

Digital image processing in the monitoring of wide-span timber structures

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Gymnasium in Murnau, Bavaria, Germany



Gymnasium in Murnau – Snow loads

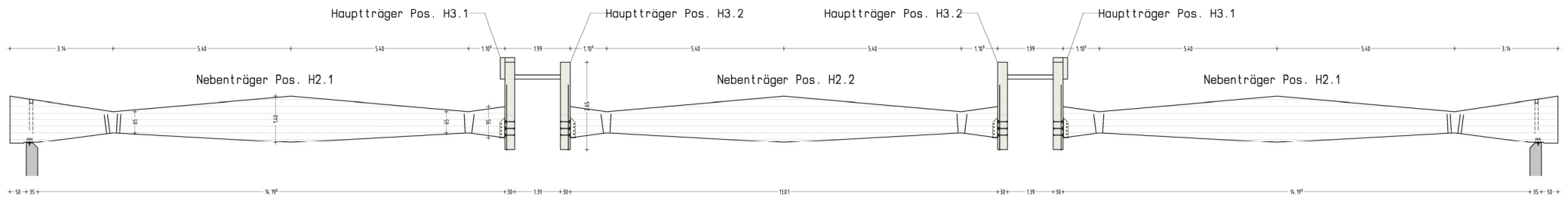
Snow load to DIN 1055-5:1975-06 (valid until 2006-12-31):

$$s_0 = 1.50 \text{ kN/m}^2$$

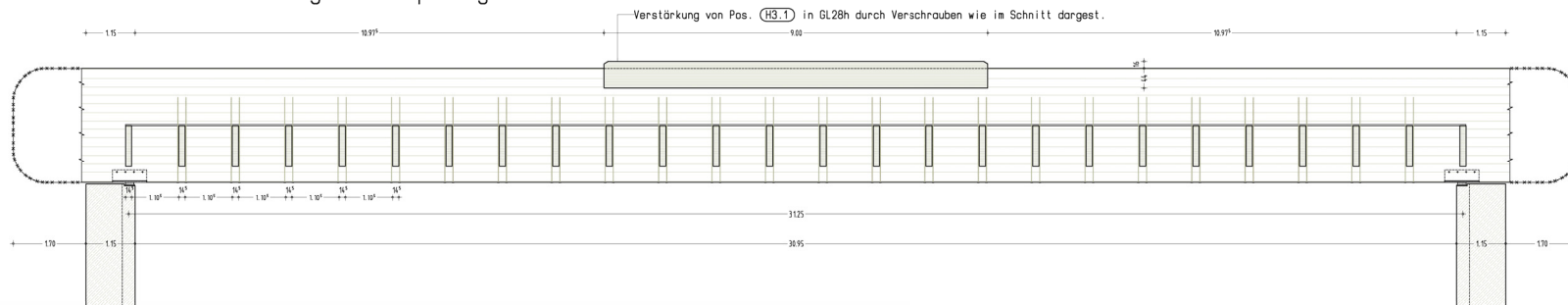
Snow load to DIN 1055-5:2005-07 (valid since 2007-01-01):

$$s_k = 3.80 \text{ kN/m}^2$$

Längsschnitt durch die Hauptträger:



Querschnitt entlang des Hauptträgers:

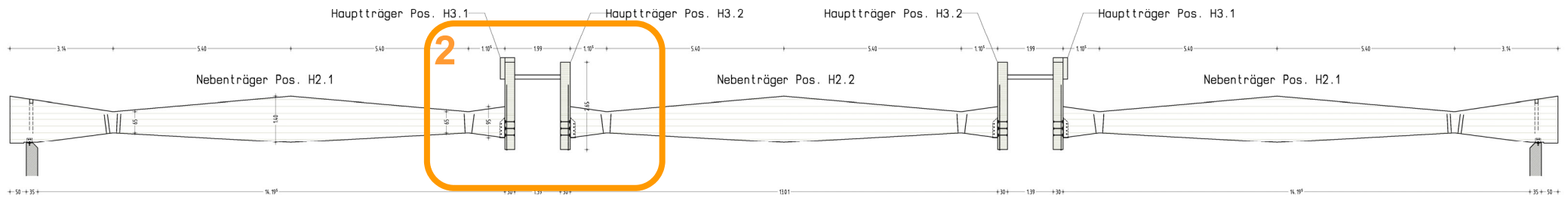


Gymnasium in Murnau – Load-bearing capacity

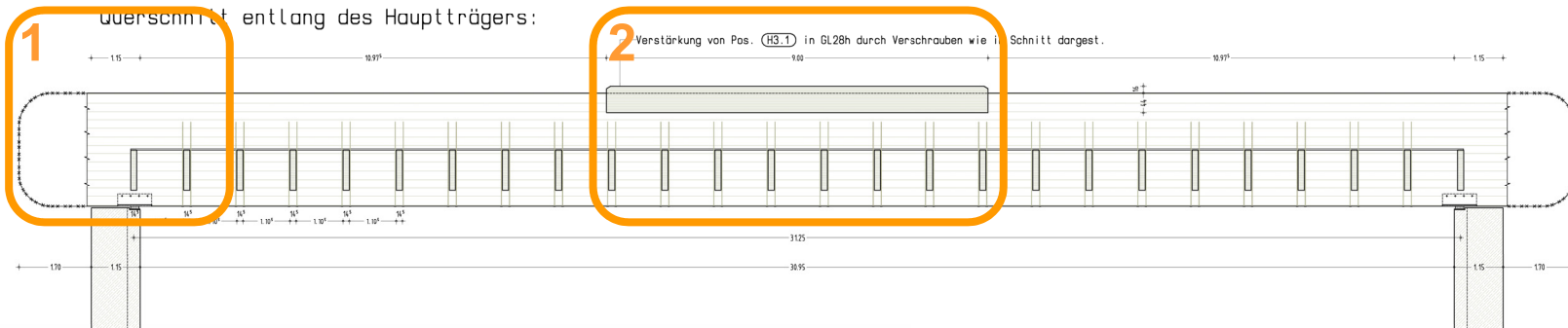
The degree of utilisation according to DIN 1052:2004-08 and DIN 1055-5:2005-07

- 1** Main beam support: $\eta=1.60$
- 2** Main beams (Pos. H3.1): $\eta=1.10$

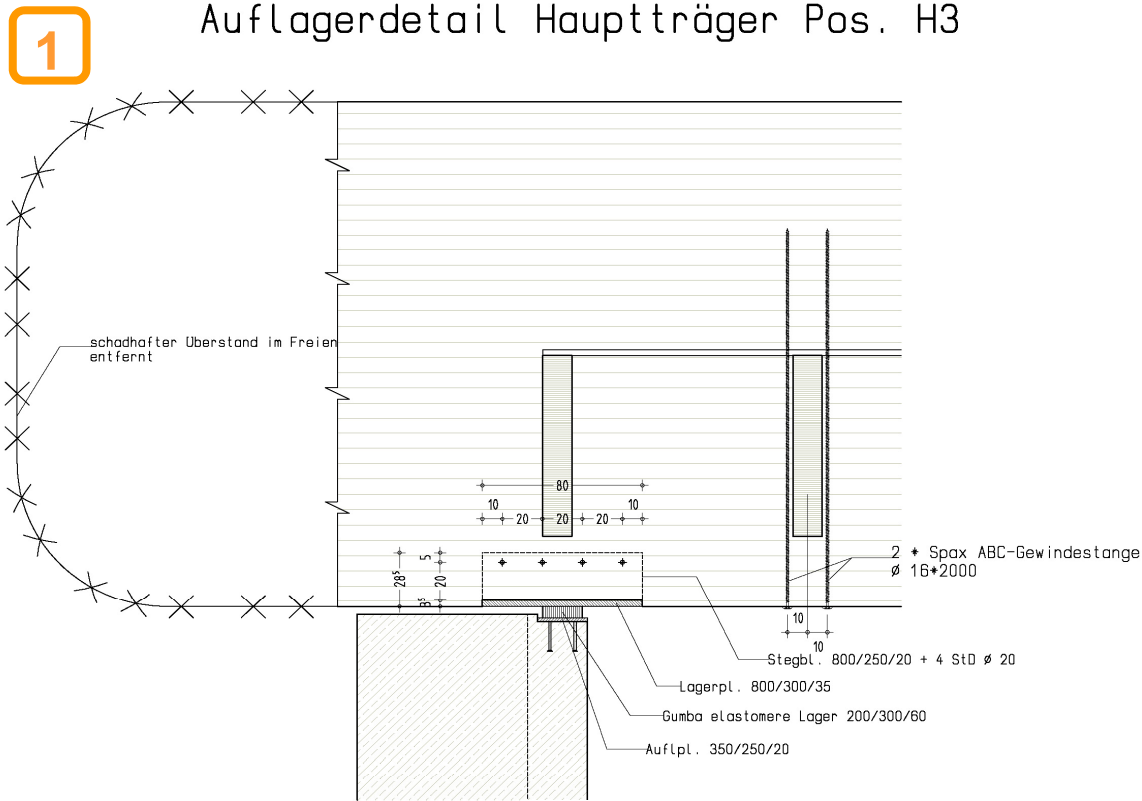
Längsschnitt durch die Hauptträger:



