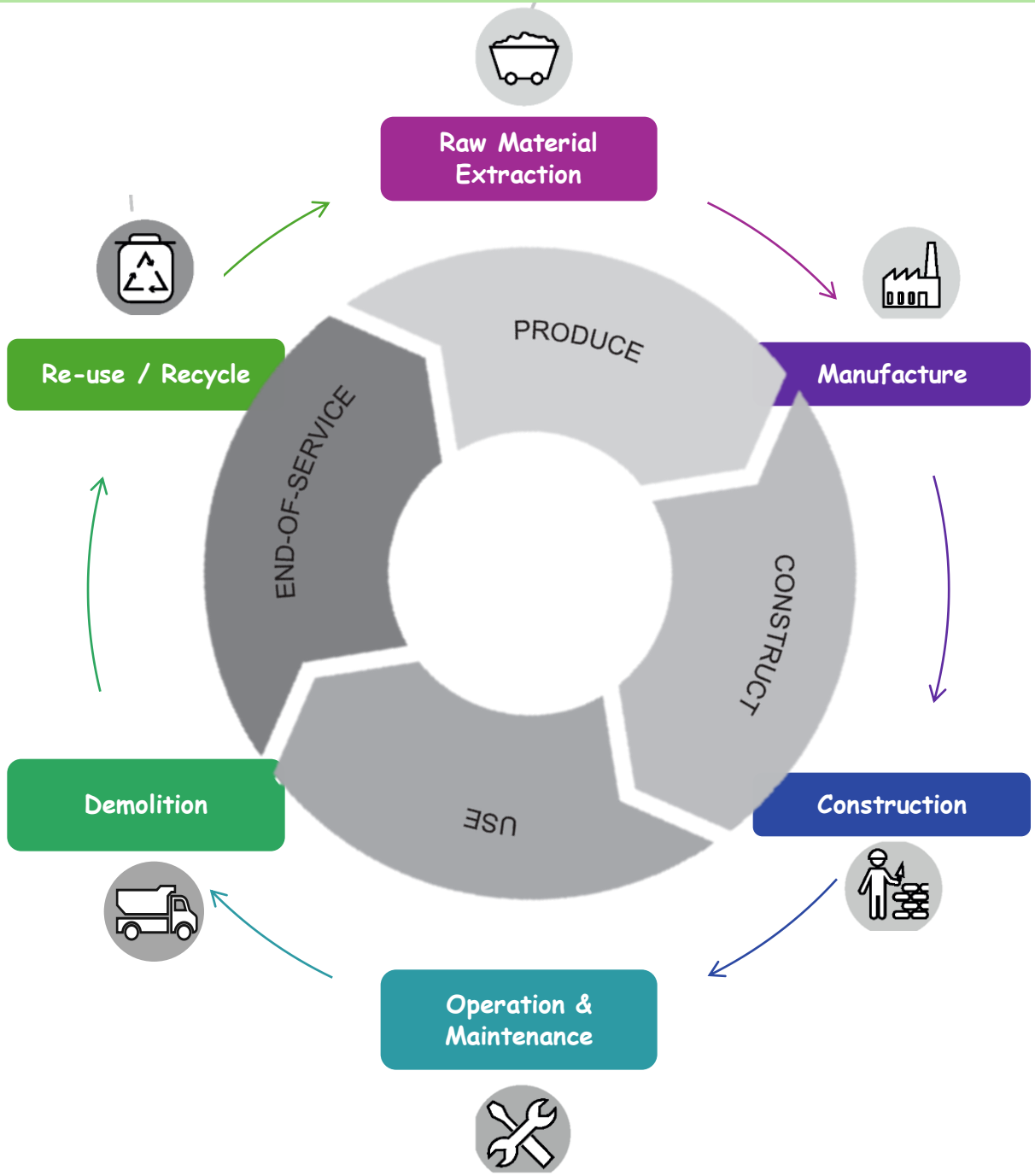
Unit 1 (1:2) Built Environment Life Cycle

The **6 stages** of the built environment cycle are: raw material extraction, manufacturing, construction operation & maintenance, demolition and re-use or recycling.

Unit 1 (1:2) The life cycle of a built environment

In terms of the built environment, 'life cycle' refers to **a product, building or service over the course of its whole life.**

Unit 1 (1:2) Built environment life cycle diagram



Unit 1 (1:2) Built Environment Life Cycle - Raw Material Extraction

Key Terms

Raw Material Extraction – We extract raw material for the production of goods and services, especially directly from the natural environment (E.g., harvesting, mining, lumbering).

Environmental impact - Raw material extraction impacts the environment, resulting in soil degradation, water shortages, biodiversity loss, damage to ecosystem functions and global warming.

