**Perhitungan Manual Pada Balok Induk Memanjang (Arah Y)**

1) As A (4-6)
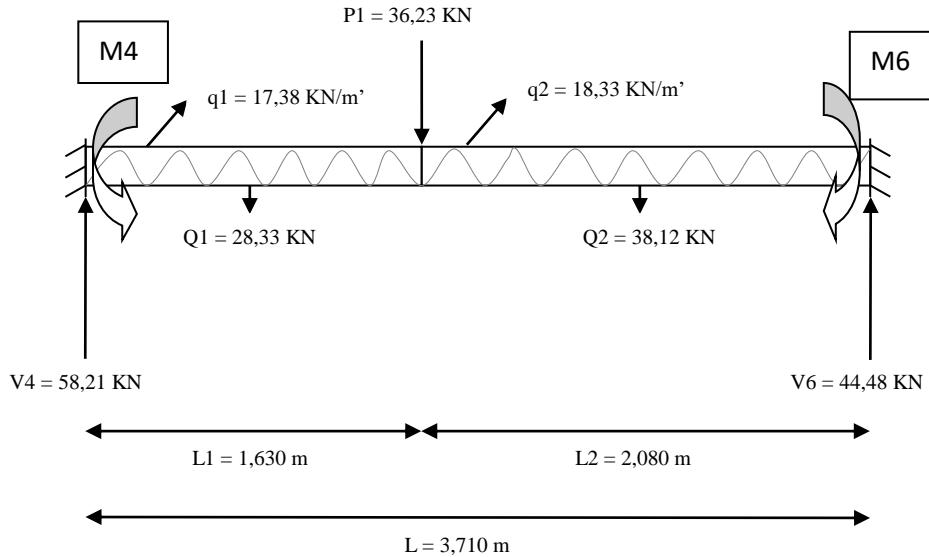
Perhitungan reaksi :

- **Pada V Kiri**

$$\uparrow P1 \quad = \frac{36,23 \; x \; 2,080}{3,710} \qquad\qquad\qquad\qquad\qquad = 20,31 \; KN$$

$$\uparrow q1 \quad = \frac{28,33 \; x \; \left(\left(\frac{1}{2} x \; 1,630\right)+2,080\right)}{3,710} \qquad = 22,11 \; KN$$

$$\uparrow q2 \quad = \frac{38,12 \; x \; \left(\frac{1}{2} x \; 2,080\right)}{3,710} \qquad\qquad\qquad = 10,69 \; KN$$

Momen Primer kiri :

$$P1 \quad = \frac{36,23 \; x \; 2,080^2 x 1,630}{3,710^2} \qquad\qquad\qquad\qquad\qquad = 18,56 \; KN$$

$$q1 \quad = \frac{17,38 \; x \; 1,630^2 \; x \; \left((6 \; x \; 2,080^2)+(4 \; x \; 1,630 \; x \; 2,080)+(1,630^2)\right)}{12 \; x \; 3,710^2} = 11,79 \; KN$$

$$q2 \quad = \frac{18,33 \; x \; 2,080^2 \; x \; \left((6 \; x \; 1,630^2)+(4 \; x \; 1,630 \; x \; 2,080)+(2,080^2)\right)}{12 \; x \; 3,710^2} \underline{= 16,24 \; KN +}$$

$$\uparrow M4 \quad = \frac{46,59}{3,710}$$

$$\uparrow M4 \quad = 12,56 \text{ KN}$$

Momen Primer M6 :

$$P1 \quad = \frac{36,23 \ x \ 1,630^2 x \, 2,080}{3,710^2} \qquad\qquad = 14,55 \text{ KN}$$

$$q1 \quad = \frac{17,38 \ x \ 1,630^2 \ x((4 \ x \ 1,630 \ x \ 2,080)+(1,630^2))}{12 \ x \ 3,710^2} \qquad\qquad = 4,53 \text{ KN}$$

$$q2 \quad = \frac{18,33 \ x \ 2,080^2 \ x \ ((4 \ x \ 1,630 \ x \ 2,080)+(2,080^2))}{12 \ x \ 3,710^2} \qquad\qquad \underline{= 8,59 \text{ KN} +}$$

$$\downarrow M6 \quad = \frac{27,67}{3,710}$$

$$\downarrow M6 \quad = 7,46 \text{ KN}$$

Total jumlah :

$\uparrow$P1 + $\uparrow$q1 + $\uparrow$q2 + $\uparrow$M4 - $\downarrow$M6

=20,31 + 22,11 + 10,69 + 12,56 + 7,46

=58,21 KN $\uparrow$

- **Pada V kanan**

$$\uparrow P1 \quad = \frac{36,23 \ x \ 1,630}{3,710} \qquad\qquad = 15,92 \text{ KN}$$

$$\uparrow q1 \quad = \frac{28,33 \ x \left(\frac{1}{2} \ x \ 1,630\right)}{3,710} \qquad\qquad = 6,22 \text{ KN}$$

$$\uparrow q2 \quad = \frac{38,12 \ x \ \left(\left(\frac{1}{2} \ x \ 2,080\right)+1,630\right)}{3,710} \qquad\qquad = 27,44 \text{ KN}$$

Momen Primer kiri:

$$P1 \quad = \frac{36,23 \ x \ 2,080^2 x \, 1,630}{3,710^2} \qquad\qquad = 18,56 \text{ KN}$$

$$q1 \quad = \frac{17{,}38 \; x \; 1{,}630^2 \; x \; ((6 \; x \; 2{,}080^2)+(4 \; x \; 1{,}630 \; x \; 2{,}080)+(1{,}630^2))}{12 \; x \; 3{,}710^2} \qquad = 11{,}79 \; KN$$

$$q2 \quad = \frac{18{,}33 \; x \; 2{,}080^2 \; x \; ((6 \; x \; 1{,}630^2)+(4 \; x \; 1{,}630 \; x \; 2{,}080)+(2{,}080^2))}{12 \; x \; 3{,}710^2} \qquad \underline{= 16{,}24 \; KN \; +}$$

$$\downarrow M4 \quad = \frac{46{,}59}{3{,}710}$$

$$\downarrow M4 \quad = 12{,}56 \; KN$$

Momen Primer kanan :

$$P1 \quad = \frac{36{,}23 \; x \; 1{,}630^2 x 2{,}080}{3{,}710^2} \qquad = 14{,}55 \; KN$$

$$q1 \quad = \frac{17{,}38 \; x \; 1{,}630^2 \; x ((4 \; x \; 1{,}630 \; x \; 2{,}080)+(1{,}630^2))}{12 \; x \; 3{,}710^2} \qquad = 4{,}53 \; KN$$

$$q2 \quad = \frac{18{,}33 \; x \; 2{,}080^2 \; x \; ((4 \; x \; 1{,}630 \; x \; 2{,}080)+(2{,}080^2))}{12 \; x \; 3{,}710^2} \qquad \underline{= 8{,}59 \; KN \; +}$$

$$\uparrow M6 \quad = \frac{27{,}67}{3{,}710}$$

$$\uparrow M6 \quad = 7{,}46 \; KN$$

Total jumlah :

