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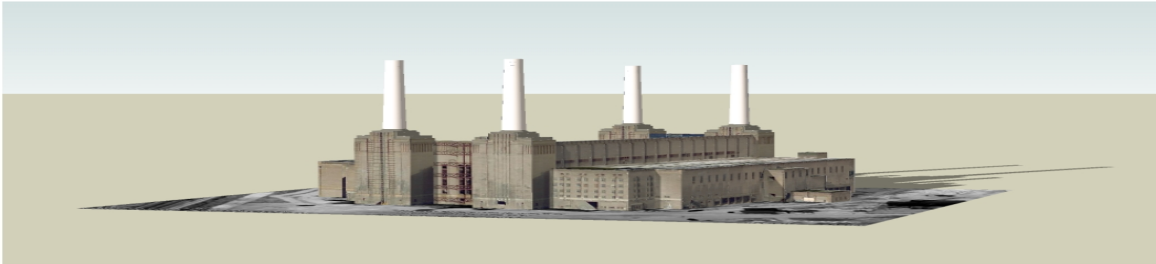
To: Geometric Puzzlers.

The Battersea Power Station Puzzle



View provided by John Sharp.

For those who don't know London, Battersea Power Station is a London landmark beside Chelsea Bridge and the Thames. This is one of the world's biggest brick buildings, using 61M bricks. Giles Gilbert Scott was asked to improve the architecture in 1931. Battersea A was started in 1929 and the first part, of 138MW, started work in 1933, with an additional 105MW in Sep 1935. Construction of Battersea B started in 1937. The first part, of 100MW, was in service in 1941. After the war, another 60MW was added and a final 100MW was added in 1953. The final result is a massive rectangular building with four huge chimneys, 337ft high, at the four corners, which are visible from much of London. Battersea A closed in 1975. Battersea B closed on 31 Oct 1983. It was planned to be converted into a theme park by 1990, but the idea fell victim to a recession and the building remains half open to the elements. A friend recently described it as looking like a dead table.

The chimneys are basically at the corners of a rectangle, whose long sides run approximately North-South. The dimensions are approximately 50 x 160 m. The problem arises because one sees the chimneys on the skyline as one drives into London from the west and one notices that the relative positions of the chimneys shift as one drives along the north side of the Thames. It appears to me that there will be some point where the chimneys will appear regularly spaced along the skyline. Is this true? If so, where does one have to be to see this effect? For consistency, let us label the four chimneys as A, B, C, D, going clockwise from A at the SW corner which we take as the origin of a coordinate system. So A is at (0, 0), B is at (0, 160), C at (50, 160), D at (50, 0). John

Sharp has found a site which does architectural views and has kindly sent the view above, but there are no dimensions given. I want to be able to go to a correct viewpoint and take a photo.

I have posed this problem several times, but have had no complete solution.

Looking at various views of London and Googlemaps, it appeared that a good view would be from Wandsworth Road which runs along the escarpement rising from the Thames flood plain. There is a British Rail station at Wandsworth Road and this is well above the road and it has an overbridge which does indeed give fine views of south London and further. I think the best of these views is the following, though measurement shows the spacings are not exactly equal.

Photo from Wandsworth Road rail station overbridge.

As a result of not getting any definitive answer, I decided to do a trial and error calculation. Unfortunately, this has not yielded any definitive points of view. I proceeded by letting the point P = (x, y) vary and computing the angles that the sides of ABCD subtend, by the Law of Cosines, e.g. for angle p = ! APB, we have

cos p = $(PA^2 + PB^2 - AB^2)/(2*PA*PB)$. I will describe some of the snags encountered.

1. The sequence of the chimneys on the skyline varies with the position of P. Using symmetry. I found I had to consider four regions with different viewing sequences

and so a first step was to determine which region the point P is in.

2. My programming language does not have an inverse cosine function. So one has to use $\cos^{-1} a = \tan^{-1} [\sqrt{(1-a^2)} / a]$ where $a = \cos p$. This leads to two difficulties.

2.A. a may be zero. This occurs when P forms a right triangle with A and B. To avoid this, one can test the value of a before trying to determine the angle.

2.B. a may be so close to one that $1-a^2$ is computed as a negative value due to rounding error. This occurs when P is in line with A and B (or nearly so). Such cases can be avoided by restricting or checking the values of x and y.

3. It soon becomes apparent that one should use multiprecision arithmetic. My results showed many points where all the subtended angles were zero to seven places. I have not yet converted my program to a multiprecision system and I don't know when I will have the inclination to do so.

Please let me know if you make any progress on this problem.