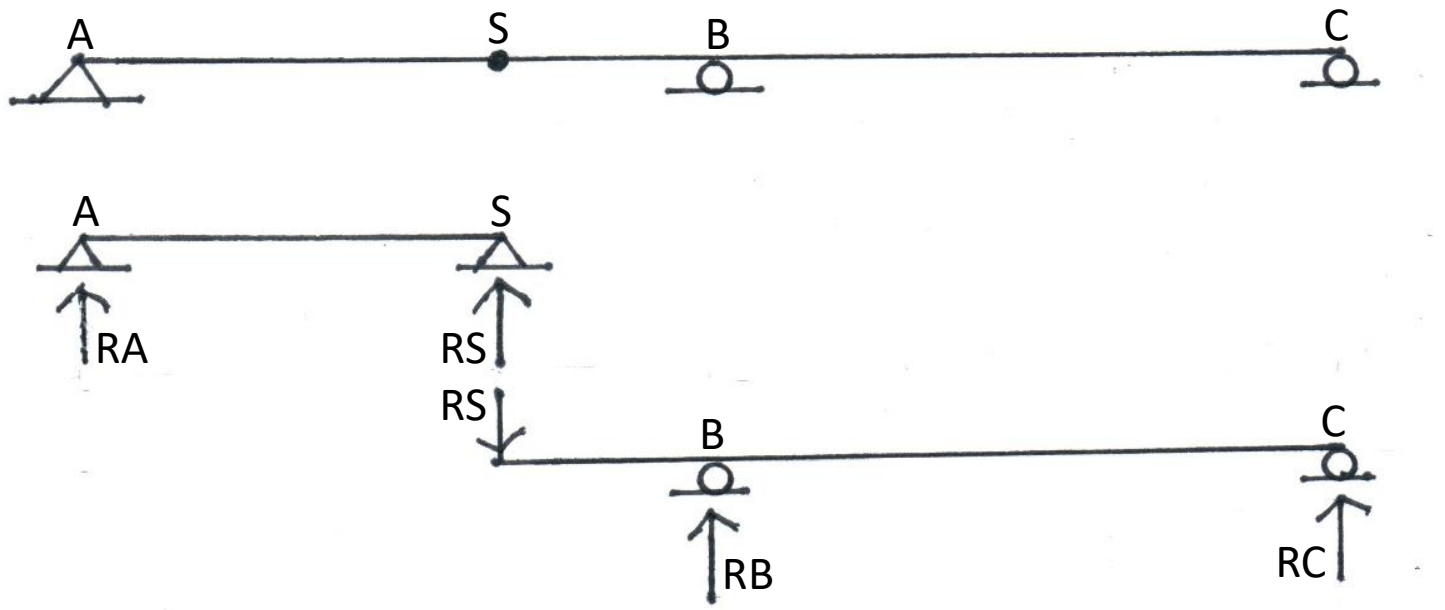
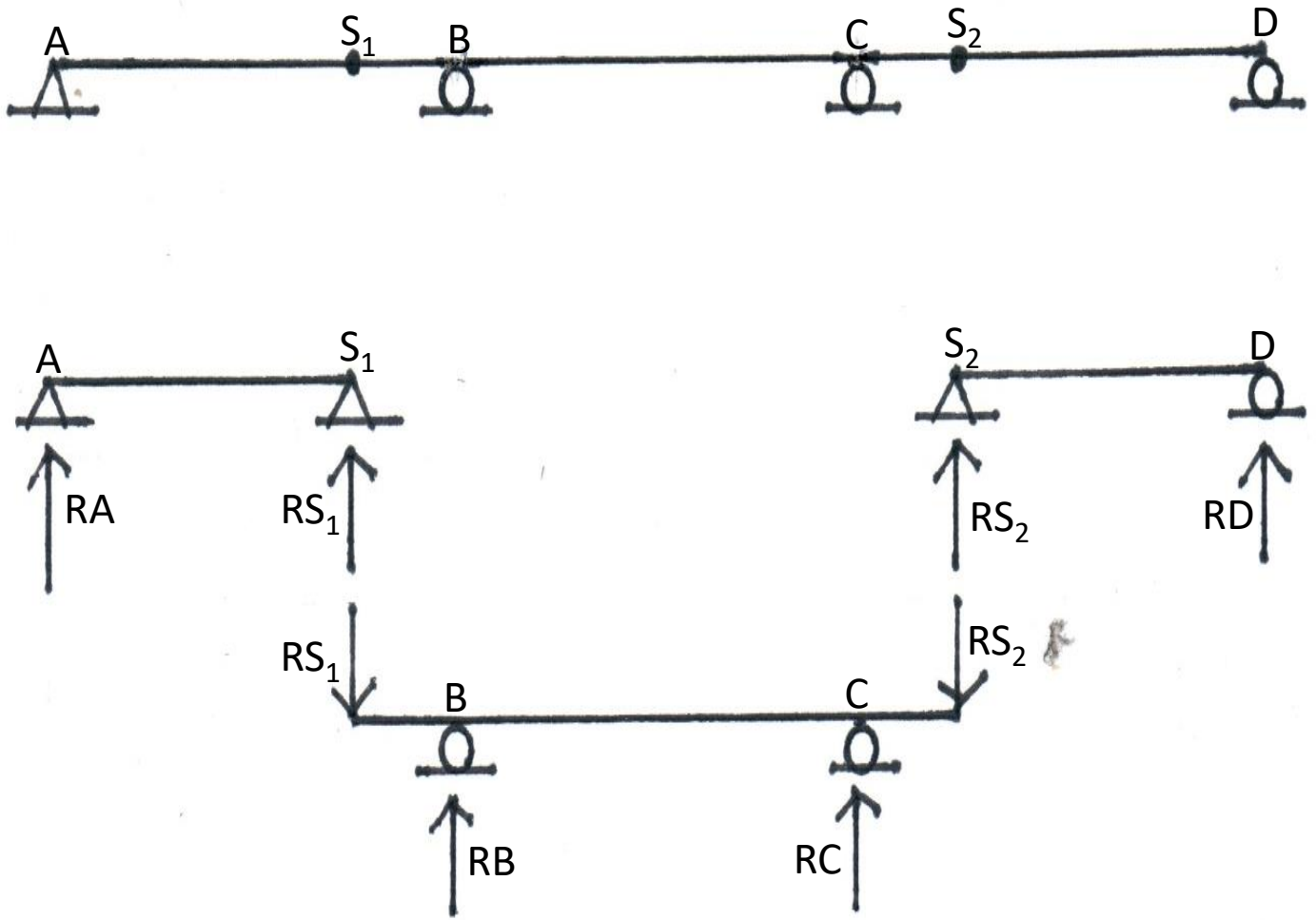
BAB 7 BALOK GERBER