$\uparrow P1 + \uparrow q1 + \uparrow q2 - \downarrow M4 + \uparrow M6$

$=20{,}31 + 22{,}11 + 10{,}69 - 12{,}56 + 7{,}46$

$= 44{,}48 \; KN \uparrow$

2) As B (1-3)
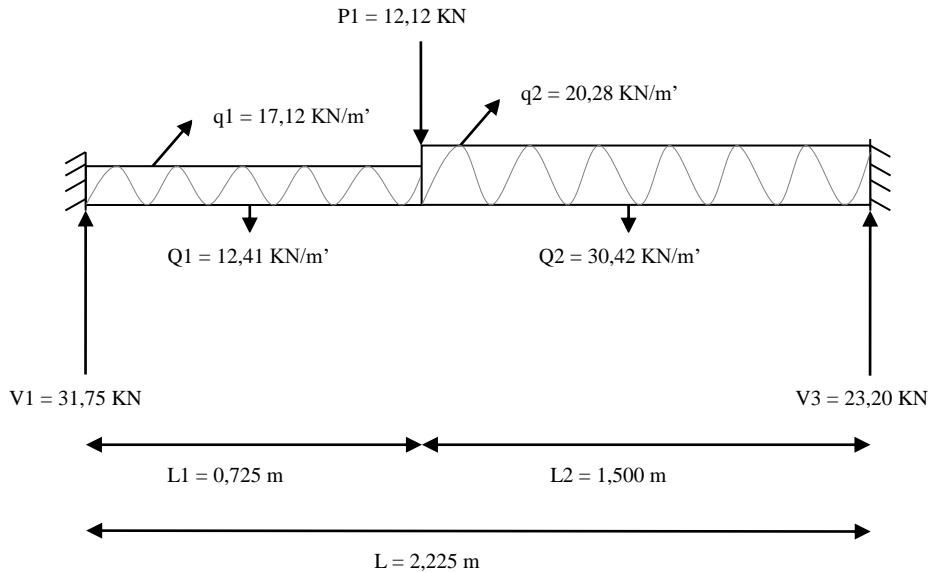
Perhitungan reaksi :

- **Pada V Kiri**

$$\uparrow P1 \quad = \frac{12,12 \ x \ 1,500}{2,225} \qquad\qquad = 8,17 \ KN$$

$$\uparrow q1 \quad = \frac{12,41 \ x \ \left(\left(\frac{1}{2} x \ 0,725\right)+1,500\right)}{2,225} \qquad\qquad = 10,39 \ KN$$

$$\uparrow q2 \quad = \frac{30,42 \ x \ \left(\frac{1}{2} x \ 1,500\right)}{2,225} \qquad\qquad = 10,25 \ KN$$

Momen :

$$P1 \quad = \frac{12,12 \ x \ 1,500^2 x 0,725}{2,225^2} \qquad\qquad = 3,99 \ KN$$

$$q1 \quad = \frac{17,12 \ x \ 0,725^2 \ x \ ((6 \ x \ 1,500^2)+(4 \ x \ 0,725 \ x \ 1,500)+(0,725^2))}{12 \ x \ 2,225^2} \qquad = 2,78 \ KN$$

$$q2 \quad = \frac{20,28 \ x \ 1,500^2 \ x \ ((6 \ x \ 0,725^2)+(4 \ x \ 0,725 \ x \ 1,500)+(1,500^2))}{12 \ x \ 2,225^2} \qquad \underline{= 7,49 \ KN +}$$

$$\uparrow M1 \quad = \frac{14,26}{2,225}$$

$$\uparrow M1 \quad = 6{,}41 \text{ KN}$$

$$P1 \quad = \frac{12{,}12 \; x \; 0{,}725^2 x 1{,}500}{2{,}225^2} \qquad\qquad = 1{,}93 \text{ KN}$$

$$q1 \quad = \frac{17{,}12 \; x \; 0{,}725^2 \; x \; ((4 \; x \; 0{,}725 \; x \; 1{,}500)+(0{,}725^2))}{12 \; x \; 2{,}225^2} \qquad = 0{,}74 \text{ KN}$$

$$q2 \quad = \frac{20{,}28 \; x \; 1{,}500^2 \; x((4 \; x \; 0{,}725 \; x \; 1{,}500)+(1{,}500^2))}{12 \; x \; 2{,}225^2} \qquad \underline{= 5{,}07 \text{ KN} +}$$

$$\downarrow M3 \quad = \frac{7{,}74}{2{,}225}$$

$$\downarrow M3 \quad = 3{,}48 \text{ KN}$$

Total jumlah :

$\uparrow P1 + \uparrow q1 + \uparrow q2 + \uparrow M1 - \downarrow M3$

$=8{,}17 + 10{,}39 + 10{,}25 + 6{,}41 - 3{,}48$

$=31{,}75$ KN $\uparrow$

- **Pada V kanan**

$$\uparrow P1 \quad = \frac{12{,}12 \; x \; 0{,}725}{2{,}225} \qquad\qquad = 3{,}95 \text{ KN}$$

$$\uparrow q1 \quad = \frac{12{,}41 \; x \; \left(\frac{1}{2} \; x \; 0{,}725\right)}{2{,}225} \qquad\qquad = 2{,}02 \text{ KN}$$

$$\uparrow q2 \quad = \frac{30{,}42 \; x \; \left(\left(\frac{1}{2} \; x \; 1{,}500\right)+0{,}725\right)}{2{,}225} \qquad\qquad = 20{,}17 \text{ KN}$$

Momen :

$$P1 \quad = \frac{12{,}12 \; x \; 1{,}500^2 x 0{,}725}{2{,}225^2} \qquad\qquad = 3{,}99 \text{ KN}$$

$$q1 \quad = \frac{17{,}12 \; x \; 0{,}725^2 \; x \; ((6 \; x \; 1{,}500^2)+(4 \; x \; 0{,}725 \; x \; 1{,}500)+(0{,}725^2))}{12 \; x \; 2{,}225^2} \qquad = 2{,}78 \text{ KN}$$

$$q2 \quad = \frac{20{,}28 \ x \ 1{,}500^2 \ x \ ((6 \ x \ 0{,}725^2)+(4 \ x \ 0{,}725 \ x \ 1{,}500)+(1{,}500^2))}{12 \ x \ 2{,}225^2} \qquad = \underline{7{,}49 \ KN \ +}$$

$$\downarrow M1 \quad = \frac{14{,}26}{2{,}225}$$

$$\downarrow M1 \quad = 6{,}41 \ KN$$

$$P1 \quad = \frac{12{,}12 \ x \ 0{,}725^2 x 1{,}500}{2{,}225^2} \qquad = 1{,}93 \ KN$$

$$q1 \quad = \frac{17{,}12 \ x \ 0{,}725^2 \ x \ ((4 \ x \ 0{,}725 \ x \ 1{,}500)+(0{,}725^2))}{12 \ x \ 2{,}225^2} \qquad = 0{,}74 \ KN$$

$$q2 \quad = \frac{20{,}28 \ x \ 1{,}500^2 \ x ((4 \ x \ 0{,}725 \ x \ 1{,}500)+(1{,}500^2))}{12 \ x \ 2{,}225^2} \qquad = \underline{5{,}07 \ KN \ +}$$

$$\uparrow M3 \quad = \frac{7{,}74}{2{,}225}$$

$$\uparrow M3 \quad = 3{,}48 \ KN$$

Total jumlah :

