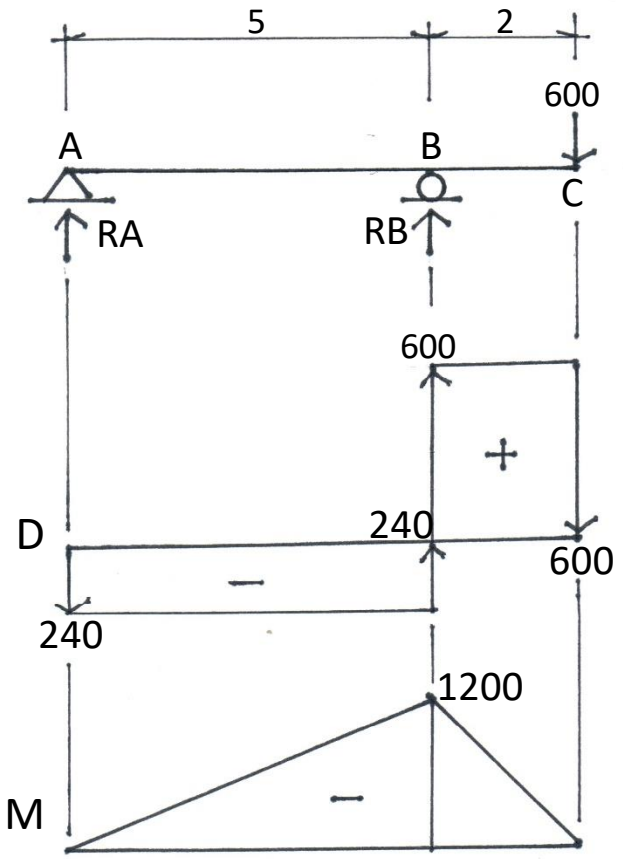
BAB 4 BALOK SEDERHANA DENGAN TAMBAHAN KANTILEVEL

4.1 Gambar bidang : gaya lintang dan momen → P = 600 kg



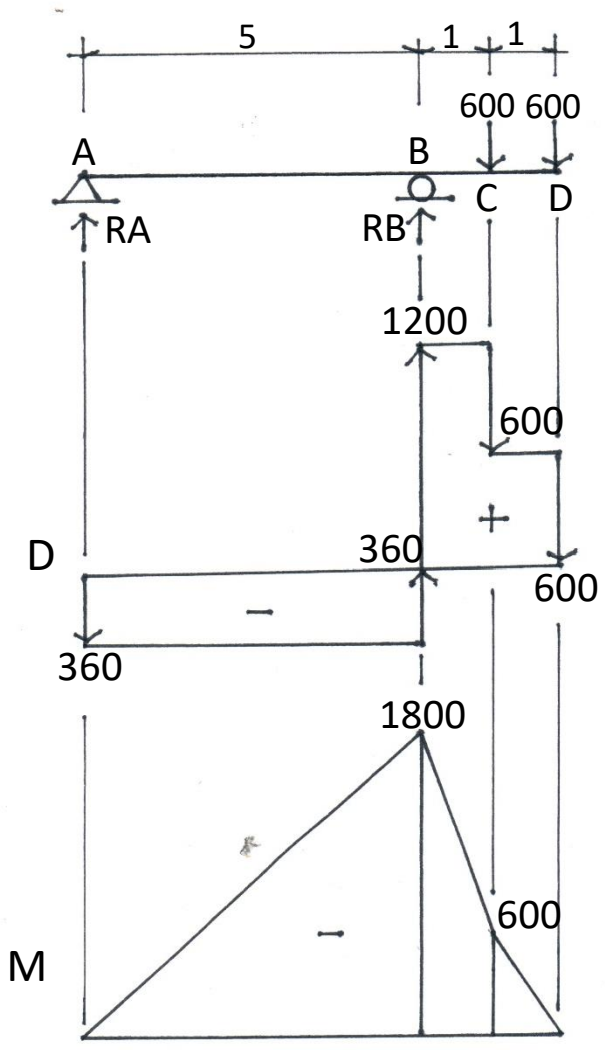
ΣMB = 0 → RA 5 + P 2 = 0 → 5 RA + 600. 2 = 0 → 5 RA = - 1200
RA = - 240 kg

ΣMA = 0 → RB 5 – P 7 = 0 → 5 RB – 600. 7 = 0 → 5 RB = 4200
RB = 840 kg

ΣV = 0 → RA + RB = P → - 240 + 840 = 600 → 600 = 600 → ok
RBC = P = 600 kg
RBA = RB – RBC = 840 – 600 = 240 kg

