

Bearing the load

The structure of a building is the basic form built to resist the loads that are imposed on it. The choice of structures determines the architectural style of a building.

The bearing structures are: bearing walls, the post and lintel system, arch and vault, framed structures and cantilevers.

Walls

Walls can be bearing or non-bearing. The **bearing wall** carries all load of roof and structure and its thickness varies according to the forces applied on it, while **non-bearing walls** have other functions such as distributing space (when internal) or sheltering¹ the building (if external).

Post and lintel

In the **post and lintel** structure (also called **prop and lintel**) vertical elements like columns, pillars or posts support horizontal elements like beams, architraves or lintels. This is the oldest and simplest system to hold up a roof, but unfortunately the weight it can carry is limited.

Arch, vaults and their combinations

This disadvantage is overcome by the **arch**, which appeared in Mesopotamia in the 2nd millennium BC and was first systematically employed by the Romans. It can be **round**, **pointed** or **parabolic**, and is used to span² an opening and sustain loads from above. Arches rise from vertical supports and are made of a series of wedge-shaped³ blocks called **voussoirs**. The central voussoir is called a **keystone** and is often enlarged and decorated.

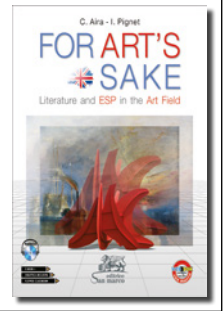
Since the arch has many applications it has been extensively employed in many constructions and building styles.

By extending the arch horizontally a heavy tunnel-like **barrel vault** is obtained, supported by strong longitudinal walls which cannot be structurally weakened by doors or windows. By intersecting two barrel vaults, a **cross vault** is obtained. Here the thrust⁴ is concentrated along the joints and supported by the piers⁵ at the four corners. To make the diagonal joints of intersection stronger, ribs or groins forming diagonal arches are employed (**groined cross-vault**). The shape is structurally weak and requires very strong piers to support it.

The Gothic builders solved the problem by using **pointed arches** which could be made the same height at the top. All the weight of the vault was transferred to the points of support from where the arches sprang. To make the support points stronger the builders devised **flying buttresses** built externally from the walls. So it became possible to insert large windows in the walls and to make the interior full of light.

GLOSSARY

- 1 protecting
- 2 to stretch between two supports
- 3 gradually narrowing to a thin edge at one end
- 4 strong push



Framed structures

In **framed structures** stability is offered by a rigid skeleton that is able to stand by itself without depending on walls to resist deformation. The traditional **timber**⁶ structure was later replaced by steel, which offers much more strength and is more adequate for higher buildings such as skyscrapers.⁷

Cantilevers

In modern buildings structural elements often hold up suspended volumes and shapes. Concrete buildings are wrapped⁸ in aluminium or glass screens; others have sections which hang over the street or with a clear space beneath (galleries, canopies, runways, etc.). This is made possible by the **cantilever**, a rigid beam⁹ or plate anchoring only at one end of a structure from which it is overhanging.

GLOSSARY

- 5 square pillars
- 6 wood
- 7 very tall modern buildings
- 8 covered



A barrel vault.



A cross vault.



A groined cross-vault.



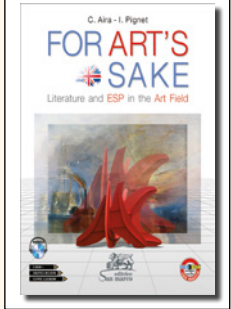
Flying buttresses.

ACTIVITIES

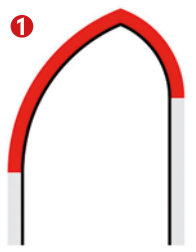
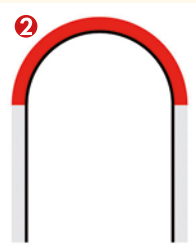
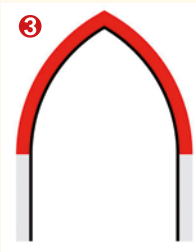
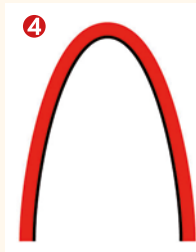
Vocabulary

1 Match each term with its Italian equivalent.

- | | |
|--------------------------|------------------------|
| 1 Bearing wall | A Legname |
| 2 Post and lintel system | B Sistema architravato |
| 3 Pillar | C Architrave |
| 4 Lintel | D Muro portante |
| 5 Keystone | E Piedritto |
| 6 Pier | F Pietra di volta |
| 7 Voussoir | G Trave a sbalzo |
| 8 Vault | H Volta a crociera |
| 9 Rib | I Costolone |
| 10 Timber | J Pilastro |
| 11 Canopy | K Volta a ogiva |
| 12 Cantilever | L Volta a botte |
| 13 Gothic vault | M Volta |
| 14 Barrel vault | N Cuneo |
| 15 Cross vault | O Passerella |
| 16 Runway | P Tettoia |



2 Match each type of arch with the corresponding image and then provide the Italian equivalent.

A Round arch	B Pointed arch	C Parabolic arch	D Flying buttress
			

Listening comprehension

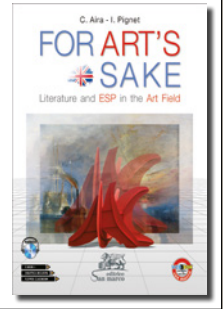
3 Listen to the recording from the novel *The Pillars of the Earth* by Ken Follett (1989) and fill in the blanks with the missing words.

THE CATHEDRAL

Jack entered the town and reined in his horse in the middle of the marketplace to look up at the west front of the 1 There was nothing revolutionary here. It was a straightforward old-fashioned 2 with twin towers and three 3 doorways. He rather liked the aggressive way the 4 thrust out from the wall, but he would not have ridden five miles to see that.

[...] Inside there was an immediate change. As Jack looked up at the ceiling he experienced a surge of excitement. The builders had used 5 and pointed 6 in combination here, and Jack saw in a flash that the two techniques went together perfectly: the grace of the pointed arch was accentuated by the ribs that followed its line.

[...] He walked along the south 7 to the crossing. When Jack stepped out of the aisle into the crossing he saw that the sun was streaming in through 8 of tall windows, some of them made of coloured 9, and all this sunshine seemed to fill the vast empty vessel of the church with warmth and 10 Jack could not understand how they had got so much window area: there seemed to be more window than wall. He was awestruck. How had this been done if not by magic?



Speaking

4 In pairs look at the following buildings and discuss which of the definitions given below in scrambled order is the most appropriate.

Big Polyphemus' eye – egg-fruit – mounting spiral – native palm leaves – row of fighters ready to take off – ship sails blown by the wind



Solomon R. Guggenheim Museum by Frank Lloyd Wright, New York, 1959.



Sydney Opera House by Jern Utzon, Sydney, 1958-73.



Metropolitan Cathedral by Oscar Niemeyer, Brasilia, 1959-70.



30 St. Mary Axe (The Gherkin) by Norman Foster, London, 1997-2004.



Lord's Cricket Ground Media Centre by Future Systems, London, 1994-99.



US Air Force Academy Chapel by Skidmore, Owings & Merrill, Colorado, 1962.