment (OLE).

2. Masts and gantries support the overhead wires that supply electricity to trains.

3. Substations are built along the railway line to convert and distribute power efficiently.

4. Insulators are used to prevent electricity from leaking into the ground or other structures.

5. Catenary systems must be precisely tensioned to function correctly in all weather conditions.

8. Translate these sentences into English.

1. До обладнання вздовж колії входять трансформатори, перемикачі та автоматичні вимикачі.

2. Усі електричні компоненти слід регулярно перевіряти та обслуговувати для забезпечення безпеки.

3. Сучасні проекти електрифікації розробляють із метою зменшення втрат енергії під час передачі.

4. Перемикальні станції дозволяють поїздам переходити між електрифікованими та неелектрифікованими ділянками.

5. Проєктування інфраструктури електрифікації має враховувати рельєф місцевості, погодні умови та стандарти безпеки.

9. Read the text and choose the correct answer (A, B, C or D).

Benefits of Railway Electrification on the Indian Railways

Railway overhead electrification has a large number of benefits in terms of both cost and time. Some of them have been 1) _____ and discussed as follows:

1. **Energy conservation:** The rail mode of transportation is far more 2) _____ as compared to the roadways. These are 6 times more energy efficient if compared with the roadways. These are 4 times more economical as compared to the roadways. These are 6 times more cost effective in terms of construction costs and in comparison to traffic as well. Electrification is the most

energy efficient in the train 3) _____. For every 100 kilometers, there is annual 4) _____ of 4 million liters of diesel which helps to save 2500 crore of the foreign exchange of the nation.

2. Importance in the suburban areas: This is very much ideal for the suburban areas due to higher acceleration and the braking features which are required for the easy starts and 5) _____. These are the backbone of the suburban transportation systems especially in the metro cities. The suburban areas 6) _____ about 5 million passengers daily. Such services have become extremely popular.

3. Heavy freight and longer route trains: Electrification has made possible of running of heavy freight and longer trains. These consist of 2 kinds of locomotives. This has made running of more than 9000 trains. Such tests have already been 7) _____ in the city of Ghaziabad so that there is no issue while implementation. There has been a massive improvement in the technology because of the efforts of the Indian railways.

<https://premnathrail.com/6-incredible-benefits-of-railway-electrification/>

1	A distributed	B constructed	C elaborated	D included
2	A alternating	B greener	C high-voltage	D efficient
3	A emissions	B transportation	C breaks	D pantograph
4	A functions	B savings	C installations	D conditions
5	A gantries	B masts	C wires	D stops
6	A cater	B support	C supply	D distribute
7	A electrified	B mounted	C conducted	D collected

10. Read the dialogue between two friends, then do the following tasks:

- find the terms in the text and explain their meanings;
- role-play the dialogue.

Alex: Hi! I've been reading about modern railway electrification. Why is it becoming so popular worldwide?

Ben: Mainly because electric trains are more energy-efficient, produce lower emissions, and perform better than diesel ones.

Alex: How do electric trains actually get their power?

Ben: Most of them use overhead wires, also called catenary systems, or sometimes a third rail.

Alex: And what connects the train to the overhead wire?

Ben: That's done by a pantograph mounted on the roof, which draws electricity to power the train's motors.

Alex: I see. Are there different types of electrical systems used?

Ben: Yes, railways mainly use alternating current and direct current. High-speed and long-distance trains usually run on high-voltage AC.

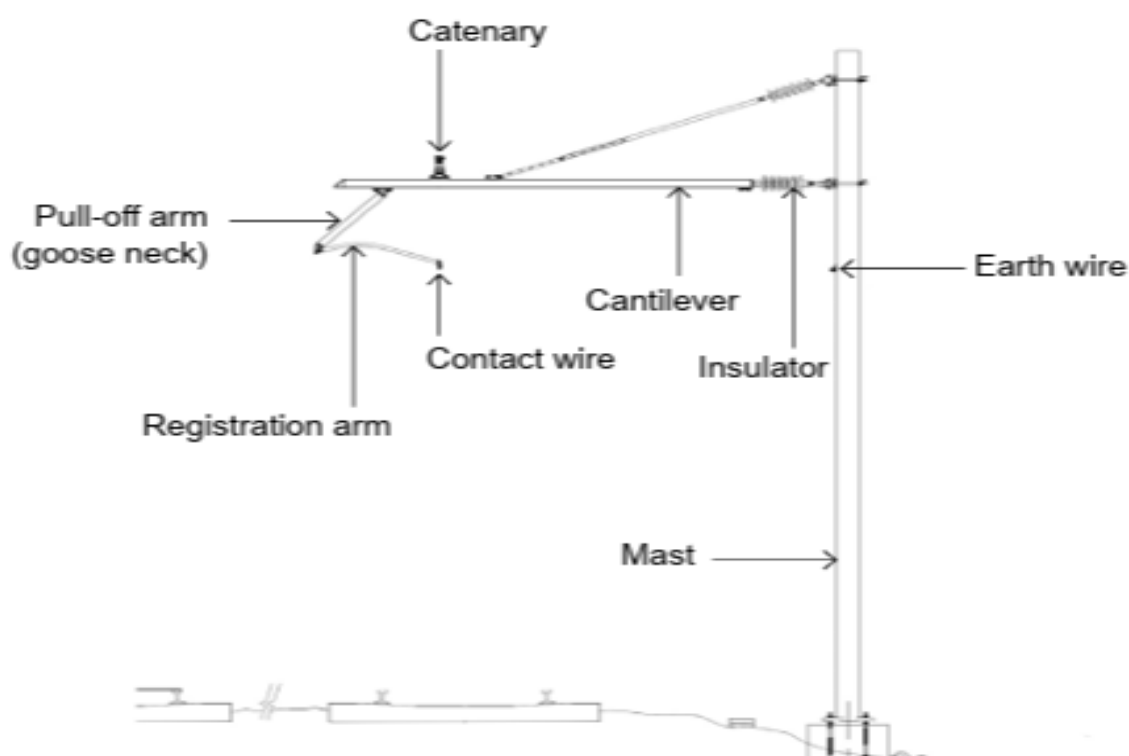
Alex: What about city transport like metros?

