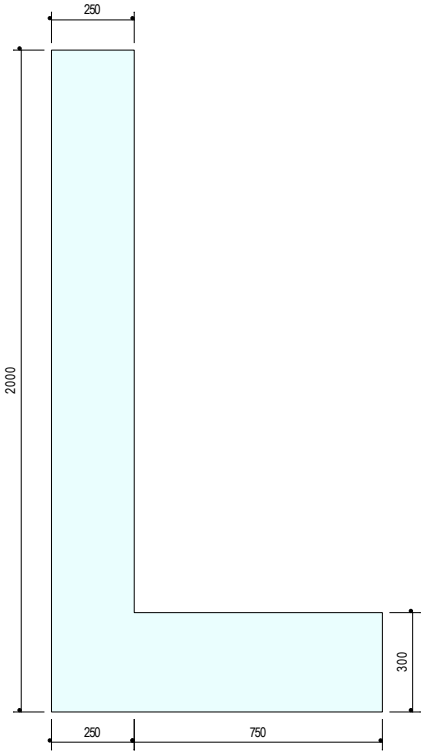
■ MEMBER NAME : RW02

1. General Information

(1) Design Code : NSR-10
(2) Code Unit : N, mm

2. Material

(1) F'_c : 28.00MPa
(2) F_y : 420MPa
(3) F_{ys} : 420MPa



3. Soil and Load

(1) Back Fill

- Inclined Back Fill : Yes
- Back Fill Slope : 2.000
- Back Fill Height : 0.000m
- Internal Friction Angle : 30.00
- Unit Density : 18.00kN/m³

(2) Surcharge Load

- Surcharge Load (Flat) : 4.000KPa
- Surcharge Load (Slope) : 0.000KPa

(3) Foundation Ground

- Internal Friction Angle : 30.00
- Cohesion : 0.000kN/m²

- Bearing Capacity : 152kN/m²

(4) Load

- Live Factor : 1.600
- Soil Factor : 1.600

4. Section

(1) Section Information

- Type : L
- Total Height : 2.000m

(2) Stem

- Top Thickness : 250mm
- Bottom Thickness : 250mm
- Back Horizontal Distance : 0.000mm
- Cover (Front) : 50.00mm
- Cover (Back) : 50.00mm

(3) Foundation

- Depth : 300mm
- Slope Depth : 0.000mm
- Heel Length : 0.750m
- Cover : 75.00mm

(4) Shear Key

- Use Shear Key : No

5. Rebar

(1) Stem Rebar (Stem at Bot)

- Vertical Bar (Front) : #3@200
- Vertical Bar (Back) : #4@200 + #4@200
- Horizontal Bar : #3@200

(2) Stem Rebar (Stem at Half)

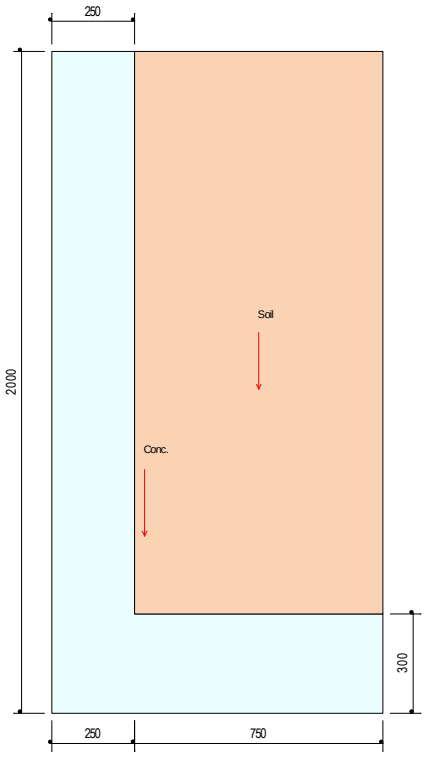
- Vertical Bar (Front) : #3@200
- Vertical Bar (Back) : #4@200 + #4@200
- Horizontal Bar : #3@200

(3) Foundation Rebar (Heel)

- Main Rebar : #4@200 +
- Distribution Bar : #3@200

(4) Foundation Rebar (Toe)

- Main Rebar : #4@200 +
- Distribution Bar : #3@200



6. Calculate Soil Pressure for stability

(1) Applied active soil pressure

- Trial wedge method

(2) Calculate coefficient of active soil pressure

- Friction angle of backfill earth ø : 30.00
- Friction angle of Wall δ : 0.000

Wedge Angle	Friction Angle	Wedge Weight (kN/m)	P_A (kN/m)	Active Coeff.
59.00	0.000	21.63	11.99	0.333
59.50	0.000	21.21	12.00	0.333
60.00	0.000	20.78	12.00	0.333
60.50	0.000	20.37	12.00	0.333
61.00	0.000	19.96	11.99	0.333

(3) Active soil pressure

- Horizontal P_{AH} : 12.00kN/m
- Vertical P_{AV} : 0.000kN/m

7. Check Overturning

(1) Calculate overturning moment

- $M_o = \frac{1}{3} P_A H = 8.000 kN \cdot m/m$

(2) Calculate resistance Moment

Part	W (kN/m)	Dist (m)	Resist. M (kN·m/m)
Concrete Self Weight	17.06	0.280	4.781

BackFill Soil Self Weight	22.95	0.625	14.34
Surcharge Load (Flat)	3.000	0.625	1.875
Surcharge Load (Slope)	0.000	0.250	0.000
Summation	43.01	-	21.00

