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Dynamic behavior of laterally loaded caisson foundations based on different cushion types: an experimental and theoretical study

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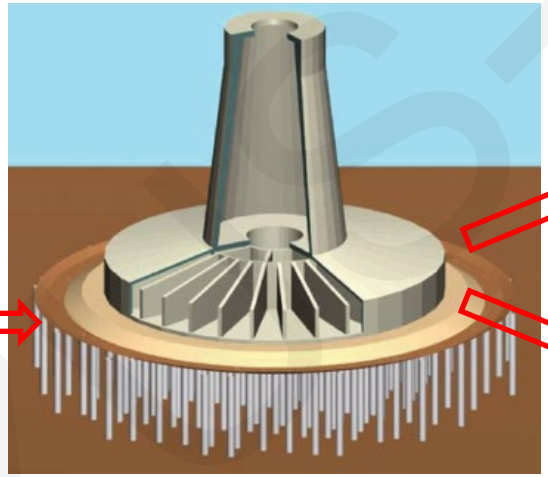
Introduction

Which cushion types was the best?

The Rion-Antirion Bridge



caisson foundations

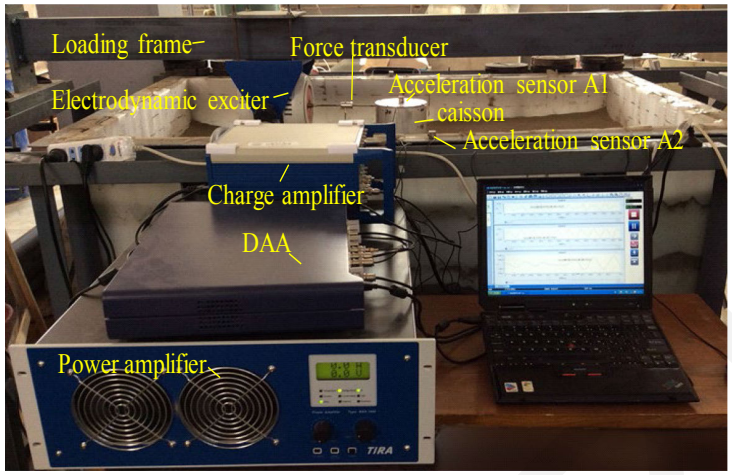
Gravel cushion: high bearing capacity

Sand cushion : low cost, long durability and easy availability

Harmonic horizontal excitation tests for the study of the lateral dynamic response of caisson foundations based on different cushion layers are conducted

