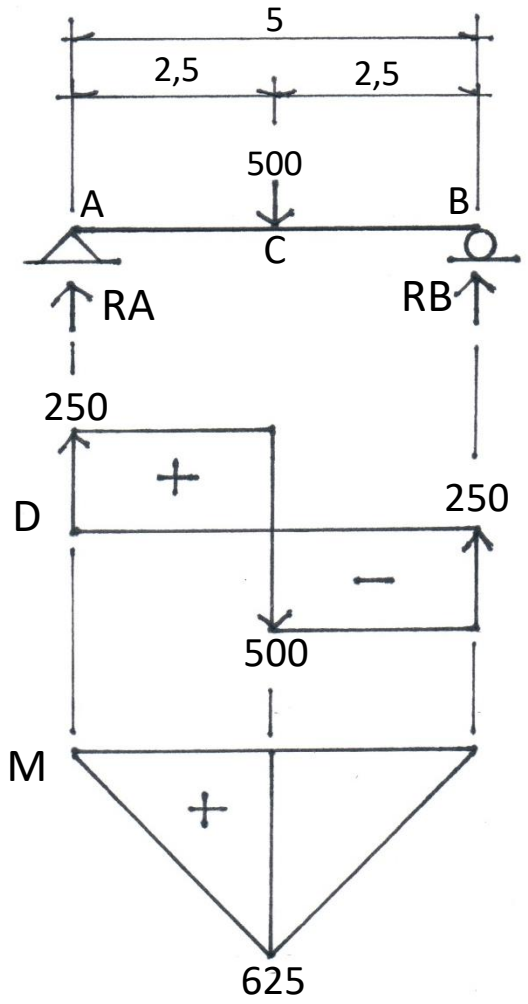
BAB 3 BALOK DIATAS DUA TUMPUAN

3.1 Gambar bidang : gaya lintang dan momen → P = 500 kg



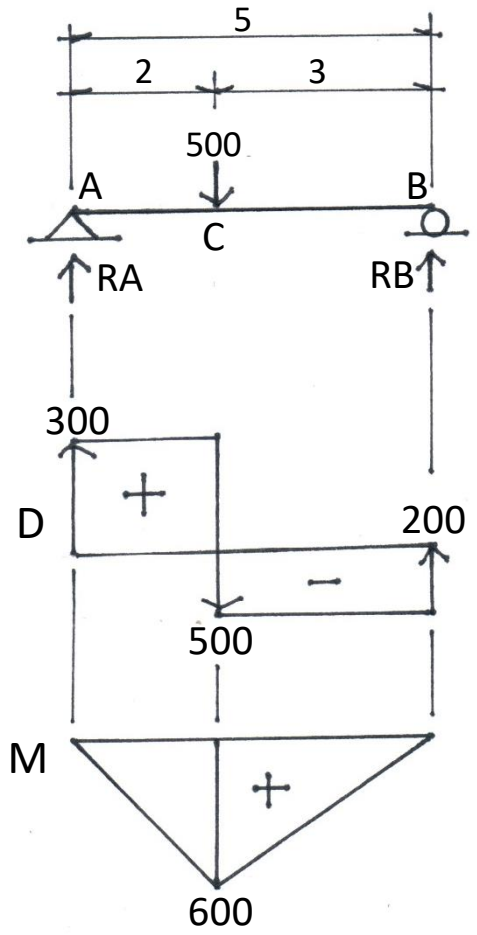
ΣMB = 0 → RA. 5 – 500. 2,5 = 0 → 5 RA = 1250 → **RA = 250 kg**