MB = P 2 = 600. 2 = **1200 kgm**

4.2 Gambar bidang : gaya lintang dan momen → P = 600 kg



ΣMB = 0 → RA 5 + P 1 + P 2 = 0 → 5 RA + 600. 1 + 600. 2 = 0
5 RA + 600 + 1200 = 0 → 5 RA = - 1800 → **RA = - 360 kg**

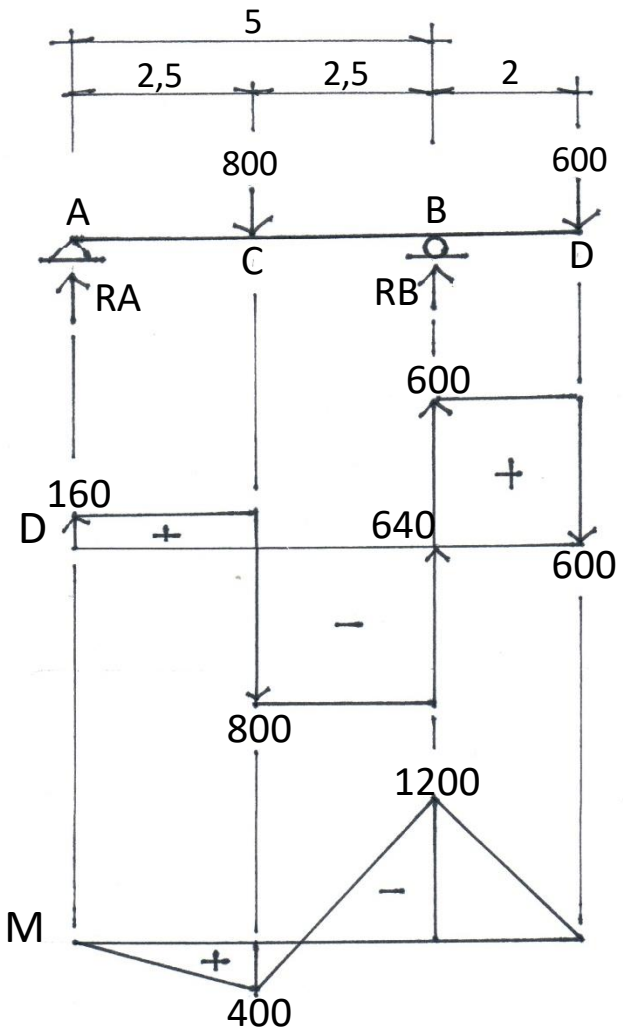
ΣMB = 0 → RB 5 – P 6 – P 7 = 0 → 5 RB – 600. 6 – 600. 7 = 0
5 RB – 3600 – 4200 = 0 → 5 RB = 7800 → **RB = 1560 kg**

ΣV = 0 → RA + RB = 2 P → - 360 + 1560 = 2. 600
1200 = 1200 → ok
RBD = 2 P = 2. 600 = 1200 kg
RBA = RB – RBD = 1560 – 1200 = 360 kg

MB = P 1 + P 2 = 600.1 + 600. 2 = 600 + 1200 = **1800 kg**
MC = P 1 = 600. 1 = **600 kgm**

4.3 Gambar bidang : gaya lintang dan momen, P_1 = 800 kg

P_2 = 600 kg



$\Sigma MB = 0 \rightarrow RA\ 5 + P_2 .2 - P_1 .2,5 = 0 \rightarrow 5\ RA + 600.\ 2 - 800.\ 2,5 = 0$

$5\ RA + 1200 - 2000 = 0 \rightarrow 5\ RA - 800 = 0 \rightarrow 5\ RA = 800$

RA = 160 kg

$\Sigma MA = 0 \rightarrow RB\ 5 - P_1 .2,5 - P_2 .7 = 0 \rightarrow 5\ RB - 800.\ 2,5 - 600.\ 7 = 0$

$5\ RB - 2000 - 4200 = 0 \rightarrow 5\ RB - 6200 = 0 \rightarrow 5\ RB = 6200$

RB = 1240 kg

$\Sigma V = 0 \rightarrow RA + RB = P_1 + P_2 \rightarrow 160 + 1240 = 800 + 600$

