

Status and Strategy Workshop Summary of Activities



Version 21/04/2016

Sebastian Thöns

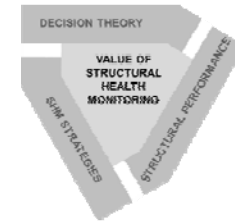
COST Action TU1402
(Action 14.11.2014 – Action 15.04.2019)

Quantifying the Value of Structural Health Monitoring

PROGRESS REPORT AT MONTH 24

This report is submitted by the MC Chair on behalf of the Management Committee.

COST TU1402: Quantifying the Value of Structural Health Monitoring



Introduction



COST Action TU1402: Quantifying the Value of Structural Health Monitoring

NEWS PROJECT ORGANISATION EVENTS STSM DOCUMENTS CONTACTS

COST Action TU1402: "Quantifying the Value of Structural Health Monitoring"
The COST Action TU1402 strives to enhance the benefit of Structural Health Monitoring (SHM) by novel utilization of applied decision analysis on how to assess the value of SHM - even before it is implemented. This improves decision basis for design, operation and life-cycle integrity management of structures and facilitates more cost efficient, reliable and safe strategies for maintaining and developing the built environment to the benefit of society.

Visual design methodological conceptualisation performance optimisation modelling theory standardisation training pre-posterior uncertainties applications tools approaches network decision identification interpretation formation fundamental development identification

cost
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

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TU1402
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TUD COST Action TU1402
Quantifying the value of structural health monitoring

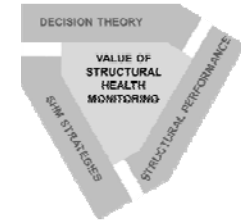
This COST Action enhances the benefit of Structural Health Monitoring (SHM) by novel utilization of applied decision analysis on how to assess the value of SHM - even before it is implemented. This improves decision basis for design, operation and life-cycle integrity management of structures and facilitates more cost efficient, reliable and safe strategies for maintaining and developing the built environment to the benefit of society. SHM is increasingly applied for collecting information on loads and aggressive environments acting on structures, structural performances, deterioration processes and changes in the use of structures. However, there is an urgent need to establish a better understanding of the value of SHM before its implementation, together with practically applicable methods and tools for its quantification. This Action thus aims to develop and describe a theoretical framework, together with methods, tools, guidelines, examples and educational activities, for the quantification of the value of SHM. The COST Action will be conducted with the support of the Joint Committee on Structural Safety (JCSS). The networks of researchers and industries established

Transport and Urban Development COST Action TU1402

Description
Partners
Management Committee

General Information*

Chair of the Action: **Dr. Sebastian Thöns (TU)**
Vice Chair of the Action: **Dr. J. J. G. M. O. van den Broek (TU)**
Science officer of the Action: **Dr. J. J. G. M. O. van den Broek (TU)**
Administrative officer of the Action: **Dr. J. J. G. M. O. van den Broek (TU)**



Introduction

5th Workshop, Technical University of Denmark

- 39 participants from 18 countries

3rd and 4th Workshop, Barcelona, Spain and Guildford, UK

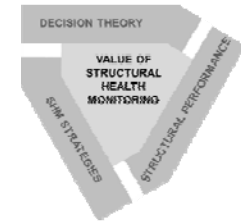
- 42 and 23 participants from 21 and 14 countries

2nd Workshop, Istanbul, Turkey

- 44 participants from 22 countries

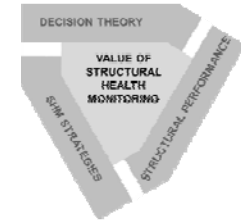
1st Workshop, Technical University of Denmark

- 65 participants from 23 countries



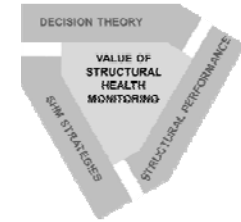
Contents

- A. Objectives
- B. Deliverables
- C. Networking
- D. Impacts
- E. Dissemination and exploitation of Action results
- F. Action successes



A. Objectives

The TU1402 objective is to enhance the benefit of Structural Health Monitoring (SHM) by novel utilization of applied decision analysis on how to assess the value of SHM - even before it is implemented. This improves decision basis for design, operation and life-cycle integrity management of structures and facilitates more cost efficient, reliable and safe strategies for maintaining and developing the built environment to the benefit of society.

