

13 The urban world

13.1 An increasingly urban world

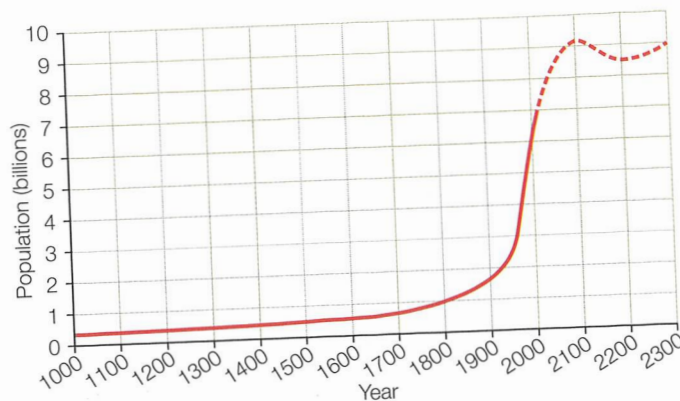
On this spread you will find out about the global pattern of urban change

What is urbanisation?

By 1804 the global population had doubled from half a billion to one billion in 300 years. By 1999 the total had doubled from 3 billion to 6 billion in just 39 years (graph A). In the twenty-second century the global population is projected to level out.

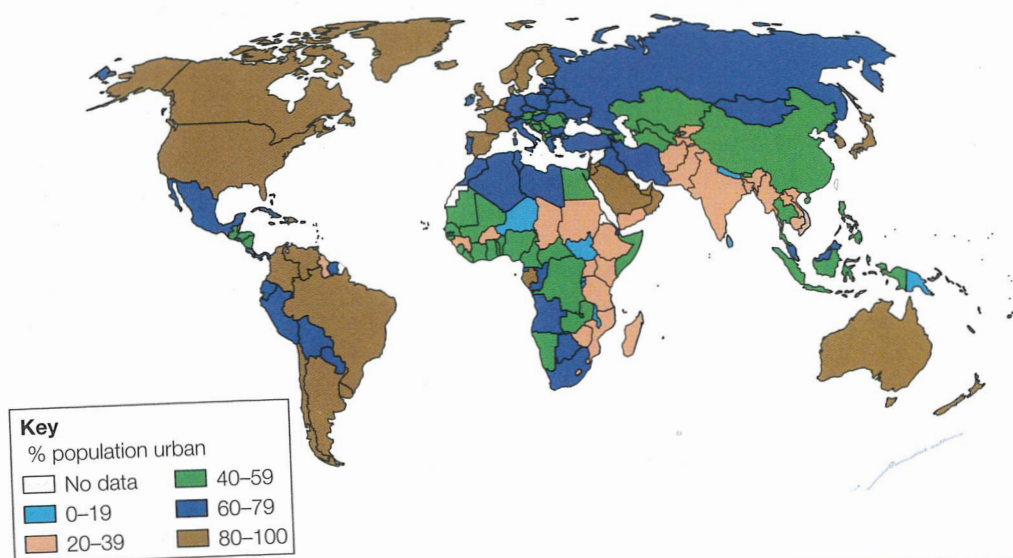
Urbanisation – the proportion of the world's population who live in cities – is also growing. It is the result of the natural increase of a population (births minus deaths) plus **migration**. Urban growth is the increase in the area covered by cities.

Urbanisation has taken place at different times and at different speeds in different parts of the world. The UK was one of the first countries in the world to become urbanised.



A Global population growth since the year 1000 (dotted line is the United Nations projection)

B Global urban population, 2017



Skills

This table shows changes in the percentage of people living in urban areas in three countries.

- Complete a copy of the table by filling in the missing values.
- Draw three pairs of parallel bars to represent the urban population percentages for 1950 and 2050 for the three countries (see graph D).

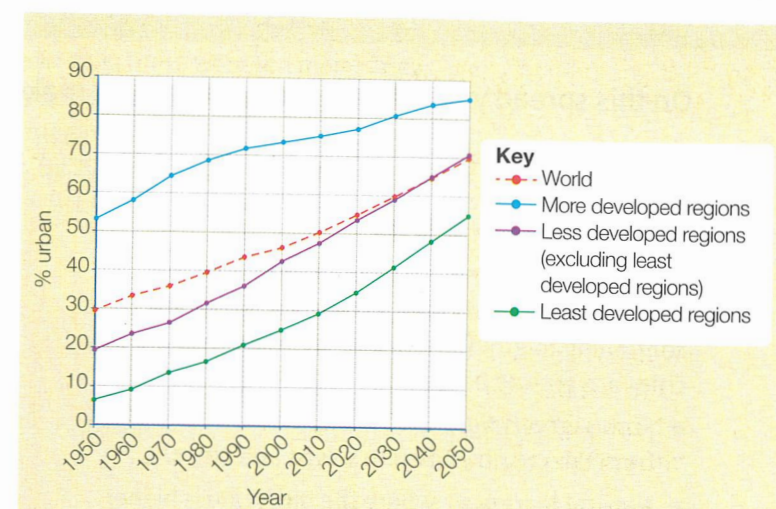
Type of country	Country	% urban population (1950)	Estimated % urban population (2050)	% change in urban population (1950–2050)
HIC	UK	79		+9
NEE	Nigeria		75	+65
LIC	Botswana	3	81	

The global pattern of urban change

In 2020 around 56 per cent of the world's population lived in urban areas. The UN expects this to increase to around 68 per cent by 2050.

The proportion of people living in towns and cities varies in different parts of the world (map B).

- In most of the world's richer countries over 60 per cent of the population live in cities.
- In south and south east Asia around half the population live in towns and cities.
- About 50 per cent of Africa's population live in urban areas. Only one country – Niger – has an urban population lower than 20 per cent. Urbanisation in Africa is expected to rise faster than in any other continent.



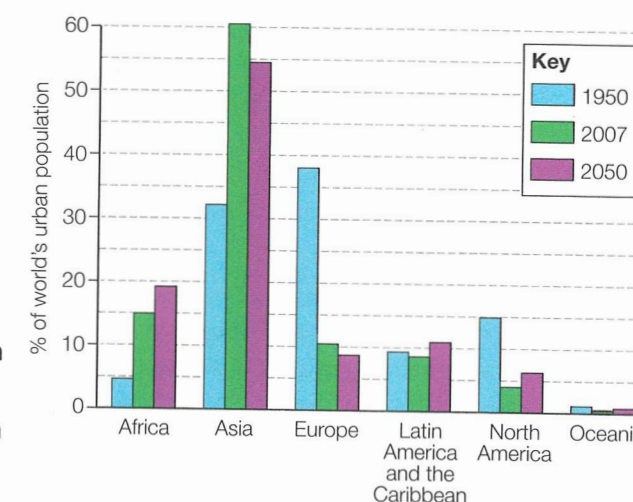
C Urban population, 1950–2050

In different regions of the world the urban population is growing at different rates (graph C).

The distribution of the world's urban population

The changing distribution of the world's urban population is shown in graph D.

- India, China and Nigeria will account for 37 per cent of the projected growth of the world's urban population between 2014 and 2050.
- Between 2014 and 2050, India is projected to add 300 million urban dwellers, China 292 million and Nigeria 212 million.
- 90 per cent of the increase in the world's urban population is taking place in Africa and Asia.
- The greatest rate of urbanisation is shown in low income countries (LICs) and newly emerging economies (NEEs).
- Urbanisation is slowing in high income countries (HICs) where counter-urbanisation is taking place.



D Distribution of the world's urban population in 1950, 2007 and 2050 (estimated)

Activities

Study graph D.

- Which continent accounted for the majority of the world's urban population in 1950? Give its percentage.
- Which continent accounted for the majority of the world's urban population in 2007 and 2050 (estimated)?
- Apart from Oceania, in which continent has the percentage of the world's urban population changed the least from 1950 to 2050?
- Create a summary table showing the percentage of the world's urban population for each continent in 1950 and 2050 (estimated).

Extension

Suggest why some Asian countries like India and China, together with most of Africa, are likely to have a higher urban population percentage in 2050 than 2020.

Practice question

Using graph D, describe the distribution of the world's changing urban population between 1950 and 2007. (4 marks)

Tips

- You should refer to the graph, using figures to support your answer.
- Consider variations over time when describing the distribution patterns.
- You do not need to 'explain' (give reasons) for the patterns and trends you have identified.

3.2 Factors affecting the rate of urbanisation

On this spread you will find out what factors make cities grow

Why do cities grow?

More than half the world's population now live in urban areas, and cities all over the world are continuing to grow. There are two main reasons why cities are getting bigger.

- **Rural-urban migration** – the movement of people from the countryside into towns and cities.
- **Natural increase** – where the birth rate is higher than the death rate.

A natural increase in population occurs when there is a high proportion of young adults aged 18–35. Therefore, more children will be born. The smaller proportion of older people means the death rate is lower. Improvements to health care, particularly in urban areas of poorer countries, can also result in a lower death rate. Natural increase therefore tends to be higher in LICs (such as Cambodia) and in some NEEs (such as India).

Rural-urban migration is caused by *push* and *pull* factors. These are the real or imagined disadvantages of living in a rural area and advantages of living in a town or city (diagram A).

'Push' factors

People may want to leave the countryside if:

- farming is hard and poorly paid
- desertification and soil erosion make farming difficult
- drought and other climate hazards reduce crop yields
- farming is often at subsistence level, producing only enough food for the family, leaving nothing to sell
- poor harvests lead to malnutrition or famine
- there are few doctors or hospitals
- schools provide only a very basic education
- rural areas are isolated due to poor roads.

Sunita's story

My name is Sunita. Two years ago my parents, my brother Rakesh and I came to live in Mumbai, in an area called Dharavi. Everyone in Dharavi is poor. Our house only has two rooms, but we have electricity. My father says at least we have work. One day maybe my brother and I will be rich! Dharavi is crowded, noisy and very busy. Outside our house people wash laundry, sew clothes and bash dents out of oil cans to recycle them. There are 15 000 small workshops here.