Ben: Metro and suburban trains often use DC systems because they're better suited for shorter distances.

Alex: Electrification sounds great, but are there any drawbacks?

Ben: The main issue is the high cost of installing infrastructure, especially in difficult terrain, but overall it's a key step toward greener and more efficient transport.

11. Write a text about overhead line electrification equipment which supplies electric power to the trains using information from the figure below. Before writing, analyse the figure and make up a plan. Use clear and structured phrases that help you organize the information logically.



Nyberg F., Pollard R. Scotland's Railway Rev 13 Version issued 2 November 2021. London. 64 p.

11. Role-play.

Work in pairs. Two railway engineers are discussing modern railway electrification during a professional meeting. They talk about how electric trains are powered, different electrification systems, and the advantages and challenges of electrification. Roles:

***Student A** is a Railway Engineer (you support railway electrification and explain how it works and why it is important);*

***Student B** is a Transport Planner (you ask questions about electrification systems, costs, and future development).*

Phrases for a Railway Engineer <i>(Explaining, organizing information, giving technical details)</i>	Phrases for a Transport Planner <i>(Asking questions, clarifying, evaluating, and responding)</i>
◆ Introducing the topic <i>I'd like to start by explaining how modern railway electrification works.</i> <i>First of all, let me outline the main principles of this system.</i> <i>Let me give you a brief overview of the electrification process.</i> ◆ Structuring information <i>There are three main aspects to consider.</i> <i>The first key element is...</i> <i>Another important component is...</i> <i>Finally, I'd like to mention...</i> ◆ Explaining processes <i>Electric trains receive power through...</i> <i>This system operates by using...</i> <i>The pantograph is responsible for collecting electricity from...</i> <i>As a result, the train's motors are powered efficiently.</i> ◆ Explaining advantages <i>One of the main advantages of electrification is...</i> <i>This leads to improved efficiency and lower emissions.</i> <i>Compared to diesel systems, electric trains are...</i> ◆ Addressing challenges <i>However, there are also some challenges to consider.</i> <i>The main drawback is the high installation cost.</i> <i>This can be particularly difficult in mountainous or remote areas.</i> ◆ Concluding <i>To sum up, railway electrification plays a crucial role in modern transport.</i> <i>Overall, this technology makes railways more sustainable and efficient.</i>	◆ Asking for information <i>Could you explain how this system works in practice?</i> <i>What are the main components involved?</i> <i>How does this differ from traditional diesel systems?</i> ◆ Asking for clarification <i>Could you clarify that point, please?</i> <i>What exactly do you mean by high-voltage AC?</i> <i>Could you give an example?</i> ◆ Evaluating advantages <i>What benefits does this bring to passengers and operators?</i> <i>How does electrification improve efficiency?</i> <i>In what way does it reduce environmental impact?</i> ◆ Discussing costs and challenges <i>What are the main financial challenges?</i> <i>Is the installation cost justified in the long term?</i> <i>How do countries deal with difficult terrain?</i> ◆ Expressing opinion <i>In my opinion, this seems like a long-term investment.</i> <i>I agree that electrification is essential for sustainability.</i> <i>From a planning perspective, this solution is very promising.</i>

Unit 12

Pantographs for Trains

Share your ideas:

What are the benefits of railway electrification?

What types of railway pantographs can you describe?

Key Vocabulary:

pantograph /'pæntəgrɑ:f/ *n* пантограф

traction motor /'trækʃən 'məʊtə/ тяговий електродвигун

onboard electrical equipment /'ɒnbɔ:d ɪ'lektrikəl ɪ'kwɪpmənt/ бортове електрообладнання

fit with /fɪt wɪð/ *v* оснащувати

despite /dɪ'spaɪt/ *prep* незважаючи на

contact strip /'kɒntækt stri:p/ контактна накладка

slide /slaɪd/ *v* ковзати

upper frame /'ʌpə freɪm/ верхня рама

lower frame /'ləʊə freɪm/ нижня рама

spring system /sprɪŋ 'sɪstəm/ пружинна система

pneumatic system /nju:'mætɪk 'sɪstəm/ пневматична система

damping mechanism /'dæmpɪŋ 'mekənɪzəm/ демпфувальний механізм

detect a fault /dɪ'tekt ə fɔ:lt/ виявляти несправність

diamond-shaped /'daɪəmənd ʃeɪpt/ *adj* ромбоподібний

single-arm pantograph /'sɪŋgl ɑ:m 'pæntəgrɑ:f/ одноважільний пантограф

operating system /'ɒpəreɪtɪŋ 'sɪstəm/ система керування

1. Match each word and word combination (1-8) to its correct definition by writing the letter (A-G) next to the word.

- | | |
|----------------------------|--|
| 1 pantograph | A a device that reduces vibrations and shocks |
| 2 contact strip | B an electric motor that drives the wheels of a train |
| 3 traction motor | C a movable metal strip that touches the power line |
| 4 upper frame | D a system of springs that keeps pressure constant |
| 5 spring system | E a device mounted on the roof to collect electricity |
| 6 damping mechanism | F a wire that supplies electrical power to trains |
| 7 overhead wire | G the top part of the pantograph structure |

