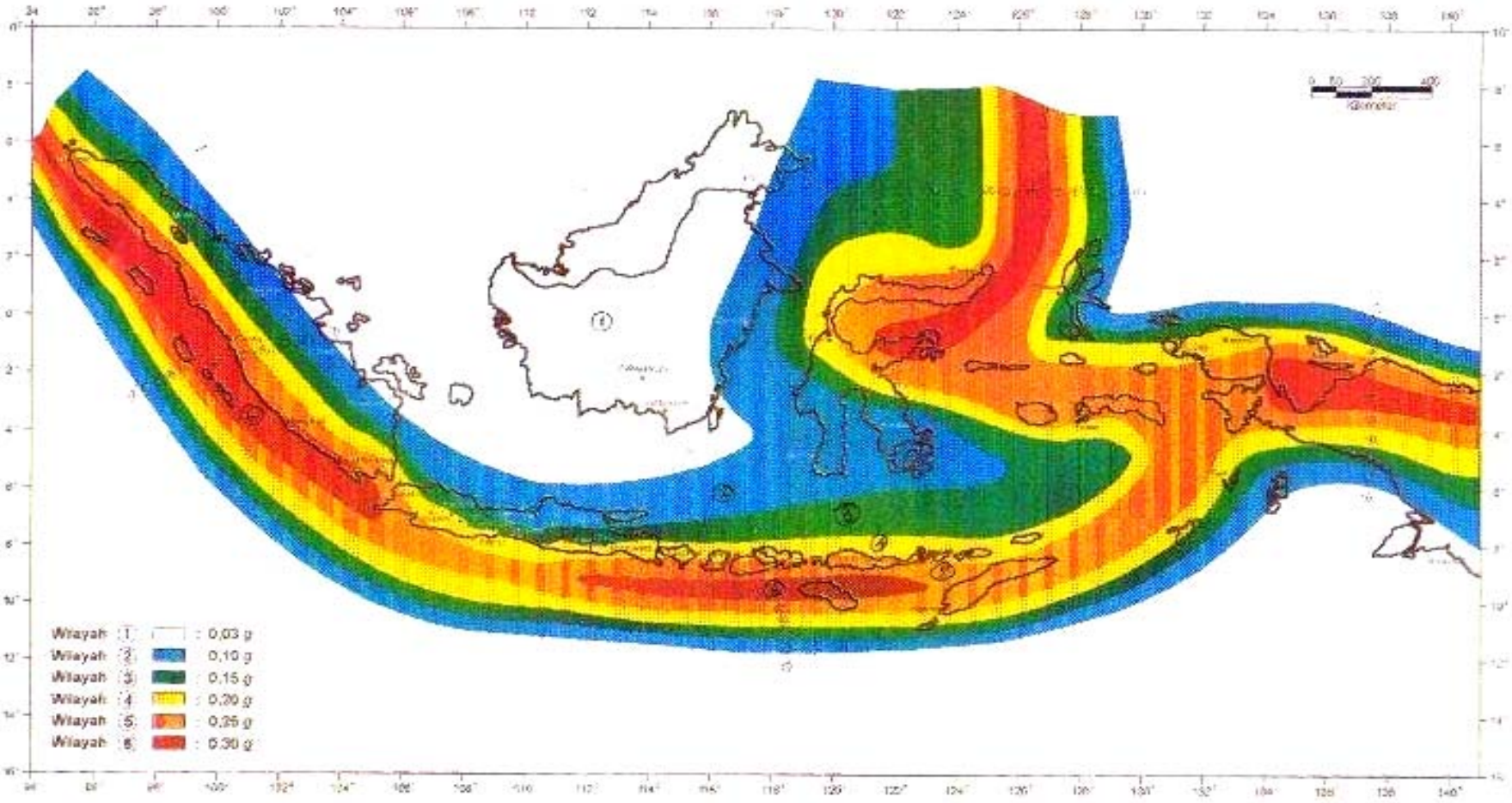
LAMPIRAN

Agar orang lain membantu kita mencapai tujuan
maka kita harus terlebih dahulu membantunya mencapai tujuan
(Deepak Chopra)

Kupersembahkan untuk mamah, papah,
dan semua orang yang kukasihi

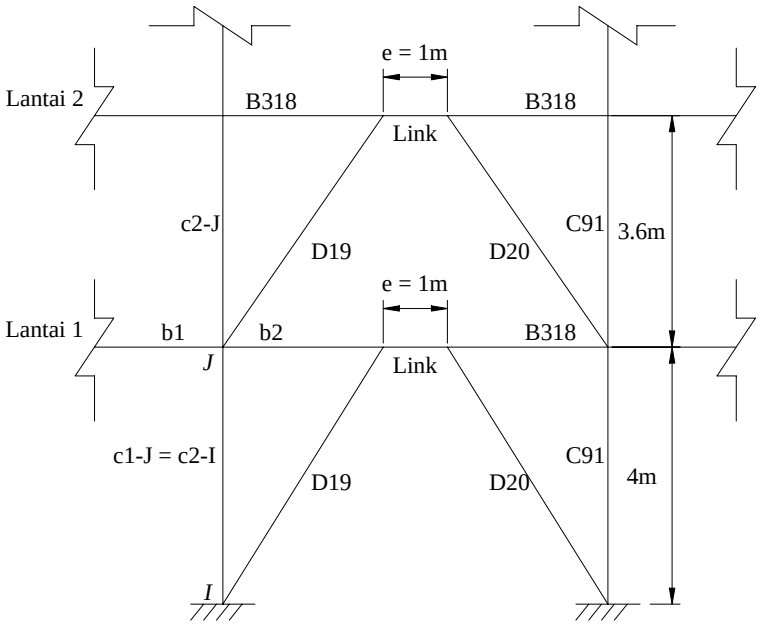


Gambar 2.3 Wilayah Gempa Indonesia dengan percepatan puncak batuan dasar dengan perioda ulang 500 tahun [3]

<u>Faktor Panjang Efektif (k)</u> (kolom lantai 1)

Satuan SI :

$MPa := 1 \frac{N}{mm^2}$ $kN := 1000N$



Gambar 5.8 Sketsa Portal as-1

$E_s := 2 \cdot 10^5 MPa$

Profil :

$c1_I :=$ "WF400X400X18X28" $b1_I :=$ "WF350X175X7X11"

$c2_I :=$ "WF400X400X18X28" $b2_I :=$ "WF350X175X7X11"

$c1_J :=$ "WF400X400X18X28" $b1_J :=$ "WF350X175X7X11"

$c2_J :=$ "WF400X400X18X28" $b2_J :=$ "WF350X175X7X11"

$L_{c1I} := 4m$ $L_{b1I} := 6m$

$L_{c2I} := 3.6m$ $L_{b2I} := 6m$

$L_{c1J} := 4m$ $L_{b1J} := 6m$

$L_{c2J} := 3.6m$ $L_{b2J} := 6m$

$I_{c1xI} := 0mm^4$ $I_{b1xI} := 0mm^4$ $I_{c1yI} := 0mm^4$

$I_{c2xI} := 9.28000 \cdot 10^8 mm^4$ $I_{b2xI} := 0 \cdot mm^4$ $I_{c2yI} := 3.1000 \cdot 10^8 mm^4$

$I_{c1xJ} := 9.28000 \cdot 10^8 mm^4$ $I_{b1xJ} := 1.36000 \cdot 10^8 \cdot mm^4$ $I_{c1yJ} := 3.1000 \cdot 10^8 mm^4$

$I_{c2xJ} := 9.28000 \cdot 10^8 mm^4$ $I_{b2xJ} := 1.36000 \cdot 10^8 \cdot mm^4$ $I_{c2yJ} := 3.1000 \cdot 10^8 mm^4$

$$S_{cxI} := \left(\frac{E_s \cdot I_{c1xI}}{L_{c1I}}\right) + \left(\frac{E_s \cdot I_{c2xI}}{L_{c2I}}\right) \qquad S_{cxJ} := \left(\frac{E_s \cdot I_{c1xJ}}{L_{c1J}}\right) + \left(\frac{E_s \cdot I_{c2xJ}}{L_{c2J}}\right)$$

$S_{cxI} = 5.156 \times 10^{10} N \cdot mm$ $S_{cxJ} = 9.796 \times 10^{10} N \cdot mm$

$$S_{cyI} := \left(\frac{E_s \cdot I_{c1yI}}{L_{c1I}}\right) + \left(\frac{E_s \cdot I_{c2yI}}{L_{c2I}}\right) \qquad S_{cyJ} := \left(\frac{E_s \cdot I_{c1yJ}}{L_{c1J}}\right) + \left(\frac{E_s \cdot I_{c2yJ}}{L_{c2J}}\right)$$

$S_{cyI} = 1.722 \times 10^{10} N \cdot mm$ $S_{cyJ} = 3.272 \times 10^{10} N \cdot mm$

$$S_{bxI} := \left(\frac{E_s \cdot I_{b1xI}}{L_{b1I}}\right) + \left(\frac{E_s \cdot I_{b2xI}}{L_{b2I}}\right) \qquad S_{bxJ} := \left(\frac{E_s \cdot I_{b1xJ}}{L_{b1J}}\right) + \left(\frac{E_s \cdot I_{b2xJ}}{L_{b2J}}\right)$$

