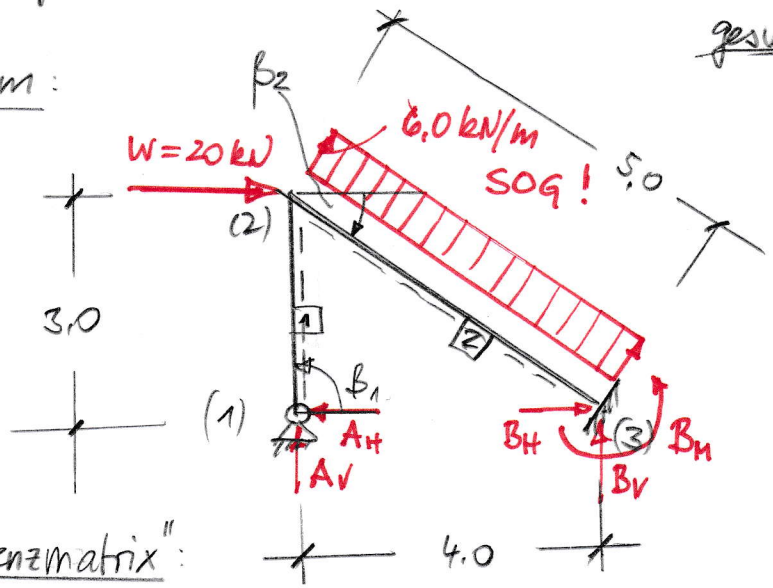
5. Beispiel zum DWV

gesucht: M, V, A, N, W

- System:



alle Stäbe: $EA = \infty$ (noch !)

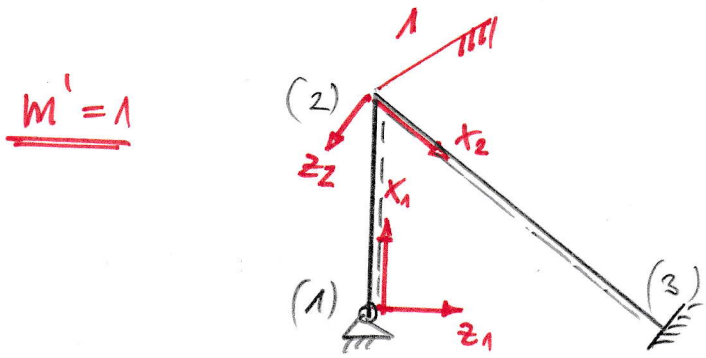
„Inzidenzmatrix":

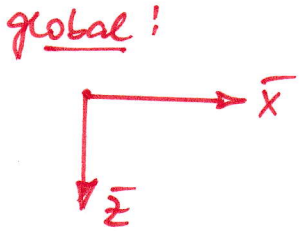
Stab i	a	e	l [m]	EJ [kNm²]	… β°
1	1	2	3,0	24000	+ 90°
2	2	3	5,0	36000	−36,87°

$\tan\alpha = 0{,}75$

⇝ Bauplan für Tragwerk !

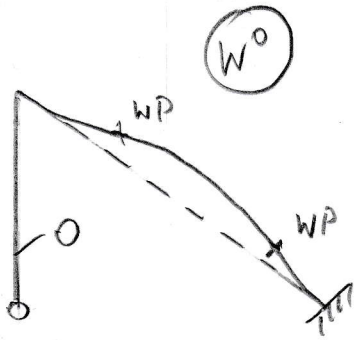
- kin. best. Hauptsystem:

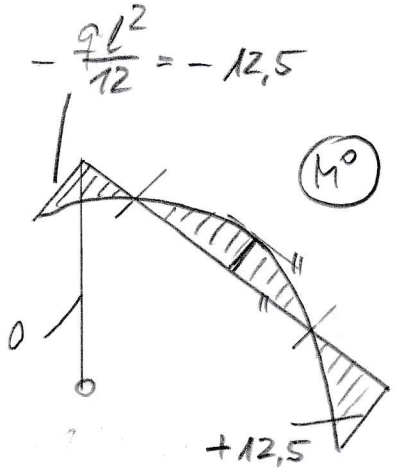


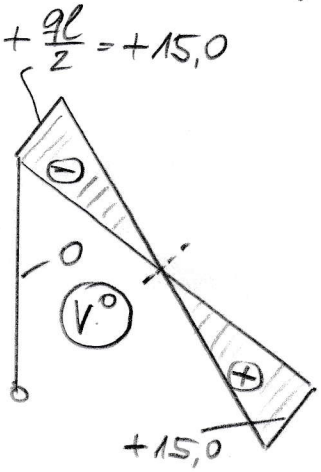


- Lastverf.-Zustand (LVZ):