$1400 = 1400 \rightarrow$ ok

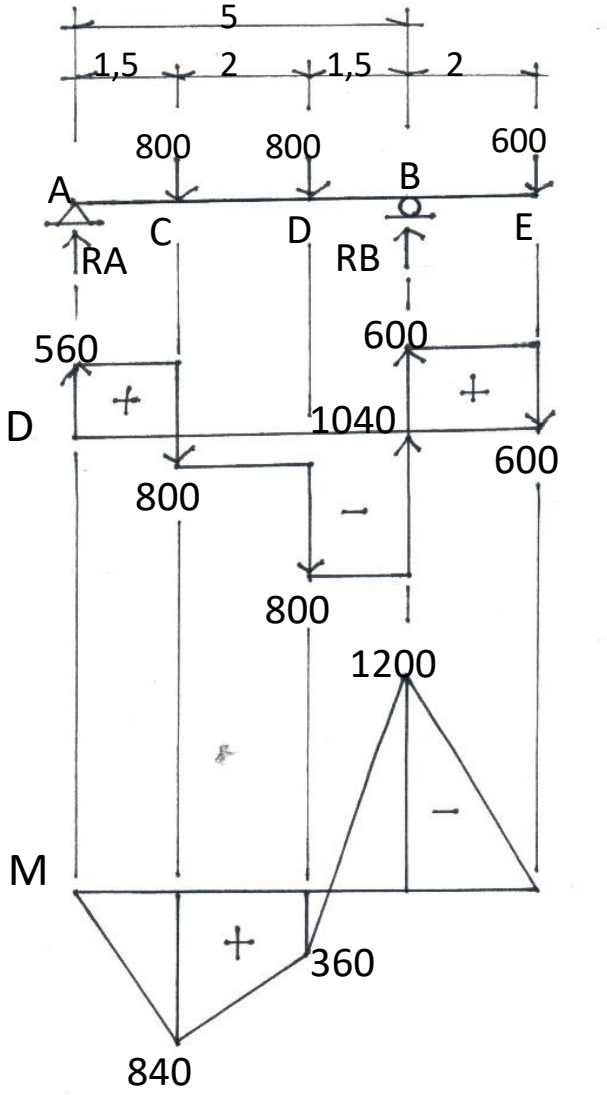
$RBD = P_2 = 600$ kg ; $RBA = RB - RBD = 1240 - 600 = 640$ kg

$MB = P_2.\ 2 = 600.\ 2 =$ **1200 kgm**

$MC = RA.\ 2,5 = 160.\ 2,5 =$ **400 kgm**

4.4 Gambar bidang : gaya lintang dan momen, P_1 = 800 kg

P_2 = 600 kg



$\Sigma MB = 0 \rightarrow RA \cdot 5 + P_2 \cdot 2 - P_1 \cdot 1,5 - P_1 \cdot 3,5 = 0$

$5\ RA + 600 \cdot 2 - 800 \cdot 1,5 - 800 \cdot 3,5 = 0 \rightarrow 5\ RA + 1200 - 1200 - 2800 = 0$

$5\ RA - 2800 = 0 \rightarrow 5\ RA = 2800 \rightarrow$ **RA = 560 kg**

$\Sigma MA = 0 \rightarrow RB \cdot 5 - P_1 \cdot 1,5 - P_1 \cdot 3,5 - P_2 \cdot 7 = 0$

$5\ RB - 800 \cdot 1,5 - 800 \cdot 3,5 - 600 \cdot 7 = 0 \rightarrow 5\ RB - 1200 - 2800 - 4200 = 0$

$5\ RB - 8200 = 0 \rightarrow$ **RB = 1640 kg**

$\Sigma V = 0 \rightarrow RA + RB = 2\ P_1 + P_2 \rightarrow 560 + 1640 = 2 \cdot 800 + 600$

$2200 = 2200 \rightarrow$ ok

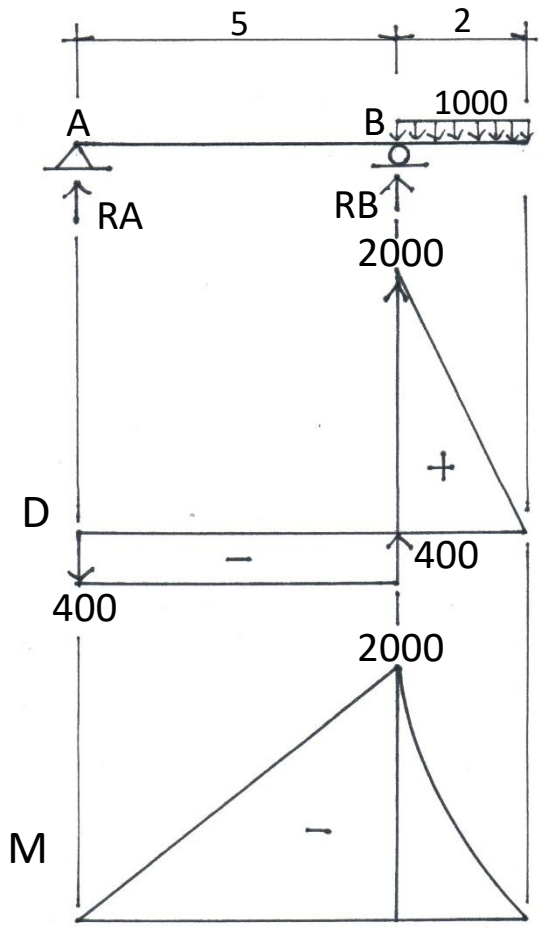
$RBE = P_2 = 600$ kg ; $RBA = RB - RBE = 1640 - 600 = 1040$ kg

