

Title: Rocking response and stability analysis of free-standing columns supporting epistyles and the frieze

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#### SUMMARY

This paper investigates the planar rocking response of an array of free-standing columns capped with a freely supported rigid beam in an effort to explain the appreciable seismic stability of ancient free-standing columns that support heavy epistyles together with the even heavier frieze atop. Following a variational formulation, the paper concludes to the remarkable result that the dynamic rocking response of an array of free-standing columns capped with a rigid beam is identical to the rocking response of a single freestanding column with the same slenderness yet with larger size, that is a more stable configuration. Most importantly, the study shows that the heavier the freely supported cap beam is (epistyles with frieze atop), the more stable is the rocking frame regardless of the rise of the center of gravity of the cap beam, concluding that top-heavy rocking frames are more stable than when they are top light. This 'counter intuitive' finding renders rocking isolation a most attractive alternative for the seismic protection of bridges with tall piers, whereas its potential implementation shall remove several of the concerns associated with the seismic connections of prefabricated bridges.