# 10th COST TU 1402 Workshop

## Case study „Digitales Test Area Autobahn“

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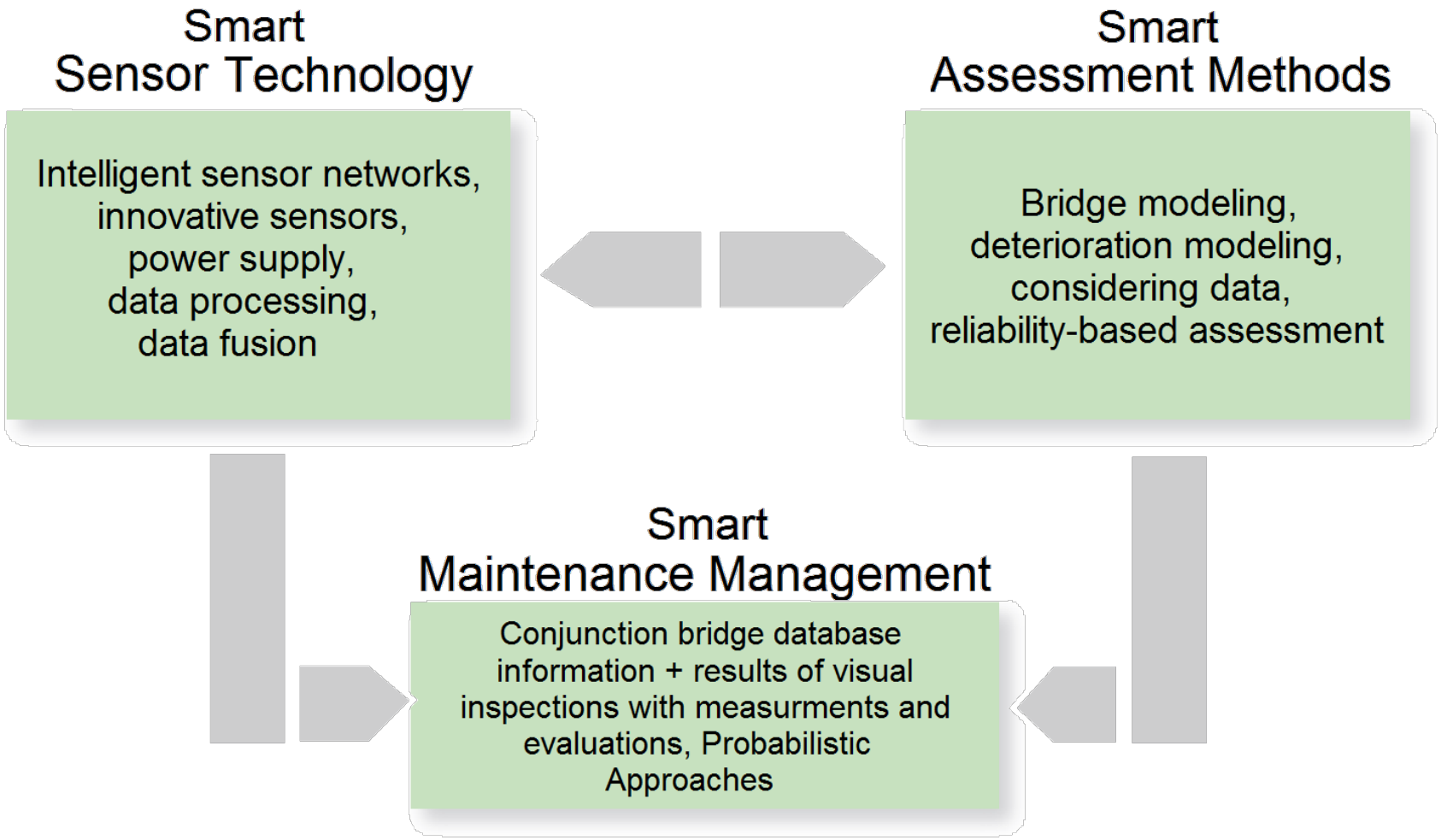
# Smart Bridge

- The “Digital Test Area Autobahn” in a project of the project cluster “Smart Bridge”
- Adaptive system for the continuous provision of relevant information and evaluation of safety and reliability:
  - recording of significant effects and reactions in "real-time“
  - Early detection of changes and problems
  - Holistic evaluation of the condition during the useful life and forecasts of the construction behavior (model- and data-based)
- Supporting of the maintenance planning in terms of a predictive maintenance planning strategy