Einzellast ≙ Knotenlast ⇝ bei Gleichgew.-bedingg. berücksichtigt.

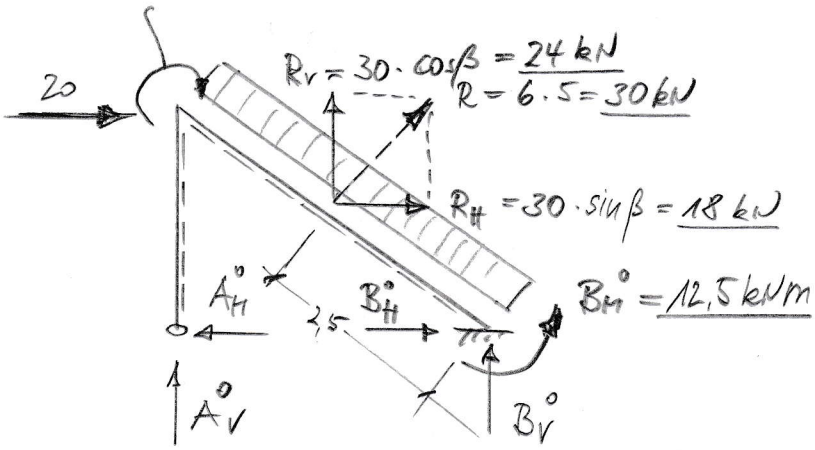






Berechnung des N°-Verlaufes (inkl. Auflagerkr.)

M aus Drehfessel



wegen $M^\circ = 0$ im Stab 1 $\rightsquigarrow$ $A_H^\circ = 0$

$\Sigma H = 0$: $\rightsquigarrow$ $B_H^\circ = -20 - 18 = -38$ kN

Drehfessel Einspannmom.

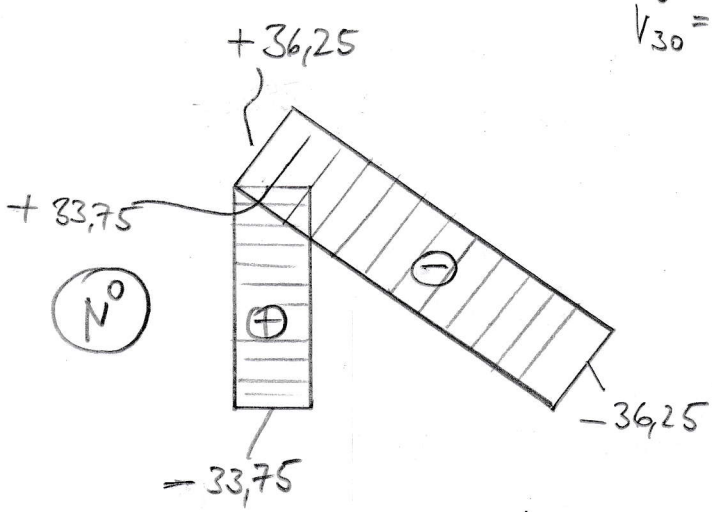
$\Sigma M_3 \overset{!}{=} 0$: $-A_V^\circ \cdot 4 - 20 \cdot 3 - 30 \cdot 2{,}5 - 12{,}5 + 12{,}5 = 0$

