

21.11.2.4

Columns or areas of concentrated wall reinforcement that have an edge within one-half of the footing depth from an edge of the footing shall have the same transverse reinforcement provided below the top of the footing as provided above the footing. This transverse reinforcement shall extend into the footing a distance not less than the smaller of the depth of the footing, mat, or pile cap or the development length in tension of the longitudinal reinforcement.

21.11.2.5

Where earthquake effects create uplift forces in columns or concentrated reinforcement of flexural walls or columns, flexural reinforcement shall be provided in the top of the footing, mat, or pile cap. Such reinforcement shall be not less than 0.001 times the gross sectional area in each direction or 120% of the required factored capacity calculated using the nominal resistance of the wall or column tension reinforcement, whichever is less.

21.11.3 Grade beams and slabs on grade**21.11.3.1**

Grade beams and slabs designed to act as horizontal ties between pile caps or footings shall have continuous longitudinal reinforcement that shall be developed within or beyond the supporting column or anchored within the pile cap or footing at all discontinuities.

21.11.3.2

Grade beams ~~not connected~~ to a slab designed to act as horizontal ties between pile caps or footings shall be proportioned in such a manner that the smallest cross-sectional dimension shall be equal to or greater than the clear spacing between connected columns divided by 20, but need not be greater than 450 mm. Closed ties shall be provided at a spacing not exceeding one-half of the smallest cross-sectional dimension or 300 mm, whichever is smaller.

21.11.3.3

Grade beams and beams that are part of a mat foundation subject to flexure from columns that are part of the SFRS shall comply with Clause 21.3. Joints between these columns and grade beams shall comply with Clause 21.5.

21.11.3.4

Slabs on grade that resist seismic forces from walls or columns that are part of the SFRS shall be designed as structural diaphragms in accordance with Clause 21.10. The design drawings shall clearly state that the slab on grade is a structural diaphragm and part of the SFRS.

21.11.4 Piles and piers**21.11.4.1**

The requirements of Clauses 21.11.4.2 to 21.11.4.6 shall apply to concrete piles and piers supporting structures designed for earthquake resistance.

21.11.4.2

Piles or piers resisting tension loads shall have continuous longitudinal reinforcement over the length resisting design tension forces. The longitudinal reinforcement shall be detailed to transfer tension forces within the pile cap to supported structural members.