

#### **4.4 Tahap Analisa**

1. Menentukan spesifikasi dan konfigurasi struktur rangka baja jembatan.
2. Menentukan beban-beban yang bekerja dengan menggunakan AASHTO.
3. Analisis struktur dengan garis pengaruh menggunakan program SAP 2000.
4. Merencanakan elemen-elemen batang struktur dengan metode LRFD.
5. Pembahasan.
6. Menyimpulkan hasil.

Tinggi manfaat tulangan pelat lantai :

$$\begin{aligned} \text{Arah } x ; dx &= h - Pb - 1/2.Dtul \\ &= 200 - 20 - 1/2.16 \\ &= 172 \text{ mm} \end{aligned}$$

$$\begin{aligned} \text{Arah } y ; dy &= h - Pb - Dtulx - 1/2.Dtuly \\ &= 200 - 20 - 16 - 1/2.12 \\ &= 158 \text{ mm} \end{aligned}$$

Momen-momen yang bekerja pada pelat :

$$\begin{aligned} Mu_x &= -Mu_y = 0,001.qU.lx^2.63 \\ &= 0,001.255,766.1,5^2.63 = 36,255 \text{ kNm} \end{aligned}$$

1. Perencanaan tulangan lx dan tx

$$Mu_x = -Mu_y = 36,255 \text{ kNm}$$

$$Mu/\phi = 36,255/0,8 = 45,318 \text{ kNm}$$

$$\rho_{\min} = \frac{1,4}{fy} = 1,4/400 = 0,0035$$

$$\beta_1 = 0,85 - 0,008(fc' - 30) = 0,85 - 0,008(35 - 30) = 0,81$$

$$\rho_b = \frac{0,85.fc'}{fy} \beta_1 \left( \frac{600}{600 + I'y} \right) = \frac{0,85.35}{400} 0,81 \left( \frac{600}{600 + 400} \right) = 0,0446$$

$$\rho_{\max} = 0,75.\rho_b = 0,75.0,0446 = 0,0335$$

$$Rn = \frac{Mu/\phi}{b.d^2} = \frac{45,318.10^6}{1000.(172)^2} = 1,532 \text{ Mpa}$$

$$m = \frac{fy}{0,85.fc'} = 400/0,85.35 = 13,445$$

$$= 47,994 \geq 45,318 \text{ kNm} \dots\dots\dots \text{Ok}$$

dipakai tulangan pokok D16-280

- Perencanaan Tulangan Susut :

$$A_{s_{susut}} = 0,002 \cdot b \cdot h$$

$$= 0,002 \cdot 1000 \cdot 200 = 400 \text{ mm}^2$$

digunakan tulangan susut  $\emptyset 12$  mm, sehingga :

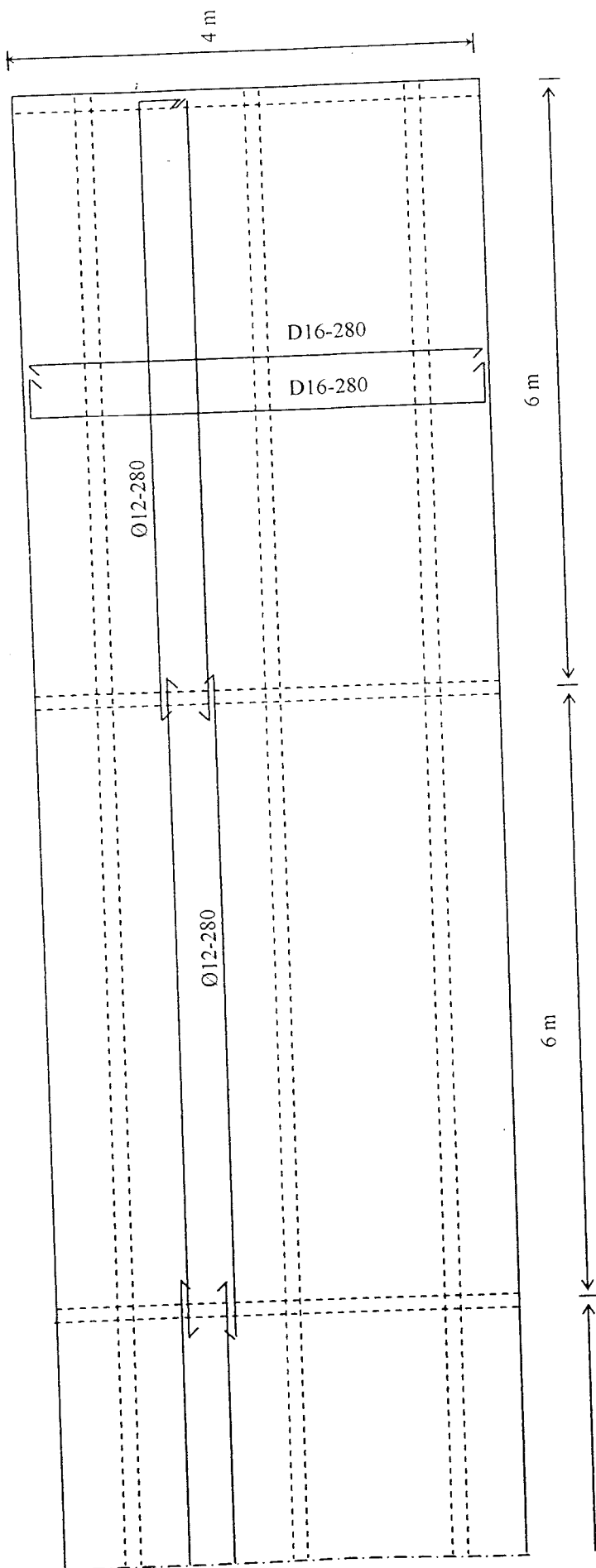
$$A_1 \phi = \frac{1}{4} \cdot \pi \cdot D^2 = \frac{1}{4} \cdot \pi \cdot 12^2 = 113,097 \text{ mm}^2$$