$\rightsquigarrow$ $A_V^\circ = -33{,}75$ kN

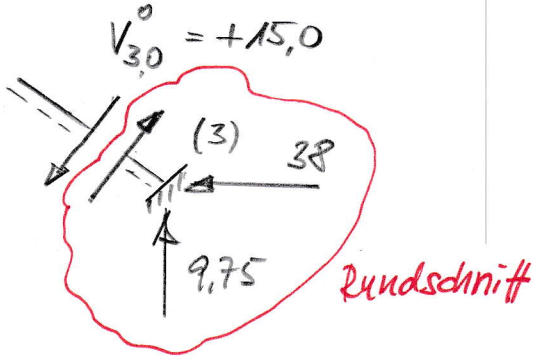
$\downarrow \Sigma V \overset{!}{=} 0$: $-A_V^\circ - B_V^\circ - R_V = 0$

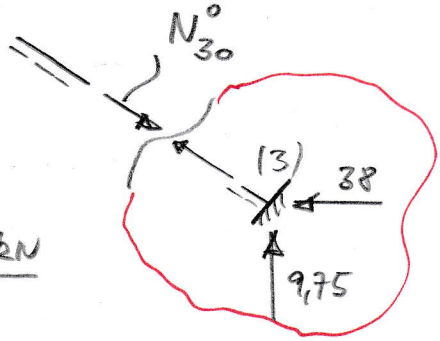
$-(-33{,}75) - 24 = B_V^\circ$ $\rightsquigarrow$ $B_V^\circ = 9{,}75$ kN

$V_{30}^\circ = +38 \cdot 0{,}6 - 9{,}75 \cdot 0{,}8 = +15{,}0$ kN



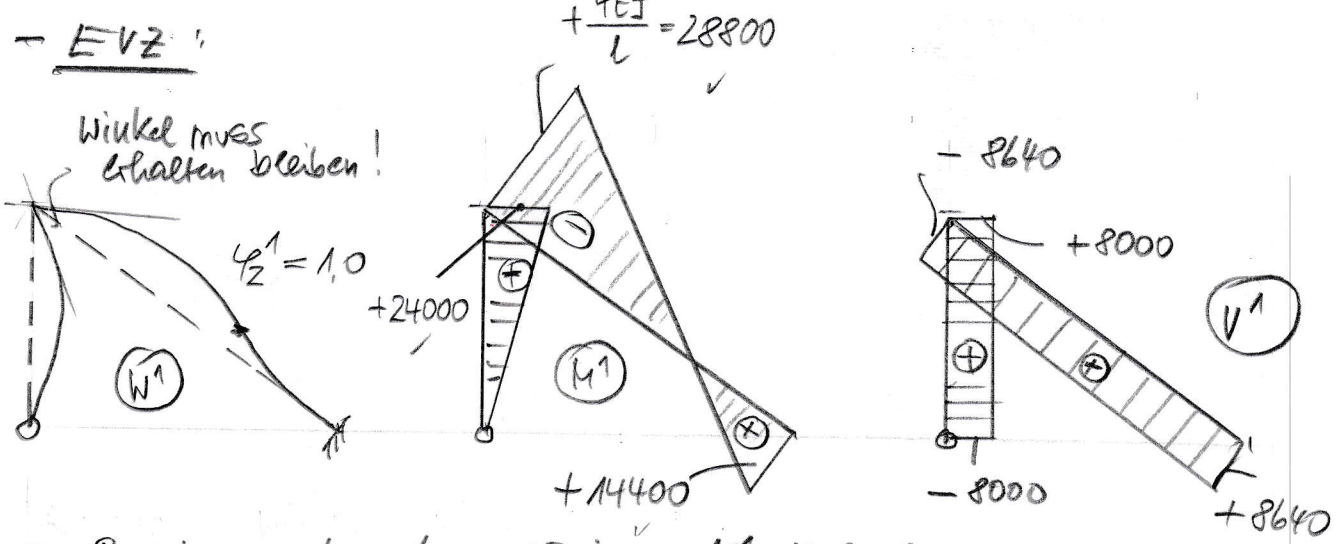
Vorzeichen nach WGV !