$S_{bxI} = 0 N \cdot mm$ $S_{bxJ} = 9.067 \times 10^9 N \cdot mm$

$$S_{byI} := \left(\frac{E_s \cdot I_{b1yI}}{L_{b1I}}\right) + \left(\frac{E_s \cdot I_{b2yI}}{L_{b2I}}\right) \qquad S_{byJ} := \left(\frac{E_s \cdot I_{b1yJ}}{L_{b1J}}\right) + \left(\frac{E_s \cdot I_{b2yJ}}{L_{b2J}}\right)$$

$S_{byI} = 0 N \cdot mm$ $S_{byJ} = 6.56 \times 10^8 N \cdot mm$

$G_{Ix} := 1$ $G_{Iy} := 1$ $G_{Jx} := \frac{S_{cxJ}}{S_{bxJ}}$ $G_{Jy} := \frac{S_{cyJ}}{S_{byJ}}$

(ujung jepit) (ujung jepit)

$G_{Jx} = 10.804$ $G_{Jy} = 49.881$

Faktor Panjang Efektif untuk struktur tidak bergoyang (Braced)

$G_{Ix} = 1$ $\qquad$ $G_{Jx} = 10.804$

$$f(k_x) := \frac{G_{Ix} \cdot G_{Jx}}{4} \cdot \left(\frac{\pi}{k_x}\right)^2 + \left(\frac{G_{Ix} + G_{Jx}}{2}\right) \cdot \left(1 - \frac{\frac{\pi}{k_x}}{\tan\left(\frac{\pi}{k_x}\right)}\right) + \frac{2k_x}{\pi} \cdot \tan\left(\frac{\pi}{2k_x}\right) - 1$$

Mulailah dengan harga awal untuk kolom tidak bergoyang $k_x := 0.501$

$\mathrm{root}(f(k_x), k_x) = 0.861$

$k_{x1} := \mathrm{root}(f(k_x), k_x)$ $\qquad$ $k_{x1} = 0.861$

$$k_x := \begin{cases} (k_{x1}) & \text{if } k_{x1} \le 1 \\ 1 & \text{if } (\mathrm{root}(f(k_x), k_x)) > 1 \end{cases}$$

jadi faktor panjang efektif, $k_x = 0.861$

Faktor Panjang Efektif untuk struktur tidak bergoyang (Braced)

$G_{Iy} := 1$ $\qquad$ $G_{Jy} = 49.881$

$$f(k_y) := \frac{G_{Iy} \cdot G_{Jy}}{4} \cdot \left(\frac{\pi}{k_y}\right)^2 + \left(\frac{G_{Iy} + G_{Jy}}{2}\right) \cdot \left(1 - \frac{\frac{\pi}{k_y}}{\tan\left(\frac{\pi}{k_y}\right)}\right) + \frac{2k_y}{\pi} \cdot \tan\left(\frac{\pi}{2k_y}\right) - 1$$

Mulailah dengan harga awal untuk kolom tidak bergoyang $k_y := 0.501$

$\mathrm{root}(f(k_y), k_y) = 0.872$

$k_{y1} := \mathrm{root}(f(k_y), k_y)$ $\qquad$ $k_{y1} = 0.872$

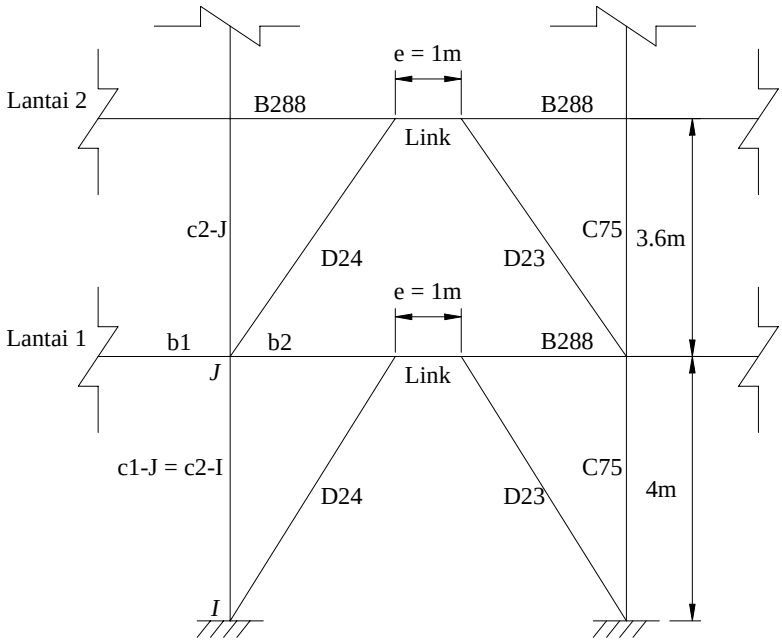
$$k_y := \begin{cases} (k_{y1}) & \text{if } k_{y1} \le 1 \\ 1 & \text{if } (\mathrm{root}(f(k_y), k_y)) > 1 \end{cases}$$

jadi faktor panjang efektif, $k_y = 0.872$

<u>Faktor Panjang Efektif (k)</u> (kolom lantai 1)

Satuan SI :

$MPa := 1 \frac{N}{mm^2}$ $kN := 1000N$



Gambar 5.18 Sketsa Portal as-A

$E_s := 2 \cdot 10^5 MPa$

Profil :

$c1_I :=$ "WF400X400X18X28" $b1_I :=$ "WF350X175X7X11"

$c2_I :=$ "WF400X400X18X28" $b2_I :=$ "WF350X175X7X11"

$c1_J :=$ "WF400X400X18X28" $b1_J :=$ "WF350X175X7X11"

$c2_J :=$ "WF400X400X18X28" $b2_J :=$ "WF350X175X7X11"

$L_{c1I} := 4m$ $L_{b1I} := 6m$

$L_{c2I} := 3.6m$ $L_{b2I} := 6m$

$L_{c1J} := 4m$ $L_{b1J} := 6m$

$L_{c2J} := 3.6m$ $L_{b2J} := 6m$

$I_{c1xI} := 0mm^4$ $I_{b1xI} := 0mm^4$ $I_{c1yI} := 0mm^4$

$I_{c2xI} := 9.28000 \cdot 10^8 mm^4$ $I_{b2xI} := 0 \cdot mm^4$ $I_{c2yI} := 3.1000 \cdot 10^8 mm^4$

$I_{c1xJ} := 9.28000 \cdot 10^8 mm^4$ $I_{b1xJ} := 1.36000 \cdot 10^8 \cdot mm^4$ $I_{c1yJ} := 3.1000 \cdot 10^8 mm^4$

$I_{c2xJ} := 9.28000 \cdot 10^8 mm^4$ $I_{b2xJ} := 1.36000 \cdot 10^8 \cdot mm^4$ $I_{c2yJ} := 3.1000 \cdot 10^8 mm^4$

$$S_{cxI} := \left(\frac{E_s \cdot I_{c1xI}}{L_{c1I}}\right) + \left(\frac{E_s \cdot I_{c2xI}}{L_{c2I}}\right) \qquad S_{cxJ} := \left(\frac{E_s \cdot I_{c1xJ}}{L_{c1J}}\right) + \left(\frac{E_s \cdot I_{c2xJ}}{L_{c2J}}\right)$$

$S_{cxI} = 5.156 \times 10^{10} N \cdot mm$ $S_{cxJ} = 9.796 \times 10^{10} N \cdot mm$

$$S_{cyI} := \left(\frac{E_s \cdot I_{c1yI}}{L_{c1I}}\right) + \left(\frac{E_s \cdot I_{c2yI}}{L_{c2I}}\right) \qquad S_{cyJ} := \left(\frac{E_s \cdot I_{c1yJ}}{L_{c1J}}\right) + \left(\frac{E_s \cdot I_{c2yJ}}{L_{c2J}}\right)$$

$S_{cyI} = 1.722 \times 10^{10} N \cdot mm$ $S_{cyJ} = 3.272 \times 10^{10} N \cdot mm$

$$S_{bxI} := \left(\frac{E_s \cdot I_{b1xI}}{L_{b1I}}\right) + \left(\frac{E_s \cdot I_{b2xI}}{L_{b2I}}\right) \qquad S_{bxJ} := \left(\frac{E_s \cdot I_{b1xJ}}{L_{b1J}}\right) + \left(\frac{E_s \cdot I_{b2xJ}}{L_{b2J}}\right)$$

$S_{bxI} = 0 N \cdot mm$ $S_{bxJ} = 9.067 \times 10^9 N \cdot mm$

$$S_{byI} := \left(\frac{E_s \cdot I_{b1yI}}{L_{b1I}}\right) + \left(\frac{E_s \cdot I_{b2yI}}{L_{b2I}}\right) \qquad S_{byJ} := \left(\frac{E_s \cdot I_{b1yJ}}{L_{b1J}}\right) + \left(\frac{E_s \cdot I_{b2yJ}}{L_{b2J}}\right)$$

$S_{byI} = 0 N \cdot mm$ $S_{byJ} = 6.56 \times 10^8 N \cdot mm$

$G_{Ix} := 1$ $G_{Iy} := 1$ $G_{Jx} := \frac{S_{cxJ}}{S_{bxJ}}$ $G_{Jy} := \frac{S_{cyJ}}{S_{byJ}}$

(ujung jepit) (ujung jepit)

$G_{Jx} = 10.804$ $G_{Jy} = 49.881$

Faktor Panjang Efektif untuk struktur tidak bergoyang (Braced)

