SERA
Seismology and Earthquake Engineering
Research Infrastructure Alliance for Europe

DELIVERABLE

D1.4. Mid-term report of the Scientific Advisory Board

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Summary

The Scientific Advisory Board (SAB) for the Seismology and Earthquake Engineering Research Infrastructure Alliance for Europe (SERA) consists of Prof. Philippe Bisch from École de Ponts, Paris Tech, Paris, France, Prof. Mauro Dolce from the Department for Civil Protection in Rome, Italy, and Prof. Ellen Rathje from the University of Texas in Austin, Texas USA. The SAB attended the 1st SERA Annual Meeting held in Bucharest, Romania on April 25 and 26, 2018 and reviewed documents provided by the SERA Management Office at ETH Zurich. The SAB is impressed by the breadth of activities encompassed by the ambitious SERA project and we look forward to the successful completion of the project. Recommendations to further improve the project are discussed in the various sections of the report.

This report also includes specific mid-term assessments of the Transnational Access (TA) and Virtual Access (VA) based on information provided in October 2018. The two main findings from these mid-term assessments are: (1) the need to ensure all of the TA projects/sites are on schedule and (2) the need to ensure that the VA-4 project includes access to disaggregation data for the ground motions at each hazard level.

1 Joint Research Activities (JRA)

The Joint Research Activities (JRA) consist of the following work packages (WP):

- JRA-1: Physics of the earthquake initiation
- JRA-2: Characterizing the activity rates of induced and natural earthquakes
- JRA-3: Updating and extending the European Seismic Hazard Model
- JRA-4: Risk modelling framework for Europe
- JRA-5: Innovative testing methodologies for component/system resilience
- JRA-6: Real-time earthquake shaking

The JRA work packages are interdisciplinary and incorporate everything from basic earthquake science to earthquake engineering to social science. The difficulties may arise from this very wide spectrum and the main comment results from the observation of a need to strengthen the interactions and connections between the WPs, for instance on the following:

- Basic science from JRA-1 may be useful for JRA-2, and in sequence to JRA-3 and JRA-4. However, it seems that JRA-1 output will not be immediately usable for JRA-2.
- Induced seismicity is dealt with in JRA-1 and JRA-2 only, noting however a common task for validation of tools and methodologies.
- A development of consistency among approaches used in JRA-3, -4 and -6 would be appreciated.
- Relationship between JRA-5 and others should also be clarified.

Specifically related to **JRA-3**, to comply with the European Commission's intention in M/515 to include SHARE results in Eurocode 8, a strong objective of JRA-3 would be to provide hazard maps compatible with the definition of seismic action in EC8, accepted by all members of CEN/TC250/SC8. JRA-3 has

already incorporated in its work program the new parameters defining the seismic hazard input in the present draft of Eurocode 8, therefore the work is on good track for the required convergence.

To reach the above objective, there should be a tight link between SC8 and JRA-3 in order to:

- define the relevant return periods for the maps;
- to comply with the definition of values of anchoring spectral points, with a clear evaluation of associated uncertainties.

The cooperation between JRA-3 and SC8 has been organized during a previous common workshop on seismic hazard for engineering purposes and confirmed during the present annual meeting. The harmonization with the national seismic hazard models, where existing, is a delicate question that needs to be addressed very carefully, as is the compatibility at the borders.

Specifically related to JRA-4, uncertainty is crucial in the treatment of this topic. Particularly the definition of exposure and vulnerability, with different approaches according to availability of more or less detailed data, and the consideration of proxies for site amplification.

Over-expectation on the resolution of the risk model should be avoided. It must be well decided the scale or representation of the results (national and subnational, but not sub-urban). Moreover, the socio-economic indicators seem tailored mainly for developing countries. The attainment of full-scale values in many European countries should be checked.

Attention to Sendai indicators is highly appreciated. This way has to be pursued.

Validation of physical vulnerability with past earthquake is ok. However, attention should be made when using old events, e.g. like 1977 Bucharest, because exposure and vulnerability can be significantly changed over time.

Concerning JRA-5, as the scope of the project is wide, the scope of each activity could be concentrated to the main topics/objectives to avoid dispersion. Probably some activities such as meta-barriers may be covered by the calls in the TA.