$MB = P_2 \cdot 2 = 600 \cdot 2 =$ **1200 kgm**

$MC = RA \cdot 1,5 = 560 \cdot 1,5 =$ **840 kgm**

$MD = RB \cdot 1,5 - P_2 \cdot 3.5 = 1640 \cdot 1,5 - 600 \cdot 3,5 = 2460 - 2100 =$ **360 kgm**

4.5 Gambar bidang : gaya lintang dan momen, W = 1000 kg/m



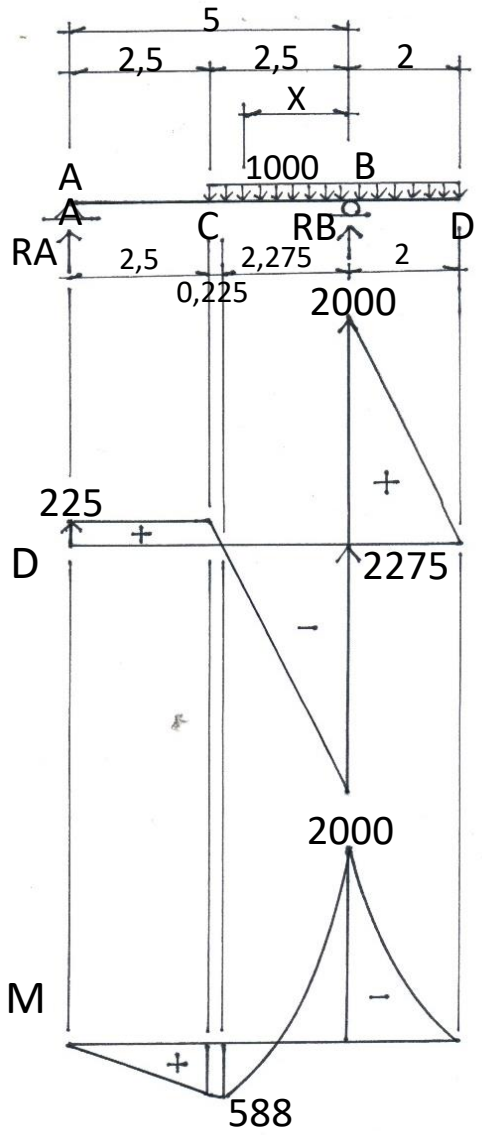
ΣMB = 0 → RA. 5 + W. 2. 1 = 0 → 5 RA + 1000.2 = 0 → 5 RA = -2000
RA = - 400 kg

ΣMA = 0 → RB. 5 – W. 2. 6 = 0 → 5 RB – 1000. 12 = 0 → 5 RB = 12000
RB = 2400 kg

ΣV = 0 → RA + RB = Q → - 400 + 2400 = 1000. 2
2000 = 2000 → ok

MB = W. 2. 1 = 1000. 2 = **2000 kgm**

4.6 Gambar bidang : gaya lintang dan momen, W = 1000 kg/m



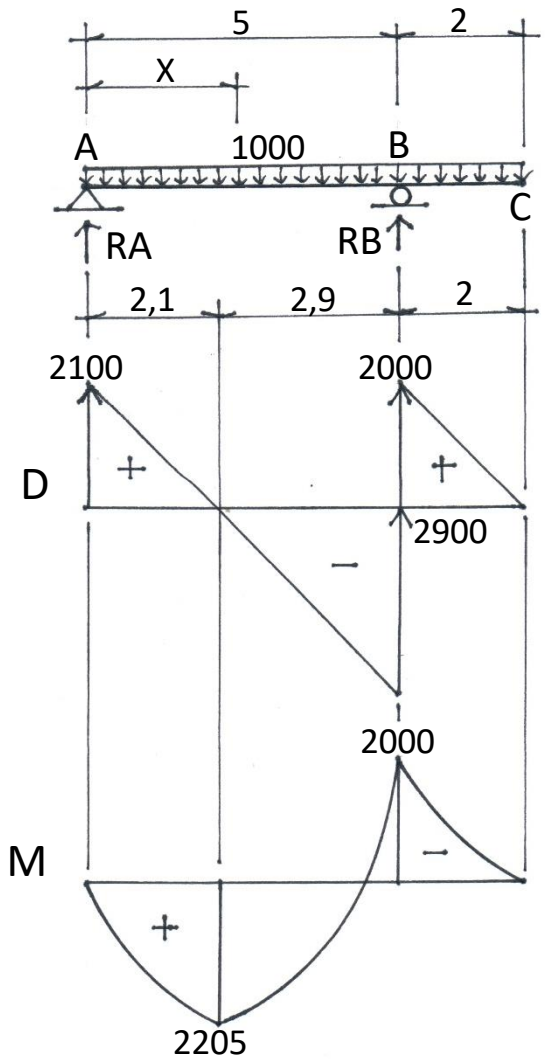
$\Sigma MB = 0 \rightarrow RA.\ 5 + W.\ 2.\ 1 - W.\ 2{,}5.\ 1{,}25 = 0 \rightarrow 5\ RA + 1000.\ 2 - 1000.\ 3{,}125 = 0$
$5\ RA + 2000 - 3125 = 0 \rightarrow 5\ RA - 1125 = 0 \rightarrow 5\ RA = 1125 \rightarrow$ **RA = 225 kg**