$G_{Ix} = 1$ $\qquad$ $G_{Jx} = 10.804$

$$f(k_x) := \frac{G_{Ix} \cdot G_{Jx}}{4} \cdot \left(\frac{\pi}{k_x}\right)^2 + \left(\frac{G_{Ix} + G_{Jx}}{2}\right) \cdot \left(1 - \frac{\frac{\pi}{k_x}}{\tan\left(\frac{\pi}{k_x}\right)}\right) + \frac{2k_x}{\pi} \cdot \tan\left(\frac{\pi}{2k_x}\right) - 1$$

Mulailah dengan harga awal untuk kolom tidak bergoyang $k_x := 0.501$

$\mathrm{root}(f(k_x), k_x) = 0.861$

$k_{x1} := \mathrm{root}(f(k_x), k_x)$ $\qquad$ $k_{x1} = 0.861$

$$k_x := \begin{cases} (k_{x1}) & \text{if } k_{x1} \le 1 \\ 1 & \text{if } (\mathrm{root}(f(k_x), k_x)) > 1 \end{cases}$$

jadi faktor panjang efektif, $k_x = 0.861$

Faktor Panjang Efektif untuk struktur tidak bergoyang (Braced)

$G_{Iy} := 1$ $\qquad$ $G_{Jy} = 49.881$

$$f(k_y) := \frac{G_{Iy} \cdot G_{Jy}}{4} \cdot \left(\frac{\pi}{k_y}\right)^2 + \left(\frac{G_{Iy} + G_{Jy}}{2}\right) \cdot \left(1 - \frac{\frac{\pi}{k_y}}{\tan\left(\frac{\pi}{k_y}\right)}\right) + \frac{2k_y}{\pi} \cdot \tan\left(\frac{\pi}{2k_y}\right) - 1$$

Mulailah dengan harga awal untuk kolom tidak bergoyang $k_y := 0.501$

$\mathrm{root}(f(k_y), k_y) = 0.872$

$k_{y1} := \mathrm{root}(f(k_y), k_y)$ $\qquad$ $k_{y1} = 0.872$

$$k_y := \begin{cases} (k_{y1}) & \text{if } k_{y1} \le 1 \\ 1 & \text{if } (\mathrm{root}(f(k_y), k_y)) > 1 \end{cases}$$

jadi faktor panjang efektif, $k_y = 0.872$

Tabel 5.1 Gaya Aksial Terfaktor akibat 6 Kombinasi Pembebanan

No.	Elemen	Lantai	Portal	Jarak (m)	Gaya Aksial yang terjadi akibat: (N)					Gaya Aksial Terfaktor yang terjadi: (N)					
					DL	LLROOF	LLFLOOR	SDL	E(+/-)	Komb 1	Komb 2	Komb 3*	Komb 4**	Komb 5*	Komb 6**
49	*B318*	1	*C-D*	*2.59*	1317.12	10.61	1187.15	2080.16	18712.32	**4756.19**	**5993.15**	**23387.94**	**21769.87**	-14036.70	-15654.77
50	*Link*		*C-D*	*2.60*	-1032.44	-11.28	-982.03	-1816.68	157.47	**-3988.77**	**-5008.24**	**-3758.13**	**-2406.74**	-4073.07	-2721.68
51	*B318*	2	*C-D*	*3.41*	1963.58	20.39	1837.53	3310.14	26371.40	**7383.21**	**9301.14**	**33628.82**	**31117.75**	-19113.98	-21625.05
52	*Link*		*C-D*	*3.40*	-551.32	-1.71	-515.80	-917.84	238.48	**-2056.82**	**-2591.01**	**-1783.27**	**-1083.76**	-2260.23	-1560.72
53	*B318*	3	*C-D*	*2.59*	1767.25	0.75	1695.81	3024.95	23047.59	**6709.08**	**8465.14**	**29646.51**	**27360.57**	-16448.67	-18734.61
54	*Link*		*C-D*	*2.60*	-674.78	-21.74	-593.54	-1091.31	256.49	**-2472.53**	**-3103.76**	**-2170.46**	**-1332.99**	-2683.44	-1845.97
55	*B318*	4	*C-D*	*3.41*	1836.34	109.92	1506.90	2833.14	18305.81	**6537.27**	**8190.29**	**24717.60**	**22508.34**	-11894.02	-14103.28
56	*Link*		*C-D*	*3.40*	-537.92	91.25	-733.98	-1193.49	251.66	**-2423.97**	**-3106.06**	**-2147.40**	**-1306.61**	-2650.72	-1809.93
57	*B318*	5	*C-D*	*2.59*	1143.02	241.20	442.37	1175.57	12760.56	**3246.03**	**3876.02**	**15884.65**	**14847.29**	-9636.47	-10673.83
58	*Link*		*C-D*	*2.60*	-1186.73	202.10	-1714.51	-2732.04	281.17	**-5486.28**	**-7122.38**	**-5177.56**	**-3245.72**	-5739.90	-3808.06
59	*B318*	Atap	*C-D*	*3.41*	1042.97	302.19	394.96	1190.74	6564.09	**3127.19**	**3795.89**	**9593.12**	**8574.43**	-3535.06	-4553.75
60	*Link*		*C-D*	*3.40*	-1097.76	-509.97	360.29	-6.83	256.86	**-1546.43**	**-1565.00**	**-1143.49**	**-737.27**	-1657.21	-1250.99
61	*B288*	1	*3 - 4*	*3.41*	1584.93	23.28	1181.80	3663.11	34541.43	**7347.26**	**8225.78**	**41441.62**	**39264.67**	-27641.24	-29818.19
62	*Link*		*3 - 4*	*3.40*	-1650.28	-32.71	-1214.07	-4670.17	219.09	**-8848.63**	**-9579.39**	**-7988.84**	**-5469.32**	-8427.02	-5907.50
63	*B288*	2	*3 - 4*	*3.41*	1862.09	34.27	1384.07	5137.46	51125.46	**9799.37**	**10668.80**	**60234.09**	**57425.06**	-42016.83	-44825.87
64	*Link*		*3 - 4*	*3.40*	-1445.25	-22.31	-1087.46	-3828.76	215.72	**-7383.61**	**-8104.44**	**-6667.98**	**-4530.89**	-7099.42	-4962.33
65	*B288*	3	*3 - 4*	*2.59*	1691.43	28.04	1258.89	4777.70	45907.30	**9056.78**	**9822.04**	**54313.72**	**51729.52**	-37500.88	-40085.08
66	*Link*		*3 - 4*	*2.60*	-1435.99	-28.83	-1059.25	-3901.10	231.09	**-7471.93**	**-8145.44**	**-6717.46**	**-4572.29**	-7179.64	-5034.47
67	*B288*	4	*3 - 4*	*3.41*	1625.25	50.43	1143.92	4355.65	36588.48	**8373.26**	**9088.04**	**44362.74**	**41971.29**	-28814.23	-31205.67
68	*Link*		*3 - 4*	*3.40*	-1330.04	-2.06	-1038.95	-4093.96	227.54	**-7593.60**	**-8174.42**	**-6801.77**	**-4654.06**	-7256.85	-5109.14
69	*B288*	5	*3 - 4*	*2.59*	1363.11	299.81	298.39	2359.41	25492.96	**5211.53**	**5424.14**	**30259.08**	**28843.23**	-20726.84	-22142.69
70	*Link*		*3 - 4*	*2.60*	-1445.18	227.85	-1714.74	-5760.96	241.48	**-10088.60**	**-11026.39**	**-9149.33**	**-6244.05**	-9632.29	-6727.01
71	*B288*	Atap	*3 - 4*	*3.41*	481.14	128.07	67.46	1046.65	13525.33	**2138.91**	**2146.20**	**15456.44**	**14900.34**	-11594.22	-12150.32
72	*Link*		*3 - 4*	*3.40*	-2035.64	-628.82	34.07	-135.08	173.30	**-3039.01**	**-3556.46**	**-2728.94**	**-1780.35**	-3075.54	-2126.95

Keterangan : Pada Kombinasi Pembebanan diatas, tidak terdapat reduksi beban hidup (RLLF) pada tingkat 1,2,3,4,5, maupun Atap (RLLF = 1)

Beban Gravitasi:

Komb1=1,4(DL + SDL)

Komb2=1,2(DL + SDL) + 1,6*RLLF*(LLROOF + LLFLOOR)

Beban Gempa:

Komb3=1,2(DL + SDL) + 0,5*RLLF*(LLROOF + LLFLOOR) + E

Komb4=0,9(DL + SDL) + E

Komb5=1,2(DL + SDL) + 0,5*RLLF*(LLROOF + LLFLOOR) - E

Komb6=0,9(DL + SDL) - E

* = ambil nilai yang terbesar, nilai ini merupakan nilai beban yang berpengaruh pada kombinasi pembebanan DSTL 3

