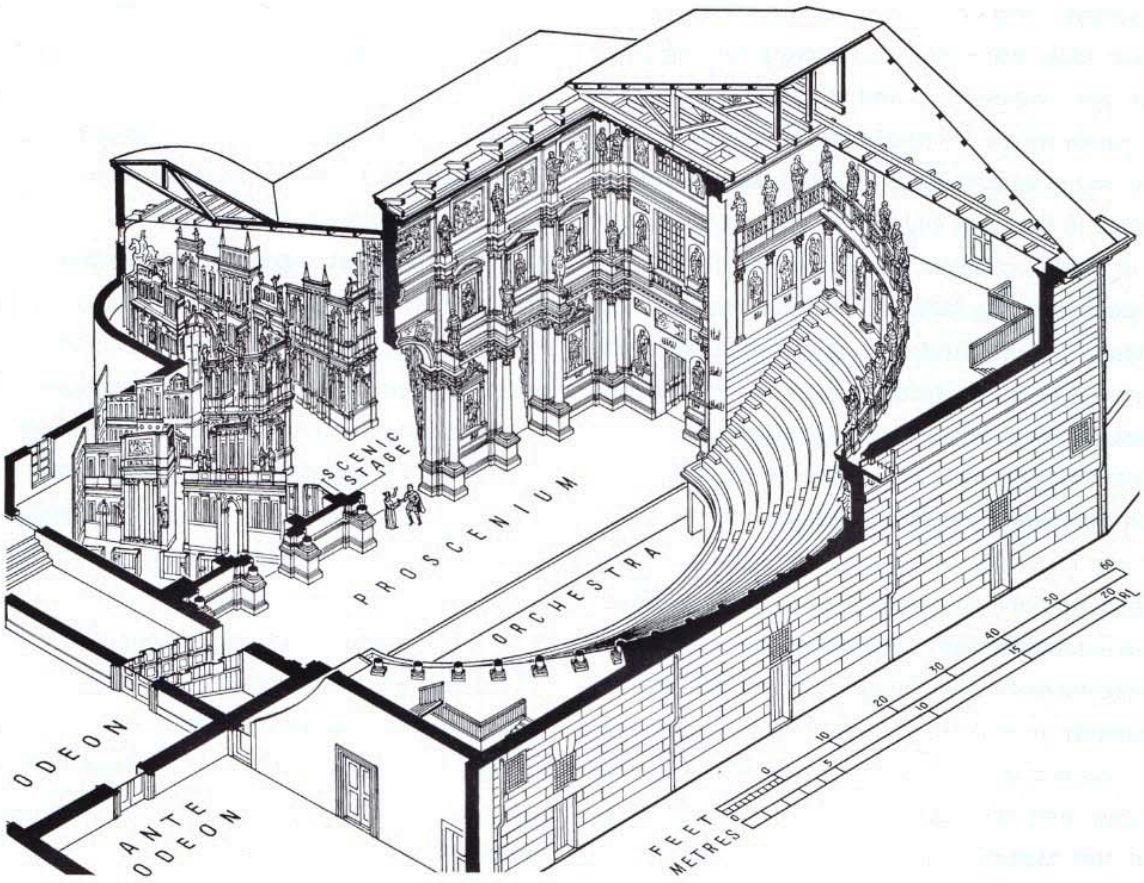
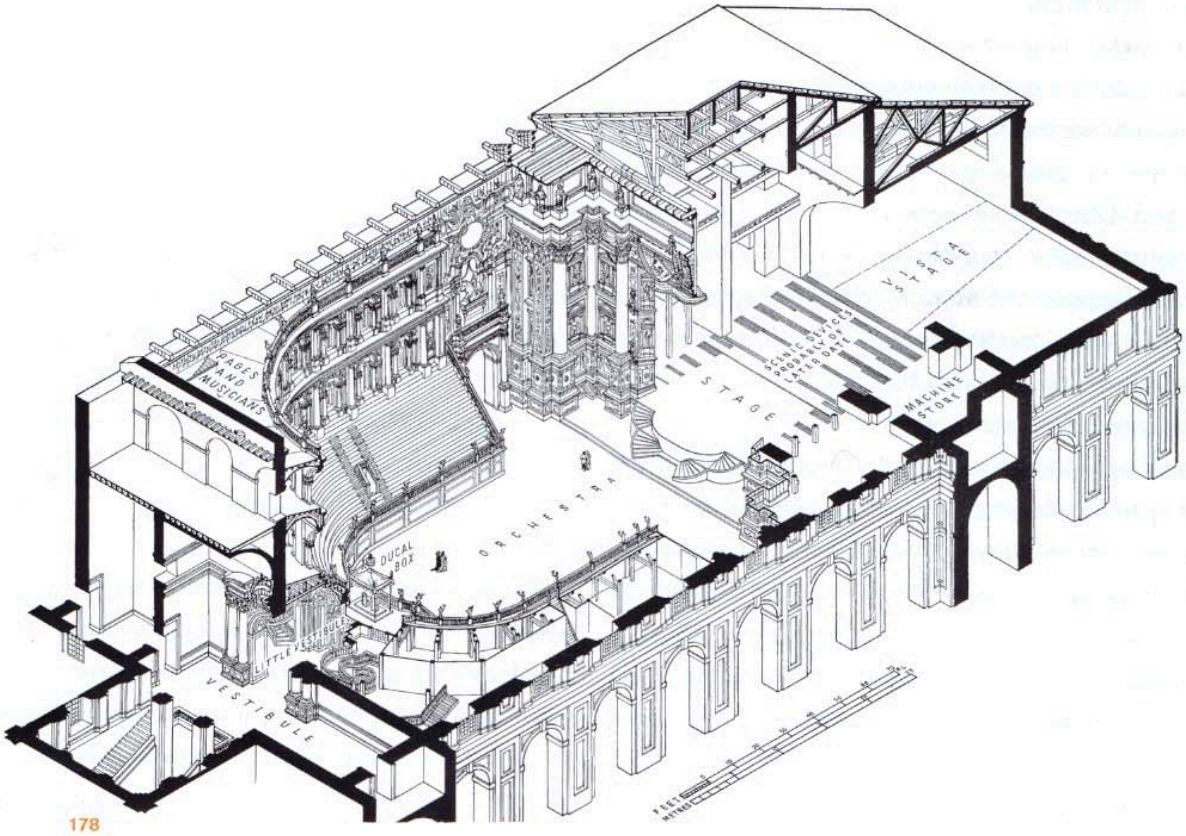