Unit 1 (1:2) Built Environment Life Cycle - Raw Material Extraction

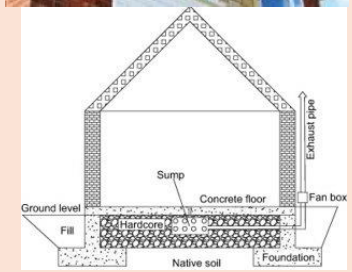
Unit 1 (1:2) Built environment - Raw Material Extraction Examples

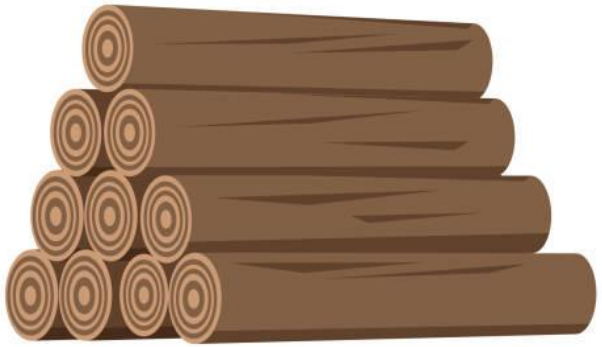
Material	Method of extraction	What is it used for?	Environmental impact
Oil/Natural Gas Fossil fuels in the liquid state is called oil, while those in the gaseous state is called natural gas.	Oil and Gas is extracted from beneath the earth's surface using traditional drilling and pumping methods.	We use petroleum products to propel vehicles, to heat buildings, and to produce electricity.	• Pollution. • Climate change. • Disrupting wildlife. • Damaging public lands.
Forestry Extraction is the term used to describe the process of removing timber fro m the point at which it is felled to the sawmill.	The trees are cut on-site and then picked up by a timber lorry, which transports the timber to a processing site.	Commonly used in construction as timber framed buildings, fencing and floorboards, in furniture or made into pallets.	• Loss of biodiversity. • Migration of wild life. • Ecological imbala nce. • Soil erosion. • Flooding.
Quarrying is the process of removing rock, sand, gravel or other minerals from the ground to use them to produce materials for construction	A form of open-pit mining used to extract limestone, granite, and marble, aggregates of rocks, sand, and minerals from the ground.	Stone - Buildings, walls, paving slabs. Aggregates – stone crushed for use in concrete, asphalt etc. Mostly used in roads, Concrete and building products.	• Damage to landscapes, • Smoke/dust • Damage to caves. • Loss of land • Deterioration in water quality.
Mining Ore is natural rock or sediment that contains one or more valuable minerals, typic ally containing metals, that can be mine.	Ore is extracted from the earth through mining and treated or refined, often via smelting, to extract the valuable metals or minerals.	Ore is essential to copper, iron and steel production.	• Deforestation • Erosion, • Contamination of soil. • Contamination of local streams. • Increase in noise level. • Dust.

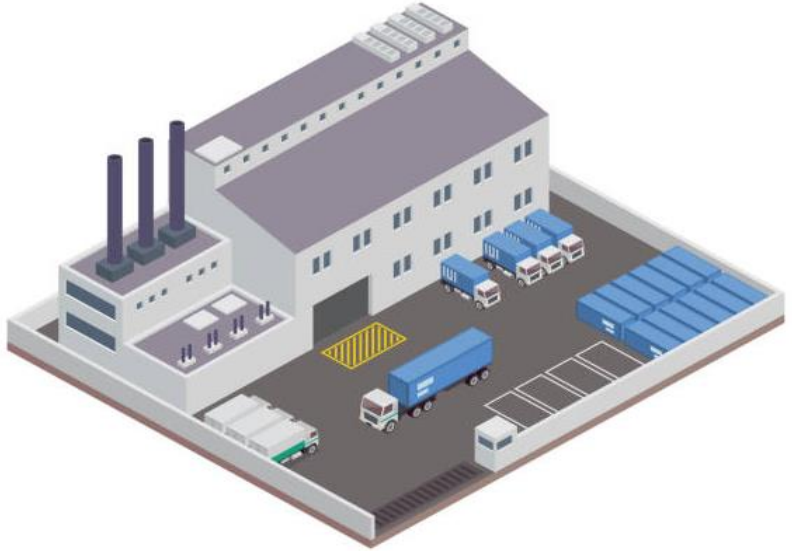
Unit 1 (1:2) Built Environment Life Cycle - Manufacture

Finished product	Raw materials Manufacturing process	Used for:
Timber Engineered wood products Plywood OSB (Oriented Strand Board)	Felled logs Debarked and cut Seasoned to remove excess water  Wood	Timber framework Furniture Stud (timber) partitions 
Structural Steel – column and beams Stainless steel – fixings and fastenings Profiled sheeting – wall and roof cladding Lightweight mild steel sections – lintels, rails	 Steel Iron ore is mined and then transformed into steel using two different processes: the blast furnace or the electric arc furnace.	  
Cement pavements, foundations, motorways, roads, bridges, architectural structures.	Raw materials are crushed, blended and heated in a kiln.  Clay	Cement is mainly used as a binder in concrete, which is a basic material used in housing, roads, schools, hospitals, dams and ports.
Copper	 Copper Oxide ores are generally processed using hydrometallurgy. This process uses aqueous (water-based) solutions to extract and purify copper from copper oxide ores at ordinary temperatures.	Wire and piping Plumbing – water and gas pipes Electric cable Good conductor
Mortar	Sand, cement and water are mixed into a paste. 	Used to bind and point building blocks

Unit 1 (1:2) Built Environment Life Cycle - Manufacture

Finished product	Raw materials Manufacturing process	Used for:
Bricks Natural clay minerals are crushed – turned into mouldable clay, then shaped, dried and fired in a kiln.	The process of manufacturing of bricks from clay involves preparation of clay, molding and then drying and burning of bricks. 	building walls, pavements and other elements in masonry construction.
Plastic piping	 Melted and moulded into pipes Plastic	Used for water, drainage, sewerage, guttering, cladding etc. 
Hardcore and granular fill materials (20mm crushed grade)	Mined/recycled and Crushed ready for use. 	Foundations, landscaping, insulation 