** = ambil nilai yang terbesar, nilai ini merupakan nilai beban yang berpengaruh pada kombinasi pembebanan DSTL 4

Tabel 5.2 Gaya Geser Terfaktor pada sumbu kuat akibat 6 Kombinasi Pembebanan

No.	Elemen	Lantai	Portal	Jarak (m)	Gaya Geser pada sumbu-x yang terjadi akibat: (N)					Gaya Geser Terfaktor pada sumbu-x yang terjadi: (N)					
					DL	LLROOF	LLFLOOR	SDL	E(+/-)	Komb 1	Komb 2	Komb 3*	Komb 4**	Komb 5*	Komb 6**
49	*B318*	1	*C-D*	*2.59*	11326.18	118.15	11703.76	17494.96	31518.99	**40349.60**	**53500.42**	**72015.31**	**57458.02**	8977.33	-5579.96
50	*Link*		*C-D*	*2.60*	-193.99	0.00	0.00	-3530.39	177309.55	**-5214.13**	**-4469.26**	**172840.29**	**173957.61**	-181778.81	-180661.49
51	*B318*	2	*C-D*	*3.41*	-10941.39	-107.36	-11427.58	-17000.45	43006.95	**-39118.58**	**-51986.11**	**3709.27**	**17859.29**	-82304.63	-68154.61
52	*Link*		*C-D*	*3.40*	193.99	0.00	0.00	3530.39	221724.26	**5214.13**	**4469.26**	**226193.52**	**225076.20**	-217255.00	-218372.32
53	*B318*	3	*C-D*	*2.59*	10587.52	109.21	11116.93	16457.92	37916.99	**37863.62**	**50416.35**	**75984.59**	**62257.89**	150.61	-13576.09
54	*Link*		*C-D*	*2.60*	-193.99	0.00	0.00	-3530.39	193310.99	**-5214.13**	**-4469.26**	**188841.73**	**189959.05**	-197780.25	-196662.93
55	*B318*	4	*C-D*	*3.41*	-10258.45	-90.67	-10881.59	-16022.70	30398.59	**-36793.61**	**-49093.00**	**-6624.92**	**6745.56**	-67422.10	-54051.63
56	*Link*		*C-D*	*3.40*	193.99	0.00	0.00	3530.39	153125.27	**5214.13**	**4469.26**	**157594.53**	**156477.21**	-148656.01	-149773.33
57	*B318*	5	*C-D*	*2.59*	10042.27	189.86	10473.65	15444.71	21688.64	**35681.77**	**47645.99**	**57604.77**	**44626.92**	14227.49	1249.64
58	*Link*		*C-D*	*2.60*	-193.99	0.00	0.00	-3530.39	105963.16	**-5214.13**	**-4469.26**	**101493.90**	**102611.22**	-110432.42	-109315.10
59	*B318*	Atap	*C-D*	*3.41*	-9124.45	-3943.82	-168.38	-5815.30	11077.40	**-20915.65**	**-24507.22**	**-8906.40**	**-2368.38**	-31061.20	-24523.18
60	*Link*		*C-D*	*3.40*	193.99	0.00	0.00	0.00	54340.49	**271.59**	**232.79**	**54573.28**	**54515.08**	-54107.70	-54165.90
61	*B288*	1	*3 - 4*	*3.41*	-4533.54	-115.78	-3973.65	-13152.48	28631.73	**-24760.43**	**-27766.31**	**5363.79**	**12714.31**	-51899.67	-44549.15
62	*Link*		*3 - 4*	*3.40*	999.56	0.00	980.67	4079.57	161572.58	**7110.78**	**7664.03**	**168157.87**	**166143.80**	-154987.29	-157001.36
63	*B288*	2	*3 - 4*	*3.41*	-4078.81	-105.30	-3619.03	-12607.21	41040.85	**-23360.43**	**-25982.15**	**19155.46**	**26023.43**	-62926.24	-56058.27
64	*Link*		*3 - 4*	*3.40*	999.56	0.00	980.67	4079.57	212185.29	**7110.78**	**7664.03**	**218770.58**	**216756.51**	-205600.00	-207614.07
65	*B288*	3	*3 - 4*	*2.59*	3743.96	105.83	3333.56	12072.30	37276.06	**22142.76**	**24482.54**	**57975.27**	**51510.69**	-16576.85	-23041.43
66	*Link*		*3 - 4*	*2.60*	-999.56	0.00	-980.67	-4079.57	190055.82	**-7110.78**	**-7664.03**	**183470.53**	**185484.60**	-196641.11	-194627.04
67	*B288*	4	*3 - 4*	*3.41*	-3423.62	-97.69	-3081.83	-11645.75	30021.75	**-21097.12**	**-23170.48**	**10348.75**	**16459.32**	-49694.75	-43584.18
68	*Link*		*3 - 4*	*3.40*	999.56	0.00	980.67	4079.57	151111.63	**7110.78**	**7664.03**	**157696.92**	**155682.85**	-144526.34	-146540.41
69	*B288*	5	*3 - 4*	*2.59*	3150.04	133.93	2765.91	11033.02	21392.29	**19856.28**	**21659.42**	**39861.88**	**117496.91**	-2922.70	-8627.54
70	*Link*		*3 - 4*	*2.60*	-999.56	0.00	-980.67	-4079.57	104732.16	**-7110.78**	**-7664.03**	**98146.87**	**6734.01**	-111317.45	-109303.38
71	*B288*	Atap	*3 - 4*	*3.41*	-2607.52	-1016.36	-62.14	-1650.12	11305.23	**-5960.70**	**-6834.77**	**5656.81**	**51804.85**	-16953.65	-15137.11
72	*Link*		*3 - 4*	*3.40*	999.56	392.27	0.00	549.17	55636.73	**2168.22**	**2486.11**	**57691.34**	**1393.86**	-53582.12	-54242.87

Keterangan : Pada Kombinasi Pembebanan diatas, tidak terdapat reduksi beban hidup (RLLF) pada tingkat 1,2,3,4,5, maupun Atap (RLLF = 1)

Beban Gravitasi:
Komb1=1,4(DL + SDL)
Komb2=1,2(DL + SDL) + 1,6*RLLF*(LLROOF + LLFLOOR)

Beban Gempa:
Komb3=1,2(DL + SDL) + 0,5*RLLF*(LLROOF + LLFLOOR) + E
Komb4=0,9(DL + SDL) + E
Komb5=1,2(DL + SDL) + 0,5*RLLF*(LLROOF + LLFLOOR) - E
Komb6=0,9(DL + SDL) - E

* = ambil nilai yang terbesar, nilai ini merupakan nilai beban yang berpengaruh pada kombinasi pembebanan DSTL 3
** = ambil nilai yang terbesar, nilai ini merupakan nilai beban yang berpengaruh pada kombinasi pembebanan DSTL 4

Tabel 5.3 Gaya Geser Terfaktor pada sumbu lemah akibat 6 Kombinasi Pembebanan

No.	Elemen	Lantai	Portal	Jarak (m)	Gaya Geser pada sumbu-y yang terjadi akibat: (N)					Gaya Geser Terfaktor pada sumbu-y yang terjadi: (N)					
					DL	LLROOF	LLFLOOR	SDL	E(+/-)	Komb 1	Komb 2	Komb 3*	Komb 4**	Komb 5*	Komb 6**
49	*B318*	1	*C-D*	*2.59*	0.00	0.00	0.00	0.00	8.64	**0.00**	**0.00**	8.64	8.64	**-8.64**	**-8.64**
50	*Link*		*C-D*	*2.60*	0.00	0.00	0.00	0.00	9.52	**0.00**	**0.00**	9.52	9.52	**-9.52**	**-9.52**
51	*B318*	2	*C-D*	*3.41*	0.00	0.00	0.00	0.00	35.76	**0.00**	**0.00**	35.76	35.76	**-35.76**	**-35.76**
52	*Link*		*C-D*	*3.40*	0.00	0.00	0.00	0.00	39.38	**0.00**	**0.00**	39.38	39.38	**-39.38**	**-39.38**
53	*B318*	3	*C-D*	*2.59*	0.00	0.00	0.00	0.00	37.18	**0.00**	**0.00**	37.18	37.18	**-37.18**	**-37.18**
54	*Link*		*C-D*	*2.60*	0.00	0.00	0.00	0.00	40.95	**0.00**	**0.00**	40.95	40.95	**-40.95**	**-40.95**
55	*B318*	4	*C-D*	*3.41*	0.00	0.00	0.00	0.00	34.17	**0.00**	**0.00**	34.17	34.17	**-34.17**	**-34.17**
56	*Link*		*C-D*	*3.40*	0.00	0.00	0.00	0.00	37.63	**0.00**	**0.00**	37.63	37.63	**-37.63**	**-37.63**
57	*B318*	5	*C-D*	*2.59*	0.00	0.00	0.00	0.00	31.34	**0.00**	**0.00**	31.34	31.34	**-31.34**	**-31.34**
58	*Link*		*C-D*	*2.60*	0.00	0.00	0.00	0.00	34.51	**0.00**	**0.00**	34.51	34.51	**-34.51**	**-34.51**
59	*B318*	Atap	*C-D*	*3.41*	0.00	0.00	0.00	0.00	23.40	**0.00**	**0.00**	23.40	23.40	**-23.40**	**-23.40**
60	*Link*		*C-D*	*3.40*	0.00	0.00	0.00	0.00	25.77	**0.00**	**0.00**	25.77	25.77	**-25.77**	**-25.77**
61	*B288*	1	*3 - 4*	*3.41*	0.00	0.00	0.00	0.00	5.86	**0.00**	**0.00**	5.86	5.86	**-5.86**	**-5.86**
62	*Link*		*3 - 4*	*3.40*	0.00	0.00	0.00	0.00	5.24	**0.00**	**0.00**	5.24	5.24	**-5.24**	**-5.24**
63	*B288*	2	*3 - 4*	*3.41*	0.00	0.00	0.00	0.00	4.96	**0.00**	**0.00**	4.96	4.96	**-4.96**	**-4.96**
64	*Link*		*3 - 4*	*3.40*	0.00	0.00	0.00	0.00	4.43	**0.00**	**0.00**	4.43	4.43	**-4.43**	**-4.43**
65	*B288*	3	*3 - 4*	*2.59*	0.00	0.00	0.00	0.00	6.36	**0.00**	**0.00**	6.36	6.36	**-6.36**	**-6.36**
66	*Link*		*3 - 4*	*2.60*	0.00	0.00	0.00	0.00	5.69	**0.00**	**0.00**	5.69	5.69	**-5.69**	**-5.69**
67	*B288*	4	*3 - 4*	*3.41*	0.00	0.00	0.00	0.00	6.41	**0.00**	**0.00**	6.41	6.41	**-6.41**	**-6.41**
68	*Link*		*3 - 4*	*3.40*	0.00	0.00	0.00	0.00	5.74	**0.00**	**0.00**	5.74	5.74	**-5.74**	**-5.74**
69	*B288*	5	*3 - 4*	*2.59*	0.00	0.00	0.00	0.00	6.68	**0.00**	**0.00**	6.68	6.68	**-6.68**	**-6.68**
70	*Link*		*3 - 4*	*2.60*	0.00	0.00	0.00	0.00	5.97	**0.00**	**0.00**	5.97	5.97	**-5.97**	**-5.97**
71	*B288*	Atap	*3 - 4*	*3.41*	0.00	0.00	0.00	0.00	6.24	**0.00**	**0.00**	6.24	6.24	**-6.24**	**-6.24**
72	*Link*		*3 - 4*	*3.40*	0.00	0.00	0.00	0.00	5.56	**0.00**	**0.00**	5.56	5.56	**-5.56**	**-5.56**