ΣMA = 0 → RB. 5 – 500. 2,5 = 0 → 5 RB = 1250 → **RB = 250 kg**

ΣV = 0 → RA + RB = P → 250 + 250 = 500 → 500 = 500 → ok

MC = RA. 2,5 = 250. 2,5 = **625 kgm**

3.2 Gambar bidang : gaya lintang dan momen → P = 500 kg



ΣMB = 0 → RA. 5 – 500. 3 = 0 → 5 RA = 1500 → **RA = 300 kg**

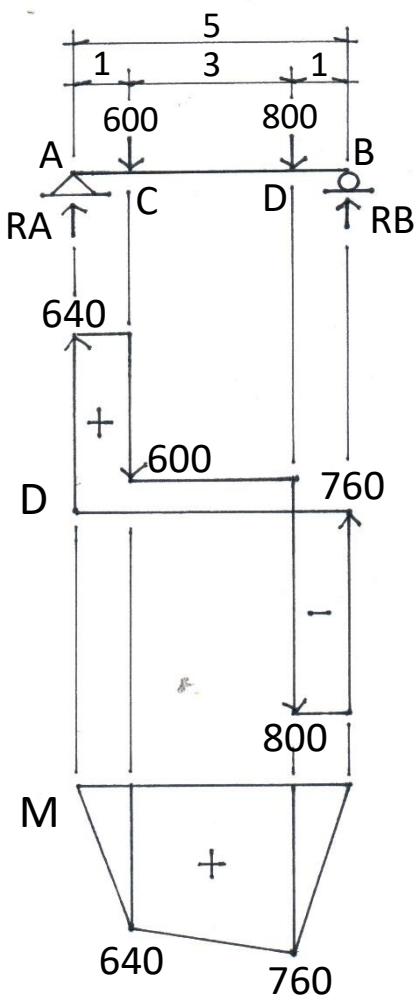
ΣMB = 0 → RB. 5 – 500. 2 = 0 → 5 RB = 1000 → **RB = 200 kg**

ΣV = 0 → RA + RB = P → 300 + 200 = 500 → 500 = 500 → ok

MC = RA. 2 = 300. 2 = **600 kgm**

3.3 Gambar bidang : gaya lintang dan momen

$P_1 = 600$ kg ; $P_2 = 800$ kg



ΣMB = 0 → RA. 5 – 600. 4 – 800. 1 = 0 → 5 RA – 2400 – 800 = 0
5 RA = 3200 → **RA = 640 kg**

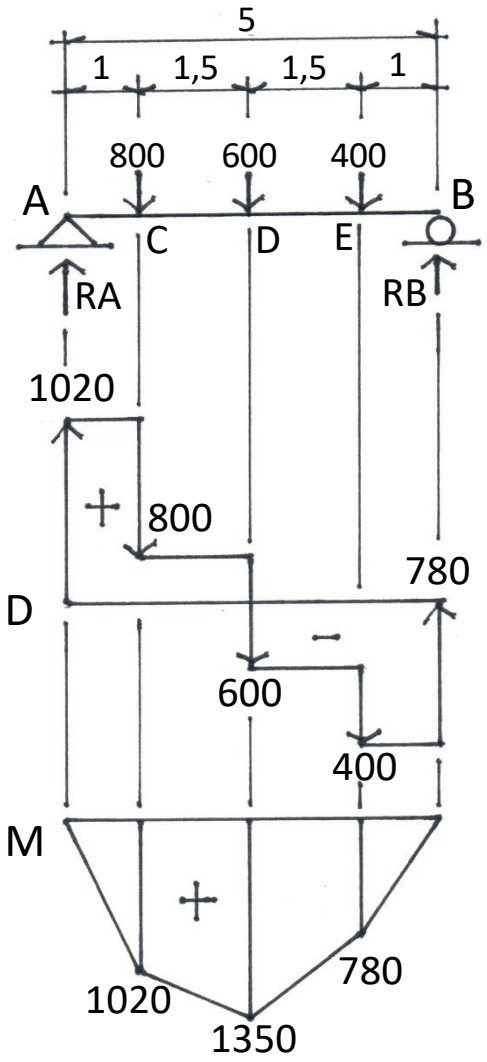
ΣMA = 0 → RB. 5 – 600. 1 – 800. 4 = 0 → 5 RB – 600 – 3200 = 0
5 RB = 3800 → **RB = 760 kg**

