

N.^o 09

Springs in series: the bearing sets the period too

A bridge pier is not just a column: bearings sit on top and a foundation sits below, and all three deform. In a typical case, adding them takes the period from 1.3 s to 1.9 s.

1.

One pier, three springs

The seismic force travels through the bearing, the column and the foundation. All three deform and their flexibilities add up.

2. Column only

$$T \approx 1.3 \text{ s}$$

1.20 m column, 8 m tall, fixed base. $K \approx 7,400 \text{ kN/m}$.

3.

The bearings weigh the same

$\approx 7,200 \text{ kN/m}$

Four $400 \times 400 \text{ mm}$ pads. Nearly the column stiffness.

4.

All three together

$$T \approx 1.9 \text{ s}$$

With bearings and foundation, $K \approx 3,300$ kN/m. The period grows about 50%.

5. What to check

Force goes down, displacement goes up.
Joint, seat width and bearing shear land on
the unsafe side if you ignore them.

Full note, with equations and tables, at the link on my profile.

Yordan Rocio Maldonado

Structural engineer, seismic and bridge specialist

CIP 215845