Keterangan : Pada Kombinasi Pembebanan diatas, tidak terdapat reduksi beban hidup (RLLF) pada tingkat 1,2,3,4,5, maupun Atap (RLLF = 1)

Beban Gravitasi:
Komb1=1,4(DL + SDL)
Komb2=1,2(DL + SDL) + 1,6*RLLF*(LLROOF + LLFLOOR)

Beban Gempa:
Komb3=1,2(DL + SDL) + 0,5*RLLF*(LLROOF + LLFLOOR) + E
Komb5=1,2(DL + SDL) + 0,5*RLLF*(LLROOF + LLFLOOR) - E

Komb4=0,9(DL + SDL) + E
Komb6=0,9(DL + SDL) - E

* = ambil nilai yang terbesar, nilai ini merupakan nilai beban yang berpengaruh pada kombinasi pembebanan DSTL 3
** = ambil nilai yang terbesar, nilai ini merupakan nilai beban yang berpengaruh pada kombinasi pembebanan DSTL 4

Tabel 5.4 Momen Terfaktor pada sumbu kuat akibat 6 Kombinasi Pembebanan

No.	Elemen	Lantai	Portal	Jarak (m)	Momen pada sumbu-x yang terjadi akibat: (Nmm)					Momen Terfaktor pada sumbu-x yang terjadi: (Nmm)					
					DL	LLROOF	LLFLOOR	SDL	E(+/-)	Komb 1	Komb 2	Komb 3*	Komb 4**	Komb 5*	Komb 6**
49	*B318*	1	*C-D*	*2.59*	-4204300.0	-137118.3	-3771684.0	-6368264.0	71020927.0	-14801589.6	-18941160.4	56379449.1	61505619.4	-85662404.9	-80536234.6
50	*Link*		*C-D*	*2.60*	-4204300.0	-137118.3	-3771684.0	-6368264.0	71020927.0	-14801589.6	-18941160.4	56379449.1	61505619.4	-85662404.9	-80536234.6
51	*B318*	2	*C-D*	*3.41*	-3667494.0	-123864.9	-3360228.0	-5631504.0	88759991.0	-13018597.2	-16733346.2	75859147.0	80390892.8	-101660835.0	-97129089.2
52	*Link*		*C-D*	*3.40*	-3667494.0	-123864.9	-3360228.0	-5631504.0	88759991.0	-13018597.2	-16733346.2	75859147.0	80390892.8	-101660835.0	-97129089.2
53	*B318*	3	*C-D*	*2.59*	-3273214.0	-124624.0	-3019653.0	-5035065.0	77375053.0	-11631590.6	-15000778.0	65832979.7	69897601.9	-88917126.3	-84852504.1
54	*Link*		*C-D*	*2.60*	-3273214.0	-124624.0	-3019653.0	-5035065.0	77375053.0	-11631590.6	-15000778.0	65832979.7	69897601.9	-88917126.3	-84852504.1
55	*B318*	4	*C-D*	*3.41*	-2901339.0	-114780.9	-2727898.0	-4513154.0	61282960.0	-10380290.2	-13445677.8	50964228.9	54609916.3	-71601691.1	-67956003.7
56	*Link*		*C-D*	*3.40*	-2901339.0	-114780.9	-2727898.0	-4513154.0	61282960.0	-10380290.2	-13445677.8	50964228.9	54609916.3	-71601691.1	-67956003.7
57	*B318*	5	*C-D*	*2.59*	-2586256.0	-167285.4	-2341592.0	-3910885.0	42403118.0	-9095997.4	-11810773.0	33352110.1	36555691.1	-51454125.9	-48250544.9
58	*Link*		*C-D*	*2.60*	-2586256.0	-167285.4	-2341592.0	-3910885.0	42403118.0	-9095997.4	-11810773.0	33352110.1	36555691.1	-51454125.9	-48250544.9
59	*B318*	Atap	*C-D*	*3.41*	-1899918.0	-805074.2	-89917.0	-1278543.0	21742703.0	-4449845.4	-5246139.1	17481054.2	18882088.1	-26004351.8	-24603317.9
60	*Link*		*C-D*	*3.40*	-1899918.0	-805074.2	-89917.0	-1278543.0	21742703.0	-4449845.4	-5246139.1	17481054.2	18882088.1	-26004351.8	-24603317.9
61	*B288*	1	*3 - 4*	*3.41*	-2874003.0	-134398.6	-2268734.0	-5514218.0	64721650.0	-11743509.4	-13910877.4	53454218.5	57172251.1	-75989081.5	-72271048.9
62	*Link*		*3 - 4*	*3.40*	-2874003.0	-134398.6	-2268734.0	-5514218.0	64721650.0	-11743509.4	-13910877.4	53454218.5	57172251.1	-75989081.5	-72271048.9
63	*B288*	2	*3 - 4*	*3.41*	-2300130.0	-121394.1	-1816833.0	-4744261.0	84940809.0	-9862147.4	-11554432.5	75518426.3	78600857.1	-94363191.7	-91280760.9
64	*Link*		*3 - 4*	*3.40*	-2300130.0	-121394.1	-1816833.0	-4744261.0	84940809.0	-9862147.4	-11554432.5	75518426.3	78600857.1	-94363191.7	-91280760.9
65	*B288*	3	*3 - 4*	*2.59*	-1921752.0	-121448.5	-1496451.0	-4151388.0	76069615.0	-8502396.0	-9876407.2	67972897.3	70603789.0	-84166332.7	-81535441.0
66	*Link*		*3 - 4*	*2.60*	-1921752.0	-121448.5	-1496451.0	-4151388.0	76069615.0	-8502396.0	-9876407.2	67972897.3	70603789.0	-84166332.7	-81535441.0
67	*B288*	4	*3 - 4*	*3.41*	-1555405.0	-116954.0	-1197255.0	-3635215.0	60474879.0	-7266868.0	-8331478.5	53589030.5	55803321.0	-67360727.5	-65146437.0
68	*Link*		*3 - 4*	*3.40*	-1555405.0	-116954.0	-1197255.0	-3635215.0	60474879.0	-7266868.0	-8331478.5	53589030.5	55803321.0	-67360727.5	-65146437.0
69	*B288*	5	*3 - 4*	*2.59*	-1212724.0	-136560.0	-861709.1	-3016928.0	41908642.0	-5921512.8	-6672813.0	36333925.0	38101955.2	-47483359.0	-45715328.8
70	*Link*		*3 - 4*	*2.60*	-1212724.0	-136560.0	-861709.1	-3016928.0	41908642.0	-5921512.8	-6672813.0	36333925.0	38101955.2	-47483359.0	-45715328.8
71	*B288*	Atap	*3 - 4*	*3.41*	-724785.5	-293006.2	-36711.0	-525576.5	22259628.0	-1750506.7	-2027981.9	20594335.1	21134302.3	-23924920.9	-23384953.7
72	*Link*		*3 - 4*	*3.40*	-724785.5	-293006.2	-36711.0	-525576.5	22259628.0	-1750506.7	-2027981.9	20594335.1	21134302.3	-23924920.9	-23384953.7

Keterangan : Pada Kombinasi Pembebanan diatas, tidak terdapat reduksi beban hidup (RLLF) pada tingkat 1,2,3,4,5, maupun Atap (RLLF = 1)

Beban Gravitasi:
Komb1=1,4(DL + SDL)
Komb2=1,2(DL + SDL) + 1,6*RLLF*(LLROOF + LLFLOOR)

Beban Gempa:
Komb3=1,2(DL + SDL) + 0,5*RLLF*(LLROOF + LLFLOOR) + E
Komb4=0,9(DL + SDL) + E
Komb5=1,2(DL + SDL) + 0,5*RLLF*(LLROOF + LLFLOOR) - E
Komb6=0,9(DL + SDL) - E

