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DELIVERABLE

PROJECT INFORMATION

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SEVENTH FRAMEWORK PROGRAMME

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Abstract

This deliverable reports on the final dissemination workshop of the STREST project that took place on the 16th of September 2016 at the Faculty of Civil and Geodetic Engineering of the University of Ljubljana in Slovenia. The deliverable presents the objectives, agenda and participants of the workshop. Based on the discussions and feedback from the participants, conclusions and recommendations are put forward.

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Deliverable contributors

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1. Introduction

The STREST project developed a stress test framework to determine the vulnerability and resilience of critical infrastructures. In particular, STREST established a common and consistent taxonomy of critical infrastructures; developed a consistent modelling approach to hazard, vulnerability, risk and resilience assessment of low probability-high consequence events; designed a stress test framework and specific applications to address the vulnerability, resilience and interdependencies of critical infrastructures.

The aim of the dissemination activities is to communicate the products developed during the project to regulators and operators of non-nuclear critical infrastructures and in general all infrastructures with potentially high risk and high economic and environmental impact. As part of these activities, a final concluding workshop was organised in order to present to stakeholders the main achievements of the project together with the results from the test applications, and to set a way forward at the European level.

This deliverable presents the objectives, agenda and participants of the workshop. Based on the discussions and feedback from the participants, conclusions and recommendations are put forward.

2. Workshop agenda

The workshop took place on the 16th of September 2016 at the Faculty of Civil and Geodetic Engineering of the University of Ljubljana in Slovenia. The main objectives of the workshop were to present to stakeholders the STREST stress test methodology and results of the exploratory application and to discuss with representatives of other research projects their work and possible future steps.

As shown in Fig. 2.1, the first session offered an overview of the project, a summary of the work performed in Work Packages 3 'Integrated low probability-high consequence hazard assessment for critical infrastructures' and 4 'Vulnerability models for the performance and consequences assessment in stress tests of critical infrastructures', as well as a detailed presentation of the stress test methodology developed in Work Package 5. The following session comprised presentations on the six exploratory applications, namely the petrochemical plant in Milazzo in Italy, the large hydropower dams of the Valais region in Switzerland, the major hydrocarbon pipelines in Turkey, the gas distribution network in the Netherlands, the port of Thessaloniki in Greece and an industrial district in Tuscany, Italy. The results of the INTACT, RAIN and INFRARISK projects, which are funded under the FP7 topics 'Impact of extreme weather on critical infrastructure' and 'Towards stress tests for critical infrastructures against natural hazards', were also presented. The closing session of the workshop included feedback from stakeholders, final remarks on project and discussion of follow-up activities.

STREST

Harmonized approach to stress tests for critical infrastructures against natural hazards

AGENDA

STREST Final Workshop

16 September 2016, 9:00-17:00

Faculty of Civil and Geodetic Engineering, Jamova 2, 1000 Ljubljana

Morning Session (Chairman: D. Giardini, ETH Zurich)	
09:00 – 09:10	Welcome (M. Dolšek, UL; D. Giardini ETH Zurich; G. Tsionis, JRC)
09:10 – 09:20	Overview of the STREST project (A. Mignan, ETH Zurich)
09:20 – 09:40	Hazard assessment with focus on extreme events (P.-Y. Bard, UJF)
09:40 – 10:00	Performance and consequence assessment at critical infrastructures (E. Salzano, AMRA)
10:00 – 10:30	The STREST stress test method for non-nuclear critical infrastructures (B. Stojadinović & S. Esposito, ETH Zurich)
10:30 – 11:00	*Coffee break*
11:00 – 11:20	Application on petrochemical plant in Milazzo, Italy (E. Salzano, AMRA)
11:20 – 11:40	Application on large dams of the Valais region, Switzerland (J. P. Matos, EPFL)
11:40 – 12:10	INTACT project: guiding the user (W. Hynes, Future Analytics Consulting)
12:10 – 13:40	*Lunch*
Afternoon Session (Chairman: B. Stojadinović, ETH Zurich)	
13:40 – 14:00	Application on major hydrocarbon pipelines in Turkey (S. Akkar & E. Uckan, KOERI)
14:00 – 14:20	Application on gas distribution network in the Netherlands (W. Courage, TNO)
14:20 – 14:40	Application on the port of Thessaloniki, Greece (K. Pitilakis & S. Argyroudis, AUTH)
14:40 – 15:00	Application to industrial districts in Tuscany, Italy (H. Crowley, EUCENTRE)
15:00 – 15:30	*Coffee break*
15:30 – 16:00	RAIN project: Risk analysis of infrastructure networks in response to extreme weather events (A. O'Connor, Trinity College Dublin)
16:00 – 16:30	INFRARISK project: Stress testing methodology for critical infrastructure – road and rail case studies (P. van Gelder, TU Delft – PSCT)
16:30 – 17:00	Feedback from stakeholders and closing remarks (D. Giardini, ETH Zurich)

Fig. 2.1 Agenda of the workshop

3. Participants

The workshop was attended by more than 40 participants, grouped as follows:

- STREST partners;
- STREST associated industry partners;
- European research projects funded under the FP7 Security theme;
- Operators of critical infrastructures;
- European Chemical Industry Council;
- Research centres;
- Universities.

