STATIKA 1

MODUL 8

BANGUNAN PORTAL DENGAN RASUK GERBER

Dosen Pengasuh :
Ir. Thamrin Nasution

Materi Pembelajaran :
1. Portal Kaki Tunggal dengan Rasuk Gerber Memikul Beban Terpusat.
2. Portal Kaki Tunggal dengan Rasuk Gerber, Garis Pengaruh.
3. Portal Kaki Tidak Simetris Dengan Dua Rasuk Gerber, Memikul Beban Terbagi Rata.
4. Portal Kaki Tidak Simetris Dengan Dua Rasuk Gerber, Garis Pengaruh.

WORKSHOP/PELATIHAN

Tujuan Pembelajaran :

- *Mahasiswa memahami dan mengetahui tentang gaya-gaya dalam dari struktur portal kaki tunggal dan kaki tidak simetris dengan rasuk gerber, memikul beban terpusat dan terbagi rata, mengetahui cara menggambarkan garis pengaruh*.

DAFTAR PUSTAKA

a) Soemono, Ir., "*STATIKA I*", Edisi kedua, Cetakan ke-4, Penerbit ITB, Bandung, 1985.

UCAPAN TERIMA KASIH

Penulis mengucapkan terima kasih yang sebesar-besarnya kepada pemilik hak cipta photo-photo, buku-buku rujukan dan artikel, yang terlampir dalam modul pembelajaran ini.

Semoga modul pembelajaran ini bermanfaat.

Wassalam

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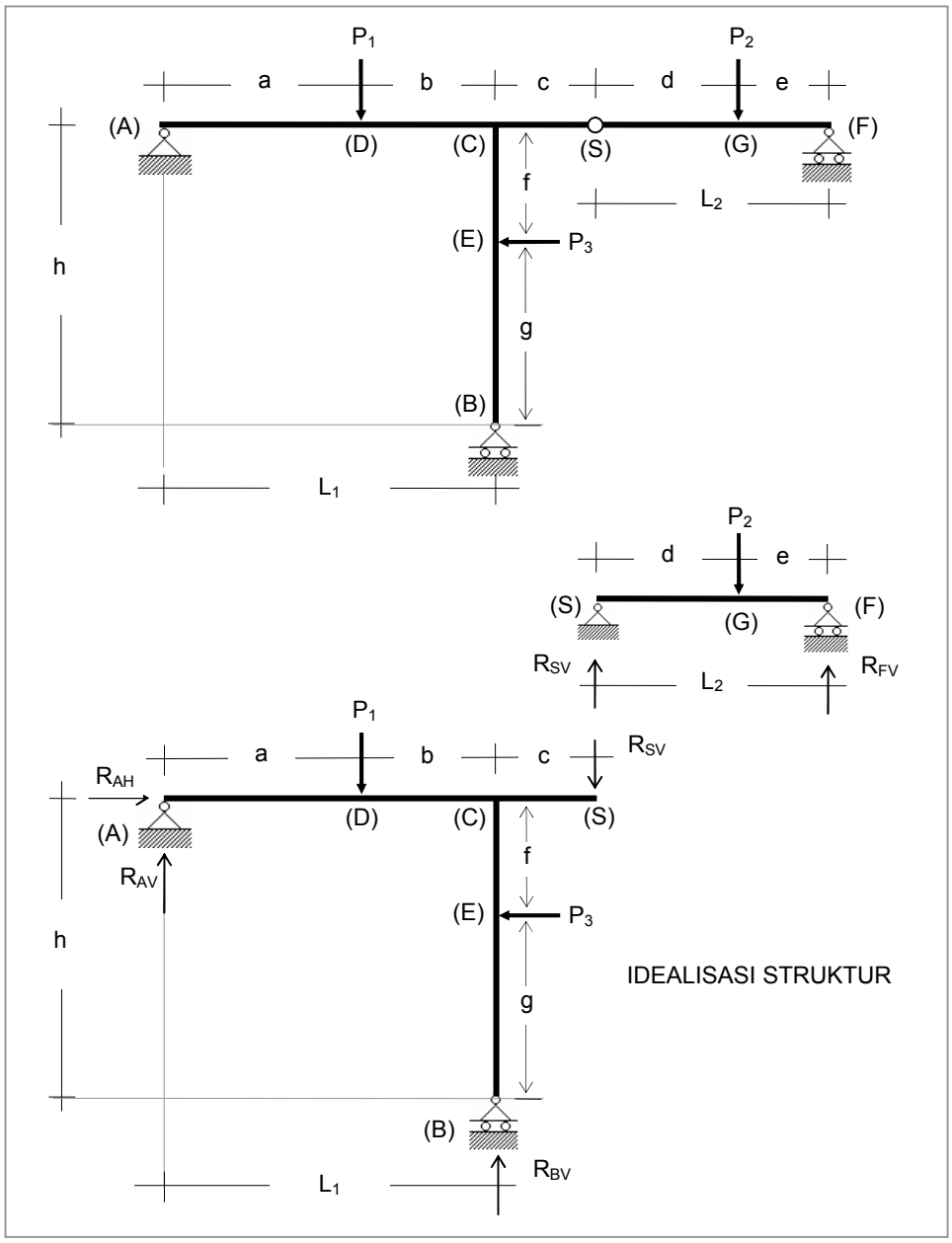
BANGUNAN PORTAL DENGAN RASUK GERBER

1. PORTAL KAKI TUNGGAL DENGAN RASUK GERBER MEMIKUL BEBAN TERPUSAT.



Gambar 1 : Portal kaki tunggal dengan rasuk gerber, memikul beban terpusat.

Penyelesaian :

Span (S) – (F).

a. Reaksi Perletakan.

$\Sigma M_F = 0,$

$R_{SV} \cdot L_2 - P_2 \cdot e = 0$

$R_{SV} = P_2 \cdot e / L_2$ (ton).

$\Sigma M_S = 0,$
$- R_{FV} . L_2 + P_2 . d = 0$
$R_{FV} = P_2 . d/L_2$ (ton).

Kontrol :
$\Sigma V = 0,$
$R_{SV} + R_{FV} - P_2 = 0$

b. Gaya lintang.
$D_{S-G} = + R_{SF}$
$D_{G-F} = + R_{SV} - P_2$ (ton).
$D_{G-F} = - R_{FV}$ (ton).

c. M o m e n .
$M_S = 0$
$M_G = + P_2 . d . e/L_2$
$M_F = 0$

d. Gaya Normal.
$N_{S-F} = 0$ (ton).

Span (A) – (B) – (S).
a. Reaksi Perletakan.
$\Sigma H = 0,$
$R_{AH} - P_3 = 0$
$R_{AH} = P_3$ (ton) (ke kanan)

$\Sigma M_B = 0,$
$R_{AV} . L_1 + R_{AH} . h - P_1 . b + R_{SV} . c - P_3 . g = 0$
$R_{AV} = + P_1 . b/L_1 + P_3 . g/L_1 - R_{AH} . h/L_1 - R_{SV} . c/L_1$ (ton).

$\Sigma M_A = 0,$
$- R_{BV} . L_1 + P_1 . a + R_{SV} . (c + L_1) + P_3 . f = 0$
$R_{BV} = + P_1 . a/L_1 + P_3 . f/L_1 + R_{SV} . (c + L_1)/L_1$ (ton).

Kontrol :
$\Sigma V = 0$
$R_{AV} + R_{BV} = P_1 + R_{SV}$

b. Gaya Lintang.
$D_{A-D} = + R_{AH}$ (ton).
$D_{D-C} = + R_{AV} - P_1$ (ton).
$D_{C-S} = + R_{AV} - P_1 + R_{BV} = + R_{SV}$ (ton).
$D_{C-E} = + R_{AH}$ (ton).
$D_{E-B} = + R_{AH} - P_3 = 0$ (ton).

