Application of Monitoring Systems for the Management of Civil Structures

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Abstract

- Application of Monitoring Systems for the Management of civil structures as part of the service of the life cycle and risk management
- planning of measurement and quality control selection of suitable measures for structural protection and repair

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Workshop on Civil Structural Health Monitoring (CSHM-4)
"SHM systems supporting extension of the structures' service life"

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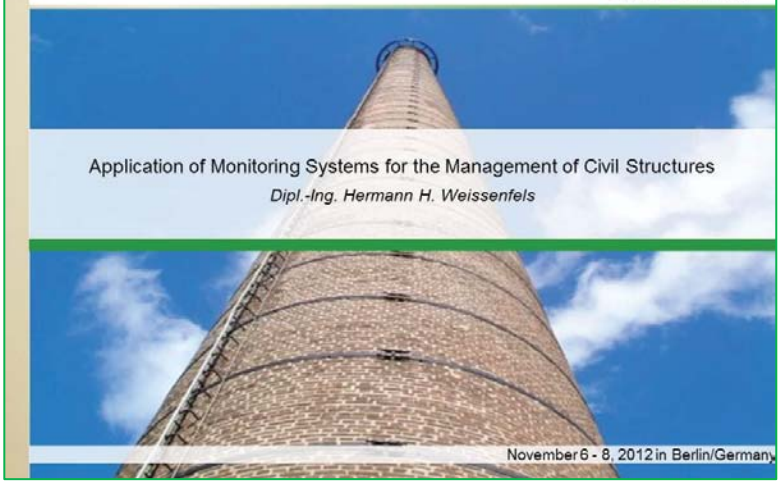

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Dipl.-Ing. Hermann H. Weissenfels

November 6 - 8, 2012 in Berlin/Germany

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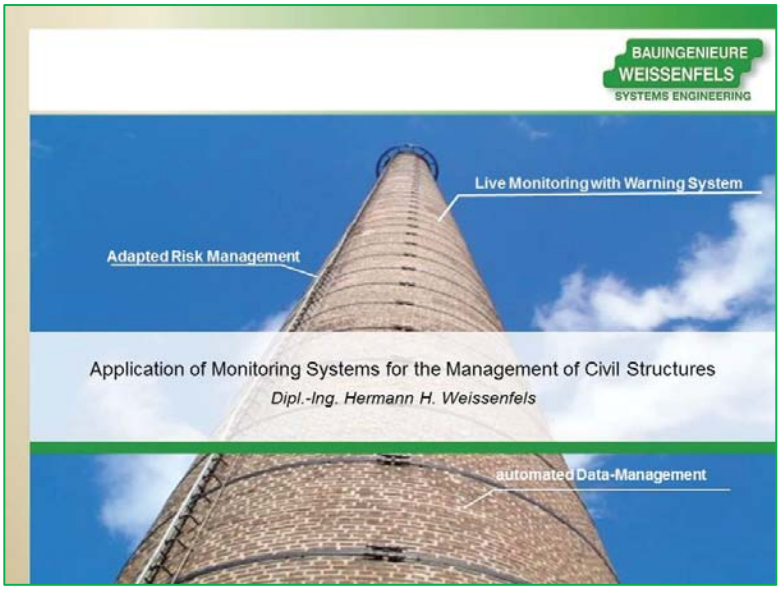

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Monitoring of Civil Structures
Open Questions

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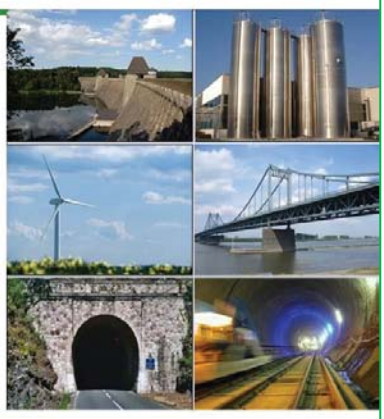
Thousands of open Questions to be solved:

- Dynamic and Static Loads
- Leakage Detection
- Deformations
- Vibration Monitoring
- Loads and Frequency
- Loads due to Temperature Changes
- Nondestructive Inventory Monitoring
- Corrosion Protection
- Carbonisation process
- Emergency cases



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who we are ...

BAUINGENIEURE WEISSENFELS
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Location Bramsche
Gilkamp 8a
49565 Bramsche

Location Essen
Rellinghauser Str. 4
45128 Essen

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- Civil Engineering in structural life-cycle-management
- Qualified support in all phases of your construction project
- Certificated consulting teams of professionals for different tasks
- Broad coverage of the disciplines of building construction
- Individual and practical solutions based on the established project characteristics

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Monitoring of Civil Structures
Setup and Define

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1. Preclarification

Problem analysis and clarification of the inspection.

Specification of the Monitoring-System

Define of:
- Place of Measurement
- Position (POI)
- Parameters
- Timerange

2. Monitoring Technique

System-Setup, Installation and Commissioning in **one** Hand.

➡ Central Data-Acquisition.

3. Monitoring

With a defined sampling rate the changes are tracked and sendet to interpretation.

4. Interpretation

The data obtained enable sustainable analysis of critical parameters for the calculation of such Limits of the building structure.

5. Information Management

Users access to the collectet data.
Regular report sending.

