11/8/12

CTV Building

Diaphragm to Wall on grid 5 connection for E-W earthquake

From ARCE calculations p S10

Total base shear = 3300 kN

Adjust by factor for building period from p S15

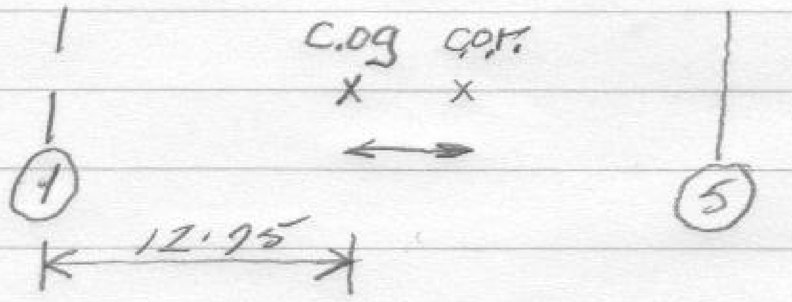
$0.712 \times 3300\ kN = 2350\ kN.$

See p S10 for shear distribution up building for E-W earthquake

Level 6 shear $= 879\ kN \times 0.712$

$= 626\ kN$

Distribution of shear between walls on grid 1 and 5



See p S3

cor not defined in calculations but approx 4.5m from com.

$b = 22.5m$ effective $\quad 0.1b = 2.25m.$

$cog - cor \approx 4.5$

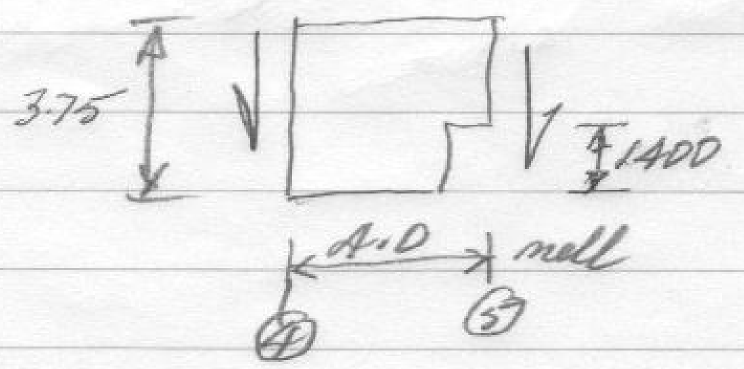
$cog - cor_{max} = 4.5 + 2.25 = 6.75\ m.$

∴ Load share for wall on grid 5

$= \frac{626}{2} + 626 \times 6.75 / 25.6 \approx 478\ kN$

Shear to be transferred from grid 4 to 5 at level 6 ≃ 480 kN

Effective slab to transfer this shear



Slab 150 mm nett

$v_i = \frac{480 \times 10^3}{.8 \times (3750 - 1400) \times 150}$

$= 1.70 MPa.$

$$v_i - v_c = \frac{A_v f_y}{b_w S} = \frac{28 \times 500}{150 \times 150} = 0.62 \text{ MPa}$$

based on 664 mesh at $f_y = 500$ MPa

$$v_b = v_c = (0.07 + 10\rho_w)\sqrt{f'_c}$$

ρ_w is very low so

$$v_c = 0.08\sqrt{f'_c} = .08 \times \sqrt{25} = 0.40 \text{ MPa}$$

For conventional truss action the shear in the section as a deep beam ($d = .8h$) exceeds the approx shear capacity of the slab between grids 4 and 5 by $\frac{1.7}{\phi} \times \frac{1}{.4 + .62}$, $\phi = .85$

So $\frac{\text{demand}}{\text{capacity}} \approx 1.96$.

Even taking account of all possible increases of allowable shear stress the $\frac{\text{demand}}{\text{capacity}}$ would not be reduced below 1.0. (See 3101 eq. 7.24 where $v_c = 1.6 \times v_b$ approx.)

Even if shear can be transferred between grids 4 & 5 look at shear friction to get the shear into the wall at grid 5.

length of wall/slab interface = 2.35 m.

Rebar crossing interface

D12 @ 400 + 664 mesh × 2. But mesh is not properly developed into wall so should not be counted.

Shear friction at $\phi = 0.85$ $\mu = 1.4$

$$V_u = .85 \times 1.4 \times \frac{2350}{400} \times 300 \times 110 \text{ (no mesh)}$$
$$= 230 \text{ KN}$$

$$V_u \text{ with mesh} = .85 \times 1.4 \left[\frac{2350}{400} \times 300 \times 110 + 2 \text{ layers} \times 186 \times 500 \times 2.35\right]$$

≈ 660 KN with mesh but not developed – see detail 2, S16.

In the truss analogy for the concrete slab between grids A & 5 the chord of the truss must be provided. The tension in the chord is approximately the same force as the shear force as the panel is approximately square.

Area of rebar at right angles to the grids

$$\simeq \frac{480 \times 10^3}{380} = 1260 \text{ mm}^2$$

$\simeq$ 12 legs of H12's.

With wall rebar 12 @ 400 a height of wall of 2000 mm (2.0 m) would be required to provide sufficient bars. (Wall line C/D)

Using $\phi = 0.85$ the height of wall would be 2.35 m.

This is not appropriate as the area of reinforcing required should be concentrated at the floor level for such an action.

In the above analysis the NZS 4203 parts and portions loads have not been used in the calculations. The purpose of the calculations is to show that getting the shear at, at least level 6, from grid 4 to 5 is not even close.

Note. The stair landing between the centre two shear wall is considered to provide no effective connection for loads from grids 4 to 5.

Note. The centre of rigidity assumed is an approximation because a difinitive figure could not be found in the docs.