* = ambil nilai yang terbesar, nilai ini merupakan nilai beban yang berpengaruh pada kombinasi pembebanan DSTL 3
** = ambil nilai yang terbesar, nilai ini merupakan nilai beban yang berpengaruh pada kombinasi pembebanan DSTL 4

Tabel 5.5 Momen Terfaktor pada sumbu lemah akibat 6 Kombinasi Pembebanan

No.	Elemen	Lantai	Portal	Jarak (m)	Momen pada sumbu-y yang terjadi akibat: (Nmm)					Momen Terfaktor pada sumbu-y yang terjadi: (Nmm)					
					DL	LLROOF	LLFLOOR	SDL	E(+/-)	Komb 1	Komb 2	Komb 3*	Komb 4**	Komb 5*	Komb 6**
49	*B318*	1	*C-D*	*2.59*	3076.93	23.65	3291.25	1704.72	6231.43	**6694.31**	**11041.83**	**13626.87**	**10534.92**	1164.00	-1927.95
50	*Link*		*C-D*	*2.60*	3076.93	23.65	3291.25	1704.72	5028.71	**6694.31**	**11041.83**	**12424.14**	**9332.19**	2366.73	-725.22
51	*B318*	2	*C-D*	*3.41*	-295.90	-3.87	-316.73	-157.51	22897.34	**-634.76**	**-1057.03**	**22192.97**	**22489.28**	-23601.72	-23305.40
52	*Link*		*C-D*	*3.40*	-295.90	-3.87	-316.73	-157.51	17691.88	**-634.76**	**-1057.03**	**16987.51**	**17283.82**	-18396.26	-18099.94
53	*B318*	3	*C-D*	*2.59*	503.30	127.89	223.20	335.27	23968.68	**1174.01**	**1568.04**	**25150.52**	**24723.40**	-22786.85	-23213.97
54	*Link*		*C-D*	*2.60*	503.30	127.89	223.20	335.27	18556.18	**1174.01**	**1568.04**	**19738.01**	**19310.89**	-17374.34	-17801.46
55	*B318*	4	*C-D*	*3.41*	-450.83	-543.69	853.44	-146.96	22177.95	**-836.91**	**-221.75**	**21615.47**	**21639.94**	-22740.42	-22715.96
56	*Link*		*C-D*	*3.40*	-450.83	-543.69	853.44	-146.96	17204.01	**-836.91**	**-221.75**	**16641.53**	**16666.00**	-17766.48	-17742.02
57	*B318*	5	*C-D*	*2.59*	3438.70	2855.98	-3377.06	1678.77	20789.82	**7164.45**	**5307.22**	**26670.24**	**25395.54**	-14909.41	-16184.11
58	*Link*		*C-D*	*2.60*	3438.70	2855.98	-3377.06	1678.77	16227.83	**7164.45**	**5307.22**	**22108.24**	**20833.54**	-10347.42	-11622.11
59	*B318*	Atap	*C-D*	*3.41*	-8406.46	-2417.53	-3173.69	-4086.41	14471.73	**-17490.03**	**-23937.40**	**-3315.33**	**3228.14**	-32258.79	-25715.32
60	*Link*		*C-D*	*3.40*	-8406.46	-2417.53	-3173.69	-4086.41	11065.95	**-17490.03**	**-23937.40**	**-6721.11**	**-177.64**	-28853.01	-22309.54
61	*B288*	1	*3 - 4*	*3.41*	1309.03	15.06	1089.53	2387.01	2674.25	**5174.45**	**6202.59**	**7661.79**	**6000.69**	2313.29	652.18
62	*Link*		*3 - 4*	*3.40*	1309.02	15.06	1089.52	2387.01	2284.74	**5174.44**	**6202.58**	**7272.27**	**5611.16**	2702.80	1041.69
63	*B288*	2	*3 - 4*	*3.41*	1163.46	20.86	846.25	3355.41	2420.26	**6326.41**	**6810.02**	**8276.45**	**6487.24**	3435.94	1646.72
64	*Link*		*3 - 4*	*3.40*	1163.46	20.86	846.25	3355.40	2083.01	**6326.41**	**6810.02**	**7939.20**	**6149.98**	3773.19	1983.97
65	*B288*	3	*3 - 4*	*2.59*	1133.36	32.17	820.99	3140.05	3034.80	**5982.77**	**6493.14**	**8589.47**	**6880.87**	2519.86	811.26
66	*Link*		*3 - 4*	*2.60*	1133.36	32.17	820.99	3140.05	2605.87	**5982.77**	**6493.14**	**8160.53**	**6451.93**	2948.79	1240.19
67	*B288*	4	*3 - 4*	*3.41*	992.56	-27.94	822.00	2742.12	3052.19	**5228.55**	**5752.11**	**7930.84**	**6413.40**	1826.45	309.02
68	*Link*		*3 - 4*	*3.40*	992.56	-27.94	822.00	2742.12	2619.97	**5228.55**	**5752.11**	**7498.61**	**5981.18**	2258.67	741.24
69	*B288*	5	*3 - 4*	*2.59*	1191.50	562.50	-377.44	1298.44	3188.30	**3485.92**	**3284.02**	**6268.76**	**5429.25**	-107.85	-947.36
70	*Link*		*3 - 4*	*2.60*	1191.50	562.50	-377.44	1298.44	2736.57	**3485.92**	**3284.02**	**5817.02**	**4977.51**	343.89	-495.62
71	*B288*	Atap	*3 - 4*	*3.41*	-715.00	-237.23	-229.90	283.69	2992.05	**-603.84**	**-1264.98**	**2240.91**	**2603.87**	-3743.18	-3380.22
72	*Link*		*3 - 4*	*3.40*	-715.00	-237.23	-229.90	283.69	2561.96	**-603.83**	**-1264.98**	**1810.82**	**2173.78**	-3313.09	-2950.14

Keterangan : Pada Kombinasi Pembebanan diatas, tidak terdapat reduksi beban hidup (RLLF) pada tingkat 1,2,3,4,5, maupun Atap (RLLF = 1)

Beban Gravitasi:

Komb1=1,4(DL + SDL)

Komb2=1,2(DL + SDL) + 1,6*RLLF*(LLROOF + LLFLOOR)

Beban Gempa:

Komb3=1,2(DL + SDL) + 0,5*RLLF*(LLROOF + LLFLOOR) + E

Komb4=0,9(DL + SDL) + E

Komb5=1,2(DL + SDL) + 0,5*RLLF*(LLROOF + LLFLOOR) - E

Komb6=0,9(DL + SDL) - E

* = ambil nilai yang terbesar, nilai ini merupakan nilai beban yang berpengaruh pada kombinasi pembebanan DSTL 3

** = ambil nilai yang terbesar, nilai ini merupakan nilai beban yang berpengaruh pada kombinasi pembebanan DSTL 4

Tabel 5.6 Kuat Tarik Nominal dan Kuat Tekan Nominal

No.	Elemen	Lantai	Portal	L (mm)	A_g (mm^2)	L_b (mm)	k_c	L_k (mm)	λ_c	F_{cr1} (MPa)	C_w (mm^6)	G (MPa)	J (mm^4)	F_e (MPa)	λ_e	F_{cr2} (MPa)
1	*B318*	1	*C-D*	*6000*	6314	2000	1	2000	0.56	210.6	2.83E+11	8.00E+04	1.93E+05	1.06E+03	0.48	218.3
2	*B288*		*3 - 4*	*6000*	6314	6000	1	6000	1.68	74.9	2.83E+11	8.00E+04	1.93E+05	2.12E+02	1.06	149.4
3	*B318*	2	*C-D*	*6000*	6314	2000	1	2000	0.56	210.6	2.83E+11	8.00E+04	1.93E+05	1.06E+03	0.48	218.3
4	*B288*		*3 - 4*	*6000*	6314	6000	1	6000	1.68	74.9	2.83E+11	8.00E+04	1.93E+05	2.12E+02	1.06	149.4
5	*B318*	3	*C-D*	*6000*	6314	2000	1	2000	0.56	210.6	2.83E+11	8.00E+04	1.93E+05	1.06E+03	0.48	218.3
6	*B288*		*3 - 4*	*6000*	6314	6000	1	6000	1.68	74.9	2.83E+11	8.00E+04	1.93E+05	2.12E+02	1.06	149.4
7	*B318*	4	*C-D*	*6000*	6314	2000	1	2000	0.56	210.6	2.83E+11	8.00E+04	1.93E+05	1.06E+03	0.48	218.3
8	*B288*		*3 - 4*	*6000*	6314	6000	1	6000	1.68	74.9	2.83E+11	8.00E+04	1.93E+05	2.12E+02	1.06	149.4
9	*B318*	5	*C-D*	*6000*	6314	2000	1	2000	0.56	210.6	2.83E+11	8.00E+04	1.93E+05	1.06E+03	0.48	218.3
10	*B288*		*3 - 4*	*6000*	6314	6000	1	6000	1.68	74.9	2.83E+11	8.00E+04	1.93E+05	2.12E+02	1.06	149.4
11	*B318*	Atap	*C-D*	*6000*	6314	2000	1	2000	0.56	210.6	2.83E+11	8.00E+04	1.93E+05	1.06E+03	0.48	218.3
12	*B288*		*3 - 4*	*6000*	6314	6000	1	6000	1.68	74.9	2.83E+11	8.00E+04	1.93E+05	2.12E+02	1.06	149.4

