Urban Environments Revision Notes – Paper 1

**Key terms:**

* Settlement
* Settlement hierarchy
* Site of a settlement
* Settlement function
* Urban area
* Conurbation
* Megacity
* Economic activity
* Retail
* Commercial activity
* Service activity
* Manufacturing
* Residential activity
* Informal sector
* Formal sector
* Push factor
* Pull factor
* Central Business District
* Inner City
* Suburbs
* Rural-urban fringe
* Centripetal movement
* Centrifugal movement
* Decentralization
* Core-frame model
* Bid-rent theory
* Urbanization
* Suburbanization
* Counter-urbanization
* Re-urbanization
* Urban regeneration
* Gentrification
* The Donut Effect
* Deindustrialization
* The cycle of urban deprivation
* Urban stress
* Microclimate
* Urban heat island
* Urban ecological footprint
* Eco-City
* Smart City
* Resilient City

**Case study of the growth of a megacity (LIC/MIC): Mumbai, India**

**Including:**

* Reasons for growth
* Urban processes e.g. urbanization, suburbanization, counter-urbanization, new town development (planned growth)
* Consequences of growth
* Symptoms of urban stress
* Reasons for the need to develop/improve infrastructure
* Contested land-use change (Dharavi)
* Management of urban problems

**Case study notes part 1**

**Including:**

* Urbanization
* Consequences of urban growth (e.g. slum development e.g. Dharavi)
* Plans for urban redevelopment
* Patterns of economic activity – including the informal and formal sectors

**The growth of Mumbai**

* Mumbai is located on a peninsular on the Western coast of Maharashtra state in western India, bordering the Arabian Sea.
* Protected from the Arabian Sea by a peninsular art the southern end of Salsette Island, it had access to sea on two sides.
* The British colonial administration in India developed the sheltered inlet into a major port.
* As with many major global ports area around the port became industrialised – processing goods for export and handling imports.
* The city grew during British rule as variety of services grew up around the port and continued to grow after British left in 1947.
* Mumbai is a **megacity** and a world city, it has grown enormously since the 1950’s and gives a great case study of urbanization and its issues within a developing country.
* Mumbaiis a sprawling megalopolis, spread over 600 sq km. Its population has grown at twice the rate of Maharashtra’s and 2.5 times that of the country of India in the past 100 years.
* Since 1971, the population of Mumbai has risen from 8 million in 1971 to 21 million today.  .
* The causes of urbanisation are multiple, but involve a high level of **natural increase** within Mumbai itself and **in-migration** principally from the surrounding district of Maharashtra but also from neighbouring states.
* Mumbai booming economy means that migrants come for job opportunities in the expanding industries, financial institutions and administration.
* Mumbai has grown in a Northern direction, limited by physical Geography.
* It is limited in where it can grow, with creek systems to the North and East, the Arabian Sea to the West and its harbor to the south East.
* Mangrove swamps further complicate the picture; these marginal lands often form the location for the poorest people who live illegally in **slums**. One such slum is Dharavi, in the heart of Mumbai.
* Slum dwellers make up an ever-increasing proportion of the population (more than 50% of the city’s population!), creating numerous problems for people and planners.

**The benefits and problems of urban growth**

**Benefits of growth for Mumbai include:**

* Increased numbers of workers – including skilled workers to work in the formal economy e.g. the IT industry.
* It’s easier to plan services for people in cities than rural areas as there are more users for the services in closer proximity.

**CASE STUDY DHARAVI SLUM – POSITIVES OF LIVING HERE:**

* Informal shopping areas exist where it is possible to buy anything you might need. There are also mosques catering for people's religious needs.
* There is a pottery area of Dharavi slum, named Khumba Wada, which has a community centre. It was established by potters from Gujarat 70 years ago and has grown into a settlement of over 10,000 people. It has a village feel despite its high population density and has a central social square.
* Many daily chores are done in social spheres because people live close to one another. This helps to generate a sense of community. The buildings in this part of the slum are all of different heights and colours, adding interest and diversity. This is despite the enormous environmental problems with air and land pollution.
* 85% of people have a job in the slum and work LOCALLY, and some have even managed to become millionaires.

**Problems of rapid city growth:**

Uncontrolled growth leads to the development of slums e.g. Dharavi. These can be unhealthy and dangerous places to live and are constructed illegally.

**In slums e.g. Dharavi people have to live with many problems:**

* People have to go to the toilet in the street
* Open sewers run through the slum, children play amongst sewage waste and doctors deal with 4,000 cases of diphtheria and typhoid every day.
* Next to the open sewers are water pipes, which can crack and take in sewage.
* Dharavi is built on an old refuse dump.
* Dharavi is made up of 12 different neighbourhoods - there are no maps or road signs.
* The further you walk into Dharavi from the edge the more permanent and solid the structures become. People live in very small dwellings (e.g. 12X12ft), often with many members of their extended families.
* There can be as many as 5 people per room. The houses often have no windows, asbestos roofs (which are dangerous if broken) and no planning to fit fire regulations. Rooms within houses have multiple functions, including living, working and sleeping.
* Clean water is a big problem for Mumbai's population; standpipes come on at 5:30am for 2 hours as water is rationed. These standpipes are shared between many people.
* Rubbish is everywhere and most areas lack sanitation and excrement and rats are found on the street. 500 people share one public latrine.
* The famous cloth washing area (a communal area for washing clothes called the the Dhobi Ghat) also has problems as sewage water filters into the water used for washing clothes.

**Patterns of informal activity**

* Dharavi has an 86% employment rate. However, much of the employment is within the informal sector.
* Dharavi may look disorganized but it is actually made up of several distinct zones that provide places for people to live and work. For example there is the pottery district called Khumba Wada and the recycling district called Compound 13.
* It is claimed that Dharavi’s recycling zone could be the way forward to a sustainable future.
* Everything is recycled from cosmetics and plastics to computer keyboards. 23% of plastic waste gets recycled in the UK, in Mumbai it is 80%.
* However, it is humans who work to sift the rubbish in the tips where children and women sift through the rubbish for valuable waste. They have to work under the hot sun in appalling conditions. Rag pickers earn around a £1 a day for their work.
* At the edge of the tip the rag dealers sort their haul before selling it on to dealers. The quandary is that people have to work in poor conditions to recycle waste.
* From the tip it arrives in Dharavi where it is processed. It is sorted into wire, electrical products, and plastics. Plastics in India are continuously recycled. People work in dangerous conditions with toxic substances without protective clothing; this could affect people’s life expectancy. Even dangerous hospital waste is recycled.
* One private enterprise makes the metal cages inside suitcases, making 700 pieces per day, paid 3 rupees per piece.
* There are 15,000 one room factories in Dharavi.
* Many of the products from Dharavi end up around the world based upon very cheap labour. Many of the people work in very poor working conditions, and includes children.
* Dharavi is trying to do in 20 years what the west did in 200, develop.

**Managing the city in a sustainable way**

**Large scale redevelopment**

* A $2billion development project threatens the recycling district (Compound 13) and part of Dharavi.
* The land upon which Dharavi is in central Mumbai. This makes the land valuable and so a prime target for redevelopment.
* Dharavi residents who can prove they have resided in the slum since 2000 will be relocated. They will be re-housed in newly built 14-storey apartment blocks. Those who cannot prove tenancy since 2000 will be displaced.
* The areas of Dharavi that are planned to be removed have strong, safe neighbourhoods with low crime and communal areas. This development scheme will result in the separation of communities and will make people work away from where they live.
* Also at risk are the local shops and markets and the community spirit that has taken generations to develop.
* The locals would prefer small improvements to the existing slum e.g. improvements in drainage, sewerage and water supply.
* Previous residential redevelopment projects in Mumbai have not been particularly successful, the housing is densely packed and lacks community areas threatening social cohesion.

**Small scale redevelopment**

* There is an alternative to large scale redevelopment and that is to allow LOCAL people design the improvements to the slum.
* The Society for the Promotion of Area Resource Centres, better known as SPARC, is an NGO that supports the efforts of local people to get better housing for their many members.
* Ideas generated from local people supported by this charity include adding an extra floor to buildings so that all family members can be accommodated in the same building. These flats also had 14-foot high ceilings and a single tall window so are well ventilated, bright, and less dependent on electric fans for cooling. Their loft spaces add extra room without seeming crowded, and include small spaces for bathing. But toilets are placed at the end of each of the building’s four floors, and kept clean by the two or three families who use each one. These ideas only work when water is running in Dharavi.
* Architecture students have also been hard at work. One student has created a multi-story building with wide outer corridors connected by ramps “space ways in the sky,” to replicate the street. These space ways allow various activities to be linked, such as garment workshops, while maintaining a secluded living space on another. Communal open space on various levels allows women to preserve an afternoon tradition, getting together to do embroidering.
* One student also tried to help the potters of Dharavi. He designed into existing houses the living space at one end and a place to make the pots at the other. Each has an additional open terrace on which to make pots, which are fired in a community kiln.
* As the National Slum Dwellers Federation has repeatedly proven; housing the poor works best, costs less and is better for the environment when the poor themselves have a say in what is being built.

**Example of a 10-mark essay question:**

“To the local population, megacities have more advantages than disadvantages.” Discuss this statement.

**Mumbai Case Study Part 2**

**Including:**

* Centrifugal population movements (suburbanization and counter-urbanization)
* The location of economic activity in Mumbai

**The cycle of urbanization:**



**Suburbanisation in Mumbai** – **suburbanisation means the movement of people to the outskirts of a city.  
(centrifugal movement)**

**Pattern of suburbanisation:**

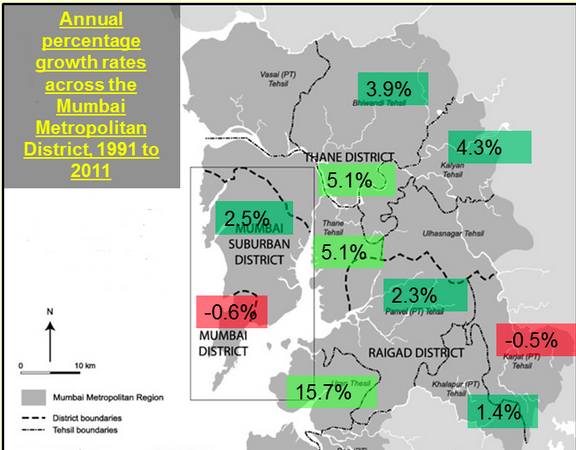
* Mumbai now has a long history of suburbanisation.
* Mumbai initially grew in a Northwards direction along major transport routes such as roads and rail links, and has now also expanded in an easterly direction.
* This suburbanisation has involved not just the growth of residential areas but also the relocation and growth of new industrial areas.
* As with other major cities, other towns and villages have been swallowed up by Mumbai in the process of suburbanisation. In the last decade, Thane, Vashi and Belapur have become extended suburbs despite being planned as individual towns.