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Monitoring of Civil Structures
Monitoring Technique

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Sensor

Define Sensor Technique to optimize Signal Value:

- Pressure
- Temperature
- Wetness
- Accelerations
- Vibrations
- Change in Lenght
- Chemical Processes (Voltage, Current)

Transfer Funktion

Regarding the different Object Structures the Individual Transfer Funktion has to be calculatet.

- Position
- Material
- Age
- Pollution impacts

Measurements

Measurements Questions to be solved:

- Thresholds has to be defined

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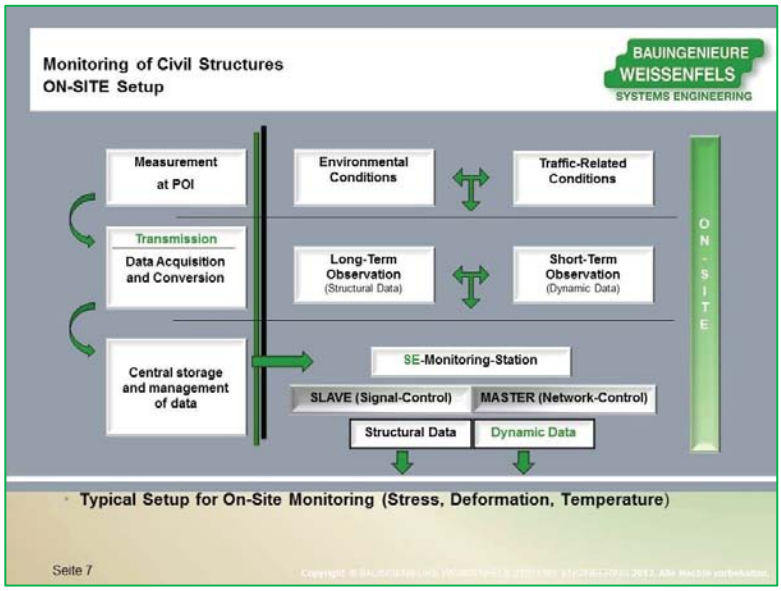
Monitoring of Civil Structures
ON-SITE Setup
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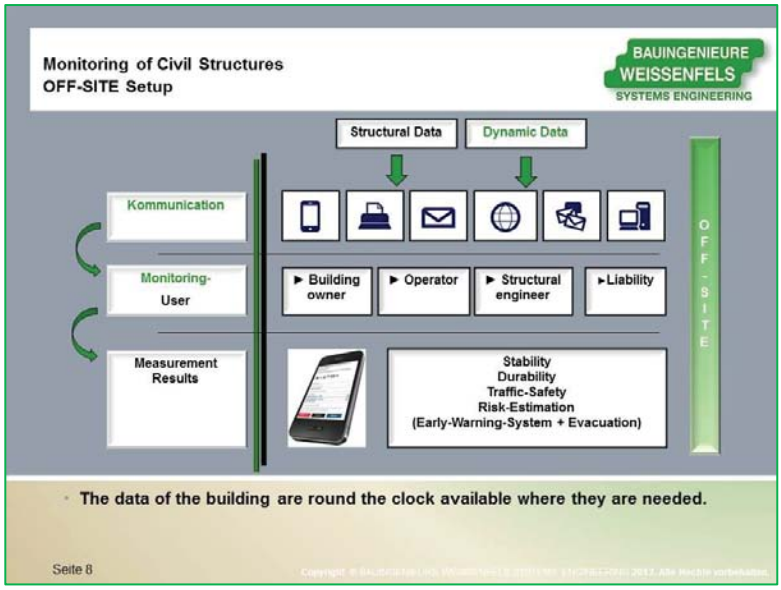
Measurement at POI
Environmental Conditions
Traffic-Related Conditions
Transmission
Data Acquisition and Conversion
Long-Term Observation
(Structural Data)
Short-Term Observation
(Dynamic Data)
O N - S I T E
Central storage and management of data
SE-Monitoring-Station
SLAVE (Signal-Control)
MASTER (Network-Control)
Structural Data
Dynamic Data
Typical Setup for On-Site Monitoring (Stress, Deformation, Temperature)
Seite 7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OFF-SITE Setup
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Structural Data
Dynamic Data
Kommunication
Monitoring-User
Measurement Results
▶ Building owner
▶ Operator
▶ Structural engineer
▶ Liability
Stability
Durability
Traffic-Safety
Risk-Estimation
(Early-Warning-System + Evacuation)
O F F - S I T E
The data of the building are round the clock available where they are needed.
Seite 8

Monitoring of Civil Structures
Special Challenges

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Monuments and historic buildings

Influences for restoration work
Destructive inventory monitoring
Crack development in damaged structures

Geotechnics

Demolitions of buildings
Open-cast mining
Tunnel linings
Stability of underground mines
Stability of embankments and slopes

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Monitoring of Civil Structures
Benefit by knowing about cause and effect

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Planning Errors

Ambitious designs and lack of experience in the design lay the foundation for lasting damage mechanisms.

Maintenance

Cost pressure and HR management often tempted to a failure-based maintenance. The results are limitless costs.

Material Failure

Small cause, big impact: fatigue, wear or corrosion have huge implications on the security and availability.

Substandard construction

Cost pressures and little-tested construction methods lead to errors that remain hidden for along time to the client.

High Load

Unplanned usage increases and ongoing optimization of life bring any structure on the edge of their endurance.

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Monitoring of Civil Structures
Outlook

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Access from everywhere	Integrated with customers issues	Integrated with structural profiling	Integrated with insitu and embaded systems	Acces even from your homeoffice

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