$$\text{jarak tulangan susut (s)} = \frac{A_1 \phi \cdot b}{A_{s_{susut}}}$$

$$= \frac{113,097 \cdot 1000}{400} = 282,7425 \text{ mm}$$

dipakai s susut = 280 mm.

dipakai tulangan susut  $\emptyset 12$ -280



Gambar 5.5 Penulangan Pelat Lantai

$$\gamma_{sat} = \gamma_k + n = 12,115 + 0,5286 \cdot 9,81 = 17,301 \text{ kN/m}^3$$

$$\gamma' = \gamma_{sat} - 9,81 = 17,301 - 9,81 = 7,491 \text{ kN/m}^3$$

$$K_a = \text{tg}^2(45 - \phi/2) = \text{tg}^2(45 - 15/2) = 0.589$$

Lapisan 2 :

$$\gamma_s = 25,506 \text{ kN/m}^3$$

$$W_{opt} = 43\%$$

$$\phi = 15^\circ$$

$$\gamma_b = 17,266 \text{ kN/m}^3$$

$$\gamma_k = \frac{\gamma_b}{1+w} = \frac{17,266}{1+0.43} = 12,361 \text{ kN/m}^3$$

$$n = (1 - \gamma_k / \gamma_s) \cdot 100\% = (1 - 12,361 / 25,506) \cdot 100\% = 48,46\%$$

$$\gamma_{sat} = \gamma_k + n = 12,361 + 0,4846 \cdot 9,81 = 17,417 \text{ kN/m}^3$$

$$\gamma' = \gamma_{sat} - 9,81 = 17,417 - 9,81 = 7,607 \text{ kN/m}^3$$

$$K_a = \text{tg}^2(45 - \phi/2) = \text{tg}^2(45 - 15/2) = 0.589$$

Lapisan 3 :

$$\gamma_s = 25,506 \text{ kN/m}^3$$

$$W_{opt} = 46\%$$

$$\phi = 15^\circ$$

$$\gamma_b = 16,971 \text{ kN/m}^3$$

$$\gamma_k = \frac{\gamma_b}{1+w} = \frac{16,971}{1+0.46} = 12,066 \text{ kN/m}^3$$

$$n = (1 - \gamma_k / \gamma_s) \cdot 100\% = (1 - 12,066 / 25,506) \cdot 100\% = 52,69\%$$

$$\gamma_{sat} = \gamma_k + n = 12,066 + 0,5269 \cdot 9,81 = 17,235 \text{ kN/m}^3$$

$$\gamma' = \gamma_{sat} - 9,81 = 17,235 - 9,81 = 7,425 \text{ kN/m}^3$$

$$Ka = \operatorname{tg}^2(45 - \phi/2) = \operatorname{tg}^2(45 - 15/2) = 0.589$$

Total beban vertikal :

$$\sum V = Va + Vt + Vmh = 2404,08 + 546,683 + 6584,891 = 9535,654 \text{ kN}$$

Momen vertikal :

$$\begin{aligned} \sum Mv &= MVa + MVt + Mmh = 1641,987 + 1138,193 + 4938,668 \\ &= 7718,848 \text{ kNm.} \end{aligned}$$

- Gaya horisontal :

a. Gaya tekanan tanah =  $H_t$

$$H_t = 225,727 \cdot 5,4 = 1218,926 \text{ kN}$$

$$Y_1 = 5,035 \text{ m.}$$

$$M_{Ht} = 1218,926 \cdot 5,035 = 6137,291 \text{ kNm.}$$

b. Gaya rem dan traksi

$$H_r = 284,375 \text{ kN.}$$

$$Y_2 = 8,6 + 1,8 = 10,4 \text{ m.}$$

$$M_{Hr} = 284,375 \cdot 10,4 = 2957,5 \text{ kNm.}$$

c. Gaya gesekan tumpuan =  $H_f$

$$H_f = 500,009 \text{ kN.}$$

$$Y_3 = 9,6 - 1 = 8,6 \text{ m.}$$

$$M_{Hf} = 500,009 \cdot 8,6 = 4300,077 \text{ kNm.}$$

Beban horisontal :

$$\sum H = H_t + H_r + H_f = 1218,926 + 284,375 + 500,009 = 2003,31 \text{ kN.}$$

Momen horisontal :

$$\begin{aligned} \sum MH &= M_{Ht} + M_{Hr} + M_{Hf} = 6137,291 + 2957,5 + 4300,07 \\ &= 13394,866 \text{ kNm} \end{aligned}$$