$\Sigma MA = 0 \rightarrow 5\ RB - W.\ 2{,}5.\ 3{,}75 - W.\ 2.\ 6 = 0 \rightarrow 5\ RB - 1000.\ 9{,}375 - 1000.\ 12 = 0$
$5\ RB - 9375 - 12000 = 0 \rightarrow 5\ RB - 21375 = 0 \rightarrow 5\ RB = 21375 \rightarrow$ **RB = 4275 kg**

$\Sigma V = 0 \rightarrow RA + RB = Q \rightarrow 225 + 4275 = 1000.\ 4{,}5 \rightarrow 4500 = 4500 \rightarrow$ ok
$RBD = Q = 1000.\ 2 = 2000$ kg
$RBA = RB - RBD = 4275 - 2000 = 2275$ kg

$MX = RB.\ X - W.\ 2\ (1 + X) - W\ X\ 0{,}5\ X = 4275\ X - 1000.\ 2\ (1 + X) - 1000.\ 0{,}5\ X^2$
$= 4275\ X - 2000 - 2000\ X - 500\ X^2 = 2275\ X - 2000 - 500\ X^2$
$dMX/dX = 2275 - 1000\ X \rightarrow dMX/dX = 0 \rightarrow 1000\ X = 2275 \rightarrow X = 2{,}275$ m
$M\ maks = 2275.\ 2{,}275 - 2000 - 500.\ 2{,}275^2 = 5176 - 2000 - 2588 =$ **588 kgm**
$MB = W.\ 2.\ 1 = 1000.\ 2 =$ **2000 kgm**
$MC = RA.\ 2{,}5 = 225.\ 2{,}5 =$ **653 kgm**

4.7 Gambar bidang : gaya lintang dan momen, W = 1000 kg/m



ΣMB = 0 → RA. 5 + W. 2. 1 - W. 5. 2,5 = 0 → 5 RA + 1000. 2 – 1000. 12,5 = 0
5 RA + 2000 – 12500 = 0 → 5 RA – 10500 = 0 → 5 RA = 10500
RA = 2100 kg

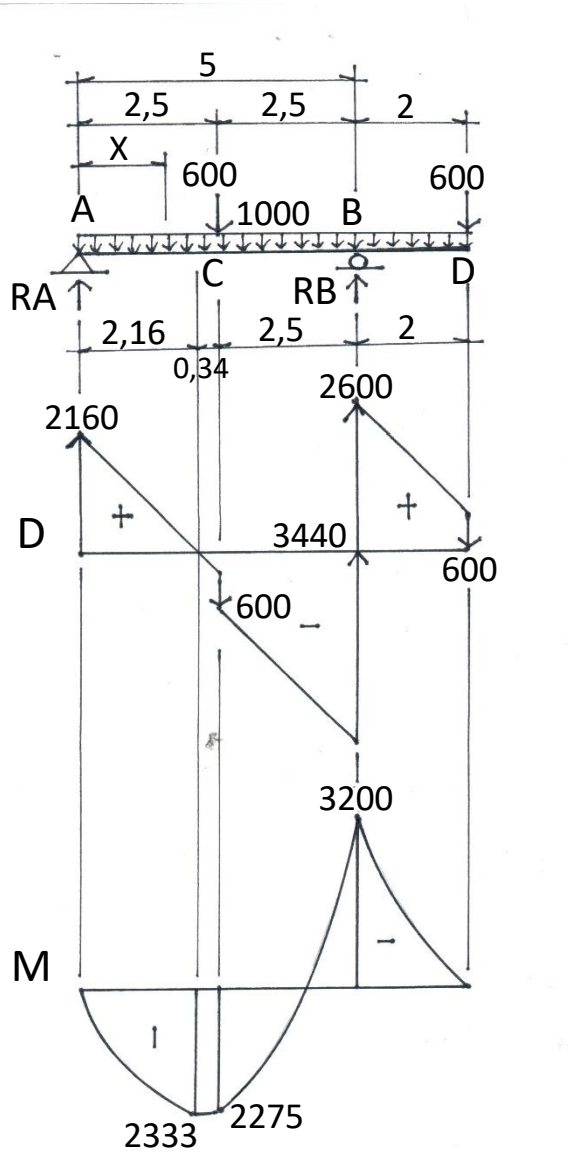
ΣMA = 0 → RB. 5 – W. 5. 2,5 – W.2. 6 = 0 → 5 RB – 1000. 12,5 – 1000. 12 = 0
5 RB – 12500 – 12000 = 0 → 5 RB – 24500 = 0 → 5 RB = 24500
RB = 4900 kg