It is very smelly, with open sewers. I like to walk to the biscuit factory because it smells nicer there! I go to school every morning and learn maths and literacy. In the afternoon I help my mother clean the

house. Then I go rag picking with my friends to earn some money.

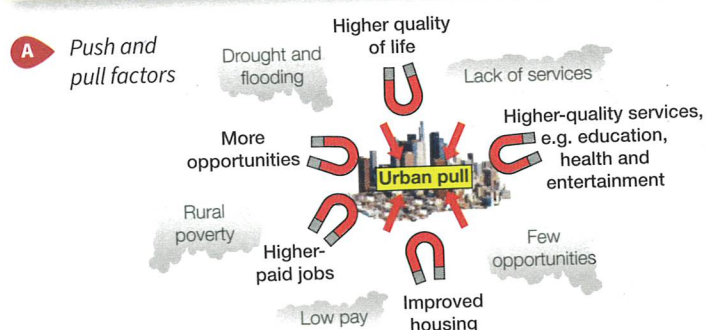
B Dharavi, Mumbai



'Pull' factors

People can be attracted to the city because often:

- there are more well-paid jobs
- a higher standard of living is possible
- they have friends and family already living there
- there is a better chance of getting an education
- public transport is better
- a range of entertainments are available
- there are better medical facilities.



The emergence of megacities

Megacities are cities with a population of over 10 million. In 1990 there were ten megacities – one in the USA, two in Japan, two in Central and South America, four in Asia and one in Africa. By 2014 there were 28 megacities. In 2018 there were 33 megacities, 27 of which were in the less-developed world. Six were in China and five in India. By 2050 there may be as many as 50 megacities, many of which will be in LICs and NEEs, particularly in Asia and Africa.

It is possible to identify three types of megacity:

Slow-growing

Where?

East Asia, Europe and North America

Features

Population at 70%+ urban
No squatter settlements

Examples

Osaka-Kobe, Tokyo, Moscow, Los Angeles

Growing

Where?

South America and south east Asia

Features

Population 40–50% urban
Under 20% in squatter settlements

Examples

Beijing, Rio de Janeiro, Shanghai, Mexico City

Rapid-growing

Where?

South/south east Asia and Africa

Features

Population under 50% urban
Over 30% in squatter settlements

Examples

Jakarta, Lagos, Mumbai, Manila



B The distribution of the world's megacities, projected to 2035

Extension

Should cities be allowed to continue to grow or should their growth be controlled? Discuss.

Activities

- a** Give three factors which might explain why Sunita's family moved to Mumbai.
- b** Explain whether these are push or pull factors.
- Draw a table with three columns headed Social, Economic and Environmental. List each of the push and pull factors listed in diagram A under the correct heading.
- a** What is 'natural increase'?
- b** How does natural increase contribute to the growth of urban areas?

Practice question

Explain why a growing percentage of the world's population lives in urban areas. (6 marks)

Tips

- The command word is 'explain' – you should give clear reasons why a growing percentage of people live in urban areas.
- Make sure you use geographical terminology correctly – refer to both 'natural increase' and 'migration'.
- You should aim to write about 12 lines.

13.3 Introducing Rio de Janeiro

On this spread you will find out why the city of Rio de Janeiro is growing so rapidly

The location of Rio and its importance

Rio de Janeiro is situated on Brazil's Atlantic coast at 23°S and 43°W. It has grown up around a large natural bay called Guanabara Bay (photo A). Until 1960 Rio was the capital of Brazil — it is now Brasília. Rio is seen as the cultural capital of Brazil, with over 50 museums, and its famous annual carnival is one of the world's biggest music and dance celebrations. It is a UNESCO World Heritage Site. The staging of the 2014 soccer World Cup and the 2016 Olympics have increased its global importance.



A Some facts about Rio

Brazil's second most important industrial centre, producing 5 per cent of Brazil's Gross Domestic Product (GDP).

A major port – main exports are coffee, sugar and iron ore.

The Statue of Christ the Redeemer is one of the Seven New Wonders of the World.

Sugar Loaf Mountain

Stunning natural surroundings and amazing beaches make it one of the most visited cities in the southern hemisphere.

Guanabara Bay

Rio hosted matches during the 2014 World Cup and hosted the 2016 Olympic Games.

Main service industries are banking, finance and insurance.

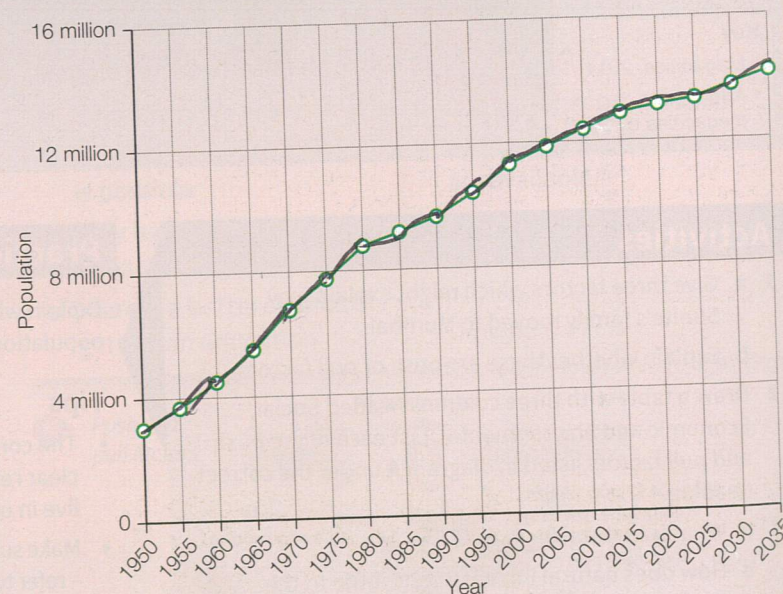
Main manufacturing industries are chemicals, pharmaceuticals, clothing, furniture and processed foods.

Rio has become a 'global city' because of its importance in the global economy as an industrial and financial centre. It is a major regional, national and international centre for many important companies and industries. It is an important international hub, with five ports and three airports.

How has Rio de Janeiro grown?

Rio de Janeiro is the second largest city in Brazil (the largest is São Paulo). In 2020 Rio had a population of 6.7 million people in the city itself and 13.4 million in the surrounding area (the population of Greater London is 9.4 million).

Rio has grown rapidly in the last 50 years to become a major industrial, administrative, commercial and tourist centre.



B The growth of Rio's population, 1950–2035 (projected)

Why has Rio grown?

The rapid growth of Rio's population (graph B) is the result of **migration** and **natural increase**.

Migration

Migration is when people move from one area or country to another. This has been responsible for 65 per cent of the growth of Rio over the last 150 years. Migrants have travelled to Rio from abroad and from elsewhere in Brazil.

International migration

Until the late 1800s immigrants from outside Brazil came almost exclusively from Portugal, the former colonial power. Many became shopkeepers and traders. Enslaved people from African countries were also forced to migrate to Brazil during this colonial period. Later migrants came from Middle Eastern countries such as Syria and Lebanon, fleeing political and economic instability.

During the twentieth century large numbers of people moved to Rio from Germany and Japan. This was mainly because of a shortage of labour on Brazil's coffee plantations. In the twenty-first century Rio has attracted skilled workers from the USA and the UK. Recent migrants from South Korea, the Philippines and China are seeking new business opportunities. The common language still attracts migrants from Portugal.

Internal migration

Most migrants nowadays move to Rio from other parts of Brazil, particularly from rural areas. This is the result of the push and pull factors discussed on page 164. In recent years internal migration has accounted for up to two-thirds of the city's increase in population.

Internal migrants include:

- former miners from the inland state of Minas Gerais
- drought-stricken farmers from north east Brazil
- indigenous peoples driven out of the Amazon forest following deforestation.

As a result Rio has a racially mixed population with about 55 per cent of European descent, 31 per cent of African descent and 14 per cent of indigenous descent.



C Rio has a racially mixed population due to migration from home and abroad

Natural increase

Most of Rio's recent population growth reflects high rates of natural increase. Rio's 2010 census showed a predominantly young population with a high proportion of people in their 20s and 30s. Most migrants to the city are young, leading to a relatively high birth rate and a low death rate. Better quality services in the city, such as health care and social services, have resulted in a healthier population (lower death rate) and also a reduction in infant mortality.

Activities

- 1 What is the difference between international and internal migration?
- 2 Construct a simple timeline to summarise the trends in international migration to Rio.
- 3 Suggest reasons why Rio has been an attractive destination for internal migrants.
- 4 Why do migrants to cities like Rio tend to increase birth rates?

Extension

Construct a spider diagram to identify the importance of Rio, nationally and internationally. Use the information on page 166 together with online research. Suggest how Rio's national and international importance may change in the future.

Practice question

Discuss the importance of migration in the growth of a named LIC or NEE city. (6 marks)

Tips

- The command word 'discuss' asks you to present different arguments or points of view.
- Consider the importance of migration in comparison with natural change.
- Use the geographical terminology correctly – consider both international and internal migration.
- You must use some facts and figures from your case study (Rio).

13.4 Social opportunities in Rio

On this spread you will find out how urban growth has created social opportunities in Rio

How has urban growth created social opportunities?

The rapid growth of Rio due to natural increase and migration has created social and economic opportunities in the city. Levels of investment are higher compared with the more rural parts of Brazil. This is due to Rio's former position as the country's capital and as a major industrial centre and trading port. Developments associated with the 2016 Rio Olympic Games included the construction of Line 4, a new Metro link (photo A). Many of the city's international migrants are skilled workers who have helped to boost the economy and established their own businesses.

People living in Rio tend to have better access to services, such as health care, education and employment. Table B compares development indicators between Rio and the average for Brazil. It shows how the growth of Rio has created opportunities for its residents and helps to explain why it is an attractive destination for internal migrants.