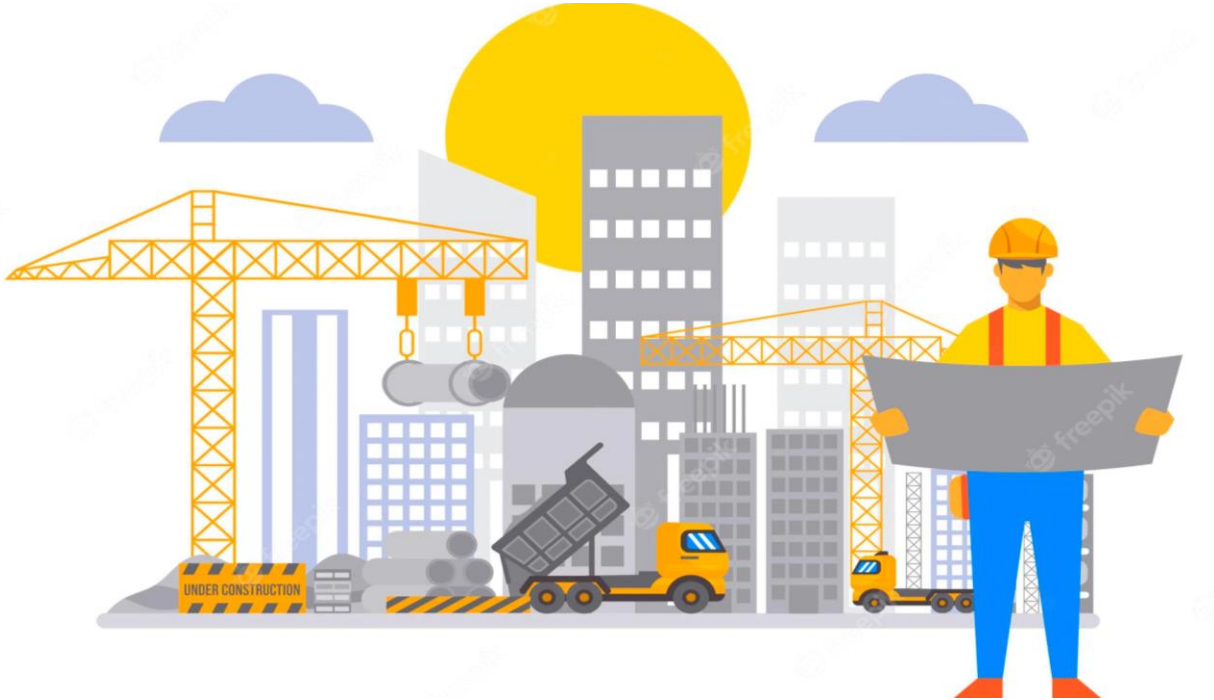


Unit 1 (1:2) Built Environment Life Cycle - Construction

The alteration, conversion or renovation of existing buildings and structures. Examples: Loft conversions, construction of a basement, redesign of floor plans, re-wiring, re-plumbing, new drainage lines, repainting the walls or cabinets, replacing fixtures or hardware. You could update old or outdated items.	
Mass concrete foundations and large diameter drainage schemes. Examples: Large foundations in cities for multiple/large buildings. Large diameter drainage in cities for aid in infrastructure.	
New buildings and structures- planning and building new structures using a combination of timber, steel and brick materials. Prefabricated elements are assembled on-site.	  

Unit 1 (1:2) Built Environment Life Cycle - Construction

Installation of mechanical, electrical, gas and communication services. Examples: Sub-surface utilities, telecommunication lines, electrical grids.	
The construction of paths, roads and bridges for an infrastructure project. Examples: Roads, bridges, paths, ports, airports, rail.	



Key Terms

Operation = Management of a built environment to provide safe and suitable conditions for occupants and their activities.

Maintenance = The repair or prevention of decay, deterioration and damage caused by weather, aging and general use so that the building looks good and operates efficiently.

Unit 1 (1:2) Built Environment Life Cycle - Operation & Maintenance

Operation may take the form of:

- **Controlling and monitoring** of heating, cooling and lighting systems.
- The **provision** of security, cleaning and other services, including testing and evacuation procedures.

Maintenance may take the form of:

- **Planned and preventive maintenance:** carried out on a regular basis, in order to keep something in working order or extend its life
- **Cyclical maintenance:** replacing over a cycle of work as an investment in stakeholders' comfort levels
- **Emergency or reactive maintenance** due to safety reasons for stakeholders

