LAMPIRAN


\( \mu = 0,45 \) (diambil dari ketentuan ACI 530-88)

\( \varepsilon_c = 0,0029 \)

\( f'_{m} = 15,09 \) MPa

\( r = \frac{h}{l} = \frac{1638}{2311} = 0,667 \)

\( \theta = \tan^{-1}\left(\frac{h_{inf}}{l_{inf}}\right) = 33,69^{0} \)

Tegangan tekan efektif dinding pengisi (Pers. 2.31)

\( f_c = 0,6 \phi f'_{m} \)

\( f_c = 0,6 \times 0,65 \times 15,09 = 5,885 \) MPa

Batas atas tegangan kontak nominal (2.16)

\[
\sigma_{c0} = \frac{f_c}{\sqrt{1 + 3\mu^2r^4}}
\]

\[
\sigma_{c0} = \frac{5,885}{\sqrt{1 + 3 \times 0,45^2 \times 0,667^4}} = 5,561 \text{ MPa}
\]
\[
\sigma_{b0} = \frac{f_c}{\sqrt{1 + 3\mu^2}}
\]

\[
\sigma_{b0} = \frac{5,885}{\sqrt{1 + 3 \times 0.667^2}} = 4,642 \text{ MPa}
\]

Mn pada kolom = 34500 Nmm, jika \(M_{pc} = \varphi M_n\) dengan \(\varphi = 1\) maka \(M_{pc} = 34500\) Nmm. Sedangkan Mn pada balok = 36300 Nmm, jika \(M_{pb} = \varphi M_n\) dengan \(\varphi = 1\) maka \(M_{pb} = 36300\) Nmm.

Panjang bidang kontak portal dengan dinding pengisi

Hubungan balok dan kolom menyatu sehingga nilai \(M_{pj}\) adalah nilai terkecil di antara \(M_{pc}\) dan \(M_{pb}\). Dengan menggunakan Pers. 2.19a dan Pers. 2.19b:

\[
\alpha_c h = \sqrt{\frac{2M_{pj} + 2\beta_0 M_{pc}}{\sigma_{c0} t}} \leq 0.4h'
\]

\[
\sqrt{\frac{2 \times 34500 + 2 \times 0.2 \times 34500}{5,561 \times 100}} \leq 0,4 \times 1422
\]

\[
400 \leq 568.8
\]

Ambil nilai \(\alpha_c h = 400\), sehingga diperoleh \(\alpha_c = 0.244\)

\[
\alpha_b l = \sqrt{\frac{2M_{pj} + 2\beta_0 M_{pb}}{\sigma_{b0} t}} \leq 0.4l'
\]
\[
\sqrt{\frac{2 \times 34500 + 2 \times 0.2 \times 36300}{4.642 \times 100}} \leq 0.4 \times 2133
\]

440 \leq 853,2

Ambil nilai \( \alpha_b l = 440 \), sehingga diperoleh \( \alpha_b = 0,190 \)

Tegangan kontak (Pers. 2.22a,b)

\[
A_c = r^2 \sigma_{c0} \alpha_c (1 - \alpha_c - \mu r)
\]

\[
A_c = 0.667^2 \times 5,561 \times 0.244 (1 - 0.244 - 0.45 \times 0.667)
\]

\[
A_c = 0.275
\]

\[
A_b = r^2 \sigma_{b0} \alpha_b (1 - \alpha_b - \mu r)
\]

\[
A_b = 0.667^2 \times 4.642 \times 0.190 (1 - 0.190 - 0.45 \times 0.667)
\]

\[
A_b = 0.200
\]

karena \( A_c > A_b \), maka sesuai Pers. (2.21a)

\[
\sigma_b = \sigma_{b0} = 4,642 \text{ MPa}
\]

\[
\sigma_c = \sigma_{c0} \left( \frac{A_b}{A_c} \right) = 5,561 \left( \frac{0.200}{0.275} \right) = 4,046 \text{ MPa}
\]

Dan sesuai Pers. (2.15)

\[
\tau_b = \mu \sigma_b
\]
\[ \tau_b = 0.45 \times 4.642 = 2.089 \text{ MPa} \]

Keruntuhan sudut/ujung diagonal (CC), dihitung memakai Pers. (2.29)

\[ R = R_{CC} = \frac{(1 - \alpha_c) \alpha_c \sigma_c + \alpha_b \tau_b}{\cos \theta} \]

\[ R = \frac{(1 - 0.244) 0.244 \times 100 \times 1638 \times 4.046 + 0.190 \times 100 \times 2311 \times 2.089}{\cos 33.690} \]

\[ R = R_{CC} = 257472.5N = 257.472 \text{ kN} \]