Querschnitt entlang des Hauptträgers:



Gymnasium in Murnau – Main beam support



$$\frac{\sigma_{c,90,d}}{k_{c,90} \cdot f_{c,90,d}} \leq 1$$

mit

$$\sigma_{c,90,d} = \frac{F_{c,90,d}}{A_{ef}}$$

Dabei ist

A_{ef} die wirksame Querschnittsfläche,

Tabelle 10/1. Beiwert $k_{c,90}$

Baustoff	$l_1 < 2 \cdot h$	$l_1 \geq 2 \cdot h$	
		Schwellen- druck	Auflagerdruck $l \leq 400 \text{ mm}$
BS-Holz aus NH	1,0	1,5	1,75 ⁾
VH aus NH	1,0	1,25	1,5
VH aus LH		1,0	

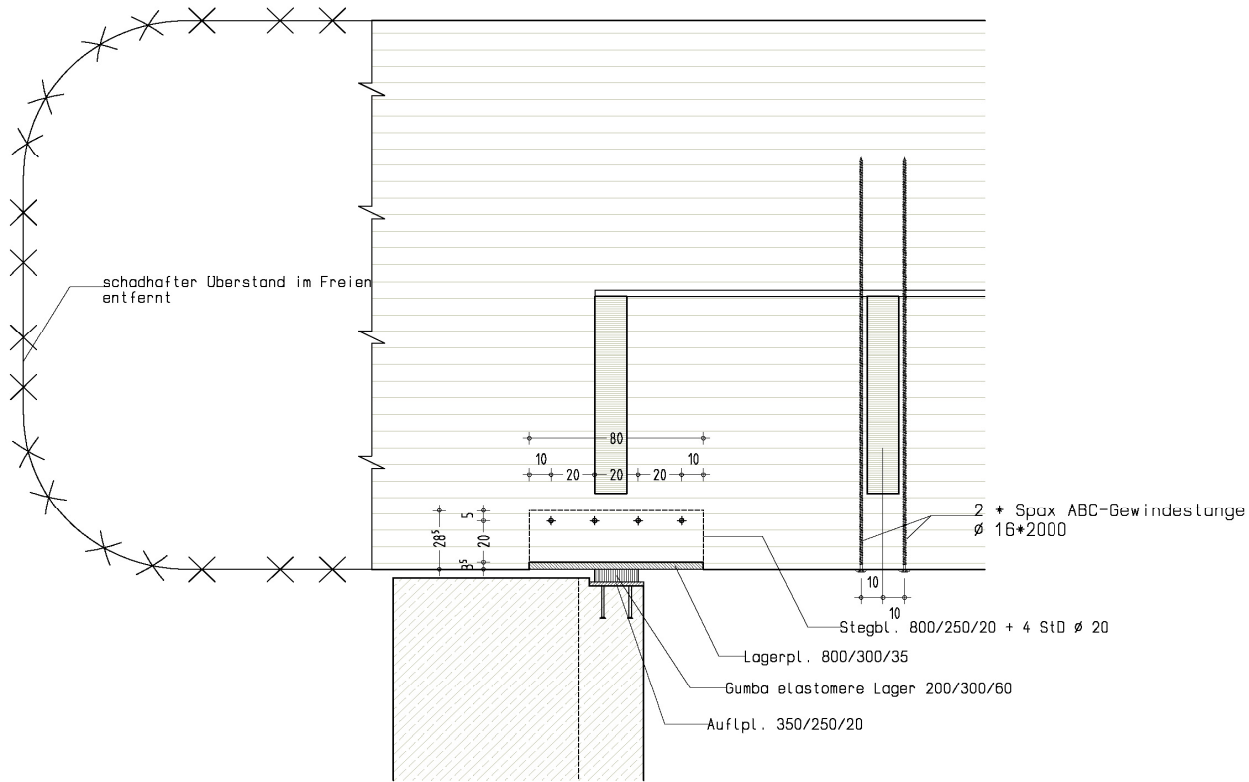
⁾ Für $l > 400 \text{ mm}$ darf mit $l = 400 \text{ mm}$ und $k_{c,90} = 1,75$ gerechnet werden.