**Impacts of suburbanization:**

* People are economically segregated into those that can afford better housing and those that cannot, rather than historical caste, religious or linguistic segregations
* Less than a third of the population of Mumbai lives in the `island' city.
* The centre of density of population has shifted from the island city well into suburban Salsette.
* The commuter traffic has changed. Rather than being just one way into the Central Business District (CBD) in the south of the city in the mornings, there is an increasing movement of people in the opposite direction. Increasing industrialization of the suburbs is increasing this movement.

**Counter-urbanisation in Mumbai** – **movement of people from cities to the rural urban fringe, new towns or villages  
 (centrifugal movement)**

* The map below shows that some of the population of Mumbai is also counter-urbanizing, with a decline in population over a 20 year period within the original heart of the city in Mumbai district.
* The largest growth is in those districts directly to the East of Salsette Island, and even districts 50 or more kilometres from Mumbai are growing.
* One such phenomenon fueling this growth is that of planned towns (new towns in the UK).
* **Navi Mumbai is a planned township directly to the East of Mumbai and was designated in 1972. It is the largest new town in the world.**
* The town was developed to reduce congestion and population densities in Mumbai, which itself was restricted by its physical geography.
* The new town now has a population of 1.1 million people is linked to Mumbai by road and rail bridges and an international airport.
* It also has an extensive bus network, an international airport and many IT and software firms in areas such as the International Infotech Park at Vashi and the New Millennium City near Mahape.



**Part 3: What is the Location of Mumbai’s Economic Activity?**

**Formal sector** activities are taxed and monitored by the government, these activities are included in the Gross Domestic Product (GDP) of a country. In contrast to formal economy is the **informal sector;** which is neither taxed nor included in the GDP of a country.

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| **Type of activity/example** | **Formal or informal?** | **Details** | **Location(s)** | **Reason for location** |
| Financial district (tertiary/quaternary). | Formal | Mumbai is the commercial capital of India.  The financial district includes the Bombay Stock Exchange and the National Stock Exchange. The financial district is also the location of many of India’s multinational companies e.g. the Tata Group. | Nariman Point is the central business district (CBD) at the southern tip of Salsette Island. | Nariman point was developed on land that was reclaimed from the sea as Mumbai wanted to develop a new financial hub for the city. Mumbai has limited development space because it is an island city. Reclamation took place in the 1940s and 1970s. A construction boom in the 1970s also led to the development of commercial high-rise buildings in the area. |
| Manufacturing (secondary) | Formal/informal | A lot of secondary manufacturing has been lost e.g. the textile industry due to other areas of the world being able to produce the goods more cheaply (e.g. Bangladesh). The old textile mills have been repurposed into sites for other industries e.g. IT and financial business centres (tertiary replacing secondary work).  However, in the city slums there are huge numbers of single room factories. Dharavi (Mumbai’s largest slum) is said to have 15,000 one room factories. For example an area called Compound 13 contains many one room factories. This area repurposes recycled goods into finished products. | Dharavi slum | Informal secondary manufacturing often takes place in slums as it is unregulated, illegal activity and it is the urban poor (who live in slums) who will work in these industries. |
| Mumbai Port  Jawaharlal Nehru Port (new port) | Formal | Mumbai Port: Still handles some commercial cargo, but has also become the main cruise terminal.  Jawaharlal Nehru (built 2000): The port handles 55-60% of India’s containerized cargo. | Mumbai Port: South of Mumbai, on the coast of the Arabian Sea.  Jawaharlal Nehru: East of Mumbai in ‘Navi Mumbai’. On the Arabian sea, accessed by Thane creek | Mumbai Port is one of the world’s best natural habours. Under British rule Mumbai was named “Bombay” (meaning good bay). Bombay was the place where the world connected to India.  Jawaharlal Nehru Port was created to relieve pressure on Mumbai Port. |
| Media e.g. Bollywood/Film City (tertiary/quaternary) | Formal | **Film City** is an integrated film studio complex. It has several recording rooms, gardens, lakes, theaters and grounds that serve as the venue of many Bollywood film shootings.  Bollywood is the largest film industry in India and one of the largest movie-making industries in the world. | Situated near Sanjay Gandhi National Park at Goregaon East, Mumbai. | The location near the National Park is appropriate for the attractive natural landscapes that often serve as a the backdrop in Bollywood films.  It is an outer city location so there is plenty of space for expansion. |
| New Business Hubs e.g. Navi Mumbai  (tertiary/quaternary) | Formal | * Navi Mumbai has a population of 1,111,000 * It has various businesses in the tertiary industry such as: IT and software firms. | Navi Mumbai (or “New” Mumbai) is located across Thane Creek, to the east of Mumbai proper. It is on the western coast of the state of Maharashtra. | A new town built to relieve pressure on Mumbai proper  Linked to Mumbai’s transport routes by road and bridges and an international airport. |
| Informal activity – much of it is within the secondary sector/but some tertiary. | Informal | A lot of informal activity is located in the slums. 68% of Mumbai’s population live in slum areas and a large proportion of these people are reliant on informal activities. For example, in Mumbai’s largest slum (Dharavi) there are distinct zones where different types of informal activity take place e.g. Khumba Wada is the pottery district. This was established when potters from Gujarat migrated to the area – today it employs 100,000 people. Another zone is Compound 13 – this is the recycling district where much of Mumbai’s waste is processed. Rag pickers collect waste from Mumbai’s refuse sites and sell it on. Hotel and restaurant workers collect plastics and glass for recycling. | Slums e.g. Dharavi | Often located in slums as it tends to be the urban poor who work in these activities. It is a survival economy. |

**Essay question:** **Referring to examples, compare the patterns formal and informal economic activities in urban areas (10).**

**Mumbai Case Study Part 4**

**Including:**

* Infrastructure improvements

**Infrastructure development in a named urban area: case study Mumbai**

**Infrastructure:** the basic physical and organizational structures and facilities (e.g. buildings, roads, power supplies) needed for the operation of a society or enterprise.

**Example exam questions:**

* Evaluate the effectiveness of infrastructure in providing for rapid population growth in a named city (10)
* Examine the reasons for and consequences of infrastructural change in one city you have studied (10)

**Mumbai’s growth:**

* Since 1971, the population of Mumbai has risen from 8 million in 1971 to 21 million today.
* Greater Mumbai houses twice as many people as those in New York City.

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| **Type of infrastructure** | **Description of improvements to infrastructure/evaluation of improvements** |
| **Transport** | **Reasons transport development is needed:**   * Mumbai is India’s commercial and financial center and one of the most densely populated cities in the world. * The city relies heavily on public transport with about 80% of all motorized trips being undertaken on public rail and bus services. More than half of these trips are undertaken on the suburban rail system which is the lifeline of the city. * The Island city of Mumbai saw a decline in population losing 140,000 residents, while the suburban areas gained 13.2 million, mostly driven by lower real estate prices in the suburbs – this puts enormous pressure on Mumbai’s transport infrastructure. * Every day some 8 million commuters use the city’s suburban rail system, travelling on more than 2,800 trains a day. The network is severely overcrowded during peak hours when the number of passengers exceeds the network’s carrying capacity by more than four times. * The lack of world class infrastructure facilities, growing vehicular population and the never ending traffic congestion is hampering city's progress and affecting local life. * On an average a resident of Mumbai spends four hours a day commuting, either crawling at five kms/hour on the crater-ridden roads or packed like sardines in the local trains.   **General description of transport schemes:**   * The Mumbai Urban Transport Project has received funding from the World Bank and is in the process of up-grading Mumbai’s transport through several phases. * New Mumbai metro by 2021. The planned metro should have nine lines and 34.5 of its 146.5 km will be underground. * The taxis have banned diesel as a fuel. * The 58,000 taxis now use compressed natural gas reducing greenhouse emissions. * The roads in and out of the city have been upgraded with 55 new flyovers. * Smoother flowing traffic should mean less congestion and pollution.   **The Mumbai Urban Transport Project (MUTP)**   * The project introduced more comfortable ventilated railway coaches, and increased the number of trains. It also improved east-west road connectivity and implemented a modern traffic management system at key congestion points, covering about half of the city. * **Benefits:** These measures have reduced long commuting times and improved the travel experience of rail and road users.   **Part 2 of the Mumbai Urban Transport Project:**   * The ongoing**MUTP2 A** is introducing 72 new trains of 12 cars each, eliminating all those services which used the 9 car trains that were in operation earlier. This will increase the carrying capacity of each train and also raise the number of train services on all lines, with peak time services reaching up to 18 trains per hour. * **Benefits:** The improvements increase the carrying capacity of each train and also raise the number of train services on all lines, with peak time services reaching up to 18 trains per hour. * The new trains being procured are also more energy efficient, with a regenerative braking system, resulting in a 30 percent reduction in energy consumption compared to conventional trains. This more efficient system will reduce journey times from about 2.5 percent to 8 percent on different lines.   **Metro improvements:**   * “Metro lines will help in significant reduction of traffic and boost the local transit facility. Along with comfort, ease and convenience, with its high-tech technologies, metros in the city will also help in reducing carbon footprint and pollution.” * The **Mumbai Metro** is a rapid transit system serving the city of Mumbai, Maharashtra, and the wider metropolitan region. * The system is designed to reduce traffic congestion in the city, and supplement the overcrowded Mumbai Suburban Railway (colloquially called *local trains*) network. * It is being built in three phases over a 15-year period, with overall completion expected in 2025. * When completed, the core system will comprise eight high-capacity metro railway lines, spanning a total of 235 kilometres (146 mi) (24% underground, the rest elevated, with a minuscule portion built at-grade), and serviced by 200 stations. * As of August 2018, Mumbai metro consisted of 1 operational line (Line 1 - elevated metro from Versova to Ghatkopar), and 4 lines under various stages of construction * Many stations will be linked via skywalks to office hubs like Bharat Diamond Bourse in BKC, malls, or large facilities like he airport so that commuters do not spill out on the roads.   **Drawbacks:** Large scale transport redevelopment schemes are incredibly expensive. Mumbai has taken out loans from the Asian Development Bank and the New Development Bank for BRICs; these loans will have to be repaid by 2025. |
| **Sanitation (water and sewage)** | * After the 2005 Mithi River flood the **Mithi River Project** was set up to try and prevent any serious flooding. * The river channel was dredged to make it deeper and improve the capacity to hold more water. * It was also widened and obstacles were removed- and the banks were smoothed near bends in the river. All of this was designed to allow water to flow more easily to the sea. * Waste discharges from factories are now checked. More public toilets have also been built to reduce the amount of raw sewage that is dumped in the river.   **Dharavi planned redevelopment:**   * To help improve the water and sanitation in the mega-slum of Dharavi the Slum Rehabilitation Authority want to comprehensively redevelop the area. * The project will involve bulldozing the slum and re-housing the residents. This will allow sanitation services to be properly planned for the residents. * A completely new city will be constructed made up of 2,787,000 meters squared of housing, schools, parks and roads for 57,000 families and 3,716,000 metres squared of residential and commercial space for sale.   **Effectiveness of the schemes:**   * The people who live in Dharavi though do not agree with the Government’s support in rebuilding a new city on the top of Dharavi. Many claim that they will not have a place to live and will lose their jobs through the destruction of the informal hubs of activity that are currently located in the slum e.g. the pottery district and recycling district. |
| **Energy** | **Reasons improvement was needed:**   * Growth of the global middle class in middle income countries like India is placing greater demands on energy usage.   **Description of improvements:**   * Maharashtra has the largest installed electricity generation capacity in the country. * A large number of hydroelectric (HEP) as well as thermal power plants have been set up across the state. * The installed capacity in the state is 12,909 MW. * Total electricity generation increased from 37,311 million kWh to 79,721 million kWh between 1990–91 and 2007–08.   **Effectiveness of improvements:**   * Although there has been investment into HEP, the reliance on thermal power stations to meet Mumbai’s growing energy needs results in greater greenhouse gas emissions and India’s increasing contribution towards global climate change. |
| **Waste** | **Reasons improvement was needed:**   * According to the Central Pollution Control Board, around 62 million tons of solid waste is produced in the country every year, of which 12 million tons are treated, with the rest ending up as untreated garbage and sewage in lakes, rivers and wetlands. * By 2050, waste is expected to rise to 436 million tons. * In India, the handling of waste is considered a huge social taboo. * Historically, the **lowest ranks of the Hindu caste system** have been left to deal with waste disposal and many will still consider a person low and dirty if they handle more than the bare minimum of waste. Consequently, waste is dumped everywhere -- in the streets, in the sea or behind homes. * Every day Mumbai will produce a veritable mountain of over 10,000 metric tonnes of solid waste.   **Informal strategies for waste management:**   * Waste is collected in large part by an army of **120,000 rag-pickers** – **unofficial waste collectors** – who take anything reusable they find to Dharavi and its famed Compound 13. * It’s estimated that 80 per cent of the Mumbai’s solid waste is recycled into usable materials. The UK’s recycling rate was almost half that, with just under 45 per cent of household waste recycled in 2015.   **Start-up companies and waste management ideas for the future:**   * Although sustainable waste management in India is not an organized industry, some entrepreneurs are combining the power of business with innovation to provide solutions. * A startup called Sampurn(e)arth. are promoting a new waste management approach by recycling dry waste and installing biogas plants to transform wet waste into cooking gas and fertilizer in the city. * The company work with scrap dealers, waste-pickers, authorized recyclers, waste generators, and citizen groups. Under this initiative they also run fair-price scrap trading centers at three different locations in Mumbai.   **Effectiveness of strategies:**   * If Dharavi undergoes comprehensive redevelopment as planned, a significant informal recycling district will be lost. This will have a negative impact on waste management in the city. * Strategies of startups like Sampurn(e)arth are getting a lot of interest from investors who want to invest in a profitable model that brings in sustainable solutions to pressing social and environmental problems. * Strategies of startups like Sampurn(e)arth are small scale and so while they will contribute to Mumbai’s waste management there will still be large amounts of waste that will continue to end up in landfill sites (especially as Mumbai’s population continues to grow and the middle class continues to expand – consuming more goods). |
| **Telecommunications** | **Reasons improvement was needed:**   * Mumbai has become a global hub for IT industries e.g. software development and is a popular location for the outsourcing of call centers. This has resulted in a need for great deal of telecommunication investment. * Furthermore, the growth of the global middle class means that more Mumbaikars are demanding high-speed internet. * The development of low-cost mobile technology means that even most slum dwellers in Mumbai have a cell phone.   **Description of improvements:**   * Maharashtra has witnessed rapid development in telecommunications services over the last decade. * Maharashtra boasts close to 4 million telephone lines, more than any other state in the country and a large number of Internet Service Providers and cell phone operators.   **Internet connection:**   * Mumbai has the network support infrastructure in place to bring the market’s potential as an interconnection hub to realization with more than 2 Tbps (terabytes per second) of international Internet capacity. * A growing diversity of submarine cables connecting it to the world, and a rush of capacity growth on one of Europe-Asia’s biggest routes (Marseille-Mumbai). * Internet in India comes via complex Internet Submarine (Under-Sea) Cable System which are also the point of international Internet gateways in India. There are 5 different landing points for Internet Submarine Cable System in India, **Mumbai, Cochin, Trivendrum, Tuticorine and Chenani.** Mumbai is the most active destination with 9 cable systems landing here.   **Colocation:**   * A **colocation** (colo) is a data center facility in which a business can rent space for servers and other computing hardware. Typically, a colo provides the building, cooling, power, bandwidth and physical security while the customer provides servers and storage. * Mumbai is the hub of international connectivity for India, it is also the nation’s key colocation market. Nearly a quarter of India’s retail colocation sites is concentrated in Mumbai, which has a gross footprint of about 1.5 million square feet of retail colocation space. |

