INTRODUCTION

Tensegrity structures are spatial structures based on compressed struts and tensioned cables. This is achieved by the pretension of the cables, allowing the tensegrity structures to withstand external loads such as the ones from a pedestrian footbridge. As a result, the lightweight of these structures leads to high strength to weight ratios making this solution an attractive one. However, its flexibility along with this lightweight could end up with not only high deflections but also high vibrations. This project studies the behaviour of these structures, showing the optimum parameters to avoid these problems and establishing initial design criteria.

PRESTRESS AND NONLINEARITY

The structure behaves in a linear manner regardless the level of prestress and the structure stiffness, unlike other tensegrity structures, due to the short length of the cables. One of the main aims of the prestress level is to avoid the presence of slack cables.

DYNAMIC BEHAVIOUR

The natural frequencies could be greatly reduced by the pedestrians` mass, ending up in excessive accelerations even if the structure itself does not have natural frequencies close to the common walking or running ones. A dynamic vibration analysis has been performed showing that tensegrity structures with the fundamental frequency above 3Hz will not have uncomfortable accelerations under dense crowds walking load cases.

CONCLUSIONS

• The optimum values of the prestress and the axial stiffness ratio between the cables and the pylons have been obtained.
• Excessive deflections can be avoided efficiently increasing the cables axial stiffness.
• Excessive vibrations can be avoided ensuring a fundamental frequency above 3Hz. This is efficiently achieved increasing either the cables axial stiffness or the deck bending stiffness.
• Linear behaviour due to the short length of the cables.
• Straightforward design criteria have been established with the purpose of obtaining initial dimensions.

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REFERENCES