Access to services

Health services

Rio's residents enjoy free health care and better access to hospitals than in other parts of Brazil. There are three public hospitals and six private ones. Most hospitals are located in the wealthier south and west zones of the city.

Since 2008 there have been improvements in Rio's health care provision, particularly before the World Cup (2014) and Olympic Games (2016). Health cover has increased from 4 per cent to 70 per cent for people in some slum areas. During the Covid-19 pandemic (2020–2021) a higher percentage of Rio's residents were vaccinated than in other parts of Brazil. This was mainly due to trained specialists in family and community medicine (photo C).

'Family health teams', comprising a GP, nurse and a number of community health agents, have each provided health care for up to 3000 people.



A Rio's Metro Line 4, connecting people across the city

B Social development indicators for Rio and Brazil

	Rio	Brazil average
Life expectancy (years)	76.3	75.7
Infant mortality (per 1000)	6.2	12.4
Literacy rate (%)	99	93



C Family health clinic, Complexo do Alemão, Rio

Education

The standard of education is high in Rio compared with rural areas of Brazil. Rio has over 1000 primary schools, 400 secondary schools and six universities. Many migrants move to Rio to improve the education opportunities for their children.

In the poorer favelas (see page 172), where school attendance has traditionally been poor, several NGOs such as 'Schools for Tomorrow' are working with communities to improve education provision. The government provides grants to help children remain in school and supports extracurricular activities such as volleyball and football. In 2001 the Estácio de Sá university opened in Roçinha favela.

Access to resources

Water supply

Rio has the largest water treatment works in the world, and people living in the city have a much greater chance of having a fresh water supply than people in rural areas of the country. Since 1998 seven new treatment plants and 300 km of new water pipes have been built.

Around 80 per cent of Rio's water comes from the Guandu River. With an annual average rainfall total of over 1000 mm, there is plenty of water for the city as long as the infrastructure is in place and people use water sparingly. About 96 per cent of the city area has safe piped water, but only about 88 per cent of houses in the favelas are connected.

Activities

- 1 Construct a spider diagram to summarise how urban growth has created social opportunities in Rio, such as improvements in health care and education.
- 2 What is the evidence that Rio offers a better health care service than elsewhere in Brazil (table B)?
- 3 Make a list of some of the health care services provided in Rio (photo C).
- 4 What are the educational opportunities available for children in Rio?

Extension

Using information on these pages and your own online research, assess the extent to which the 2016 Rio Olympics improved access to services for the city's residents.



D The Angra dos Reis nuclear plant

Energy

Rio's inhabitants have greater access to an electricity supply than people living in rural areas. About 99 per cent of the city's residents have direct access to electricity. The system has recently been extended by the installation of new power lines and the construction of the Simplicio hydro-electric plant (2013), which increased the city's supply of electricity by 30 per cent. Two nuclear reactors have been constructed and a third is due to start operating in 2023 (photo D). In the Santa Marta slum, a community energy programme has fitted over 150 solar panels to the roofs of many buildings, providing affordable clean energy.

Practice question

Explain why urban change in a named city in an LIC or NEE has created access to health services and education. (6 marks)

Tips

- The command word 'explain' means that reasons must be given why urban growth creates access to health care and education.
- Write about both health care and education and aim for a balanced answer.
- Use facts and figures from your case study (Rio) to support your answer.

13.5 Economic opportunities in Rio

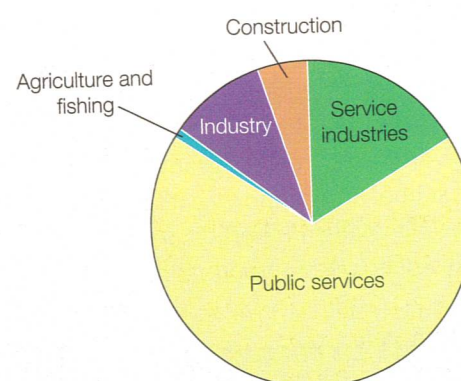
On this spread you will find out how the industrial areas of Rio have become a stimulus for economic development

Economic opportunities for growth

Economic development has brought improvements to Rio's roads, transport, services and environment. Growing economic prosperity has attracted large companies to Rio from other parts of Brazil and South America, as well as from abroad. These developments have created a range of new **economic opportunities** in the formal economy.

There are several factors associated with Rio's industrial growth that have helped to stimulate economic development in the city.

- Rio has one of the highest levels of income per head in the country, creating high demand for services and retail. A growing number of jobs are in the service sector and public services (pie chart A).
- Rio is Brazil's second most important industrial centre after São Paulo. Its extensive industrial areas (map B) and port facilities (photo C) have contributed to the city's rapid economic development.
- With its growing population, including skilled migrants from abroad, there is a large labour supply.
- Existing industries stimulate the development of new industries to support the supply chain (see the 'multiplier effect', page 224).
- Oil has been discovered offshore and this has stimulated a number of oil-related industries associated with extraction and processing.
- Rio is a popular tourist destination with its attractive beaches and rich historical heritage. The tourist industry has helped to stimulate economic development.



A Types of employment in Rio



C The port of Rio



B Rio's main zones

North Zone

- The city's main industrial and port areas
- Location of the city's main international airport

West Zone

- The industrial area of Campo Grande has low quality housing around the steelworks
- The main 2016 Olympic stadiums are in this zone

Centro

- The oldest part of the city, with the central business district (CBD) and main shopping area
- The financial district has the headquarters of Petrobras and CVBB, Brazil's largest oil and mining companies

South Zone

- Connected to the rest of Rio by tunnels through the mountains
- A wealthy district dominated by retail and the tourism industry

How have industrial areas stimulated economic development?

Map B shows that the main industrial areas are concentrated in the North and Centro Zones, where they benefit from proximity to the port (photo C). Rio is the third busiest port in Brazil, exporting raw materials including coffee, sugar and oil. Oil refining and shipbuilding employ many local people, providing secure incomes and stimulating economic development. These industries attract investment and encourage supply chain industries to set up in the area, boosting the economy and creating employment opportunities.

Rio has one of the most diverse ranges of industries in any Brazilian city. It has a rapidly expanding service and quaternary sector as well as established traditional manufacturing industries, such as engineering, printing and publishing, pharmaceuticals and food processing.

Ternium steelworks, Sepetiba Bay

Brazil has rich iron ore deposits in the central Minas Gerais region. To exploit these reserves and stimulate economic growth, the Brazilian mining company Companhia Vale do Rio Doce (CVRD) partnered with the German steel company ThyssenKrupp Steel in constructing a giant steelworks on Sepetiba Bay in Rio's West Zone (map B).



D Ternium steelworks, Sepetiba Bay, Rio

Built in an area of great natural beauty, this has been a controversial project. However, it has triggered significant multiplier effects, attracting construction and supply industries into the area and stimulating economic development. These industries have created job opportunities and increased incomes for local people, many of whom live in poor quality housing. In 2017 ThyssenKrupp sold the steelworks to Ternium, an Argentinian company and the leading steel producer in South America (photo D).

The wide range of industries have stimulated economic development at a range of scales.

- The Brazilian and local government have benefited from tax revenues and investment into the city.
- Local people have secure employment, increasing disposable incomes and better health care and education for their children.
- Local communities, particularly the favelas, have benefited from investment and self-help projects, improving service provision such as electricity, water and sanitation.

Activities

- 1 Describe the location of the industrial areas in Rio (map B).
- 2 How has the port (photo C) contributed to Rio's growth?
- 3 How has the Ternium steelworks helped stimulate economic development?
- 4 Suggest how people living in favelas have benefited from economic development in industrial areas.

Extension

Research online to find out why the Ternium steelworks has been so controversial. To what extent has the controversy affected economic development?

Practice question

Discuss the importance of industrial areas in stimulating economic development in a named city in an LIC or NEE. (6 marks)

Tips

- The command word 'discuss' means there may be different opinions about the importance of industrial areas.
- Refer to the industrial areas of your chosen case study (Rio).
- Refer to the multiplier effect and consider the different scales of economic development.

13.6 Managing the challenges of urban growth

On this spread you will find out about the challenges associated with slums and squatter settlements in Rio

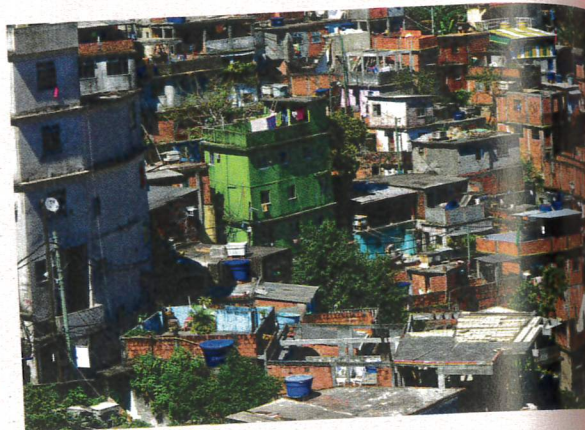
The challenges of managing slums and squatter settlements

The rapid growth of Rio's population has meant the city has not been able to build enough housing to meet demand. Whilst the wealthy middle classes have benefited from privately built apartments and villas in the South Zone (map B, page 170), the majority of the poorer population have been forced to live in slums or construct their own makeshift dwellings in squatter settlements.

Slums

Locally known as cortiços or 'guetos' (as in 'ghettos'), Rio's slums are usually older industrial or residential buildings abandoned when industry moved to new areas of the city. Many were built in the 1890s as tenement blocks for industrial workers, and they are mostly located in the city centre and near the port.

Most buildings have been illegally sub-divided, often with many people living in a single room. Dangerously overcrowded, they typically have inadequate services like bathrooms, kitchens or proper ventilation and lighting. They are often owned by landlords who charge high rents. Whilst many buildings have been demolished, some still stand (photo A).