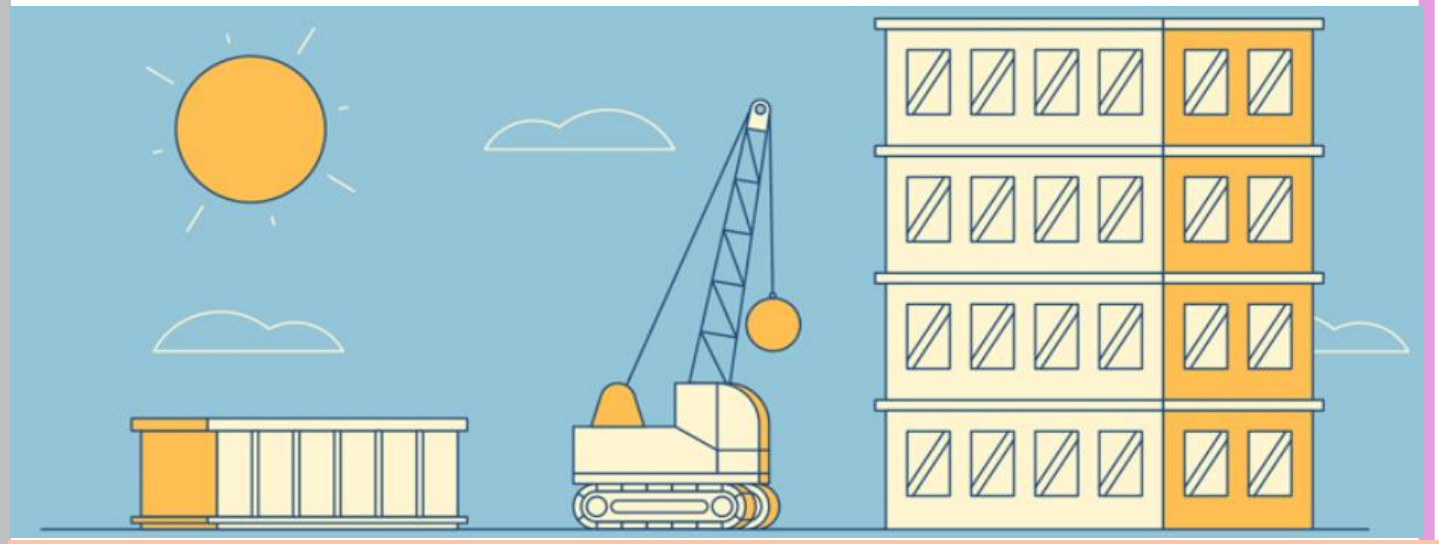
The main objective of maintenance is to **limit deterioration**. Inspections carried out at **regular intervals**, coupled with prompt action to **pre-empt or remedy problems**, are the basis of effective maintenance:

- **Preserving the heritage:** regular maintenance keeps up a building's appearance and extends its life. It also prevents the loss of original fabric, because less material is lost in regular, minimal and small-scale work.
- **Preventing large repair bills:** extending the period between repair projects by carrying out maintenance.
- **Preserving resources:** it is far better to keep our existing buildings in use and in a good state of repair. This will reduce our need for new materials.
- **Promoting guardianship:** if we want to be able to share our heritage with future generations, we need to make sure that we **look after our historic buildings**.

Unit 1 (1:2) Built Environment Life Cycle – Demolition

Pre-demolition Plan

Pre-demolition audits (including asbestos) and surveys provide an understanding of key products and construction materials that can be **reused** on/off site, reclaimed or **recycled** prior to the demolition or major refurbishment or redevelopment of the site.



Unit 1 (1:2) Built environment life cycle diagram

Building Survey

Study the materials, construction method, and physical conditions.

Hazardous Materials

Remove flammable and contaminated materials from the site.

Demolition Plan

Outline the demolition method, equipment needed, debris and material cleanup.

Safety Measures

Advise site workers of hazards, secure permits, and block off areas.

Unit 1 (1:2) Built Environment Life Cycle – Pre-demolition Plan

Building survey

Experts examine the different characteristics of a building, such as:

- materials,
- building usage,
- method of construction,
- condition,
- draining conditions,
- traffic conditions,
- building codes,
- neighbouring communities.

A study of these parameters will help to dictate the best demolition method.

Removal of hazardous materials

Specialized personnel is called upon to remove dangerous materials from the building prior to demolition, such as:
asbestos minerals,
foam insulation
MDF (medium density fibre board)
radioactive substances,
flammable materials
petroleum contamination.

Demolition plan:

Experts craft a detailed plan illustrating what will be involved in the demolition, how it will be carried out, the equipment that will be used, and how much debris they will need to clean up.

demolition may involve the use of explosives, hand demolition or machine demolition.

Safety measures

Statutory rights need to be considered when undertaking a demolition project.

Site workers, supervisors, operators , and engineers are advised of potential hazards such as flammable materials and exposure to noise and dust. The demolition company must also secure the proper permits.

Unit 1 Built Environment Life Cycle – Reuse and Recycle

Key Terms

Reuse - Using an item/material again.

Recycle - The process of changing waste into reusable material.

Waste - Any material/item which is not needed or cannot be used anymore.

Landfill - A large site where waste is disposed of by burying it in the ground.

Salvage - Saving an item/material before it is disposed of so it can be reused or recycled.