ΣV = 0 → RA + RB = Q → 2100 + 4900 = 1000. 7
7000 = 7000 → ok
RBC = Q = 1000. 2 = 2000 kg
RBA = RB – RBC = 4900 – 2000 = 2900 kg

$MX = RA. X – 0,5\ W\ X^2 = 2100\ X – 0,5. 1000\ X^2$
dMX /dX = 2100 – 1000 X → dMX/dX = 0 → 1000 X = 2100 → X = 2,1 m
$M\ maks = 2100. 2,1 – 500. 2,1^2 = 4410 – 2205 =$ **2205 kgm**
MB = W. 2. 1 = 1000. 2 = **2000 kgm**

4.8 Gambar bidang : gaya lintang dan momen, W = 1000 kg/m

P = 600 kg



ΣMB = 0 → RA. 5 + W. 2. 1 – W. 5. 2,5 + P.2 – P. 2,5 = 0
5 RA + 1000. 2 – 1000. 12,5 + 600. 2 – 600. 2,5 = 0
5 RA + 2000 – 12500 + 1200 – 1500 = 0 → 5 RA – 10800 = 0
5 RA = 10800 → **RA = 2160 kg**

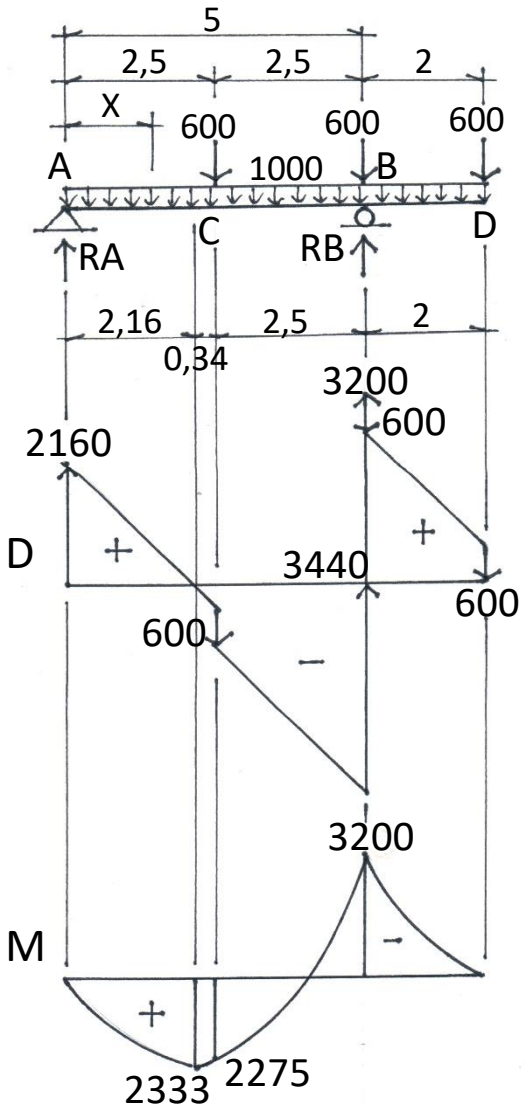
ΣMA = 0 → RB. 5 – W. 7. 3,5 – P. 2,5 – P. 7 = 0
5 RB – 1000. 24,5 – 600. 2,5 – 600. 7 = 0
5 RB – 24500 – 1500 – 4200 = 0 → 5 RB – 30200 = 0
5 RB = 30200 → **RB = 6040 kg**

ΣV = 0 → RA + RB = Q + 2 P → 2160 + 6040 = 1000. 7 + 2. 600
8200 = 8200 → ok
RBD = 600 + 1000. 2 = 2600 kg ; RBA = 6040 – 2600 = 3440 kg