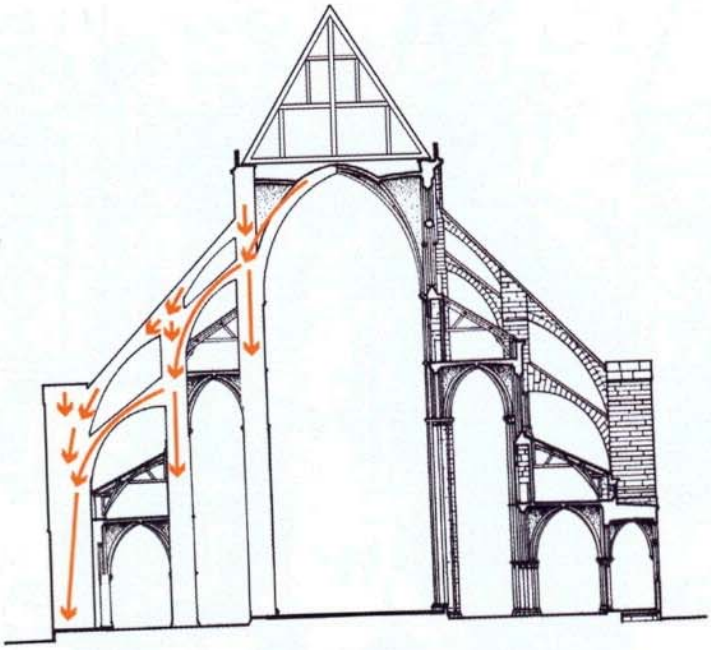