2. Give the English equivalents to these words and word combinations using the key vocabulary.

механічний пристрій	контактна лінія
виявляти несправність	пневматична система
верхня і нижня рами	ромбоподібний пантограф
система пружин	структура пантографа
тяговий електродвигун	втрата контакту
система керування	механічна сила

[illegible][illegible]

3. Make up collocations using the words from the box.

resistance	stability	electricity	contact	carbon	force	collection
------------	-----------	-------------	---------	--------	-------	------------

to be fitted with _____
reliable supply of _____
stable contact _____
transfers mechanical _____
prevent loss of _____
current _____
aerodynamic _____

4. Complete these sentences using the appropriate vocabulary word.

pantograph *alignment* *contact strip* *damping mechanism*
traction motor *overhead wire*

1. The ... is mounted on the roof of the train to collect electricity.
2. The ... must remain properly adjusted to ensure smooth operation.
3. Electricity flows from the ... to the onboard electrical equipment.
4. The ... helps reduce vibration during high-speed travel.
5. Power collected by the pantograph is used to drive the
6. Good ... prevents excessive wear of pantograph components.

5. Read the text and answer the comprehension questions below.

Railway Pantographs

A railway pantograph is a mechanical device mounted on the roof of an electric train and is used to collect electrical power from overhead contact wires. It plays a crucial role in railway electrification systems by ensuring a continuous and reliable supply of electricity to the traction motors and onboard electrical equipment. The pantograph must maintain stable contact with the overhead line despite variations in speed, wire height, and track conditions.

The structure of pantographs depends on operating speed, load, and contact line condition of electric trains, and may vary depending on different manufacturing experience and technical convention of each country. However, all pantographs consist of four basic parts: pantograph head, frame, base frame, and drive system.

The basic construction of a pantograph includes several key components. The most important element is the *collector head*, which is fitted with carbon or graphite *contact strips*. These strips slide along the overhead wire and are designed to minimize wear on both the wire and the pantograph. Below the collector head is the *upper frame*, which transfers mechanical force and ensures correct alignment. The *lower frame* or *arm structure* supports the upper elements and is connected to

the train roof through an insulated base. Springs or pneumatic systems are used to apply an upward force, keeping the collector head pressed against the contact wire with controlled pressure. Insulators are essential parts of the construction, as they electrically isolate the pantograph from the vehicle body.

Pantographs are also equipped with *damping mechanisms* to reduce vibrations and prevent loss of contact at high speeds. In modern designs, sensors and monitoring systems are often included to detect faults, excessive wear, or abnormal contact forces.

There are several types of pantographs, classified mainly by their mechanical design and application. The *diamond-shaped pantograph* is one of the earliest designs and consists of a symmetrical framework forming a diamond shape. Although robust, it is heavier and creates more aerodynamic resistance, which limits its use on high-speed trains.

The *single-arm pantograph* is the most widely used type today. It has a lighter and simpler structure with one main arm and offers better aerodynamic performance, making it suitable for high-speed and modern passenger trains. This design reduces wear on overhead wires and improves current collection stability.

Another classification is based on the *operating system*. Pantographs can be *spring-operated* or *pneumatically operated*. Pneumatic pantographs allow more precise control of contact force and are commonly used on high-speed and heavy-duty electric trains.

In conclusion, the pantograph is a vital component of electric railway systems. Its construction and type directly influence energy efficiency, operational safety, and maintenance requirements, making it an important subject for railway engineering studies. [10; 8]

Reading Comprehension Questions

1. What is the main function of a railway pantograph?

- A) To store electrical energy for later use
- B) To transfer electricity from overhead wires to the train
- C) To control the speed of the train
- D) To support the weight of the train

2. Which part of the pantograph is in direct contact with the overhead wire?

- A) The lower frame
- B) The traction motor
- C) The contact strip
- D) The damping mechanism

3. Why is correct alignment of the pantograph important?

- A) It reduces the need for onboard electrical equipment
- B) It increases the speed of the train

- C) It ensures stable contact and reduces wear
- D) It allows the pantograph to fold automatically

4. What role do springs or pneumatic systems play in pantograph construction?

- A) They generate electricity
- B) They keep constant pressure on the overhead wire
- C) They detect electrical faults
- D) They cool the traction motor

5. Which type of pantograph is more common on modern high-speed trains?

- A Diamond-shaped pantograph
- B Double-frame pantograph
- C Single-arm pantograph
- D Rigid pantograph

6. What is one advantage of the single-arm pantograph compared to the diamond-shaped type?

- A) It is cheaper to manufacture
- B) It provides higher electrical voltage
- C) It has lower weight and causes less air resistance
- D) It does not require a damping mechanism

7. How do modern pantographs improve operational safety?

- A) By increasing the thickness of overhead wires
- B) By eliminating the need for maintenance
- C) By using systems that can detect faults
- D) By replacing mechanical parts with manual controls

6. Post-reading discussion.

1. What is the main function of a railway pantograph in an electric train?
2. Why is it important for the pantograph to maintain stable contact with the overhead wire?
3. What factors influence the structure and design of pantographs?
4. What are the four basic parts that all pantographs consist of?
5. What materials are used for the contact strips, and why are they chosen?
6. How do springs or pneumatic systems contribute to pantograph operation?
7. What is the purpose of insulators in the pantograph construction?
8. How do damping mechanisms improve pantograph performance at high speeds?
9. What are the main differences between diamond-shaped and single-arm pantographs?

