

FORCES AND STRESSES

Static and Dynamic Loads

A static load does not move and will exert far less stress than a dynamic load

Force = Mass x Acceleration

Designers have to consider the speed behind the force as well as the type of force

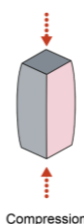
Tension

Helicopter blades are under tension when the rotor spins. They need to have high tensile strength to withstand these forces



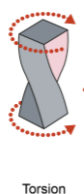
Compression

The impact of a car crash exerts compressive force on the vehicle



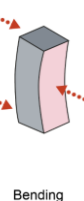
Torsion

Twisting a material puts it under torsion



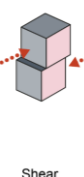
Bending

Stiffness is the ability of a material to resist being bent out of shape. Some products and materials are designed to have a certain degree of stiffness to perform their function



Shear

A shear force occurs when opposite forces act on an object in a direction perpendicular to its length



IMPROVING FUNCTIONALITY

Improving Functionality

Materials can be reinforced, stiffened or made more flexible. Techniques include: Folding, Bending, Webbing, Lamination, Fabric interfacing

Folding and Bending

Reshaping or changing the structure of a material can reinforce it. Corrugated cardboard gets its rigidity from a central layer of paper with concertina folds

Strengthening and enhancing

Parts of a product might be made thicker, or have ribs, gussets or fillets added. Materials can be combined to reinforce each other, increase toughness, durability, safety

Reinforcing

Reinforcing is a way of strengthening materials. Metal frameworks are used in the construction of concrete

Webbing

Webbing fabric is used to reinforce various products. Its tightly woven strips are usually made from high-strength synthetic fibres such as nylon, polyester and Kevlar

Stiffening Materials

Lamination involves bonding two or more layers of materials together to improve working properties such as: Strength, Rigidity, Flexibility

Fabric Interfacing

Fabric interfacing is added to textile products to make them more rigid

ECOLOGICAL AND SOCIAL FOOTPRINT

Greenhouse effect



Carbon footprint

A carbon footprint is the amount of carbon dioxide released into the atmosphere as a result of the actions of an individual, organisation or community

Mining/Drilling

Fossil fuels are harvested through mining and drilling

Deforestation

Large areas of forest and rain forest are destroyed to harvest wood and/or make way for farmland

Product Miles

Product mileage refers to the distance travelled by a product, from raw material source, to manufacturer, to user and on to final disposal

Oceanic pollution

The pollution of waterways and oceans is caused by the mismanagement of toxic by-products

Atmospheric pollution

Emissions from all kinds of human activity can have a detrimental affect on the quality of our air

THE SIX RS

The 6R's

The six Rs are a set of strategies used to help make more sustainable decisions as a consumer and as a designer: Refuse, Rethink, Reduce, Reuse, Repair, Recycle

Miniaturisation

Modern materials and composites are often lighter and stronger than traditional materials so less material is needed. Micro- and nano-technology means that electronic products are getting smaller

Upcycling

There is a growing trend for upcycled products. These products are revamped to celebrate past fashions, industrial aesthetics and retro styling

Planned Obsolescence

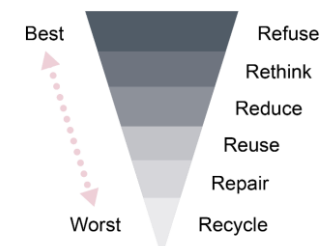
Some designers and manufacturers make products that are only built to last a short amount of time

WEEE Directive

Electronic waste is one of the fastest growing waste streams in the UK. The Waste Electronic and Electrical Equipment Directive sets targets for the recycling of electrical items.

Hierarchy of sustainability

This system ranks the six Rs from worst to best in terms of their impact on the environment



SCALES OF PRODUCTION

One Off

A single product or unit is made. One-off production is suitable for prototypes and when a product is designed for a client with specific needs

Batch Production

More than one unit is produced at a time in a set or batch e.g. confectionary, newspapers or furniture items. Patterns, templates or jigs are used to increase efficiency

Mass Production

Mass produced products are made in large volumes, in factories with a high level of automation and very few, if any, processes completed by hand.

Continuous Production

A continuous production line is run non-stop, 24 hours a day, 7 days a week, manufacturing products to meet a constant demand

Jigs, Patterns and Templates

Jigs and patterns can be made or bought in to expedite a certain process. They can help to perform repetitive or awkward tasks accurately

CNC Machines

CNC stands for Computer Numerical Control. These are CAD/CAM machines like laser cutters and CNC routers

Set up Costs

The more automation in a production line, the higher the set-up costs will be. Products made using complex industrial machinery will be mass produced