↑P1 + ↑q1 + ↑q2 - ↓M1 + ↑M3

= 8,17 + 10,39 + 10,25 - 6,41 + 3,48

= 23,20 KN ↑

3) As B (4-6)
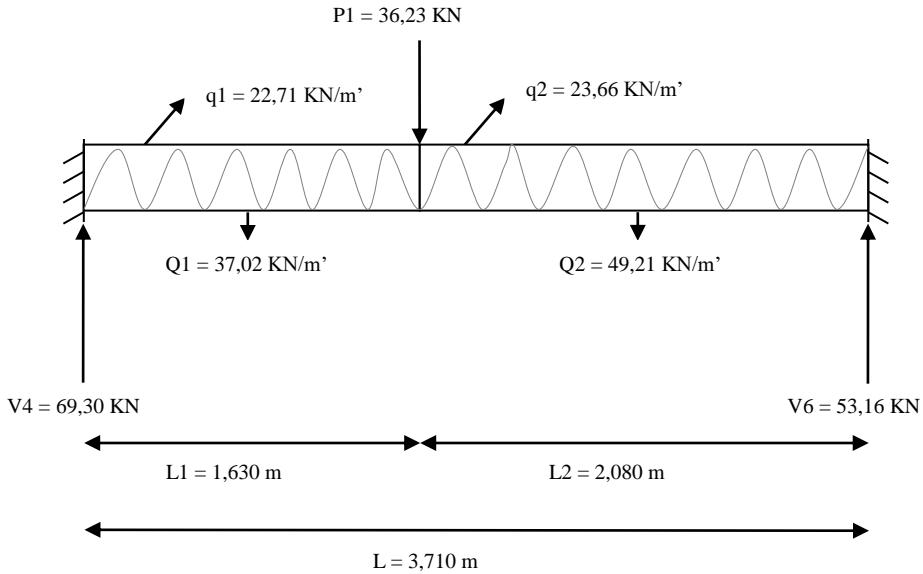
Perhitungan reaksi :

• **Pada V Kiri**

$$\uparrow P1 \quad = \frac{36,23 \; x \; 2,080}{3,710} \qquad\qquad\qquad\qquad = 20,31 \; KN$$

$$\uparrow q1 \quad = \frac{37,02 \; x \; \left(\left(\frac{1}{2} \; x \; 1,630\right)+2,080\right)}{3,710} \qquad\qquad = 28,89 \; KN$$

$$\uparrow q2 \quad = \frac{49,21 \; x \; \left(\frac{1}{2} \; x \; 2,080\right)}{3,710} \qquad\qquad\qquad = 14,81 \; KN$$

Momen :

$$P1 \quad = \frac{36,23 \; x \; 2,080^2 x \, 1,630}{3,710^2} \qquad\qquad\qquad = 18,56 \; KN$$

$$q1 \quad = \frac{22,71 \; x \; 1,630^2 \; x \; \left((6 \; x \; 2,080^2)+(4 \; x \; 1,630 \; x \; 2,080)+(1,630^2)\right)}{12 \; x \; 3,710^2} = 15,41 \; KN$$

$$q2 \quad = \frac{23,66 \; x \; 2,080^2 \; x \; \left((6 \; x \; 1,630^2)+(4 \; x \; 1,630 \; x \; 2,080)+(2,080^2)\right)}{12 \; x \; 3,710^2} \quad \underline{= 20,97 \; KN +}$$

$$\uparrow M4 \quad = \frac{54,94}{3,710}$$

$\uparrow M4 \quad = 14,81 \ KN$

$$P1 \quad = \frac{36,23 \ x \ 1,630^2 x 2,080}{3,710^2} \qquad \qquad = 14,55 \ KN$$

$$q1 \quad = \frac{22,71 \ x \ 1,630^2 \ x ((4 \ x \ 1,630 \ x \ 2,080)+(1,630^2))}{12 \ x \ 3,710^2} \qquad = 5,93 \ KN$$

$$q2 \quad = \frac{23,66 \ x \ 2,080^2 \ x \ ((4 \ x \ 1,630 \ x \ 2,080)+(2,080^2))}{12 \ x \ 3,710^2} \qquad \underline{= 11,09 \ KN +}$$

$$\downarrow M6 \quad = \frac{31,57}{3,710}$$

$\downarrow M6 \quad = 8,51 \ KN$

Total jumlah :

$\uparrow P1 + \uparrow q1 + \uparrow q2 + \uparrow M4 - \downarrow M6$

$= 20,31 + 28,89 + 13,80 + 14,81 - 8,51$

$= 69,30 \ KN \uparrow$

- **Pada V kanan**

$$\uparrow P1 \quad = \frac{36,23 \ x \ 1,630}{3,710} \qquad \qquad = 15,92 \ KN$$

$$\uparrow q1 \quad = \frac{22,71 \ x \left(\frac{1}{2} x \ 1,630\right)}{3,710} \qquad \qquad = 8,13 \ KN$$

$$\uparrow q2 \quad = \frac{23,66 \ x \ \left(\left(\frac{1}{2} x \ 2,080\right)+1,630\right)}{3,710} \qquad \qquad = 35,42 \ KN$$

Momen :

$$P1 = \frac{36,23 \; x \; 2,080^2 x 1,630}{3,710^2} \qquad = 18,56 \; KN$$

$$q1 = \frac{22,71 \; x \; 1,630^2 \; x \; ((6 \; x \; 2,080^2)+(4 \; x \; 1,630 \; x \; 2,080)+(1,630^2))}{12 \; x \; 3,710^2} \qquad = 15,41 \; KN$$

$$q2 = \frac{23,66 \; x \; 2,080^2 \; x \; ((6 \; x \; 1,630^2)+(4 \; x \; 1,630 \; x \; 2,080)+(2,080^2))}{12 \; x \; 3,710^2} \qquad \underline{= 20,97 \; KN +}$$

$$\downarrow M4 = \frac{54,94}{3,710}$$

$$\downarrow M4 = 14,81 \; KN$$

$$P1 = \frac{36,23 \; x \; 1,630^2 x 2,080}{3,710^2} \qquad = 14,55 \; KN$$

$$q1 = \frac{22,71 \; x \; 1,630^2 \; x ((4 \; x \; 1,630 \; x \; 2,080)+(1,630^2))}{12 \; x \; 3,710^2} \qquad = 5,93 \; KN$$

$$q2 = \frac{23,66 \; x \; 2,080^2 \; x \; ((4 \; x \; 1,630 \; x \; 2,080)+(2,080^2))}{12 \; x \; 3,710^2} \qquad \underline{= 11,09 \; KN +}$$

$$\uparrow M6 = \frac{31,57}{3,710}$$

$$\uparrow M6 = 8,51 \; KN$$

Total jumlah :