ΣV = 0 → RA + RB = $P_1 + P_2$ → 640 + 760 = 600 + 800
1400 = 1400 → ok

MC = RA. 1 = 640. 1 = **640 kgm**
MD = RB. 1 = 760. 1 = **760 kgm**

3.4 Gambar bidang : gaya lintang dan momen.

$P_1 = 800$ kg ; $P_2 = 600$ kg ; $P_3 = 400$ kg



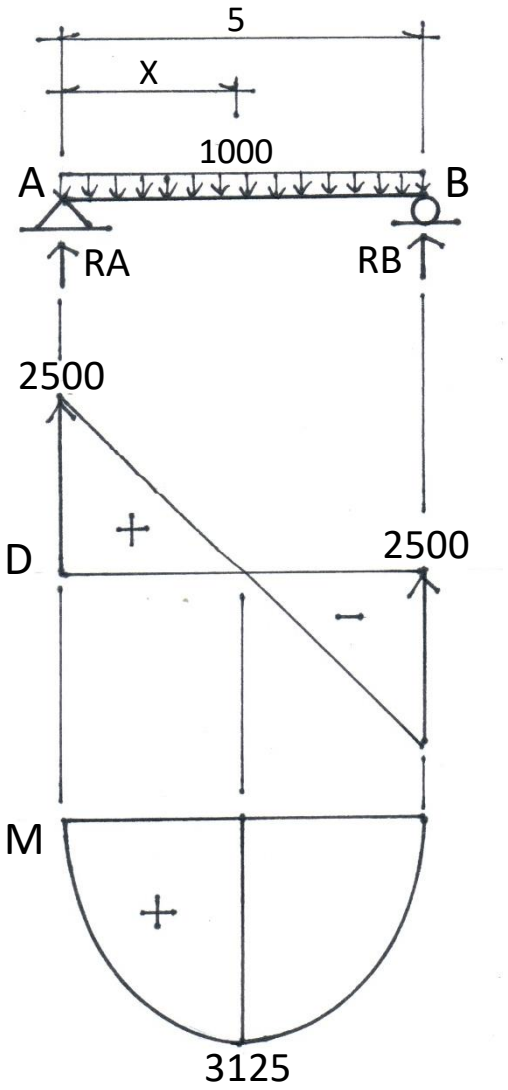
$\Sigma MB = 0 \rightarrow RA. 5 - 800. 4 - 600. 2,5 - 400. 1 = 0$
$5\ RA - 3200 - 1500 - 400 = 0$
$5\ RA = 5100 \rightarrow$ **RA = 1020 kg**

$\Sigma MA = 0 \rightarrow RB. 5 - 800. 1 - 600. 2,5 - 400. 4 = 0$
$5\ RB - 800 - 1500 - 1600 = 0$
$5\ RB = 3900 \rightarrow$ **RB = 780 kg**

$\Sigma V = 0 \rightarrow RA + RB = P_1 + P_2 + P_3 \rightarrow 1020 + 780 = 800 + 600 + 400$
$1800 = 1800 \rightarrow$ ok

$MC = RA. 1 = 1020. 1 =$ **1020 kgm**
$MD = RA. 2,5 - P_1. 1,5 = 1020. 2,5 - 800. 1,5 =$ **1350 kgm**
$ME = RB. 1 = 780. 1 =$ **780 kgm**

3.5 Gambar bidang : gaya lintang dan momen → W = 1000 kg/m



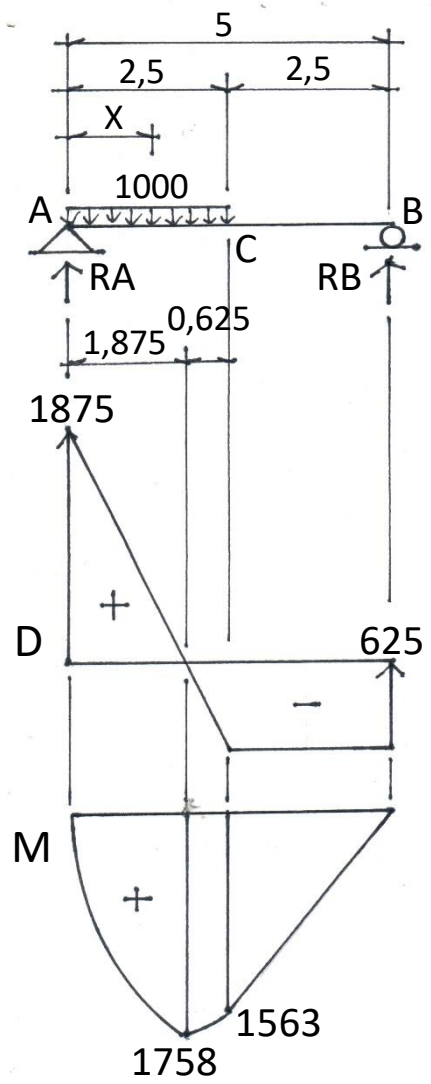
ΣMB = 0 → RA. 5 – W. 5. 2,5 = 0 → 5 RA – 1000. 12,5 = 0
5 RA = 12500 → **RA = 2500 kg**

ΣMA = 0 → RB. 5 – W. 5. 2,5 = 0 → 5 RB – 1000. 12,5 = 0
5 RB = 12500 → **RB = 2500 kg**

ΣV = 0 → RA + RB = W. 5 → 2500 + 2500 = 1000. 5
5000 = 5000 → ok

$MX = RA.\ X - W.\ X.\ 0{,}5\ X = 2500\ X - 1000.\ 0{,}5\ X^2$
$dMX/dX = 2500 - 1000\ X \rightarrow dMX/dX = 0$
$1000\ X = 2500 \rightarrow X = 2{,}5$ m
$M\ maks = M\ lap = 2500.\ 2{,}5 - 500.\ 2{,}5^2$
$= 6250 - 3125 =$ **3125 kgm**