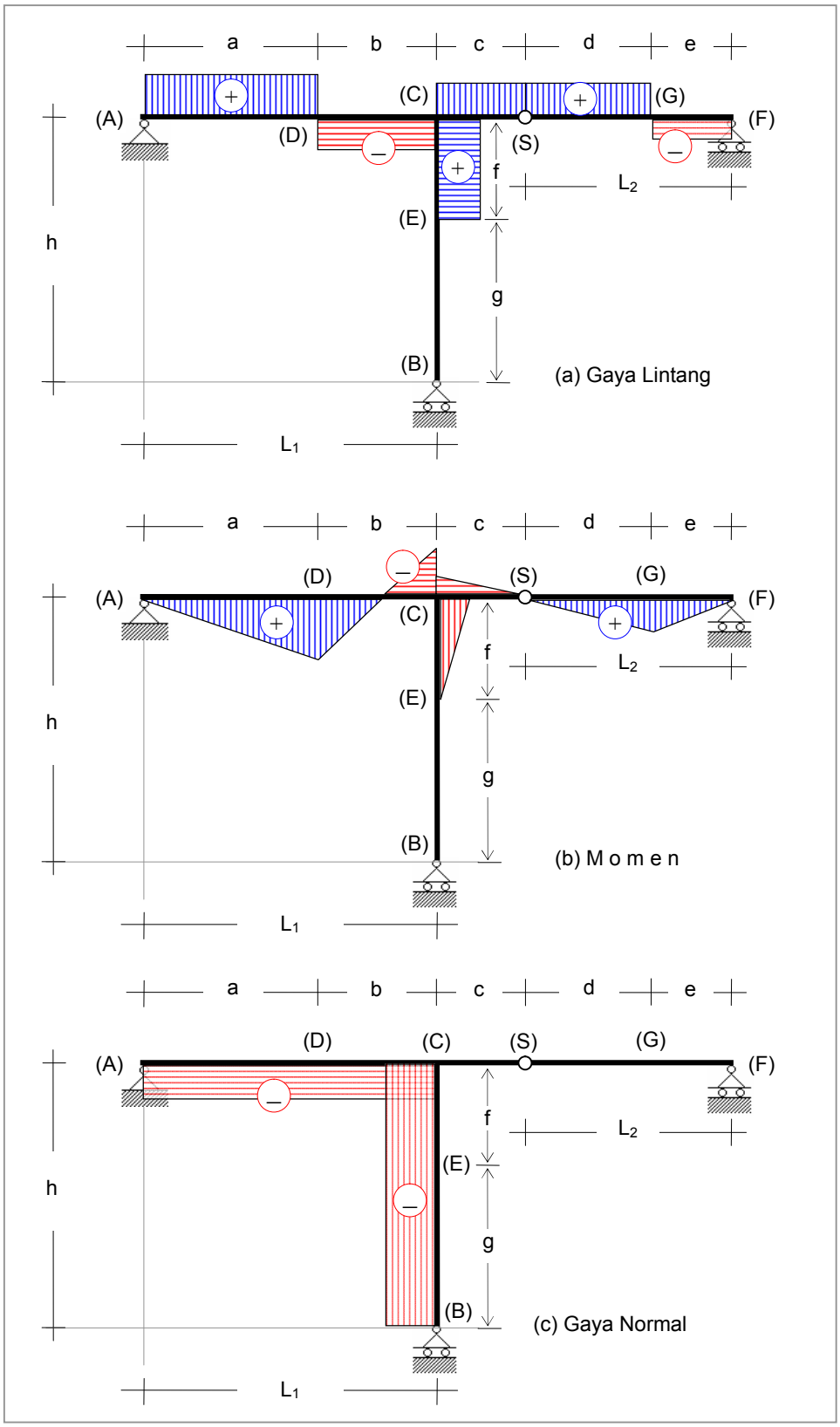
c. M o m e n .
$M_A = 0$
$M_D = + R_{AV} . a$ (t.m').
$M_{CD} = R_{AV} . a - P_1 . b$ (t.m').
$M_{CS} = - R_{SV} . c$ (t.m').
$M_{CE} = - P_3 . f$ (t.m')

$M_B = 0$

d. Gaya Normal.

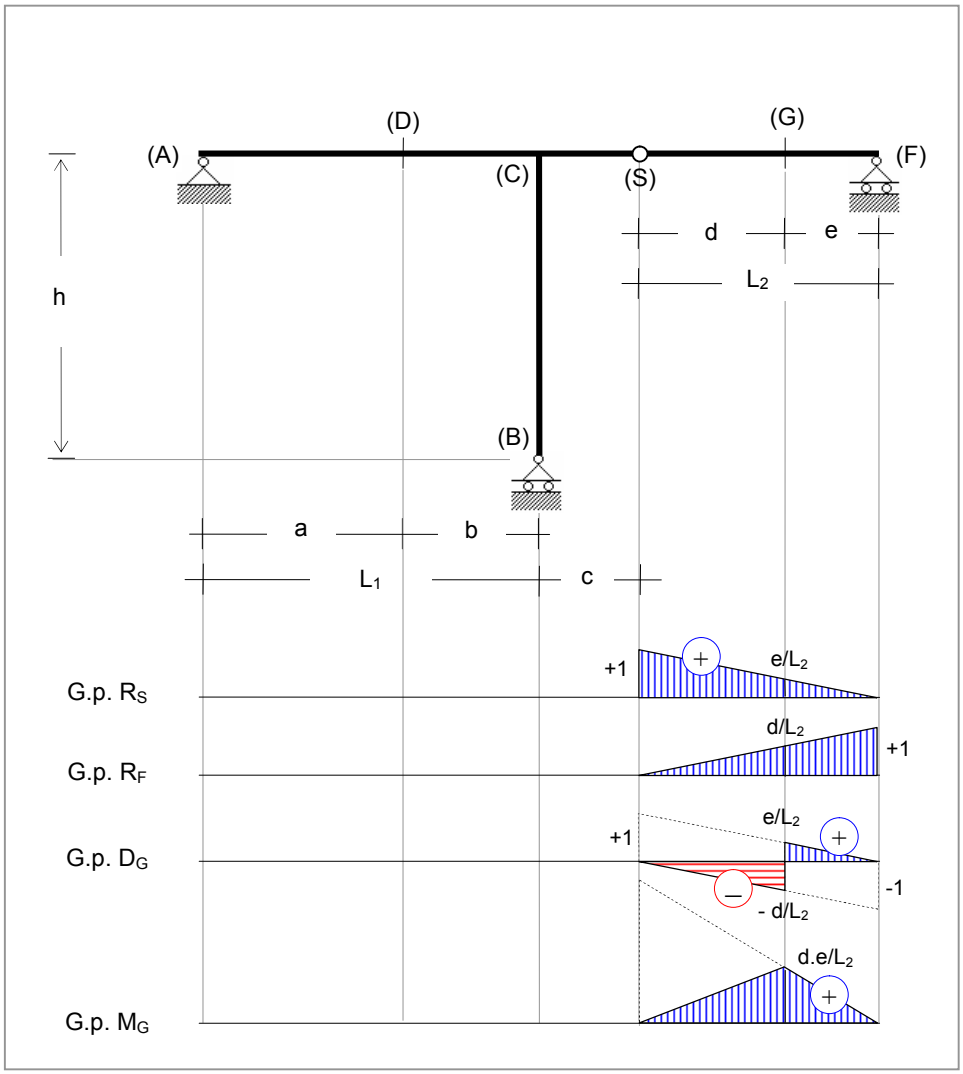
$N_{A\text{-}C} = -R_{AH}$ ton (tekan).

$N_{C\text{-}B} = -R_{BV}$ ton (tekan).



Gambar 2 : Bidang-bidang gaya lintang, momen dan gaya normal.

2. PORTAL KAKI TUNGGAL DENGAN RASUK GERBER GARIS PENGARUH (*Influence Line*).



Gambar 3 : Garis pengaruh span (S)-(F), section (G).