↑P1 + ↑q1 + ↑q2 - ↓M4 + ↑M6

=20,31 + 28,89 + 13,80 - 14,81 + 8,51

= 53,16 KN ↑

4) As C (1-3)
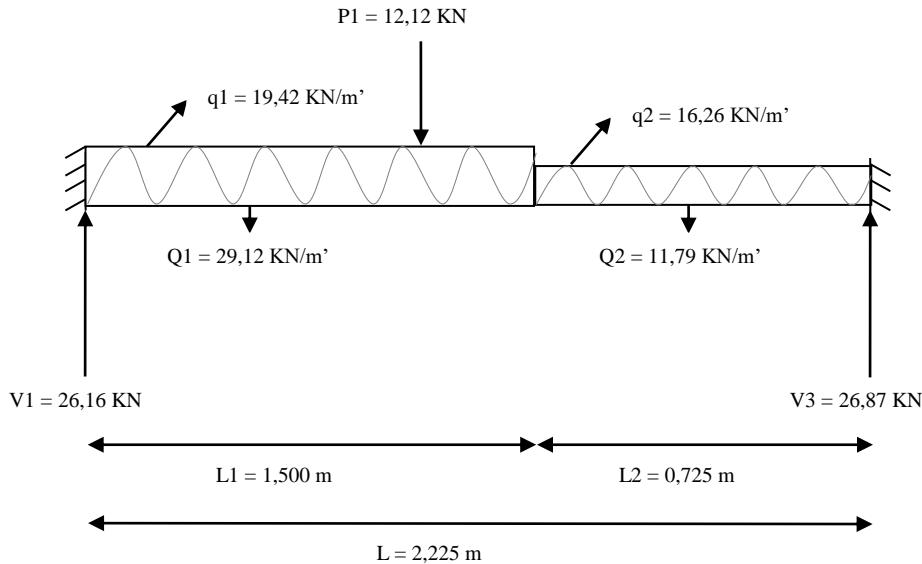
Perhitungan reaksi :

- **Pada V Kiri**

$$\uparrow P1 \quad = \frac{12,12 \; x \; 0,725}{2,225} \qquad = 3,95 \; KN$$

$$\uparrow q1 \quad = \frac{29,12 \; x \; \left(\left(\frac{1}{2} \; x \; 1,500\right)+0,725\right)}{2,225} \qquad = 19,31 \; KN$$

$$\uparrow q2 \quad = \frac{11,79 \; x \; \left(\frac{1}{2} \; x \; 0,725\right)}{2,225} \qquad = 1,92 \; KN$$

Momen :

$$P1 \quad = \frac{12,12 \; x \; 0,725^2 x 1,500}{2,225^2} \qquad = 1,93 \; KN$$

$$q1 \quad = \frac{19,41 \; x \; 1,500^2 \; x \; \left((6 \; x \; 0,725^2)+(4 \; x \; 0,725 \; x \; 1,500)+(1,500^2)\right)}{12 \; x \; 2,225^2} \qquad = 7,17 \; KN$$

$$q2 \quad = \frac{16,26 \; x \; 0,725^2 \; x \; \left((6 \; x \; 1,500^2)+(4 \; x \; 0,725 \; x \; 1,500)+(0,725^2)\right)}{12 \; x \; 2,225^2} \qquad \underline{= 2,64 \; KN \; +}$$

$$\uparrow M1 \quad = \frac{11,74}{2,225}$$

$$\uparrow \text{M1} \quad = 5,28 \text{ KN}$$

$$\text{P1} \quad = \frac{12,12 \ x \ 1,500^2 x 0,725}{2,225^2} \qquad\qquad = 3,99 \text{ KN}$$

$$\text{q1} \quad = \frac{19,42 \ x \ 1,500^2 \ x \ ((4 \ x \ 0,725 \ x \ 1,500)+(1,500^2))}{12 \ x \ 2,225^2} \qquad = 4,85 \text{ KN}$$

$$\text{q2} \quad = \frac{16,26 \ x \ 0,725^2 \ x ((4 \ x \ 0,725 \ x \ 1,500)+(0,725^2))}{12 \ x \ 2,225^2} \qquad \underline{= 0,70 \text{ KN} +}$$

$$\downarrow \text{M3} \quad = \frac{9,54}{2,225}$$

$$\downarrow \text{M3} \quad = 4,29 \text{ KN}$$

Total jumlah :

↑P1 + ↑q1 + ↑q2 + ↑M1 - ↓M3

= 3,89 + 19,31 + 1,92 + 5,28 − 4,29

= 26,16 KN ↑

- **Pada V kanan**

$$\uparrow \text{P1} \quad = \frac{12,12 \ x \ 1,500}{2,225} \qquad\qquad = 8,17 \text{ KN}$$

$$\uparrow \text{q1} \quad = \frac{29,12 \ x \ \left(\frac{1}{2} x \ 1,500\right)}{2,225} \qquad\qquad = 9,82 \text{ KN}$$

$$\uparrow \text{q2} \quad = \frac{11,79 \ x \ (\left(\frac{1}{2} x \ 0,725\right) + 1,500)}{2,225} \qquad = 9,87 \text{ KN}$$

Momen :

$$P1 \quad = \frac{12,12 \; x \; 0,725^2 x 1,500}{2,225^2} \qquad\qquad = 1,93 \; KN$$

$$q1 \quad = \frac{19,41 \; x \; 1,500^2 \; x \; ((6 \; x \; 0,725^2)+(4 \; x \; 0,725 \; x \; 1,500)+(1,500^2))}{12 \; x \; 2,225^2} \qquad = 7,17 \; KN$$

$$q2 \quad = \frac{16,26 \; x \; 0,725^2 \; x \; ((6 \; x \; 1,500^2)+(4 \; x \; 0,725 \; x \; 1,500)+(0,725^2))}{12 \; x \; 2,225^2} \qquad \underline{= 2,64 \; KN \;+}$$

$$\downarrow M1 \quad = \frac{11,74}{2,225}$$

$$\downarrow M1 \quad = 5,28 \; KN$$

$$P1 \quad = \frac{12,12 \; x \; 1,500^2 x 0,725}{2,225^2} \qquad\qquad = 3,99 \; KN$$

$$q1 \quad = \frac{19,42 \; x \; 1,500^2 \; x \; ((4 \; x \; 0,725 \; x \; 1,500)+(1,500^2))}{12 \; x \; 2,225^2} \qquad = 4,85 \; KN$$

$$q2 \quad = \frac{16,26 \; x \; 0,725^2 \; x ((4 \; x \; 0,725 \; x \; 1,500)+(0,725^2))}{12 \; x \; 2,225^2} \qquad \underline{= 0,70 \; KN \;+}$$

$$\uparrow M3 \quad = \frac{9,54}{2,225}$$

$$\uparrow M3 \quad = 4,29 \; KN$$

Total jumlah :

↑P1 + ↑q1 + ↑q2 - ↓M1 + ↑M3

= 3,89 + 19,31 + 1,92 - 5,28 + 4,29

= 26,87 KN ↑

Perhitungan Manual Pada Balok Khusus Memanjang (Arah X)