3.6 Gambar bidang : gaya lintang dan momen → W = 1000 kg/m



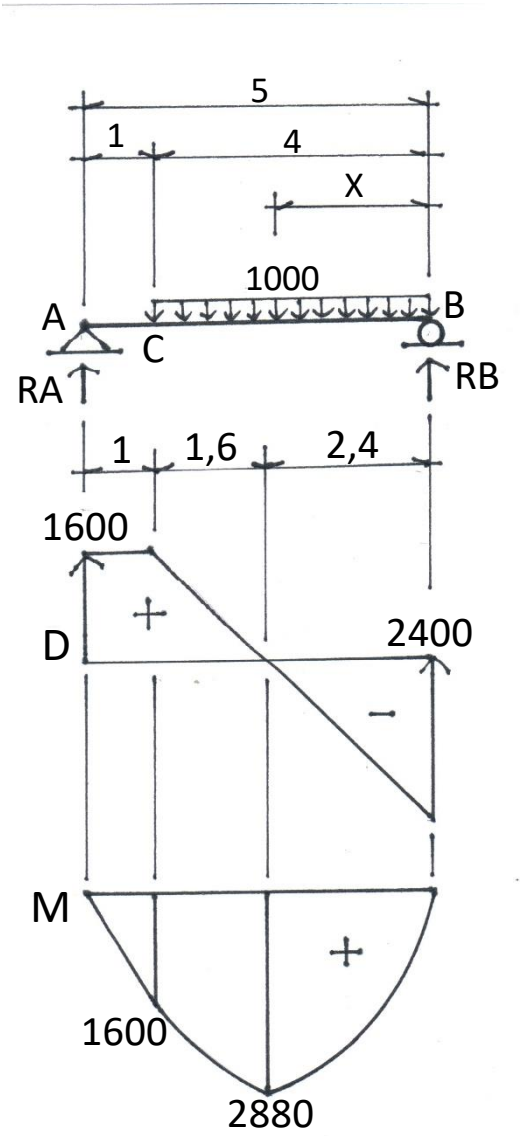
ΣM B = 0 → RA. 5 – W. 2,5. 3,75 = 0 → 5 RA – 1000. 9,375 = 0
5 RA = 9375 → **RA = 1875 kg**

ΣMA = 0 → RB. 5 – W. 2,5. 1,25 = 0 → 5 RB – 1000. 3,125 = 0
5 RB = 3125 → **RB = 625 kg**

ΣV = 0 → RA + RB = W. 2,5 → 1875 + 625 = 1000. 2,5
2500 = 2500 → ok

$MX = RA.\ X - WX.\ 0{,}5\ X = 1875\ X - 1000\ X.\ 0{,}5\ X = 1875\ X - 500\ X^2$
dMX/dX = 1875 – 1000 X → dMX/dX = 0 → 1000 X = 1875
X = 1,875 m dari A
$M\ maks = 1875.\ 1{,}875 - 500.\ 1{,}875^2 = 3516 - 1758 =$ **1758 kgm**
MC = RB. 2,5 = 625. 2,5 = **1563 kgm**

3.7 Gambar bidang : gaya lintang dan momen → W = 1000 kg/m



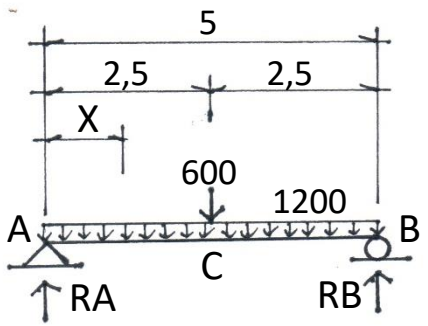
ΣMB = 0 → RA. 5 – W. 4. 2 = 0 → 5 RA – 1000. 8 = 0
5 RA = 8000 → **RA = 1600 kg**