**Urban Patterns in an HIC – case study Houston**

**Included:**

* Patterns of economic activity
* Residential Patterns

Houston: The location of economic activity:

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| **Type of Activity (example)** | **Description of economic activity** | **Location and reasons for location** |
| **Commercial Activity** | TNC offices such as Chevron and Chase Bank.  The Energy Corridor is a secondary peak of economic activity that is an agglomeration of oil company offices, including BP America, Shell and ConocoPhilipps. | * Many TNC offices are located in the CBD aka Downtown Houston. Chase tower is the tallest building in the CBD therefore is the presumed to be the PLVI (peak land value intersection). * The Chevron Towers are comprised of 4 high rise office blocks containing operations for the Chevron Oil Company, these towers are located towards the edge of the CBD, next to a freeway exit. * Bid rent theory is a theory that shows that the highest land values are found in the centre of a city (CBD) and that commercial activity is the activity that is most willing to pay these high rents. Therefore, commercial activity, in the form of TNC offices, is the most prominent land-use in Houston’s CBD. These offices are in high-rise blocks, as vertical development maximises the use of the valuable land. * TNCs companies often desire office space in the CBD of a city as it is a prestigious location. The CBD is also the most accessible area of a city as all transport routes lead here. * The Energy Corridor is a business district in Greater Houston located on the west side of the metropolitan area between Beltway 8 and Grand Parkway  The district straddles a 7-mile (11 km) stretch of Interstate 10. * Houston’s Energy Corridor is located in an outer city location along the most major arterial route in the city (Interstate I10). This location is in the west of Houston, which is the wealthier side of the city. This means the area is accessible for its highly paid workers (who typically live in the suburbs of west Houston). This area is a secondary peak within Houston, you can see that land value rises again when you reach the energy corridor as the development is a high-rise development. |
| **Industrial Activity** | Houston is one of the world’s most important regions in the global oil and gas industry.  Not only does the Houston area contain the US Headquarters of many oil companies, but it is also a centre for manufacturing oil based products, including oil refining and fertlizer production.  **Oil refinery** is an industrial process where crude oil is transformed and refined into more useful products e.g. gasoline, diesel fuel and jet fuel.  Houston contains two of the of the four largest oil refineries in the USA. For example, the Galveston Bay oil refinery, operated by Marathon, is the second-largest petroleum refinery in Texas and third-largest in the United States. | * Oil refineries are located along the Houston Shipping Canal due to the ability to move heavy goods into and out of the industrial complexes. The shipping canal is connected to Galveston bay, allowing easy access to Port of Houston and the Gulf of Mexico. * The shipping canal was created beginning in 1910 when Buffalo Bayou was widened and deepened in order to allow access to larger shipping vessels. * Large companies are able have their own private berthing locations e.g. the Deer Park Complex for the Shell Oil Company. |
| **Retail Activity** | There are many opportunities for different types of retail in large urban areas such as Houston. These range from convenience stores to enormous suburban shopping malls.  Shopping Malls for high-order shopping e.g. for the purchase of clothing and electronics.  For example:  The Galleria - high end shopping mall.  Memorial City Mall – large suburban shopping mall  Shopping parades - strip malls that include a combination of high and low order stores.  Big box stores- Costco/ Super Target  Specialist stores e.g. Chinese stores which sell Asian goods in Chinatown | * Like the majority of cities in North America, Houston’s urban growth has been planned around the use of the private motor car. As a result, high order retail does not occur in the CBD (unlike cities in Europe). Instead, high order shopping is located in suburban shopping malls. The land is cheaper in the suburbs, allowing for more floor space for retailers and ample space that can provide free parking for customers. * Houston’s largest shopping malls, for example the Galleria and Memorial Mall, are located in very accessible locations. For example the Galleria is located on the 6-10 loop – a ring road that encircles the CBD and inner suburbs of the city. Memorial Mall is located along the I10 freeway, a major arterial route through the city. Accessibility allows for the delivery of goods and easy access for customers. * The Galleria is a high-end mall with a whole section dedicated to designer fashion – for example Chanel, Gucci and Versace. The Galleria’s location is in a wealthy inner suburb of west Houston as this means that there are plenty of affluent customers who are able to afford to purchase designer goods. * As Houston continues to expand outwards, there is an increase of superstores built on greenfield suburban sites with good accessibility and plenty of space for future expansion. An example of this are the Houston premium outlets off of 290 out in Cypress, TX. * The increasing development of residential areas in the city’ outskirts increases demand for supermarkets and strip malls to cater for the people who are living in these areas - an abundance of these facilities can be found in close proximity to the residential areas. * A lot of big box stores are located off of major transport links. An example Costco is located in Memorial area just off of the I10 and there is another at the junction of I10 and 99 out in Katy. The big box stores are located close to transport links so that they are easily accessible by everyone. Furthermore they are out of the CBD which means that land prices are not high. Therefore it is easier to build the larger stores and costs less money. * There is an abundance of Chinese stores located within Chinatown (in Bellaire, which is an outer suburb of Houston). Chinatown is an ethnic enclave and there are a large concentration of Chinese shops to cater for the needs of the local population. |
| **Informal Activity** | 1. Sex trafficking through informal businesses such as massage parlors and nail salons  2. Forced labor through businesses such as cleaning services, construction, landscaping and grounds-keeping  3. Illegal drug dealing in Houston’s Fifth Ward | 1. Sex trafficking occurs throughout the entire city, however, a primary hub is located within the Galleria area.  Houston is close to the Mexican border, where most human trafficking victims enter the U.S. -Houston has one of the busiest ports in the world. Therefore, there can be large imports of human trafficking victims into the city  2. Forced labor occurs throughout the entire city (Houston suburbs, and Downtown Area)  Houston is midway along the I-10 corridor from Florida to California making it easy to transport forced labor and sex trafficking victims to and from different areas of the U.S.  3. Houston’s Fifth Ward neighborhood in the northeast of downtown Houston (inner city area). This is a low income area where there are less job opportunities and law enforcements are low. |

**Example exam question: “Examine the reasons for the location of economic activities (such as retailing, service and/or manufacturing industries) within an urban area.” [10]**

**Residential areas – location and characteristics:**

**Key theory: factors affecting the location of residential areas:**

**Physical factors:**

* In some urban areas wealthier people live near rivers/canals due to opportunities for pleasant views and recreation. However, in LICs it may be urban poor who live close to rivers/areas that experience flood risk.
* High ground may be attractive for wealthy residential neighbourhoods in HIC cities. However, in LICs it is often the poor who have to build their housing on steep slopes on the periphery of the city - where landslides may be a risk.