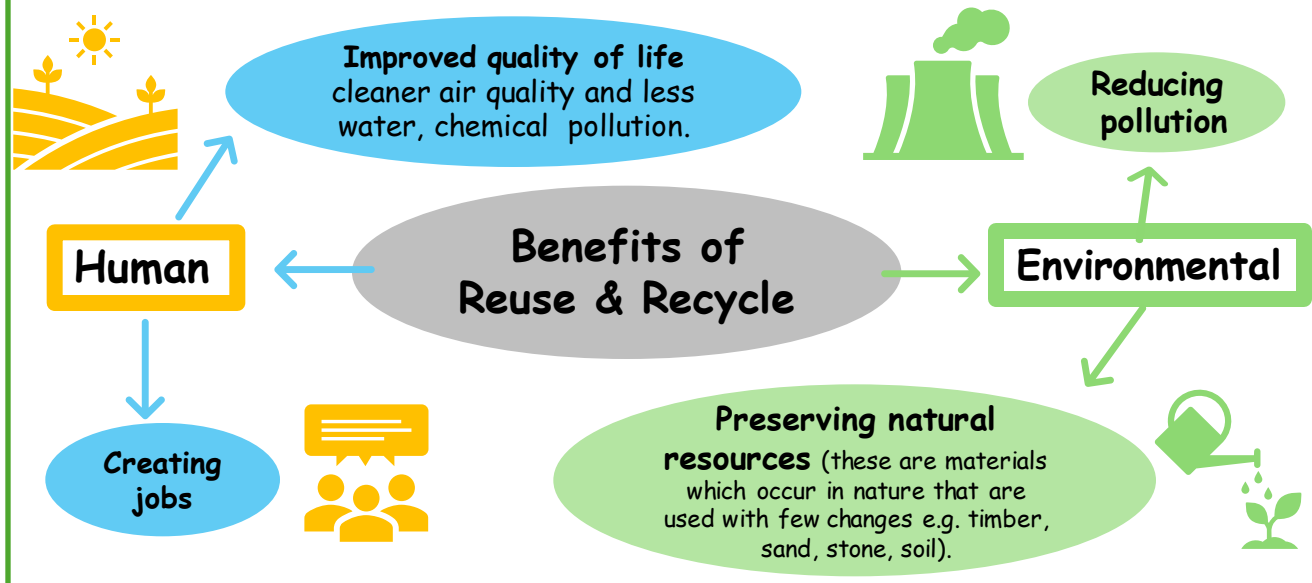
Sustainable - A material/resources/state that can be replaced and maintained at a certain level.

Renewable - A material/resource that will not run out for example: solar energy, wind energy.

Managed source - Ensuring materials and processes are sourced and used responsibly to ensure. sustainability. E.g. Planting trees each time 1 is cut down.

Unit 1 Built Environment Life Cycle – The Benefits of Reuse and Recycle

Construction can produce significant amounts of waste.
Encouraging more reuse or recycling has the following benefits:



Unit 1 - Reuse and Recycle: Embankment & Landscape Bunding

In earthmoving, **cut and fill** is the process of constructing a railway, road or canal whereby the amount of material from cuts roughly matches the amount of fill needed to make nearby embankments to minimize the amount of construction labour.

Constructed embankment

Man-made (artificial) mounds made of compacted soil to change the ground level. Embankments -can be used to reduce flood risk, transport infrastructure.

Landscape bunding

Placement of lines of stones/soil in the landscape to retain the soil 'wall' and help drainage.

Unit 1 Built Environment Life Cycle – Reuse and Recycle

Reclaimed wood

Recycled steel/metals

Recycled glass

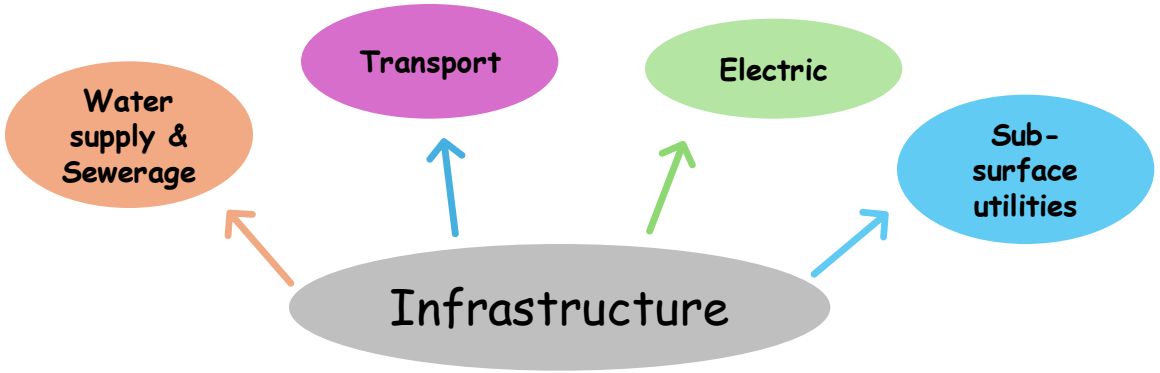
Bamboo

Sustainable forest timber

Unit 1 (1:1) Infrastructure

Building and infrastructure projects are **HIGH COST LONG TERM** activities that are a good indictor of the overall health of the **wider economy**.

Unit 1 (1:1) Infrastructure



Water supply & Sewerage:
- -Water supply
- -Agricultural water distribution (canals, rivers)
- -Sewers
- -Storm water drainage

Transport
- -Airports,
- -Trams
- -Railways,
- -Ports
- -Bridge,
- -Roads,

Electric
- -optical fiber
- -cell tower site
- -radio antenna
- -phone equipment and data networks
- -appliances

Sub-surface utilities
- -Waterlines
- -Fiber Optic
- -Gas
- -Oil
- -Sewerage

Unit 1.1 Infrastructure Construction

Infrastructure construction is building anything which helps link towns, cities, and rural areas. This can include power systems (electrical distribution and power lines), roads, bridges, tramways, harbour works, motorways, and rail cycle paths. **Think of it as building services or facilities, rather than homes or office buildings....**

Unit 1.1 Infrastructure Construction – Benefits and Drawbacks

Projects are often controversial because developers, planning authorities and communities have to weigh the benefits against the drawbacks.