MX = RA. X – 0,5 W X^2 = 2160 X – 0,5. 1000 X^2 → dMX/dX = 2160 – 1000 X
dMX/dX = 0 → 1000 X = 2160 → X = 2,16 m
M maks = 2160. 2,16 – 500. $2,16^2$ = 4666 – 2333 = **2333 kgm**
MB = 600. 2 + 1000. 2. 1 = 1200 + 2000 = **3200 kgm**
MC = 2160. 2,5 – 1000. 2,5. 1,25 = 5400 – 3125 = **2275 kgm**

4.9 Gambar bidang : gaya lintang dan momen, W = 1000 kg/m

P = 600 kg



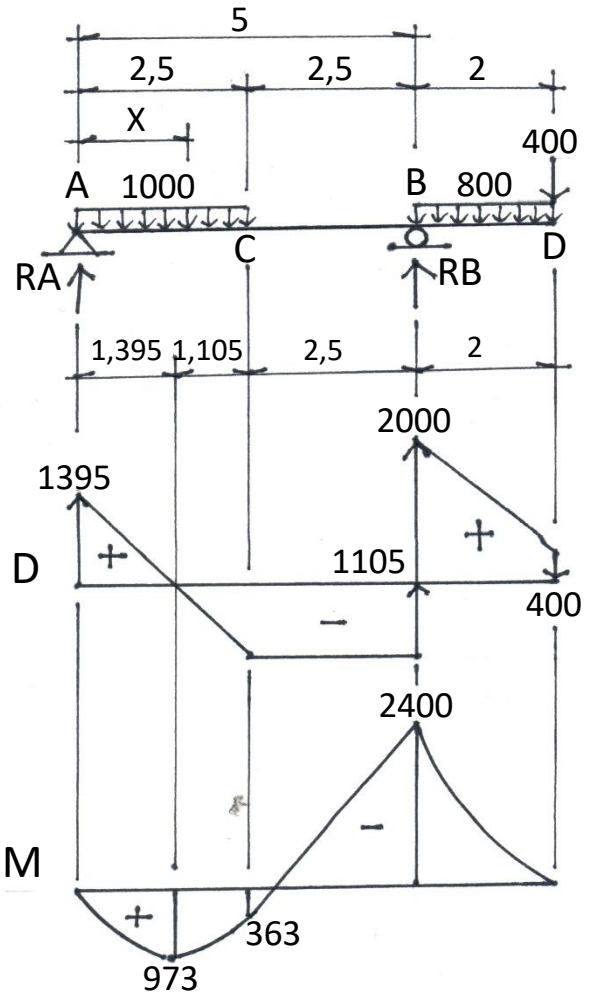
ΣMB = 0 → RA. 5 + 600. 2 – 600. 2,5 + 1000. 2. 1 – 1000. 5. 2,5 = 0
5 RA + 1200 – 1500 + 2000 – 12500 = 0 → 5 RA – 10800 = 0
5 RA = 10800 → **RA = 2160 kg**

ΣMA = 0 → RB. 5 – 600. 2,5 – 600. 5 – 600. 7 – 1000.7. 3,5 = 0
5 RB – 1500 – 3000 – 4200 – 24500 = 0 → 5 RB – 33200 = 0
5 RB = 33200 → **RB = 6640 kg**

ΣV = 0 → 2160 + 6640 = 3. 600 + 1000. 7 → 8800 = 8800 → ok
RBD = 2. 1000 + 600 + 600 = 3200 kg
RBA = 6640 – 3200 = 3440 kg

MX = 2160 X – 0,5. 1000 X^2 → dMX/dX = 2160 – 1000 X
dMX/dX = 0 → 1000 X = 2160 → X = 2,16 m
M maks = 2160. 2,16 – 500. $2,16^2$ = 4666 – 2333 = **2333 kgm**
MB = 600. 2 + 1000. 2. 1 = 1200 + 2000 = **3200 kgm**
MC = 2160. 2,5 – 1000. 2,5. 1,25 = 5400 – 3125 = **2275 kgm**

4.10 Gambar bidang : gaya lintang dan momen, W_1 = 1000 kg/m, W_2 = 800 kg/m, P = 400 kg



$\Sigma MB = 0 \rightarrow RA.\ 5 + P.\ 2 + W_2.\ 2.\ 1 - W_1.\ 2{,}5.\ 3{,}75 = 0$
$5\ RA + 400.\ 2 + 800.\ 2 - 1000.\ 9{,}375 = 0 \rightarrow 5\ RA + 800 + 1600 - 9375 = 0$
$5\ RA - 6975 = 0 \rightarrow 5\ RA = 6975 \rightarrow$ **RA = 1395 kg**