177



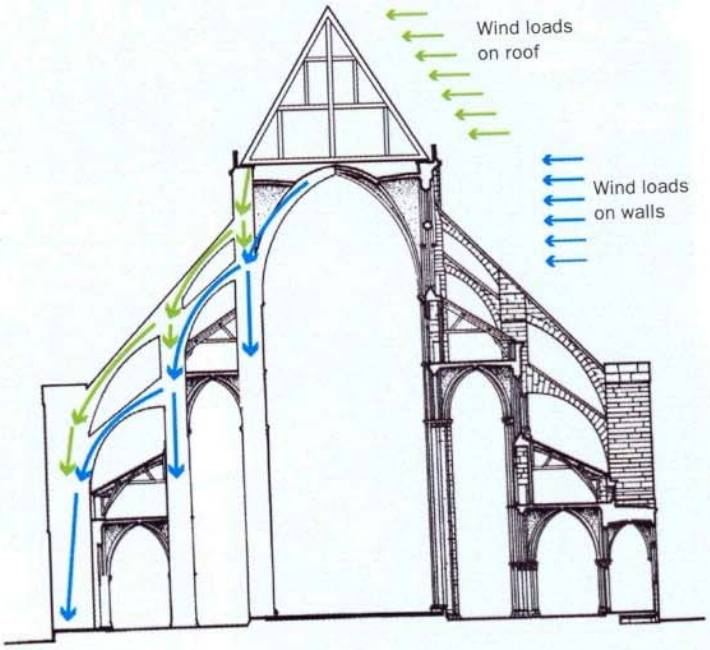
178

177 Teatro Olimpico, Vicenza, Italy, 1580–84. Architect: Andrea Palladio. Cutaway isometric. 178 Teatro Farnese, Parma, Italy, 1618–19. Architect: Giovanni Battista Aleotti. Cutaway isometric. 179 Teatro Farnese. Interior.

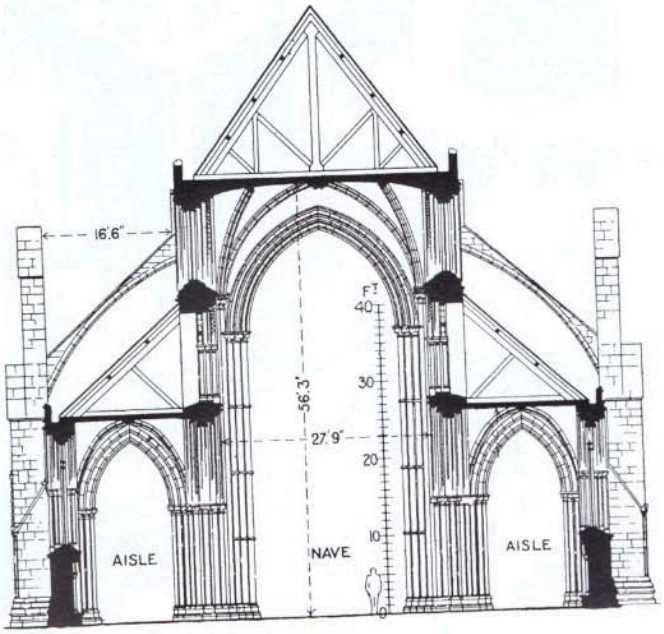


Load paths of thrusts from main vault and buttresses, due to gravity.