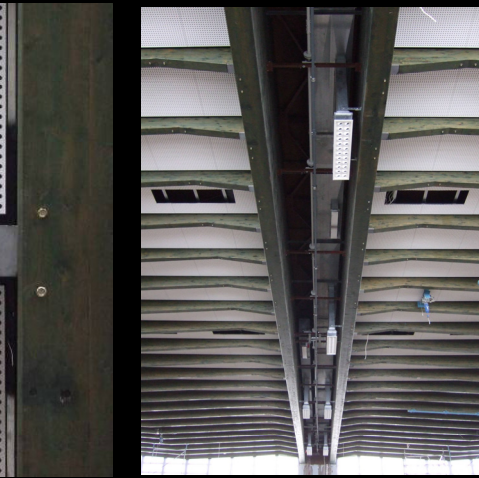
Gymnasium in Murnau – Main beam support

1

Auflagerdetail Hauptträger Pos. H3

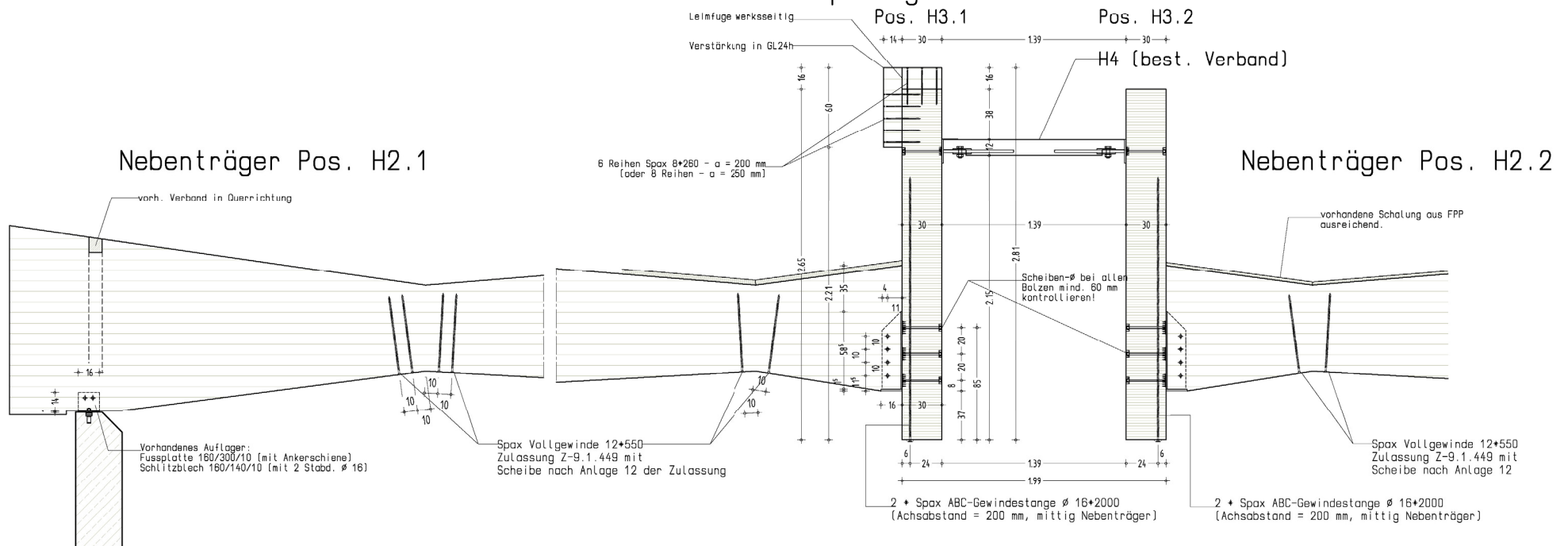


Gymnasium in Murnau – Main beams

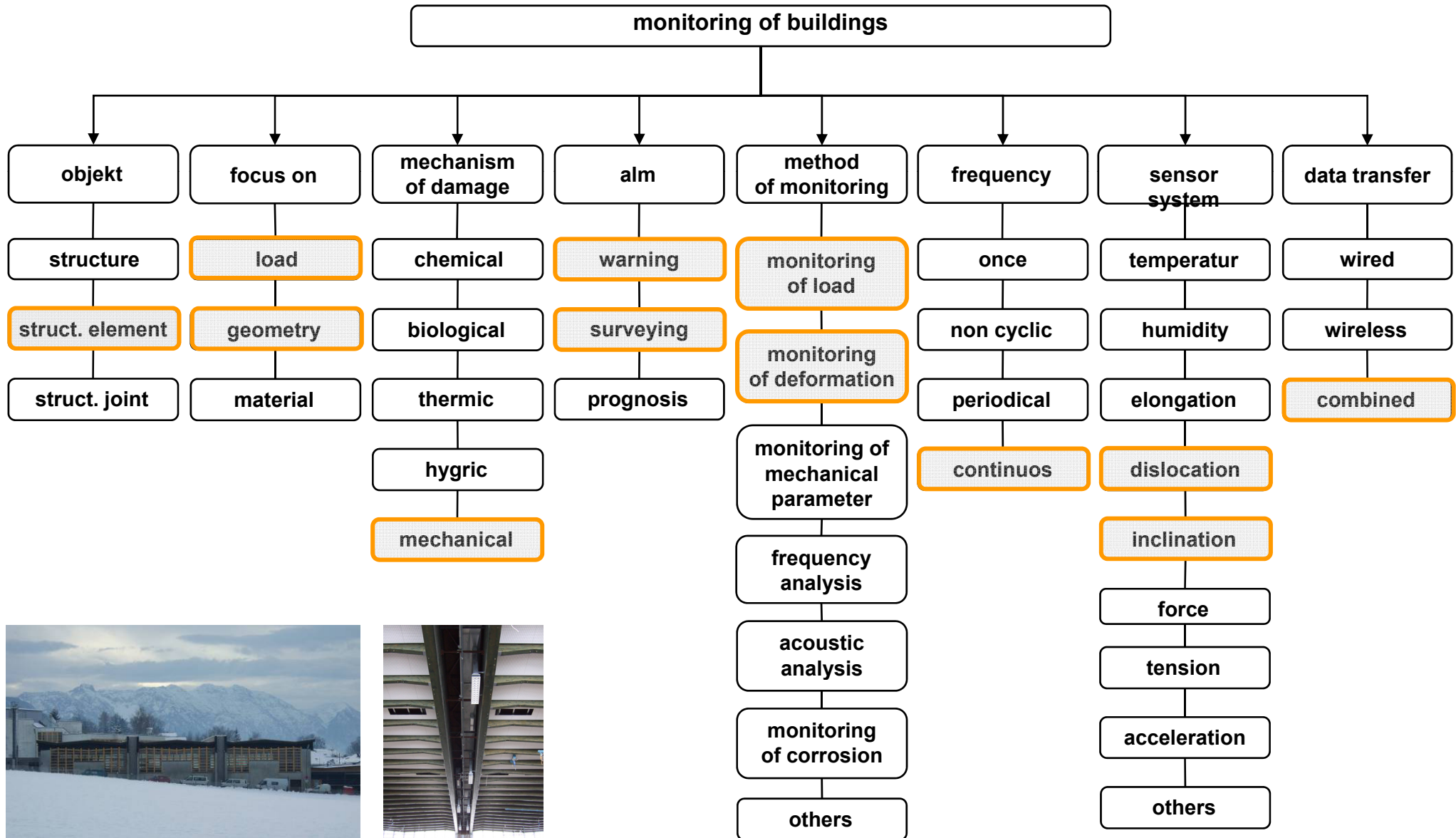


2

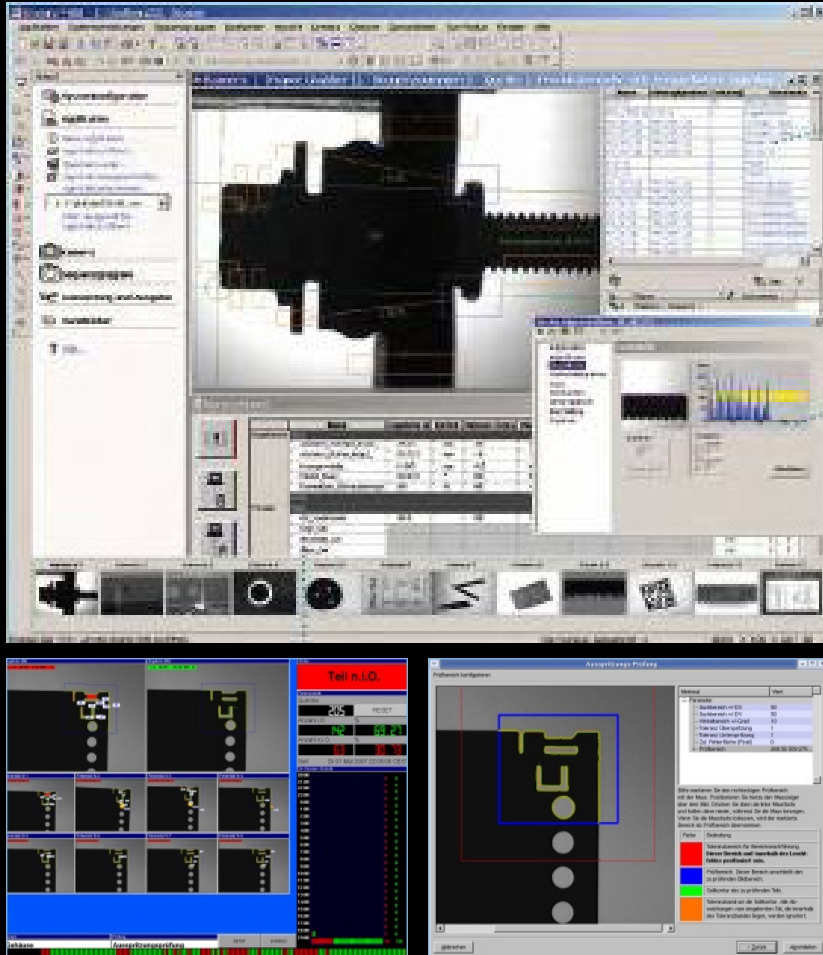
Schnitt Hauptträger Pos. H3:



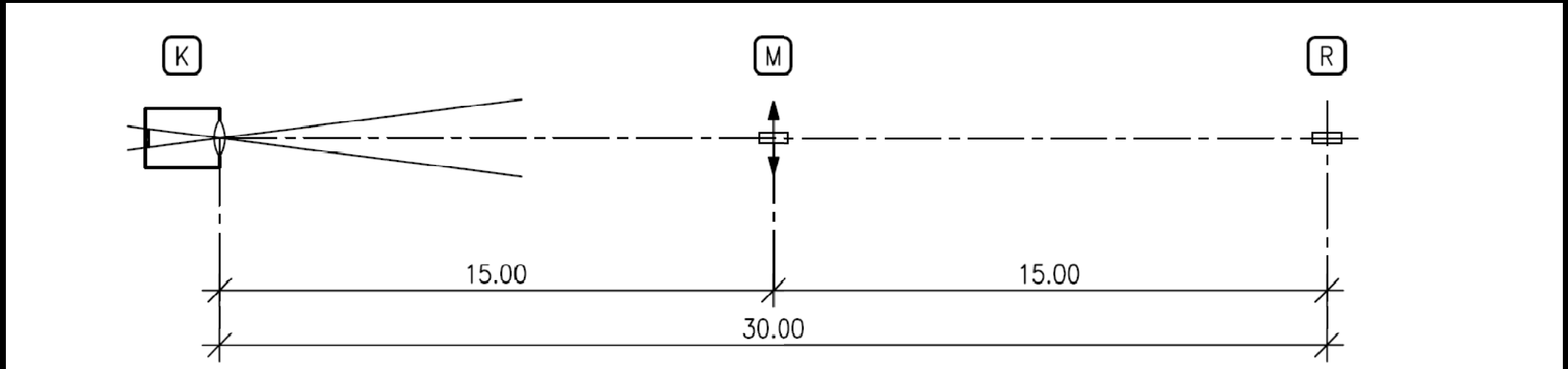
Gymnasium in Murnau – Monitoring systematics