1) As 1 (B-E)
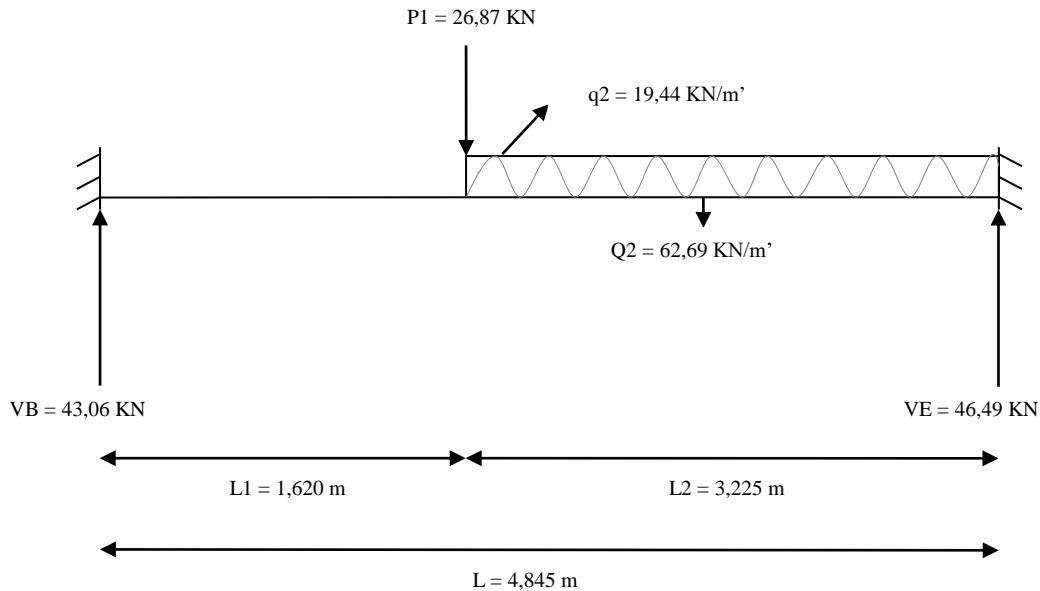
Perhitungan reaksi :

- **Pada V Kiri**

$$\uparrow P1 = \frac{26,87 \; x \; 3,225}{4,845} \qquad\qquad = 17,88 \; KN$$

$$\uparrow q2 = \frac{62,69 \; x \; (\frac{1}{2} \; x \; 3,225)}{4,845} \qquad\qquad = 20,86 \; KN$$

Momen :

$$P1 = \frac{26,87 \; x \; 3,225^2 \; x \; 1,620}{4,845^2} \qquad\qquad = 19,28 \; KN$$

$$q2 = \frac{19,44 \; x \; 3,225^2 \; x \; ((6 \; x \; 1,620^2)+(4 \; x \; 1,620 \; x \; 3,225)+(3,225^2))}{12 \; x \; 4,845^2} \qquad \underline{= 33,76 \; KN \; +}$$

$$\uparrow MB = \frac{53,04}{4,845}$$

$$\uparrow MB = 10,95 \text{ KN}$$

$$P1 = \frac{26,87 \; x \; 1,620^2 x \; 3,225}{4,845^2} \qquad = 9,69 \text{ KN}$$

$$q2 = \frac{19,44 \; x \; 3,225^2 \; x \; ((4 \; x \; 1,620 \; x \; 3,225)+(3,225^2))}{12 \; x \; 4,845^2} \qquad \underline{= 22,46 \text{ KN} +}$$

$$\downarrow ME = \frac{32,15}{4,845}$$

$$\downarrow ME = 6,64 \text{ KN}$$

Total jumlah :

$$\uparrow P1 + \uparrow q2 + \uparrow MB - \downarrow ME$$

$$= 17,88 + 20,86 + 10,95 - 6,64$$

$$= 43,06 \text{ KN} \uparrow$$

- **Pada V kanan**

$$\uparrow P1 = \frac{26,87 \; x \; 1,620}{4,845} \qquad = 8,98 \text{ KN}$$

$$\uparrow q2 = \frac{62,69 \; x \; ((\frac{1}{2} \; x \; 3,225)+1,620)}{4,845} \qquad = 41,82 \text{ KN}$$

Momen :

$$P1 = \frac{26,87 \; x \; 3,225^2 x \; 1,620}{4,845^2} \qquad = 19,28 \text{ KN}$$

$$q2 = \frac{19,44 \; x \; 3,225^2 \; x \; ((6 \; x \; 1,620^2)+(4 \; x \; 1,620 \; x \; 3,225)+(3,225^2))}{12 \; x \; 4,845^2} \qquad \underline{= 33,76 \text{ KN} +}$$

$$\downarrow MB = \frac{53,04}{4,845}$$

$$\downarrow MB = 10,95 \text{ KN}$$

P1 $= \dfrac{26,87 \; x \; 1,620^2 x \; 3,225}{4,845^2}$ = 9,69 KN

q2 $= \dfrac{19,44 \; x \; 3,225^2 \; x \; ((4 \; x \; 1,620 \; x \; 3,225)+(3,225^2))}{12 \; x \; 4,845^2}$ = 22,46 KN +

$\uparrow ME = \dfrac{32,15}{4,845}$

$\uparrow ME$ = 6,64 KN

Total jumlah :

$\uparrow$P1 + $\uparrow$q2 - $\downarrow$MB + $\uparrow$ME

= 17,88 + 20,86 - 10,95 + 6,64

= 46,49 KN $\uparrow$

2) As 3 (B-E)

Perhitungan reaksi :

- **Pada V Kiri**

$$\uparrow P1 = \frac{50,12 \; x \; 3,225}{4,845} \qquad\qquad = 33,36 \; KN$$

$$\uparrow q1 = \frac{16,62 \; x \; \left(\left(\frac{1}{2} \; x \; 1,620\right)+3,225\right)}{4,845} \qquad\qquad = 13,84 \; KN$$

$$\uparrow q2 = \frac{85,57 \; x \; \left(\frac{1}{2} \; x \; 3,225\right)}{4,845} \qquad\qquad = 28,48 \; KN$$

Momen :

$$P1 = \frac{50,12 \; x \; 3,225^2 \, x \, 1,620}{4,845^2} \qquad\qquad = 35,98 \; KN$$

$$q1 = \frac{10,26 \; x \; 1,620^2 \; x \; \left((6 \; x \; 3,225^2)+(4 \; x \; 1,620 \; x \; 3,225)+(1,620^2)\right)}{12 \; x \; 4,845^2} \qquad = 8,21 \; KN$$

$$q2 = \frac{26,53 \; x \; 3,225^2 \; x \; \left((6 \; x \; 1,620^2)+(4 \; x \; 1,620 \; x \; 3,225)+(3,225^2)\right)}{12 \; x \; 4,845^2} \qquad \underline{= 46,09 \; KN \; +}$$

$$\uparrow MB = \frac{90,28}{4,845}$$

$$\uparrow MB = 18,63 \text{ KN}$$

$$P1 = \frac{50,12 \; x \; 1,620^2 x \, 3,225}{4,845^2} \qquad\qquad = 18,07 \text{ KN}$$

$$q1 = \frac{10,26 \; x \; 1,620^2 \; x((4 \; x \; 1,620 \; x \; 4,845)+(1,620^2))}{12 \; x \; 4,845^2} \qquad\qquad = 2,25 \text{ KN}$$

$$q2 = \frac{26,53 \; x \; 3,225^2 \; x \; ((4 \; x \; 1,620 \; x \; 3,225)+(3,225^2))}{12 \; x \; 4,845^2} \qquad\qquad = 30,66 \text{ KN +}$$

$$\downarrow ME = \frac{50,98}{4,845}$$

$$\downarrow ME = 10,52 \text{ KN}$$

Total jumlah :