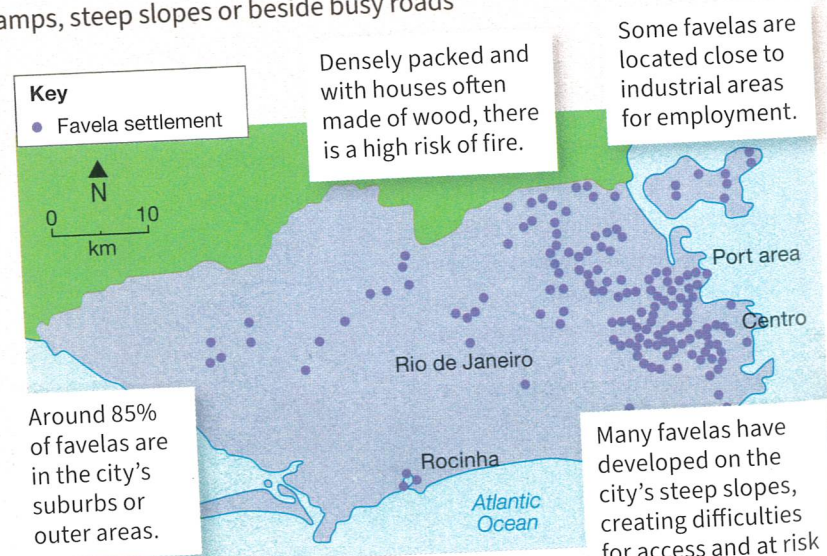
A Cortiços slum housing in Rio

Squatter settlements

Squatter settlements are unplanned uses of land by homeless people, and they may be improved over time. There are three types of squatter settlement in Rio:

- **Loteamentos** – illegal subdivisions of land without any proper infrastructure, but with a planned layout. These are mainly located in the industrial area of Campo Grande in the West Zone of the city (map B, page 170).
- **Invasões** – poor and temporary makeshift dwellings built on marginal (often dangerous) land such as river banks, swamps, steep slopes or beside busy roads and motorways.
- **Favelas** – self-built housing on public or private land which initially lacks any proper infrastructure. Over time, services such as water and electricity may be introduced.

Favelas are the most common type of squatter settlement in Rio. There are around 1000 favelas across the city, housing about 24 per cent of Rio's population (map B). In recent years the city authorities have controversially cleared the favelas near the city centre to make the area more attractive to businesses and tourists.



B The distribution of Rio's favelas

The challenges of living in favelas

Construction

- Houses were initially poorly constructed as they were built illegally. They are now mostly built from concrete and brick.
- Heavy rain from storms can cause landslides on steep slopes. In 2010, 224 people were killed and 13 000 lost their homes when houses were swept away.
- There is limited road access due to the steepness of the slopes.

Services

- In the non-improved favelas, around 12% of homes do not have running water, over 30% have no electricity and around 50% have no sewage connections.
- Many homes use illegal connections to electricity pylons.
- Sewers are often open drains.
- Drinking water often comes from tapping into city water mains – located at the bottom of the steep slopes.

Unemployment

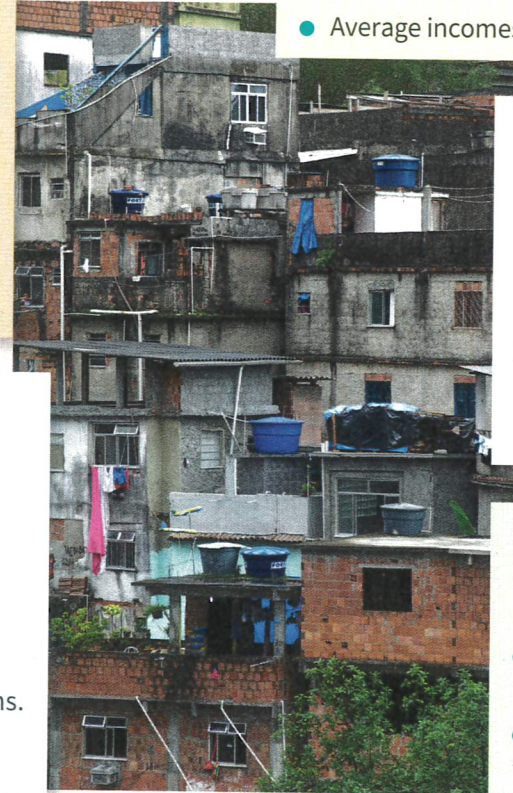
- Unemployment rates are as high as 20%.
- Much employment is poorly paid with irregular jobs in the informal sector.
- Average incomes may be less than £75 a month.

Crime

- There is a high murder rate of 20 per 1000 people in many favelas.
- Drug gangs dominate many favelas.
- Many inhabitants distrust the police because of violence and corruption.

Health

- There are population densities of 37 000 per km².
- Infant mortality rates are as high as 50 per 1000.
- Waste can build up in the street, increasing the danger of disease.
- Occasionally fires break out. Smoke is harmful to health.



C A favela on a Rio hillside

Activities

- 1 What is a 'slum' and how is it different from a 'squatter settlement'?
- 2 What are the challenges created by favelas being constructed on steep slopes?
- 3 Suggest how the rapid urban growth of Rio has contributed to the housing challenges.

Extension

Suggest strategies that Rio's city authorities could adopt to reduce the challenges associated with slums and squatter settlements.

Practice question

To what extent has urban growth resulted in the development of slums and squatter settlements in a named city in an LIC or NEE? (9 marks)

Tips

- 'To what extent' means you have to show how far you agree or disagree with the statement.
- You must write about both slums and squatter settlements in your answer, but you do not need to write the same amount on both.
- Use detailed information from your case study (Rio).

13.7 Managing water, sanitation and energy

On this spread you will find out about providing clean water, sanitation systems and energy for Rio

What are the challenges with the provision of basic services?

The rapid population growth of Rio, the city's physical geography and the high proportion of people living in densely packed favelas and cortiços present significant challenges in the provision of basic services. One of the main challenges of service provision is the inequality between different areas.

Water supply

In the hills above the city is the Guandu treatment plant, the world's largest water treatment plant, which supplies 92 per cent of Rio's fresh water. Despite the plentiful supply, around 12 per cent of the city's population do not have access to clean running water. Over one-third of water is lost through leaky pipes, fraud and illegal access.

Rio frequently experiences water shortages, mainly due to problems with infrastructure. In January 2020 residents throughout the city found water to be murky and foul-tasting, with the problem most extreme in the favelas. Here, people described the water coming out of taps as tasting like mud. Many could not afford to buy bottled water.

Providing access to water in the favelas is difficult. With many residents having no legal proof of ownership, the city's water and sewerage organisation (CEDAE) do not have a duty to supply water to individual households. Instead, water is supplied to a central area for residents to access. Underground pipes are often accessed illegally to supply individual houses (photo A). Poor maintenance and leakages result in water being cut off, sometimes for several days.



A Water is only supplied to central areas in the favelas, where people have to wait their turn

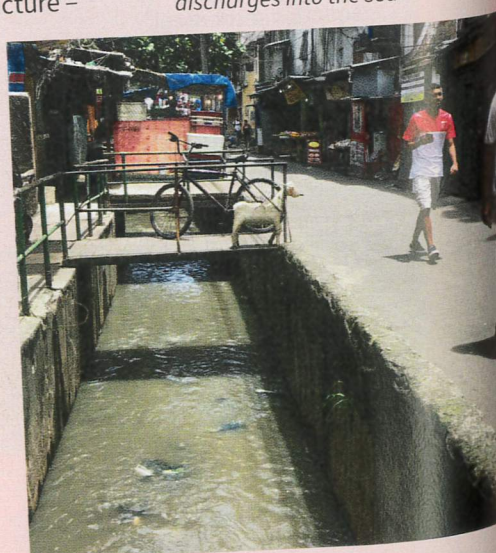
Sanitation systems

Sanitation systems involve the capture (toilets), transfer and treatment or disposal of human waste and wastewater. In Rio about 35 per cent of the city's sewage is transferred in open sewers and dumped into Guanabara Bay. The city's infrastructure – pipes and sewage treatment works – cannot cope with the volume of waste.

During the rainy season (April to October) rainfall can overwhelm the sewers that carry waste to the treatment plants. In addition, about 150 metric tons of industrial wastewater – which may be toxic or contaminated with chemicals – flow into the bay.

As with water supply, legal land ownership issues in the favelas means many houses are not connected to the city's sewage system.

- In the North Zone favela of Pica-Pau, most homes lack piped water and sanitation.
- In Rocinha favela, open sewers transfer raw sewage into the sea (photo B).
- Lack of adequate sanitation and piped water can lead to the spread of waterborne diseases such as cholera.



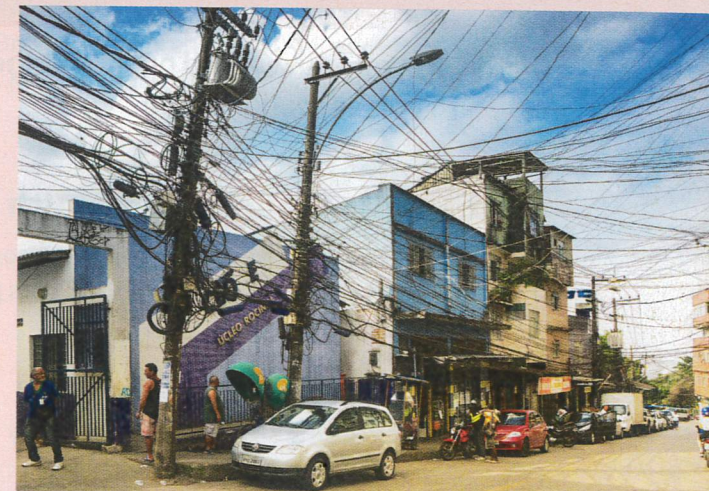
B An open sewer in Rocinha favela that discharges into the sea

Energy

Throughout Rio – including its favelas – about 99 per cent of all homes have access to electricity. However, the infrastructure lacks resilience, with illegal connections and overloading of the system often resulting in power cuts. In favelas, the illegal tapping of electricity is common (photo C). This is dangerous and can lead to fires and electrocution, as well as blackouts.