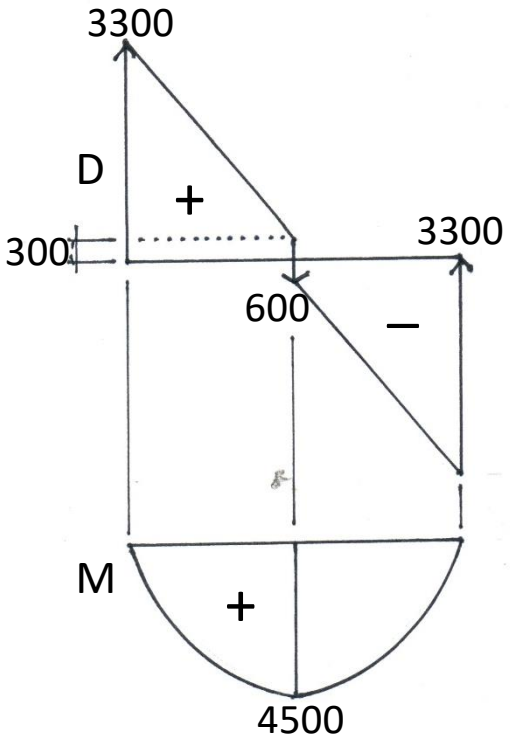
ΣMA = 0 → RB. 5 – W. 4. 3 = 0 → 5 RB – 1000. 12 = 0
5 RB = 12000 → **RB = 2400 kg**

ΣV = 0 → RA + RB = W. 4 → 1600 + 2400 = 1000. 4
4000 = 4000 → ok

$MX = RB.\ X - WX.\ 0{,}5\ X = 2400\ X - 1000.\ 0{,}5\ X^2$
$dMX/dX = 2400 - 1000\ X \rightarrow dMX/dX = 0$
1000 X = 2400 → X = 2,4 m dari B
$M\ maks = 2400.\ 2{,}4 - 500.\ 2{,}4^2 = 5760 - 2880 =$ **2880 kgm**
MC = RA. 1 = 1600. 1 = **1600 kgm**

3.8 Gambar bidang : gaya lintang dan momen → W = 1200 kg/m dan P = 600 kg





ΣMB = 0 → 5 RA – W. 5. 2,5 – P. 2,5 = 0 → 5 RA – 1200. 12,5 – 600. 2,5 = 0
5 RA – 1500 – 15000 = 0 → 5 RA = 16500 → **RA = 3300 kg**

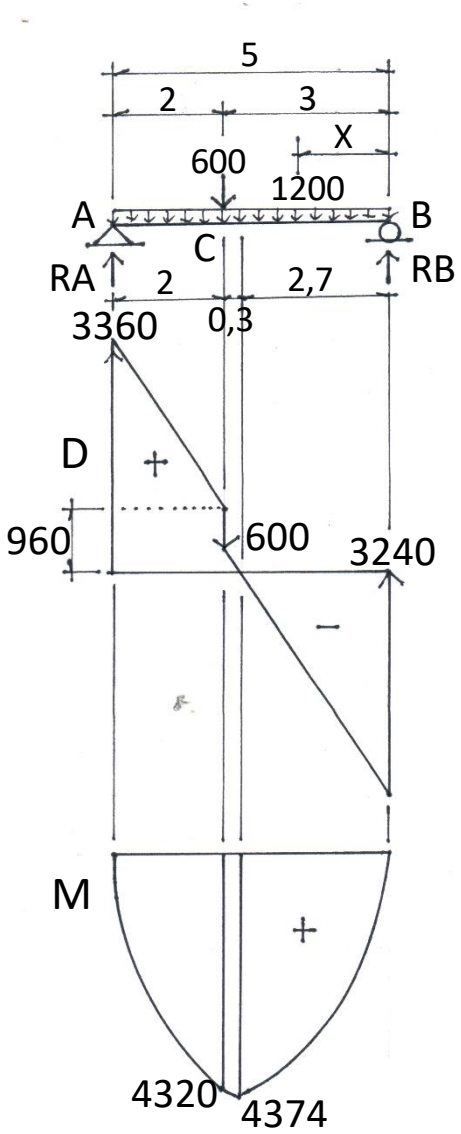
ΣMA = 0 → 5 RB – W. 5. 2,5 – P. 2,5 = 0 → 5 RB – 1200. 12,5 – 600. 2,5 = 0
5 RB – 1500 – 15000 = 0 → 5 RB = 16500 → **RB = 3300 kg**

ΣV = 0 → RA + RB = W. 5 + P → 3300 + 3300 = 1200. 5 + 600
6600 = 6600 → ok
DC = RA – W. 2,5 = 3300 – 1200. 2,5 = 300 kg

MX = RA. X – WX. 0,5 X = 3300. X – 1200. 0,5 X^2
dMX/dX = 3300 – 1200 X → dMX/dX = 0 → 1200 X = 3300
X = 2,75 m > 2,75 m → tidak mungkin
M maks = MC = 3300. 2,5 – 600. $2,5^2$ = 8250 – 3750 = **4500 kgm**