(3) Check Overturning

- $M_r / M_o = 2.625 > 2.000$

8. Check Bearing

(1) Calculate eccentricity

- $e = \left| \frac{L}{2} \frac{M_r - M_o}{\sum W} \right| = 198mm > \frac{L}{6} = 167mm$

(2) Check Bearing

- $q_{max} = \frac{2\sum W}{3B(L/2-e)} = 94.88kN/m^2 < q_a = 152kN/m^2$

9. Check Sliding

(1) Applied passive soil pressure

- Rankine's passive soil pressure

(2) Calculate coefficient of passive soil pressure

- $K_p = \frac{1 + \sin \phi}{1 - \sin \phi} = 3.000$

(3) Calculate friction coefficient

- $\mu = MIN[0.6, \tan \phi_b] = 0.577$

(4) Calculate sliding force

- $H_h = P_{AH} = 12.00kN/m$

(5) Calculating Resistance Force

- $H_r = \mu \sum W = 24.83kN/m$

(6) Check Sliding

- $H_r / H_h = 2.069 > 1.500$

10. Calculate Soil Pressure for section design

(1) Applied active soil pressure

- Trial wedge method

(2) Calculate coefficient of active soil pressure

- Friction angle of backfill earth ø : 30.00
- Friction angle of Wall δ : 10.00
- Wall back face inclined angle θ : 0.000

Wedge Angle	Friction Angle	Active Coeff.	Wedge Weight (kN/m)	P_A (kN/m)
57.00	0.175	0.308	16.89	8.019
57.50	0.175	0.308	16.57	8.023
58.00	0.175	0.308	16.25	8.023
58.50	0.175	0.308	15.94	8.020
59.00	0.175	0.308	15.63	8.013

11. Calculate capacity of Stem - Bottom

(1) Calculate design forces

- $p_{AH} = K_{ah} \gamma H = 0.00930MPa$
- $p_{AHs} = K_{ah} \gamma w_s = 0.00122MPa$
- $V_u = p_{AH} \frac{H}{2} + p_{AHs} H = 15.95kN/m$
- $M_u = p_{AH} \frac{H}{2} \frac{H}{3} + p_{AHs} H \frac{H}{2} = 9.973kN \cdot m/m$

(2) Calculate minimum rebar area required

- $A_{s.min} = 450mm^2$

- A_s = 1,290mm²

(3) Calculate minimum rebar space required

- s_{req} = 450mm
- s = 200mm < s_{req}

(4) Check moment capacity

- d_{eff} = 175mm
- ø = 0.900
- M_u = 9.973kN·m/m
- øM_n = 79.70kN·m/m
- M_u / øM_n = 0.125

(5) Check shear capacity

- ø = 0.750
- V_u = 15.95kN/m
- øV_c = ø 0.17 $\sqrt{f'_c}$ b_w d = 131kN/m
- V_u / øV_c = 0.122

(6) Calculate distribution bar

- $A_{s.dist}$ = 0.2 * A_s = 258mm²
- s_{dist} = 270mm

12. Calculate capacity of Stem - Middle

(1) Calculate design forces

- p_{AH} = K_{ah} γ H = 0.00465MPa
- p_{AHs} = K_{ah} γ w_s = 0.00122MPa
- V_u = $p_{AH} \frac{H}{2}$ + p_{AHs} H = 4.813kN/m
- M_u = $p_{AH} \frac{H}{2} \frac{H}{3}$ + p_{AHs} H $\frac{H}{2}$ = 1.598kN·m/m

(2) Calculate minimum rebar area required

- $A_{s.min}$ = 450mm²
- A_s = 1,290mm²

(3) Calculate minimum rebar space required

- s_{req} = 450mm
- s = 200mm < s_{req}

(4) Check moment capacity

- d_{eff} = 175mm
- ø = 0.900
- M_u = 1.598kN·m/m
- øM_n = 79.70kN·m/m
- M_u / øM_n = 0.0200

(5) Check shear capacity

- ø = 0.750
- V_u = 4.813kN/m
- øV_c = ø 0.17 $\sqrt{f'_c}$ b_w d = 131kN/m
- V_u / øV_c = 0.0368

(6) Calculate distribution bar

- $A_{s.dist}$ = 0.2 * A_s = 258mm²
- s_{dist} = 270mm

13. Calculate capacity of heel

(1) Calculate design forces

Part	Shear (kN/m)	Dist (m)	Moment (kN·m/m)	Load Factor

Concrete Self Weight	6.355	0.375	2.383	1.200
Soil Self Weight	27.54	0.375	10.33	1.200
Surcharge Flat	4.800	0.375	1.800	1.600
Surcharge Slope	0.000	0.000	0.000	0.000
Soil Pressure	0.000	0.000	0.000	1.600
Foundation Reaction	-17.56	0.114	-1.993	1.000
Summation	21.13	-	12.52	-

(2) Calculate minimum rebar area required

- $A_{s.min}$ = 540mm²
- A_s = 645mm²

(3) Calculate minimum rebar space required

- s_{req} = 450mm
- s = 200mm < s_{req}

(4) Check moment capacity

- d_{eff} = 244mm
- ø = 0.900
- M_u = 12.52kN·m/m
- øM_n = 58.03kN·m/m
- M_u / øM_n = 0.216

(5) Check shear capacity

- ø = 0.750
- V_u = 21.13kN/m
- øV_c = ø 0.17 $\sqrt{f'_c}$ b_w d = 164kN/m
- V_u / øV_c = 0.129

(6) Calculate distribution bar

- $A_{s.dist}$ = 0.2 * A_s = 129mm²
- s_{dist} = 450mm
-