10. Why are pneumatic pantographs commonly used on high-speed and heavy-duty trains?

7. Translate these sentences into Ukrainian.

1. A railway pantograph is a device mounted on the roof of an electric train to collect electricity from overhead wires.

2. The pantograph provides a continuous electrical connection between the train and the overhead line equipment.

3. The pantograph transfers electrical energy to the traction motors of the train.

4. Modern pantographs are designed to operate at high speeds.

5. The contact strip is usually made of carbon to reduce wear.

6. A spring or pneumatic system keeps the pantograph pressed against the overhead wire.

7. Proper alignment is essential for safe and stable current collection.

8. Translate these sentences into English.

1. Існує два основних типи пантографів: ромбоподібні та одноважільні.

2. Верхня рама пантографа підтримує контактну накладку.

3. Одноважільні пантографи легші та мають кращу аеродинаміку.

4. Нижня рама закріплена на даху поїзда.

5. Демпфувальний механізм зменшує вібрації під час роботи.

6. Регулярний огляд пантографа запобігає електричним несправностям.

7. Пантографи відіграють ключову роль в ефективній роботі електрифікованих залізничних систем.

9. Read the text below. Match choices (A-H) to (1-5). There are three choices you do not need to use.

OLE in Sensitive Landscapes

1. _____

Overhead Line Equipment – or OLE – is the name railway engineers give to the assembly of masts, gantries and wires found along electrified railways. All this steel and cable has only one purpose – to supply power to make electric trains move. Environmentally, operationally and from the perspective of passenger service and comfort, OLE is the preferred means of powering trains throughout the world. For example, when HS2 was conceived (HS2 is Britain's second purpose-built high-speed railway after High Speed 1), there was only one choice for the engineers – OLE. For these reasons, further electrification of Scotland's railway network is central to Transport Scotland's Rail Services Decarbonisation Action Plan to make passenger railways Net Zero by 2035.

2. _____

Railways pass through some of Scotland's most beautiful landscapes. Our acceptance that these lines now form part of the character of the countryside is both a testament to the skill of their Victorian engineers and a reflection of the extent to which the line of route is determined by topography and geology.

3. _____

OLE has been installed for decades in some of the most beautiful parts of the UK, as the photographs on the following pages illustrate. We have learnt from this experience that the masts have little impact on our appreciation of these places, especially where lines consist of one or two tracks, and when viewed from a distance. When they are installed, galvanised steel OLE supports reflect the light, but with time they take on a dull patina that blends well with the tones of our landscape. In Denmark they use a weathering steel, whose natural rusted finish has similar benefits.

4. _____

In shorter views, electrification may make the railway more prominent because it is necessary to remove vegetation within 6 m of electrified tracks to avoid the risk of trees and shrubs interfering with or falling on the OLE, and reduce the risk of lineside fires caused by sparks. Sometimes it might be necessary to divert or modify utilities that cross the line, such as power lines, or gas and water pipes, to accommodate OLE.

5. _____

Intelligent use of standard components can minimise the impact of OLE on sensitive landscapes. Consistency, simplicity and placement are key principles, illustrated in the sketch overleaf. There may be occasions in especially important locations where planting might be considered to screen more prominent equipment such as feeder stations, if these cannot be positioned in place such as cuttings that already offer cover. This is an approach being adopted by HS2. [7]

A Railways as an Integrated Part of Scotland's Natural Landscape

B A Facility to Electricity Transmission Lines

C The Role of OLE in Modern and Sustainable Railway Electrification

D Environmental and Infrastructure Adjustments for Electrification

E Avoiding Colliding with Line-side Structures

F Design Strategies to Minimise OLE Impact in Sensitive Areas

G Visual Impact and Material Integration of OLE Structures

H A System for Minimising Electrical Clearance

10. Read the dialogue between two friends, then do the following tasks:

- highlight the phrases for clarifying technical information in the text;
- find the synonyms to the phrases for clarifying technical information from the list below the dialogue.

Ben: John, could you explain what a railway pantograph is?

John: Certainly, Ben. A pantograph is a mechanical device mounted on the roof of an electric train to collect electrical power from overhead contact wires. **In other words**, it connects the train to the power supply system.

Ben: Could you clarify why it is so important in railway electrification systems?

John: Of course. **What I mean is that** it ensures a continuous and reliable supply of electricity to the traction motors and onboard electrical equipment. Without it, the train simply would not move.

Ben: I see. What challenges does the pantograph face during operation?

John: **Let me explain how it works.** It must maintain stable contact with the overhead line despite variations in speed, wire height, and track conditions. **More precisely**, it has to adapt to constant movement while keeping steady pressure.

Ben: That makes sense. What are the main structural parts of a pantograph?