**Land values:**

* There tends to be lower residential densities in the CBD (downtown) area of a city. This is because the land is so valuable that it is typically too expensive to use for housing. The bid rent theory shows that commerce is willing to pay the highest rents and rates, therefore the CBD is characterized by offices/high-end shopping etc.
* The highest density housing areas are in inner city areas (these are areas that are next to the CBD. They are zones of transition. Housing types may include high-rise apartment blocks or terraced housing.
* Residential densities decrease with distance from the CBD, this is because the land is cheaper and so it can be used less intensively. Detached houses can therefore be built on large plots.
* In HICs, traditionally poorer households have tended to be located in the inner city (close to jobs) and wealthier residents in the suburbs (they can afford to commute to work).
* Residential densities in the suburbs have increased as decentralisation has occurred.
* Gentrification has also occurred in inner city areas as a result of urban regeneration policies.

**Ethnicity:**

* Some ethnic groups may choose to live close together, and so end up forming neighbourhoods.
* These neighbourhoods are known as ethnic enclaves. In these areas residents can benefit from their close proximity to others members of their cultural group e.g. through the organisation of culturally services e.g. places of worship and cultural centers, as well as shared opportunities for economic activity e.g. restaurants etc.
* However, there are more negative forms of ethnic segregation. These have historically occurred due to enforced ethnic/racial segregation e.g. through the Jim Crow Laws or the process of “red-lining” in the United States or Apartheid in South Africa.
* Today some ethnic/racial groups may be excluded from certain areas of the city – this tends to be due to the cost of housing.

**Urban planning:**

* City authorities often try to attain a balanced social mix by having a mixture of different housing types dispersed around the city.
* However, in many cities this does not occur.
* Houston is a good example of this. Houston has plenty of space to expand outwards. This has resulted in urban sprawl. Housing companies purchase large plots of land and construct entire neighbourhoods, often that are catered to only affluent or low income families (these are known as **master-planned communities**). This creates economic segregation.
* Unfortunately Houston has been called the most economically segregated city in the USA.

Example of residential areas and their characteristics – Case Study Houston:

|  |  |
| --- | --- |
| **Type of residential area and location** | **Residential characteristics and reasons** |
| **CBD: Downtown Houston – the geographic center of the city.** | * Low amounts of residential land-use due to high land * values. * Residential here is typically high-rise apartments as this maximise the use of space available, creating a higher density development. * The people who tend to live here are young professionals who work in the CBD or students at the University of Houston (which has a campus in downtown). * Greater investment in the downtown region of Houston’s CBD has led to a trend of re-urbanization in the city, where people are starting to move back towards the centre of the city, including the CBD. * Many luxury apartment complexes that have been built in the frame of Houston’s CBD, for example No.1 Park Place which is located next to Discovery Green, the largest park in the CBD. |
| **Inner City: For example EADO (meaning east of downtown)** | * EADO is a regenerated warehouse district. * Due to deindustrialization many factories in this inner city area were closed and warehouse space was let vacant. * The area fell into dis-use and dereliction. * Artists later moved into the region, taking advantage of the available warehouse space and set up art studios. Artists started to bring the area back to life by painting murals and artistic graffiti on the walls of disused buildings. * The area was becoming more vibrant which enticed developers to the area. * The area has since seen the conversion of warehouse space into apartments, restaurants and breweries. * Gentrification is taking hold in the area – there has been an increase in white collar workers moving in/poorer communities/blue collar workers moving out due to higher rents. |
| **Inner city: Houston’s Third Ward** | * One of Houston’s historic wards (6 in total) * Traditional shotgun homes, low grade apartments, section 8 housing * Concentration of African American community (84% of the population are non-white) * Area of enforced racial segregation during era of Jim Crow Laws * Investment taking place. * Houston’s donut effect has resulted in a cycle of urban deprivation in this area – wealthier residents have left the area, leaving only poorer members of the community behind. * Investment is starting to occur in this area, due to its proximity to downtown. New town-homes are starting to be built on the edge of the Third Ward. There is the possibility of gentrification which may threaten the local community. |
| **Inner Suburb: Mahatma Gandhi District (Hillcroft area Houston)** | * Inner suburb * Ethnic enclave * Concentration of Indian and Pakistani community * Concentration of ethnic businesses e.g. Indian restaurants and clothing shops. * Ethnic concentration benefits local people as ethnic businesses such as restaurants thrive due to availability of customers and services can be planned for the community e.g. places of worship such as mosques. * Middle income area |
| **Outer suburb: Lakes on Eldridge** | * Outer suburb * High income area * Housing tenure: Large % owner occupied * Large detached family homes (the suburbs have more land available at lower prices and so larger homes can be constructed). * The outer suburbs are appealing for families as there is more green space available, services are available that cater to families e.g. playing fields, sports pitches and leisure centres, crime rates are lower, schools are better and the air is cleaner. * The process of decentralization has occurred in Houston, whereby wealthy people have moved outwards to the suburbs. This has caused businesses and services to follow them e.g. many outer-lying business districts have been established in Houston’s suburbs e.g. the Energy Corridor, as well as many shopping e.g. Memorial Mall that cater to the needs of the local population. * There is a high concentration of white collar workers living in Lakes on Eldridge who work in nearby outer-lying business districts such as the Energy Corridor. |

**Exam question: Examine the factors that determine the socio-economic characteristics and location of residential areas within cities (10)**

Deindustrialization and patterns of inequality and the cycle of urban deprivation

**Including:**

* Causes and consequences of deindustrialization (case study Detroit)
* The management of urban deprivation

Deindustrialization – case study Detroit

**Exam question: Examine the economic, demographic and social stresses resulting from deindustrialization (10 marks)**

**Objective:** The causes and impacts of deindustrialization (including the demographic, social and economic consequences).

**Definition:** Deindustrialization is the long-term, absolute decline in employment in the manufacturing sectors of an economy.

**Background:** Whilst industry is booming in many MICs and LICs as a result of outsourcing (global shift) and significant Direct Foreign Investment, there have been cases of severe urban deindustrialization in other parts of the world, notably in major HIC manufacturing cities such as Sheffield, UK (Steel),  Glasgow, UK (ship building) and Detroit, USA (car manufacturing). For the purposes of this section of work, we will be focusing on the USA and the city of Detroit.

**Location/background/:**

* Detroit is a city in the Midwest of the United States.
* It is famous for its car industry, being nick-named “motor city”.
* Between 1900 - 1950 Detroit prospered with General Motors (GM), Ford and Chrysler were based there (manufacturing cars for the USA market).
* In 1960 Detroit has the highest per capita income in the USA.
* Suburbanisation of Detroit’s population occurred during the 1950s, 60s and 70s. One of the push factors was due to race riots that occurred in 1943 and 1967. This resulted in a donut effect; whereby wealthier (mostly white) populations lived in the outskirts and poorer black workers remained in the inner city.
* Detroit lies within a region of the USA known as the “rust-belt”, this is an area of the country that was previously heavily reliant on manufacturing industry and has faced serious economic decline as a result of deindustrialization.
* Detroit was heavily reliant on the car industry. The **decline** began in the 1970s and continued into the 1980s and thereafter, right up to the bankruptcy of **General Motors** and **Chrysler in 2009**.

**Causes of deindustrialization in Detroit:**

* The industry has faced **global competition** and initially was unable to compete. For, example Japan and Germany are world renowned for being excellent innovators in vehicular technology.
* Due to automation far fewer workers are needed in car plants today; this reduces the number of jobs available.

**Demographic consequences:**

* Population decline occurred rapidly since the 1970s, a result of heavy job losses in the car industry. The population of the city has fallen from a high of 1. 8 million in 1950 to 670,000 in 2015, kicking it off the top 20 US most populated cities for the first time since 1850.
* Today, 81.6% of Detroit’s population are African American. Over a third of Detroit’s population and over half of its children live below the poverty line.

**Economic consequences:**

* **Detroit's** single-industry economy, heavily reliant on the car industry, meant that when this industry was lost the city suffered immensely.
* General Motors and Chrysler declared bankruptcy in 2009.
* By 2009 the unemployment rate peaked at 28%. In Feb 2018 the rate was 8.7% in Detroit, compared to 4.7% in the rest of the state of Michigan.
* Detroit is the largest US city to declare bankruptcy, its long-term debts are thought to exceed $18 billion.

**Social consequences**

* The donut effect has led to a cycle of decline.
* People have left and there is less demand for housing and so house prices have fallen. Due to little demand for housing, many homes have abandoned all together and boarded up.
* Nearly half of Detroit’s adults are functionally illiterate and 29% of the city’s schools closed down in 2009 alone.
* According to a report in The Economist, law and order has completely broken down in the inner city. Drugs and prostitution are commonplace.
* Of the city’s 85,000 street lights, half are usually out of service because thieves have stripped them for their copper.
* Detroit has the amongst the highest crime rates of all cities in the USA.

**Hope for the future?**

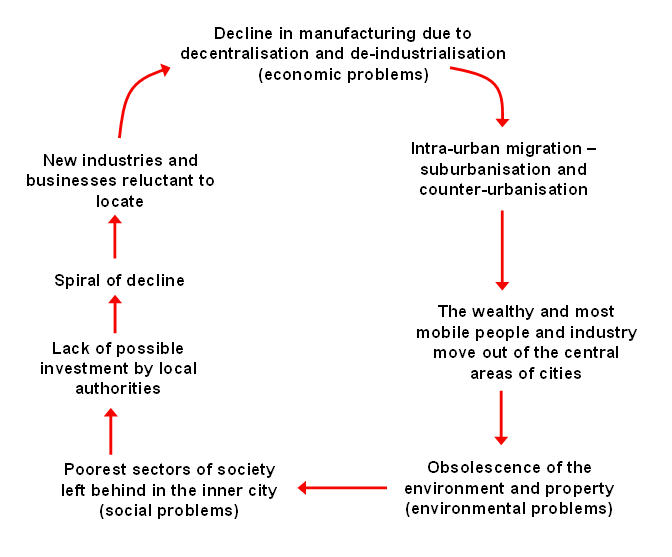
* However, there is some growth.
* Urban farms are appearing, taking over urban waste lands.
* Young people, especially artists and musicians, are moving into Detroit to make use of the abandoned and affordable urban spaces.
* Low rents, good universities and tax breaks are attempting to attract businesses back to the city.

Managing the impacts of urban social deprivation, including the cycle of deprivation and geographic patterns of crime.

**Urban social deprivation** is where the standard of living is below that of the majority in a town or city. This results in hardships e.g. poverty, debt, poor quality housing and a lack of access to services. Places suffering from urban deprivation have visible differences in housing and economic opportunities.

