Numerical analysis to evaluate ultimate flexural performance of precast concrete piles subjected to tensile or high compressive axial load.

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Purpose of Research

**AIM**: To establish a reliable modeling technique to analyze flexural cyclic behavior of SC piles.

**OBJECTIVE**: To numerically analyze test piles using a fiber-based model to simulate moment-curvature relationships.

- predict behaviors beyond ultimate deformation capacity.
- simulate characteristics of hysteresis loop.

Material Model

For isotropic hardening in steel,

\[ \sigma_{st} = a_3 \left( \frac{e_{max}}{e_y} - a_4 \right) \]

*(a) Kent-Scott-Park model with linear tension softening for concrete.\n*(b) Giuffré-Menegotto-Pinto model with isotropic strain hardening for steel.

Finite Element Model

6 SC piles were analyzed using a fiber section analysis with force based beam-column elements using OpenSees.

Conclusions

- Steel model **WITHOUT ISOTROPIC HARDENING** resulted in an understimation of maximum moment capacity, with an error of about 20%.
- Steel model **WITH ISOTROPIC HARDENING** in tension and compression, calibrated for SC_2 pile, resulted in reduction in overall error to about 6%.
- With proper adjustment of isotropic hardening parameters better estimations of moment capacity of piles can be achieved.