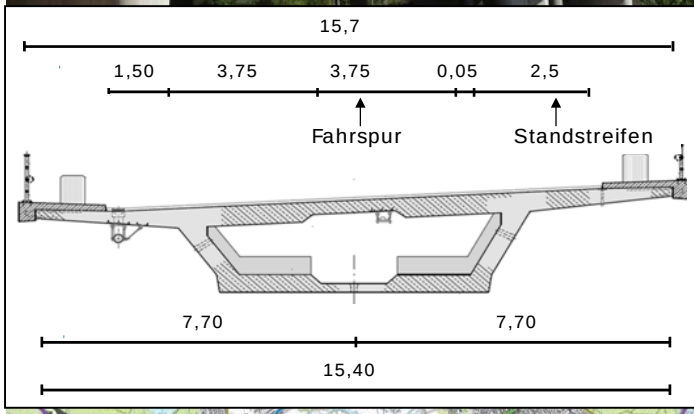
# Smart Bridge

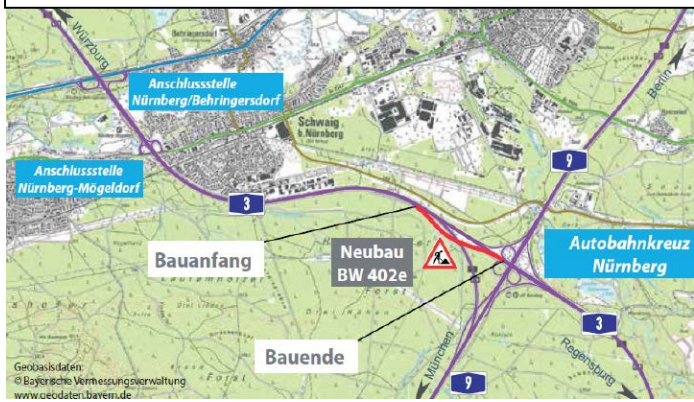



Source: BASt

# Digital Test Area Autobahn

- New concrete bridge in the highway A9 from Frankfurt to Munich:
  - built in 2016
  - longitudinally pre-stressed
  - length is 156 m and width 12 m
- The bridge is equipped with sensors for the detection of:
  - impacts of traffic loads
  - climatic influences
  - reaction of the components with regard to the functionality of individual bridge components
- The condition and reliability of the bridge construction and its components can be determined by using analytical bridge models and evaluation methods.




Source: BASt

# Digital Test Area Autobahn

- instrumented expansion joints
  - impacts of traffic loads
  - self-monitoring the function
  - sensors equipment: force sensor, draw wire sensor und acceleration sensor

instrumented expansion joints

- instrumented bearing
  - self-monitoring the function
  - detection of static load, rotation and displacement
  - sensors equipment: pressure sensor, displacement sensors and distance sensors

instrumented bearing

Source: BASt

# Digital Test Area Autobahn

- Roadtraffic Management System
  - impacts of traffic loads
  - bridge parameters: Prestressing force curve of the external tendons, actual object-specific static traffic load and fatigue state and global stiffness
  - sensor equipment: foil strain gauges, inductive displacement sensor, temperature sensor and acceleration sensor


Source: BASt

- sensor network
  - data fusion, data evaluation and integration in the bridge model