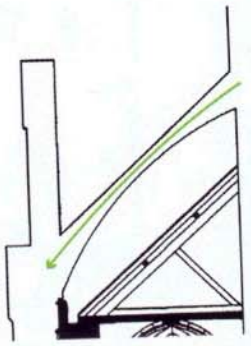
94



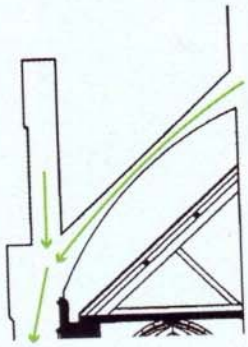
Load paths of forces due to wind



95

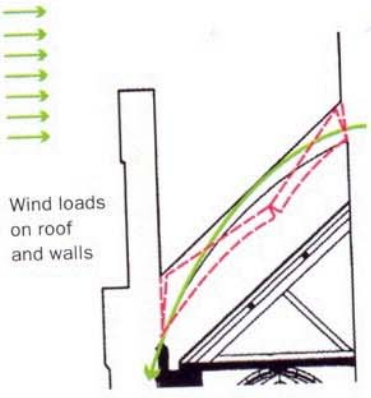


(a) Force in flying buttress sheers the top of the main buttress

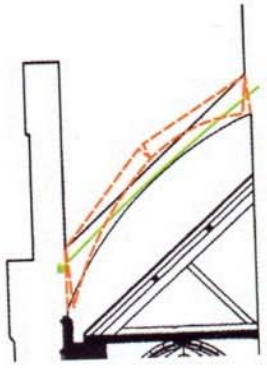


(b) Weight of pinnacle applies compressive prestress and prevents shear failure of buttress