Keterangan:

1) $\lambda_c := \frac{L_k}{\pi \cdot r} \cdot \sqrt{\frac{F_y}{E_s}}$

2) $F_{cr1} := \begin{cases} \left[\left(0.658^{\lambda_c^2}\right) \cdot F_y\right] & \text{if } \lambda_c \le 1.5 \\ \left[\left(\frac{0.877}{\lambda_c^2}\right) \cdot F_y\right] & \text{if } \lambda_c > 1.5 \end{cases}$

3) $J := \left(\frac{1}{3}\right) \cdot \left[\left(2 \cdot b_f \cdot t_f^3\right) + \left[\left(d - 2 \cdot t_f\right) \cdot t_w^3\right]\right]$

4) $F_e := \left[\frac{\pi^2 \cdot E_s \cdot C_w}{\left(K_z \cdot L_k\right)^2} + G \cdot J\right] \frac{1}{I_x + I_y}$

5) $\lambda_e := \sqrt{\frac{F_y}{F_e}}$

6) $F_{cr2} := \begin{cases} \left[\left(0.658^{\lambda_e^2}\right) \cdot F_y\right] & \text{if } \lambda_e \le 1.5 \\ \left[\left(\frac{0.877}{\lambda_e^2}\right) \cdot F_y\right] & \text{if } \lambda_e > 1.5 \end{cases}$

7) $F_{cr} := \min\left(F_{cr1}, F_{cr2}\right)$

8) $P_{nt} := A_g \cdot F_y$

9) $\phi P_{nt} := \phi \cdot P_{nt}$

10) $P_{nc} := A_g \cdot F_{cr}$

11) $\phi P_{nc} := \phi_c \cdot P_{nc}$

F_{cr} (MPa)	ΦP_{nt} [9] (N)	ΦP_{nc} [11] (N)
210.6	1363824	1130307.48
74.9	1363824	402113.58
210.6	1363824	1130307.48
74.9	1363824	402113.58
210.6	1363824	1130307.48
74.9	1363824	402113.58
210.6	1363824	1130307.48
74.9	1363824	402113.58
210.6	1363824	1130307.48
74.9	1363824	402113.58
210.6	1363824	1130307.48
74.9	1363824	402113.58

5.7 Gaya Geser Nominal Pada Sumbu-x dan Sumbu-y (Lanjutan)

No.	Elemen	Lantai	Portal	L (mm)	V_{ux} (N)	V_{uy} (N)	a (mm)	h_{aksen} (mm)	k_n	A_{w1} (mm^2)	A_{w2} (mm^2)	λ_w	V_{nx} (N)	V_{ny} (N)	Φ	ΦV_{nx} 7) (N)	ΦV_{ny} 9) (N)	Rasio 10) (x)	Rasio 11) (y)
1	*C85*	1	*C-D*	*4000*	42703.5	-17628.11	*4000*	314	5.031	7452	18900	17.44	1073088	2721600	0.9	965779.2	2449440	0.044	7.2E-03
2	*C75*		*3 - 4*	*4000*	34890.3	27033.11	*4000*	314	5.031	7452	18900	17.44	1073088	2721600	0.9	965779.2	2449440	0.036	1.1E-02
3	*C85*	2	*C-D*	*3600*	25608.3	-19416.98	*3600*	314	5.038	7452	18900	17.44	1073088	2721600	0.9	965779.2	2449440	0.027	7.9E-03
4	*C75*		*3 - 4*	*3600*	19813.2	34545.98	*3600*	314	5.038	7452	18900	17.44	1073088	2721600	0.9	965779.2	2449440	0.021	1.4E-02
5	*C85*	3	*C-D*	*3600*	22496.5	-17430.92	*3600*	314	5.038	7452	18900	17.44	1073088	2721600	0.9	965779.2	2449440	0.023	7.1E-03
6	*C75*		*3 - 4*	*3600*	16675.2	30905.61	*3600*	314	5.038	7452	18900	17.44	1073088	2721600	0.9	965779.2	2449440	0.017	1.3E-02
7	*C85*	4	*C-D*	*3600*	22162.2	-16893.73	*3600*	314	5.038	7452	18900	17.44	1073088	2721600	0.9	965779.2	2449440	0.023	6.9E-03
8	*C75*		*3 - 4*	*3600*	15832.1	31077.87	*3600*	314	5.038	7452	18900	17.44	1073088	2721600	0.9	965779.2	2449440	0.016	1.3E-02
9	*C85*	5	*C-D*	*3600*	21362.8	-14563.39	*3600*	314	5.038	7452	18900	17.44	1073088	2721600	0.9	965779.2	2449440	0.022	5.9E-03
10	*C75*		*3 - 4*	*3600*	15340.9	27522.30	*3600*	314	5.038	7452	18900	17.44	1073088	2721600	0.9	965779.2	2449440	0.016	1.1E-02
11	*C85*	Atap	*C-D*	*3600*	17884.7	-16526.89	*3600*	314	5.038	7452	18900	17.44	1073088	2721600	0.9	965779.2	2449440	0.019	6.7E-03
12	*C75*		*3 - 4*	*3600*	9648.3	35025.27	*3600*	314	5.038	7452	18900	17.44	1073088	2721600	0.9	965779.2	2449440	0.010	1.4E-02

Keterangan:

1) $h_{aksen} := d - 2t_f - 2r_c$

2) $k_n := 5 + \left[\dfrac{5}{\left(\dfrac{a}{h_{aksen}}\right)^2}\right]$

3) $A_{w1} := d \cdot t_w$

4) $\lambda_w := \dfrac{h_{aksen}}{t_w}$

5) $A_{w2} := \left(\dfrac{5}{3} \cdot b_f \cdot t_f\right)$

6) $V_{nx} := \begin{cases} (0.6 \cdot F_y \cdot A_{w1}) & \text{if } \lambda_w \le \left(1.10 \cdot \sqrt{\dfrac{k_n \cdot E_s}{F_y}}\right) \\ 0.6 \cdot F_y \cdot A_{w1} \cdot 1.10 \cdot \sqrt{\dfrac{k_n \cdot E_s}{F_y}} \cdot \dfrac{1}{\lambda_w} & \text{if } 1.10\sqrt{\dfrac{k_n \cdot E_s}{F_y}} < \lambda_w < 1.37\sqrt{\dfrac{k_n \cdot E_s}{F_y}} \\ \dfrac{0.9 \cdot A_{w1} \cdot k_n \cdot E_s}{(\lambda_w)^2} & \text{if } \lambda_w \ge 1.37\sqrt{\dfrac{k_n \cdot E_s}{F_y}} \end{cases}$

7) $\phi V_{nx} := \phi \cdot V_{nx}$

8) $V_{ny} := 0.6 \cdot F_y \cdot A_{w2}$

9) $\phi V_{ny} := \phi \cdot V_{ny}$

10) $Rasio(x) := \dfrac{V_{ux}}{\phi V_{nx}}$

11) $Rasio(y) := \dfrac{V_{uy}}{\phi V_{ny}}$

Tabel 5.8 Kondisi Batas Tekuk Lokal Pada Pelat Sayap dan Pada Pelat Badan (Lanjutan)

No.	Elemen	Lantai	Portal	L (mm)	λ_w	λ_f	Φ	P_u (N)	P_y (N)	$\lambda_{ps(web)}$	$\lambda_{ps(flange)}$	λ_{pw}	λ_{rw}	λ_{pf}	λ_{rf}	Kesimpulan	M_p (Nmm)	M_r (Nmm)	ΦM_{nFLB} [1)] (Nmm)	ΦM_{nWLB} [4)] (Nmm)
1	*C85*	1	*C-D*	*4000*	17.44	7.23	0.9	-1496196.8	7.1E+06	**67.636**	8.714	**67.6**	**136.1**	10.97	28.38	Tidak ada LB	1.2E+09	7.6E+08	1086480000	1086480000
2	*C75*		*3 - 4*	*4000*	17.44	7.23	0.9	-1495459.5	7.1E+06	**67.642**	8.714	**67.6**	**136.1**	10.97	28.38	Tidak ada LB	1.2E+09	7.6E+08	1086480000	1086480000
3	*C85*	2	*C-D*	*3600*	17.44	7.23	0.9	-1123196.2	7.1E+06	**69.52**	8.714	**69.5**	**143.2**	10.97	28.38	Tidak ada LB	1.2E+09	7.6E+08	1086480000	1086480000
4	*C75*		*3 - 4*	*3600*	17.44	7.23	0.9	-1129569.6	7.1E+06	**69.489**	8.714	**69.5**	**143.0**	10.97	28.38	Tidak ada LB	1.2E+09	7.6E+08	1086480000	1086480000
5	*C85*	3	*C-D*	*3600*	17.44	7.23	0.9	-791182.0	7.1E+06	**71.289**	8.714	**71.5**	**149.5**	10.97	28.38	Tidak ada LB	1.2E+09	7.6E+08	1086480000	1086480000
6	*C75*		*3 - 4*	*3600*	17.44	7.23	0.9	-799233.4	7.1E+06	**71.159**	8.714	**71.2**	**149.4**	10.97	28.38	Tidak ada LB	1.2E+09	7.6E+08	1086480000	1086480000
7	*C85*	4	*C-D*	*3600*	17.44	7.23	0.9	-487493.6	7.1E+06	**77.745**	8.714	**85.7**	**155.3**	10.97	28.38	Tidak ada LB	1.2E+09	7.6E+08	1086480000	1086480000
8	*C75*		*3 - 4*	*3600*	17.44	7.23	0.9	-506513.7	7.1E+06	**77.345**	8.714	**84.8**	**154.9**	10.97	28.38	Tidak ada LB	1.2E+09	7.6E+08	1086480000	1086480000
9	*C85*	5	*C-D*	*3600*	17.44	7.23	0.9	-238233.1	7.1E+06	**83.044**	8.714	**97.3**	**160.1**	10.97	28.38	Tidak ada LB	1.2E+09	7.6E+08	1086480000	1086480000
10	*C75*		*3 - 4*	*3600*	17.44	7.23	0.9	-249775.2	7.1E+06	**82.804**	8.714	**96.8**	**159.8**	10.97	28.38	Tidak ada LB	1.2E+09	7.6E+08	1086480000	1086480000
11	*C85*	Atap	*C-D*	*3600*	17.44	7.23	0.9	-82354.4	7.1E+06	**86.358**	8.714	**104.6**	**163.0**	10.97	28.38	Tidak ada LB	1.2E+09	7.6E+08	1086480000	1086480000
12	*C75*		*3 - 4*	*3600*	17.44	7.23	0.9	-92598.1	7.1E+06	**86.144**	8.714	**104.1**	**162.8**	10.97	28.38	Tidak ada LB	1.2E+09	7.6E+08	1086480000	1086480000