The representatives of STREST associated industry partners, stakeholders and FP7 projects were reimbursed by the JRC for Travel and Subsistence. The names and projects for these participants are:

- P. Burgherr, Paul Scherrer Institute;
- M. Cilsal, Botas Inc;
- D. Coletsos, Patras Port Authority;
- R. Company, Valenciaport Foundation;
- W. Hynes, Future Analytics Consulting – INTACT project;
- B. Inanc, Botas Inc;
- G. Martin, Petrochemicals Europe;
- J.-F. Lechaudel, TOTAL SA (did not attend due to strike of air traffic controllers);
- E. Lucarelli, Regione Toscana;
- A. O'Connor, Trinity College Dublin – RAIN Project;
- G. Stallenberg, Gasunie;
- P. van Gelden, TU Delft / PSCT – INFRARISK project.

The complete list of participants and their affiliations is given in Table 3.1.

Invitations to the workshop were sent also to about 30 other representatives of owners and operators of various types of critical infrastructures, as well as of the regulatory authorities identified in the project Description of Work, namely the Council of European Energy Regulators (CEER), the Agency for the Cooperation of Energy Regulators (ACER), the European Network of Transmission System Operators for Electricity (ENTSO-E), the European Network of Transmission System Operators for Gas (ENTSO-G), the European Chemical Industry Council (CEFIC), the European Sea Ports Organisation (ESPO) and the International Commission on Large Dams (ICOLD).

Table 3.1 List of participants

Name	Surname	Affiliation
Sinan	AKKAR	Bogazici University, Turkey
Sotirios	ARGYROUDIS	Aristotle University of Thessaloniki, Greece
Anže	BABIČ	University of Ljubljana, Slovenia
Pierre-Yves	BARD	ISTerre (Institut des Sciences de la Terre), France
Maximilian	BILLMAIER	Basler & Hofmann AG, Switzerland
Gabriella Francesca	BORTONE	Regione Toscana, Italy
Peter	BURGHERR	Paul Scherrer Institut, Switzerland
Murad	CILSAL	Botas Int.Ltd., Turkey
Dimitrios	COLETSOS	Patras Port Authority, Greece
Rafael	COMPANY	Valencia Port Foundation, Spain
Fabrice	COTTON	GFZ, Germany
Wim	COURAGE	TNO, Netherlands
Helen	CROWLEY	EUCENTRE, Italy
Matjaz	DOLSEK	University of Ljubljana, Slovenia
Simona	ESPOSITO	ETH Zurich, Switzerland
Peter	FAJFAR	University of Ljubljana, Slovenia
Luca	GALBUSERA	Joint Research Centre
Domenico	GIARDINI	ETH Zurich, Switzerland
Philippe	GUEGUEN	Institute of Earth Science ISTerre, France
William	HYNES	Future Analytics Consulting Ltd, Ireland
Iunio	IERVOLINO	Universita degli Studi di Napoli Federico II, Italy
Bulent	INANC	Botas Int.Ltd., Turkey
Tatjana	ISAKOVIĆ	University of Ljubljana, Slovenia
Jean-François	LECHAUDEL	TOTAL SA, France
Stefano	LORITO	INGV, Italy
Elena	LUCARELLI	Regione Toscana, Italy
Gerson	MARTIN	CEFIC, Belgium
José Pedro	MATOS	EPFL, Switzerland
Arnaud	MIGNAN	ETH Zurich, Switzerland
Alan	O'CONNOR	Trinity College Dublin, Ireland
Kyriazis	PITILAKIS	Aristotle University of Thessaloniki, Greece
Johan	REINDERS	TNO, Netherlands
Daniela	RODRIGUES	EUCENTRE, Italy
Bahadır	ŞADAN	OBS, Turkey
Ernesto	SALZANO	University of Bologna, Italy
Jacopo	SELVA	INGV, Italy
Athanasios	SFETSOS	NCSR Demokritos, Greece
Gerard	STALLENBERG	N.V. Nederlandse Gasunie
Bozidar	STOJADINOVIC	Swiss Federal Institute of Technology (ETH) Zurich
Georgios	TSIONIS	Joint Research Centre
Cuneyt	TUZUN	Bogazici University, Turkey
Eren	UCKAN	Bogazici University, Turkey
Pieter	VAN GELDER	PSCT

4. Feedback forms

A questionnaire was distributed at the workshop in order to gain feedback on the organization of the workshop, content and possible recommendations for the project. The questions included in the feedback forms were graded by the participants between 5 (fully agree) and 1 (not agree at all). The results about the agenda, speakers and overall outcome of the event are given in Table 4.1 (in terms of percentage) for a total of 14 questionnaires that were filled-in.