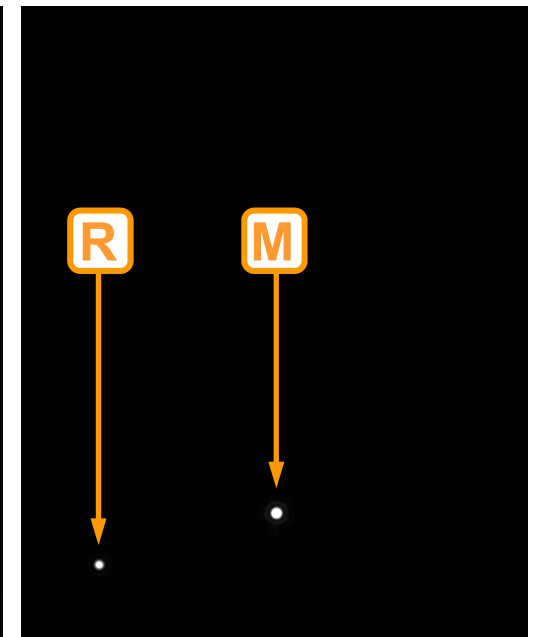
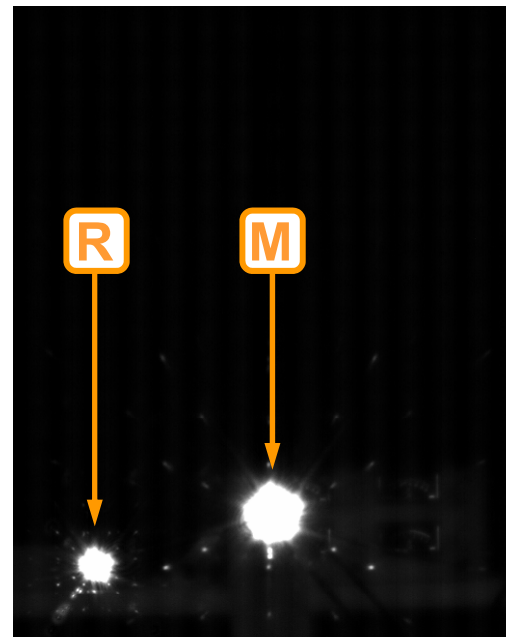
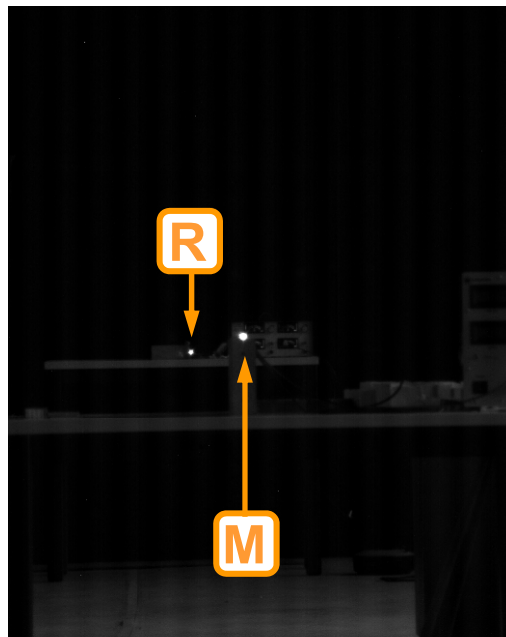
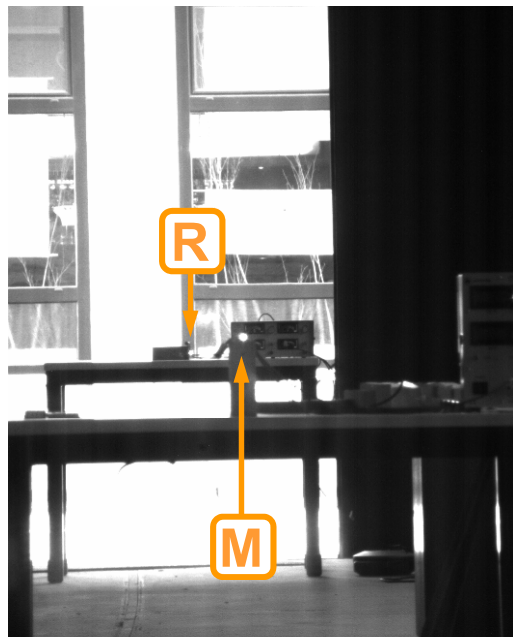
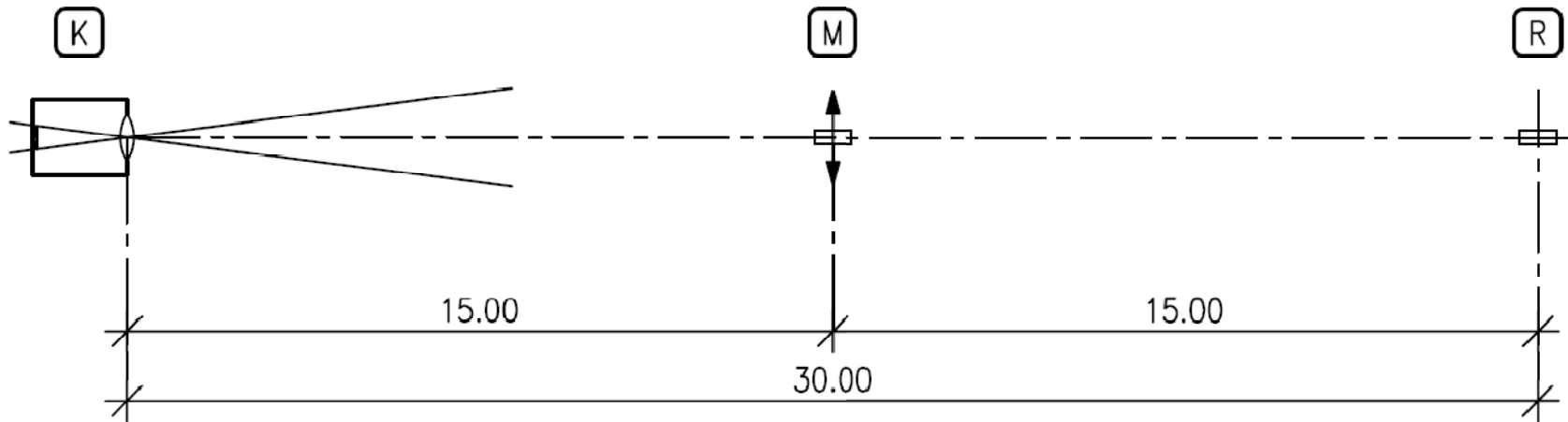
Gymnasium in Murnau – Digital image processing



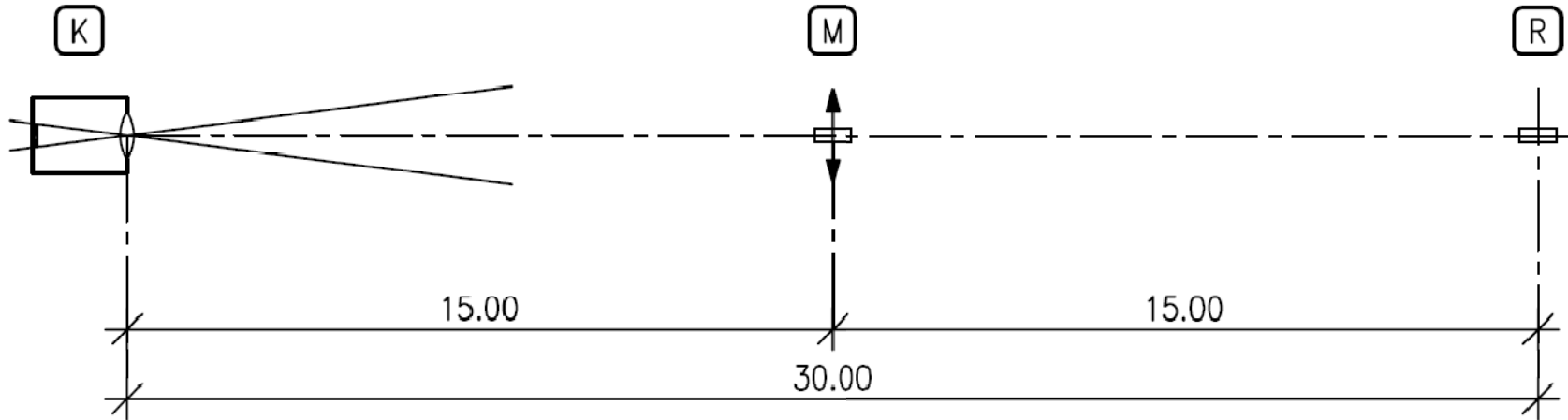
Gymnasium in Murnau – First preliminary test (TUM)



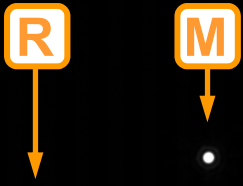
Gymnasium in Murnau – First preliminary test (TUM)



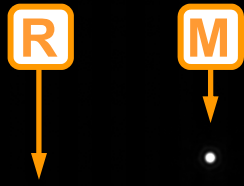
Gymnasium in Murnau – First preliminary test (TUM)