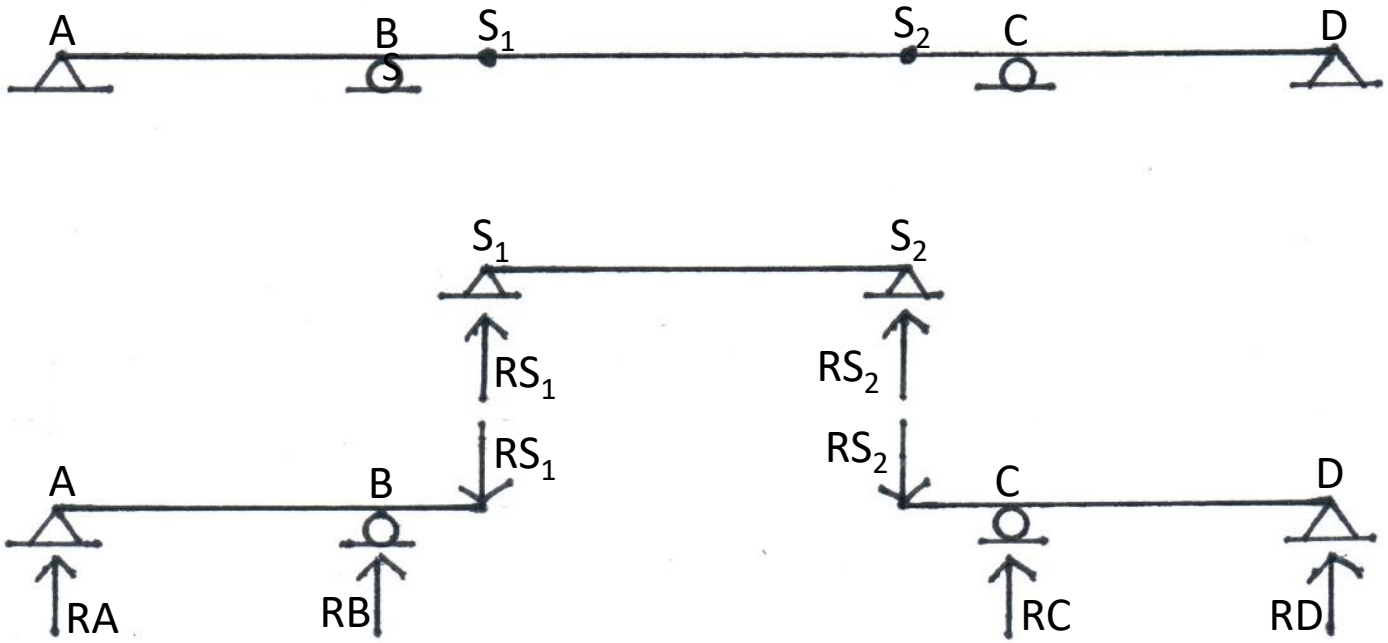
7.1 **SATU** sendi dengan **TIGA** tumpuan



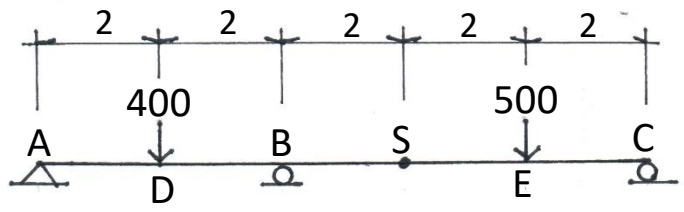
7.2 **DUA** sendi dengan **EMPAT** tumpuan

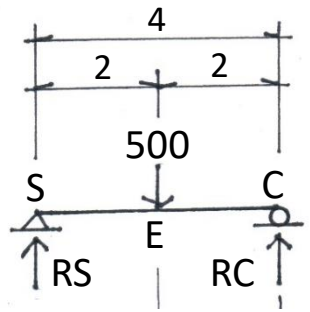


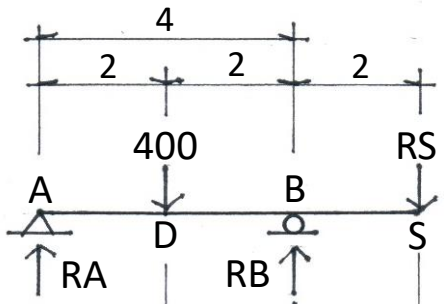
7.3 **DUA** sendi dengan **EMPAT** tumpuan.