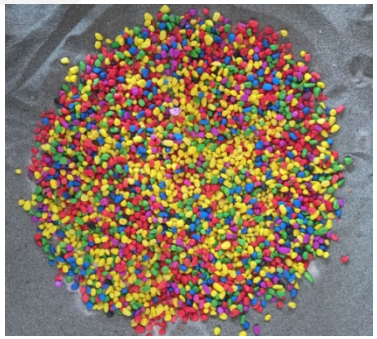
Experimental investigation

Take the Greek Rion-Antirion Bridge as the prototype



Experimental setup

model foundation

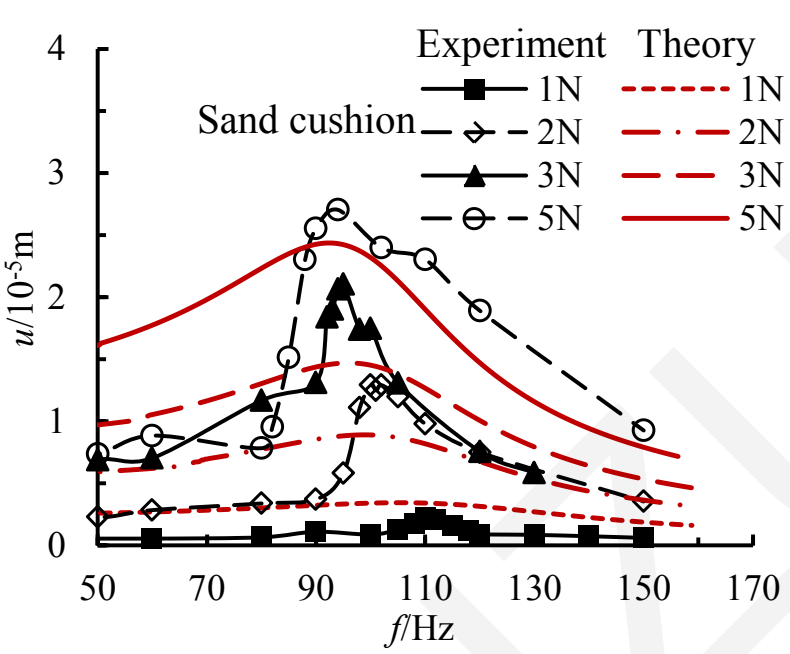


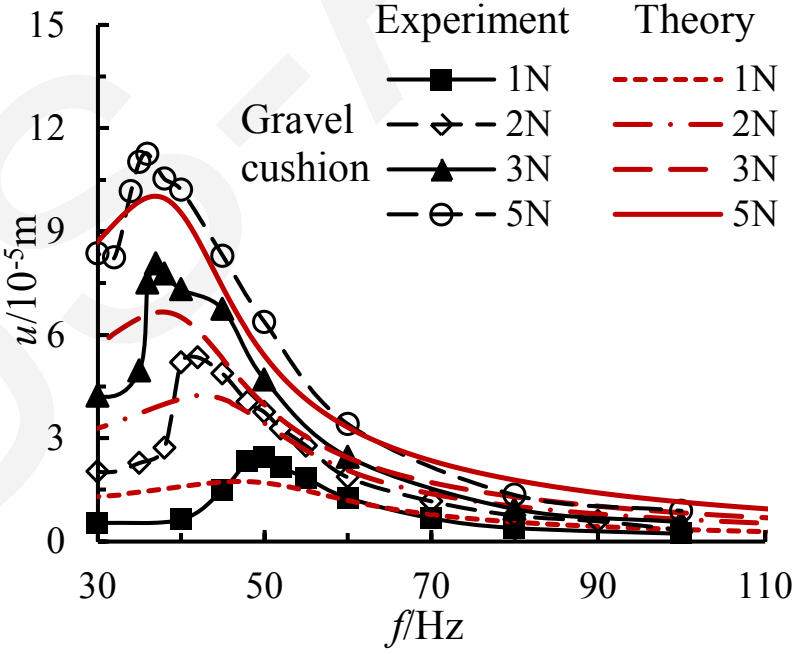
gravel cushion

Different lateral loads and two different cushion types (sand cushion and gravel cushion) are considered in the laboratory test

Test results and analysis

Lateral dynamic response of caisson foundation





The gravel cushion shows better vibration isolation performance than the sand cushion as the gravel cushion can more effectively dissipate the energy from the bottom part of the foundation.

Test results and analysis

The resonant frequency of the foundation

Cushion type	Load amplitude/N	Resonant frequency of model foundation	Resonant frequency of prototype foundation
Sand cushion	1	110	5.68
	2	100	5.16
	3	95	4.91
	5	92	4.75
Gravel cushion	1	50	2.58
	2	42	2.17
	3	37	1.91
	5	35	1.81

the resonant frequency of the $1/\lambda_N$ model is $\lambda_N^{0.5}$ times the resonant frequency of a prototype, the relationships between the model and prototype foundation are closely related to the shear modulus of soil

Conclusions

- During the static loading test, the ultimate bearing capacity of the foundation based on the sand cushion is larger than that of the foundation based on the gravel cushion.

- The gravel cushion shows better vibration isolation performance than the sand cushion as the gravel cushion can more effectively dissipate the energy from the bottom part of the foundation.