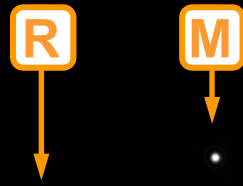
0°



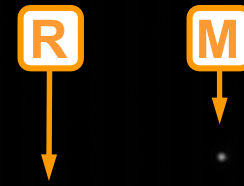
5°



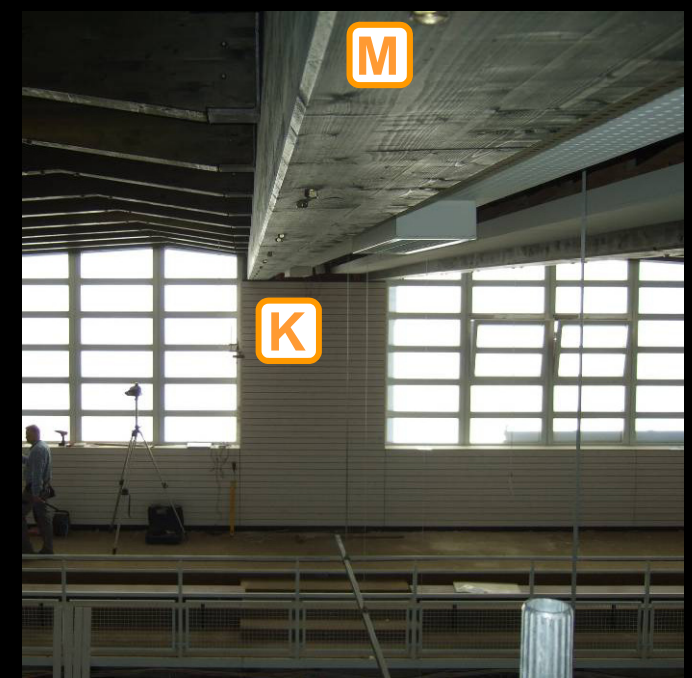
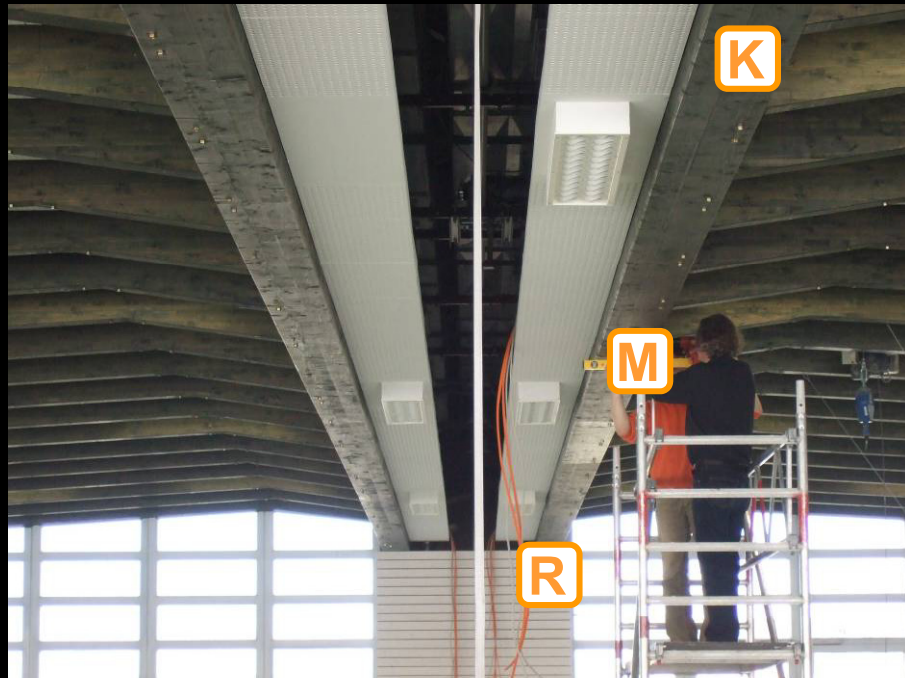
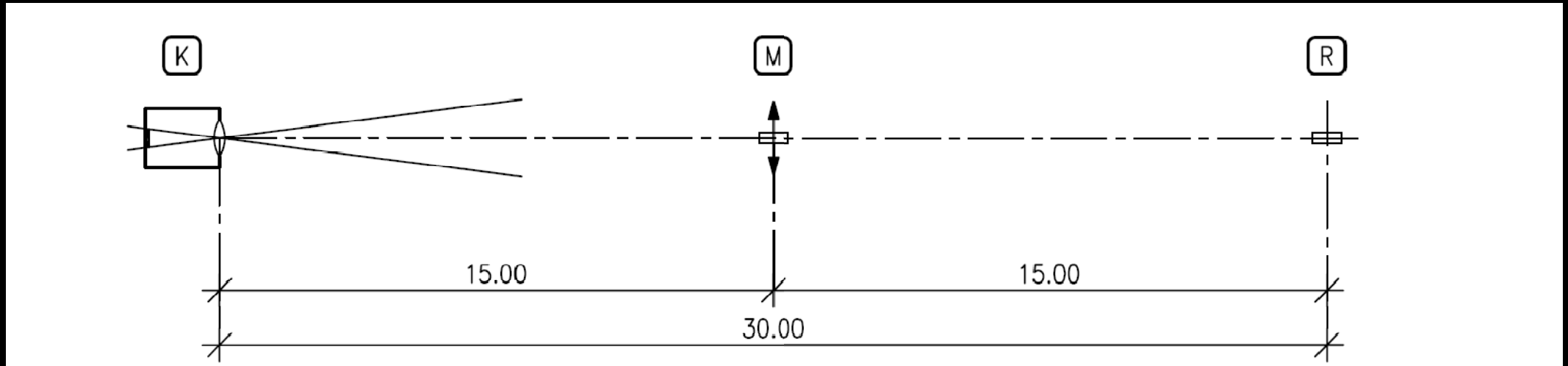
10°



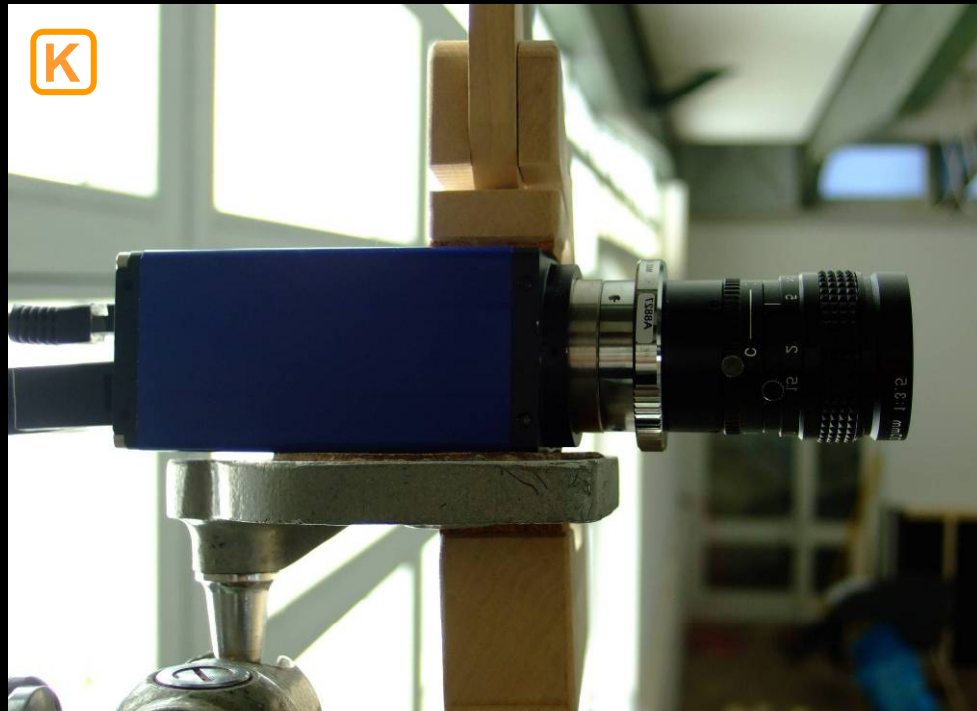
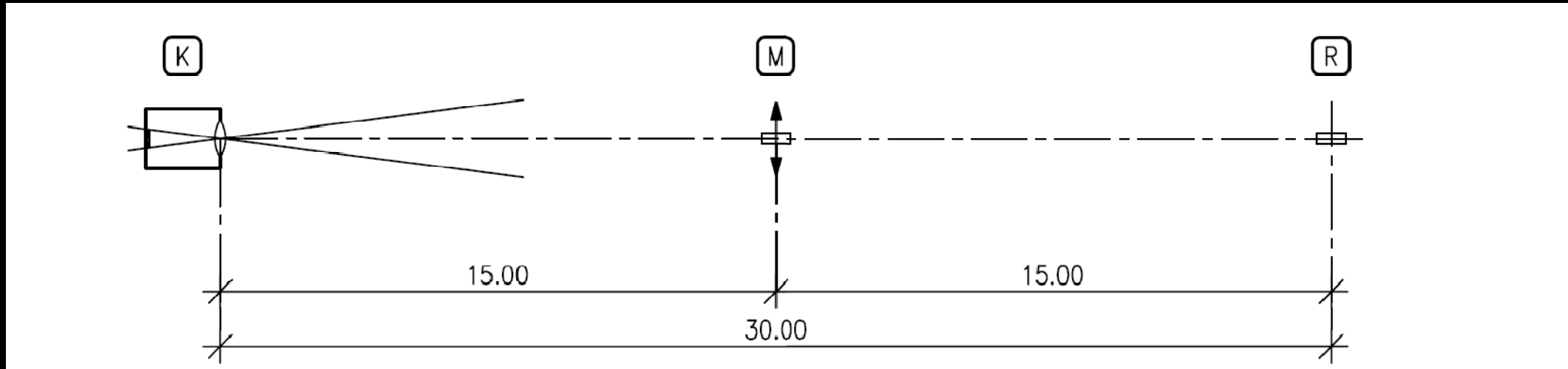
15°



