



STRUCTURAL ENGINEERS ASSOCIATION OF CALIFORNIA SEISMOLOGY AND STRUCTURAL STANDARDS COMMITTEE Position Statement – May 2004

Cantilever Column Elements in Light Frame Shear Wall Systems (LRFD)

Scope: The use of steel cantilever column elements in light frame wood shear wall systems.

For light frame shear wall systems in Type V construction, it is acceptable to use steel columns in cantilever action without applying the lower R value to the remaining portion of the structure, providing the following requirements are met:

1. The maximum inelastic response displacement of the cantilever column (at the higher R value of the mixed system), with consideration of the base plate and anchor bolt deflection, shall be limited to the lesser of 0.01H or the approximate deflection of the adjacent shear walls in the same direction.
2. The design of the column, its connection to the diaphragm, its connection to the foundation, and the foundation shall be based on loads factored up by the ratio of the larger R/lower R (e.g. $5.5/2.2=2.5$).
3. The column axial design force ratio shall be based on a $K=2.1$ and shall not exceed the force ratio of $P_u/P_n \leq 0.15$
4. A reinforced concrete grade beam shall join the cantilever column to the adjacent vertical structural element(s) with sufficient stiffness to satisfy the deflection limit along each line of resistance. Other reinforced concrete foundation systems may be used, providing the foundation rotation and stiffness is included in the deflection calculation.

Commentary:

Guidance is necessary for the current practice of using cantilever column elements within a predominantly light frame wood shearwall lateral force resisting system. Cantilever columns currently compete with proprietary prefabricated shear panels and proprietary light gage braced elements in light frame shearwall systems.

The emphasis is on deformation compatibility, including validation of the base fixity of the column to foundation connection. Unconstrained flag pole footings and spread footings should not be used, given the large contribution of foundation rotation and soil deformation expected for those foundation types. Where a grade beam connects to an adjacent vertical element, adequate stiffness for the cantilever base is easy to ascertain. The adjacent vertical structural element(s) may be an adjacent cantilever column, a gravity load post, or the building wall which can provide some restraint for the grade beam foundation.

The use of higher forces created by the lower R value of the cantilever column system is required along each independent line of resistance that includes cantilever columns. While it is not recommended to mix different lateral force resisting element types along the same line of resistance, the higher force level required in item 2 for the cantilever column would also apply to a shear wall placed along the same line of resistance. This is consistent with the exception to section 105.4.4 (1999 Blue Book) which permits the use of the least value of R for different structural systems used on each independent line of resistance.