Diminta : Gambarkanlah garis pengaruh gaya lintang, momen dan gaya normal untuk potongan (D), (G) dan (F).

Penyelesaian :

Span (S) - (F).

a. Garis pengaruh R_S.

P = 1 t berada di (S),

$R_S = + P = + 1$ (ton)

P = 1 t berada di (G),

$\Sigma M_F = 0$

$R_S = + P \cdot e/L_2 = + 1 \cdot e/L_2$ (ton)

P = 1 t berada di (F),

$R_S = 0$ (ton)

b. Garis pengaruh R_F

P = 1 t berada di (S),

$R_F = 0$ (ton)

P = 1 t berada di (G),

$\Sigma M_S = 0$

$R_F = + P \cdot d/L_2 = + 1 \cdot d/L_2$ (ton)

P = 1 t berada di (F),

$R_S = + P = + 1$ (ton)

c. Garis pengaruh Gaya lintang pada titik (G).

P = 1 t berada di (S),

$R_S = + P = + 1$ t,

$D_G = R_S - P = 0$

P = 1 t berada di (G), P belum melewati (G),

$\Sigma M_F = 0$

$R_S = + P \cdot e/L_2$ (ton)

$D_G = R_S - P = P.e/L_2 - P = P \cdot (L_2 - d)/L_2 - P \cdot L_2/L_2 = - P \cdot d/L_2$

$D_G = - d/L_2$ (ton)

P = 1 t berada di (G), P sudah melewati (G),

$\Sigma M_F = 0$

$R_S = + P \cdot e/L_2$ (ton)

$Dc = + R_S = + P \cdot e/L_2$ (ton)

P = 1 t berada di (F),

$\Sigma M_B = 0$

$R_S = 0$ (ton)

$D_G = R_S = 0$ (ton)

d. Garis pengaruh Momen pada titik (G).

P = 1 t berada di (S),

$R_S = + P = + 1$ (ton)

$M_G = (R_S - P) \cdot d = 0$ (t.m')

P = 1 t berada di (G),

$\Sigma M_F = 0$

$R_S = + P \cdot e/L_2 = + 1 \cdot e/L_2$ (t.m')

$M_G = R_S \cdot d = d \cdot e/L_2$ (t.m')

P = 1 t berada di (F),

$R_S = 0$ (ton)

$M_G = 0$ (t.m')

Span (A) - (B)

a. Garis pengaruh R_A.

P = 1 t berada di (A),

$R_A = + P = + 1$ (ton)

P = 1 t berada di (C),

$\Sigma M_B = 0$

$R_A = 0$ (ton)

P = 1 t berada di (S),

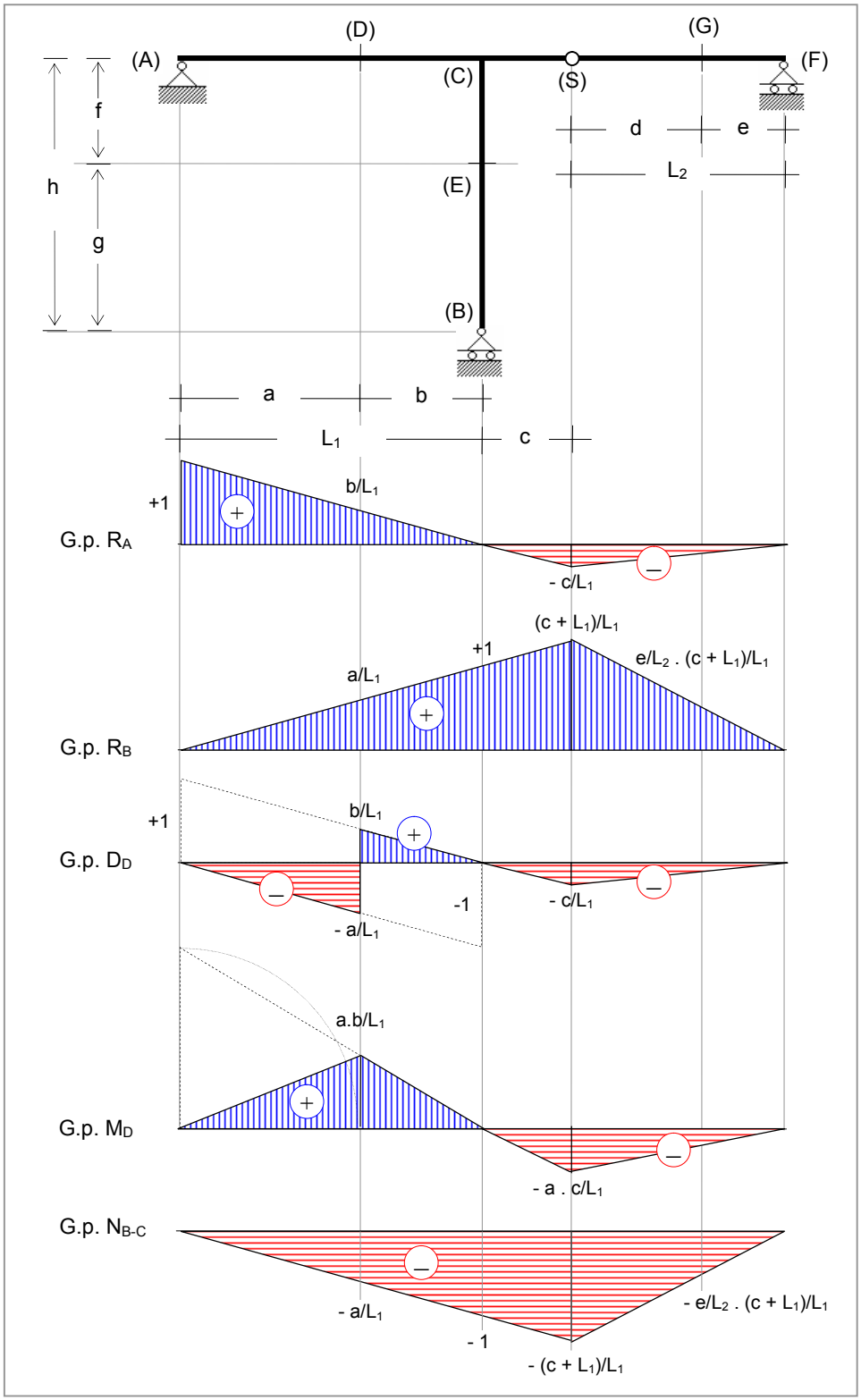
$\Sigma M_B = 0$,

$R_A \cdot L_1 + P \cdot c = 0$

$R_A = - P \cdot c/L_1 = - 1 \cdot c/L_1$ (ton)

P = 1 t berada di (F),

$R_A = 0$ (ton).



Gambar 4 : Garis pengaruh span (A)-(B), section (D), gaya normal kolom (B)-(C).

b. Garis pengaruh R_B.

P = 1 t berada di (A),

$R_B = 0$ (ton)

P = 1 t berada di (C),

$\Sigma M_B = 0$

$R_B = + P = +1$ (ton).

P = 1 t berada di (S),

$\Sigma M_A = 0$,

$- R_B . L_1 + P . (c + L_1) = 0$

$R_B = + P . (c + L_1)/L_1 = + 1 . (c + L_1)/L_1$ (ton)

P = 1 t berada di (F),

$R_B = 0$ (ton).

c. Garis pengaruh Gaya lintang pada titik (D).

P = 1 t berada di (A),

$R_A = + P = + 1$ t,

$D_D = R_A – P = 0$

P = 1 t berada di (D), P belum melewati (D),

$\Sigma M_B = 0$

$R_A = + P . b/L_1$(ton)

$D_D = R_A – P = P.b/L_1 – P = P . (L_1 - a)/L_1 – P . L_1/L_1 = – P . a/L_1$

$D_D = – a/L_1$ (ton)

P = 1 t berada di (D), P sudah melewati (D),

$\Sigma M_B = 0$

$R_A = + P . b/L_1$ (ton)

$D_D = + R_A = + P . b/L_1$ (ton)

P = 1 t berada di (C),

$\Sigma M_B = 0$

$R_A = 0$ (ton)

$D_D = R_A = 0$ (ton)

P = 1 t berada di (S),

$\Sigma M_A = 0$,

$+ R_A . L_1 + P . c = 0$

$R_A = - P . c/L_1 = - 1 . c/L_1$ (ton)

$D_D = R_A = - c/L_1$

P = 1 t berada di (F),

$R_A = 0$ (ton).