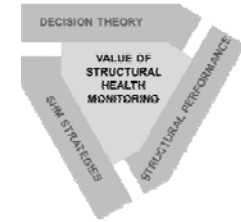


A. Objectives

Aim1: Newly developed **theoretical and methodical framework**

Specific aim 1: Documentation of the theoretical and methodical basis

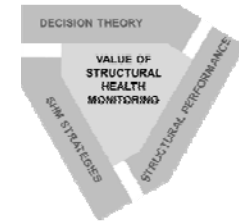
- Framework developed and documented with WG1 factsheets in workshop report
- Disseminated via TU1402 website and database



A. Objectives

Aim2: The **collected expertise and joint efforts of experts** which will make it possible to adapt, and **utilize the framework** to a broad and representative range of **practical application** of design and assets management contexts involving structures and infrastructure systems.

- “**collected expertise and joint efforts of experts**” documented with WG2 and WG3 factsheets in workshop report
- “**utilize the framework**” prepared with WG1 Test Case
- Glossary developed
- Collaboration with TU1406
- Disseminated via TU1402 website and database



A. Objectives

Specific aim 2: Appropriate and efficient tools

- WG2 and WG3 factsheets
- Disseminated via TU1402 website and database

Specific aim 3: Developed practical examples

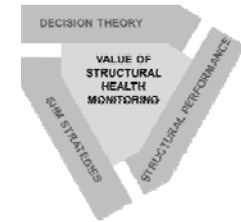
- WG4 in starting phase
- Prepared with WG1 Test Case

Specific aim 4: Guidelines for practicing engineers

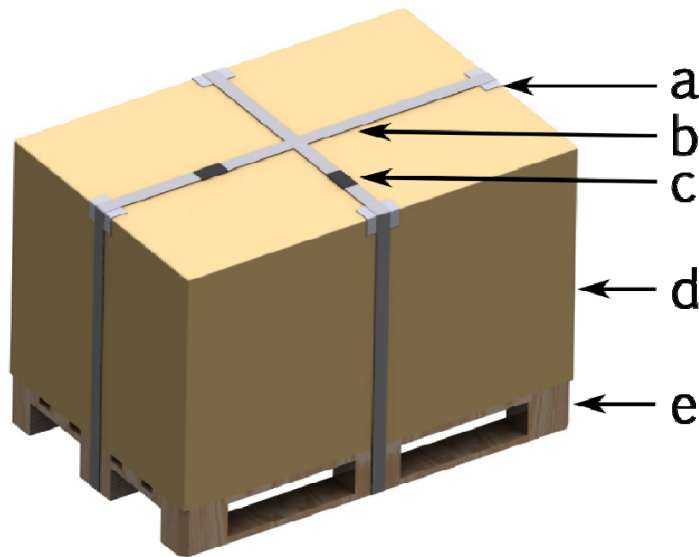
- WG5 start later according Scientific Programme

Specific aim 5: Educational activities and influence on standardization

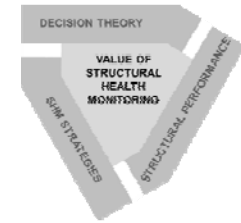
- Focus for the second half of the Action



B. Deliverables



1. Dedicated dissemination activities.
2. A well-developed homepage.
3. A library of tools and algorithms.
4. A chapter to the Probabilistic Model Code of the JCSS.
5. A guideline on the quantification of the value and optimization of SHM.



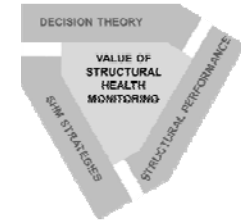
B. Deliverables

Action website

- Documentation of events, presentations and videos of the workshops and workshop reports
- Database for project internal use

Dedicated dissemination activities

- 5 Workshops
- 3 Special sessions
- 7 Scientific Missions
- 30 Publications



B. Deliverables

A library of tools and algorithms

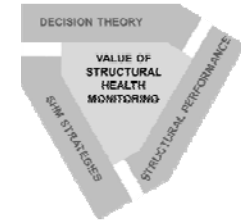
- Under development
- Fact sheets are collected into the proceedings of the 3rd and 4th Workshops held in March 2016 in Barcelona and in April 2016 in Guildford.

A chapter to the Probabilistic Model Code of the JCSS

- Networking started according to Scientific Program JCSS, EUROCODES (e.g. CEN/ TC 250), ISO, IABSE, RILEM, fib, ECCS, CIB members are represented in the Network and as WG leaders.

A guideline on the quantification of the value and optimization of SHM

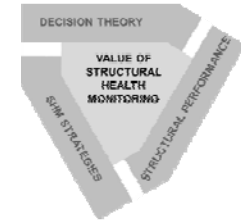
- Not started according to Scientific Program



B. Deliverables

Additional outputs and achievements

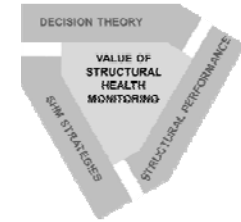
1. Collaboration with COST Action TU1406 and IABSE. Joint Workshop in Zagreb.
2. Special Issue “SHM value in performance assessment of existing structures”
3. Development of STSM program in collaboration of partners from industry is decided to obtain more practical cases for developing guidelines for practicing engineers.