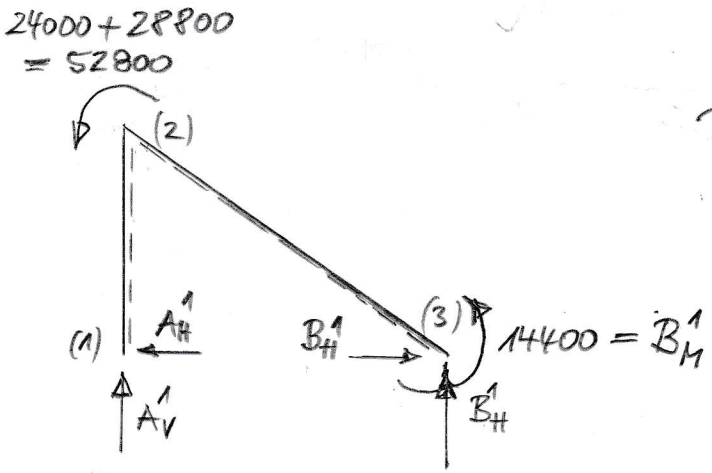


$N_{30}^\circ = -9{,}75 \cdot 0{,}6 - 38 \cdot 0{,}8 = -36{,}25$ kN

– EVZ:



Berechnung des dargestellten N^1-Verlaufes:



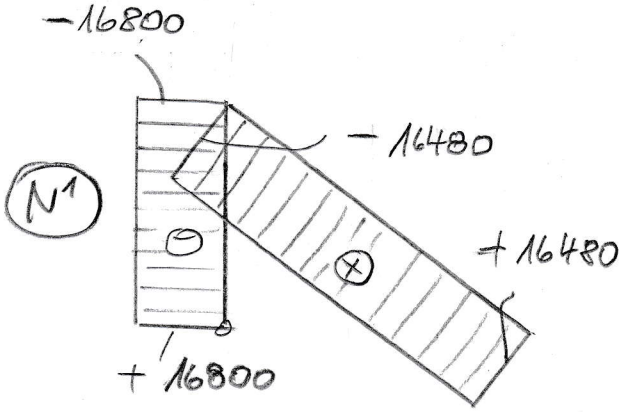
$A_H^1 = +8000\ kN$

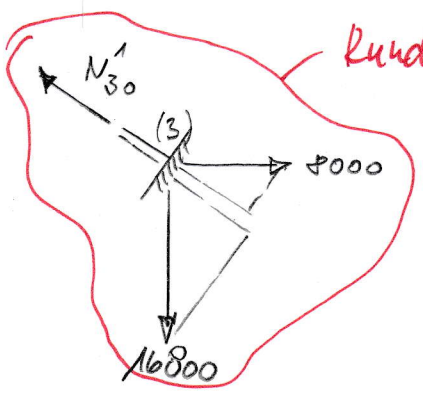
$\rightsquigarrow B_H^1 = 8000\ kN$

$\curvearrowright \Sigma M_3 \overset{!}{=} 0: \quad -A_V^1 \cdot 4 + 52800 + 14400 \overset{!}{=} 0$

$\rightsquigarrow A_V^1 = \frac{52800 + 14400}{4} = +16800\ kN$

$\downarrow \Sigma V \overset{!}{=} 0: \quad -A_V^1 - B_H^1 = 0 \quad \rightsquigarrow B_H^1 = -16800\ kN$





$N_{30}^1 = 16800 \cdot 0{,}6 + 8000 \cdot 0{,}8 = +16480\ kN$

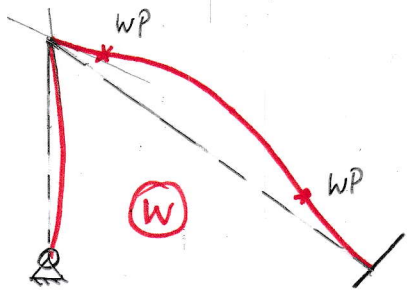
— Aufstellen der Gleichgewichtsbed. ($\rightsquigarrow$ 1 Ge. mit 1 Unbek.)
Drehfessel am Knoten 2 $\rightsquigarrow$ ΣM der Stabendmomente!