Table 4.1 Summary of feedback from participants

	Reply				
Question	**1**	**2**	**3**	**4**	**5**
The agenda (duration, structure, discussion vs. speakers) was appropriate to the event				29	**71**
Speakers were professional and their knowledge of the subject was appropriate				14	**86**
Presentation style was suitable for the event				21	**79**
Speakers covered all expected topics				36	**64**
Time for questions and discussion was sufficient		14	14	**36**	**36**
My expectations about the event were met				29	**71**

The majority of the participants expressed a positive assessment of the workshop regarding all the aspects. As pointed out by the participants, more time for interaction with questions and discussion should be planned in similar events in the future.

5. Conclusions and recommendations

The overall objective of the dissemination activities of the STREST project is to incorporate stress test methodologies in the management and long-term planning of non-nuclear critical infrastructures. To this end, the development of European guidelines for the application of stress tests is recommended. Such guidelines shall make use of the knowledge and tools developed by STREST and other relevant European research projects, define harmonised risk levels and address resilience issues.

The presentations of the work performed within STREST highlighted a number of technical aspects relevant to hazard and vulnerability assessment of critical infrastructures that should be further developed in future studies. Firstly, uncertainties, cascade effects and multiple hazards were shown to be important aspects to properly include in stress tests. The exploratory applications revealed in some cases lack of input data to perform the stress tests and lack of loss data for the calibration of models, e.g. for loss of life following damage to critical infrastructures. Regarding vulnerability assessment, fragility curves need to be developed for loss of containment in components of petrochemical plants, for dam components and systems, for pipelines in case of liquefaction and to include the effect of cumulative damage. With a view to the life-cycle management and planning of interventions in critical infrastructures, it is advisable to account for the long-term degradation of components. Lastly, it is recommended to use high-level, validated and preferably open-source softwares to perform the calculations needed for stress tests.

A key issue that emerged from the exploratory applications is the lack of harmonised levels of acceptable risk across countries and types of critical infrastructures. In fact, a critical infrastructure may pass or fail a stress test, depending on the adopted risk targets. It is therefore recommended that regulators and operators define common levels of risk objectives.

Societies and policy-makers are increasingly concerned with resilience. The scientific community and stakeholders should examine the role of critical infrastructures and propose engineering measures to increase the resilience of societies, within a risk-informed European policy for the safety of critical infrastructures.

STREST continued the technical dialogue with relevant ongoing FP7 and H2020 projects that was established at the first workshop, where a common approach to uncertainty estimation, the review of good practice in risk analysis, and harmonisation of hazard indicators and risk metrics were identified as areas where common work would be beneficial. Furthermore, it is proposed to discuss a common classification and taxonomy of elements at risk among projects, to identify commonalities and possible discrepancies among the methodologies – for instance by applying them to a portfolio of critical infrastructures – and to coordinate the dissemination activities.

The participants agreed on the need for joint dissemination beyond the individual projects, with a view to the development of European guidelines for stress tests. A joint communication from all relevant projects will be addressed to the European Commission and the European associations of regulators and operators of non-nuclear critical infrastructures. The communication will present the work of STREST and other projects and will support the need for a coordination action to capitalise on the new knowledge and methods towards the development of European guidelines. Individual partners are advised to inform the authorities and stakeholders in their countries. For the dissemination to the scientific community, it is proposed to organise a special session dedicated to stress tests for critical infrastructures during the 16th European Conference on Earthquake Engineering that will take place in Thessaloniki in June 2018.

Lastly, it is essential to overcome the difficulties in involving regulating authorities, owners and operators of critical infrastructures in all stages of the development and implementation of stress tests. Their cooperation is valuable for the collection of input data, the definition of common risk levels, their needs and experience in risk

management of extreme events, and comments for the improvement of the stress test methodology. The widest possible range of stakeholders should be contacted and invited to interact through a number of workshops, case studies and short meetings on specific infrastructures. The benefits for stakeholders will be the opportunity to shape the stress test methodology and the acquisition of know-how for assessing, managing and communicating risk in a harmonised manner applicable to all types of critical infrastructures.

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