Demand for energy in Rio is high and rising rapidly, due to the city's growing population and expanding industrial sector. In common with many NEE and HIC cities, increasing wealth boosts energy demand for electrical appliances, lighting and heating or cooling systems. The 2016 Rio Olympics were a huge challenge for energy supply.

To address the challenges, power supply to the city has been increased and the new Simplicio hydro-electric complex has increased Rio's electricity provision by 30 per cent.



C Illegal electricity connections in Rocinha favela, Rio

Babilonia favela energy project

In the favelas, community energy projects are being introduced, using photovoltaic systems to harness solar energy. In Babilonia favela a non-governmental organisation called Revolusolar has installed solar panels to provide sustainable energy to 35 families, two shops and one school (photo D).

D Solar system installer Natalia Noel Nazario checking solar panels installed in Babilonia favela, Rio



Activities

- a** Where does most of Rio's water come from?
- b** What are the problems with Rio's water infrastructure?
- a** Why do many houses in the favelas not have direct piped water supplied by the city authority?
- b** How do these residents obtain their water (photo A)?
- Outline the issues associated with Rio's sanitation system (photo B).

Extension

Using photos C and D, evaluate the options for providing Rio's favela residents with a safe and reliable electricity supply.

Practice question

Assess the challenges of providing an efficient water supply and sanitation system in an LIC or NEE city. (9 marks)

Tips

- In 'assessing', you should consider the relative importance of each of the challenges – which do you think are most important and why?
- You should write about both water supply and sanitation systems. You do not need to write about electricity.
- Use details from your case study (Rio) to support your answer.

13.8 Social challenges – access to health and education

On this spread you will find out about the social challenges of providing access to health and education in Rio

What are the challenges in health and education provision?

Rio has a youthful population with a high proportion of people in their 20s and 30s. There are a large number of children in the city, which puts pressure on the health and education systems.

Health

Health care in Brazil is free for all residents and is provided through the Sistema Único de Saúde (SUS) – the Unified Health System. Although there is greater access to health care in Rio than in surrounding rural areas, there are only six hospitals in the city. There are also insufficient health clinics to serve local communities.

There are great social and economic **inequalities** across the city. Table A compares health indicators for two districts in the West Zone. Barra da Tijuca is an affluent beach district characterised by expensive apartments and shopping malls. In contrast, Cidade de Deus is a high-density, low-income area built by the government in the 1960s to rehouse people from inner-city slums.

The challenges of health care provision are particularly difficult in the favelas.

- On average, favela residents live 13 years less than people in the wealthier parts of Rio.
- In Rocinha, there are about 6000 people suffering from at least one serious health problem.
- Health care services are poor, with just two health clinics for a population of about 100 000 (photo B).
- The incidence of tuberculosis is ten times the Brazilian average and many people suffer from diseases associated with inadequate sanitation systems and a lack of safe water (see page 174).
- The Covid-19 pandemic in 2020–2021 had devastating impacts on people living in overcrowded favelas (photo C). Infections spread rapidly through the densely packed communities. Many people were not able to isolate at home because they could not afford to stay away from work.

District	Zone	Infant mortality rate	Pregnant women getting medical care	Average life expectancy
Cidade de Deus	West	21 per 1000	60%	45
Barra da Tijuca	West	6 per 1000	100%	80
Rio de Janeiro (as a whole)		19 per 1000	74%	63

A Comparing health in two contrasting districts with Rio as a whole



B Primary health care clinic in a favela



C Disinfecting the streets in a favela against Covid-19

Education

In Rio about 90 per cent of children aged ten can read and write because there are more schools compared to rural areas. Despite education being compulsory in Brazil for children aged 6–14, about 25 per cent of the poorest children do not attend school regularly. Most of these live in the favelas.

- Rio das Pedras is the third largest favela in Rio, with a population of over 50 000 and only two public elementary schools.
- Rio das Pedras has only one public high school, and Maré in the North Zone has none.

Only about half of all children in Rio continue with education beyond the age of 14. Due to the high adult unemployment rate many are expected to work to help support their family. There is a shortage of local schools, and children often have to travel long distances, which can be expensive and time-consuming (photo D). Teenage pregnancy is another cause of pupils dropping out of school.

Violence and drug-related crime in favelas can have an impact on schooling, and schools may be shut for several days during a police operation. Schools were closed during the Covid-19 pandemic and many children were forced to stay at home. This had a detrimental effect on their education due to the lack of computers and poor internet connection.

Several NGOs are working to provide education in Rio's favelas. Founded in 1998, Alfazendo works to improve literacy and prepare students for college exams in Cidade de Deus.



D Children in a favela making their way to school

Activities

- Look at table A.
 - Compare the infant mortality rates in the two districts. How do they compare with the average for Rio?
 - Why is infant mortality rate a good indicator of health care?
 - Calculate the difference in life expectancy between the two districts.
 - What is the evidence that residents of Barra da Tijuca enjoy better health care than those living in Cidade de Deus?
- Suggest why favelas were particularly badly affected by the Covid-19 pandemic (photo C).
- What are the benefits of local health clinics being located in the favelas (photo B)?
 - Consider the challenges of establishing health clinics in favelas.

Extension

Outline the difficulties faced by the authorities in providing good education provision for the inhabitants of Rio. How have these difficulties contributed to the development of inequalities across the city?

Practice question

Discuss the challenges of providing good access to health care in an LIC or NEE city. (6 marks)

Tips

- The command word 'discuss' means that in addition to an overview of the topic you need to consider the different viewpoints of the people involved.
- Focus on writing about health care only. You do not have to write about education.
- More than one challenge must be considered – aim to write about at least two or three.
- Use details from your case study (Rio).

13.9 Challenges of social and environmental issues

On this spread you find out about the challenges of unemployment, crime and the environmental issues of waste disposal, pollution and traffic congestion in Rio

The challenges of unemployment and crime

The rapid growth of Rio's population, due to high rates of migration and natural increase, has created social challenges such as unemployment and crime. These issues particularly affect low-income groups living in the city's favelas.

Unemployment

Between 2017 and 2020 the unemployment rate in Rio averaged around 15 per cent, compared to just over 4 per cent in the UK. Female unemployment in Rio is higher than male unemployment, reaching an all-time high of 18 per cent in 2019. Youth unemployment is also high.

As table A shows, there are huge inequalities in unemployment rates, and rates in the favelas can be very high. It is impossible to measure unemployment accurately due to the large number of people employed in the *informal economy* (e.g. street vendors, labourers and maids) (photo B). An estimated 3.5 million workers do not have a formal employment contract, with no insurance or unemployment benefits. They do not pay any taxes and the government receives no income.

There are several reasons for the high rates of unemployment in Rio:

- In 2015 Brazil was hit by an economic recession.
- In 2018 the Brazilian government faced an economic crisis, and many people employed in public services (such as health and education) lost their jobs.
- Corruption involving Brazil's Rio-based oil company Petrobras resulted in many job losses.
- The stimulus provided by the 2016 Olympics was short-lived, with few long-term employment opportunities.

Crime

Robbery and violent crime, including murder and armed assault, occur regularly in Rio. Powerful gangs control drug trafficking in the favelas. Since 2017 the murder rate has increased by 20 per cent, associated with the rise in unemployment and a reduction in the police budget since the Olympics.

Police regularly target drug gangs in the favelas. In 2020 at least 25 people were killed after armed police stormed Jacarezinho, one of Rio's largest favelas, in pursuit of drug traffickers (photo C). Jacarezinho has long been dominated by one of Brazil's most violent criminal organisations, the Red Command.

A Unemployment rates in Rio

District	Zone	Unemployment rate
Barra da Tijuca (wealthy, middle-class)	West	2%
Complexo do Alemão (favelas)	North	Estimated 37%



B Working in Rio's informal economy



C Police raid in Jacarezinho favela

Environmental challenges in Rio

Waste disposal

Each year Rio produces 3.5 million tonnes of waste, of which less than 2 per cent is recycled. Most of the city's waste ends up in the recently opened Seropedica landfill site, about 70 km from the city. Landfill gas (LFG) produced here is used to generate electricity or is converted to fuel waste collection vehicles.

Waste collection varies hugely across the city and is particularly infrequent in the favelas where narrow, steep streets make access difficult. Waste litters the streets and much of it enters rivers flowing into Guanabara Bay (photo D), causing algal blooms, contamination and floating debris.



D Waste from Rio collects in Guanabara Bay

Water pollution

Guanabara Bay is highly polluted, causing a major threat to wildlife. Commercial fishing has declined by 90 per cent in the last 20 years. There is a danger that pollution could affect Ipanema and Copacabana beaches, which would have an impact on tourism and the local economy. There are several sources of Rio's water pollution:

- Many of the rivers flowing into the bay are heavily polluted with sewage and waste.
- Over 50 tonnes of industrial waste is discharged each day.
- Oil spills and other ship discharges contaminate the bay.

Traffic congestion and air pollution

Rio is the most congested city in South America. Traffic congestion increases stress and levels of air pollution. It also wastes time for commuters and costs businesses huge amounts of money in delays.

- Rio's mountainous coastal location restricts the options for road building, causing congestion on the city's main routes.
- Car ownership has increased by 40 per cent in recent years.
- Air pollution is estimated to cause 5000 deaths per year.
- Heavy traffic and exhaust fumes combine with industrial pollutants to create a brown smog which hangs over the city.



