COST TU1402 2017

Structural Health Monitoring System for „PODIUM” sport hall (Gliwice, Poland)

C A S E S D T U D Y

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Structural Health Monitoring

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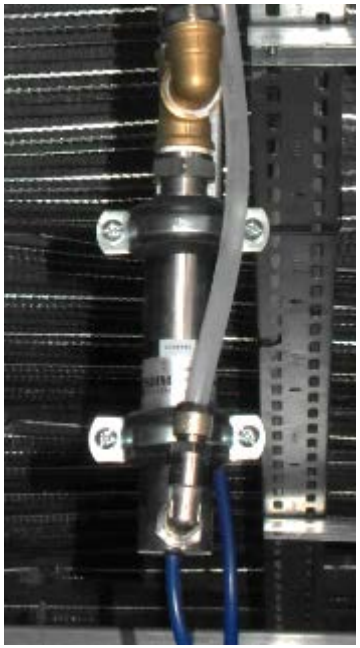
Symbols and signs for measured physical values:

Main Hall / Training Hall

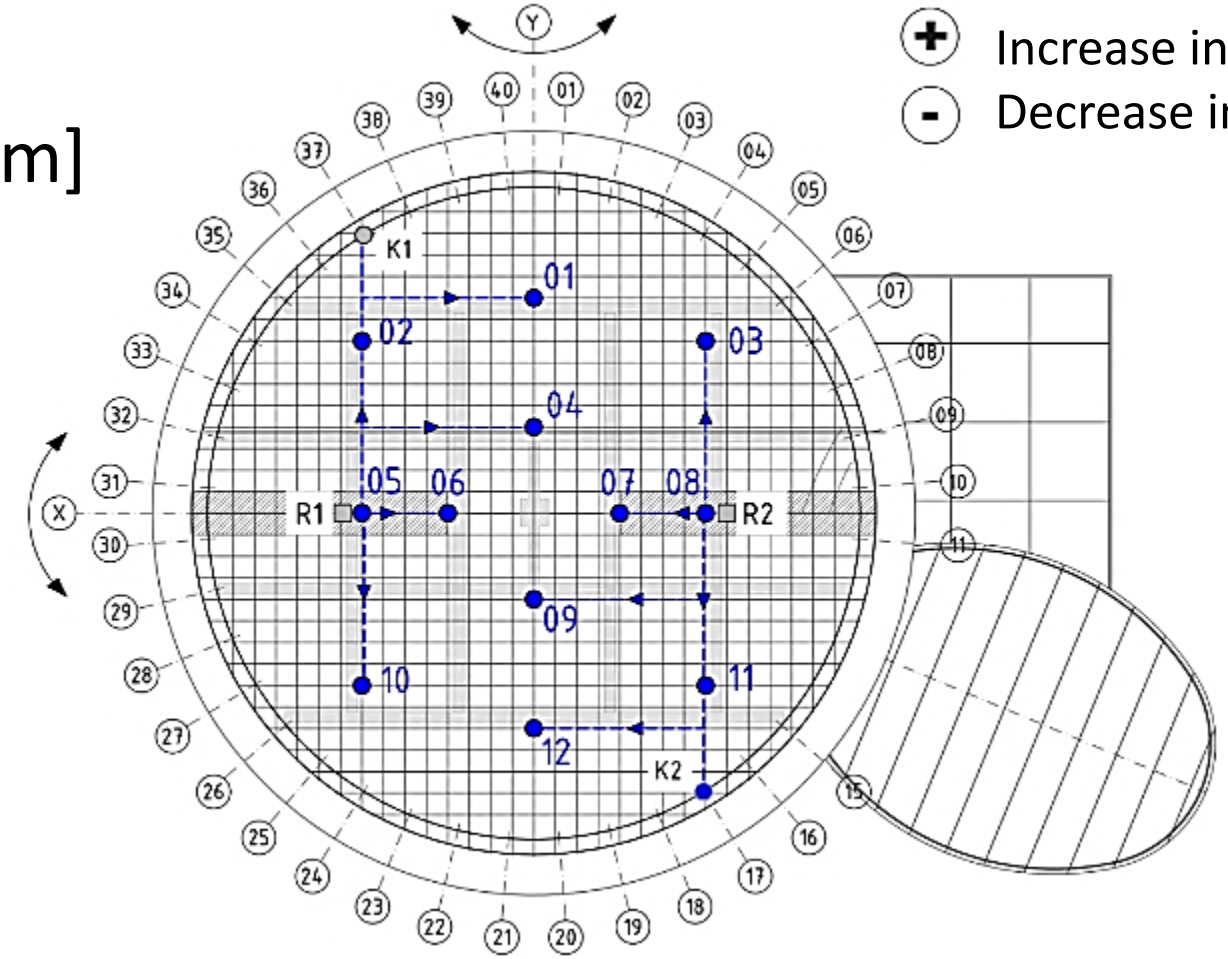
A	Accelerations [m/s^2]
H	Horizontal displacements of bearings [mm]
V	Vertical displacements of tendons [mm]
T	Temperature [°C]
S	Strains [με = 10^{-6} = 0,001‰]
T	Temperature [°C]
M	Meteorological quantities

