3. Disain Balok

Dalam disain balok kita membutuhkan data-data perencanaan seperti momen perlu, mutu beton maupun mutu baja. Balok bertulangan rangkap dibutuhkan apabila perencanaan balok bertulangan sebelah tidak mampu menahan beban yang direncanakan atau karena alasan arsitektural yang menuntut dimensi balok tidak boleh terlalu besar. Sebelum kita merencanakan disain balok bertulangan rangkap kita harus terlebih dahulu mengecek apakah mungkin untuk menggunakan balok tulangan sebelah saja. Pengecekan dilakukan dengan membandingkan momen perlu (Mu) dengan momen maksimal (M maks), apabila didapatkan momen maksimal lebih kecil dari momen perlu maka perencanaan balok harus menggunakan tulangan rangkap, dimana :

$$M_{mak} = R_{mak}.b.d^2 \quad \text{..... (3.3.3)}$$

dimana

$$R_{mak} = 0{,}6375.fc'.\beta_1.(\varepsilon_c.E_s)\left\{\frac{(\varepsilon_c.E_s + fy) - 0{,}375.\beta_1.(\varepsilon_c.E_s)}{(\varepsilon_c.E_s + fy)^2}\right\} \quad \text{..... (3.3.4)}$$

Apabila didapatkan M_{mak} > Mu maka dapat dilakukan disain balok bertulangan sebelah sehingga didapat persamaan momen kopel sebagai berikut:

$$Cc = 0{,}85.fc'.a.b \quad \text{..... (3.3.5)}$$

$$Ts = As.fs \quad \text{..... (3.3.6)}$$

sehingga :

$$M = Cc.\left(d - \frac{a}{2}\right) = 0{,}85.fc'.a.b.\left(d - \frac{a}{2}\right) \quad \text{..... (3.3.7)}$$

$$M = Ts.\left(d - \frac{a}{2}\right) = As.fs.\left(d - \frac{a}{2}\right) \quad \text{..... (3.3.8)}$$

$$d = \text{tp} - (\text{pb}+0{,}5.\text{øtul}) \quad \text{..... (3.6.37)}$$

$$\rho_{\min} = \frac{1{,}4}{fy} \quad \text{..... (3.6.38)}$$

$$\rho_b = \frac{0{,}85.fc'}{fy}\beta\left(\frac{600}{600+fy}\right) \quad \text{..... (3.6.39)}$$

$$\rho_{\max} = 0{,}75.\rho_b \quad \text{..... (3.6.40)}$$

$$R_n = \frac{Mu/\phi}{b.d^2} \quad \text{..... (3.6.41)}$$

$$m = \frac{fy}{0{,}85.fc'} \quad \text{..... (3.6.42)}$$

$$\rho_{\text{perlu}} = \frac{1}{m}\left(1-\sqrt{1-\frac{2.R_n.m}{fy}}\right) \quad \text{..... (3.6.43)}$$

$$As_{perlu} = \rho.b.d \quad \text{..... (3.6.44)}$$

jarak antar tulangan :

$$S \le \frac{A_{\phi.tul}.b}{As_{perlu}} \quad \text{..... (3.6.45)}$$

$$\text{As}_{\text{ada}} = \frac{A_{\phi.tul}.b}{S} \quad \text{..... (3.6.46)}$$

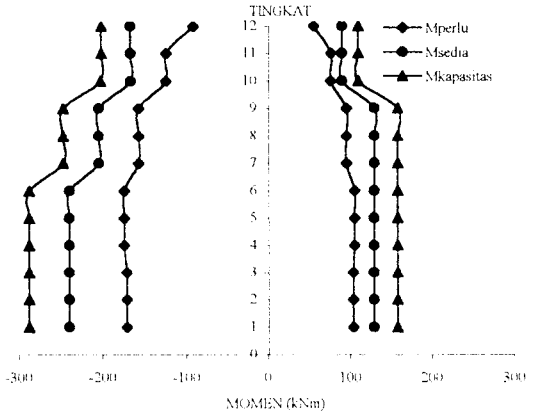
Cek kapasitas lentur:

$$a = \frac{As_{ada}.fy}{0{,}85.fc'.b} \quad \text{.....(3.6.47)}$$

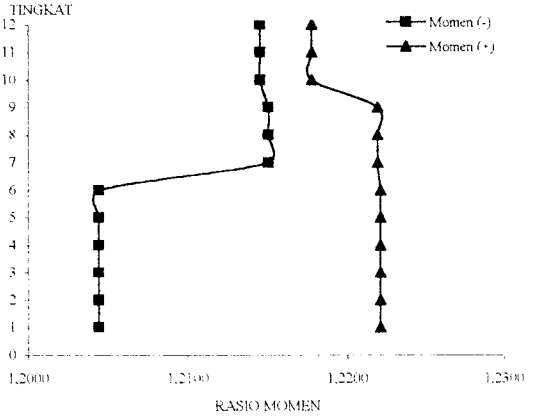
$$Mn = As_{ada}.fy.\left(d-\frac{a}{2}\right) \quad \text{..... (3.6.48)}$$