In HICs it is often the **inner city** areas of cities that suffer from urban deprivation, as these are the areas that have tended to be affected by the processes of deindustrialization and decentralization. These processes are explained in the cycle of urban decline below.

**The cycle of urban deprivation (linked to deindustrialization):**



**Case study Detroit**

**The issue:**

**Decentralization/suburbanization:**

* Detroit has suffered from decentralization processes. During the 1950s, 60s and 70s there was widespread suburbanization and counter-urbanization that took place.
* This has been described as “white flight” from inner city Detroit. The reason for this is that many black workers had moved from the deep south to take up jobs in the car industry in Detroit. This led to ethnic tensions between white workers and black workers.
* Black workers were not treated equally and were segregated from white workers in the factories. They were also segregated within communities and were prevented from renting/buying homes in white areas through illegal processes such as redlining.
* When 3 black employees were promoted and came to work in a white production line, many of the white workers protested and walked out.
* The unfair treatment of black people within Detroit’s society led to race riots during the late 1940s and again the in 1960s. This prompted wealthier white people to leave the inner city for the suburbs and beyond.
* Today 81% of Detroit’s urban population identify as black or African American (this compares to the Michigan State average of 13% and the US average of 12%).

**Deindustrialization:**

* Detroit was heavily reliant on the car manufacturing industry and when this industry suffered, largely due to competition from abroad, enormous amounts of jobs were lost.
* This has resulted in further out migration of anyone who can afford to leave the area. Detroit’s population declined from 1. 8 million in 1950 to 670,000 by 2015.
* By 2013 the city had reached 30% unemployment rate.
* The donut effect has led to a cycle of decline….
* People have left and there is less demand for housing and so house prices have fallen. Due to little demand for housing, many homes have abandoned all together and boarded up.
* The city declared bankruptcy in 2013, this has resulted in a lack of investment in social services e.g. schools, healthcare and the police force.
* 29% of the city’s schools closed down in 2009 alone.
* According to a report in The Economist, law and order has completely broken down in the inner city. Drugs and prostitution are commonplace.
* Of the city’s 85,000 street lights, half are usually out of service because thieves have stripped them for their copper.
* Detroit has the amongst the highest crime rates of all cities in the USA.

**Managing the impacts of social deprivation:**

* One of the ways in which the Detroit authorities are trying to tackle urban deprivation is by tackling criminal activity in Detroit’s inner city.
* Project Green Light is one way in which crime is being tackled, this is described below.

**PROJECT GREEN LIGHT**

A customer walks out of Southern Smokehouse on West McNichols Road in Detroit, Michigan, on Thursday, April 19, 2018.
This carryout BBQ restaurant participates in the Detroit Police Green Light program. This restaurant has four cameras that are connected to the Detroit Police.

**What is it?**

* **On January 1st of 2016,**the Detroit Police Department (DPD) partnered with eight gas stations that have installed **real-time camera connections** with **police headquarters** as part of a ground-breaking crime-fighting partnership between local businesses, the City of Detroit and community groups called “Project Green Light Detroit."
* This project is the first public-private-community partnership of its kind, blending a mix of **real-time crime-fighting and community policing** aimed at improving neighborhood safety, promoting the revitalization and growth of local businesses, and strengthening DPD’s efforts to deter, identify, and solve crime.
* Participating businesses pay about $4,000 up front, plus a monthly fee, for surveillance cameras that stream directly to DPD's Real Time Crime Center at its downtown headquarters.
* The program has been expanding at breakneck speed. Today, the city has more than 300 Green Light partners, including the first **school** to join, and Mayor Mike Duggan has talkedabout making it mandatory for all businesses open between 10 p.m. and 4 a.m.
* Much of the cost of Project Green Light is being shouldered by the businesses that buy into the program —taxpayers also face costs.

**Evaluation of the scheme:**

**Successes:**

* There is some **evidence of crime reduction.**
* Since January 2016, crime had decreased by **40% at the first eight Project Green Light sites**
* All Green Light locations in 2017 (just over 200 locations at the time) saw an 11% decrease in crime from 2016. The city as a whole experienced a 7% decrease in violent crimes in 2017 compared with 2016.
* **There has been a 20% reduction in carjackings from 2016 to 2017.** Carjackings typically will occur at places where there is an increased opportunity. If it’s during darkness, it’s where people congregate e.g. gas stations. So if there is a reduction in robberies, a reduction in carjackings, then Green Light may be playing a role in that.
* **Detroit's homicide rate had dropped to the lowest in decades.** Project Green Light was one of several initiatives highlighted and credited for the improvements.
* Many residents state that they **don’t mind the constant surveillance** and that they tend to gravitate towards Green Light stores as they feel safer. Residents feel it helps to cut down on drug activities and loitering around in areas such as around gas stations. **Residents even protested one gas station for not buying into the Green Light Program.**

**Criticism:**

* Researchers, however, claim that the data on crime reduction represents **too small of a sample and the over too short a time frame.** No study compares Green Light locations to non-Green Light locations, and the chief says no such dataset exists.
* In the absence of this, researchers say it is nearly impossible to tie Detroit's crime reduction to Green Light. **Violent crimes have been declining in many cities across the country.** Without rigorous evaluations that use comparison groups, it is difficult to attribute the decline in any city to a specific program or policy.
* The fact that some public money is being used to fund the scheme has drawn criticism as it has been likened to an additional **public safety tax.**
* The project creates **civil liberties problems** as it involves constant surveillance of the local population.
* Some believe that money diverted here is **wasted funds** and that is should instead be used to invest in communities to **revitalize** them.This scheme is tackling the consequences of urban deprivation i.e. higher crime rates, but it is not tackling the underlying causes of crime a lack of educational and job opportunities, lack of access to services e.g. recreation areas for young people etc.
* **Studies** on the use of **surveillance for policing have been inconclusive**, whereas studies show that **real community policing has a positive impact** on crime. Community policing involves the police working with the community to understand the problems in the area. This involves real life patrols, including the monitoring of activity in crime hotspot areas and developing an understanding of the under-lying causes of crime.
* A **tipping point** may be reached in this project, this will be the point at which the police get into a situation where they’ve installed so many cameras that they can **no longer effectively police them.** Police departments should only install only the number of cameras they can realistically and proactively monitor.

**Urban Stress**

**Including**

* Urban microclimates
* Traffic congestion
* Air pollution

**Urban microclimates**

**Definition: Microclimate**

* The climate of a small, specific place within an area as contrasted with the climate of the entire area.

**Definition urban heat island:**

* An **urban heat island** is *a city or metropolitan area that is significantly warmer than its surrounding rural areas due to human activities.*

**Urban heat island development:**

* Firstly one human factor that contributes to the urban heat island effect is anthropogenic heating. This is the rise in temperature caused by the release of heat energy from traffic and buildings.
* Secondly urban development can play a part in the urban heat island effect. The removal of vegetation to make way for development means that there is less evapotranspiration, this leads to increased warming in the urban area as there is less cool water vapour in the atmosphere.
* Finally another factor that causes increased heat is urban design. Due to there being lots of high rise buildings in the CBD this leads to less wind as the buildings act as wind breaks. This means that central areas are warmer as there is less wind to cool the environment.

**Managing urban heat islands:**

* White roofing – painting the roofs of buildings in urban areas white, this increases the reflectivity (albedo) of the surface and means that more solar energy is reflected than absorbed.
* Green roofing – creating roof gardens means that pollutants such as co2 can be absorbed by green plants, improving air quality. Increased greenery also leads to higher evapo-transpiration rates, the processes of evaporation and condensation cool the atmosphere.
* Planting more trees and creating more urban parkland has the same effect as above.
* Improving public transport networks in cities reduces car travel and so the amount of heat released from car exhausts.

**Other characteristics of urban microclimates:**

**Wind:**

* Tall buildings act as windbreaks ⇒ wind velocity 30% lower than in countryside
* Sometimes, high-rises can also form “canyons” which channel air and create strong local winds and turbulences (NY, Hong Kong) – this is known as the **wind tunnel effect.**

**Building design:**

* The design of a building can also result in localized changes in weather in urban areas.

**Example 1:**

* A building at 20 Fenchurch Street in the financial district of London was initially given the nickname the “walkie-talkie” due to its distinctive shape. However, it has since been re-nicknamed the “walkie-scorchie” as it has led to very high temperatures being recorded on the street below. This is due to the concave design of the building which causes the sun to shine directly onto street below.
* The temperatures were so intense on the street below that cars were melting and shop door-mats caught fire!
* The building has since been fitted with a sun-shade to deflect the sunshine.

**Example 2:**

* Bridgewater Place is the tallest building in the City of Leeds in the UK.
* The building's shape accelerates winds in its immediate vicinity, creating winds so strong that pedestrians and even vehicles have been knocked over.
* In March 2011 a man was killed when a lorry overturned on him due to a strong gust of wind.
* Following the inquest into the death safety measures have been put in place.
* Vertical fins have now been added to the building to deflect the wind.

**Mexico City -traffic congestion and air pollution**

**Example of:**

* Traffic congestion – causes, impacts and management
* Air pollution problems in cities and its management

**Traffic congestion**

**The issue:** The TomTom Traffic Index 2017 rated Mexico City as No.1 in the world for traffic congestion.

**Causes of traffic congestion in Mexico City include:**

* **Poor planning:** Urban sprawl is an issue in Mexico City. Many inhabitants live at

great distances from their places of work.

* **Subsidised petrol**: makes it cheaper to use a car than use alternatives
* **Quality of public transit:** Mexico City has a poor and neglected public transit network, making car travel a preferred alternative.

**Impacts of traffic congestion:**

* **A major impact of traffic congestion for Mexico City is AIR POLLUTION. See impacts of air pollution below - these can also be used as impacts for your traffic congestion case study.**

**Other impacts of traffic congestion:**

**Social:**

* The TomTom Traffic Index 2017 found that drivers can expect to spend 66% extra travel time stuck in traffic at any time of the day.
* More cars on the road brings more safety challenges. Road traffic incidents were responsible for [954 deaths](http://www.sedema.df.gob.mx/educacionambiental/folleto_aire_digital_20140717/img/file.pdf) in Mexico City in 2012.

**Economic:**

* Car congestion is thwarting economic growth. Businesses spend large sums of money on parking lots and vehicle acquisition. Office buildings in Mexico City allocate on average [42 percent of their land](http://mexico.itdp.org/noticias/urgente-optimizar-el-estacionamiento-en-la-ciudad-de-mexico-itdp/) to parking spaces to support employees' current transport habits.
* Intense traffic congestion is impacting workers' productivity, as all the time spent sitting in the car ultimately reduces workers' abilities to concentrate, think critically or even be present on time in the office.

**Political:**

* Mexico City has been rated as the most congested city in the world for the past 2 years. This is an embarrassment for the city and it is little wonder that the government are trying to develop strategies to manage this problem.

**Air pollution:**

**Background:**

Mexico City is one of the largest cities in the world, it is a global megacity with a population of more than 20 million people. Like many large cities, particularly those in the developing world, Mexico City experiences problems with air pollution.