Keruntuhan tekan diagonal (DC), dihitung memakai Pers. (2.30); (2.31) dan (2.32)

\[ l_{eff} = \sqrt{(1 - \alpha_c)^2 h'^2 + l'^2} \]

\[ l_{eff} = \sqrt{(1 - 0.224)^2 \times 1422^2 + 2133^2} \]

\[ l_{eff} = 2388.466 \text{ mm} \]

\[ f_a = f_c \left[ 1 - \left( \frac{l_{eff}}{40 \times t} \right)^2 \right] \]

\[ f_a = 5.885 \left[ 1 - \left( \frac{2388.466}{40 \times 100} \right)^2 \right] \]

\[ f_a = 3.787 \text{ MPa} \]

Maka,
\[ R = R_{DC} = \frac{0.5 \ h'\ t\ f_a}{\cos \theta} \]

\[ R = R_{DC} = \frac{0.5 \times 1422 \times 100 \times 3.787}{\cos 33.690} \]

\[ R = R_{DC} = 323586.14 \ N = 323,586 \ kN \]

Keruntuhan Geser (S) dihitung memakai Pers. (2.34)

\[ \tan \theta' = (1 - \alpha_c) \frac{h'}{l'} \]

\[ \tan \theta' = (1 - 0.244) \frac{1422}{2133} = 0.504 \]

\[ R = R_s = \frac{\gamma \ v\ t\ l'}{(1 - 0.45 \tan \theta') \tan \theta} < \frac{0.83 \gamma \ t\ l'}{\cos \theta} \]

\[ R = R_s = \frac{1.5 \times 0.41 \times 100 \times 2133}{(1 - 0.45 \times 0.504) \tan 33.690} < \frac{0.83 \times 1.5 \times 100 \times 2133}{\cos 33.690} \]

\[ 254467.1 < 319162 \]

\[ R = R_s = 254467.1 \ N = 254,467 \ kN \]

Dari ketiga mode keruntuhan yang ditinjau, keruntuhan geser akan terjadi lebih dahulu dibanding dengan mode keruntuhan yang lain sehingga dianggap yang paling menentukan, maka \( R = R_{DC} = 254,467 \) Kn

Dengan menggunakan Per.(2.28)
\[ H = R \cos \theta + \left( \frac{2M_{pl}}{h} \right) \]

\[ H = 254467,1 \cos 33,690 + \left( \frac{2 \times 34500}{1638} \right) \]

\[ H = 211,729 \text{ kN} \]

Gaya horizontal penyebab retak dinding pengisi

\[ C_c = \sigma_c \cdot t \cdot \alpha_c \cdot h \]

\[ C_c = 161847,36 \text{ N} = 161,847 \text{ kN} \]

\[ F_b = \tau_b \cdot t \cdot \alpha_b \cdot h \]

\[ F_b = 91905,933 \text{ N} = 91,906 \text{ kN} \]

\[ \frac{H}{C_c + F_b} = 0,834 \leq 1,0 \]

\[ H_t = H_{ti} = 2\sqrt{2}th'f_c \cos^2 \theta \]

\[ H_t = H_{ti} = 59866,271 \text{ N} = 59,866 \text{ kN} \]

Deformasi dan kekakuan sekan portal-isi

\[ \Delta_h = 5,8 \varepsilon_c h \cos \theta (\alpha_c^2 + \alpha_b^2)^{0,333} \]

\[ \Delta_h = 10,500 \text{ mm} \]
\[ K_0 = 2 \frac{H}{\Delta_h} = 40,327 \text{ kN/mm} \]

2. Properti elemen balok dan kolom

<table>
<thead>
<tr>
<th>Elemen</th>
<th>Panjang Elemen (m)</th>
<th>Momen Inersia Efektif (m^4)</th>
<th>Modul Elastisitas Beton, E (kN/m^2)</th>
<th>Kekakuan Elemen, Ko (kN/m)</th>
<th>Momen Leleh, My (kN/m)</th>
<th>Rotasi Leleh, ( \theta_y )</th>
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<td>Momen Leleh, (M_y) ((kNm))</td>
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**Model 1 zona 6**

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Universitas Sumatera Utara
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**Model 2 zona 4**

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<th>Momen Inersia Efektif (m^4)</th>
<th>Modulus Elastisitas Beton, E (kN/m^2)</th>
<th>Kekakuan Element, Ko (kN/m)</th>
<th>Momen Leleh, My (kNm)</th>
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Universitas Sumatera Utara
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<th>Moment Inertia (m^4)</th>
<th>Effective Moment Inertia (m^4)</th>
<th>Modulus Elasticity of Concrete, E (kN/m²)</th>
<th>Keakuan Element, Ko (kN/m)</th>
<th>Moment Leaking, My (kNm)</th>
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Model 4 zona 4

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Universitas Sumatera Utara
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