7.4 Gambar bidang : gaya lintang dan momen, P_1 = 400 kg ; P_2 = 500 kg







balok : S – C → RS = RC = 0,5. 500 = **250 kg**

ME = 250. 2 = **500 kgm**

balok : ABS → ΣMB = 0 →RA. 4 + 250. 2 – 400. 2 = 0

4 RA + 500 – 800 = 0 →4 RA = 300 → **RA = 75** kg

ΣMA = 0 →RB. 4 – 400. 2 – 250. 6 = 0

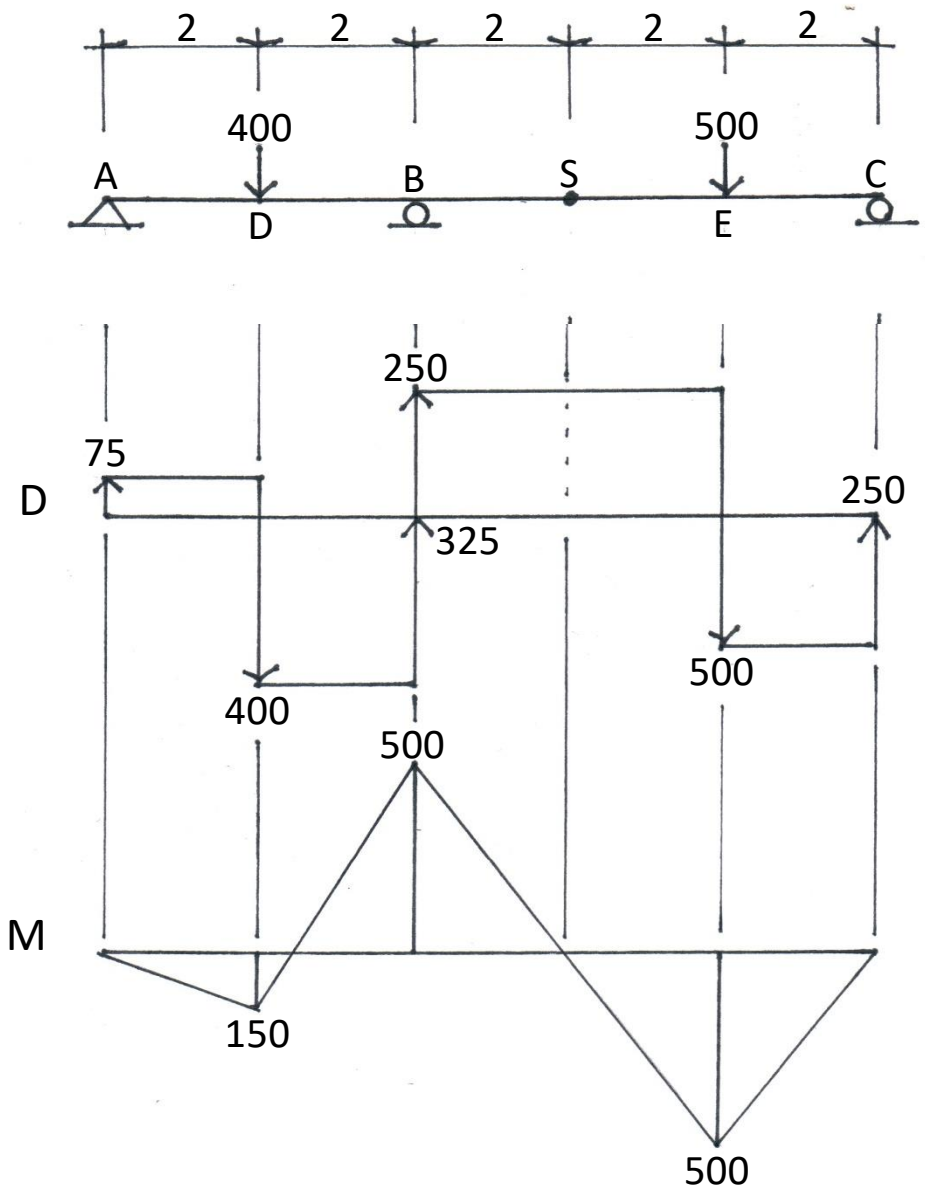
4 RB – 800 – 1500 = 0 → 4RB = 2300 → **RB = 575 kg**

RBS = 250 kg ; RBA = 575 – 250 = 325 kg

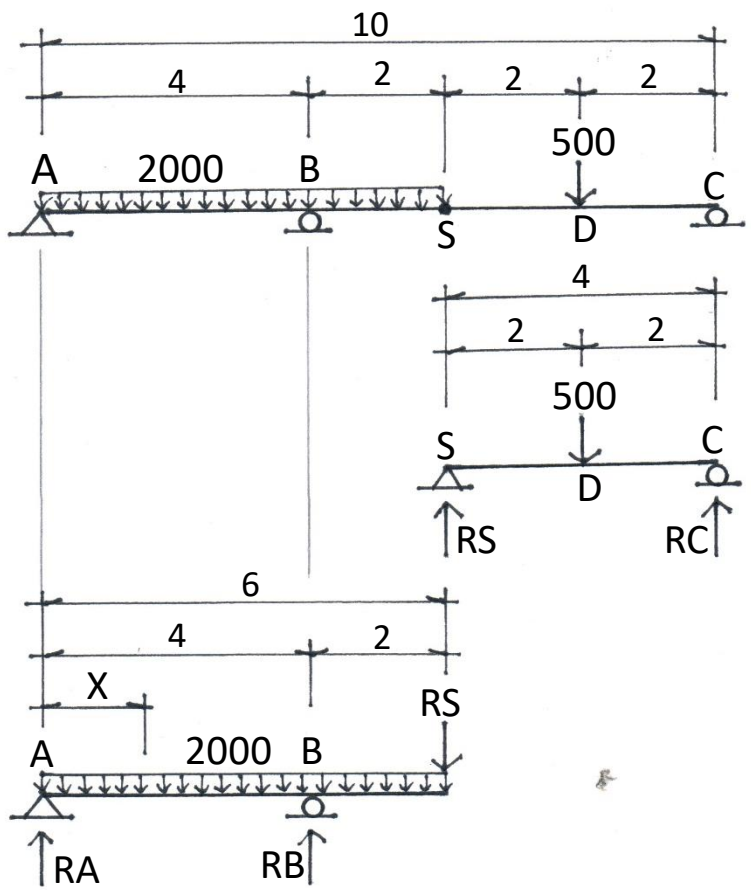
ΣV = 0 →RA + RB = P1 + P2 →75 + 575 = 400 + 250