**The causes of air pollution:**

**Human causes:**

* **Traffic congestion:** The TomTom Traffic Index 2017 rated Mexico City as No.1 in the world for traffic congestion. Having lots of standing traffic increases air pollution through greater exhaust emissions. Carbon monoxide, from traffic,is a dangerous gas that results in pollution of the urban environment Fine particulate matter from vehicle exhausts is also problematic and it results in poor air quality. Additionally, ozone is a by-product of fossil fuel combustion. When pollutants such as hydrocarbons and nitrogen oxides react with sunlight then ozone is produced.
* **Poorer quality vehicles/low-grade petrol:** Fewer people own new cars in Mexico City (Mexico is an MIC) – newer models are designed to be more fuel efficient and have reduced emissions. Older vehicles are more heavily polluting. People also tend to use lower quality petrol sources as it is cheaper.

**Causes of traffic congestion include:**

* **Poor planning:** Urban sprawl is an issue in Mexico City. Many inhabitants live at

great distances from their places of work.

* **Subsidised petrol**: makes it cheaper to use a car than use alternatives
* **Quality of public transit:** Mexico City has a poor and neglected public transit network, making car travel a preferred alternative.

**Physical causes:**

* Mexico City’s physical geography also helps to cause air pollution problems in the city.
* Mexico City lies at an altitude of 2400 metres. It is situated on an old lake bed, surrounded on all sides by mountains which trap polluted air over the city. Pollution of this kind especially occurs during the winter, when layers of cold air in the city trap pollution below warmer air above – this phenomenon is known as a temperature inversion.

**Explanation of how a temperature inversion works:**

* Temperature inversions are where the normal decrease in air temperature with increasing altitude is reversed and air above the ground is warmer than the air below it.
* Topography (shape of the land) plays a role in creating a temperature inversion since it can sometimes cause cold air to flow from mountain peaks down into valleys. This cold air then pushes under the warmer air rising from the valley, creating the inversion.
* One of the most important things impacted by an inversion layer is **smog** (stands for smoke and fog).
* This is the brownish gray haze that covers many of the world’s largest cities and is a result of dust, auto exhaust, and industrial manufacturing.
* Smog is impacted by the inversion layer because it is, in essence, capped when the warm air mass moves over an area. This happens because the warmer air layer sits over a city and prevents the normal mixing of cooler, denser air. The air instead becomes still and over time the lack of mixing causes pollutants to become trapped under the inversion, developing significant amounts of smog.

**Other physical causes:**

* **Strong sunlight:** Another problem is that sunlight is stronger at higher altitudes. In the presence of strong ultra violet light, chemicals in the air react with each other to produce ozone,  
  a particularly toxic gas.
* **Reduced oxygen:** because there's less oxygen high altitudes, most of the air pollution is the result of incomplete combustion of hydrocarbons, mainly diesel emissions. Since the diesel fuels aren’t burnt properly at this altitude, this leads to the formation of high amounts of soot particles (also known as black carbon).

**Impacts of air pollution:**

**SEEP:**

**Social**

* Vehicle fumes, and other air pollution sources, are responsible for many residents suffering from severe respiratory health related problems e.g. bronchitis.

**Environmental:**

* There have been reports of birds literally dropping dead from the sky because air quality has been so poor.
* In 2017 there were 24 days with clean air, according to Mexico City’s System of Atmospheric Monitoring. In other words, the area had more than 240 days during which the pollution index was more than 50 points over recommended levels.
* Low level ozone can result in acid rain that damages trees and plants.

**Political:**

* The authorities are prompted to take action due to the negative consequences brought about by air pollution. For example:
* **Pollution emergency declarations:** In 2016, ozone and particulates climbed so high that the environment commission has declared eight pollution emergencies within a 4 month time period.
* **City officials order people to stay indoors:** At times during the past two years, ozone concentration levels in the city have reached such extreme levels that officials issued environmental risk [alerts](https://apnews.com/6139f3a31af24aac8c63d35b870d60e2), urging people to stay indoors.
* Mexico City has been rated as the most congested city in the world for the past 2 years. This is an embarrassment for the city and it is little wonder that they are trying to develop strategies to manage air pollution.

**Management of air pollution/traffic congestion:**

**Hoy no Circula:**

* Beginning in 1989, a system called *Hoy No Circula*, or “No-Drive Days,” prohibited drivers from using their vehicles one weekday per week, with a schedule based on license-plate numbers. In 2008, this system was expanded to include Saturdays.
* The restrictions are in place between 5 a.m. and 10 p.m. Originally the restrictions affected the vast majority of residential and commercial vehicles, although taxis are excluded. When imposed in 1989, the restrictions applied to 2.3 million vehicles, or 460,000 vehicles per day. Today, the scheme applies to about 20% of the city’s vehicles.

**Evaluation of the scheme:**

* Despite *Hoy No Circula*, the enormous number of cars and trucks—and the nitrogen oxide they emit—remain a problem. A scientific study of the Saturday driving rule found that [it hasn’t reduced pollution levels](https://www.nature.com/articles/srep41652) or increased use of public transportation.
* The primary cause of the program’s failure turns out to be human adaptation. While the hope was that drivers would shift to low-emissions forms of transportation, such as the subway or the public or private bus systems, no one got out of their cars. Instead, the evidence indicates that Hoy No Circula has led to an increase in the total number of vehicles in circulation. What is the easiest way to circumvent the *Hoy No Circula* program? Buy a second car. A driver with two vehicles can drive every day of the week as long as the last digits of the license plates don’t match.
* An additional explanation is the increased use of taxis. There are over 100,000 taxis in Mexico City, or approximately one taxi for every 100 residents. In comparison, New York City has approximately one taxi for every 600 residents and Beijing has one taxi for every 175 residents. Mexico City’s unusually large stock of taxis was well positioned to absorb any increase in demand from Hoy No Cicula. Moreover, from 1986–2005, taxis in Mexico City were among the highest-emitting vehicles in circulation; most were Volkswagen Beetles, a vehicle that has not been sold in the United States since 1977.

**Other strategies:**

* Mexico City’s government has opened [bus rapid transit](https://www.theatlantic.com/technology/archive/2009/11/take-the-metrob-s-in-mexico-city/30339/) lines and launched a large [bike-share system](https://www.ecobici.cdmx.gob.mx/) (called **Ecobici**) to promote alternatives to driving.
* **New emissions standards** for engines used in heavy-duty vehicles were adopted by the Mexican government in [what has been called](https://www.theicct.org/publications/mexico-heavy-duty-vehicle-emission-standards) the single most critical policy to **reduce**[**black carbon**](https://www.c2es.org/document/what-is-black-carbon/)**emissions.** **Soot-free buses** started operating this year on Mexico City’s historic Reforma Avenue.

**Example essay questions:**

**Urban microclimates:**

* Examine the effects of human activity on the climate of urban areas (10).

**Air pollution:**

* Discuss the varying effects of air pollution in one **named** urban area. *[10]*
* With reference to **one** named example, evaluate the success of a strategy designed to manage pollution in an urban area. *[10]*

**Traffic congestion:**

* Examine the impacts of traffic congestion on one named city you have studied (10)
* Examine a management response to traffic congestion for one named city you have studied (10)
* Evaluate the management response to traffic congestion for one named city you have studied (10)

Urban Stress: Contested land-use change

* Including slum clearances and urban redevelopment

**Example exam question: “Examine the issues surrounding contested land use change in two contrasting neighborhoods and populations.” (10)**

**Neighborhood 1: Dharavi slum, Mumbai**

**The issue:** Dharavi is a mega slum located in the city of Mumbai. It is located on prime real-estate, making it a target for urban redevelopment.

**The redevelopment plan:**

* A $2billion development project is planned for Dharavi by Mumbai’s Slum Rehabilitation Authority.
* This is a comprehensive redevelopment scheme, which will involve Dharavi being bulldozed.
* Those who can prove they have been residents since 2000 will be re-housed in 14-storey apartment blocks.

**Why is the redevelopment contested?**

* The locals would prefer improvements to the existing slum e.g. improvements in drainage, sewerage and water supply.
* Dharavi has strong, safe neighbourhoods with low crime and communal areas.
* Also at risk are the local shops, markets and zones of economic activity (e.g. the recycling and pottery districts).
* Previous redevelopment projects have not gone that well – new housing schemes are densely packed and lack community areas, resulting in a lack of social cohesion.
* This is a top down development and Dharavi residents feel they want a say in their future.

**What will happen in the future?**

* There is such as clash of opinions about Dharavi’s future that the plans have been in a decade long stale-mate. No-body seems completely sure what to do with Dharavi.
* **The Society for the Promotion of Area Resource Centres, better known as SPARC**, is an **NGO** that supports the efforts of local people to get better housing for their many members.
* Ideas generated from local people supported by this charity include adding an extra floor to buildings so that all family members can be accommodated in the same building. These flats also had 14-foot high ceilings and a single tall window so are well ventilated, bright, and less dependent on electric fans for cooling. Their loft spaces add extra room without seeming crowded, and include small spaces for bathing. But toilets are placed at the end of each of the building’s four floors, and kept clean by the two or three families who use each one. These ideas only work when water is running in Dharavi.
* Architecture students have also been hard at work. One student has created a multi-story building with wide outer corridors connected by ramps “space ways in the sky,” to replicate the street. These space ways allow various activities to be linked, such as garment workshops, while maintaining a secluded living space on another. Communal open space on various levels allows women to preserve an afternoon tradition, getting together to do embroidering.
* One student also tried to help the potters of Dharavi. He designed into existing houses the living space at one end and a place to make the pots at the other. Each has an additional open terrace on which to make pots, which are fired in a community kiln.
* As the **National Slum Dwellers Federation** has repeatedly proven; housing the poor works best, costs less and is better for the environment when the poor themselves have **a say in what is being built.**
* Dharavi has received a lot of attention. For example, Prince Charles visited the slum and declared it as a model for the world. He said that he was impressed by Dharavi’s use of local materials, its walkable neighbourhoods, and mix of employment and housing
* The film Slumdog Millionaire (partially set in Dharavi Slum) also made Dharvi internationally famous. Perhaps accolades such as these will help to safeguard dharavi’s future.

**Neighborhood 2: Vila Autodromo, Rio de Janeiro**

**The issue:** The city authorities in Rio de Janeiro offered slum dwellers in the Vila Autodromo favela financial compensation to leave the slum so that it could be bulldozed. The authorities wanted the slum to be bulldozed because it was located adjacent to the site for the 2016 Olympic Games. The city authorities wanted to clean up the area surrounding the Olympic facilities and developers were keen to get their hands on the land that was rapidly increasing in value.