$D_D = 0$ (ton).

d. Garis pengaruh Momen pada titik (D).

P = 1 t berada di (A),

$R_A = + P = + 1$ (ton)

$M_D = (R_A – P) . a = 0$ (t.m')

P = 1 t berada di (D),

$\Sigma M_B = 0$

$R_A = + P . b/L_1 = + 1 . b/L_1$ (t.m')

$M_D = R_A . a = a . b/L_1$ (t.m')

P = 1 t berada di (C),

$R_A = 0$ (ton)

$M_D = 0$ (t.m')

P = 1 t berada di (S),

$\Sigma M_A = 0$,

$+ R_A . L_1 + P . c = 0$

$R_A = - P . c/L_1 = - 1 . c/L_1$ (ton)

$M_D = R_A . a = - a .c/L_1$ (t.m')

P = 1 t berada di (F),

$R_A = 0$ (ton).

$M_D = 0$ (t.m').

e. Garis pengaruh gaya normal kolom (B)-(C).

P = 1 t berada di (A),

$R_B = 0$ (ton)

$N_{B-C} = - R_B = 0$ (ton)

P = 1 t berada di (C),

$\Sigma M_B = 0$

$R_B = + P = +1$ (ton)

$N_{B-C} = - R_B = - 1$ (ton).

P = 1 t berada di (S),

$\Sigma M_A = 0$,

$- R_B . L_1 + P . (c + L_1) = 0$

$R_B = + P . (c + L_1)/L_1$

$= + 1 . (c + L_1)/L_1$ (ton)

$N_{B-C} = - R_B$

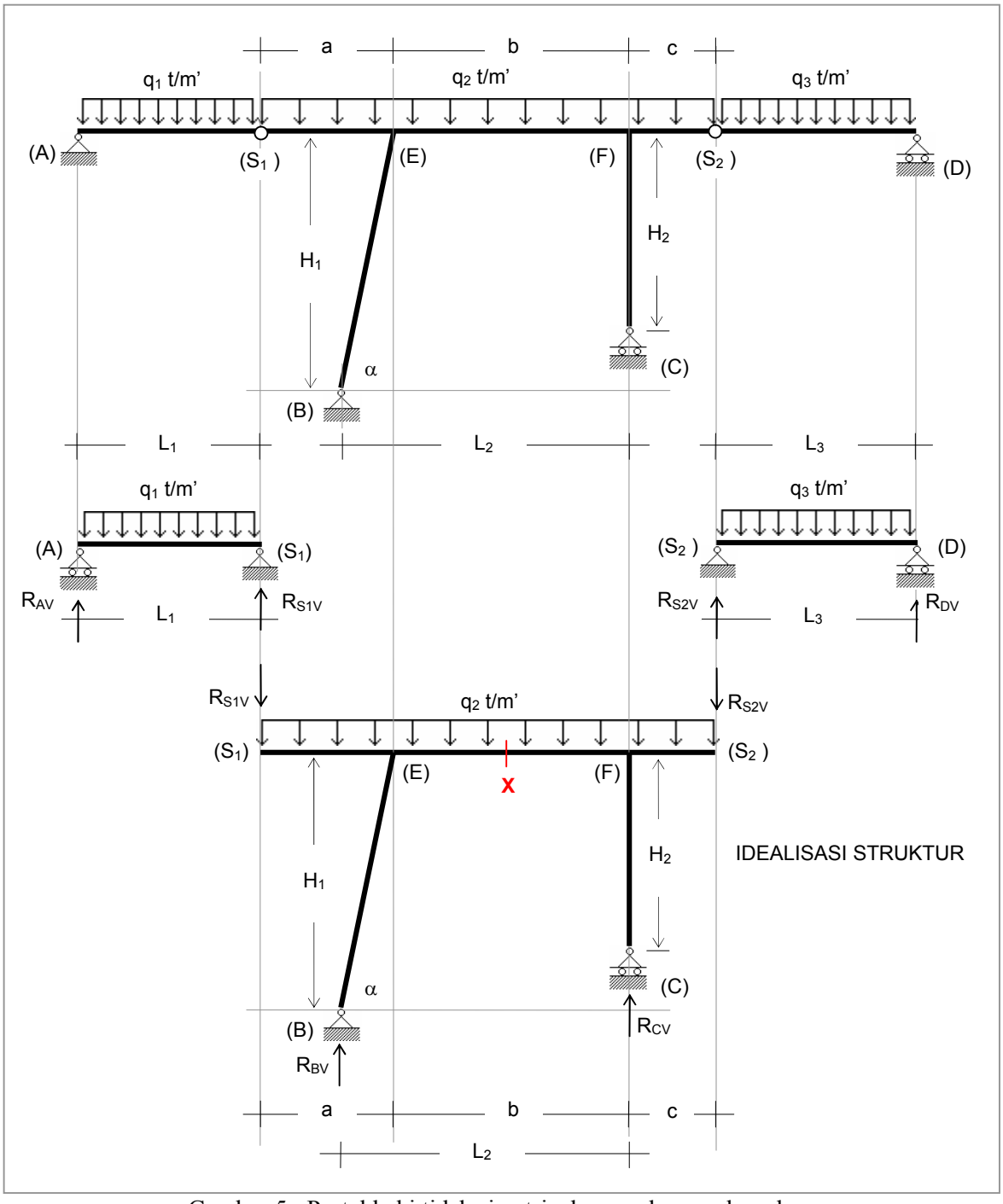
$= - 1 . (c + L_1)/L_1$ (ton)

P = 1 t berada di (F),

$R_B = 0$ (ton).

$N_{B-C} = - R_B = 0$ (ton)

3. PORTAL KAKI TIDAK SIMETRIS DENGAN DUA RASUK GERBER MEMIKUL BEBAN TERBAGI RATA.



Gambar 5 : Portal kaki tidak simetris dengan dua rasuk gerber.

Penyelesaian :

Span (A) – (S_1).

a. Reaksi Perletakan.

$\Sigma M_{S1} = 0,$

$R_{AV} \cdot L_1 - \frac{1}{2} \cdot q_1 . L_1^2 = 0$

$R_{AV} = \frac{1}{2} q_1 . L_1$ (ton).

$R_{S1V} = R_{AV} = \frac{1}{2} q_1 . L_1$ (ton).

Kontrol :

$\Sigma V = 0,$

$R_{AV} + R_{S1V} = q_1 . L_1$

b. Gaya Lintang.

$D_{AS1} = R_{AV} = ½\ q_1.L_1$ (ton)

$D_{S1A} = R_{AV} – q_1.L_1 = – R_{S1} = – ½\ q_1.L_1$ (ton).

c. Momen.

$M_A = 0$ (t.m').

$M_{maks} = 1/8\ q_1.L_1^2$ (t.m').

$M_{S1} = 0$ (t.m').

Span (S_2) – (D).

a. Reaksi Perletakan.

$\Sigma M_D = 0,$

$R_{S2V} . L_3 - ½ . q_3.L_3^2 = 0$

$R_{S2V} = ½\ q_3.L_3$ (ton).

$R_{DV} = R_{S2V} = ½\ q_3.L_3$ (ton).

Kontrol :

$\Sigma V = 0,$

$R_{S2V} + R_{DV} = q_3 . L_3$

b. Gaya Lintang.

$D_{S2D} = R_{S2V} = ½\ q_3.L_3$ (ton)

$D_{DS2} = R_{S2V} – q_3.L_3 = – R_{DV} = – ½\ q_3.L_3$ (ton).

c. Momen.