3.9 Gambar bidang : gaya lintang dan momen.

W = 1200 kg/m ; P = 600 kg



ΣMB = 0 → RA. 5 – P. 3 – W. 5. 2,5 = 0 → 5 RA – 600. 3 – 1200. 12,5 = 0
5 RA – 1800 – 15000 = 0 → 5 RA = 16800 → RA = 3360 kg

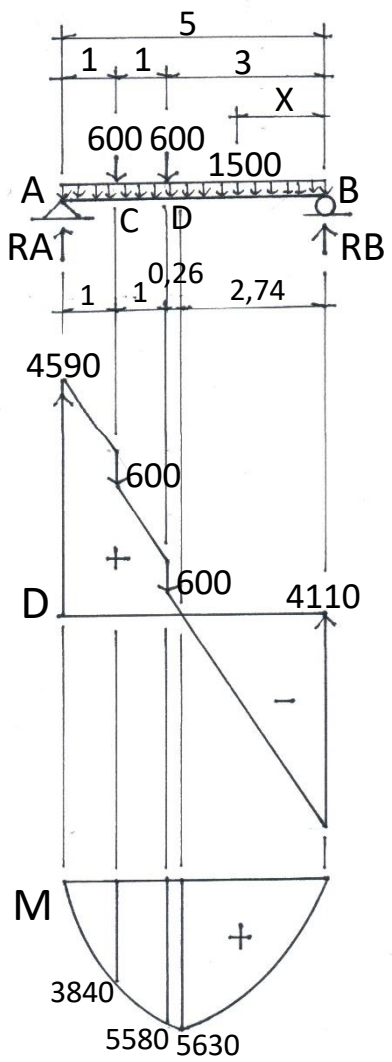
ΣMB = 0 → RB. 5 – P. 2 – W. 5. 2,5 = 0 → 5 RB – 600. 2 – 1200. 12,5 = 0
5 RB – 1200 – 15000 = 0 → 5 RB = 16200 → RB = 3240 kg

ΣV = 0 → RA + RB = P + W. 5 → 3360 + 3240 = 600 + 1200. 5
6600 = 6600 → ok
DC = RA – W. 2 = 3360 – 1200. 2 = 960 kg

$MX = RB.\ X – W\ X.\ 0,5\ X^2 = 3240\ X – 1200.\ 0,5\ X^2$
$dMX/dX = 3240 – 1200\ X$ → $dMX/dX = 0$ → $1200\ X = 3240$
X = 2, 7 m dari B
$M\ maks = 3240,\ 2,7 – 600.\ 2,7^2 = 8748 – 4374 = 4374$ kgm
MC = RA. 2 – W. 2. 1 = 3360. 2 – 1200. 2 = 6720 – 2400 = 4320 kgm

3.10 Gambar bidang : gaya lintang dan momen.

P = 600 kg ; W = 1500 kg/m



ΣMB = 0 → RA. 5 – P. 4 – P. 3 – W. 5. 0,5. 5 = 0
5 RA – 600. 4 – 600. 3 – 1500. 12,5 = 0 → 5 RA – 2400 - 1800 – 18750 = 0
5 RA = 22950 → **RA = 4590 kg**

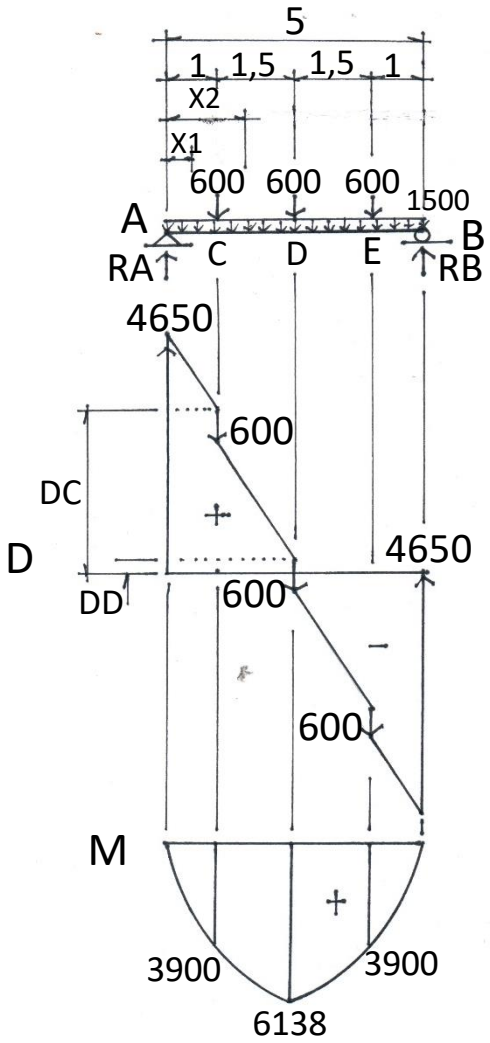
ΣMA = 0 → 5 RB – P. 1 – P. 2 – W. 5. 0,5. 5 = 0
5 RB – 600. 1 – 600. 2 – 1500. 12,5 = 0 → 5 RB – 600 – 1200 – 18750 = 0
5 RB = 20550 → **RB = 4110 kg**