Keterangan :
1) $M_{nFLB} = M_p$ jika $\lambda_f \leq \lambda_{pf}$
2) $M_{nFLB} = M_p - \{(\lambda_f - \lambda_{pf})*(M_p - M_r)/(\lambda_{rf} - \lambda_{pf})\}$ jika $\lambda_{pf} < \lambda_f < \lambda_{rf}$
3) $M_{nFLB} = \{(\lambda_{rf} / \lambda_f)^2\}*M_r$ jika $\lambda_f \geq \lambda_{rf}$
4) $M_{nWLB} = M_p$ jika $\lambda_w \leq \lambda_{pw}$
5) $M_{nWLB} = M_p - \{(\lambda_w - \lambda_{pw})*(M_p - M_r)/(\lambda_{rw} - \lambda_{pw})\}$ jika $\lambda_{pw} < \lambda_w < \lambda_{rw}$
6) $M_{nWLB} = \{(\lambda_{rw} / \lambda_w)^2\}*M_r$ jika $\lambda_w \geq \lambda_{rw}$
7) $P_y = A_g * F_y$
8) LB = Lateral Buckling

Tabel 5.9 Kondisi Batas Tekuk Lateral Pada Sumbu-x dan Sumbu-y (Lanjutan)

No.	Elemen	Lantai	Portal	L (mm)	L_b (mm)	L_p (mm)	L_r (mm)	C_w (mm^6)	M_p (Nmm)	M_r (Nmm)	M_{cr} (Nmm)	M_{py} (Nmm)	Φ	$ΦM_{nLTBx}$ (Nmm)	$ΦM_{nLTBy}$ (Nmm)
1	*C85*	1	*C-D*	*4000*	*4000*	5204.17	24458.067	1.16E+13	1.21E+09	7.62E+08	1.47E+10	5.51E+08	0.9	1086480000	495999936
2	*C75*		*3 - 4*	*4000*	*4000*	5204.17	24458.067	1.16E+13	1.21E+09	7.62E+08	1.47E+10	5.51E+08	0.9	1086480000	495999936
3	*C85*	2	*C-D*	*3600*	*3600*	5204.17	24458.067	1.16E+13	1.21E+09	7.62E+08	1.47E+10	5.51E+08	0.9	1086480000	495999936
4	*C75*		*3 - 4*	*3600*	*3600*	5204.17	24458.067	1.16E+13	1.21E+09	7.62E+08	1.47E+10	5.51E+08	0.9	1086480000	495999936
5	*C85*	3	*C-D*	*3600*	*3600*	5204.17	24458.067	1.16E+13	1.21E+09	7.62E+08	1.47E+10	5.51E+08	0.9	1086480000	495999936
6	*C75*		*3 - 4*	*3600*	*3600*	5204.17	24458.067	1.16E+13	1.21E+09	7.62E+08	1.47E+10	5.51E+08	0.9	1086480000	495999936
7	*C85*	4	*C-D*	*3600*	*3600*	5204.17	24458.067	1.16E+13	1.21E+09	7.62E+08	1.47E+10	5.51E+08	0.9	1086480000	495999936
8	*C75*		*3 - 4*	*3600*	*3600*	5204.17	24458.067	1.16E+13	1.21E+09	7.62E+08	1.47E+10	5.51E+08	0.9	1086480000	495999936
9	*C85*	5	*C-D*	*3600*	*3600*	5204.17	24458.067	1.16E+13	1.21E+09	7.62E+08	1.47E+10	5.51E+08	0.9	1086480000	495999936
10	*C75*		*3 - 4*	*3600*	*3600*	5204.17	24458.067	1.16E+13	1.21E+09	7.62E+08	1.47E+10	5.51E+08	0.9	1086480000	495999936
11	*C85*	Atap	*C-D*	*3600*	*3600*	5204.17	24458.067	1.16E+13	1.21E+09	7.62E+08	1.47E+10	5.51E+08	0.9	1086480000	495999936
12	*C75*		*3 - 4*	*3600*	*3600*	5204.17	24458.067	1.16E+13	1.21E+09	7.62E+08	1.47E+10	5.51E+08	0.9	1086480000	495999936

Keterangan:

1) $$M_{nLTBx} := \begin{cases} M_p & \text{if } L_b \le L_p \\ \min\left[C_b\cdot\left[M_r + \left(\frac{L_r - L}{L_r - L_p}\right)\cdot(M_p - M_r)\right], M_p\right] & \text{if } L_p < L_b < L_r \\ \min(M_{cr}, M_p) & \text{if } L_b \ge L_r \end{cases}$$

2) $M_{nLTBy} := M_{py}$ dimana: $M_{py} := \min(Z_y\cdot F_y, 1.5S_y\cdot F_y)$

3) $$M_{cr} := C_b\cdot\frac{\pi}{L}\cdot\sqrt{A_1 + A_2}$$

dimana: $A_1 := E_s\cdot I_y\cdot G\cdot J$ $\quad C_w := \frac{\left[I_y\cdot(d - t_f)^2\right]}{4}$

$$A_2 := \left(\frac{\pi\cdot E_s}{L}\right)^2\cdot I_y\cdot C_w$$

Tabel 5.10 Momen Nominal Pada Sumbu-x dan Sumbu-y (Lanjutan)

No.	Elemen	Lantai	Portal	L (mm)	M_p (Nmm)	M_{py} (Nmm)	Φ	$ΦM_{nFLB}$ (Nmm)	$ΦM_{nWLB}$ (Nmm)	$ΦM_{nLTBx}$ (Nmm)	$ΦM_{nx}$ 3) (Nmm)	$ΦM_{nLTBy}$ (Nmm)	$ΦM_{ny}$ 4) (Nmm)
1	*C85*	1	*C-D*	*4000*	1.21E+09	5.51E+08	0.9	1086480000	1086480000	1086480000	1086480000	495999936	495999936
2	*C75*		*3 - 4*	*4000*	1.21E+09	5.51E+08	0.9	1086480000	1086480000	1086480000	1086480000	495999936	495999936
3	*C85*	2	*C-D*	*3600*	1.21E+09	5.51E+08	0.9	1086480000	1086480000	1086480000	1086480000	495999936	495999936
4	*C75*		*3 - 4*	*3600*	1.21E+09	5.51E+08	0.9	1086480000	1086480000	1086480000	1086480000	495999936	495999936
5	*C85*	3	*C-D*	*3600*	1.21E+09	5.51E+08	0.9	1086480000	1086480000	1086480000	1086480000	495999936	495999936
6	*C75*		*3 - 4*	*3600*	1.21E+09	5.51E+08	0.9	1086480000	1086480000	1086480000	1086480000	495999936	495999936
7	*C85*	4	*C-D*	*3600*	1.21E+09	5.51E+08	0.9	1086480000	1086480000	1086480000	1086480000	495999936	495999936
8	*C75*		*3 - 4*	*3600*	1.21E+09	5.51E+08	0.9	1086480000	1086480000	1086480000	1086480000	495999936	495999936
9	*C85*	5	*C-D*	*3600*	1.21E+09	5.51E+08	0.9	1086480000	1086480000	1086480000	1086480000	495999936	495999936
10	*C75*		*3 - 4*	*3600*	1.21E+09	5.51E+08	0.9	1086480000	1086480000	1086480000	1086480000	495999936	495999936
11	*C85*	Atap	*C-D*	*3600*	1.21E+09	5.51E+08	0.9	1086480000	1086480000	1086480000	1086480000	495999936	495999936
12	*C75*		*3 - 4*	*3600*	1.21E+09	5.51E+08	0.9	1086480000	1086480000	1086480000	1086480000	495999936	495999936

Keterangan:

1) $M_{nx} := \min(M_{nFLB}, M_{nWLB}, M_{nLTBx}, M_p)$
2) $M_{ny} := M_{nLTBy}$
3) $\phi M_{nx} := \phi \cdot M_{nx}$
4) $\phi M_{ny} := \phi \cdot M_{ny}$