$M_{S2} = 0$ (t.m').

$M_{maks} = 1/8\ q_3.L_3^2$ (t.m').

$M_D = 0$ (t.m').

Span (B) – (C).

a. Reaksi Perletakan.

$\Sigma M_C = 0,$

$R_{BV} . L_2 – R_{S1V} . (a + b) – q_2.(a + b).1/2.(a + b) + q_2.(c).1/2.(c) + R_{S2V} . (c) = 0$

$R_{BV} = + R_{S1V}.(a + b)/L_2 + 1/2\ q_2.(a + b)^2/L_2 – 1/2\ q_2.(c)^2/L_2 – R_{S2V}.(c)/L_2 = 0$

$\Sigma M_B = 0,$

$– R_{CV} . L_2 – R_{S1V} . (a – H_1/tg\alpha\ ) + q_2.(L_2 + c).1/2.(L_2 + c) –$

$q_2.(a + b – L_2).1/2.\ (a + b – L_2) + R_{S2V} . (L_2 + c) = 0$

$R_{CV} = – R_{S1V}.(a – H_1/tg\alpha\ )/L_2 + ½.q_2.(L_2 + c)^2/L_2 – ½.q_2.(a + b – L_2)^2/L_2$

$+ R_{S2V}.(L_2 + c)/L_2$

Kontrol :

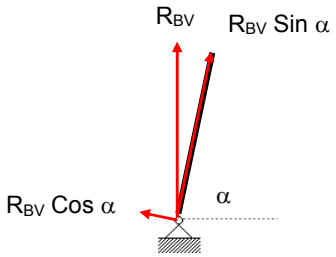
$\Sigma V = 0,$

$R_{BV} + R_{CV} = R_{S1V} + q_2 . (a + b + c) + R_{S2V}$

b. Gaya Lintang.

$D_{B\text{-}E} = + R_{BV}\ Cos\ \alpha$

$D_{S1E} = – R_{S1V}$ (ton).



$D_{ES1} = - R_{S1V} - q_2 \,.\, a$ (ton).
$D_{EF} = - R_{S1V} - q_2 \,.\, a + R_{BV}$ (ton).
$D_{FE} = - R_{S1V} - q_2 \,.\, (a + b) + R_{BV}$ (ton).
$D_{FS2} = - R_{S1V} - q_2 \,.\, (a + b) + R_{BV} + R_{CV}$ (ton).
$D_{S2F} = - R_{S1V} - q_2 \,.\, (a + b + c) + R_{BV} + R_{CV}$ (ton) $= - R_{S2V}$ (ton).

c. M o m e n .

$M_B = 0$
$M_{EB} = + R_{BV} \,.\, a$ (t.m').
$M_{ES1} = - R_{S1V} \,.\, a - ½.q_2 \,.\, a^2$ (t.m').
$M_{EF} = - R_{S1V} \,.\, a - ½.q_2 \,.\, a^2 + R_{BV} \,.\, a$ (t.m').

Momen yang terjadi pada titik sejauh x dari (F),
$Mx = - R_{S1V} \,.\, (a + x) - ½.q_2 \,.\, (a + x)^2 + R_{BV} \,.\, (H_1/\tan\alpha + x)$

Momen maksimum terjadi pada titik dimana gaya lintang Dx = 0, yaitu
$Mx = - R_{S1V}.a - R_{S1V} \,.\, x - ½.q_2 \,.\, (a^2 + 2ax + x^2) + R_{BV} \,.\, (H_1/\tan\alpha + x)$

$d(Mx)/dx = - R_{S1V} - q_2 \,.\, a - q_2 \,.\, x + R_{BV} = 0$
$x = (- R_{S1V} - q_2 \,.\, a + R_{BV})/q_2$ (m), dari titik (E).

Titik dimana momen Mx = 0, adalah
$Mx = - R_{S1V} \,.\, (a + x) - ½.q_2 \,.\, (a + x)^2 + R_{BV} \,.\, (H_1/\tan\alpha + x) = 0$
$½.q_2 \,.\, (a + x)^2 + R_{S1V} \,.\, (a + x) - R_{BV} \,.\, (H_1/\tan\alpha + x) = 0$

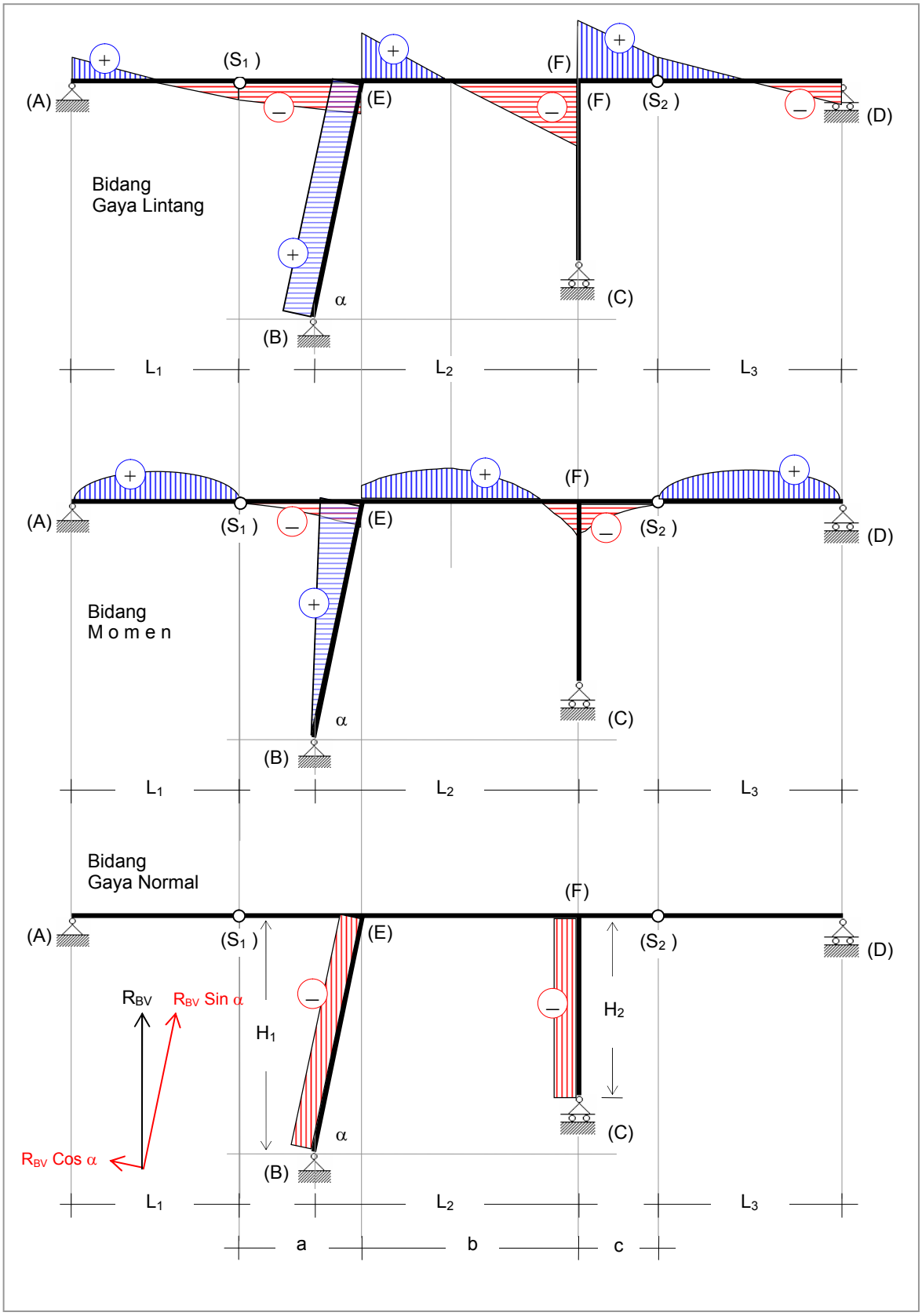
Selanjutnya persamaan diatas diselesaikan dengan rumus abc, sebagai berikut,

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$M_{FE} = - R_{S1V} \,.\, a - ½.q_2.(a + b)^2 + R_{BV} \,.\, a$ (t.m').
Atau,
$M_{FS2} = - R_{S2V} \,.\, c - ½.q_2 \,.\, c^2$ (t.m').
$M_{FE} = M_{FS2}$ (t.m').
$M_{FC} = 0$ (t.m').

