

Structures

Definition of Structures

- Made of different members (parts)
- joined together
- perform certain functions

Structures are classified according to origin (man-made or natural) and by their type/design

Types

Shell Structure

- Hollow structure
- Function: Contain/protect or to enclose, support a load, span a gap
- Every part of structure supports load - gives it strength
- egg, nest, car, box

Frame Structure

- made of different members joined together
- gaps in between
- Function: Enclose, protect, span a gap, support a load
- Supports from inside
- bicycle wheel, skeleton, roof trusses

Solid Structure

- Solid, not hollow
- made of one material
- no gaps
- Function: support a load, enclose or protect, span a gap
- relies on own mass to resist forces
- stone wall, concrete paving, tiles, rocks

Functions

Supporting a load

- all structures support own weight
- load - person, object, animal, force
- skeleton, pillars, bookshelf

Spanning a gap

- crossing or filling a gap
- natural: spider web, man-made: bridge

Enclosing people, animals or objects

- structures made to enclose people, animals, plants, objects
- some enclose to protect - egg
- some enclose to contain - prison

Forces

Compressive (pushing)

structural member under compression - **strut**

Tensile (pulling)

structural member under tension - **tie**

These forces can:
Bend
Separate (shear)
Twist (torsion)

Properties Frame Structures

Strength

- Should not break or collapse
- Made stronger - folding/tubing

Rigid/stiff

- Will not bend, buckle/ change shape
- Triangulation**- using triangles to make structure more rigid

Stability

- Will not fall over, be stable
- Make structure **LEVEL**
- use **SUPPORTing members**
 - guys** (steel cables)
 - buttresses** (wood poles or stone supports)
 - struts**
 - stays**



Structures - Terminology

Term/phrase	Definition
Structure	A structure is something that is made up of different members (parts) joined together that can perform certain functions.
Functions of Structures	Supporting a load Spanning a gap Enclosing or protecting someone or something
Types of Structures	Shell structure Frame structure Solid structure
Shell structure	A shell structure is a hollow structure that contains or protects something, e.g. egg, bicycle helmet, car. A shell structure spreads the forces throughout the structure, meaning every part supports and gives strength.
Frame structure	A frame structure is made of stiff parts, with members joined together to provide a strong support that cannot easily collapse or fall over. A frame structure have gaps or spaces between the columns and beams and consist of a framework, e.g. bicycle, trusses, skeleton, pylons, etc. A frame structure supports from inside.
Solid structure	A solid structure is solid and is not hollow or with any gaps. Usually a solid structure is made of one material, e.g. stone wall, paving, rocks, etc. Solid structures rely on their own mass to resist forces.
Force	A force is something that either pushes against something or pulls something. A force can also cause something to bend.
Compressive Forces/ Compression	Pushing force acting in on a structure. A structural member under a compressive force is a strut.
Tensile Force/Tension	Pulling force acting in on a structure. A structural member under a tensile force is a tie.
Properties of structures	Strength (does not break or collapse), Rigid (does not bend or change shape), Stable (cannot fall over)
Corrugated	Means folded. For example corrugated cardboard is used to strengthen cardboard boxes.
Folding or Tubing	Used to make frame structures stronger.
Triangulation	Using triangles to make a structure more rigid.
Guys	Supporting members, usually steel cables or ropes used to make a structure more stable, e.g. cables that keep a flagpole stable or ropes that are used to keep a tent stable.
Columns	Vertical members of a structure
Beams	Horizontal members of a structure - spread a load across columns
Materials	Something that is used to make a product out of e.g. plastic/wood
Tools	That which is used to help you make a product out of materials, e.g. saw, hammer, paint, nails, etc.
Product	Anything that is manufactured or made using materials and tools.



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