



The Arch Never Sleeps

Stone

John Trapp: (The Open University)

Stone is one of the most ancient building materials and is still in use today. One nice feature about stone is that one can stack it. I can put one block upon another, and then another one, and so on, and this way we can reach quite a tall height. But one of the problems that we have with stone is that when we try and span a distance like that we can put a stone block on there, it's called a lintel. But there's a limit to what can be achieved.

Narrator:

The Greeks used stone lintels to span pillars in their temples, such as the Parthenon. The gaps between the pillars have been successfully spanned by lintels here since most are still in place even after thousands of years. But there's an inherent limitation to the gap which can be spanned – about three metres. In supporting a load, or just its own weight, the top of the lintel experiences forces of compression, which stone can happily deal with, whereas the bottom of the lintel experiences tension forces which stone is very poor at withstanding. These forces bend the lintel. If the lintel isn't thick enough for the span, it will tend to crack. However, even cracks in stone needn't prove disastrous. Here's a lintel which has cracked, as you can see if you look closely at the sculpturing and follow the line of the broken central pillar. In fact this lintel spans the main West door to Chartres but, besides the damage to the artwork, no-one's unduly worried. Nevertheless, a technique was developed which allowed widely-spaced pillars or walls to be roofed in stone, without the need for lintels.

John Trapp:

I'm in the Lady Chapel at Ely Cathedral. This is a very spacious building. It has a wide expanse of windows covered with a stone vault. So how's this possible? The mortar doesn't glue the blocks together and so we assume that there's no tension. The stone is only in compression and provided there's enough friction between the stones then it's possible to create a stable structure – the arch.