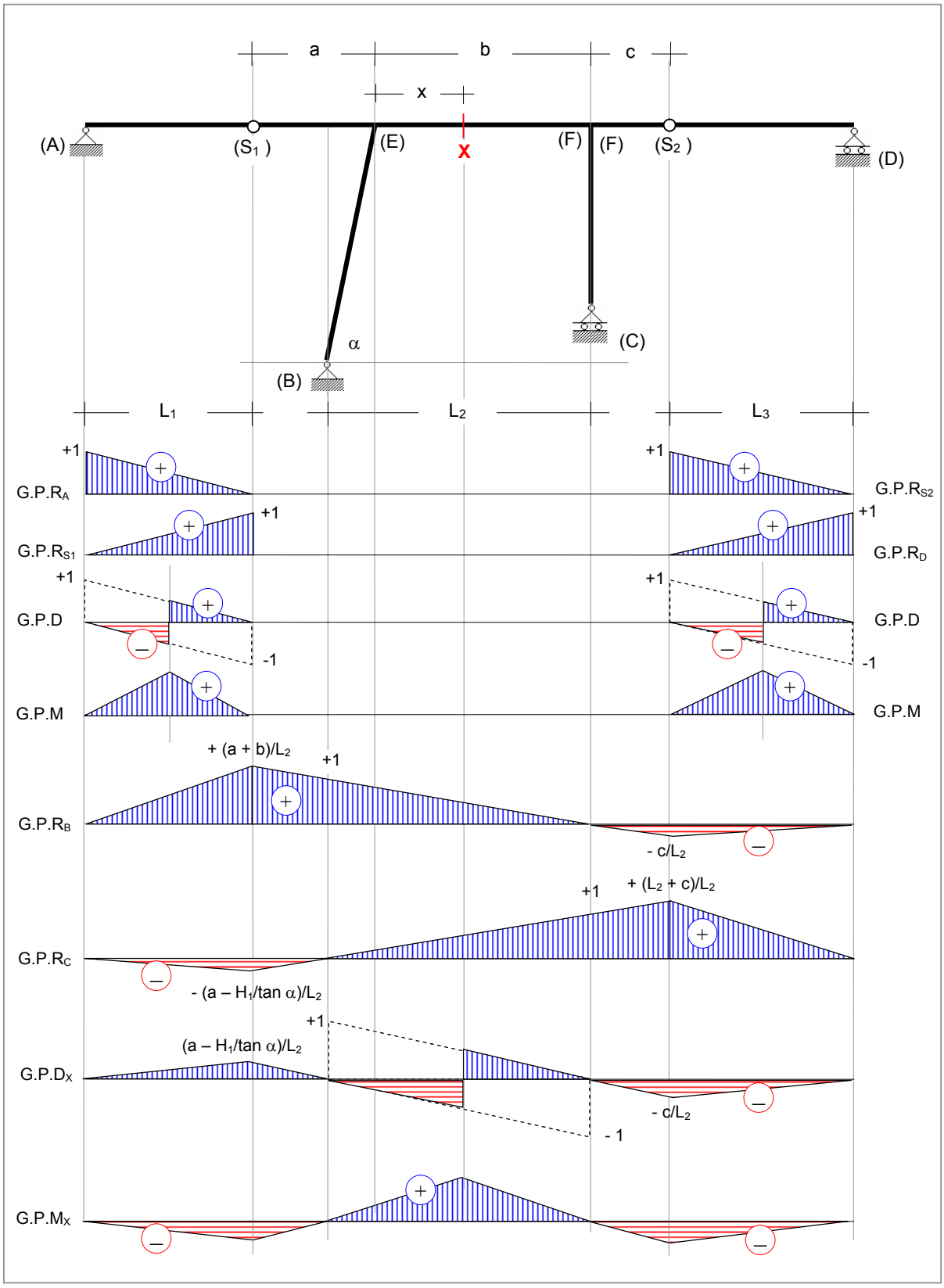
d. Gaya Normal.

$N_{B\text{-}E} = - R_{BV} \sin\alpha$ (ton) (tekan).
$N_{C\text{-}F} = - R_{CV}$ (ton) (tekan).

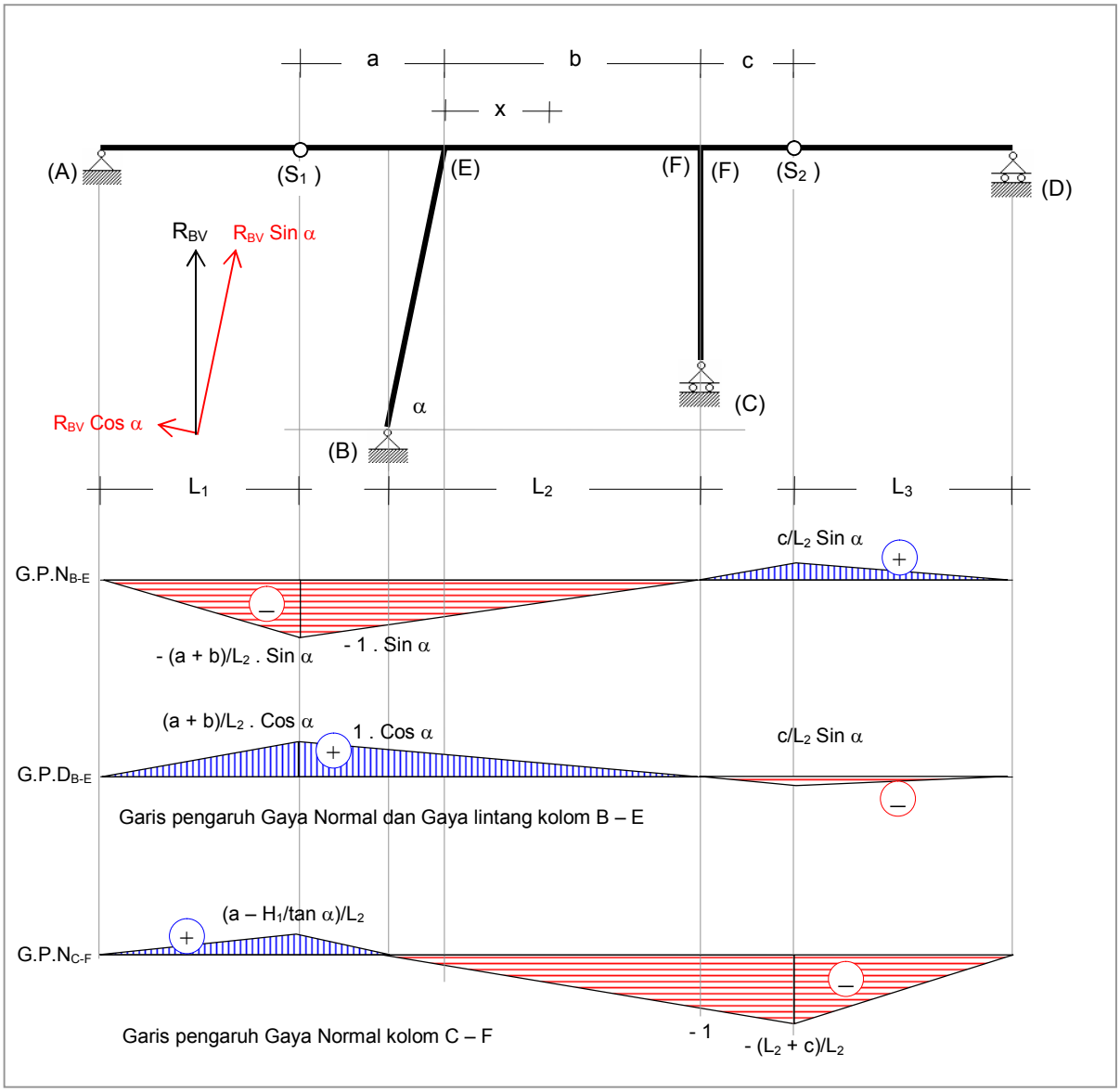


Gambar 6 : Bidang-bidang gaya lintang, momen dan gaya normal..