650 = 650 → ok

MD = 75. 2 = **150 kgm**


2
2
2
2
2
400
500
A
B
S
C
D
E
250
75
D
250
325
500
400
500
M
150
500

7.5 Gambar bidang gaya lintang dan momen, W = 2000 kg/m, P = 500 kg



BALOK : S – C

RS = RC = 0,5. 500 = **250 kg**

MD = 250. 2 = **500 kgm**

BALOK : A – B – S

ΣMB = 0 → RA. 4 + 250. 2 + 2000. 2. 1 – 2000. 4. 2 = 0 →

4 RA + 500 + 4000 – 16000 = 0 → 4 RA = 11500 → **RA = 2875 kg**

ΣMA = 0 → RB. 4 – 2000. 6. 3 – 250. 6 = 0 →

4 RB – 36000 – 1500 = 0 → 4 RB = 37500 → **RB = 9375 kg**

ΣV = 0 → RA + RB = 2000. 6 + 250 → 2875 + 9375 = 12000 + 250

12250 = 12250 → ok

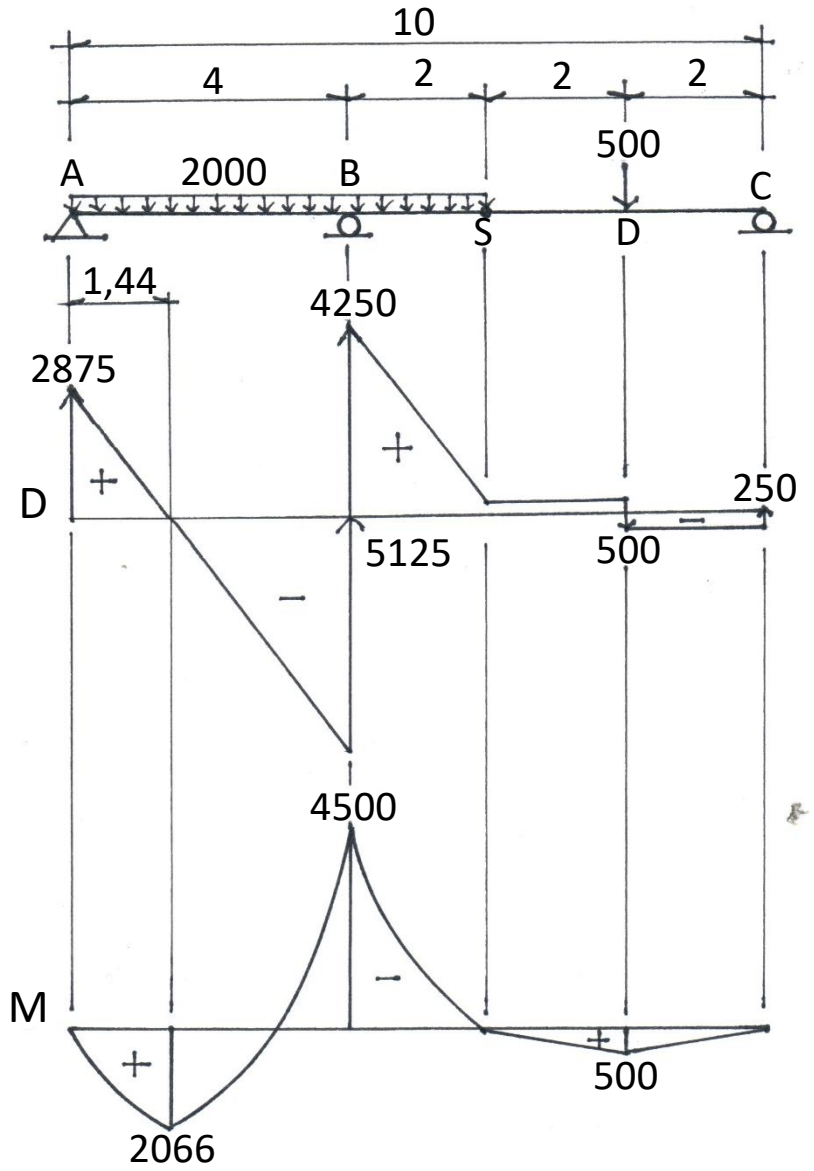
RBS = 250 + 2000. 2 = 4250 kg ; RBA = 9375 – 4250 = 5125 kg

$MX = 2875\ X – 0{,}5.\ 2000\ X^2$ → $dMX/dX = 2875 – 2000\ X$ →

dMX/dX = 0 → 2000 X = 2875 → X = 1,44 m

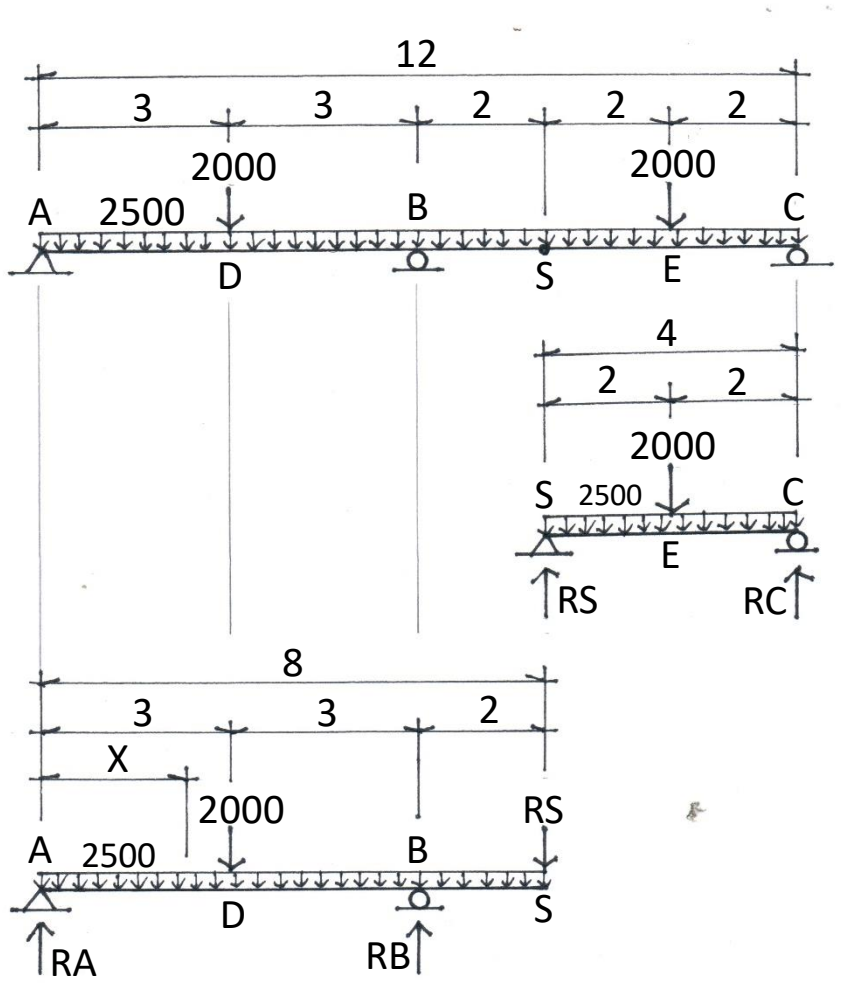
M maks = $2875.\ 1{,}44 – 1000.\ 1{,}44^2 = 4140 – 2074$ = **2066 kgm**

