



The Arch Never Sleeps

Flying Buttresses at Chartres

Narrator:

At Chartres early records are incomplete and so some of its past is conjecture.

Sandrine Aumon:

Well Chartres Cathedral was built in an incredibly short period. It took only sixteen years to complete the whole nave.

John Trapp:

That's a very short space of time.

Sandrine Aumon:

Yes, exactly, really.

John Trapp:

Can you tell me something about the design of it?

Sandrine Aumon:

Well the builders changed their plan as they built it, and originally two flying buttresses, and then they added the third one at the top. But the question is why – we don't really know why they added.

Narrator:

Current opinion is that the top tier was most probably added to balance the sideways force of wind on the roof. These are the flying buttresses above the North Aisle as they appear today. But, as you've heard, originally the top tier of arches was absent. In 1194 with no top arches the flying buttresses looked like this, but they stood like this for less than a generation after which the masons return to add these top arches. You can examine the forces mathematically. The top arches aren't very massive and the gentle line of slope indicates that any sideways thrust is almost horizontal. To stay within the upright buttress, the reaction force has to be almost vertical, there's no pinnacle and so the only downwards force comes from the weight of the arch, and this arch must be exerting a pretty small sideways force as it's not overturning the pillar. In other words, the geometry suggests that the top tier was added to stop a relatively small problem from getting worse. The East End of Chartres was constructed later than the nave and there the masons seem to have built on experience.

John Trapp:

At the curved end of the cathedral the geometry is much more complicated but essentially we have the same problem of carrying the forces from the vault, down across the aisles and into the ground. And the solution's the same. We have these flying buttresses carrying the load and by this time, then realising that they needed the third tier, they built it straight into the structure.