John: All pantographs consist of four basic parts: the pantograph head, the frame, the base frame, and the drive system. **To put it simply**, the head collects current, and the rest of the structure supports and controls it.

Ben: What materials are used in the collector head?

John: The collector head is fitted with carbon or graphite contact strips. **In other words**, these materials are chosen to minimize wear on both the overhead wire and the pantograph.

Ben: Are there different types of pantographs used today?

John: Yes. The diamond-shaped pantograph is an older and heavier design, while the single-arm pantograph is lighter and more aerodynamic. **More precisely**, the single-arm type is preferred for high-speed trains because it improves stability and reduces wear.

Phrases for Clarifying Technical Information

Asking for Clarification

Could you clarify what you mean by...?

What exactly does this term refer to?

Could you explain that in more detail?

Do you mean that...?

Could you be more specific about...?

Giving Clarification

In other words, ...

What I mean is that...

To put it simply, ...

Let me explain how it works.

More precisely, ...

Checking Understanding

Does that make sense?

Is that clear?

Do you follow me?

Let me know if anything is unclear.

Would you like me to give an example?

11. Role-play.

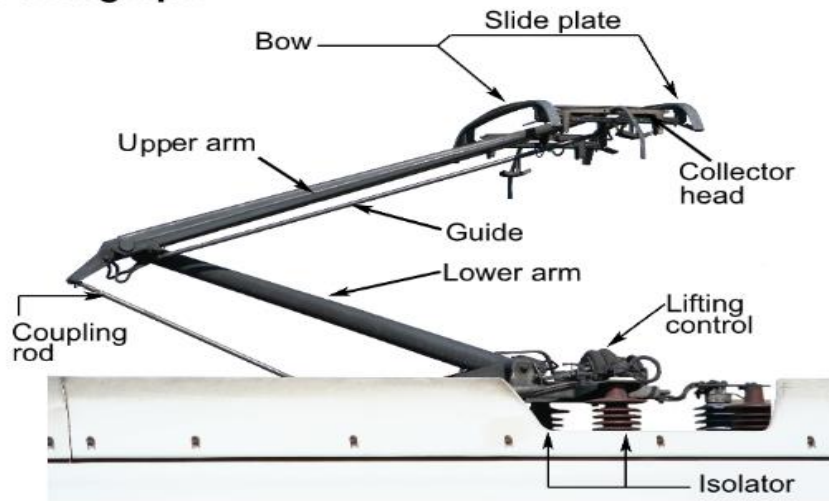
Work in pairs. You are two railway engineering students preparing for a technical seminar on electric train systems. One student (Junior Engineer) needs clarification about pantographs, and the other (Senior Engineer) explains the concept using clear technical language.

 Student A – Junior Engineer	 Student B – Senior Engineer
You are preparing for an exam on railway electrification. You need to: • Ask for clarification about pantographs • Ask about their function and importance • Ask about structure and materials • Ask about different types • Check your understanding Use phrases such as: • <i>Could you clarify what you mean by...?</i> • <i>Do you mean that...?</i> • <i>Could you explain that in more detail?</i> • <i>So, in other words...?</i>	You are explaining pantographs to your colleague. You need to: • Define what a pantograph is • Explain its role in electrification • Describe its main parts • Explain the materials used • Compare diamond-shaped and single-arm pantographs • Clarify technical details Use phrases such as: • <i>In other words...</i> • <i>What I mean is that...</i> • <i>Let me explain how it works.</i> • <i>More precisely...</i> • <i>To put it simply...</i>

Task Instructions

1. Prepare for 3–4 minutes.
2. Act out a 3–5 minute technical discussion.
3. Use at least **4 clarification phrases** in your dialogue.
4. Make your explanation clear and logically structured.
5. Use the information from the figure below.

Pantograph

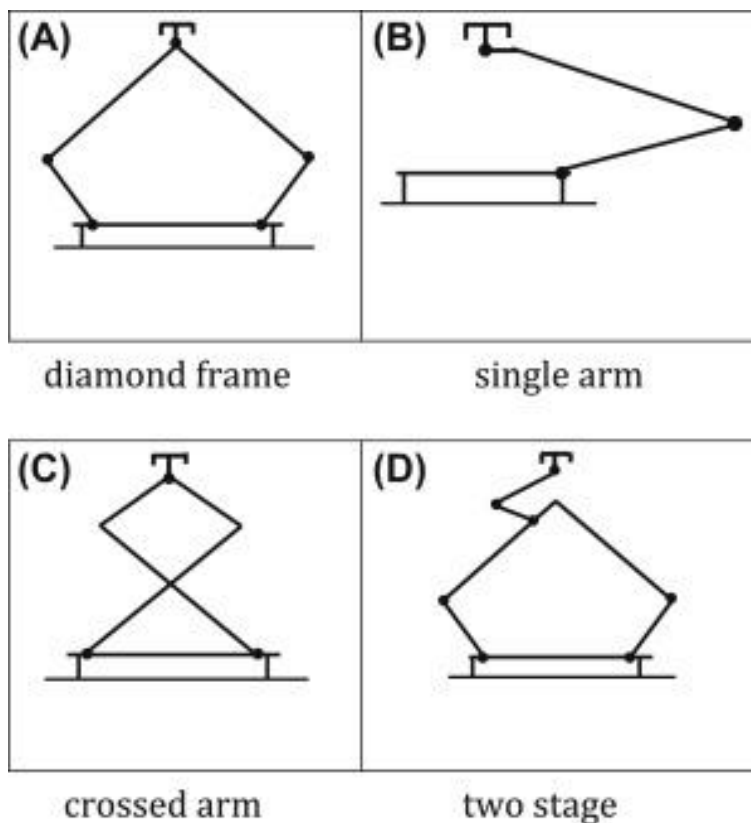


Parts of a pantograph

[https://en.wikipedia.org/wiki/Pantograph_\(transport\)/#/media/File:Pantograph_ICE_3.png](https://en.wikipedia.org/wiki/Pantograph_(transport)/#/media/File:Pantograph_ICE_3.png)