V → vertical displacements [mm]

- 12 measuring points **V**
- 2 control points **K**
- 2 reservoirs **R** with hydraulic liquid for two measuring lines
- 14 vibrating wire sensors: Geokon model 4655



V [mm]



⊕ Increase in deflection

⊖ Decrease in deflection

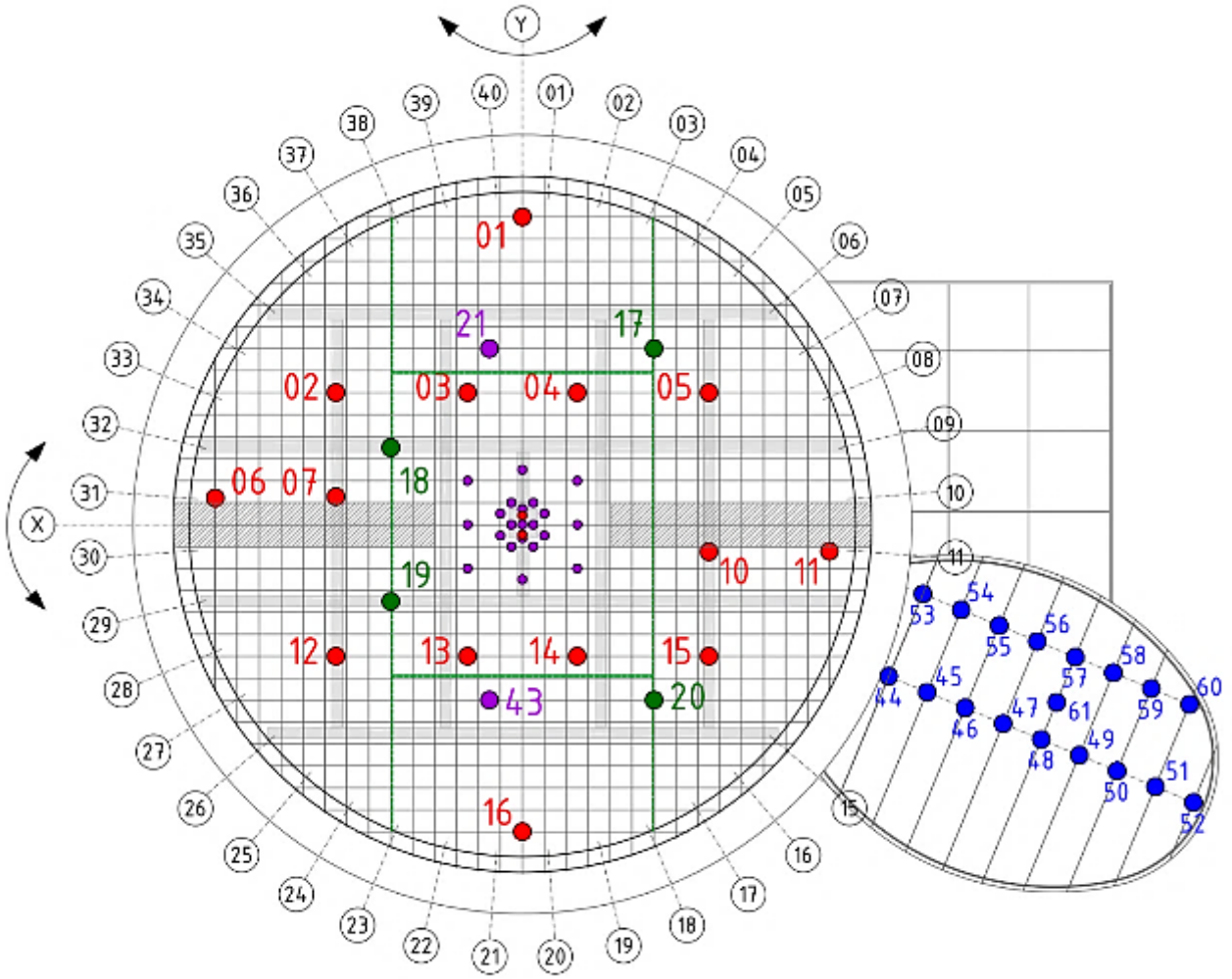
K, R

T → temperature [°C]

- 61 high-temperature sensors Pt-1000
- 18 points within training hall
- 23 points on load-bearing tendons
- 16 points at the height of 95% of hall height
- 4 points at smoke curtains