MB = 250. 2 + 2000. 2. 1 = 500 + 4000 = **4500 kgm**


10
4
2
2
2
500
A
2000
B
C
S
D
1,44
4250
2875
D
250
5125
500
4500
M
500
2066

7.6 Gambar bidang gaya lintang dan momen, P = 2000 kg ;

W = 2500 kg/m



Balok : S – C

RS = RC = 0,5. 2500. 4 + 0,5. 2000 = 5000 + 1000 = **6000 kg**

ME = 6000. 2 – 2500. 2. 1 = 12000 – 5000 = **7000 kgm**

Balok : A – B – S

ΣMB = 0 → RA. 6 + 6000. 2 + 2500. 2. 1 – 2500. 6. 3 – 2000. 3 = 0

6 RA + 12000 + 5000 – 45000 - 6000 = 0 → 6 RA – 34000 = 0

6 RA = 34000 → **RA = 5667 kg**

ΣMA = 0 → RB. 6 – 2500. 8. 4 – 2000. 3 – 6000. 8 = 0

6 RB – 80000 – 6000 – 48000 = 0 → 6 RB – 134000 = 0

6 RB = 134000 → **RB = 22333 kg**

ΣV = 0 → 5667 + 22333 = 2500. 8 + 2000 + 6000

28000 = 28000 → ok

RBS = 2500. 2 + 6000 = 5000 + 6000 = 11000

RBA = 22333 – 11000 = 11333 kg

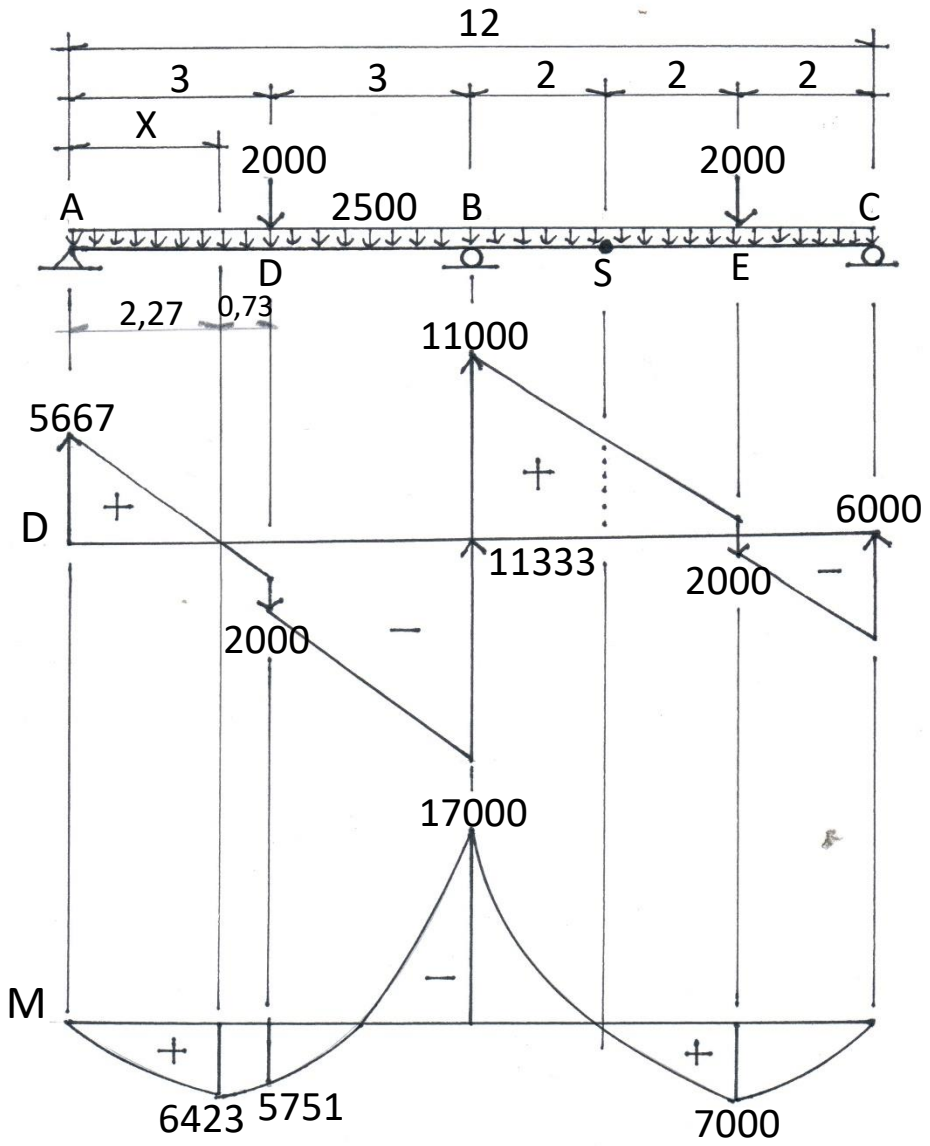
MX = 5667 X – 0,5. 2500 X^2 → dMX/dX = 5667 – 2500 X

dMX/dX = 0 → 2500 X = 5667 → X = 2,27 m

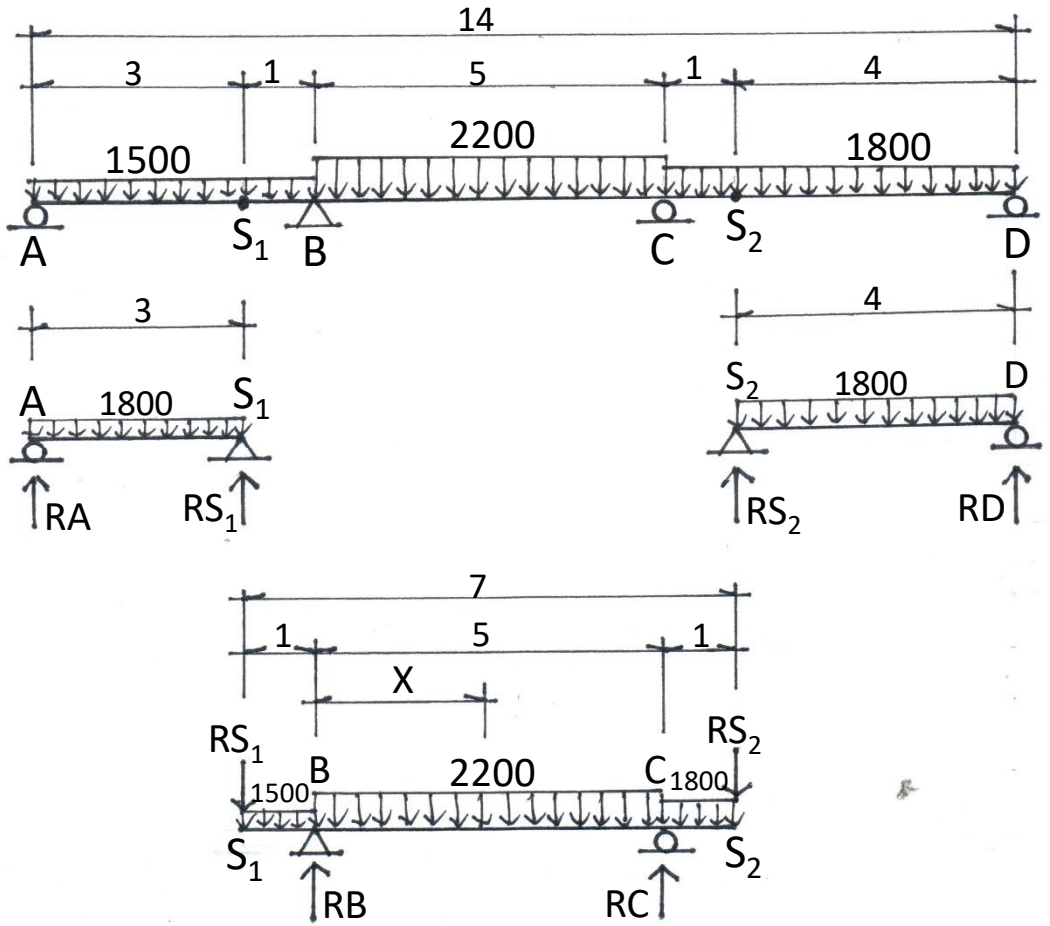
M maks = 5667. 2,27 – 1250. $2,27^2$ = 12864 – 6441 = **6423 kgm**