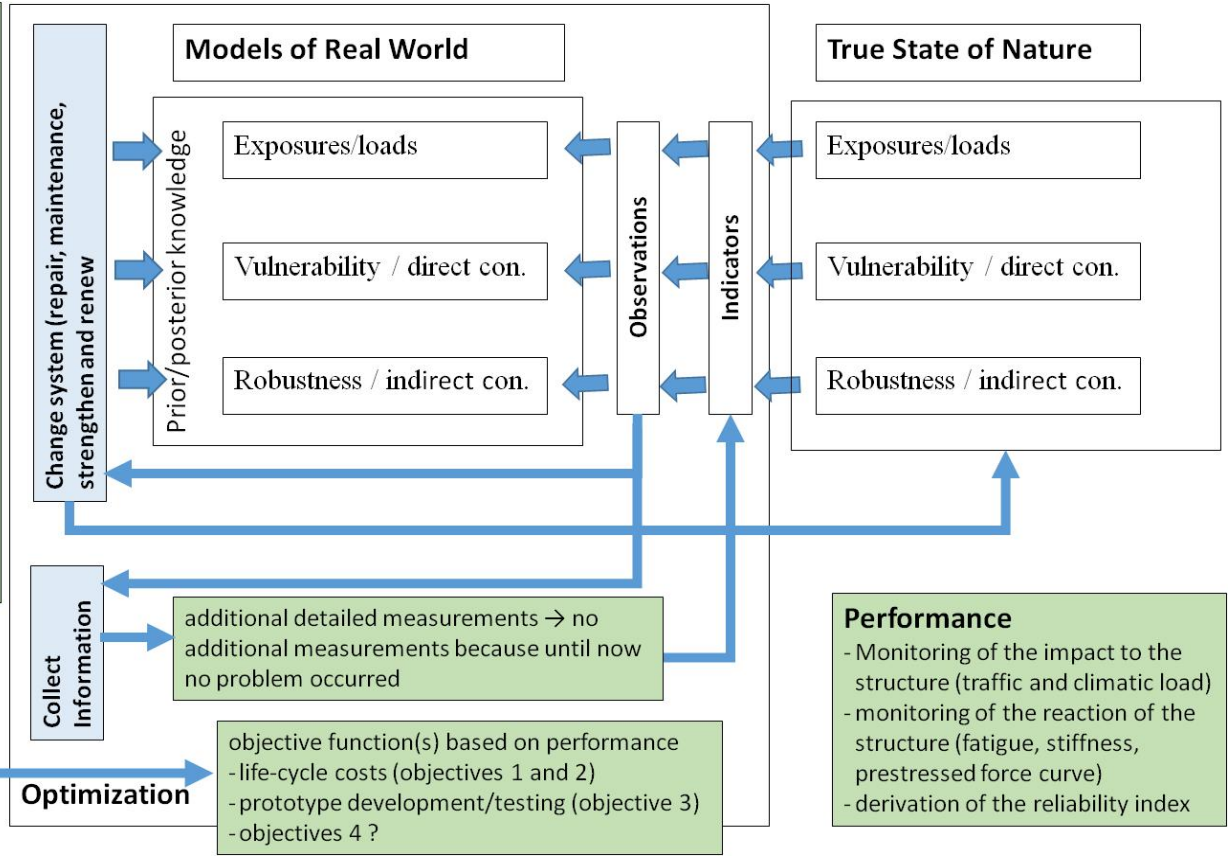
# Flowchart „Digital Test Area Autobahn“

**Remedial actions**
- do nothing
- retrofitting
- maintenance of structural elements
- replacement of structural elements
- limit traffic (reducing allowed weight)
- partially or completely closing of the bridge

**Indicators**
- impact:
  - traffic load (dynamic (expansion joint) und static (RTMS)
  - climatic influence
- structure and component reaction (expansion, temperature, displacement and acceleration)

**Knowledge on decision context**
- decision maker: Federal Ministry of Transport and Digital Infrastructure
- additional stakeholders: local road administration
- minimize cost (life cycle cost)
- fulfill functionality, safety (code requirements)
- service life (100 years)

**Asset information**
- new built pre-stressed concrete bridge (2016)
- design data
- as built information (characteristics of the material)
- FE model
- existing Records:
  - monitoring data records:
    - demands (traffic load)
    - environmental influence
    - response (models of traffic load, fatigue, stiffness (reliability index))




**Objectives**
- minimize operational / maintenance / inspection costs (1)
- maximize service life relating to individual components (2)
- testing of newly developed monitoring systems (3)
- marketing of elements of the ”smart bridge” (4)

**Performance**
- Monitoring of the impact to the structure (traffic and climatic load)
- monitoring of the reaction of the structure (fatigue, stiffness, prestressed force curve)
- derivation of the reliability index

# Facebook post of the case study „Digital Test Area Autobahn“

The „Digital Test Area Autobahn“ is a new built concrete bridge at the highway A9 in Nuremberg, Germany. The bridge is equipped with different sensor systems for the detection of the loads (for example traffic load) and the reaction of the bridge and its individual components.

Different aims were pursue with the instrumentation of the bridge. These are the reducing of the life time costs, the maximizing of the service life and the testing of newly developed monitoring systems. The measurement has started in October 2016 and now the data will be evaluated.

Source: Federal Highway Research Institute

#costaction #tu1402
#valueofinformation
#structuralhealthmonitoring

**Thank you for you kind attention!**