ΣV = 0 → RA + RB = P + P + W. 5 → 4590 + 4110 = 600 + 600 + 1500. 5
8700 = 8700 → ok
DC = RA – W. 1 = 4590 – 1500. 1 = 3090 kg
DD = RB – W. 3 = 4110 – 1500. 3 = - 390 kg

$MX = RB.\ X - 0{,}5\ WX^2 = 4110\ X - 0{,}5.\ 1500\ X^2$
$dMX/dX = 4110 - 1500\ X \rightarrow dMX/dX = 0 \rightarrow 1500\ X = 4110 \rightarrow X = 2{,}74$ m
$M\ maks = 4110.\ 2{,}74 - 750.\ 2{,}74^2 = 11261 - 5631 =$ **5630 kgm**
$MC = 4590.\ 1 - 0{,}5.\ 1500.\ 1^2 = 4590 - 750 =$ **3840 kgm**
$MD = 4110.\ 3 - 0{,}5.\ 1500.\ 3^2 = 12330 - 6750 =$ **5580 kgm**

3.11 Gambar bidang : gaya lintang dan momen

P = 600 kg ; W = 1500 kg/m



$\Sigma MB = 0 \rightarrow RA.\ 5 - P.\ 4 - P.\ 2{,}5 - P.\ 1 - W.\ 5.\ 0{,}5.\ 5 = 0$

$5\ RA - 600.\ 4 - 600.\ 2{,}5 - 600.\ 1 - 1500.\ 5.\ 2{,}5 = 0$

$5\ RA - 2400 - 1500 - 600 - 18750 = 0$

$5\ RA = 23250 \rightarrow$ **RA = 4650 kg**

Struktur simetris → **RA = RB = 4650 kg**

$DC = RA - W\ 1 = 4650 - 1500.\ 1 = 3150$ kg

$DD = RA - P - W\ 2{,}5 = 4650 - 600 - 1500.\ 2{,}5 = 4050 - 3750 = 300$ kg

$X_1 = (0 - 1)$ m $\rightarrow MX = RA.\ X_1 - 0{,}5\ W\ X_1^2 = 4650\ X - 0{,}5.\ 1500\ X_1^2$

$dMX/dX = 4650 - 1500\ X_1 \rightarrow dMX/dX = 0 \rightarrow 1500\ X_1 = 4650 \rightarrow$

$X_1 = 3{,}1$ m > 1m → tidak mungkin

$X_2 = (0 - 2{,}5)$ m $\rightarrow MX = RA.\ X_2 - P\ (X_2 - 1) - 0{,}5\ W\ X_2^2$

$MX = 4650\ X_2 - 600\ (X_2 - 1) - 0{,}5.\ 1500\ X_2^2$

$= 4650\ X_2 - 600\ X_2 + 600 - 750\ X_2^2 = 4050\ X_2 + 600 - 750\ X_2^2$

$dMX/dX = 4050\ X - 1500\ X_2 \rightarrow dMX/dX = 0 \rightarrow 1500\ X_2 = 4050$