4. PORTAL KAKI TIDAK SIMETRIS DENGAN DUA RASUK GERBER GARIS PENGARUH.

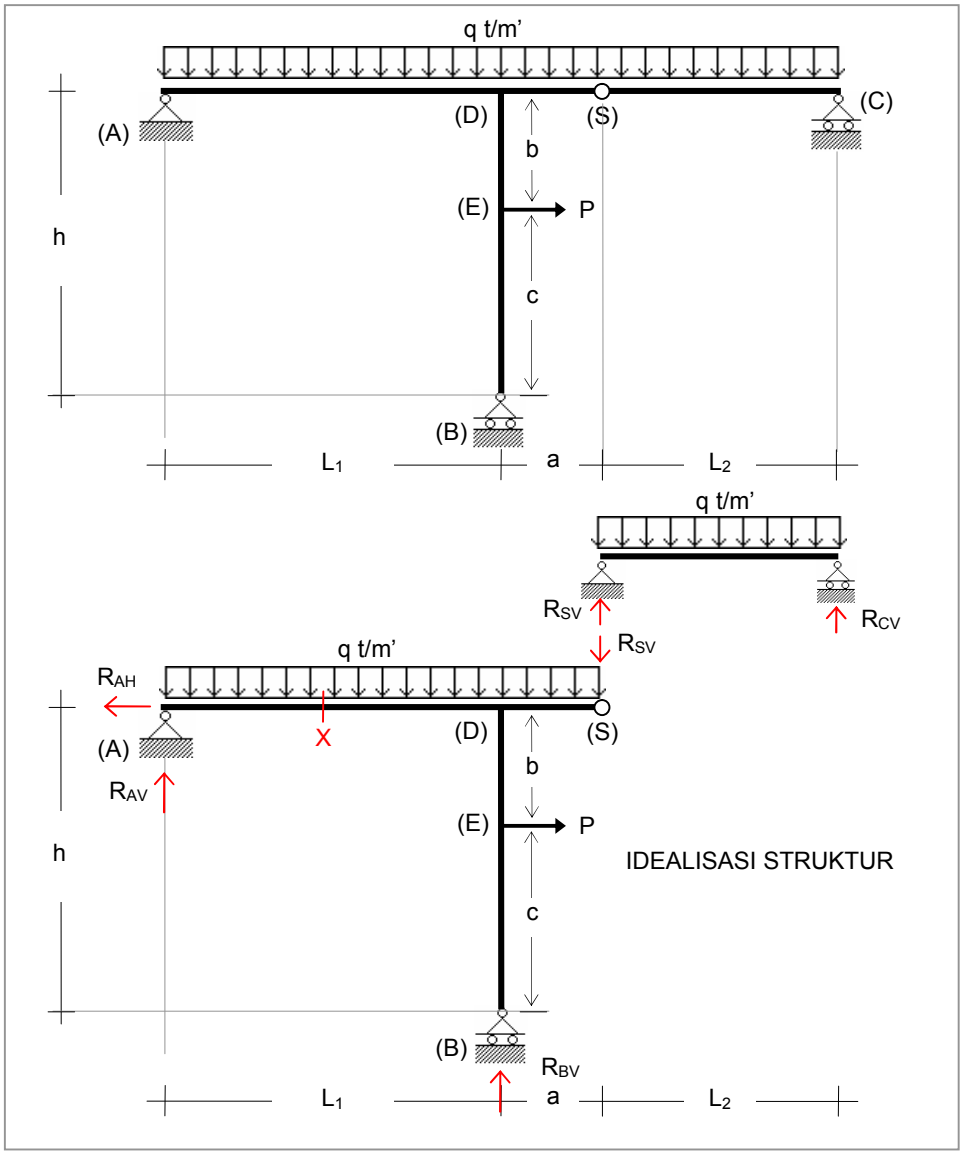


Gambar 7 : Garis pengaruh reaksi, gaya lintang dan momen balok A-S_1, S_2-D dan balok E-F .



Gambar 8 : Garis pengaruh gaya normal dan gaya lintang kolom B – E dan C – F.

WORKSHOP/PELATIHAN



Diketahui : Struktur seperti tergambar.
Diminta : Gambarkan bidang-bidang gaya lintang, momen dan gaya normal pada seluruh bentang.
Penyelesaian :
DATA.

No. Stb.	L_1 m	L_2 m	a m	h m	b m	c m	q t/m'	P ton
-1	4.00	2.50	1.00	4.00	1.60	2.40	1.00	2.00
0	4.40	2.70	1.10	4.10	1.64	2.46	1.25	2.15
1	4.80	2.90	1.20	4.20	1.68	2.52	1.50	2.30
2	5.20	3.10	1.30	4.30	1.72	2.58	1.75	2.45
3	5.60	3.30	1.40	4.40	1.76	2.64	2.00	2.60
4	6.00	3.50	1.50	4.50	1.80	2.70	2.25	2.75
5	6.40	3.70	1.60	4.60	1.84	2.76	2.50	2.90
6	6.80	3.90	1.70	4.70	1.88	2.82	2.75	3.05
7	7.20	4.10	1.80	4.80	1.92	2.88	3.00	3.20
8	7.60	4.30	1.90	4.90	1.96	2.94	3.25	3.35
9	8.00	4.50	2.00	5.00	2.00	3.00	3.50	3.50

Pada contoh ini, X = -1

SPAN (S) – (C)

a). Reaksi perletakan.

$R_{SV} = ½\ q\ L_2 = ½ . (1\ t/m') . (2{,}50\ m) = 1{,}25$ ton.
$R_{CV} = R_{SV} = ½\ q\ L_2 = 1{,}25$ ton.
Kontrol :
$R_{SV} + R_{CV} = q . L_2$
1,25 ton + 1,25 ton = (1 t/m').(2,5 m) (memenuhi).

b). Gaya lintang.

$D_{SC} = + R_{SV} = + 1{,}25$ ton.
$D_{CS} = + R_{SV} – q.L_2 = 1{,}25$ ton – (1 t/m').(2.5 m) = – 1,25 ton.

c). Momen.

$Mmaks = 1/8\ q.L_2^2 = 1/8 . (1\ t/m').(2{,}5\ m)^2 = 0{,}78125$ t.m'.

SPAN (A) – (B) – (S)

a). Reaksi perletakan.

$\Sigma H = 0,$
$R_{AH} + P = 0$
$R_{AH} = – P = – 2{,}000$ ton (ke kiri).

$\Sigma M_B = 0,$
$R_{AV} . L_1 – R_{AH} . h – ½ . q . L_1^2 + ½ . q . a^2 + R_{SV} . a + P . c = 0$
$R_{AV} = R_{AH} . h/L_1 + ½ . q . (L_1^2 – a^2)/L_1 – R_{SV} . a/L_1 – P . c/L_1$
= (2,0 t).(4,0 m)/(4,0 m) + ½.(1 t/m').{(4 m)^2 – (1 m)^2}/(4 m) – (1,25 t).(1 m)/(4 m)
– (2 t).(2,40 m)/(4 m)
$R_{AV} = 2{,}0000 + 1{,}8750 – 0{,}3125 – 1{,}2000 = 2{,}3625$ ton.

