"A timeline for a solution - boundaries and fire radiation"

In 1875, in the House of Commons, during: a debate concerning the National Opera House a question was asked by Colonel Beresford:

"If it be true that on a representation having been made by Mr. Mapleson of his inability to purchase two houses in Cannon Row, Westminster, the Metropolitan Board of Works allowed him to advance his building frontage for the new National Opera House to within about thirty feet of the roadway on the Embankment, thereby giving him, after allowing for a twenty feet road on each side of the building, a net additional area of nearly nine thousand feet; and, if so, what money payment was, or is to be made by Mr. Mapleson or by those whom he represents, for such additional ground and accommodation?"

The reply of Sir James Hogg, the then Chairman of the Metropolitan Board of Works, included the following:

"As an inducement to the Metropolitan Board of Works to allow him to advance the frontage an average distance of 75 feet, he proposed to give up sufficient land to make roadways upon each side of the Opera House, and these roadways the Board have required to be of a width of 20 feet. The building will, therefore, be isolated from adjacent buildings, which will be in accordance with the wishes of the Lord Chamberlain, and is most desirable in the event of fire for a building of this description. So far from Mr. Mapleson having gained by the exchange, he gives up 11,920 feet and receives 11,560 feet, thus ceding 360 square feet; and, therefore, the Metropolitan Board of Works have not required him to make any money payment, and do not intend to do so. I should add that the consent of the Metropolitan Board of Works to the arrangement is dependent upon that of the First Commissioner of Her Majesty's Works being obtained."

Why it was considered 'most desirable' that: the building was isolated in the event of a fire was not discussed. It must be remembered that this was the era of the horse drawn carriage and may have a bearing on the road width. However the mention of fire and associating it with isolation suggests that the old fear of fire in one building adversely affecting another building was still a problem. It had been so since the Great Fire of London in 1666,

In 1941 a paper was read before the Institution of Structural Engineers by W Cyril Cocking[6] a Member. The paper was entitled 'Some problems in structural engineering". After discussing the interesting ideas of 'safety' and 'stability', concrete walled houses and other such topics he introduced some fire problems. The one of interest he introduced as follows:

"One of the aspects which would appear to have been neglected is that of the prevention of contagious fires. In Great Britain, especially in the older districts of many of our cities and towns, the streets and public passage ways are relatively very narrow; many are so narrow that it is only with the greatest difficulty that a fire breaking out in premises on one side of the street can be prevented from spreading to the buildings on the opposite side."

As this was read a tick was placed against it on the assumption that this problem had been solved. The Solution was in the Building Regulations. Then the question arose "Is it?"

The common system of the Building Regulations[1] which applied to England and Wales, but exempted the Inner London area, was introduced in 1965 and it was in this set of 'regulations' that a number at new features related to fire was introduced - among them being "space separation related to exposure hazard'. This approach to the control of 'external fire spread' is based on research work started in the 1950's in the Fire Research Station.

The research apparently culminated in the paper by Law, "Heat radiation from fires and building separation" (Fire Research Technical Paper No 5, 1963). The background to this document is commented on by Margaret Law in the Arup publication, "Some Selected Papers by Margaret Law - engineering fire safety" (2002). In her comment on this reproduced Technical Paper she wrote:

"When curtain-walling systems were introduced after the Second World War most were rejected because they did not have the fire resistance required by the by-laws. However, a curtain wall that was 100% glass and thus of negligible fire resistance could be accepted because it was called a 'window'. A new approach was needed ……"

Upon what was the new approach based? First, consideration of the level of radiation required to ignite a material and, second, the level of radiation from a building on fire.

Two types of ignition were considered - spontaneous ignition and pilot ignition. Un-protected, oven dried wood was the material chosen. Spontaneous ignition was determined to occur at 0.8cal cm^{-2} s^{-1}, and pilot ignition at 0.3cal cm^{-2} s^{-1}.

Considered next was the time needed for ignition to occur in an open space. Spontaneous ignition was considered to take place within 2 minutes or not at all, but pilot ignition in the open could be up to 10 minutes. Counting the 10 minutes from the fully developed fire and using a time of attendance within 5 minutes after receiving a call to attend it was argued that it would be reasonable to adopt a "distance such that the intensity of radiation on an exposed building would not exceed the minimum of 0.3 cal cm^{-2} s^{-1}. In 1957 the time of attendance was 4 minutes for 4 out of 5 Fire Brigades.

The results of experiments, to determine the time to spontaneous ignition of contents within a 'room' (modelled at one-tenth and subjected to an intensity of 0.3 cal cm^{-2} s^{-1}), were used with those from experiments on lined model rooms subject to pilot ignition to determine the worst situation.

The 'worst situation' envisaged was "a room with one whole side occupied by a Window, the glazing destroyed, and exposed to the peak radiation from a building fire for at least 20 minutes."

The level of radiation from a building fire was based on considering the intensity of radiation from the common two types of fire - restricted ventilation and fully ventilated. For space separation regulations a maximum radiating level of 4.0 cal cm^{-2} s^{-1} was adopted for both types of fire. However if the fire load was less than 25 kg/m^2 then the radiating level was reduced to 2.0 cal cm^{-2} s^{-1}.

To determine how much emitted radiation would reach a neighbouring building 'configuration factors' were adopted.

After all the experiments and theoretical justification of some fifteen or so years, I have been unable to find any full scale tests that prove or disprove the space separation regulations used in the Building Regulations. In recent books written about Fire Engineering there does not appear to be any consideration of space separation. The rise in the fire brigade response time from 4 minutes to 6.5 minutes appears to have gone unnoticed. The change from single to double glazing has not attracted too much attention. The deterioration of sealants, and so allowing radiation to penetrate around a window frame, has not raised eyebrows. This is surprising.

Attention is drawn to the Loss Prevention Council's "Code of Practice for the Construction of Buildings", 1992 Edition.

"Separating distance - there should be at least 10m separation between buildings. In the case of tall buildings it is suggested that the separating distance is at least half the sum of the heights of the adjacent buildings." (Page 30).