

## Paper ID:89-23

# Comparing cable-supported to archstructures footbridges across historic sites

Philippe Van Bogaert

[Philippe.vanbogaert@ugent.be](mailto:Philippe.vanbogaert@ugent.be)

Civil Engineering Department/Ghent University  
Ghent, Belgium

Gilles Van Staen, Hans De Backer

[gilles.vanstaen@ugent.be](mailto:gilles.vanstaen@ugent.be); [hans.debacker@ugent.be](mailto:hans.debacker@ugent.be)

Civil Engineering Department/Ghent University  
Ghent, Belgium

### ABSTRACT

Three arch-type as well as 3 cable supported alternatives have been developed for footbridges above historic sites. The two categories of arches and cable supported structures exhibit a completely different behaviour, since the latter are more flexible. The first cable variant is a straight intersection of variable width. In comparison with an arch, it is striking that the deformability is much greater the fundamental frequencies being significantly lower. However, the characteristic values for dynamics, such as the Scruton number and the accelerations of the bridge deck are significantly better. To span the site of 200 m in length, pylons of 46.7 m in height are needed. As a second alternative, a semi-circular suspension footbridge of variable height has been developed. Direct comparison with an arch counterpart is not evident. However, it could be deduced that this structure has a fairly high frequency and is also not sensitive to the important types of vibration. A full elevated walkway around a circular site can certainly be compared to its arch-shaped counterpart. Despite the lower fundamental frequency, the higher flexibility and the increased consumption of steel, the cable-supported structure performs better as for its dynamic behaviour.

**Keywords:** Historic sites, cable-supported structures, vortex shedding, human induced vibration, Scruton number, conceptual development.

### 1 INTRODUCTION

Covering historic sites has been implemented on several locations in order to protect them from unwanted intrusion, from disturbing of the archeologic activity and to provide shelter from weather, erosion and weir. However, these shelter structures may have negative influence on the protected remains, as demonstrated by Cassar et al (2018). This generated the idea that partial cover, including movable additional shelters by foils, might provide a limited answer to this issue. In addition, the public should be allowed to see valuable remains and archeologic activity, without interfering with it. For this, several historic sites have been equipped with elevated walkways around the places of interest. The latter mostly allow a bird's eye view on the remains.

This idea has inspired to try develop concepts for walkways above historical sites. In previous research of Van Bogaert et al. (2021) 3 concepts, mainly based on arch forms, have been developed. For each one satisfactory results were obtained, although 2 out of 3 alternatives required structural damping due to vortex as this has proven to be the most detrimental condition. Vortex shedding might