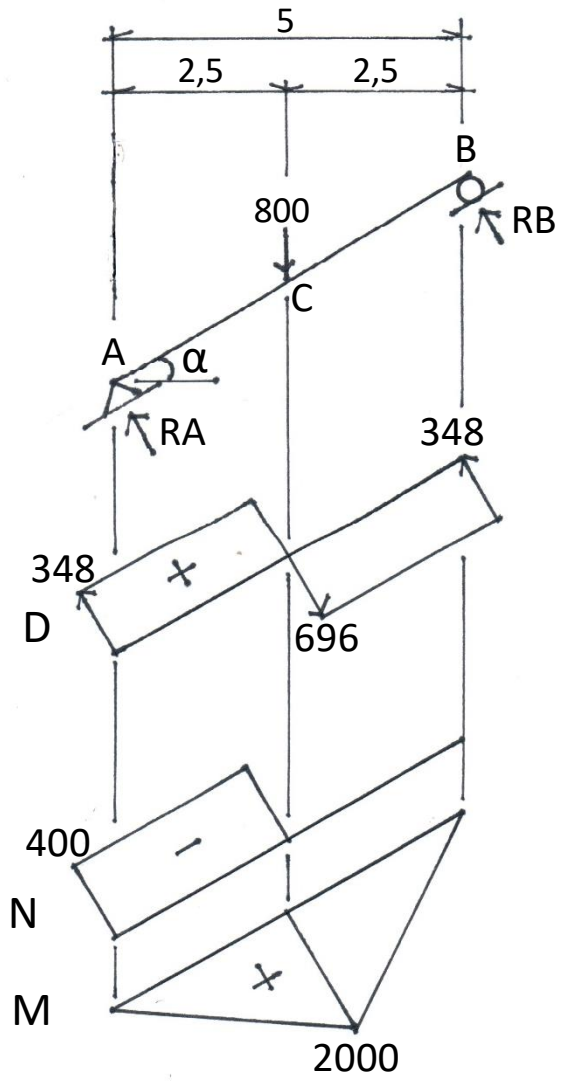
$X_2 = 2{,}7$ m > 2,5 m → tidak mungkin

$M\ maks = M\ lap = MD = RA.\ 2{,}5 - P.\ 1{,}5 - 0{,}5\ W\ 2{,}5^2$

$= 4650.\ 2{,}5 - 600.\ 1{,}5 - 0{,}5.\ 1500.\ 2{,}5^2 = 11625 - 900 - 4687 =$ **6038 kgm**

$MC = ME = RA.\ 1 - W\ 1.\ 0{,}5 = 4650.\ 1 - 1500.\ 0{,}5 = 4650 - 750 =$ **3900 kgm**

3.12 Gambar bidang : gaya lintang dan momen → P = 800 kg , α = 30°



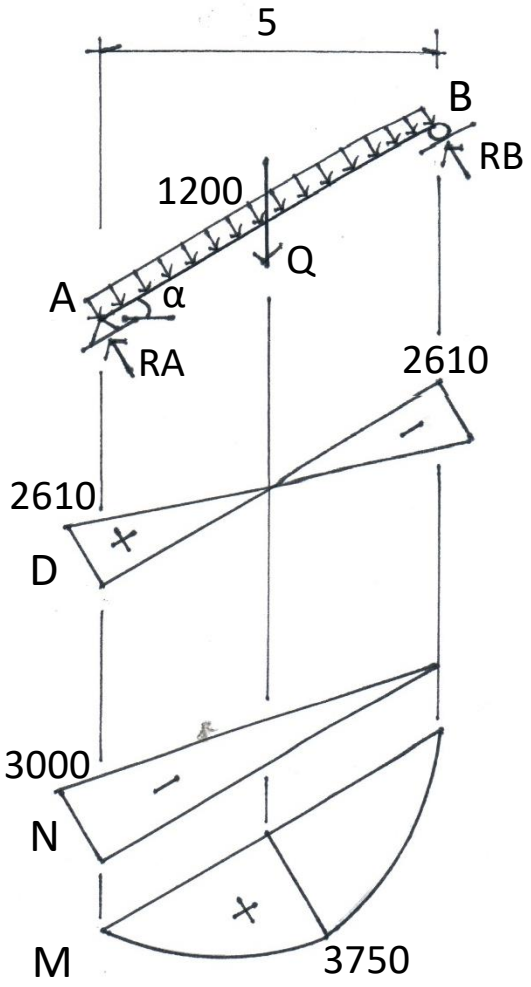
ΣV = 0 → RA = RB = 0,5 P cos 30° = 0,5. 800. 0,87 = **348 kg**

ΣH = 0 → RAH = P sin 30° = 800. 0,5 = **400 kg**

MC = 0,5 P. 5 = 0,5. 800. 5 = **2000 kgm**

3.13 Gambar bidang : gaya lintang, gaya aksial, momen →

W = 1200 kg/m, α = 30°



Q = W L = 1200. 5 = 6000 kg

ΣV = 0 → RA = RB = 0,5 Q cos 30°

= 0,5. 6000. 0,87 = **2610 kg**

ΣH = 0→RAH = Q sin 30° = 6000. 0,5

= **3000 kg**

M maks = 1/8 W L^2 = 1/8. 1500. 5^2

= **3750 kgm**