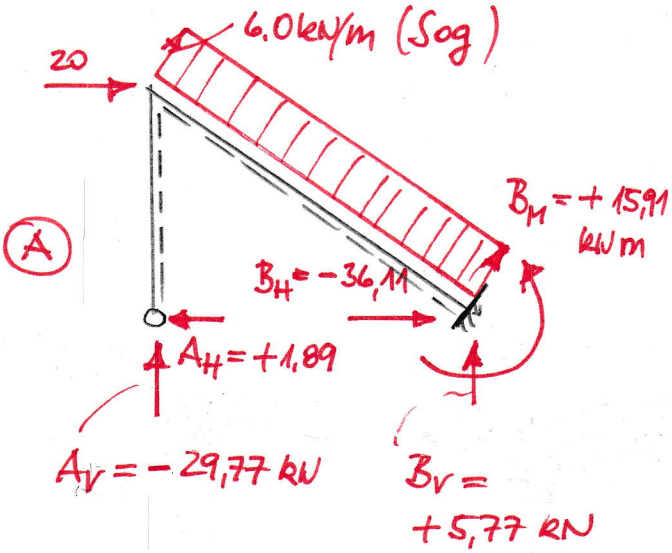
$$\Sigma M_z \overset{!}{=} 0 \;:\quad -12{,}5 + y_1 (24000 + 28800) = 0$$

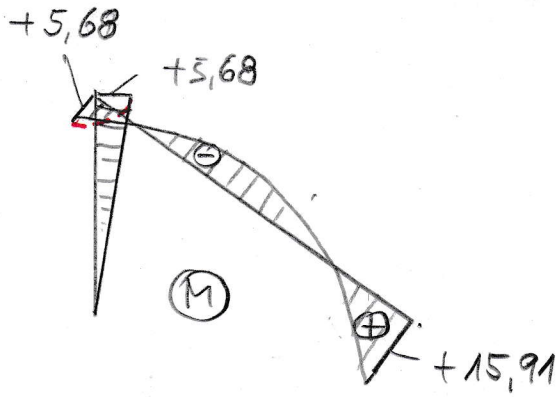
$$\rightsquigarrow y_1 = \frac{12{,}5}{52800} = +2{,}367 \cdot 10^{-4}$$

— Superposition: $\underline{z = z^0 + y_1 \cdot z^1}$ $\quad z = \{N, V, M, A, W\}$

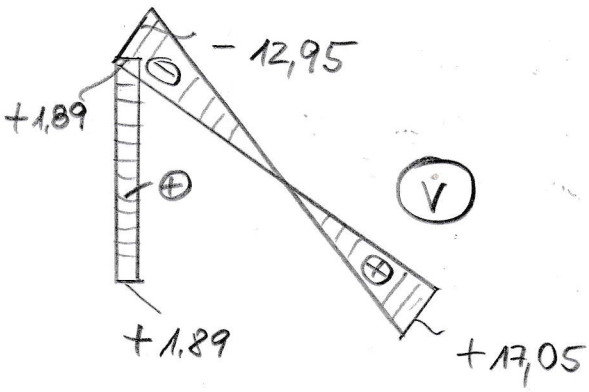
$\varphi_2 = 2{,}367 \cdot 10^{-4}$ [rad]

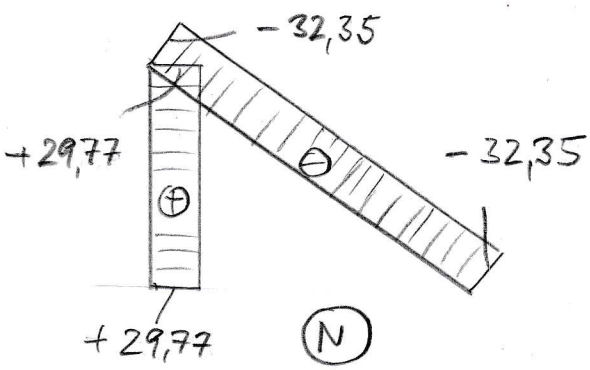






Vorzeichen nach Baustatik!





Kontrolle: Rundschnitt um Kn. 2 oder 3
inkl. Kraftzerlegung
$\rightsquigarrow$ Gleichgewichtskontrolle ΣH; ΣV; ΣM