



International Symposium on "Novel Structural Skins: Improving sustainability and efficiency through new structural textile materials and designs"

## Ontario Celebration Zone pavilion: a large pneumatic structure

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### Abstract

The project is an assembly of two Polyester/PVC-pneumatic structures located at the east coast of Lake Ontario in Toronto/Canada. High wind loads due to the exposed location were expected. The larger of the two structures is 15m high and 60m long. The pneumatic nature of the design was key for winning the public competition, because it allowed erection of a spatial enclosure of this size only within the given timeframe of one week prior to the beginning of the Pan American Games. The build-up of the pneumatic system in an alteration of 1.4m diameter (in average) arch shaped tubes and patches of repetitive pneumatic cushions. A form finding exercise for gravity loads (catenary shape) and wind loads (pneumatic form finding) was combined to optimize the structure's performance towards wind and gravity loads. Physical tube tests were performed by the manufacturer (Tectoniks) and compared by TT with pneumatic EASY<sup>TM</sup> models. Following that, calculations were performed to normalize the stiffness of FEM-Elements in SOFISTIK<sup>TM</sup> with the measured tubes and afterwards globally analyze the geometry to determine deflections (important for the operation of the pavilion), stresses and global reactions. ~60 ground screws were used to anchor both structures to the ground.

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### 1. Introduction

Hariri Pontarini Architects (HPA) was chosen to design a temporary pavilion as part of the festivities surrounding the Pan American Games in Toronto. The site was a public park and therefore construction time and impact were greatly limited. The structure was to be constructed in one week and not to have a substantial foundation. The

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program was to consist of a zip-line route, eating and drinking areas and two performance stages. HPA assembled the project team consisting of Thornton Tomasetti as the consulting engineer, Blackwell as local engineer and Tectoniks as the manufacturer.

The role of Thornton Tomasetti, was primarily as structural design engineers: in the early stages assisting with form finding, in mid stages combining the efforts of Blackwell and Tectoniks, and in later stages analyzing global deflections and the foundations. The larger pavilion structure, shown in Figure 1 below, was constructed of pneumatic arches with quilted infill and measured approximately 60 meters long by 15 meters high.

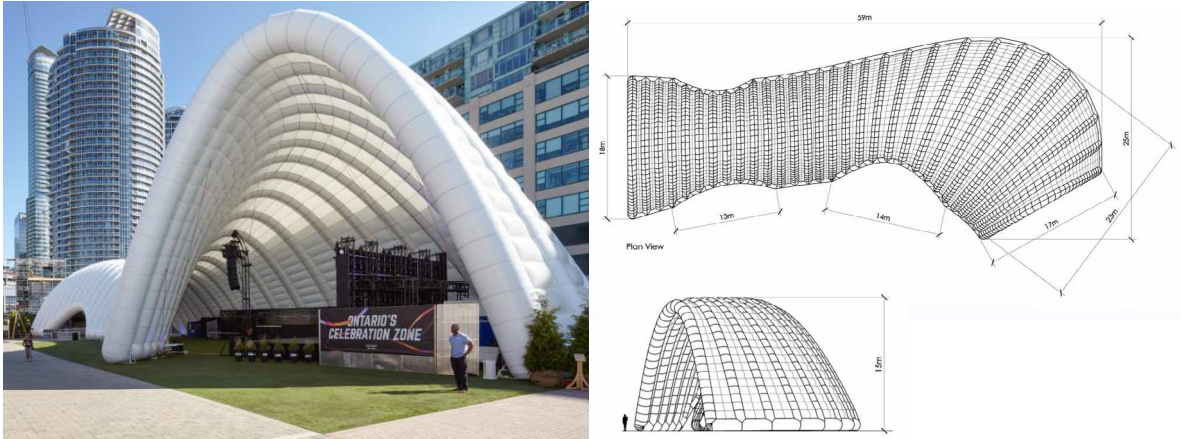


Fig. 1. (a) large structure fully inflated (photo by AFrame); (b) overall dimensions (image by Tectoniks).

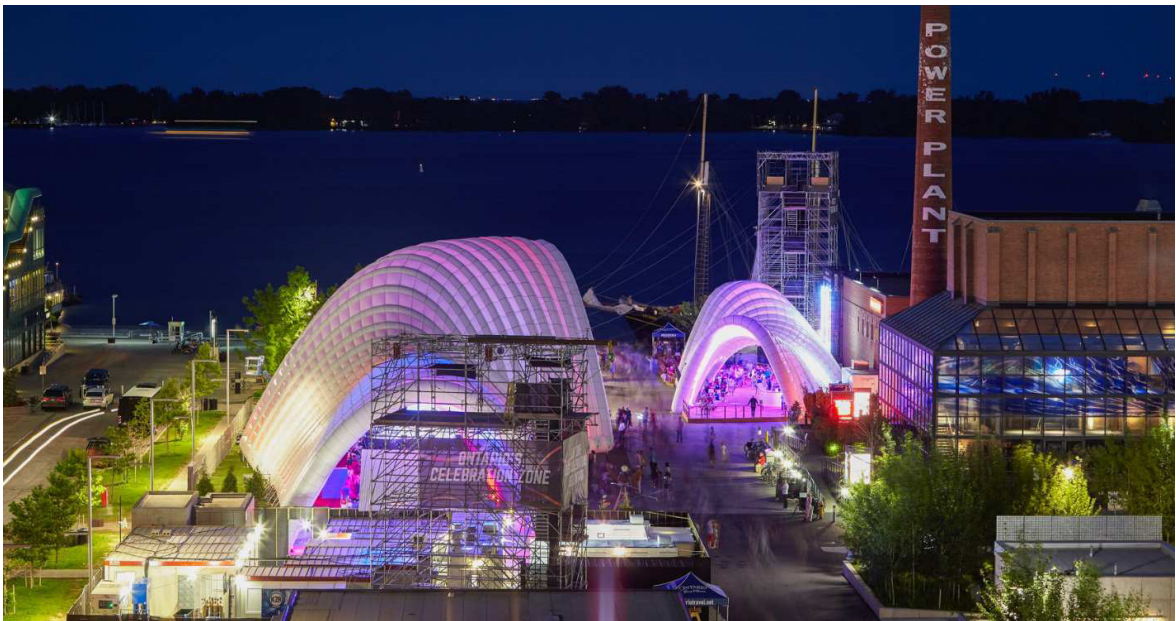


Fig. 2. Overview of the Ontario Celebration Zone (photo by AFrame).

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