Gauthy found that, in some cases compared by him, it requires a greater thickness of abutment for the second case than for the first.

	Thickness of abutments.	Pos. of joint of fracture.	Thickness of abutments.	Pos. of joint of fracture.
For semicircles	1·47 ft.	30°	4·31 ft.	15°.
anse-paniers rising $\frac{1}{3}$ the span	2·16 ft.	50°	5·30 ft.	35°.
anse-paniers rising $\frac{1}{4}$ the span	2·68 ft.	60°	7·32 ft.	45°.

The **ar**ch above supposed, is 67·4 feet span, arch-stones 3·27 feet long, backed up level, and springing from the broad platform of the foundation without any height of abutment.

But where the abutments have height, as in ordinary cases of smaller arches, the thickness found by him would have been vastly increased, on account of the great increase of thrust from greater leverage.

The actual position of joints of fracture can only be found by trial of several suppositions, and that is to be taken where the resistance is weakest when compared to the thrust at that point, or where they are most nearly equal, and consequently their ratio is the least.

It is well to remember that the resistance is much diminished when the abutments are immersed in water, as in piers in rivers.

In the case of the Monocacy aqueduct, tried upon the last supposition, we find $\frac{w\,a}{c} = 12{,}630$ pounds, and $(W + u)\,r + s\,h = 50{\cdot}023$ pounds, showing a greater excess of resistance than in the other case, supposing it to yield by overturning.

If in an arch the joints of rupture be at the springing lines and the extrados of the crown, the horizontal thrust is $\frac{a\,w}{b}$, in which a is the distance from the springing line to the perpendicular, through the centre of gravity; b is the vertical distance equal to the rise of arch + thickness of ringstones, w the weight of half the arch.

The conditions of equilibrium of the abutment are simply that the moments of the horizontal and vertical forces shall be equal, the weight of the arch being applied at the springing line.