96

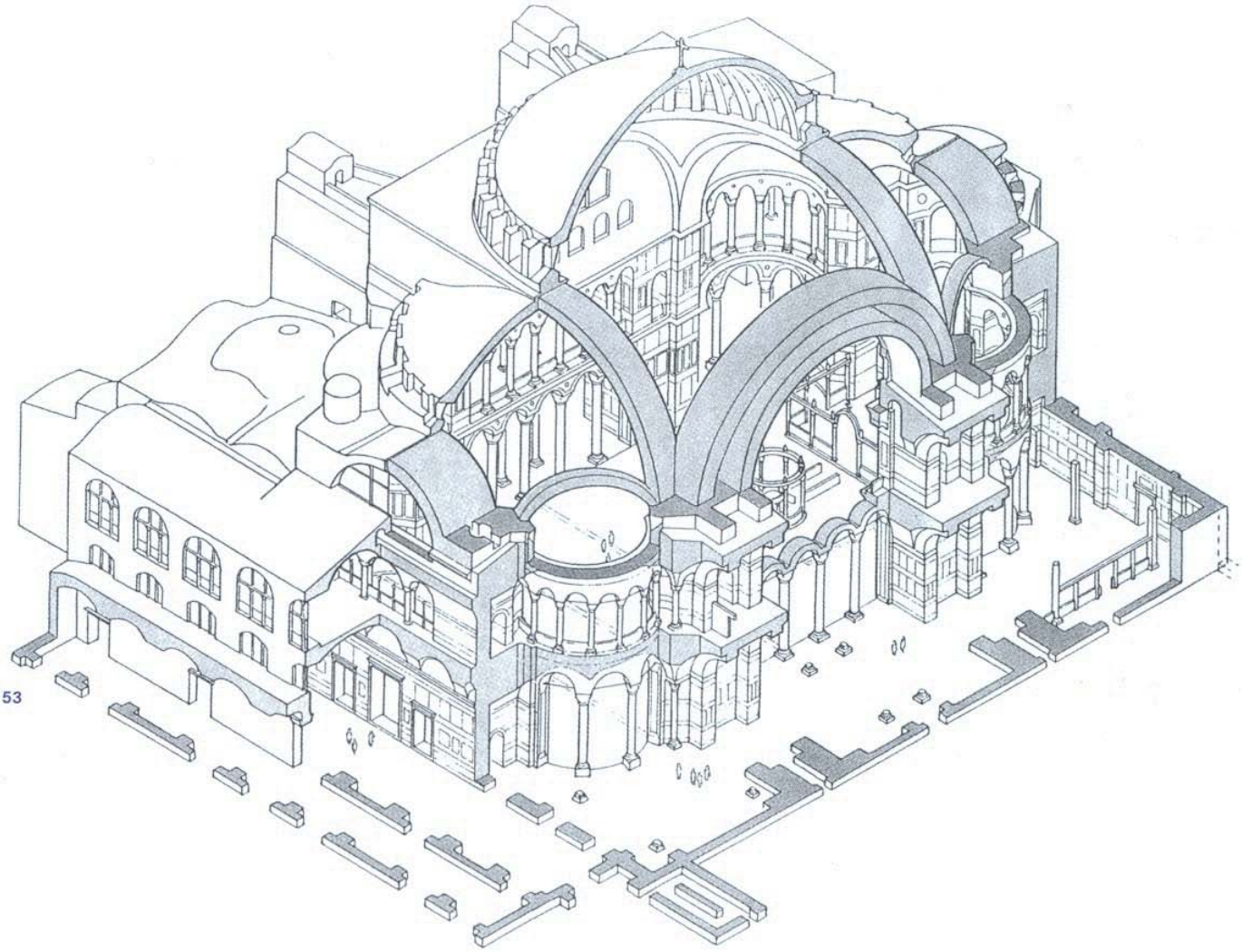


(a) Wind from left
Load path touches upper face of buttress; would collapse downwards

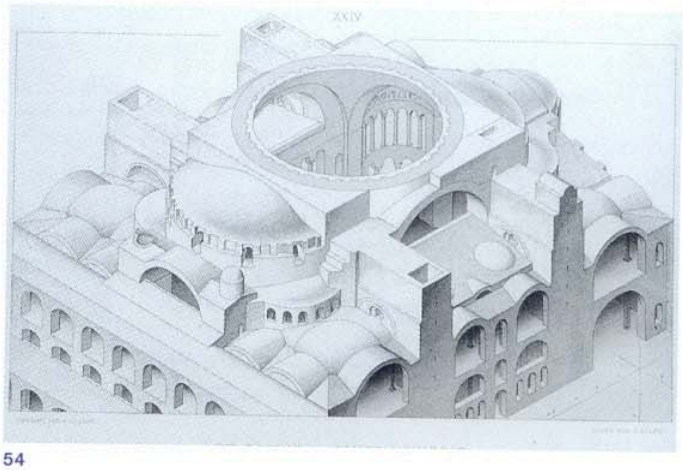


(b) Wind from right
Load path touches lower face of buttress; would collapse upwards