MB = 6000. 2 + 2500. 2. 1 = 12000 + 5000 = **17000 kgm**

MD = 5667. 3 – 2500. 3. 1,5 = 17001 – 11250 = **5751 kgm**


12
3
3
2
2
2
X
2000
2000
A
2500
B
C
D
S
E
2,27
0,73
11000
5667
6000
D
11333
2000
2000
17000
M
6423
5751
7000

7.7 Gambar bidang gaya lintang dan momen, W_1 = 1500 kg/m ; W_2 = 1800 kg/m ; W_3 = 2200 kg/m



Balok : A – S_1

RA = RS_1 = 0,5. 1500. 3 = **2250 kg**

M maks = 1/8. 1500. 3^2 = **1688 kgm**

Balok : S_2 – D

RS_2 = RD = 0,5. 1800. 4 = **3600 kg**

M maks = 1/8. 1800. 4^2 = **3600 kgm**

Balok : S_1 – B – C – S_2

ΣMC = 0 → RB. 5 + 3600. 1 + 1800.1. 0,5 – 2250. 6 – 1500. 1. 5,5 – 2200. 5. 2,5 = 0

5 RB + 3600 + 900 – 13500 – 8250 – 27500 = 0

5 RB – 44750 = 0 → 5 RB = 44750 → **RB = 8950 kg**

ΣMB = 0 → RC. 5 + 2250. 1 + 1500. 1. 0,5 – 2200. 5. 2,5 – 1800. 1. 5,5 – 3600. 6 = 0

5 RC + 2250 + 750 – 27500 – 9900 – 21600 = 0

5 RC – 56000 = 0 → 5 RC = 56000 → **RC = 11200 kg**

ΣV = 0 → 8950 + 11200 = 2250 + 1500. 1 + 2200. 5 + 3600 + 1800. 1 → **20150 = 20150** → ok

$RBS_1 = 2250 + 1500.\ 1 = 3750$ kg

RBC = 8950 – 3750 = 5200 kg

$RCS_2 = 3600 + 1800.\ 1 = 5400$ kg

RCB = 11200 – 5400 = 5800 kg

$MX = 8950\ X – 2250\ (1 + X) – 1500.\ 1\ (0{,}5 + X) – 0{,}5.\ 2200\ X^2$

$= 8950\ X – 2250 – 2250\ X – 750 – 1500\ X – 1100\ X^2$

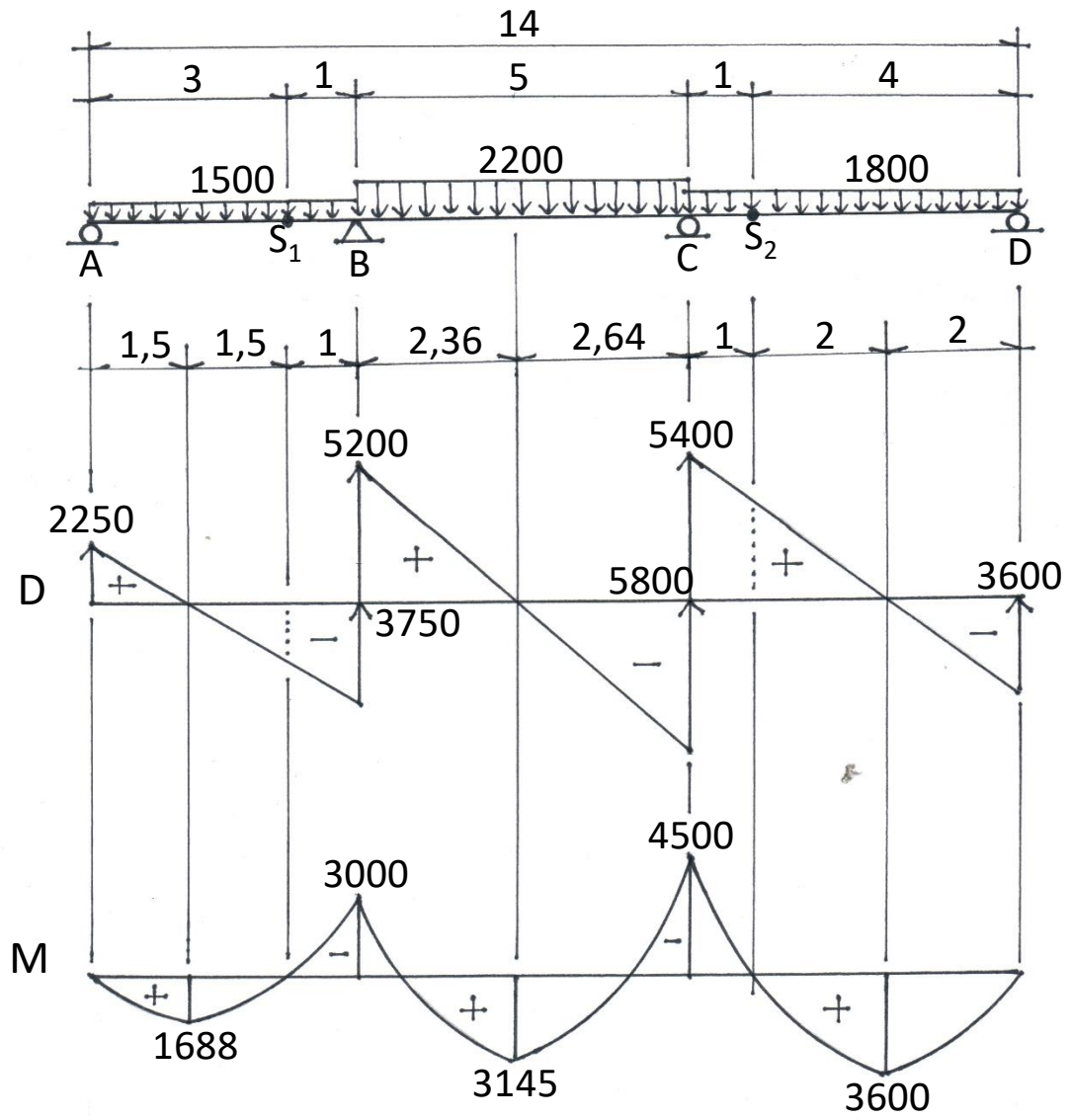
$= 5200\ X – 3000 – 1100\ X^2 \rightarrow dMX/dX = 5200 – 2200\ X$