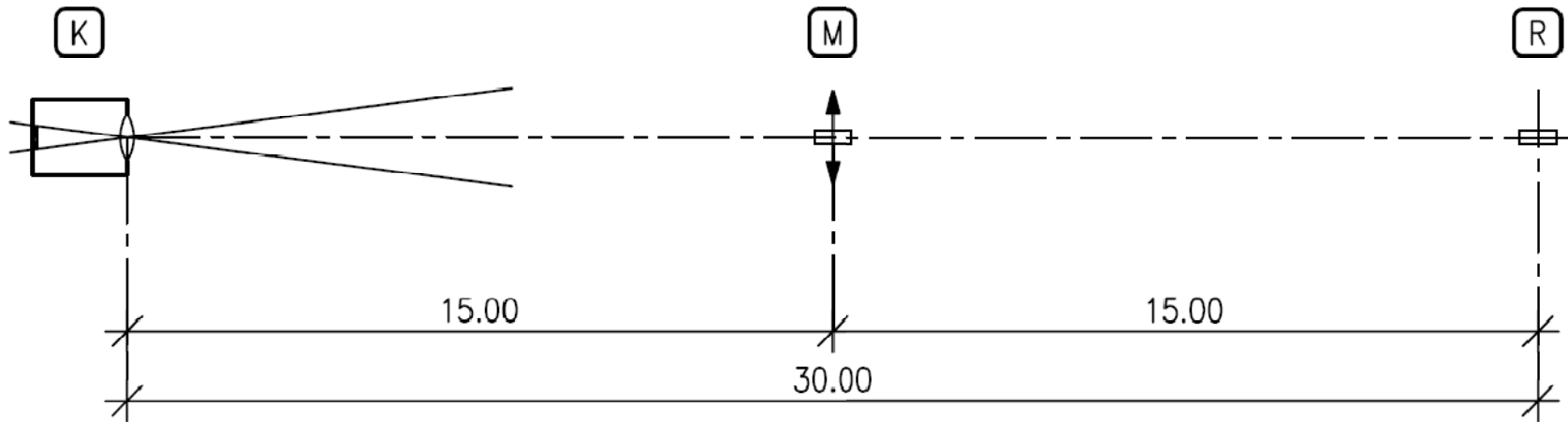
Gymnasium in Murnau – Second preliminary test (Murnau)



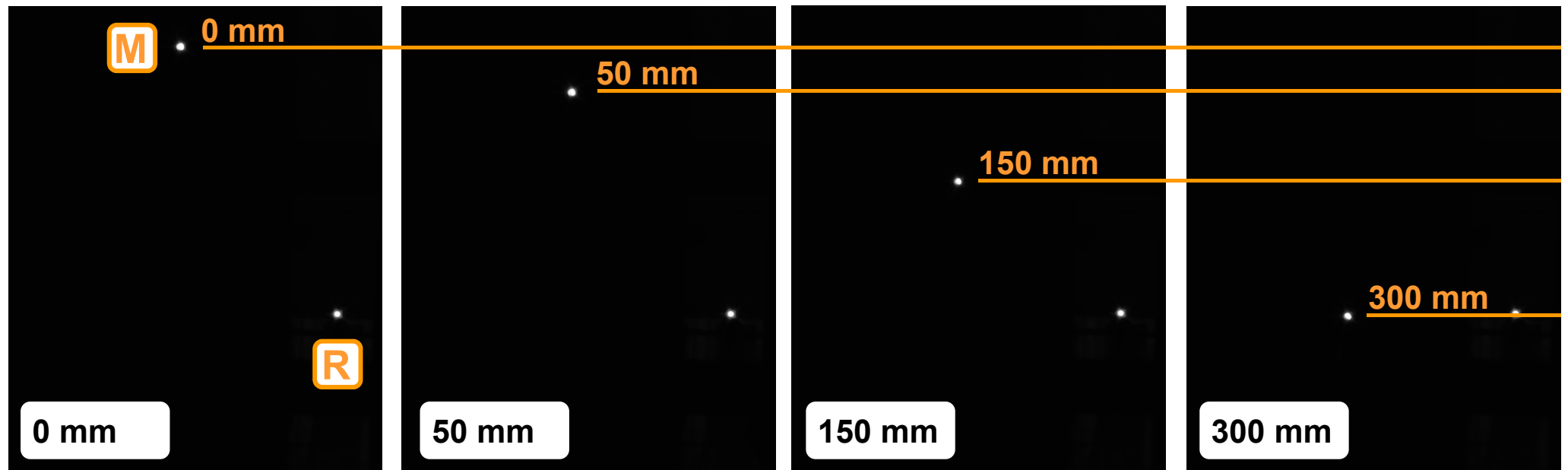
Gymnasium in Murnau – Second preliminary test (Murnau)



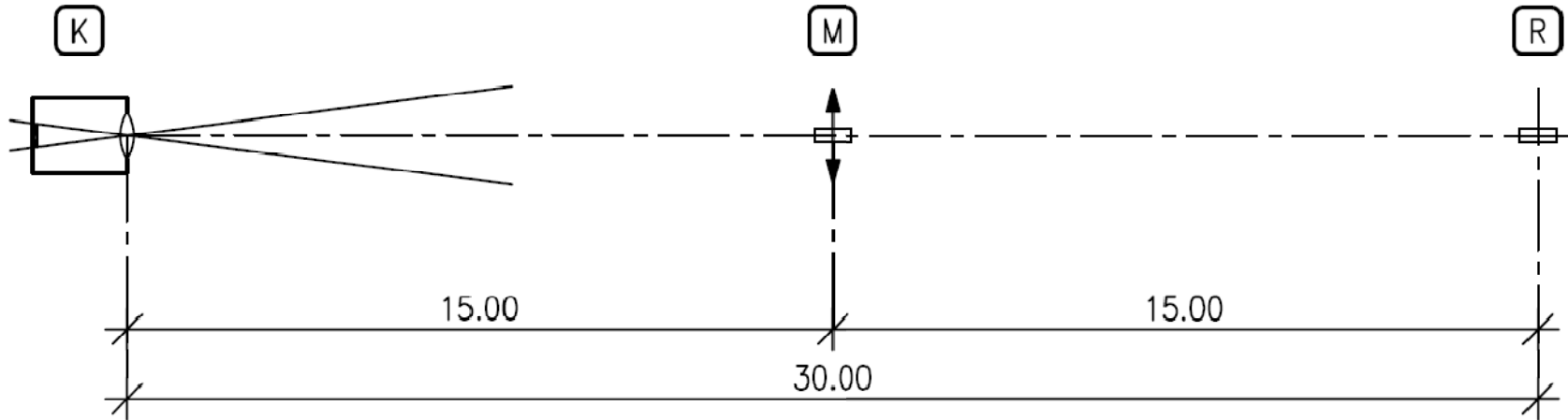
Gymnasium in Murnau – Second preliminary test (Murnau)