E Traffic congestion in Rio

Activities

- 1 a What happens to most of Rio's waste?
b What are the problems associated with waste collection from the favelas?
- 2 a Why is water pollution concentrated in Guanabara Bay?
b What are the main causes of water pollution in Rio?
- 3 Explain the causes of air pollution in Rio.
- 4 Why does Rio experience severe traffic congestion?

Extension

Evaluate the options for reducing Rio's environmental issues.

Practice question

Assess the challenges of managing environmental issues in an NEE or LIC city. (6 marks)

Tips

- In 'assessing', consider the relative importance of the challenges.
- You should write about at least **two** issues from waste disposal, water and air pollution and traffic congestion.
- Use details from your case study (Rio) to support your answer.

3.10 Planning for Rio's urban poor

On this spread you will find out about improvements to slums and squatter settlements aimed at improving the quality of life for the urban poor in Rio

What is quality of life?

Quality of life describes the extent to which a person is comfortable, healthy and able to enjoy life. Although largely subjective, it can be measured using the Physical Quality of Life Index (PQLI) which considers literacy, life expectancy and infant mortality. We will focus on Rio's urban poor who live in slums and squatter settlements, and how urban planning is helping to improve their quality of life.

How are favelas being improved?

Until 1980 the authorities in Rio did not acknowledge the existence of favelas. These areas were not shown on any maps. In the mid-1980s city planners felt that something needed to be done for the city's poorest citizens. Rather than destroy the favelas and squeeze their large populations into public housing, the city decided to upgrade them and provide essential services (photo A). After Rio was awarded the 2016 Olympics there was a move to destroy favelas in areas where Olympic facilities were being built.



A Building simple, low-cost housing

The Favela Bairro Project

The Favela Bairro Project (1995–2009) was a US\$1 billion 'slum to neighbourhood' project that aimed to integrate Rio's favelas into the fabric of the city by addressing issues of land ownership, infrastructure and service provision. The scheme involved over 250 000 residents in 73 communities. A typical plan would attempt to address the social, economic and environmental problems of a favela.

Social

- Daycare and after-school care, enabling adults to seek secure employment
- Improving adult literacy to increase employment opportunities and incomes
- Medical services for drug addiction, alcoholism and victims of domestic violence

Economic

- Inhabitants can apply to own their properties legally, encouraging them to improve their housing (self-help)
- Access to credit to allow people to buy materials to improve their homes

Favela Bairro Project

Environmental

- Replacement of wooden buildings with brick, making them permanent and less likely to be damaged by the weather
- Removal of houses from dangerous steep slopes
- Infrastructure improvements (water, sanitation and electricity)
- Widening and paving of streets to allow access for waste collection and emergency services

B Aims of the Favela Bairro Project

Extension

Evaluate whether the Favela Bairro Project will have more long-term benefits for favela inhabitants or the city authorities.

How successful has the Favela Bairro Project been?

The city authorities worked closely with local communities to make the project successful. By 2005 around 100 favelas had been improved. Residents had been granted land ownership, roads had been paved and new childcare centres opened. Training was available in hygiene, computing and community development.

The quality of life, mobility and employment prospects of the inhabitants improved considerably. Photo C shows the cable car system in Complexo do Alemão, a 3.5 km public transport system which has improved mobility across the favela. Described as 'the most ambitious squatter settlement in the world', the scheme has been recognised as a model by the UN and has been used in other Brazilian cities.

Despite the successes, there have been a number of issues:

- Training for employment has had limited success, as many residents lacked the appropriate literacy skills – basic literacy was not addressed.
- Credit schemes were not widely available to help residents afford to improve their homes.
- Some of the new infrastructure improvements were costly and were not maintained.
- New elevated pavements have caused rainwater to flood homes.
- A 2005 study by the International American Development Bank found that, despite the improvements, mortality from vector-borne diseases such as malaria had not improved.
- Rents have risen in some of the improved favelas.

What has happened since?

In 2010 the Brazilian government announced a massive upgrade project as a legacy of the 2016 Olympic Games. The ambitious Morar Carioca programme aimed to improve over 800 favelas by installing water, sanitation and drainage systems, as well as improving roads and social services (photo D). Whilst some upgrades have taken place, progress has been slow. Conflicts have arisen where people have been forced to move and others face higher rents in improved areas.

Activities

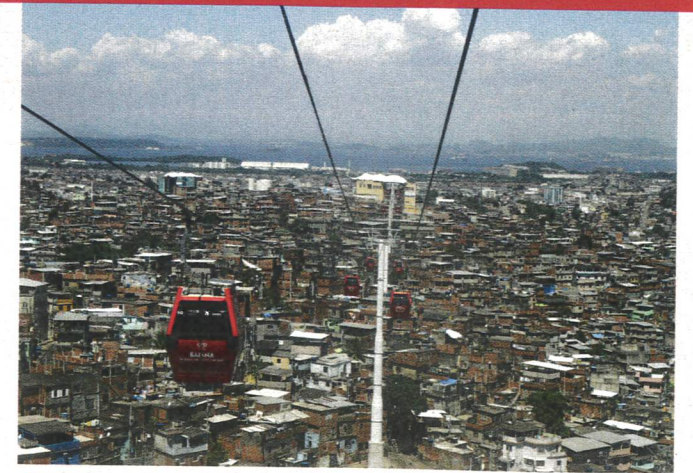
- 1 When was the Favela Bairro Project introduced and what were its aims?
- 2 Suggest why land ownership was considered so important.
- 3 Explain how **two** social improvements were designed to help improve people's quality of life.
- 4 Suggest why the building of the cable car is important to the people living in the Complexo do Alemão favela (photo C).
- 5 Construct a spider diagram to summarise the issues (failures) of the project. Highlight the one that you think is most important.

Practice question

Using an example, evaluate the success of urban planning in improving the quality of life for the urban poor. (9 marks)

Tips

- In 'evaluating', you need to consider both the advantages and disadvantages. Are some more important than others?
- Consider how urban planning has improved people's quality of life.
- Make use of facts and figures from your example (Favela Bairro Project, Rio).



C The cable car system in Complexo do Alemão



D An example of a favela improvement

11 Line chart and satellite image

On this spread you will use a line chart and satellite images to investigate the growth of Rio

Skills

- Constructing a line chart
- Calculating percentage change
- Extrapolating data
- Interpreting satellite images – estimating area and measuring length

How does the growth of Rio compare to Barra da Tijuca, one of the city's wealthiest suburbs?

In 1990 the urban area of Rio had a population of around 9.7 million. By 1993 the population had reached 10.1 million and the city officially became a 'megacity'. Since then the population has continued to grow, to reach around 13.5 million in 2020 (table A).

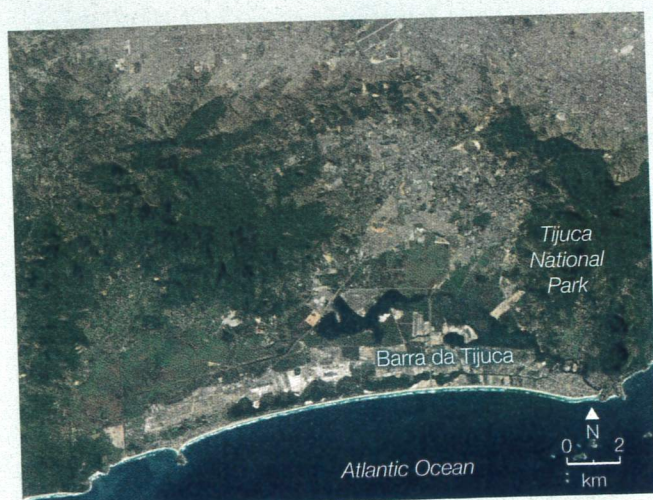
Barra da Tijuca (Barra) is a coastal suburb in Rio's West Zone (see page 170). It is one of the wealthiest neighbourhoods in the city and in 2016 hosted most events in the Olympic Games.

Barra is one of the city's fastest growing neighbourhoods. Between 1990 and 2010 the population tripled from 100 000 to 300 000. One of its main attractions is the 18 km sandy beach, the longest in Rio, and a huge shopping mall. The Barra Olympic Park near Lake Jacarepagua provides superb sporting facilities, including swimming, tennis and basketball. Luxury apartments and villas accommodate most of Barra's middle-class population.

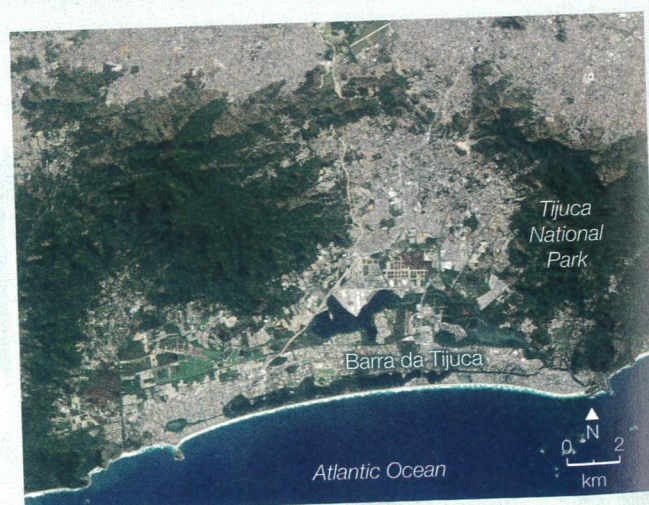
The two satellite images (photos B and C) show the growth of Barra between 1984 and 2015. These are natural-colour images collected by Landsat satellites. Forested areas are shown as green and urban areas grey.

Date	Population (millions)
1950	3.0
1960	4.5
1970	6.8
1980	8.8
1990	9.7
2000	11.3
2010	12.4
2020	13.5

A Population of Rio, 1950–2020



B Satellite photo of Barra da Tijuca, 1984



C Satellite photo of Barra da Tijuca, 2015

Skills

- Look at table A.
 - Calculate the population increase in Rio between 1950 and 2020.
 - Calculate the percentage change of population between 2010 and 2020.
 - Assuming the rate of change stays the same, calculate the expected population in 2030.
 - Calculate the rate of change between 1990 and 2010. Compare this with the rate of change for Barra (100 000 in 1990 and 300 000 in 2010).
- Use the data in table A to construct a line chart to show Rio's population growth between 1950 and 2020 and its predicted growth to 2030.
 - Draw axes for your line chart. The horizontal axis (x-axis) should extend from 1950 to 2030. Use equal intervals for each ten-year period.