$\Sigma M_A = 0,$
$– R_{BV} . L_1 + ½ . q . (L_1 + a)^2 + R_{SV} . (L_1 + a) – P . b = 0$
$R_{BV} = ½ . q . (L_1 + a)^2/L_1 + R_{SV} . (L_1 + a)/L_1 – P . b/L_1$
= ½.(1 t/m').{(4 m) + (1 m)}^{2}/(4 m) + (1,25 t).{(4 m) + (1 m)}/(4 m)
– (2 t).(1,6 m)/(4 m)
$R_{BV} = 3{,}1250 + 1{,}5625 – 0{,}8000 = 3{,}8875$ ton.

Kontrol :
$R_{AV} + R_{BV} = q . (L_1 + a) + R_{SV}$
0,3625 t + 3,8875 t = (1 t/m') . (4 m + 1 m) + 1,250 t
6,250 t = 6,250 t (memenuhi)

b. Gaya Lintang.

$D_{AD} = + R_{AV} = + 2{,}3625$ (ton).
$D_{DA} = + R_{AV} – q . L_1 = 2{,}3625 – (1\ t/m').(4\ m) = – 1{,}6375$ (ton).
$D_{DS} = + R_{AV} – q . L_1 + R_{BV} = 2{,}3625 – (1\ t/m').(4\ m) + 3{,}8875 = + 2{,}250$ (ton).
Atau,
$D_{DS} = + q . a + R_{SV} = (1\ t/m').(1\ m) + 1{,}25 = + 2{,}250$ (ton)
$D_{DE} = – R_{AH} = – 2$ (ton).
$D_{EB} = – R_{AH} + P = – 2 + 2 = 0$ (ton).

c. M o m e n .

$M_A = 0$
$M_{DA} = + R_{AV} . L_1 – ½ . q . L_1^2 = (2{,}3625\ t).(4\ m) – ½.(1\ t/m').(4\ m)^2 = + 1{,}4500$ (t.m').
$M_{DS} = – ½ . q . a^2 – R_{SV} . a = – ½.(1\ t/m').(1\ m)^2 – (1{,}25\ t).(1\ m) = – 1{,}7500$ (t.m').
$M_{DE} = + P . b = + (2\ t) . (1{,}6\ m) = + 3{,}2000$ (t.m').

Momen yang terjadi pada titik X sejauh x dari (A),
$Mx = + R_{AV} . x - ½.q . x^2$

Momen maksimum terjadi pada titik dimana gaya lintang Dx = 0, yaitu
$d(Mx)/dx = R_{AV} - q . x = 0$
$x = R_{AV}/q = (2,3625 t)/(1 t/m') = 2,3625 (m)$, dari titik (A).
$Mmaks = (2,3625 t).(2,3625 m) - ½ . (1 t/m') . (2,3625 m)^2 = 2,79070 (t.m')$.

Apabila pada bentang (A)-(D), momen M_{DA} bertanda positip, maka tidak terdapat titik peralihan momen dari positip ke negatip, titik dimana momen Mx = 0.
Apabila M_{DA} bertanda negatip, maka
$Mx = + R_{AV} . x - ½.q . x^2 = 0$
$R_{AV} - ½.q . x = 0$
$x = 2 R_{AV}/q$

d. Gaya Normal.
$N_{A-D} = + R_{AH} = + 2,000$ (ton) (tarik).
$N_{B-D} = - R_{BV} = - 3,8875$ (ton) (tekan).

e. Bidang-bidang gaya lintang, momen dan gaya normal dipersilahkan digambar sendiri.

Kunci Jawaban

SPAN (S) – (C)

No. Stb.	R_{SV} ton	R_{CV} ton	D_{SC} ton	D_{SC} ton	Mmaks t.m'
-1	1.250	1.250	1.250	-1.250	0.78125
0	1.688	1.688	1.688	-1.688	1.13906
1	2.175	2.175	2.175	-2.175	1.57688
2	2.713	2.713	2.713	-2.713	2.10219
3	3.300	3.300	3.300	-3.300	2.72250
4	3.938	3.938	3.938	-3.938	3.44531
5	4.625	4.625	4.625	-4.625	4.27813
6	5.363	5.363	5.363	-5.363	5.22844
7	6.150	6.150	6.150	-6.150	6.30375
8	6.988	6.988	6.988	-6.988	7.51156
9	7.875	7.875	7.875	-7.875	8.85938

SPAN (A) – (B) – (S)
Reaksi Perletakan

No. Stb.	R_{AH} ton	R_{AV} ton	R_{BV} ton	$R_{AV} + R_{BV}$ ton	$q.(L_1+a)+R_{SV}$ ton
-1	2.0000	2.3625	3.8875	6.250	6.250
0	2.1500	2.9576	5.6049	8.563	8.563
1	2.3000	3.6363	7.5388	11.175	11.175
2	2.4500	4.3979	9.6896	14.088	14.088
3	2.6000	5.2421	12.0579	17.300	17.300
4	2.7500	6.1688	14.6438	20.813	20.813
5	2.9000	7.1775	17.4475	24.625	24.625
6	3.0500	8.2682	20.4693	28.738	28.738
7	3.2000	9.4408	23.7092	33.150	33.150
8	3.3500	10.6952	27.1673	37.863	37.863
9	3.5000	12.0313	30.8438	42.875	42.875

Gaya Lintang

No. Stb.	D_{AD} ton	D_{DA} ton	$D_{DS\ kiri}$ ton	$D_{DS\ kanan}$ ton	D_{DE} ton	D_{EB} ton
-1	2.3625	-1.6375	2.2500	2.2500	-2.000	0.0
0	2.9576	-2.5424	3.0625	3.0625	-2.150	0.0
1	3.6363	-3.5638	3.9750	3.9750	-2.300	0.0
2	4.3979	-4.7021	4.9875	4.9875	-2.450	0.0
3	5.2421	-5.9579	6.1000	6.1000	-2.600	0.0
4	6.1688	-7.3313	7.3125	7.3125	-2.750	0.0
5	7.1775	-8.8225	8.6250	8.6250	-2.900	0.0
6	8.2682	-10.4318	10.0375	10.0375	-3.050	0.0
7	9.4408	-12.1592	11.5500	11.5500	-3.200	0.0
8	10.6952	-14.0048	13.1625	13.1625	-3.350	0.0
9	12.0313	-15.9688	14.8750	14.8750	-3.500	0.0

M o m e n

No. Stb.	M_{DA} t.m'	M_{DS} t.m'	M_{DE} t.m'	$x = R_{AV}/q$ m	Mmaks t.m'	$x = 2R_{AV}/q$ m
-1	1.45000	-1.75000	3.20000	2.36250	2.79070	-
0	0.91350	-2.61250	3.52600	2.36609	3.49899	-
1	0.17400	-3.69000	3.86400	2.42417	4.40744	-
2	-0.79100	-5.00500	4.21400	2.51308	5.52611	5.026
3	-2.00400	-6.58000	4.57600	2.62107	6.87002	5.242
4	-3.48750	-8.43750	4.95000	2.74167	8.45633	5.483
5	-5.26400	-10.60000	5.33600	2.87100	10.30330	5.742
6	-7.35600	-13.09000	5.73400	3.00663	12.42977	6.013
7	-9.78600	-15.93000	6.14400	3.14694	14.85489	6.294
8	-12.57650	-19.14250	6.56600	3.29083	17.59804	6.582
9	-15.75000	-22.75000	7.00000	3.43750	20.67871	6.875

Gaya Normal

No. Stb.	N_{A-D} ton	N_{B-D} ton
-1	2.0000	-3.8875
0	2.1500	-5.6049
1	2.3000	-7.5388
2	2.4500	-9.6896
3	2.6000	-12.0579
4	2.7500	-14.6438
5	2.9000	-17.4475
6	3.0500	-20.4693
7	3.2000	-23.7092
8	3.3500	-27.1673
9	3.5000	-30.8438