$dMX/dX = 0 \rightarrow 2200\ X = 5200 \rightarrow X = 2{,}36$ m

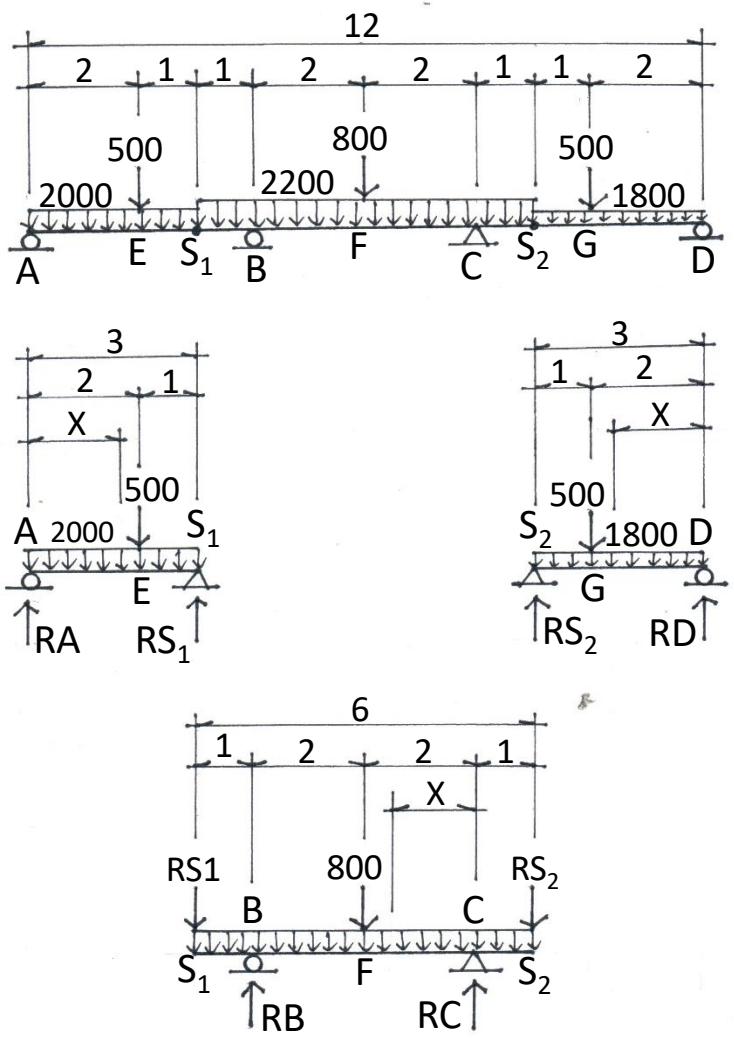
$M\ maks = 5200.\ 2{,}36 – 3000 – 1100.\ 2{,}36^2 = 12272 – 3000 – 6127 =$ **3145 kgm**

$MB = 2250.\ 1 + 1500.\ 1.\ 0{,}5 = 2250 + 750 =$ **3000 kgm**

$MC = 3600.\ 1 + 1800.\ 1.\ 0{,}5 = 3600 + 900 =$ **4500 kgm**


14
3
1
5
1
4
1500
2200
1800
A
S1
B
C
S2
D
1,5
1,5
1
2,36
2,64
1
2
2
5200
5400
2250
D
5800
3600
3750
4500
3000
M
1688
3145
3600

7.8 Gambar bidang gaya lintang dan momen, W_1= 1800 kg/m, W_2 = 2000 kg/m, W_3 = 2200 kg/m, P_1 = 500 kg, P_2 = 800 kg



Balok : A – S_1

$\Sigma MS_1 = 0 \rightarrow RA.\ 3 - 500.\ 1 - 2000.\ 3.\ 1{,}5 = 0 \rightarrow 3\ RA - 500 - 9000 = 0$

$3\ RA - 9500 = 0 \rightarrow$ **RA = 3167 kg**

$\Sigma MA = 0 \rightarrow RS_1.\ 3 - 500.\ 2 - 2000.\ 3.\ 1{,}5 = 0 \rightarrow 3\ RS_1 - 1000 - 9000 = 0$

$3\ RS_1 - 10000 = 0 \rightarrow 3\ RS_1 = 10000 \rightarrow$ **RS_1 = 3333 kg**

$\Sigma V = 0 \rightarrow 3167 + 3333 = 500 + 2000.\ 3 \rightarrow 6500 = 6500 \rightarrow$ ok

$MX = 3167\ X - 0{,}5.\ 2000\ X^2 \rightarrow dMX/dX = 3167 - 2000\ X$

$dMX/dX = 0 \rightarrow 2000\ X = 3167 \rightarrow X = 1{,}58$ m

M maks = $3167.\ 1{,}58 - 1000.\ 1{,}58^2 = 5004 - 2496 =$ **2508 kgm**

ME = $3333.\ 1 - 2000.\ 1.\ 0{,}5 = 3333 - 1000 =$ **2333 kgm**

Balok : S_2 – D

$\Sigma MD = 0 \rightarrow RS_2.\ 3 - 500.\ 2 - 1800.\ 3.\ 1{,}5 = 0 \rightarrow 3\ RS_2 - 1000 - 8100 = 0$

$3\ RS_2 - 9100 = 0 \rightarrow 3\ RS_2 = 9100 \rightarrow$ **RS_2 = 3033 kg**

$\Sigma MS_2 = 0 \rightarrow RD.\ 3 - 500.\ 1 - 1800.\ 3.\ 1{,}5 = 0 \rightarrow 3\ RD - 500 - 8100 = 0$

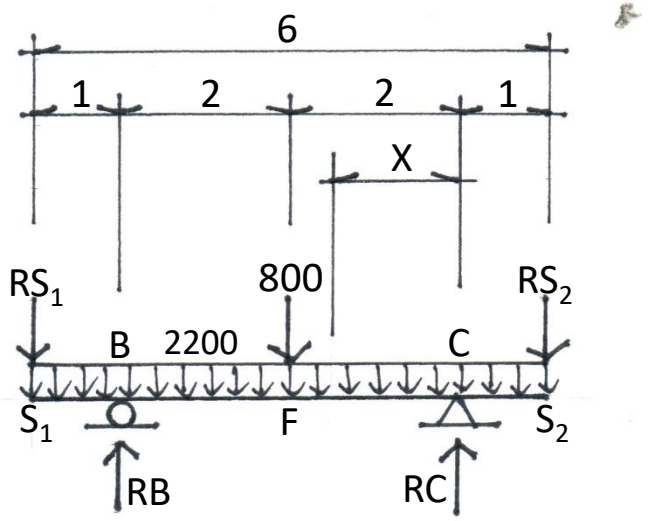
$3\ RD - 8600 = 0 \rightarrow 3\ RD = 8600 \rightarrow$ **RD = 2867 kg**