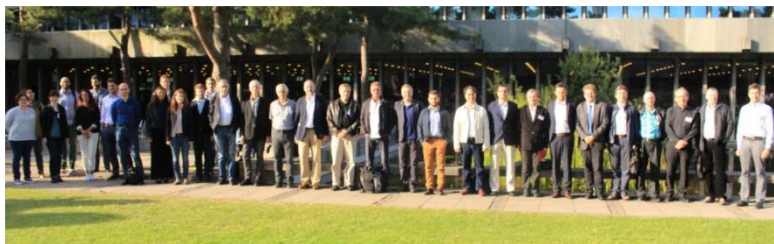
B. Deliverables

Co-authored publications and FP7/ H2020 proposals

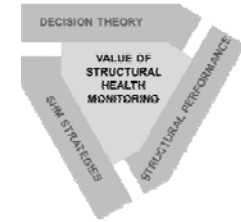
- We have selected 10 out of 30 publications
- 1 Horizon 2020 project is funded: INFRASTAR: Innovation and Networking for Fatigue and Reliability Analysis of Structures - Training for Assessment of Risk, Marie Skłodowska-Curie Innovative Training Network, H2020-MSCA-ITN-2015
- 2 non successful Horizon 2020 proposals



C. Networking



- Integration of the knowledge and experience
- Researchers, engineers and operators work together
- Ensuring the contribution of relevant experts and relevance
- Innovation
- Distributed anchorage across Europe with worldwide links



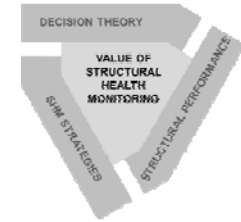
C. Networking

Integration of the knowledge and experience of experts representing the broad range of research and applied engineering fields necessary to develop, apply and disseminate the framework for assessing the value of SHM before its implementation.

- Achieved with a large network of 130 participants in 27 European countries and Australia as an IPC

Ensuring critical mass for scientific and practical engineering developments within highly specialized and thinly populated research disciplines related to **methods and tools**.

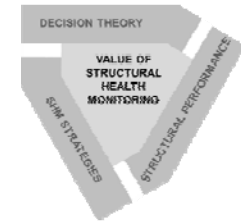
- Organisation, collaboration and dissemination by Working Group 3 with about 30 participants



C. Networking

Assuring by participation of researchers, engineers and operators and owners that the developed **framework** is **scientifically sound**, **practically applicable** and **relevant**.

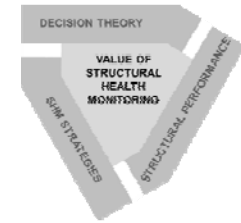
- About 30% of the participants are affiliated with commercial research and engineering institutions and infrastructure owners and operators.
- Advisory Board
 - Helmut Wenzel (VCE), Austria
 - Inger Birgitte Kroon (COWI), Denmark
 - Peter Haardt, BASt, Germany
 - The advice of the AB is documented in the TU1402 database.



C. Networking

Generation of **innovation** in development of methodology, tools and adaptation to practice – catalysed from the “close encounters” between different scientific disciplines and the confrontation of theoretical idealizations with practical reality.

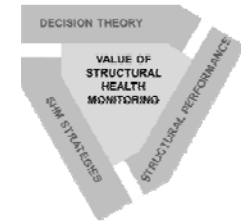
- Organised by the Innovation Committee.
- Brainstorming sessions organized in the 2nd workshop in Istanbul during the WG1 and WG2 meetings
- Pushing Short-Term Scientific Missions (STSMs) towards to industrial partners, in addition to academic partners, seeking to strength links between academia and industry envisaging possible job opportunities for young researchers and/or projects in consortium



C. Networking

Geographically distributed anchoring, promotion, dissemination and use of the results of the Action within Europe and beyond.

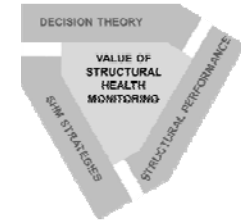
- 130 participants in 27 European countries
- Organisation of special session at International conferences in Europe and in Canada (<http://www.cost-tu1402.eu/events>)
- Interactions of experts and researcher from different institutions through Short Scientific Term Mission



C. Networking

Inclusion of perspectives, knowledge and experiences from representatives of the **international research community**.