$\uparrow$P1 + $\uparrow$q1 + $\uparrow$q2 + $\uparrow$MB - $\downarrow$ME

= 33,36 + 13,84 + 28,48 + 18,63 − 10,52

= 83,79 KN $\uparrow$

- **Pada V kanan**

$$\uparrow P1 = \frac{50,12 \; x \; 1,620}{4,845} \qquad\qquad = 16,76 \text{ KN}$$

$$\uparrow q1 = \frac{16,62 \; x \; \left(\frac{1}{2} \; x \; 1,620\right)}{4,845} \qquad\qquad = 2,78 \text{ KN}$$

$$\uparrow q2 = \frac{85,57 \; x \; \left(\left(\frac{1}{2} \; x \; 3,225\right)+1,620\right)}{4,845} \qquad\qquad = 57,09 \text{ KN}$$

Momen :

$$P1 \quad = \frac{50,12 \ x \ 3,225^2 x 1,620}{4,845^2} \qquad\qquad = 35,98 \ KN$$

$$q1 \quad = \frac{10,26 \ x \ 1,620^2 \ x \ ((6 \ x \ 3,225^2)+(4 \ x \ 1,620 \ x \ 3,225)+(1,620^2))}{12 \ x \ 4,845^2} \qquad = 8,21 \ KN$$

$$q2 \quad = \frac{26,53 \ x \ 3,225^2 \ x \ ((6 \ x \ 1,620^2)+(4 \ x \ 1,620 \ x \ 3,225)+(3,225^2))}{12 \ x \ 4,845^2} \qquad \underline{= 46,09 \ KN \ +}$$

$$\downarrow MB \quad = \frac{90,28}{4,845}$$

$$\downarrow MB \quad = 18,63 \ KN$$

$$P1 \quad = \frac{50,12 \ x \ 1,620^2 x \ 3,225}{4,845^2} \qquad\qquad = 18,07 \ KN$$

$$q1 \quad = \frac{10,26 \ x \ 1,620^2 \ x ((4 \ x \ 1,620 \ x \ 3,225)+(1,620^2))}{12 \ x \ 4,845^2} \qquad = 2,25 \ KN$$

$$q2 \quad = \frac{26,53 \ x \ 3,225^2 \ x \ ((4 \ x \ 1,620 \ x \ 3,225)+(3,225^2))}{12 \ x \ 4,845^2} \qquad \underline{= 30,66 \ KN \ +}$$

$$\uparrow ME \quad = \frac{50,98}{4,845}$$

$$\uparrow ME \quad = 10,52 \ KN$$

Total jumlah :

↑P1 + ↑q1 + ↑q2 - ↓M4 + ↑M6

=33,36 + 13,84 + 28,48 - 18,63 + 10,52

= 68,52 KN ↑

3) As 4 (B-E)
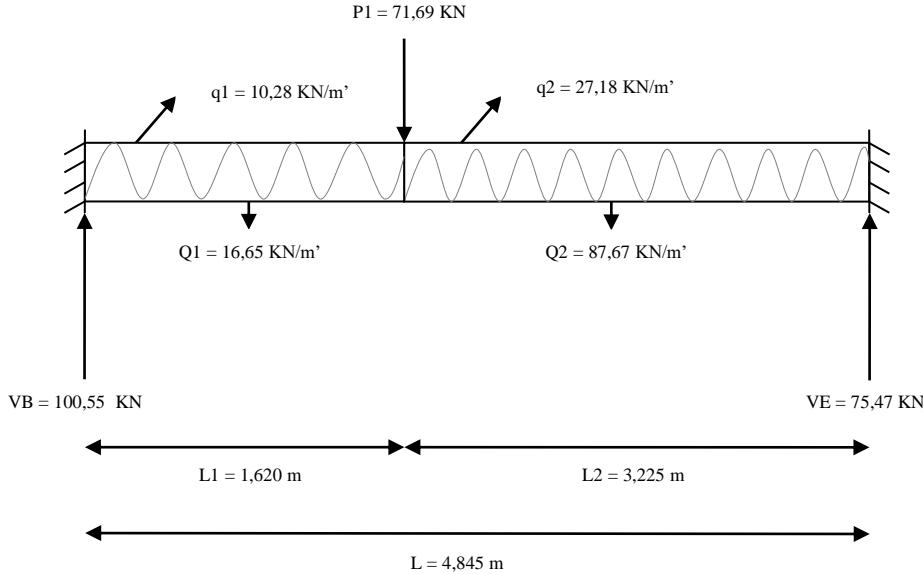
Perhitungan reaksi :

- **Pada V Kiri**

$$\uparrow P1 \quad = \frac{71,69 \ x \ 3,225}{4,845} \qquad\qquad = 47,72 \ KN$$

$$\uparrow q1 \quad = \frac{16,65 \ x \ \left(\left(\frac{1}{2} x \ 1,620\right)+3,225\right)}{4,845} \qquad = 13,86 \ KN$$

$$\uparrow q2 \quad = \frac{87,67 \ x \ \left(\frac{1}{2} x \ 3,225\right)}{4,845} \qquad\qquad = 29,18 \ KN$$

Momen :

$$P1 \quad = \frac{71,69 \ x \ 3,225^2 x 1,620}{4,845^2} \qquad\qquad = 51,46 \ KN$$

$$q1 \quad = \frac{10,28 \ x \ 1,620^2 \ x \ \left((6 \ x \ 3,225^2)+(4 \ x \ 1,620 \ x \ 3,225)+(1,620^2)\right)}{12 \ x \ 4,845^2} \qquad = 8,23 \ KN$$

$$q2 \quad = \frac{27,18 \ x \ 3,225^2 \ x \ \left((6 \ x \ 1,620^2)+(4 \ x \ 1,620 \ x \ 3,225)+(3,225^2)\right)}{12 \ x \ 4,845^2} \qquad \underline{= 47,22 \ KN \ +}$$

$$\uparrow MB = \frac{106,91}{4,845}$$

$$\uparrow MB = 22,07 \text{ KN}$$

$$P1 = \frac{71,69 \ x \ 1,620^2 x 3,225}{4,845^2} \qquad\qquad = 25,85 \text{ KN}$$

$$q1 = \frac{10,28 \ x \ 1,620^2 \ x ((4 \ x \ 1,620 \ x \ 4,845)+(1,620^2))}{12 \ x \ 4,845^2} \qquad = 2,25 \text{ KN}$$

$$q2 = \frac{27,18 \ x \ 3,225^2 \ x \ ((4 \ x \ 1,620 \ x \ 3,225)+(3,225^2))}{12 \ x \ 4,845^2} \qquad \underline{= 31,42 \text{ KN} +}$$

$$\downarrow ME = \frac{59,52}{4,845}$$

$$\downarrow ME = 12,28 \text{ KN}$$

Total jumlah :