Dimana $ØM_n$ harus lebih besar dari M_u

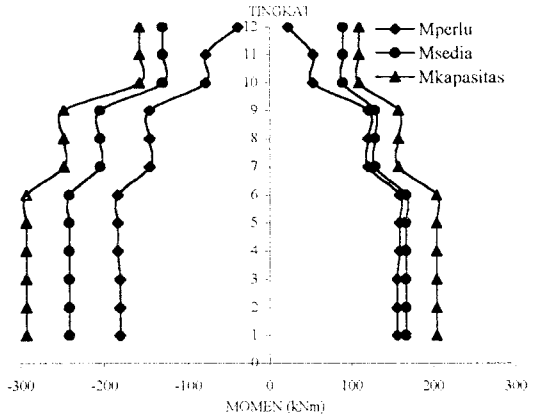
$$ØM_n \ge M_u \quad \text{..... (3.6.49)}$$



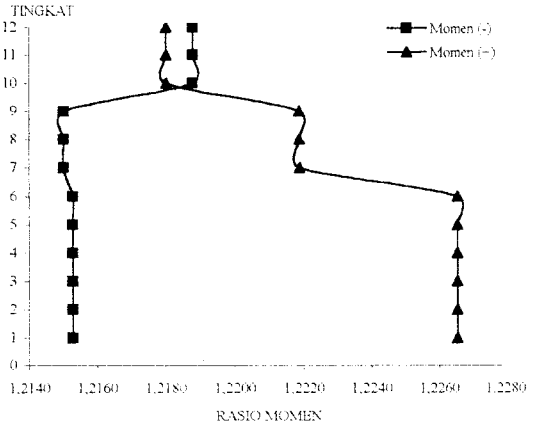
Gambar 6.2.25 Grafik Momen Tumpuan Portal E Bentang 7m R/W 4/4 Lama



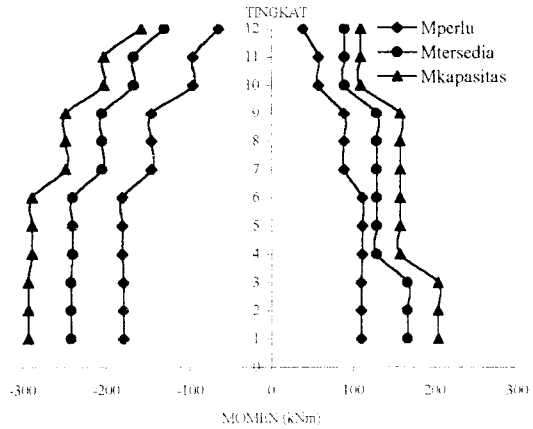
Gambar 6.2.26 Grafik Rasio Mkap - Mtersedia Tumpuan Portal E Bentang 7m R/W 4/4 Lama



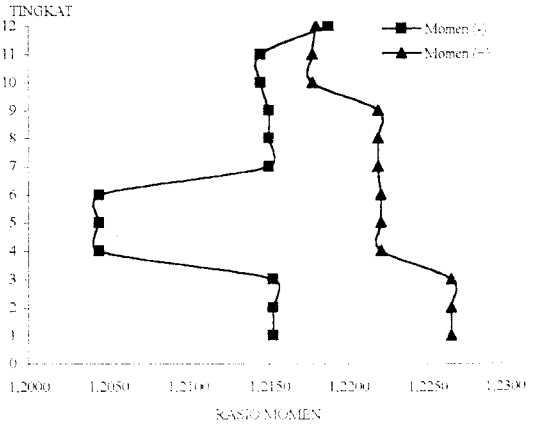
Gambar 6.2.27 Grafik Momen Tumpuan Portal E Bentang 4m R/W 4/4 Lama



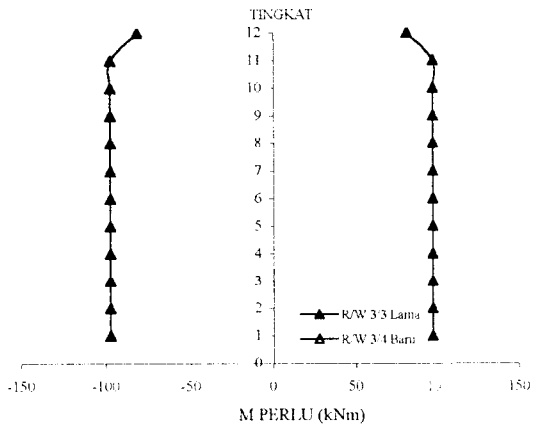
Gambar 6.2.28 Grafik Rasio Mkap - Mtersedia Tumpuan Portal E Bentang 4m R/W 4/4 Lama