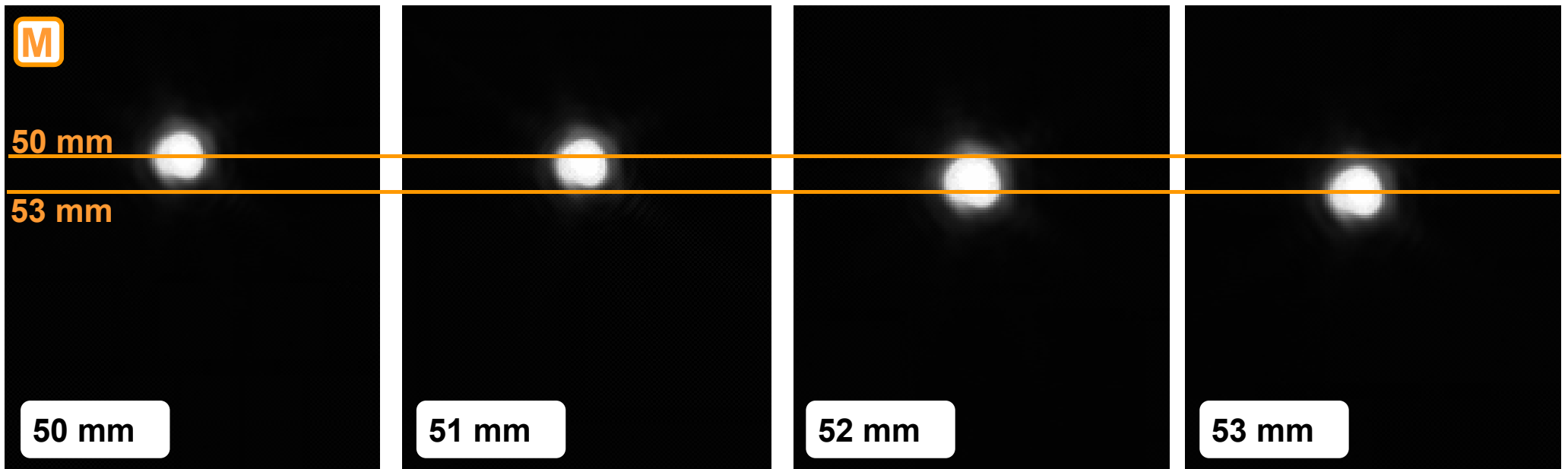
Vertical deflection of measuring point M



Gymnasium in Murnau – Second preliminary test (Murnau)

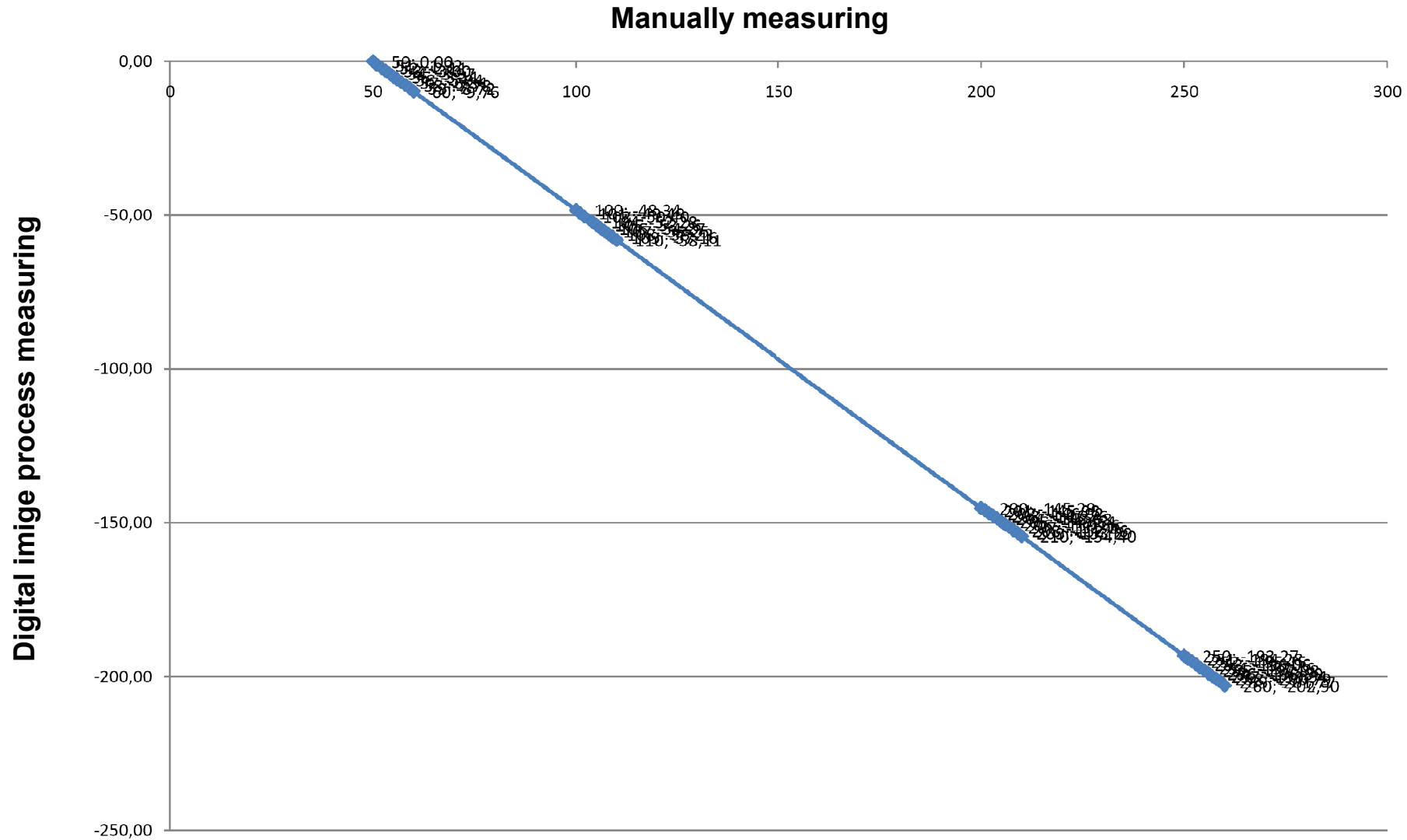


Vertical deflection of measuring point M

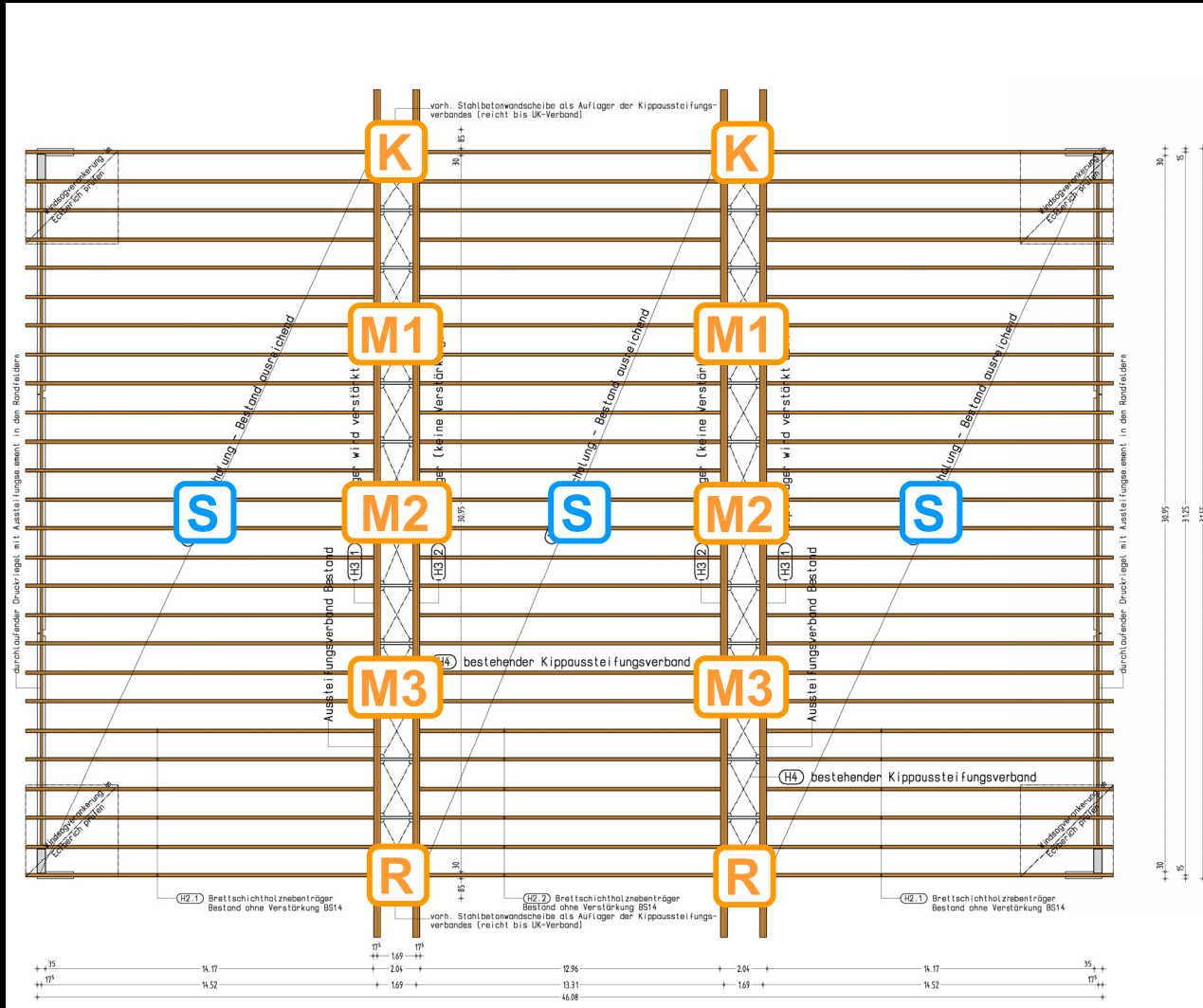


Gymnasium in Murnau – Second preliminary test (Murnau)