$\uparrow P1 + \uparrow q1 + \uparrow q2 + \uparrow M4 - \downarrow M6$

$= 47,72 + 13,86 + 29,18 + 22,07 - 12,28$

$= 100,55 \text{ KN} \uparrow$

- **Pada V kanan**

$$\uparrow P1 = \frac{71,69 \ x \ 1,620}{4,845} \qquad\qquad\qquad = 23,97 \text{ KN}$$

$$\uparrow q1 = \frac{16,65 \ x \left(\frac{1}{2} \ x \ 1,620\right)}{4,845} \qquad\qquad = 2,78 \text{ KN}$$

$$\uparrow q2 = \frac{87,67 \ x \ \left(\left(\frac{1}{2} \ x \ 3,225\right)+1,620\right)}{4,845} \qquad = 58,49 \text{ KN}$$

Momen :

$$P1 = \frac{71,69 \; x \; 3,225^2 x \, 1,620}{4,845^2} \qquad\qquad = 51,46 \; KN$$

$$q1 = \frac{10,28 \; x \; 1,620^2 \; x \; ((6 \; x \; 3,225^2)+(4 \; x \; 1,620 \; x \; 3,225)+(1,620^2))}{12 \; x \; 4,845^2} \qquad = 8,23 \; KN$$

$$q2 = \frac{27,18 \; x \; 3,225^2 \; x \; ((6 \; x \; 1,620^2)+(4 \; x \; 1,620 \; x \; 3,225)+(3,225^2))}{12 \; x \; 4,845^2} \qquad = \underline{47,22 \; KN \; +}$$

$$\downarrow MB = \frac{106,91}{4,845}$$

$$\downarrow MB = 22,07 \; KN$$

$$P1 = \frac{71,69 \; x \; 1,620^2 x \; 3,225}{4,845^2} \qquad\qquad = 25,85 \; KN$$

$$q1 = \frac{10,28 \; x \; 1,620^2 \; x \, ((4 \; x \; 1,620 \; x \; 3,225)+(1,620^2))}{12 \; x \; 4,845^2} \qquad = 2,25 \; KN$$

$$q2 = \frac{27,18 \; x \; 3,225^2 \; x \; ((4 \; x \; 1,620 \; x \; 3,225)+(3,225^2))}{12 \; x \; 4,845^2} \qquad = \underline{31,42 \; KN \; +}$$

$$\uparrow ME = \frac{59,52}{4,845}$$

$$\uparrow ME = 12,28 \; KN$$

Total jumlah :

$\uparrow$P1 + $\uparrow$q1 + $\uparrow$q2 - $\downarrow$MB + $\uparrow$ME

= 47,72 + 13,86 + 29,18 - 22,07 + 12,28

= 75,47 KN $\uparrow$

4) As 6 (B-E)

P1 = 47,74 KN   P2 = 39,31 KN

q2 = 25,16 KN/m'

q1 = 11,08 KN/m'   q3 = 26,79 KN/m'

Q1 = 17,94 KN/m'   Q2 = 11,45 KN/m'   Q3 = 74,20 KN/m'

VB = 122,50 KN   VE = 68,14 KN

L1 = 1,620 m   L2 = 0,455 m   L3 = 2,770 m

L = 4,845 m
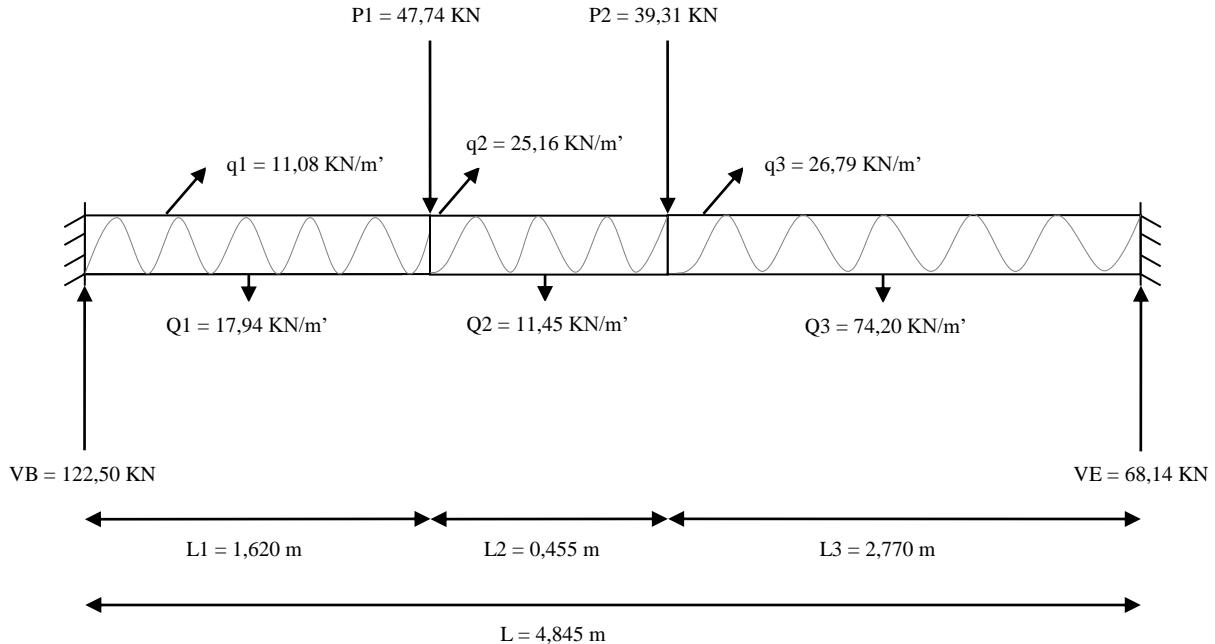
Perhitungan reaksi :

- **Pada V Kiri**

$$\uparrow P1 \quad = \frac{47,74 \; x \; (0,455+2,770)}{4,845} \qquad\qquad = 31,77 \text{ KN}$$

$$\uparrow P2 \quad = \frac{39,31 \; x \; 2,770}{4,845} \qquad\qquad = 22,48 \text{ KN}$$

$$\uparrow q1 \quad = \frac{17,94 \; x \; \left(\left(\frac{1}{2} x \; 1,630\right)+0,455+2,77\right)}{4,845} \qquad\qquad = 14,94 \text{ KN}$$

$$\uparrow q2 \quad = \frac{11,45 \; x \; \left(\left(\frac{1}{2} x \; 0,455\right)+2,770\right)}{4,845} \qquad\qquad = 7,08 \text{ KN}$$

$$\uparrow q3 \quad = \frac{74,20 \; x \; \left(\frac{1}{2} x \; 2,770\right)}{4,845} \qquad\qquad = 21,21 \text{ KN}$$

Momen :

$P1 \quad = \dfrac{47,74 \ \times \ (0,455+2,770)^2 \times 1,620}{4,845^2}$ $\qquad\qquad\qquad\qquad\qquad$ = 34,26 KN