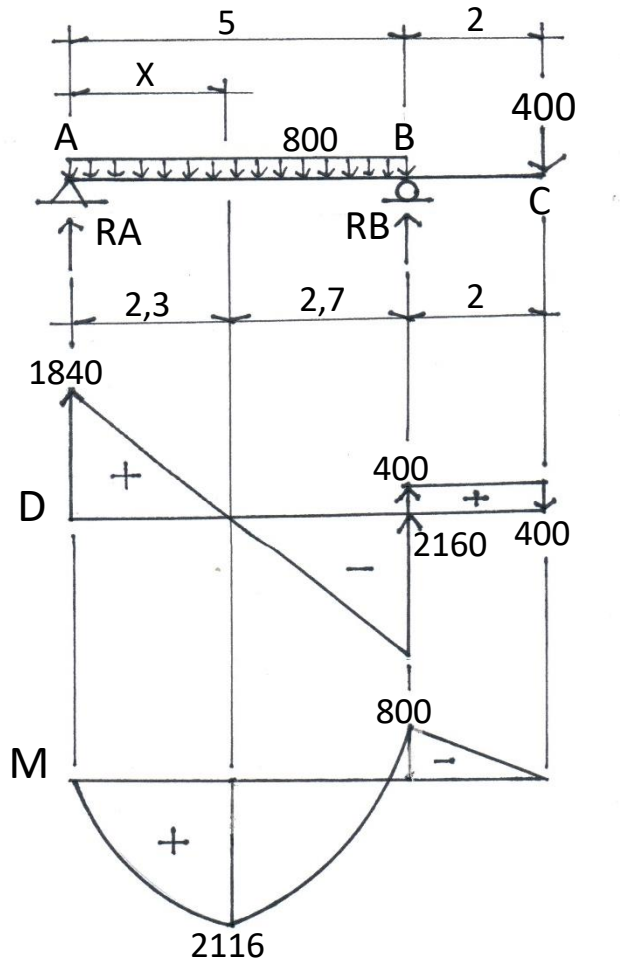
$\Sigma MA = 0 \rightarrow RB.\ 5 - W_1.\ 2{,}5.\ 1{,}25 - W_2.\ 2.\ 6 - P.\ 7 = 0$
$5\ RB - 1000.\ 3{,}125 - 800.\ 12 - 400.\ 7 = 0 \rightarrow 5\ RB - 3125 - 9600 - 2800 = 0$
$5\ RB - 15525 = 0 \rightarrow 5\ RB = 15525 \rightarrow$ **RB = 3105 kg**

$\Sigma V = 0 \rightarrow RA + RB = Q_1 + Q_2 + P \rightarrow 1395 + 3105 = 2500 + 1600 + 400$
$4500 = 4500 \rightarrow$ ok
RBD = 400 + 800. 2 = 2000 kg
RBA = 3105 – 2000 = 1105 kg

$MX = 1395\ X - 0{,}5.\ 1000\ X^2 \rightarrow dMX/dX = 1395 - 1000\ X$
$dMX/dX = 0 \rightarrow 1000\ X = 1395 \rightarrow X = 1{,}395$ m
M maks = $1395.\ 1{,}395 - 500.\ 1{,}395^2 = 1946 - 973 =$ **973 kgm**
MB = 400. 2 + 800. 2. 1 = 800 + 1600 = **2400 kgm**
MC = 1395. 2,5 - 1000. 2,5. 1,25 = 3488 – 3125 = **363 kgm**

4.11 Gambar bidang : gaya lintang dan momen, W = 800 kg/m

P = 400 kg



ΣMB = 0 → RA. 5 + 400. 2 – 800. 5. 2,5 = 0 → 5 RA + 800 – 10000 = 0
5 RA – 9200 = 0 → 5 RA = 9200 → **RA = 1840 kg**

ΣMA = 0 → RB. 5 – 800. 5. 2,5 – 400. 7 = 0 → 5 RB – 10000 – 2800 = 0
5 RB – 12800 = 0 → 5 RB = 12800 → **RB = 2560 kg**

ΣV = 0 → 1840 + 2560 = 800. 5 + 400 → 4400 = 4400 → ok

$MX = 1840\ X – 0{,}5.\ 800\ X^2$ → $dMX/dX = 1840 – 800\ X$ → $dMX/dX = 0$
800 X = 1840 → X = 2,3 m
M maks = $1840.\ 2{,}3 – 400.\ 2{,}3^2 = 4232 – 2116 =$ **2116 kgm**
MB = 400. 2 = **800 kgm**