**Why was it a contested land-use change?**

* The favela was home to 600 families. The residents took pride in the neighborhood and had spent a lot of time and effort renovating their homes – some of which were multi-storey homes with verandas and even pools. The favela was, therefore, well established; people took pride in the area and there was a close knit community.
* 80% of the original families agreed to move in exchange for apartments in a nearby complex and a cash payout. However 20% of the residents refused to leave.
* The residents organised protests, marches and anti-eviction vigils. They also developed a People’s Plan and a Human Right’s dossier. They met with the mayor and were unrelenting in their objection to eviction. One woman refused a $700,000 payout and relocation to a new apartment, saying she refused to live in a tiny box.
* In the end 20 families ended up staying the area – the government compromised with by building new homes for the residents on the existing site.
* Although 97% of the original residents left the area, the residents of Vila Autodromo consider the agreement a success. It can be considered a success because it became the first collectively negotiated rehousing agreement in Rio de Janeiro. Also, many of the residents who did eventually leave obtained much better relocation packages due to their resistance.

Urban Stress: The depletion of green space:

**Why is greenspace important in cities?**

* Green plants act as carbon sinks, absorbing co2 and so reducing atmospheric pollutants
* Greenery increases evapo-trasnpiration which helps to cool the environment and reduce the urban heat island effect
* Green spaces provided opportunities for leisure which improves the health and happiness of residents
* Green spaces provide important habitats for species

**Houston Texas green space facts:**

* A ParkScore index from The Trust for Public Land ranked the 50 largest cities in the United States according to how well each is meeting the need for parks. Houston was ranked at 38 on the list, scoring 39 on a scale of 100.
* Houston's council spends just $40 per resident for greenspace compared to New York's council who spends $160
* Only 5% of Houston's population lives within 1.5 miles of a park

**Causes of depletion of green space:**

* Houston is known for its urban sprawl and the outward expansion of the city has led to a significant reduction in prairie land. The prairie should help to absorb heavy rains. The depletion of this green space is thought to have exacerbated the effects of 2016’s Hurricane Harvey as infiltration rates have been reduced due to the loss of permeable surfaces.
* Due to the trend of re-urbanisation (where people are being attracted back to live towards the centre of cities) a lot of in-filling has been occurring in Houston. Trees and green spaces are being demolished to make way for new apartment blocks “inside the loop” (the inner loop is an inner ring road that encircles Houston’s CBD, inner city and inner suburbs).
* Houston’s infrastructure projects also lead to the depletion of green space. Houston is still in the process of constructing a third ring road around the city (an outer, outer loop). Highway 99 has led to the depletion of green spaces in Houston’s outer suburbs and rural-urban fringe.

Sustainable cities

**Sustainable cities** are designed with consideration for their social, economic and environmental impact. They aim to provide a resilient habitat for existing populations, without compromising the ability of future generations to experience the same.

**Eco cities**

**Definition:** An eco-city is a city that aims to have a low impact on the environment.

In particular, cities can be redesigned to reduce their **urban ecological footprint.**

The urban ecological footprint is the amount of land needed to produce resources for an urban area and absorb its waste. There are 1.7 global hectares of land available per person.

Existing cities can be made more ecologically friendly. However, entire purpose planned settlements have also been constructed using ecological principles – two such examples are Masdar City in the UAE and BedZED in Greater London.

Eco-City Case Study 1: Masdar City UAE

**Background:**

* Masdar is a newly planned eco-city that is being built in the United Arab Emirates.
* It is due to cost $22 billion.
* Work began in 2006 and it is due to be completed by 2030.
* It is located 10 miles outside Abu Dhabi.
* The city is aimed to accommodate population of 50,000 people and it is hoped that 60,000 people will also commute into the city for work. The city is 2.3 square miles in size.
* Abu Dhabi are committed to this project because they want to show the world that there is more to the Arab World than oil, they are trying to create a sustainable future based on diversifying the range of industries available. Masdar is designed to be a hub for CleanTech companies.
* At the heart of Masdar City is the Masdar Institute of Science and Technology. Students of the Institute have been the first people to move into Masdar and they are helping to make the city work by testing the technology.
* A British Architects firm called Foster and Partners are in charge of building the city.

Every aspect of Masdar has been planned to have the lowest possible environmental impact. Everything from the materials used in construction, the disposal of waste, the supply of energy and water and methods of transport have been carefully and meticulously planned.

**Building materials:**

* 96% of the material used was recycled material, including 100% of the steel.
* The waste created through the building process was also recycled. The construction team assembled a recycling plant next to the site to avoid wasting fuel when transporting waste. A lot of materials arrive in packaging e.g. wooden pallets – these were recycled by being ground up to create mulch, this mulch was then sold on to other businesses e.g. golf courses.
* Materials that were available locally were used to avoid transport emissions and to make the development more cost effective. For example sand was used as a major component of the reinforced concrete that was used in construction.

**Building design:**

* A move away from homogenized skyscrapers that use a lot of energy and water and towards more traditional desert architecture.
* The city layout has been deliberately designed so that strong winds that come off the desert are funneled down the narrow streets, this creates a cooling breeze that will enable residents to walk to reach their destinations.
* The buildings have been placed close together in order to create shade. The streets between areas are deliberately narrow (only 20ft wide) to keep them shaded and so cooler.
* Wind towers have been constructed to help cool the environment.
* No façade more than 30% glass to help keep the buildings cool.
* Walls have layers that have reflective chips which stop heat getting into the building – reducing the need for air conditioning.

**Energy:**

* Every roof has solar panels – but these only provide a 1/3 of the energy needed.
* Additional solar fields are being constructed to meet the energy demands. Surpluses will able to be used to provide Abu Dhabi with energy.
* Smart city digital technology is used to track water and energy usage.
* Residents of the student accommodation cannot alter their thermostats, meaning that they cannot over-use energy to cool their rooms.

**Transport**

**The PRT – Personal Rapid Transit System:**

* The plan proposed a driverless fleet of 3,000 free-moving, electric vehicles that could transport 2 to 6 passengers between 85 to 100 stations, tallying up to 135,000 trips a day along preprogrammed routes. This system of podcars was basically a replacement for taxis, providing privacy to passengers without the congestion common in other urban centers. A wi-fi network would maneuver the podcars through obstacles in real time as magnets along the path continuously pull the vehicle into alignment .
* However, the PRT has been abandoned and has been replaced plans for an underground metro line and a Light Rail Transit system running through the center of the city. Both of these lines are part of larger systems in and around Abu Dhabi that also links to the nearby airport.
* The changes to the plans were to reduce costs as the funding for Masdar was cut due to the economic crisis that began in 2008.

**Evaluation Masdar City:**

|  |  |
| --- | --- |
| **Strengths** | **Weaknesses/problems/drawbacks** |
| The centre piece for the city is the Masdar Institute of Science and Technology and the HQ of International Renewable Energy Agency.The students of the institute have become Masdar’s first residents.By basing the city around a university the region will hopefully achieve its aim of becoming a leader in renewable energy and sustainability.Ideas that are generated in Masdar will be able to be exported elsewhere to improve environmental sustainability in existing cities. | * In 2008, world economic crisis struck and Masdar’s budget was decreased by 15% - this meant that certain key parts of the project had to be abandoned e.g. the plans for the Personal Rapid Transit System and plans for a sustainable water supply system (should have been a solar powered desalination plant). It has also meant a delay in completion – the city only be finished in 2030, instead of initially proposed 2020. * Masdar City currently has to rely on water supply from Abu Dhabi. This water is produced in desalination plants and uses vast quantities of unrenewable energy in its production. * Sand is constantly blowing over the solar farms meaning they can to be regularly cleaned to keep them working. This uses vast quantities of water – increasing water resource consumption (which is produced unsustainably in Abu Dhabi). * Monitoring energy and water uses threatens civil liberties. Students complain that AC doesn't go below 22C. * Only 2000 people currently live there, not worth $22 billion * Greenpeace stated that there should be greater emphasis on retrofitting existing cities rather than creating new eco-cities. |

Eco-city case study 2: BedZED, South London

* BedZED is an eco-community, consisting of 82 homes built on reclaimed land in Beddington, Greater London.
* BedZED stands for Beddington Zero Energy development.
* It was completed in 2002 and is the largest carbon neutral eco-community in the UK.
* Carbon neutral means that it doesn’t add any extra carbon to the atmosphere.
* BedZED aimed to achieve living at a one planet level – by planning and designing a community with a low urban ecological footprint.
* At the time of construction BedZED homes used 81% less energy for heating than a conventional home, as well as 45% less electricity and 58% less water.

**BedZED key details:**

Resource consumption has been reduced by:

* Using natural or recycled building materials
* Building homes facing south to maximise solar gain (reducing the need for artificial lighting)
* Using insulation jackets on all buildings.
* Producing at least as much renewable energy that is consumed – this was done through use of wind cowls on the roofs that produce wind energy and through a combined heat and power biomass system.
* Using low-energy lighting and appliances throughout
* Using energy tracking meters in kitchens
* Providing homes with roof gardens rainwater recycling and wastewater recycling
* Providing a green transport plan – the site was deliberately chosen for its excellent transport links, including tram, bus and rail links within walking distance. They also have secure bike storage and a fleet of ZEDcars – these are available for residents to share if they join the car club, removing the need to own a private vehicle.

**Evaluation BedZED:**

|  |  |
| --- | --- |
| **Strengths** | **Weaknesses/problems/drawbacks/difficulties** |
| * BedZED was started in 1997 and was a pioneer for sustainable living. It was the UK’s first zero carbon development and has inspired many other projects throughout the world – including Masdar City (UAE) – which is aiming to become a zero carbon city. | * BedZED used new and relatively untested technology that is expensive to maintained that was prone to problems. * For example, a biomass-fueled system that was designed to provide zero-carbon heat and electricity. Unfortunately this system broke down and was not replaced as the technology proved too expensive. This forced BedZed to draw its electricity entirely from the National Grid on what, residents were dismayed to discover, was not even a green tariff. * Other new technology that caused a problem for the development was its Living Machine, which uses reed beds to filter sewage water for use in toilets and gardens – in 2006 this was out of operation for seven months because the Peabody Trust (housing association) could not afford to replace the operator. |

**Smart Cities**

**Definition:** A **smart city** is a **city** that incorporates information and communication technologies (ICT) to enhance the quality and performance of urban services such as energy, transportation and utilities in order to reduce resource consumption, wastage and overall costs.

**Examples of Smart Cities:**

* Newly developed cities: Songdo, South Korea
* Existing cities: Singapore

**Singapore**

* In 2014, the government of Singapore launched its **Smart Nation** vision in which the authorities of the Asian nation stipulated the implementation of a number of smart city initiatives as a response to growing urban challenges including urban density and energy sustainability.
* The most developed smart services in Singapore are within the transportation and urban mobility sector.

**One Monitoring – traffic monitoring system**

* Singapore has implemented a system to enhance traffic flow and keep road traffic running safety.
* One Monitoring is a portal serving all drivers and vehicle owners in the country.
* Through the portal, citizens can access traffic information collected from surveillance cameras installed on roads
* The system also provides information on sections where road work is in progress, traffic images of major highways, traffic news, travel time calculator, road maps, street directions and parking information.