12. Write a text describing the peculiarities of every type of railway pantographs using information from the Internet.

There are a range of different designs of railway pantographs, but they broadly fall into two main types: single arm or multiple arms. Figure below shows these generic types. Most pantographs are more usually of the single-arm type and this design will be considered herein.



<https://www.sciencedirect.com/topics/engineering/pantograph>

Railway Engineering English **Термінологічний мінімум**

Rolling Stock and Traction Systems

locomotive /ˌləʊkəˈməʊtɪv/ локомотив
electric locomotive /ɪˈlektrɪk ˌləʊkəˈməʊtɪv/ електровоз
diesel locomotive /ˈdiːzəl ˌləʊkəˈməʊtɪv/ тепловоз
multiple unit /ˈmʌltɪpl ˈjuːnɪt/ моторвагонний поїзд
rolling stock /ˈrəʊlɪŋ stɒk/ рухомий склад
traction /ˈtrækʃən/ тяга
traction motor /ˈtrækʃən ˈməʊtə/ тяговий двигун
bogie /ˈbəʊgi/ візок
axle /ˈæksəl/ вісь
wheelset /ˈwiːlset/ колісна пара
suspension /səˈspenʃən/ підвіска
braking system /ˈbreɪkɪŋ ˈsɪstəm/ гальмівна система
pneumatic brake /ˈnjuːˈmætɪk breɪk/ пневматичне гальмо
disc brake /dɪsk breɪk/ дискове гальмо
dynamic brake /daɪˈnæmɪk breɪk/ динамічне гальмо
coupler /ˈkʌplə/ автозчеп
buffer /ˈbʌfə/ буфер
pantograph /ˈpæntəɡrɑːf/ пантограф
contact strip /ˈkɒntækt striːp/ контактна накладка
onboard equipment /ˈɒnbɔːd ɪ ˈkwɪpmənt/ бортове обладнання
control unit /kənˈtrəʊl ˈjuːnɪt/ блок керування
cab /kæb/ кабіна машиніста
driver /ˈdraɪvə/ машиніст
freight wagon /freɪt ˈwæɡən/ вантажний вагон
passenger coach /ˈpæsɪndʒə kəʊtʃ/ пасажирський вагон
sleeping car /ˈsliːpɪŋ kɑː/ спальний вагон
dining car /ˈdaɪnɪŋ kɑː/ вагон-ресторан
observation car /ˌɒbzəˈveɪʃən kɑː/ оглядовий вагон
boxcar /ˈbɒks kɑː/ *n* критий вантажний вагон
flatcar /ˈflæt kɑː/ *n* платформний вагон
load capacity /ləʊd kəˈpæsəti/ вантажопідйомність
adhesion /ədˈhiːʒən/ зчеплення
power output /ˈpaʊə ˈaʊtpʊt/ вихідна потужність
acceleration /ækˌseləˈreɪʃən/ прискорення
deceleration /ˌdiːˌseləˈreɪʃən/ уповільнення
tank car /ˈtæŋk kɑː/ цистерна
hopper car /ˈhɒpə kɑː/ вагон-хопер
gondola car /ˈɡɒndələ kɑː/ вагон-гондола
refrigerated car /rɪˈfrɪdʒəreɪtɪd kɑː/, reefer /ˈriːfə/ рефрижераторний вагон

Electrification and Power Supply

electrification /ɪˌlektʃɪfɪˈkeɪʃən/ електрифікація
overhead wire /ˌəʊvəˈhed ˈwaɪə/ контактний провід
overhead line equipment /ˌəʊvəˈhed laɪn ɪˈkwɪpmənt/ контактна мережа
catenary /kəˈtɪnəri/ контактна підвіска
third rail /ˈθɜːd reɪl/ третя рейка
substation /ˈsʌbˌsteɪʃən/ тягова підстанція
power supply /ˈpaʊə səˈplaɪ/ електроживлення
voltage /ˈvəʊltɪdʒ/ напруга
current /ˈkʌrənt/ струм
alternating current /ˈɔːltəneɪtɪŋ ˈkʌrənt/ змінний струм
direct current /dəˈrekt ˈkʌrənt/ постійний струм
high-voltage /ˌhaɪ ˈvəʊltɪdʒ/ високовольтний
transformer /ˈtrænsˈfɔːmə/ трансформатор
circuit breaker /ˈsɜːkɪt ˌbreɪkə/ автоматичний вимикач
insulator /ˈɪnsjʊleɪtə/ ізолятор
feeder line /ˈfiːdə laɪn/ живильна лінія
return circuit /rɪˈtʜːn ˈsɜːkɪt/ зворотне коло
earthing /ˈɜːθɪŋ/ заземлення
short circuit /ʃɔːt ˈsɜːkɪt/ коротке замикання
power grid /ˈpaʊə grɪd/ електромережа
energy consumption /ˈenədʒi kənˈsʌmpʃən/ енергоспоживання
regenerative braking /rɪˈdʒenərətɪv ˈbreɪkɪŋ/ рекуперативне гальмування
converter /kənˈvɜːtə/ перетворювач
inverter /ɪnˈvɜːtə/ інвертор
neutral section /ˈnjuːtrəl ˈsekʃən/ нейтральна вставка
voltage drop /ˈvəʊltɪdʒ drɒp/ падіння напруги
switchgear /ˈswɪtʃɡɪə/ розподільче обладнання
contact line mast /ˈkɒntækt laɪn mɑːst/ опора контактної мережі
linear motor /ˈlɪniə ˈməʊtə/ лінійний двигун
fourth rail /ˈfɔːθ reɪl/ четверта рейка