The vertical axis should extend from 0 to 15 million, also using equal intervals.

- Use the data in table A to plot a cross for each population value.
 - Join the crosses to complete the line chart.
 - Label the axes and give your chart a title.
- Look at the two satellite images photos B and C. Compare the change of land use between 1984 and 2015.
 - Draw a grid with each square representing an area of 4 km² (2 km × 2 km) on a sheet of tracing paper (or print and draw a grid directly onto a copy of the photos).
 - Place the tracing paper grid over each photo and count the squares for each type of land use. Copy and complete table D to compare the data.
 - Calculate the total area for each land use.

D Comparing land use at Barra da Tijuca, 1984–2015

Land use	1984		2015	
	Number of squares	Total area km ² (number of squares × 4)	Number of squares	Total area km ² (number of squares × 4)
Forest/grass				
Urban				
Sea/water				
TOTAL				

Analysis

- Look at table A and your completed line chart.
 - Using your completed graph, extrapolate the line to predict the population for 2030.
 - How does this compare with your answer to Skills activity 1c?
 - Suggest the advantages and disadvantages of extrapolating population data in cities such as Rio and districts such as Barra.
- Look at satellite photos B and C.
 - What is the evidence that Barra has a sandy beach?
 - In what direction does the beach face?
 - Use the linear scale on the images to calculate the length of the freshwater lagoon just inland from the beach.
 - Describe the physical growth (urban sprawl) of the urban area between 1984 and 2015.

- Suggest reasons why some areas of the forest remain undeveloped.
 - Suggest how Barra might expand in the future.
- Look at your completed table D. Describe the changes in land use between 1984 and 2015.

Evaluation

- To what extent does a line chart support the use of tabulated data in extrapolating a trend?
- Assess the accuracy of estimating the area of different land uses using satellite photos.

Practice question

In 2035 the population of Rio is predicted to be 14.8 million. Assuming an annual rate of growth of 0.5 per cent, does the predicted population reach 15 million in 2037? (1 mark)

14 Urban change in the UK

14.1 Where do people live in the UK?

On this spread you will find out about the distribution of population in the UK and the location of the major cities

How many people live in the UK?

Graph A shows how the population of the UK has changed since 1951 and how it is likely to change in the future. The total population in 2021 was 66.8 million.

How is the population distributed?

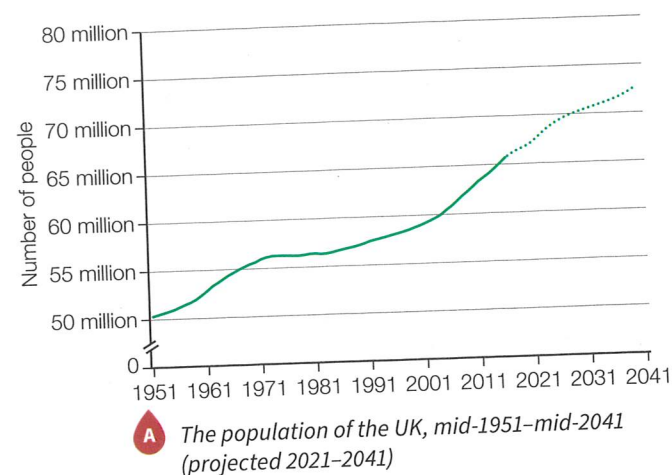
The UK population is unevenly distributed, with 84 per cent living in urban areas. One in seven of those live in London and the south east. In contrast, many highland regions of Scotland and Wales are very sparsely populated. These are upland areas that are remote and can experience harsh climatic conditions.

The UK's urban areas

The distribution of the UK's major cities and most densely populated areas reflect its industrial past (map B). This was shaped by the Industrial Revolution in the eighteenth century. There was a development of heavy industries and concentration of population near supplies of coal and raw materials such as iron ore. For example:

- the Central Lowlands of Scotland (Glasgow)
- north east England (Newcastle and Sunderland)
- Lancashire (Manchester)
- Yorkshire (Leeds and Sheffield)
- South Wales (Cardiff and Swansea).

London developed because of its position as the capital of the UK with associated political and administrative functions. From being the capital of a large empire it became a global city and a financial centre. Belfast, Cardiff and Edinburgh grew because of their function as capital cities of Northern Ireland, Wales and Scotland. The UK's second city, Birmingham, grew mainly as a centre of industrial innovation due to its key position in the centre of the country. The UK's position as an important trading nation explains the growth of ports such as London, Liverpool and Bristol.

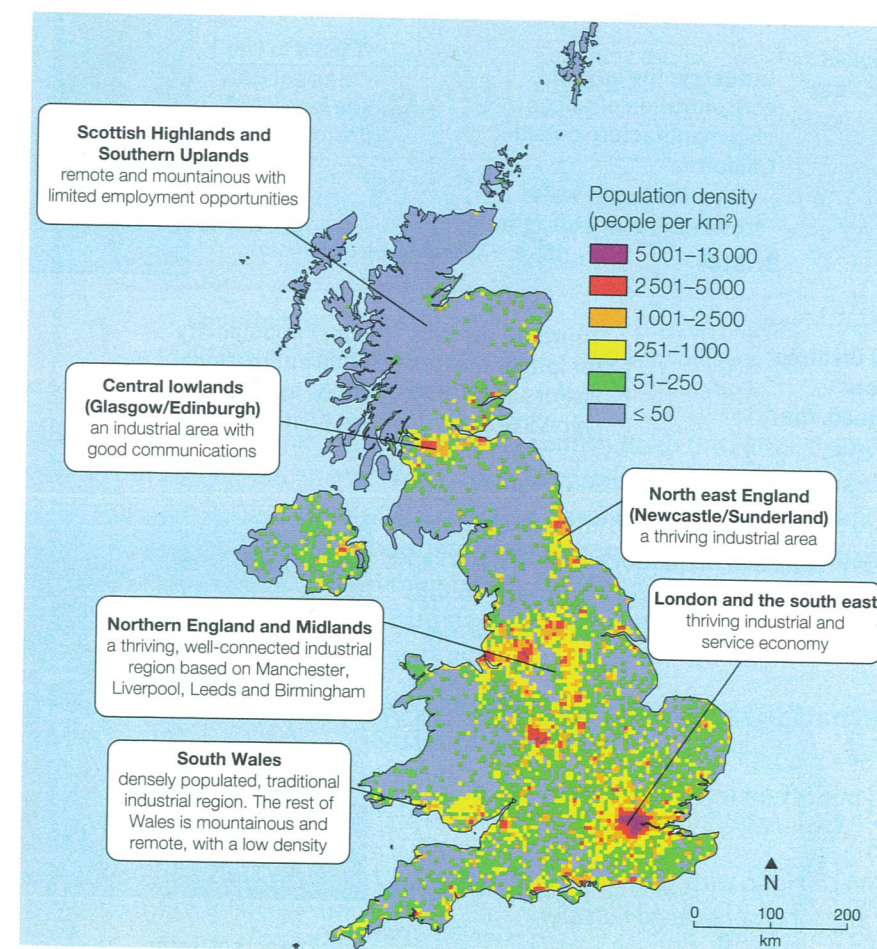


How might this distribution change?

There are key factors affecting the distribution of the UK population (map C).

- There has been a general drift towards south east England and London – one of the world's financial, business and cultural centres.
- Since 1997 annual inward migration to the UK has been greater than outward migration. The net migration (inward minus outward migration) has declined every year from 2015 to 2021. This is likely to continue with the UK's exit from the EU.
- There has recently been a movement from urban to rural areas. The UK has an increasing proportion of older people, many choosing to retire to live on the coast or in the country.

C The distribution of the population in the UK



Extension

Suggest reasons for the uneven distribution of the UK's population.

Skills

Use map B to draw a bar graph to show the population of the UK's major cities.

Activities

- 1 What percentage of the UK's total population live in each of its four nations (map B)?
- 2 How much bigger is London than the second biggest city in the UK?
- 3 Using map C, identify three areas of high population density and three areas of low population density.

Practice question

Using map C, describe the distribution of population in the UK. (4 marks)

Tips

- The command word is 'describe', so you should not give any explanation.
- In your answer you should include all four nations of the UK.
- Demonstrate your use of map C by referring to specific locations and using the key.

15 Sustainable urban development

15.1 Planning for urban sustainability

On this spread you will find out about urban sustainability

What is urban sustainability?

Urban sustainability (**sustainable urban living**) involves creating an environment that meets the social, economic and environmental needs of existing residents without compromising the same for future generations. Diagram A identifies a range of features associated with urban sustainability.

We will focus on water and energy conservation, waste recycling and the creation of green spaces.

Water conservation

A sustainable water supply depends on individuals using as little water as possible. This involves conserving and recycling water rather than relying on new supplies from reservoirs or underground aquifers. There are several approaches to **water conservation** in cities:

- installation of water saving devices in the home, including water meters to encourage homeowners to use water sparingly
- collecting rainwater in tanks for watering the garden
- creating 'rain gardens' (gardens watered by downpipes from rooftop gutters) and green roofs to store water and create green spaces.

