



## All Glass Columns.

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### Summary

Glass is more and more accepted as a structural material. Glass floors and especially glass facades are widely used in modern architecture. In this paper the translation of another structural elements : a column into an all glass structural element is discussed and illustrated by experimental applications. Prototypes of glass structural columns are tested on structural integrity in the Stevin laboratory of the University of Delft (NL).

**Keywords:** glass, structure, beams, columns, curved glass facades.

### 1. Introduction

Glass is a fascinating material: it combines transparency with a potential high bearing capacity and, most striking, is waterproof! However the material behaviour under tensile loading is dangerous; it is linear elastic but at breaking it loses its coherence completely. A structure built up from single layer plates of glass is therefore an unsafe structure, if one part fails the complete structure will collapse. We have to make safe structures and that is why structural glass is always laminated, that is built up of various layers, at least two but preferably three or more. The philosophy behind this is that if one layer of glass breaks to whatever cause, the remaining layers of glass are still able to carry the weight and the loading on the structural glass element with sufficient safety.

For the sake of transparency the adhesives that glue the panels of glass together must be transparent as well. Two types of adhesives are used; a weak, more viscous one: p.v.b. foil (polyvinylbutiral) and a stronger, more stiff one: acrylic or epoxy based adhesives. Since p.v.b. foils are by far the most used since they are the most safe and transparent adhesive we have to live with the not so strong behaviour when loaded. Especially for long term material behaviour this is an influence to be reckoned with. We have to mention that the "Sentry Glass"-foil has an improved structural behaviour compared to p.v.b..

### 2. Glass structures in general.

#### 2.1 From a simple beam to a complicated span

We have a nice catalogue to tell the story of the spanning of a short span by a beam to an ultra-long span by a cable structure.

In this overview all possible types of structures are shown that we, as structural engineers, have at our proposal. The task of the glass engineer is now to change all these structural shape into an all glass one. They are in line with their spanning capacity: 1. Beam, 2. Truss, 3. Cable stayed structure and 4. Hanging cable structure