Lesson 3: Structural Systems in Buildings

In this lesson students explore how buildings stand up.

Support material: Information Sheet 21 "Structural Systems", Information Sheet 10 "Bearing the Load", Worksheets C2 and C3.

Spotlight

Anatomy of buildings

Key Concepts

Load-bearing walls. Frame. Skin.

Review of work

- Award a point for each correct answer to Question B on worksheet C1.

Monastic settlement:	Coursed regular rubble
Merrion Square Houses:	Brick and stone
Four Courts:	Ashlar
Community School:	Concrete block

- On the board, list the new terms students learned in Lesson 2 and Worksheet C1.
- What did they learn about methods for spanning an opening? For spanning a room?

Discussion — Support Systems

Distribute Information Sheet 21 "Structural Systems". Refer to it in discussing the following with the class.

What is the difference between the way in which the Gallarus Oratory and a crannóg building were built?

- A crannóg building was built mostly of wood. The Gallarus Oratory was built of stone. The building materials used in both of these structures are different. There is also another very big difference between the two — the way in which they were constructed.
- Wooden materials were used in two ways in a crannóg house. First, the builders made a support structure of wooden poles — the **frame.** Then they attached a layer of materials — the **skin** — to the frame. The skin sheltered them from the weather and kept out intruders.
- The Gallarus Oratory has no frame. The stone walls are **load-bearing walls** which provide support and shelter at the same time.
- Can students think of other examples of buildings made in these two different ways? Tent, igloo . . . . .?

These two ways of making buildings have been used since ancient times. They are still used today. Which is used in an ordinary modern Irish house?

- Answer: Both. In most Irish houses, the materials used in the walls (brick, stone, concrete blocks) provide both support and protection. The roof usually has a structural framework of wood, covered by a skin of slates, tiles or other material which keeps the weather out.

Load-bearing walls

Distribute Information Sheet 10 "Bearing the Load". Refer to this and Information Sheet 21 "Structural Systems" when discussing the following with the class.

Load-bearing walls which are very long or very tall have to be quite thick. Otherwise, they would collapse. Such walls would use a lot of brick, stone or concrete blocks. One way of avoiding this is to use **buttresses** or **piers.**

- How would a pier or buttress help to support a wall? What is the difference between a buttress and a flying buttress? Can the students name any buildings which use these support systems?

Even with piers and buttresses it is not easy to make big buildings, with many storeys or big spans, using load-bearing wall construction. Frames do this job better. They often provide the roof structure for the building at the same time.

Frames

Not all materials are suitable for making frames. For example, stone is not suitable because it cannot span long distances. What kinds of material might be good for making frames — wood, iron, steel . . .?

Concrete was invented by the Romans. It is fireproof, quite cheap, and can take the shape of almost any mould into which it is poured. Once it is set, it behaves very much like stone. Ordinary concrete is strong in compression but weak in tension, so it is not good for making frames. This problem was solved when **reinforced concrete** was invented in the late 19th century. Reinforced concrete is concrete with steel bars or steel mesh inside. The concrete provides strength in compression. The steel provides strength in tension.

Skin

Once you have a frame, most building materials can be used to make the skin. Very light or thin materials, like aluminium or glass, can be attached to the frame. Quite thin walls made of brick, stone or block can be built up and connected to the frame at every floor. In this way, the frame itself, instead of piers or buttresses, prevents the wall from falling down.

Sometimes, the frame is inside the skin. Occasionally, the frame is outside the skin. The frame can also be buried within the skin, so that you can't see it at all. But it is the frame which stops the building from collapsing.