Vertical deflection of measuring point M



Gymnasium in Murnau – Monitoring system



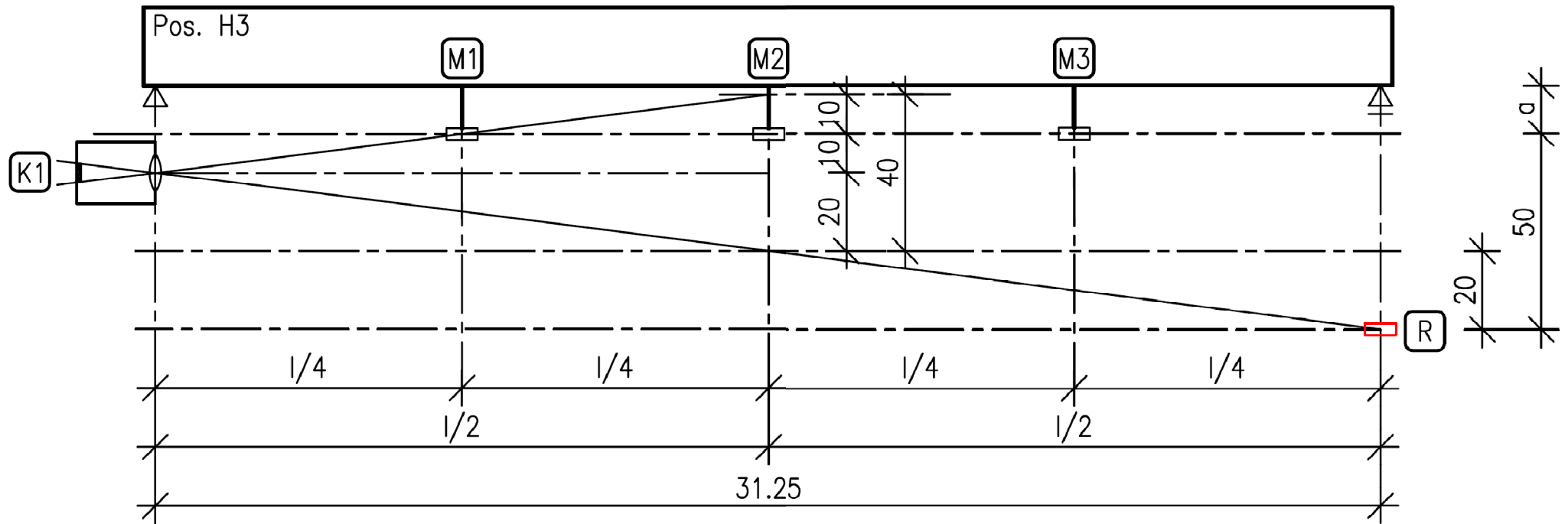
K Camera

M Measuring point

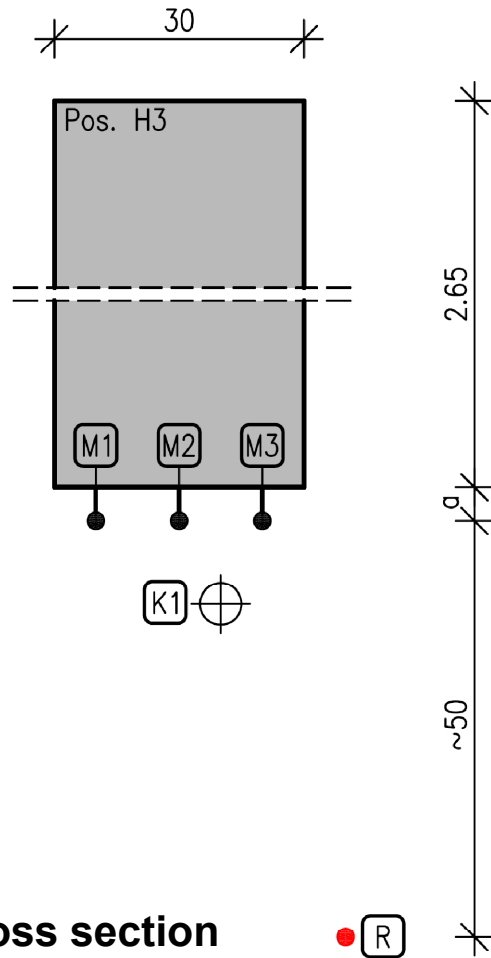
R Reference point

S Measuring of snow load

Gymnasium in Murnau – Monitoring system



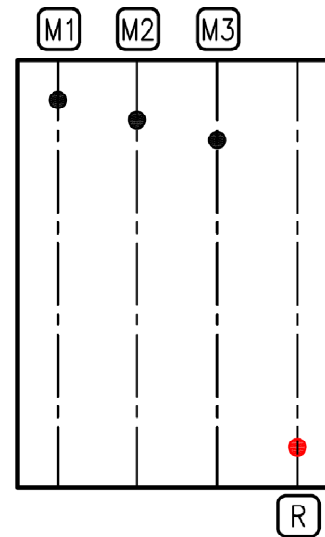
Gymnasium in Murnau – Monitoring system – View of measuring points



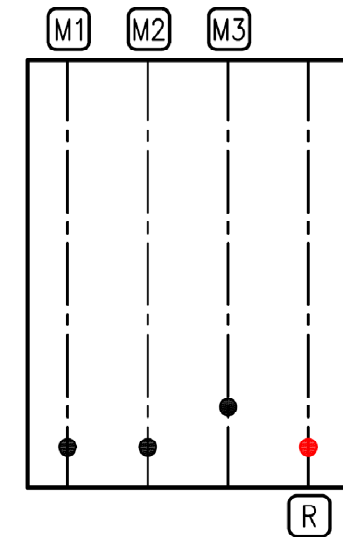
Cross section

View of measuring points for

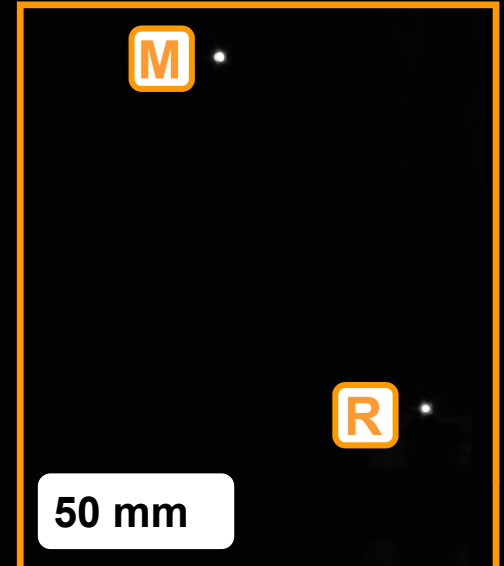
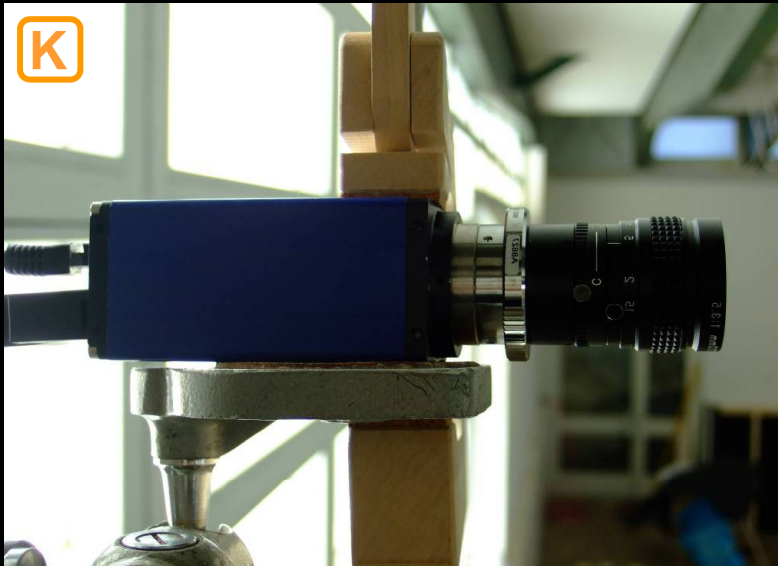
load case: min $s = 0$
(without snow load)



load case: max s
(for maximal snow load)



Gymnasium in Murnau – Monitoring system



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