	Benefits	Drawbacks
Environmental	Sustainable & eco-friendly building design = reduction in waste & more green energy Creating habitat & increase in bio-diversity	Noise, Pollution – CO2 – global warming/climate change Loss of natural habitat & decrease in bio-diversity
Social	• Connects people (telecommunications, transport). • increased access to cleaner water, education, medical care, police/emergencies services	• Light pollution • Air pollution • Illegal crime is more likely. • Longer working hours
Economic	creates jobs Opportunities to broaden business	Tax-payers money – less investment put into education, health care systems and other public facilities

Unit 1 Safety and Security – Key Terms

Key Terms

Hazard - Anything that can cause harm or danger.

Risk - The chance, high or low, that any hazard will actually cause somebody harm.

Control Measure - Something that is put in place to reduce risks.

Eliminate – Get rid of completely.

Mitigate – Get rid of as much as possible.

Contaminated – Exposed to pollution or chemicals/substances.

Substructure – Any part of a building below ground level.

Superstructure – Any part of a building above ground level.

Effects of Hazards

- Physical
- Psychological
- Financial
- Environmental

Those affected by hazards

- Self
- Others working in the area
- Local Community
- Environment
- Users

Unit 1 Safety and Security –Risk assessment example

Risk	Control Measure
Someone who is working at height, they could fall.	Scaffold with fixed ladders or access platform with integral steps and suitable guard rails.
They also have tools and materials at their feet. These could fall and hit someone below	Control risks from falling objects by installing kick boards and wearing of hard hats.
There are lots of tripping hazards on the floor. Someone could fall and hurt themselves.	Avoid tripping hazards by removing all rubbish and debris as it arises using shoots directly to containers for disposal.

Unit 1 Safety and Security – Hazard vs Risk

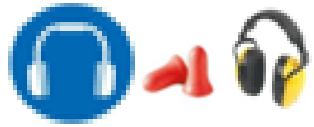
Hazard: Something that could potentially cause harm.

Risk: The degree of likelihood that harm will be caused.

Unit 1 Safety and Security – Personal Protective Equipment


Safety Gloves

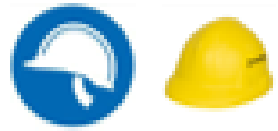

Work boots


Ear defenders/plugs


Knee pads


Safety Goggles


Overalls


Hard hat


Dust Mask


High Visibility


Harness

Trade	Job Role	Example
Bricklaying	• Works from plans and specifications to measure out work areas. • Lays rows of bricks or blocks • Mixes mortar by hand or with a mechanical mixer • Shapes and trims bricks or blocks using hammers chisels and power tools • Constructs structures by spreading layers of mortar and placing bricks or blocks. • Checks vertical and horizontal alignment using a spirit level, laser level or plumb line. • Constuction brick work using tradition bonding patterns using Stretcher, Old English and Flemish bond.	
Stonemasonry	• Dresses blocks of stone (dressing is the process of cutting rough stone obtained from quarrying to the required size shape and surface finish). • Carves stonework (stone carving is an activity where pieces of rough natural stone are shaped by the controlled removal of stone). • Repairs and cleans existing tradition stone mouldings and other features. • Lays traditional stonework including drystone walling. A drystone wall is built without mortar and its strength depends on the skill of the stone mason in carefully selecting natural stones that interlock with one another.	
Plastering	• Prepares surfaces and levels off uneven areas mixes plaster to the right consistency by hand or with an electric mixer applies wet finishes and protective coverings such as pebbledash or render on external walls applies wet finishes to walls and ceilings (this is known as solid plastering). • Creates ornamental features such as ceiling roses, cornices and architraves (this is known as fibrous plastering) • fixes internal plasterboard or wallboard on stud partitions type of work known as dry lining). • Replicates traditional ornamental plasterwork using plaster, moulds and casts.	

Painting and decorating	• Prepares and applies paint, wallpaper and other finishes to interior surfaces. • Prepares and applies paint and other finishes to exterior surfaces. • Follows relevant safety regulations. • Strips off old wallpaper or layers of paint. • Fills holes and cracks and makes sure that surfaces are level. • Covers surfaces with primer and undercoat. • Applies coats of paint and hangs wallpaper. • Adds special finishes such as stains, varnishes or marbling.	
Flooring and tiling	• A floor layer: • Prepares and applies levelling compounds. • Lays carpets and laminates and applies vinyl floor finishes to internal floors. • A tiler: • Prepares surfaces by levelling off with plaster, sand or cement. • Cuts tiles to the required size and shape using hand cutters or bench-mounted tools. • Fixes and grouts tiles in place.	
Plumbing installation	• Follows relevant safety regulations (e.g. Gas Safe) installs cold water, hot water, sanitation (toilets), boilers and central heating systems. • Cuts, shapes and joins pipes and fittings • Finds and fixes faults • Services gas and oil-fired central heating systems and radiators • Installs and repairs domestic appliances such as showers and washing machines. • Responds to emergency callouts, such as boiler breakdowns or blocked drains • Fits weatherproof materials, joints and traditional lead flashings to roofs, chimneys and walls.	