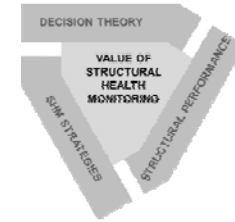
- Australia included as International Partner Country (IPC)
- Joint activity with COST Action TU1406 and IABSE
- Will be focussed on in the second half of the Action as there is now achievements as a basis for cooperation



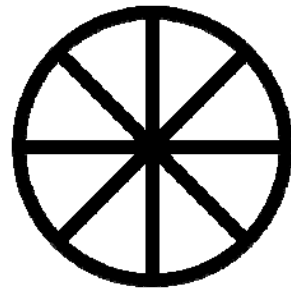
C. Networking

Extent of the networking

- All participants were equally offered participation to Workshops and activities.
- Female participants performed STSMs (3 out of 7)
- Early Career Investigators (ECIs) performed STSMs (4 out 7), leading or co-leading of Working Groups.
- Participants from Inclusiveness Target Countries such are Turkey, Croatia, Slovenia, former Yugoslav Republic of Macedonia, Poland and Portugal
- 3. Workshop has been held in Inclusiveness Country Turkey
- 6. Workshop will be held in Inclusiveness Country Croatia



D. Impacts



Categories

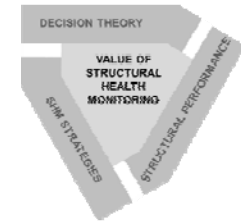
- Scientific
- Technological
- Economic
- Societal

| No. | Strategy | System state | Value of Information |
|-----|---------------------------|---------------------------------|--------------------------------|
| 1 | Fatigue loading | Exposure | $\overline{Vol}_{e_1} = 18\%$ |
| 2 | Hot spot monitoring | Exposure and constituent damage | $\overline{Vol}_{e_2} = 31\%$ |
| 3 | System loading monitoring | Exposure | $\overline{Vol}_{e_3} = 0.7\%$ |

Time horizons

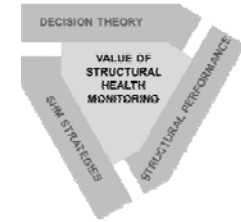
- Achieved
- Foreseen within 2 years
- Foreseen 2-5 years
- Foreseen 5-10 years
- Foreseen 10+ years





D. Impacts

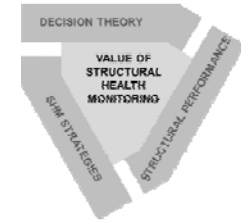
| Description of the impact | Type of impact ⁵ | Timing of impact ⁶ |
|--|-------------------------------------|--|
| According to MoU, Section C.4 | | |
| Development of the scientific field for quantifying the value of SHM. | Scientific/ technological | Achieved, further progress expected |
| Making the scientific field accessible | Scientific/ technological | Achieved, further progress expected |
| Improved economic efficiency in the continued development, operation and maintenance and asset management of structures and infrastructure systems | Scientific/ technological, Economic | Achieved (Scientific/ technological), Foreseen within 2-5 years (Economic) |
| New business opportunities for European small and medium-sized (SME) and large industrial enterprises and the opportunity to create high quality jobs. | Economic, Societal | Foreseen within 2-5 years |
| Increased competitiveness in the building, construction and structural engineering industry | Economic | Foreseen within 2-5 years |
| Enhanced management of risks to individuals, environment and economy | Scientific/ technological, Economic | Foreseen within 2-5 years |



E. Dissemination and exploitation of Action results

Item/ activity - Target audience - Result

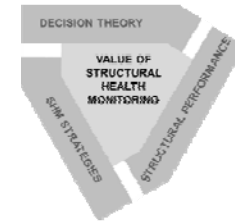
- Website
- Workshops, Training Schools (TS) and Teaching
- Short term scientific missions (STSMs)
- Guideline and probabilistic model code
- Conferences, Peer-reviewed articles and state-of-the-art reports
- Link to standardisation



F. Success stories



- Breakthrough: scientific, technological or socioeconomic
- Policy implementation (specify which policy)
- Capacity building

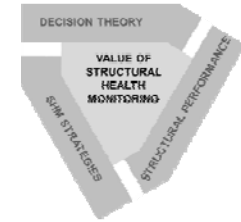


F. Success stories

Scientific breakthrough in the field of Value of Structural Health Monitoring analyses:

The topic of the COST Action TU1402 has received a large interest which is reflected by the growth of the Action from 50 participants from 20 European countries to 130 participants from 27 European countries throughout science, industry and infrastructure owners, operators and authorities. Moreover, special sessions on this topic at international conferences (see <http://www.cost-tu1402.eu/events>) have emerged which have not been there before.

- Scientific and socioeconomic breakthrough: The topic of Value of SHM analyses integrates scientific, technological, economic and societal models.



Thank you for your attention.