Track, Signalling and Safety

rail /reɪl/ рейка
track /træk/ колія
rail joint /reɪl dʒɔɪnt/ стикове з'єднання рейок
sleepers /ˈsliːpəz/ шпали
ballast /ˈbæləst/ баласт
track alignment /træk əˈlaɪnmənt/ вирівнювання колії
gauge /ɡeɪdʒ/ ширина колії
switch /swɪtʃ/ стрілка
turnout /ˈtʜːnaʊt/ стрілочний перевід
crossing /ˈkrɒsɪŋ/ хрестовина

signalling system /'signəliŋ 'sistəm/ система сигналізації
interlocking /,intə'ləkiŋ/ централізація
control centre /kən'trəʊl 'sentə/ диспетчерський центр
automatic block system /,ɔ:tə'mætɪk blɒk 'sistəm/ автоблокування
ERTMS /'ɜ:ti:ɑ:rti:em'es/ Європейська система управління рухом
level crossing /'levəl 'krɒsiŋ/ переїзд
speed limit /spi:d 'lɪmɪt/ обмеження швидкості
derailment /dɪ'reilmənt/ сходження з рейок
collision /kə'liʒən/ зіткнення
hazard /'hæzəd/ небезпека
risk assessment /rɪsk ə'sesmənt/ оцінка ризиків
safety compliance /'seɪfti kəm'plaɪəns/ відповідність нормам безпеки
maintenance /'meɪntənəns/ технічне обслуговування
inspection /ɪn'spekʃən/ інспекція
fault detection /fɔ:lt dɪ'tekʃən/ виявлення несправностей
reliability /rɪ'laɪə'bɪləti/ надійність
redundancy /rɪ'dʌndənsi/ резервування
emergency brake /ɪ'mɜ:dʒənsi breɪk/ аварійне гальмо
operating rules /'ɒpəreɪtɪŋ ru:lz/ правила експлуатації
incident report /'ɪnsɪdənt rɪ'pɔ:t/ звіт про інцидент [1]

Maintenance, Diagnostics and Reliability

maintenance /'meɪntənəns/ технічне обслуговування
preventive maintenance /pri'ventɪv 'meɪntənəns/ профілактичне обслуговування
predictive maintenance /pri'dɪktɪv 'meɪntənəns/ прогнозне обслуговування
corrective maintenance /kə'rektɪv 'meɪntənəns/ коригувальне обслуговування
inspection /ɪn'spekʃən/ огляд
routine check /ru:'ti:n tʃek/ планова перевірка
troubleshooting /'trʌblʃu:tɪŋ/ пошук і усунення несправностей
fault /fɔ:lt/ несправність
failure /'feɪljə/ відмова
wear /weə/ зношування
tear /teə/ пошкодження
fatigue /fə'ti:g/ втома матеріалу
corrosion /kə'rəʊʒən/ корозія
lubrication /,lu:bri'keɪʃən/ змащування
alignment /ə'laimmənt/ вирівнювання
calibration /,kælə'breɪʃən/ калібрування
diagnostic system /,daɪəg'nɒstɪk 'sistəm/ діагностична система
sensor /'sensə/ датчик
monitoring system /'mɒnɪtərɪŋ 'sistəm/ система моніторингу
condition monitoring /kən'dɪʃən 'mɒnɪtərɪŋ/ моніторинг технічного стану
reliability /rɪ'laɪə'bɪləti/ надійність [2]

availability /ə,veɪlə'bɪləti/ експлуатаційна готовність
downtime /'daʊntaɪm/ простій
service life /'sɜ:vɪs laɪf/ термін служби
overhaul /'əʊvə,hɔ:l/ капітальний ремонт
spare parts /speə pɑ:ts/ запасні частини
replacement /rɪ'pleɪsmənt/ заміна
breakdown /'breɪkdaʊn/ поломка
technical support /'teknɪkəl sə'pɔ:t/ технічна підтримка
maintenance schedule /'meɪntənəns 'ʃedʒu:l/ графік технічного обслуговування