Bricklaying Tools

Gauge rod

Trowel

Brick jointer

Pointing Trowel

Eyes on me

Bolster chisel & Hammer

Mortar Mixer

Tape Measure

Spot board

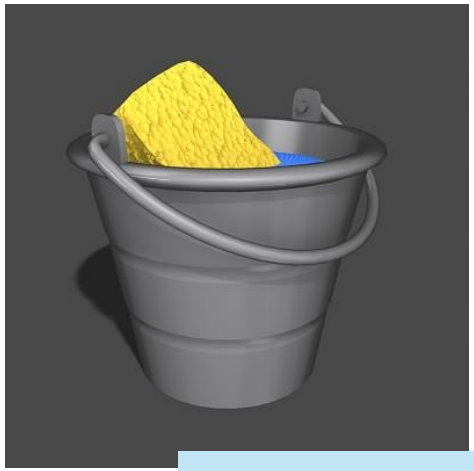
Spirit level

Boat level

Tiling Tools

Wet tile cutter

Notched trowel



bucket + sponge

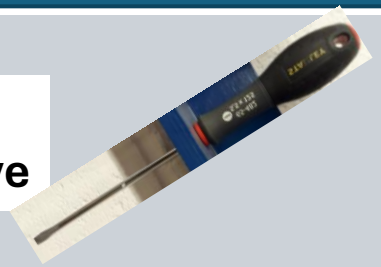
Tile nippers

Grout float

Flat bed tile cutter

Plumbing Tools and their uses

Slot head screwdriver

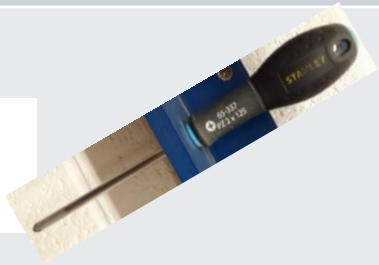


A slotted screwdriver is a tool used **to apply torque to screws using a fla**

Adjustable Spanner

An open-ended wrench with a moveable jaw. Its function is the same as any regular spanner - **to grip fasteners, such as nuts and bolts**

Cross head screwdriver



These tools are designed **to fit screws with Phillips heads,** which have a cross-shaped recess

Heat Mat

A heat mat is for **use when using a blow torch.**

Basin Wrench

A specialty plumbing tool with a rotating, self-adjusting gripping head and long handle. It is used **to tighten and remove the mounting nuts of faucet tailpieces**.

Pipe Slicer

Pipe cutters are tools used for **slicing or cutting pipes**.

Water pump pliers

Mainly used **to cut thick metal in plumbing, automotive and household applications**.

Flux Brush

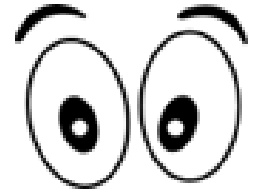
The brushes are primarily intended for use with **flux or glue on joints and threads**.

Plumbing Tools and their uses

Pipe Bender 	Used **to shape pipe such as copper or steel, creating angles and bends.**		
Blow Torch 	The blowtorch is commonly used **where a diffuse (wide spread) high temperature naked flame heat is required.**		
Spirit Level 	A tool used **to indicate how parallel (level) or perpendicular a surface is relative to the earth.**		

Carpentry and joinery	• ***A Joiner:*** • Measures and marks out wood from technical plans. • Cuts wood by hand or with a machine. • Joins pieces of wood to create a variety of structure including, staircases, windows, doors and roof trusses. • ***A Carpenter:*** • Installs floor joists, floorboards, roof trusses and wall partitions. • Fits interior woodwork such as staircases, doors, skirting boards, window frames, cupboards and kitchens. • Replicates traditional ornamental mouldings. • Builds wooden supports or shuttering to hold setting concrete in place. • Fits interior woodwork in shops, bars, restaurants, offices and public buildings.	
Electrical installation	• Installs, inspects and tests electrical services and equipment. • Follows relevant safety regulations checks electrical systems to make sure they are working safely. • Builds and installs control panels that operate electrical systems in buildings. • Installs street lighting and traffic management systems. • Fits electrical wiring, sockets and switches to new-build homes. • Rewires homes and commercial premises during refurbishment.	

Define what 'residential dwellings' are



Residential – used as places of habitation*

Non-residential – buildings and structures NOT for habitation

KEY WORD: habitation* - where you live / home

What is the meaning of **residential** and **non-residential**? Sort these buildings into **residential** and **non-residential**.

What we already know about TYPES of residential dwellings...

Bungalow

Semi-Detached house

Terraced house

Detached house

Over to you!