**The Parking Guidance System**.

* This smart service provides drivers with real-time information on parking availability. The system is designed to reduce the amount of circulating traffic searching for available spaces and seeks a more efficient use of existing parking facilities. Information is displayed on electronic signs, online at the One Motoring Portal or on mobile applications such as MyTransport.SG.

**Smart Safety Initiatives**

* The government has also implemented a number of smart city initiatives in the field of safety and citizen security.
* The Singapore Police Force provides a web-based electronic police center for citizens to gather information and file police reports online.

**Smart Power**

* Another key initiative in the environmental sector includes a mobile application developed by local utility Singapore Power, which allows citizens to view their bills and payment status, and submit meter readings. The app enables consumers to audit their home usage to manage energy consumption.

**Smart Waste**

* Smart waste bins were introduced in 2015 as a part of smart waste management program.
* Under the initiative, monitors attached on bin lids collect information on contents and location, with the information transmitted to a garbage team through a central server.
* The waste collection team can optimize their route planning with the information provided by the sensors.

**Urban design and planning**

* A virtual 3D map of the city scape of Singapore has been created, this is known as **Virtual Singapore**. The maps contains an accurate 3D representation of every building on the island.
* In time, it will map vegetation and the dense network of pipes, cabling and even air ducts and trash chutes.
* Virtual Singapore isn’t just a pretty map to zoom around for fun, either: it’s a model built to help government departments plan more effectively.
* The map allows for modelling, for example because you know the dimensions of a rooftop, you can calculate its solar potential. You could even model how many solar panels would be needed to power an entire block.
* Virtual mapping allows the government to see how new buildings will change the city’s skyline and infrastructure before building begins. For example, government agencies can see how a building would disrupt traffic flow, how parking in the area could change, how vegetation could be affected by shadows cast from taller buildings.
* Virtual Singapore is designed to be the hub that other government initiatives ultimately plug into, it’s built to give the government a city-wide view of what’s happening. Working as either a simulation or live feed, health services could use it to map the spread of infections and the flow of Zika and Dengue-carrying mosquitos around the city. This data could then be used to help quash diseases e.g.by informing the relevant department about nests that need clearing out.
* Every data point in Virtual Singapore can also be drawn upon by private companies to help build apps and services for consumers.

**Plans for the future**

**Vehicle to Everything:**

* Vehicle to Everything, or “V2X’ for short, is the automotive initiative that Singapore needs to truly transform it into a smart city.
* A team of researchers are working are working on the future of the connected car.
* V2X comes in two parts: vehicle-to-vehicle (V2V), and vehicle-to-infrastructure (V2I).
* V2V allows two cars to securely communicate with one another without the need to connect to a wider network; V2I allows traffic lights, road signs, and security cameras to talk to each other, to cars on the road and straight back to a centralised government agency.
* In a V2I future, cars will actually understand the cities they exist within. Cameras located at crossings could tell cars that pedestrians are ahead well before a driver – human or autonomous – will have seen them.
* Traffic lights and road signs will be able to self-regulate the flow of traffic around a city, and cars will know of traffic diversions well ahead of actually encountering them.
* V2I will also flow back into Virtual Singapore, so there’s a live update of traffic around the city. Not only is this excellent for traffic modelling when developing in the city, it’s perfect for emergency services to know the fastest route to any incident, taking traffic flow into account.

**Smart city evaluation:**

|  |  |
| --- | --- |
| **Strengths** | **Weaknesses/problems/drawbacks/difficulties** |
| Singapore is leading the world in government-led IT infrastructure, educating both its government and citizens about the benefits of technology.  It is thought that Singapore are forging the way towards becoming a smart nation/city more quickly than other nations/cities because of the following factors:   * It is a very wealthy country so has lots of money to invest in the technology. * The same political party has been in power since 1956 so it is easier for the government to implement their plans. * 86% of housing is government owned and so it is easier to make changes on a large scale. * The country has a small population of 5 million, so it provides a perfect test-bed for developing a smart city. | **The cost of the infrastructure needed:**   * Smart Cities utilize sensor technology to gather and analyze information in an effort to improve the quality of life for residents. * Complicated and costly infrastructure is involved in installing and maintaining these sensors. How will they be powered? Will it involve hard-wiring, solar energy, or battery operation? Or, in case of power failure, perhaps a combination of all three? * Major metropolitan areas are already challenged with replacing decades-old infrastructure, such as underground wiring, steam pipes, and transportation tunnels, as well as installing high-speed internet. Broadband wireless service is increasing, but there are still areas in major cities where access is limited. In short, funding for infrastructure projects is limited.   **Security and hackers:**   * As sensor technology use expands, so does the threat level to security.   **Privacy concerns:**   * In any major city, there’s a balance between quality of life and invasion of privacy. * While everyone wants to enjoy a more convenient, peaceful, and healthy environment, nobody wants to feel like they are constantly being monitored by “Big Brother.” * Cameras installed on every street corner may help deter crime, but they can also install fear and paranoia in law-abiding citizens.   **Social inclusiveness:**   * Smart transit programs that give riders real-time updates are a great idea for a bustling city. But what if half the population of that city can’t afford to take mass transit or Uber? * What about a growing elderly population that doesn’t use mobile devices or apps? * How will smart technology reach and benefit these groups of people? * It’s vital that Smart City planning involves the consideration of all groups of people, not just the affluent and technologically advanced. * Technology should always be working to bring people together, rather than divide them further based on income or education levels. |

**Resilient Cities**

**Definition:** A resilient city is a city that is able to survive, adapt and grow no matter what kind of stresses or shocks it might experience.

**Resilient cities are economically productive, socially inclusive and environmentally friendly.**

**They should:**

* Have a properly functioning economy
* Have a properly functioning public transport network
* Have energy, water and waste infrastructure
* Allow for social mobility
* Develop resilience to natural hazards

Case Study 1: Improving Urban Resilience in Houston, Texas

**Building flood resilience in Houston:**

Floods come from nature, but the disaster is man-made.

* It’s estimated that more than 80 percent of buildings had no flood insurance before Hurricane Harvey- including flood insurance as part of a better package of home insurance essentials could help with this
* Houston and Harris County already have adopted higher building elevation standards- mandate that all new homes built in the region’s floodplains be elevated two feet above the projected water level in a 500-year storm
* Better risk communication — which could include rules for mandatory disclosure of flood history — could help increase the uptake of flood insurance.
* Texas Medical Center, buffered against floods after Tropical Storm Allison in 2001, services went virtually uninterrupted through Harvey because it took many approaches to reducing risk.
* Proposed investment of roughly $500 million to plan and build a third reservoir

**Houston and Cyber Attacks**

* Atlanta was hit by a “ransomware” attack known as SamSam, nearly bringing down all city operations. Millions in lost revenue because residents can’t paying water bills, and vital communications like sewer and infrastructure repair requests can’t be processed. Finally, all electronic communication systems for first responders is rendered inoperable for several days.
* Municipalities often have very limited technology budgets, with investments funneled to meet immediate tech needs rather than focusing on cyber defense.
* Houston was the No. 1 ranked city most vulnerable to cyber-attacks.
* Houston has in many ways led on the issue of cyber-security and protection. One of the earliest cities in the country to have a chief information/technology officer, it has since 2013 also had a chief technology Security officer who is tasked with maintaining a consistent and uniform security plan for the city’s technical infrastructure. Houston, unlike many other cities, does maintain a formal cybersecurity policy that is updated on a real time basis.
* What’s missing however, is the budgetary flexibility to quickly update systems and software.

Case Study 2: Improving Urban Resilience in Mexico City

**Mexico City Air Pollution and Traffic Congestion**

Use the notes from the section on urban stress to understand how Mexico City is building resilience to traffic congestion and poor air quality through improving its public transport network and reducing vehicle emissions through regulation.

**Managing earthquakes in Mexico City:**

* Every year, on September 19, Mexico holds a public drill to mark the anniversary of the devastating earthquake of 1985, which killed 9,500 people and had a traumatic effect on the country.
* Since 1985, Mexico has been credited with taking significant steps to reduce deaths, injuries and damage from earthquakes.
* Mexico City itself has been held up as a model for the developing world, having become an earthquake-conscious city within a moderate budget.
* Here are some of the ways that both city and state have worked to minimise the disastrous impacts of earthquakes.

## **Early warning:**

* Mexico City is built on a former lake bed, which makes it vulnerable to earthquakes hundreds of kilometres away, as the soft clay amplifies the tremors.
* Seismic waves from the 1985 earthquake took over two minutes to travel from the epicentre, which was over 350 kilometres away on the Pacific coast. This represents a **“time of opportunity”** – the period between when an earthquake occurs, and the arrival of its damaging effects.
* The time of opportunity for Mexico City is typically 60 seconds. These critical moments have been exploited by the authorities, through the development of an early warning system called SASMEX: the Seismic Alert System of Mexico.
* Sensors pinpoint the location and intensity of an earthquake, and if the magnitude is considered to be a threat then alerts are sent to state and local governments and emergency organisations.
* More than 90,000 users in Mexico City – such as schools – have dedicated receivers for receiving warnings.
* Authorities also issue mass warnings to the public through radio and television broadcasts, Mexico City’s municipal loudspeaker network and smartphone apps.

## **Be prepared:**

* A culture of preparedness has also spread following the 1985 earthquake, with earthquake simulation exercises being held monthly in hotels, schools and offices.
* During the annual nationwide earthquake drill, people in large buildings were given advice based on a hypothetical 40-second warning.
* Those on the ground or first floors were advised to evacuate to pre-determined meeting points, if these could be reached within the warning time.
* Those on the second floor or higher were advised to “drop, cover and hold-on”: drop to their knees to prevent falls, seek cover under a desk or beside an interior wall and hold on for stability until the shaking stopped, and then evacuate.
* The city received 20 seconds advanced warning in its most recent earthquake; enough time for people to take life-saving actions such as “drop, cover and hold on”.

## **Better building:**

* Mexico has also improved building codes and invested heavily in resilient infrastructure as a way of minimising the destruction caused by earthquakes.
* Most of the city’s critical buildings, such as hospitals, have been structurally reinforced to make them more resistant to earthquakes.
* Seismic-resistant design using dampers (shock absorbers) and deep foundations has been adopted for major buildings in the city centre such as the Torre Major, Pemex Tower and Torre Latino America.
* But actually enforcing building codes remains a challenge throughout Mexico – as in other countries around the world. Mexico’s National Coordinator for Civil Protection said recently that compliance was still a major issue, as a large proportion of the nation’s buildings are constructed without permits or professional guidance.
* Indeed, these “non-engineered” types of construction are estimated to account for 40% of Mexico City’s building stock, and there are concerns that poverty and inequality contribute to continuing vulnerability to earthquakes, especially away from the city centre.

**Example exam questions sustainable cities:**

* ‘Eco-cities and smart cities offer great opportunities for high- income countries’ Discuss this statement  (10)
* “Sustainable urban management is desirable but impossible to achieve.” Discuss this statement (10)
* Evaluate **two or more** strategies designed to improve the sustainability of cities. (10)