Railway Project Management and Sustainability

project management /'prɒdʒekt 'mænɪdʒmənt/ управління проєктами
feasibility study /,fi:zə'bɪləti 'stʌdi/ техніко-економічне обґрунтування
cost estimation /kɒst ,estɪ'meɪʃən/ оцінка вартості
budget /'bʌdʒɪt/ бюджет
funding /'fʌndɪŋ/ фінансування
procurement /prə'kjʊəmənt/ закупівля
contract /'kɒntrækt/ контракт
stakeholder /'steɪk,həʊldə/ зацікавлена сторона
infrastructure development /'ɪnfə,striktʃə dɪ'veləpmənt/ розвиток інфраструктури
modernization /,mɒdənaɪ'zeɪʃən/ модернізація
implementation /,ɪmplɪmen'teɪʃən/ впровадження
tender /'tendə/ тендер
deadline /'dedlaɪn/ кінцевий термін
milestone /'maɪlstəʊn/ ключовий етап
quality control /'kwɒləti kən'trəʊl/ контроль якості
quality assurance /'kwɒləti ə'ʃʊərəns/ забезпечення якості
risk management /rɪsk 'mænɪdʒmənt/ управління ризиками
compliance /kəm'plaɪəns/ відповідність нормам
regulation /,regjʊ'leɪʃən/ нормативне регулювання
safety standard /'seɪfti 'stændəd/ стандарт безпеки
sustainability /sə'steɪnə'bɪləti/ сталість
energy efficiency /'enədʒi ɪ'fɪʃənsi/ енергоефективність
carbon emissions /'kɑ:bən ɪ'mɪʃənz/ викиди вуглецю
environmental impact /ɪn,vaɪrən'mentl 'ɪmpækt/ вплив на довкілля
renewable energy /rɪ'nju:əbl 'enədʒi/ відновлювана енергія
life-cycle cost /'laɪf saɪkl kɒst/ життєвий цикл витрат
innovation /,ɪnə'veɪʃən/ інновація
digitalization /,dɪdʒɪtəlaɪ'zeɪʃən/ цифровізація
strategic planning /strə'ti:dʒɪk 'plænɪŋ/ стратегічне планування
performance indicator /pə'fɔ:məns 'ɪndɪkeɪtə/ показник ефективності [2]

Список використаної літератури

1. ДСТУ 2644-94. Рейки і основні вироби рейкових скріплень. Терміни та визначення. [Чинний від 1995-07-01]. Київ : ДП «УкрНДНЦ», 1995. 34 с. (дата звернення: 27.12.2025).
2. Новий англо-український політехнічний словник / упоряд. В. В. Бутник ; відп. ред. О. П. Онуфрієнко. Київ : Арії, 2008. 704 с.
3. A guide to railroad track. *AGICO Rail* : URL: <http://www.railway-fasteners.com/news/railway-track-parts.html> (date of access: 19.12.2025).
4. Chandra S., Agarwal M. M. *Railway Engineering*. New Delhi : Oxford University Press, 2013. 676 p.
5. Elbelkasi M. S., Badran E. A., Abedl-Rahman M. H. Overview of DC and AC Electric Railway Systems Considering Energy Efficiency Enhancement Methods. *Port-Said Engineering Research Journal*. 2020. Vol. 24, Iss. 1. P. 128–140. DOI: <https://doi.org/10.21608/pserj.2019.18206.1012>
6. Günay M., Korkmaz M. E., Özmen R. An investigation on braking systems used in railway vehicles. *Engineering Science and Technology, an International Journal*. 2020. Vol. 23, Iss. 2. P. 421–431. DOI: <https://doi.org/10.1016/j.jestch.2020.01.009> (date of access: 18.11.2025).
7. Nyberg F., Pollard R. *A Guide to Overhead Electrification*. Rev. 13, Version issued 2 November 2021. London : Alan Baxter Ltd, 2021. 64 p.
8. Pantograph ICE 3. *Wikimedia Commons*. 2017. URL: https://commons.wikimedia.org/wiki/File:Pantograph_ICE_3.png (date of access: 21.02.2026).
9. Rail Clips and Rail Fastening Systems in the UK. *AGICO Rail*. URL: <http://www.railtrackfastener.com/rail-clips-and-rail-fastening-systems-in-the-uk.html> (date of access: 12.09.2025).
10. Railway Track Engineering and Railway Construction for the Rail Industry. *Railway Technology*. URL: <https://www.railway-technology.com/buyers-guide/railway-track-engineering-construction/> (date of access: 07.05.2025).
11. Types of Rail Vehicles. *Marline*. URL: <https://marline.ua/en/railway-platforms/> (date of access: 19.12.2025).
12. What are Railway Tracks? *ADORTech*. 2024. URL: <https://adortech.com/blog/different-types-of-railway-tracks> (date of access: 02.12.2025).

Навчальне видання

*Мірошниченко Ірина Григорівна,
Шуліченко Тетяна Сергіївна*

Іноземна мова (англійська мова)
Англійська для інженерів-залізничників
English for Railway Engineers

Навчальний посібник

Електронне видання

Відповідальний редактор І. Г. Мірошниченко
Комп'ютерна верстка І. Г. Мірошниченко
Дизайн обкладинки І. Г. Мірошниченко

Експертний висновок склала канд. філол. наук, доц. А. О. Мунтян

Зареєстровано НМВ УДУНТ (№ 1.873 від 11.05.2026)

Формат 60x84 ¹/₆. Ум. друк. арк. 6,85. Обл.-вид. арк. 6,94.
Зам. № 50

Видавець: Український державний університет науки і технологій.
вул. Лазаряна, 2, ауд. 2216, ауд. 263 (наукова бібліотека)
м. Дніпро, 49010.

Свідоцтво суб'єкта видавничої справи ДК № 7709 від 14.12.2022