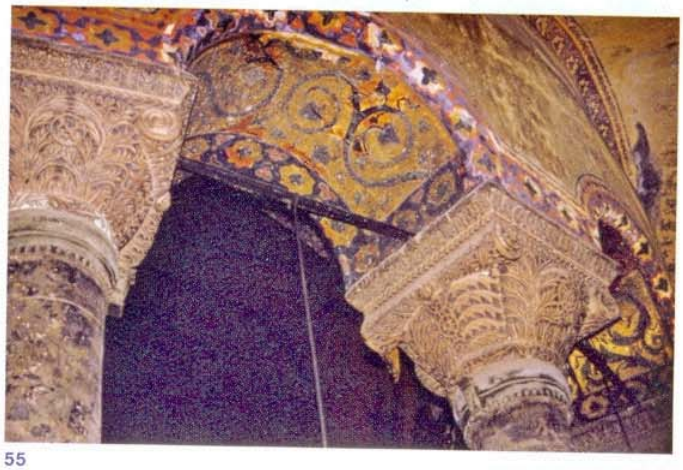
97



53

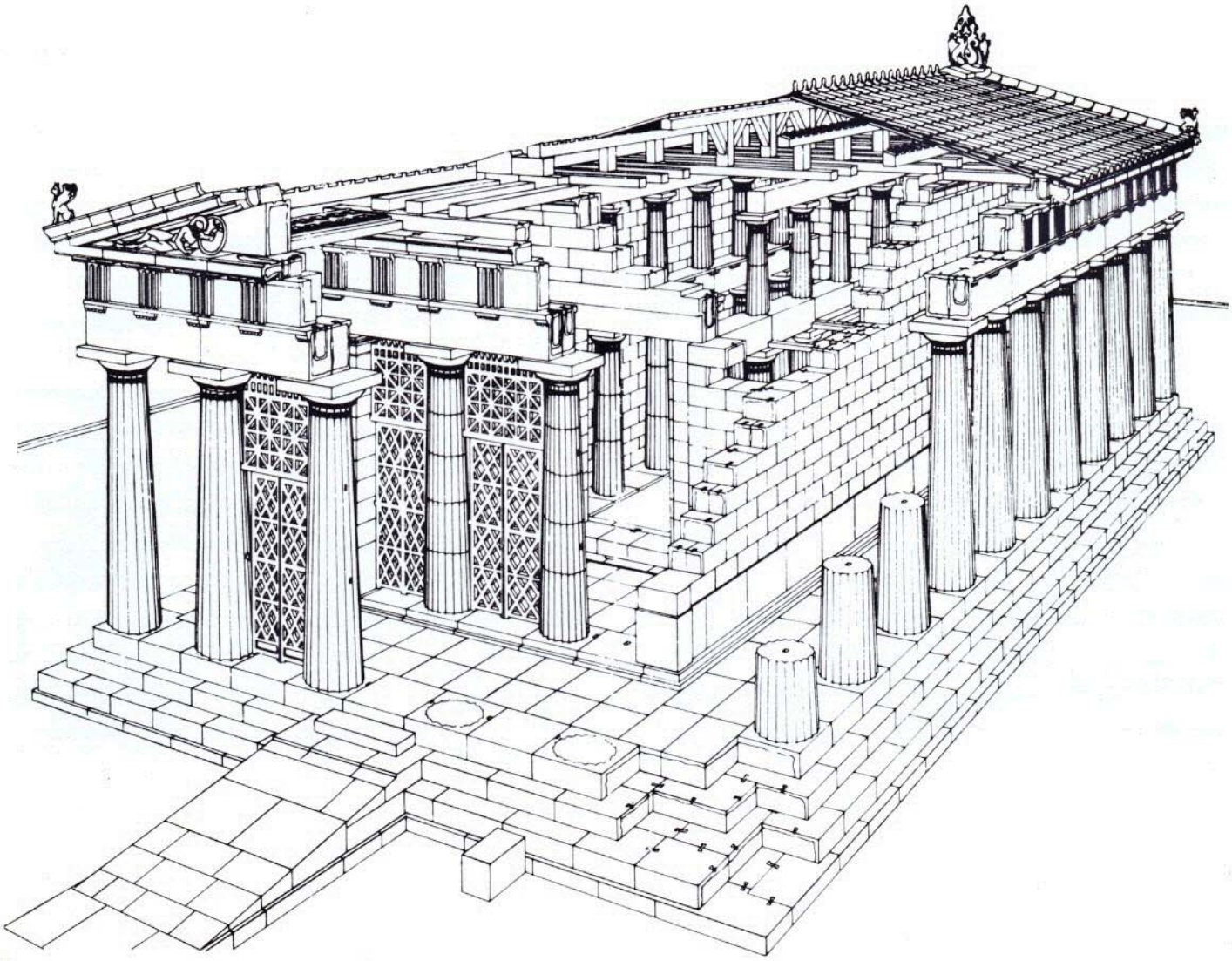


54



55

52 (previous page) Saint Sophia, Constantinople (now Istanbul), 532–37. Designers and engineers: Anthemius of Tralles and Isidorus of Miletus. Interior, after 1849 restoration. 53 Saint Sophia. Cutaway isometric drawing. 54 Saint Sophia. Cutaway isometric drawing. 55 Saint Sophia. Detail of iron tie on interior columns. Iron ties were widely used to carry outward thrusts of arches, especially during construction.



6

cross section for a beam has more material where it carries tension than where it suffers tension. In a beam spanning two columns or across a window or door opening, this would be the lower part of the beam. And this is just what we find in the remains of a number of stone
9 beams dating from the sixth to the fourth centuries B.C.

One remarkable beam, from the island of Samothrace in the north Aegean, 6 meters long and dating from the fourth century B.C., demonstrates an understanding of both the most effective cross section and the benefits of making the beam deepest at midspan. Its elevation cor- 10
responds approximately to what we would now call the bending moment diagram, which indicates the resistance to bending that a beam must develop in order to carry its own weight and the superimposed loads.

If such understanding did exist, then why was it not more widely employed? The answer is probably an economic one. Timber and stone were the main structural materials, and both of these are manufactured into useful building components by cutting them down to size, from a tree

6 Temple of Aphaia, Aegina, Greece, c. 500 B.C. Cutaway isometric drawing showing construction.