1.3 Types of building and structure

Date:

Type of building		Characteristics	Examples
Commercial buildings	Designed to accommodate businesses that either provide a service (e.g., bank) or sell products (food, clothing, fuel etc). Aimed at making a profit for the owners or shareholders.	Can be either purpose-built or adapted to meet their function. Vary in size and location (both urban and rural).	• Retail/service shops • Cafes/restaurants/takeaways • Banks • Offices • Call centres • Pubs (public houses)
Industrial buildings	Designed to store, manufacture and process materials.	Generally larger in size and adapted to industrial function. Located away from town centres often in purpose built industrial parks/estates that have easy access to road/rail transport networks.	• **Processing plants** – where raw materials and chemicals are changed into a form suitable for later use in manufacturing e.g., crude oil into plastic. • **Engineering/manufacturing factories**- where processed materials are used to create products. • **Warehouses** – storage
Agricultural buildings	Shelter for animals, the storage of crops and machinery, or the cultivation of plants.	Located in rural areas. Can be very large buildings so careful consideration is given to how they look in the rural landscape so that they blend in.	• Grain stores • Storage sheds • Barns • Livestock sheds • Stables

Community buildings	Intended for use by the local community and so need to be situated in a convenient location.	Could be purpose built or an older building that has been adapted.	• Community centres • Day centres • Surgeries • Clinics • Hospitals • Schools • Colleges
Religious buildings	Intended meeting places for the worship of a specific religion.	Age of these buildings can vary considerably some could be centuries old and others new. Design is influenced by history and tradition – architectural style can be very decorative and expressive (stained glass windows, domes, towers etc). Vary in size.	• Jewish synagogues • Sikh gurdwaras • Christian churches • Hindu temples • Islamic mosques
Recreational buildings	Intended as places for leisure.	Vary considerably in size and style. Can be new, purpose built or be extensions of existing buildings such a spa being added to an existing hotel.	• Health clubs • Night clubs • Pubs • Sports clubs • Gyms • Swimming pools • Leisure centres

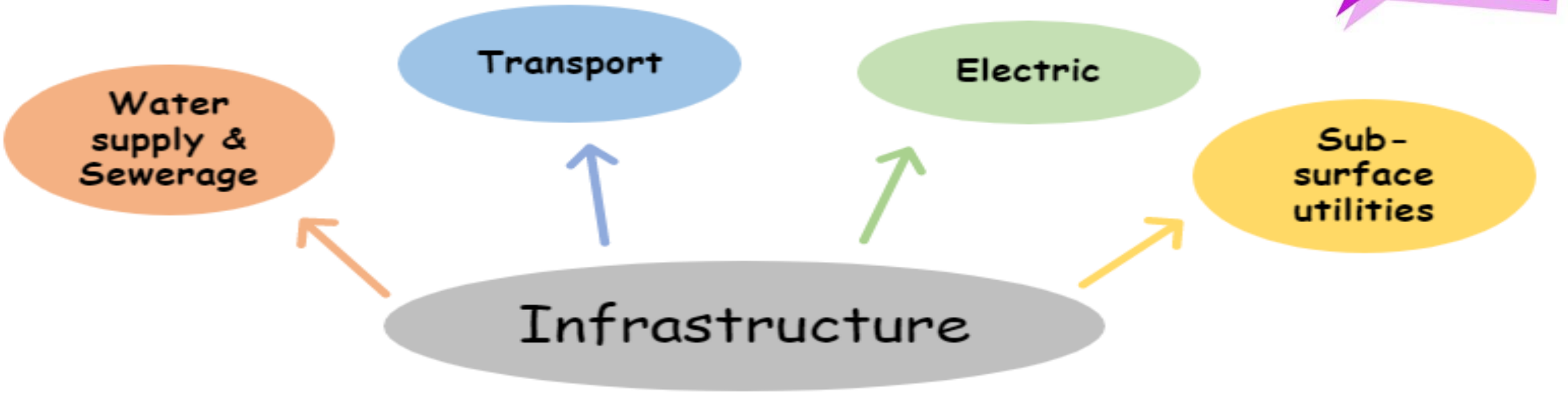
Define what '**infrastructure construction**' is

Infrastructure construction is **building anything which helps link towns, cities, and rural areas**. This can include power systems (electrical distribution and power lines), roads, bridges, tramways, harbour works, motorways, rail cycle paths.

Think of it as building services or facilities, rather than homes or office buildings....

Are there any that you didn't have?

Over to you!



Water supply & Sewerage:
- Water supply
- Agricultural water distribution (canals, rivers)
- Sewers
- Storm water drainage

Transport
- Airports,
- Trams
- Railways,
- Ports
- Bridge,
- Roads,

Electric
- optical fiber
- cell tower site
- radio antenna
- phone equipment and data networks
- appliances

Sub-surface utilities
- Waterlines
- Fiber Optic
- Gas
- Oil
- Sewerage

Identify benefits and drawbacks of **infrastructure construction** AND know that these must be 'weighed up' before construction can go ahead.

Local or national scale

Social

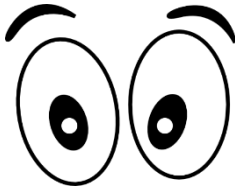
*Complete the worksheet with your answers.

Benefits

connects people (telecommunications, transport)

Improved access to services e.g. cleaner water, better education, medical care, police/emergencies services

Drawbacks



Light pollution
Air pollution

Disruption (roadworks and increased journey times)

Longer working hours

Over to you!

- Identify benefits and drawbacks of **infrastructure construction** AND know that these must be 'weighed up' before construction can go ahead.

Local or national scale

Economic

Benefits

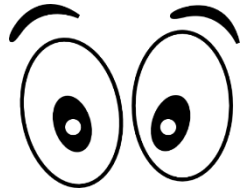
creates jobs

Opportunities to broaden business

Drawbacks

Tax-payers money - less investment put into education, health care systems and other public facilities

Over to you!



- Projects are often controversial because developers, planning authorities and communities have to weigh the **benefits** 👍 against the **drawbacks** 👎