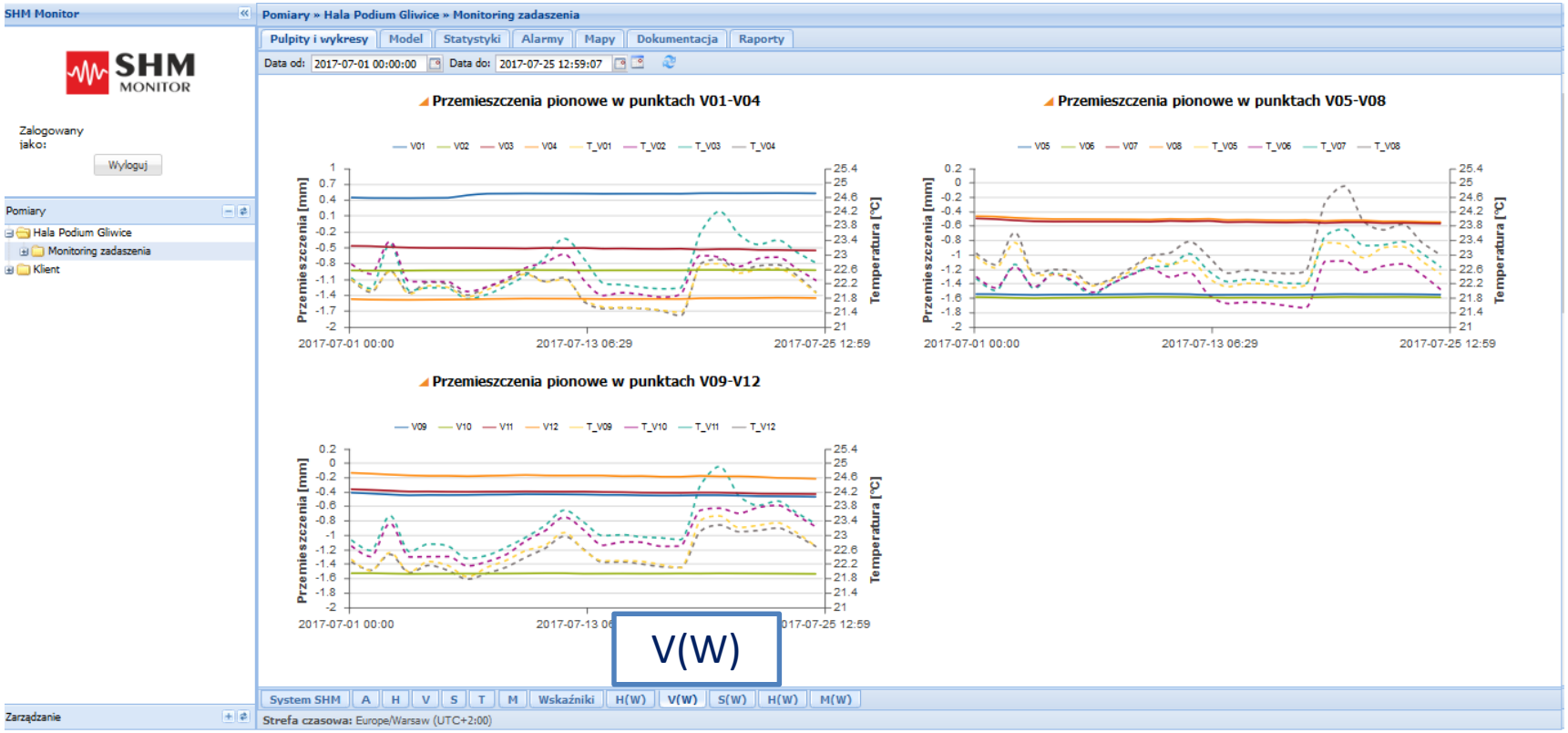
Measuring points

T [°C]



- 01 - 16
- 17 - 20
- 21 - 43
- 44 - 61

Data presentation



- Value of Information
  - with SHM
  - without SHM
- One displacement&temperature sensor
- Realiability analysis focused on the critical tendon
- Limit state function (model uncertainty times the resistance from the model < 50 years max. of snow load)
- FEM model resistance affected by the tendon strength
- Resistance model uncertainty (unbiased), CoV 20%

- Assume that model uncertainty is similar for snow and temperature loads
- No monitoring:

$$P_{f0} \rightarrow K_{R0} \cdot \mathrm{f_y} \cdot A - \mathrm{S_{50}} > 0$$

$$\mathrm{C_f} \cdot \mathrm{P_{f0}} = \mathrm{Risk_0}$$

- Monitoring:

$$R_{displ} \rightarrow K_{R,upd} = \mathrm{D(T)/\ R_{FEM}\ (E,T)}$$

$$P_{f,upd} \rightarrow (K_{R,upd} + \mathrm{K_{sensor}}) \cdot \mathrm{f_y} \cdot A - \mathrm{S_{50}} > 0$$

$$\mathrm{C_f} \cdot \mathrm{P_{f,upd}} = \mathrm{Riskup_d}$$

The monitoring system was realized by:

SHM System Sp. z o.o., Sp. kom.

f r o m P O L A N D

Thank You for Your attention!

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