$MX = 2867\ X - 0{,}5.\ 1800\ X^2 \rightarrow dMX/dX = 2867 - 1800\ X$

$dMX\ /dX = 0 \rightarrow 1800\ X = 2867 \rightarrow X = 1{,}59$ m

M maks = $2867.\ 1{,}59 - 900.\ 1{,}59^2 = 5004 - 2496 =$ **2283 kgm**

MG = 3033. 1 – 1800. 1. 0,5 = 3033 – 900 = **2133 kgm**



Balok : $S_1 – B – C – S_2$

ΣMC = 0 → RB. 4 + 3033. 1 + 2200. 1. 0,5 – 3333. 5 – 800. 2 – 2200. 5. 2,5 = 0

4 RB + 3033 + 1100 – 16665 – 1600 – 27500 = 0 → 4 RB – 41632 = 0

4 RB = 41632 → **RB = 10408 kg**

ΣMB = 0 → RC. 4 + 3333. 1 + 2200. 1. 0,5 – 800. 2 – 3033. 5 – 2200. 5. 2,5 = 0

4 RC + 3333 + 1100 – 1600 – 15165 – 27500 = 0 → 4 RC – 39832 = 0

4 RC = 39832 → **RC = 9958 kg**

ΣV = 0 → 10408 + 9958 = 3333 + 3033 + 800 + 2200. 6

10408 + 9958 = 3333 + 3033 + 800 + 13200 → 20366 = 20366 → ok

RBS_1 = 3333 + 2200. 1 = **5533 kg** ; RBC = 10408 – 5533 = **4875 kg**

RCS_2 = 3033 + 2200. 1 = **5233 kg** ; RCB = 9958 – 5233 = **4725 kg**

$MX = 9958 X – 3033 (1 + X) – 2200. 1 (0,5 + X) - 0,5. 2200 X^2$

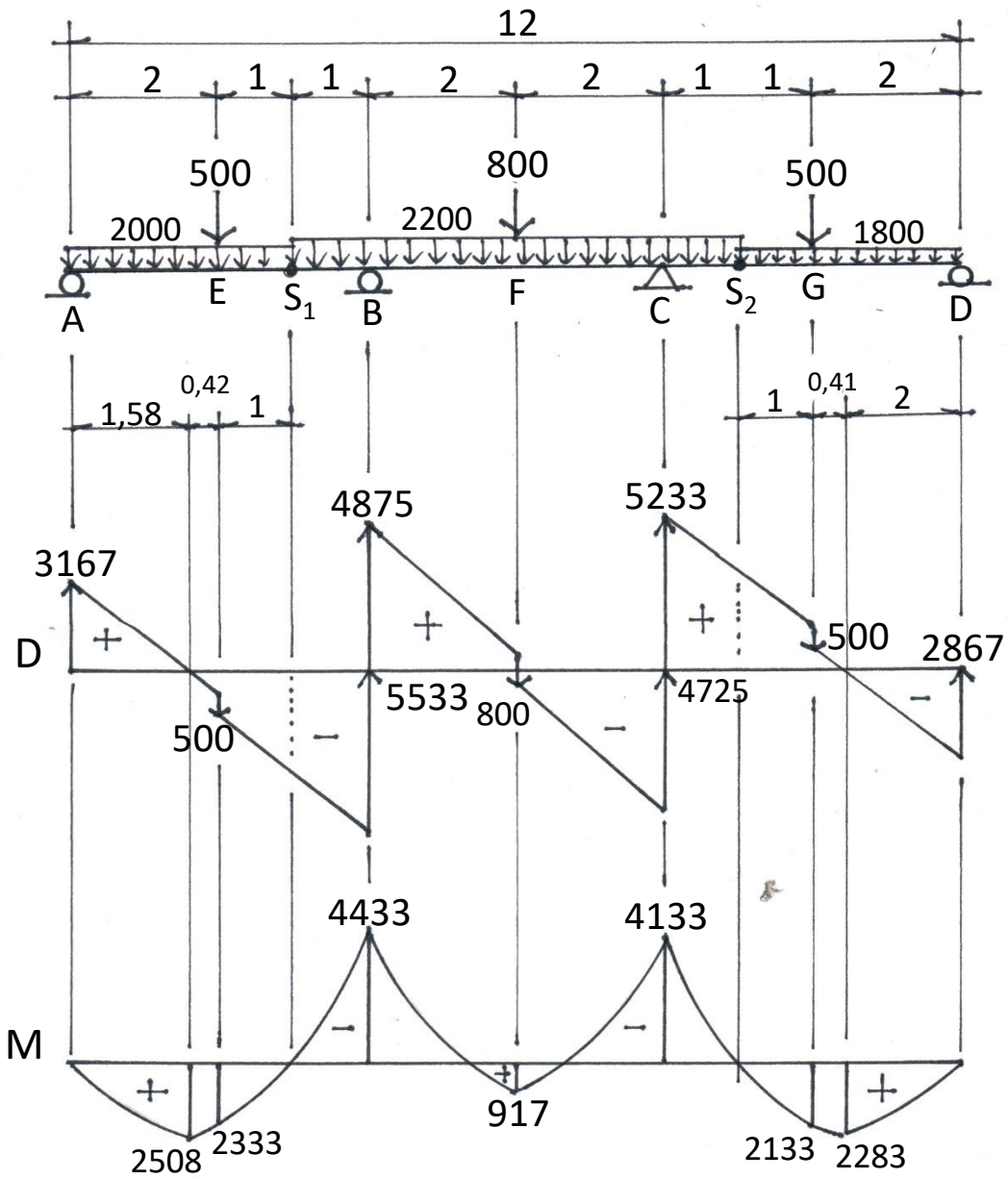
$= 9958 X – 3033 – 3033 X – 1100 – 2200 X – 1100 X^2 = 4752 X – 4133 – 1100 X^2$

dMX/dX = 4752 – 2200 X → dMX/dX = 0 → 2200 X = 4752 → X = 2,15 m → tidak mungkin

M maks = MF = 10408. 2 – 3333. 3 – 2200. 3. 1,5 = 20816 – 9999 – 9900 = **917 kgm**

MB = 3333. 1 + 2200. 1. 0,5 = 3333 + 1100 = **4433 kgm**

MC = 3033. 1 + 2200. 1. 0,5 = 3033 + 1100 = **4133 kgm**


12
2
1
1
2
2
1
1
2
500
800
500
2000
2200
1800
A
E
S1
B
F
C
S2
G
D
1,58
0,42
1
1
0,41
2
3167
4875
5233
D
500
2867
5533
800
4725
500
4433
4133
M
2508
2333
917
2133
2283