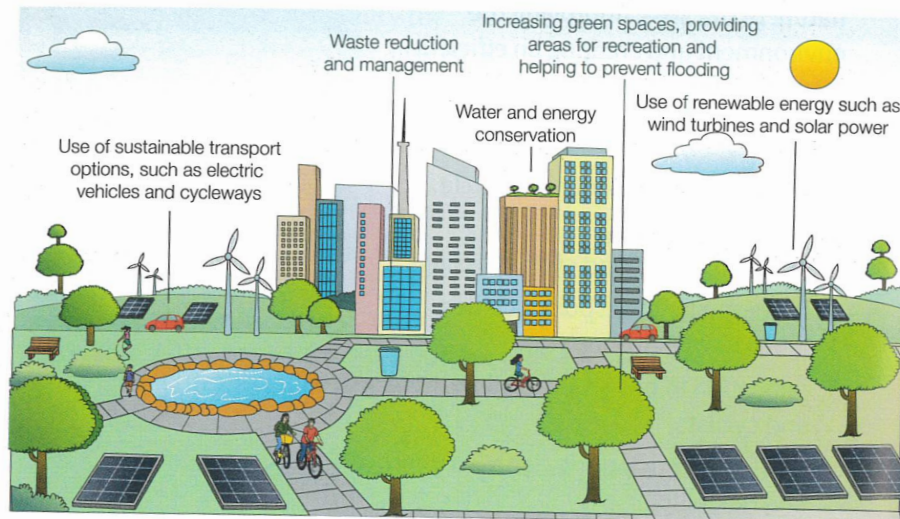
Sustainable Drainage Systems (SuDS)

SuDS aims to reduce surface water flooding by capturing and storing water to reduce its speed of transfer. This can be achieved by:

- using green roofs to store water
- planting vegetation to use up water, slow down its transfer and filter out pollutants
- creating and maintaining wetlands for water storage (photo B)
- using permeable surfaces, such as pavements and driveways, to slow water transfer through the soil.

Energy conservation

Cities make great demands on energy for heating (and, increasingly, cooling), lighting, power and transport. Until recently, this mainly involved burning fossil fuels, creating harmful greenhouse gas emissions. Today, most energy comes from renewable sources and many cities are embracing energy conservation.



A Urban sustainability



B Sustainable drainage system in Lancashire

- Combined heat and power (CHP) technology captures heat produced when generating electricity, rather than releasing it to the atmosphere.
- Energy efficiency of buildings can be increased by insulation and double glazing. In the UK, buildings are required to have an Energy Efficiency Rating. The higher the rating, the greater the efficiency and the cheaper the energy bills.
- The use of energy-efficient appliances can be encouraged.
- Solar panels and wind turbines can be used to generate electricity.

Waste recycling

Waste recycling involves recovering and reprocessing waste materials. Recycling saves raw materials and reduces energy use. In 2020 the UK government set a legally binding target of recycling 65 per cent of waste by 2035, with no more than 10 per cent going to landfill sites.

Cities generate huge quantities of domestic and industrial waste. Whilst some of it is toxic and cannot be reused, much of it can be recycled (e.g. paper, cardboard, glass, plastic, garden and food waste). Seven million tonnes of food waste is thrown away each year in the UK, the equivalent of £700 per family. This is a huge waste of energy, water and packaging, as well as transportation and storage costs. Two methods of recycling are used:

- In-vessel composting – food is mixed with garden waste.
- Anaerobic digestion – microorganisms break down food to create compost and also gas, which can be used to generate electricity (diagram C).

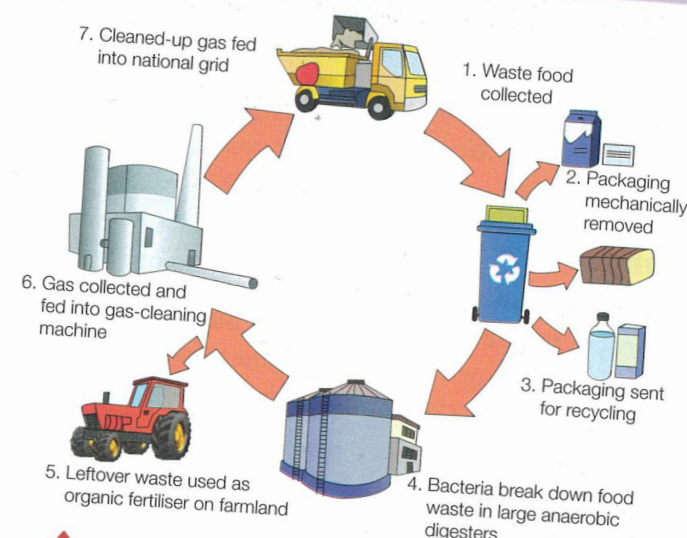
Activities

- 1 Identify measures of water and energy conservation shown in diagram A.
- 2 How can water be conserved in the home?
- 3 a What is 'SuDS'?
b How can SuDS help to reduce the risk of flooding (photo B)?
- 4 How can an Energy Efficiency Rating help to conserve energy?

Extension

Carry out research online into the creation of green space in a city of your choice. Assess the extent to which this has contributed towards sustainability in your chosen city.

Sustainable urban development



C Recycling food waste

Creating green space

Green space contributes to urban sustainability in several ways:

- acting as the city's 'green lungs' by absorbing carbon dioxide from the air and releasing oxygen and water, helping to keep cities cool and conserving energy
- providing areas of recreation as well as improving mental health
- providing important wildlife habitats and promoting biodiversity
- trees protect soil from heavy rainfall and reduce runoff thereby helping to reduce the flood risk.

One of the most famous newly created green spaces is the High Line in New York, USA. Here a derelict elevated railway line has been converted into a 2.3 km linear green park with trees and community gardens. (See page 193 about urban greening in Bristol).

Practice question

Explain how water and energy conservation can help to increase urban sustainability. (6 marks)

Tips

- Focus only on water and energy conservation.
- In your explanation, make clear links between water and energy conservation and urban sustainability.
- Show you understand the term 'urban sustainability'.
- Refer to examples, facts and figures.

15.2 Sustainable traffic management strategies

On this spread you will find out how urban transport strategies can reduce traffic congestion

Impacts of traffic congestion

Traffic congestion occurs when the volume of traffic exceeds the capacity of the roads. It often results in slow traffic, queues and long journey times. The impacts of traffic congestion can be categorised as follows:

- **Social** – people may be late for work, miss appointments and may become anxious and stressed.
- **Economic** – congestion causes expensive delays for businesses and hauliers. In 2018–2019, traffic congestion in London cost businesses an estimated £4.9 billion and in Manchester, £176 million.
- **Environmental** – congestion increases exhaust emissions, reducing local air quality and increasing a city's carbon footprint. It also uses more fuel, increasing transport costs.



A Traffic congestion in central Bangkok, Thailand



B Congestion charging and ultra-low emission zone in London

Transport management strategies

Urban transport management strategies need to reduce the impact on people and the environment whilst serving the needs of the urban area. Management strategies can be divided into 'carrot' and 'stick' measures.

- 'Carrot' measures give incentives for changing to more sustainable actions.
- 'Stick' measures discourage or prohibit non-sustainable actions.

'Carrot'	'Stick'
Encourage people to walk and cycle by widening pavements and creating more cycleways.	Establish exclusion zones in residential areas where large lorries are prohibited.
Increase use of public transport, making it cheap, safe and pleasant to use.	Establish ultra-low emission zones (ULEZ) where highly polluting vehicles are banned or pay high charges (photo B).
Provide dedicated lanes for buses, bikes and cars with more than one occupant.	Introduce a Congestion Charge in cities to make it expensive for cars to enter. In London, the congestion charge is £15 per day (2021) (photo B).
Establish 'Park and Ride' schemes to keep cars out of city centres.	Construct speed humps and other traffic-calming measures to slow traffic and avoid queues.
Introduce integrated transport systems (ITS) where different forms of transport are linked together, for example bike racks at railway or underground stations.	Restrict parking in city centres, with few car parks with high charges, and restrict on-street parking to residents only.

Extension

Compare the transport strategies for Bristol (page 192) with Singapore and Beijing (page 209).

Singapore

Singapore's sustainable urban public transport strategy is based on a rapid rail and bus transit system. Commuters can take a bus or train to a transport hub and then onward to the city centre.

The public transport system is comfortable and efficient. There are over 4500 buses and 450 routes and all fares are strictly controlled. There are plans to nearly double the number of rail lines to over 300 by 2030. Rates for travel are lower or even free at certain times of day. By 2030 it is expected that:

- 75 per cent of journeys will be made by public transport
- 85 per cent of journeys of less than 20 km will take less than one hour
- 80 per cent of the population will live within walking distance of a railway station.

The growth in car ownership has been reduced from 7 per cent to 0.25 per cent over ten years. Anybody wishing to buy a car has to purchase a Certificate of Entitlement costing nearly £40 000 (three times the price of a medium-sized car!).

An Electronic Road Pricing system (ERP) operates on expressways to regulate traffic flow (photo **C**). Pricing is determined by traffic conditions, with motorists encouraged to drive at a steady optimal speed. When traffic flows freely, ERP rates are lower than when roads become congested.



C ERP in Singapore

Beijing

Six million cars are registered in Beijing, compared with about 2.5 million in London. Congestion often causes gridlock in the city, and levels of air pollution are often dangerously high. Several measures have been introduced to try to combat the problem.

- Recent restrictions have led to a 20 per cent reduction in car use. These include banning each car for one day a week, based on its registration plate.
- A rapid bus transit system has been created and 30 new Metro lines have been constructed.
- Bike parks have been established at public transport hubs.



D Bike parking in Beijing

Activities

- 1 Complete a table to summarise the effects of traffic congestion under three headings: social, economic and environmental (photo **A**).
- 2 What is meant by 'carrot' and 'stick' approaches to traffic management?
- 3 Construct a spider diagram to summarise the 'carrot' and 'stick' approaches in Singapore and Beijing (photos **C** and **D**).

Practice question

Explain how urban transport strategies are used to reduce traffic congestion. (6 marks)

Tips

- You must refer to more than one transport strategy.
- In your explanation, make clear links between each transport strategy and how it reduces congestion.
- Try to refer to examples and use the correct geographical terminology.