$P2 \quad = \dfrac{39,31 \ \times \ (2,770)^2 \times (1,620+0,455)}{4,845^2}$ $\qquad\qquad\qquad\qquad$ = 26,66 KN

$q1 \quad = \dfrac{11,08 \ x \ 1,620^2 \ x \ \left((6 \ x \ (0,455+2,770)^2)+(4 \ x \ 1,620 \ x \ (0,455+2,770))+(1,620^2)\right)}{12 \ x \ 4,845^2}$ $\quad$ = 8,87 KN

$q2 \quad = -(\frac{25,16}{4,845^2}) \ x \ \left(\frac{1}{2} \ x \ 4,845^2 x \ ((1,620+0,455)^2 - 1,620^2) - \frac{2}{3} \ x4,845 \ x((1,620+0,445)^3 - 1,620^3) + \frac{1}{4} \ x((1,620+0,455)^4 - 1,620^4)\right)$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ = 77,15 KN

$q3 \quad = \dfrac{26,79 \ x \ 2,770^2 \ x \ \left((6 \ x \ (1,620+0,455)^2)+(4 \ x \ 2,770 \ x \ (1,620+0,455))+(2,770^2)\right)}{12 \ x \ 4,845^2}$ $\qquad$ = 41,22 KN +

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ ↑ MB $\quad = \dfrac{188,16}{4,845}$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ ↑ MB $\quad$ = 38,84 KN

$P1 \quad = \dfrac{47,74 \ x \ 1,620^2 x (0,455+2,770)}{4,845^2}$ $\qquad\qquad\qquad\qquad\qquad$ = 17,21 KN

$P2 \quad = \dfrac{39,31 \ x \ (1,620+0,445)^2 x \ 2,770}{4,845^2}$ $\qquad\qquad\qquad\qquad\quad$ = 19,97 KN

$q1 \quad = \dfrac{11,08 \ x \ 1,620^2 \ x((4 \ x \ 1,620 \ x \ (0,455+2,770))+(1,620^2))}{12 \ x \ 4,845^2}$ $\qquad\qquad$ = 2,43 KN

$q2 \quad = (\frac{25,16}{4,845^2}) \ x \ \left(\frac{1}{3} \ x4,845 \ x((1,620+0,445)^3 - 1,620^3) - \frac{1}{4} \ x((1,620+0,455)^4 - 1,620^4)\right)$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ = 4,98 KN

$q3 \quad = \dfrac{26,79 \ x \ 2,770^2 \ x \ ((4 \ x \ (2,770)x \ (1,620+0,455))+(2,770^2))}{12 \ x \ 4,845^2}$ $\qquad\qquad$ = 22,37 KN +

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ ↓ ME $\quad = \dfrac{66,96}{4,845}$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ ↓ ME $\quad$ = 13,82 KN

Total jumlah :

↑P1 + ↑P2 + ↑q1 + ↑q2 + ↑q 3 + ↑MB - ↓ME

= 31,77 + 22,48 + 14,94 + 7,08 + 21,21 + 38,84 − 13,82

= 122,50 KN ↑

- **Pada V kanan**

$$↑ P1 = \frac{47,74 \ x \ 1,620}{4,845} = 15,96 \ KN$$

$$↑ P2 = \frac{39,31 \ x \ (1,620+0,455)}{4,845} = 16,84 \ KN$$

$$↑ q1 = \frac{17,94 \ x \left(\frac{1}{2} x \ 1,620\right)}{4,845} = 3,00 \ KN$$

$$↑ q2 = \frac{11,45 \ x \ \left(\left(\frac{1}{2} x \ 0,455\right)+1,620\right)}{4,845} = 4,37 \ KN$$

$$↑ q3 = \frac{74,20 \ x \ \left(\left(\frac{1}{2} x \ 2,770\right)+1,620+0,455\right)}{4,845} = 52,99 \ KN$$

Momen :

$$P1 = \frac{47,74 \ x \ (0,455+2,770)^2 x 1,620}{4,845^2} = 34,26 \ KN$$

$$P2 = \frac{39,31 \ x \ (2,770)^2 x (1,620+0,455)}{4,845^2} = 26,66 \ KN$$

$$q1 = \frac{11,08 \ x \ 1,620^2 \ x \ \left((6 \ x \ (0,455+2,770)^2)+(4 \ x \ 1,620 \ x \ (0,455+2,770))+(1,620^2)\right)}{12 \ x \ 4,845^2} = 8,87 \ KN$$

$$q2 = -\left(\frac{25,16}{4,845^2}\right) x \left(\frac{1}{2} \ x \ 4,845^2 x \left((1,620+0,455)^2 - 1,620^2\right) - \frac{2}{3} \ x 4,845 \ x((1,620+0,445)^3 - 1,620^3) + \frac{1}{4} \ x((1,620+0,455)^4 - 1,620^4)\right)$$

$$= 77,15 \ KN$$

$$q3 = \frac{26,79 \ x \ 2,770^2 \ x \ \left((6 \ x \ (1,620+0,455)^2)+(4 \ x \ 2,770 \ x \ (1,620+0,455))+(2,770^2)\right)}{12 \ x \ 4,845^2} = \underline{41,22 \ KN \ +}$$

$$\downarrow \text{MB} = \frac{188,16}{4,845}$$

$$\downarrow \text{MB} = 38,84 \text{ KN}$$

$$\text{P1} = \frac{47,74 \; x \; 1,620^2 x(0,455+2,770)}{4,845^2} \qquad = 17,21 \text{ KN}$$

$$\text{P2} = \frac{39,31 \; x \; (1,620+0,445)^2 x \; 2,770}{4,845^2} \qquad = 19,97 \text{ KN}$$

$$\text{q1} = \frac{11,08 \; x \; 1,620^2 \; x((4 \; x \; 1,620 \; x \; (0,455+2,770))+(1,620^2))}{12 \; x \; 4,845^2} \qquad = 2,43 \text{ KN}$$

$$\text{q2} = (\tfrac{25,16}{4,845^2}) \; x \; \left(\tfrac{1}{3} \; x4,845 \; x((1,620 + 0,445)^3 - 1,620^3) - \tfrac{1}{4} \; x((1,620 + 0,455)^4 - 1,620^4) \right)$$

$$= 4,98 \text{ KN}$$

$$\text{q3} = \frac{26,79 \; x \; 2,770^2 \; x \; ((4 \; x \; (2,770)x \; (1,620+ 0,455))+(2,770^2))}{12 \; x \; 4,845^2} \qquad \underline{= 22,37 \text{ KN } +}$$

$$\uparrow \text{ME} = \frac{64,96}{4,845}$$

$$\uparrow \text{ME} = 13,82 \text{ KN}$$

Total jumlah :

$\uparrow$P1 + $\uparrow$P2 + $\uparrow$q1 + $\uparrow$q2 + $\uparrow$q3 - $\downarrow$MB + $\uparrow$ME

= 31,77 + 22,48 + 14,94 + 7,08 + 21,21 - 38,84 + 13,82

= 68,14 KN $\uparrow$