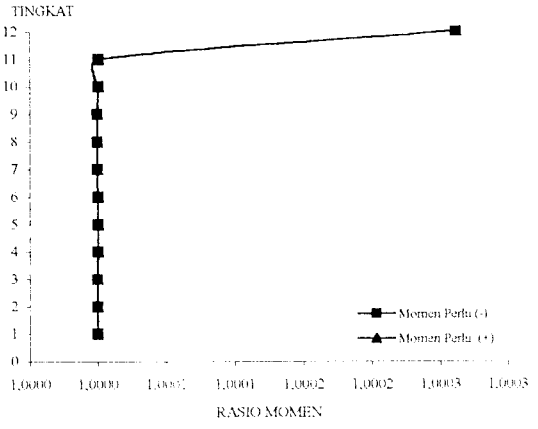
Gambar 6.2.29 Grafik Momen Tumpuan Portal 2 R W 4 4 Lama



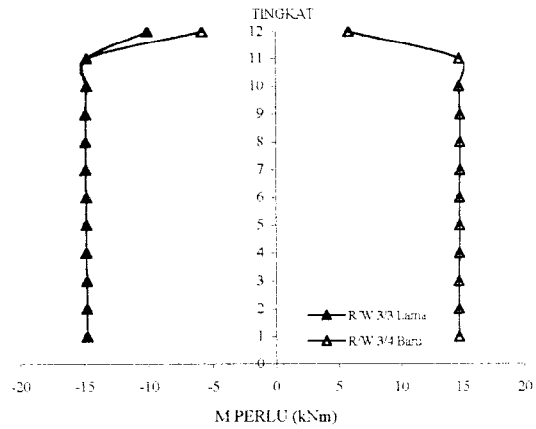
Gambar 6.2.30 Grafik Rasio Mkap - Mtersedia Tumpuan Portal 2 R W 4 4 Lama



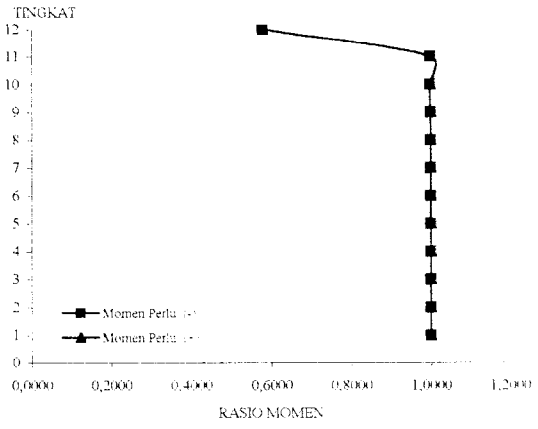
Gambar 6.2.61 Momen Perlu Lapangan Portal E Bentang 7m



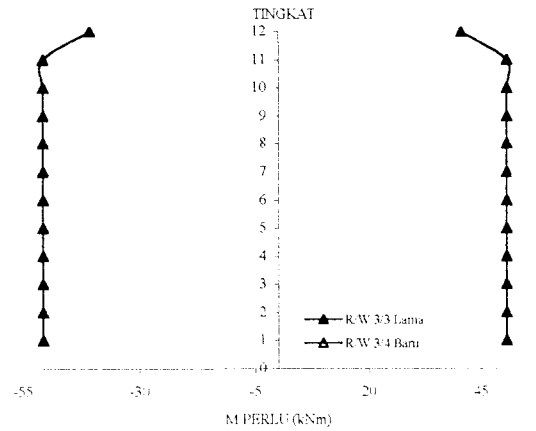
Gambar 6.2.62 Rasio Mperlu Lapangan Portal E Bentang 7m R/W 3/4 Baru - R/W 3/3 Lama



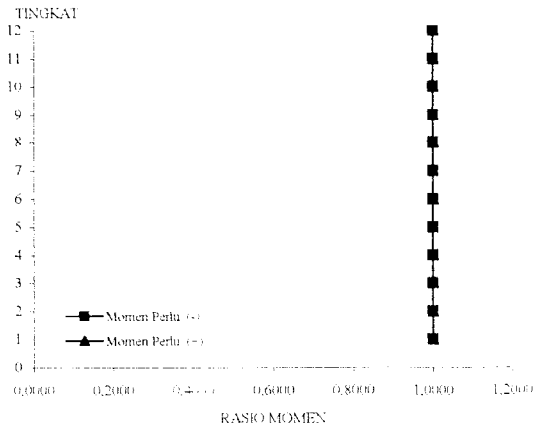
Gambar 6.2.63 Momen Perlu Lapangan Portal E Bentang 4m



Gambar 6.2.64 Rasio Mperlu Lapangan Portal E Bentang 4m R/W 3/4 Baru - R/W 3/3 Lama



Gambar 6.2.65 Momen Perlu Lapangan Portal 2



Gambar 6.2.66 Rasio Mperlu Lapangan Portal 2 R/W 3/4 Baru - R/W 3/3 Lama