For JRA-6, although it is clear that real time activity includes assessment of damages, it appears that there is some overlapping with JRA-4 activities, and at least some coordination is needed to try to use the same tools for vulnerability assessment. Also, there may be some overlapping with JRA-3 activities.

2 Transnational Access (TA)

A large number of research infrastructures, exactly ten, have been involved in the Transnational Access (TA) program. They are characterised by a wide variety of facilities, with the capability to deal with different important aspects of earthquake structural and geotechnical engineering. In particular access to five shaking tables, two reaction wall systems, one bearing tester, one geotechnical centrifuge, one very well-characterised and monitored test site are available. Moreover one seismological array is also offered for seismological studies.

Three calls for proposals are planned and, to date, two out of the three have already been made and have allocated 85% of the available funds (i.e., 2.53 M € out of 2.98 M € total budget). The funded projects include 33 selected projects proposed by 168 users. Approximately 12 more projects are expected to be funded in the third call, which should be launched by the end of 2018. This will make for a total number of 45 projects in the entire TA program.

The criteria used for the selection of the proposals appear well sounded, as they are mainly related to their scientific value, importance and competitiveness, transnational interest and synergies.

Focusing on earthquake structural engineering projects, the TA research program based on calls 1 and 2 includes tests on different "objects" at different scales. Reinforced concrete, masonry, or steel structures/structural parts tested at full or reduced scale are studied. Special structural devices, mainly seismic isolation or energy dissipation devices, are also being considered, to study their specific behaviour under seismic actions or to study the response of structures or other objects (e.g. statues, silos) seismically protected by those devices. Soil-structure interaction tests for different types of soils and structures (e.g. tunnels, retaining walls) are also being carried out.

Different testing techniques are being used, based on facility availability, the type of tested "objects", and the aim of the research. The different testing techniques include 1D to 3D shaking table testing and pseudo-dynamic testing for structures/structural parts, as well as novel tests aimed at evaluating soil-structure interaction using a shaking table, centrifuge facility and a monitored test site.

The TA research portfolio has a very wide range of objects, activities and scopes, with a huge involvement of researchers and research institutions. This will produce important scientific exchanges in the European scientific community, besides useful and interesting improvements of understanding of the seismic behaviour of a very large number of case studies.

To add value to the enormous scientific experimental work that is being done, in the opinion of the Scientific Advisory Board it would be beneficial to clearly summarise the research portfolio to better understand the connections between projects and gaps in the portfolio. In particular two recommendations are given.

The first recommendation is related to the seismic actions considered when performing the experimental simulations. Whenever possible, it would be useful to standardise the seismic input. Using accelerograms or forces derived from same seismic inputs could add value to the entire experimental program, referring the intensity of the action to the Eurocode 8 provisions. This would permit to compare the seismic response of different types of structures and devices, as well as to more easily translate the research findings into proposals for Eurocodes.

The second recommendation is related to the way this ambitious program is explained and presented. It would be useful to classify tests according to their scope (e.g., understanding seismic behaviour of specific structures, improvement of seismic code or of European norms, innovation in design or in devices, etc.). In particular, in the opinion of this SAB, Eurocode 8 should be the main reference for all the proposals, and the parts and the clauses that are directly or indirectly investigated, and for which improvements can be expected from the proposed research in the short and long run, should be indicated for each proposal.

Finally, considering the D8.1/Technical report on SERA Transnational Access activities TA1-TA10 M12 and the update on TA activities at M18 sent to SAB by SERA office, it can be noticed that, although there has been an initial delay of about 5 months in the first 12 months, there is a considerable percentage increment in the activity progress in the following six months, excepted IZIIS, with zero increase, and some others (CEA, LNEC and EUROSEISTEST), with small increases. Therefore, SAB recommends to speed up the activities for these latter projects, in order to recover the delay during the second part of the project.

3 Networking Activities (NA) and Virtual Access (VA)

The Networking Activities (NA) are geared to improve the availability and access to data, with a focus on integrating datasets into the framework of the European Plate Observatory System (EPOS). The five NA components involve:

- NA-1: Outreach programs for schools
- NA-2: Expanding access to European seismic monitoring data
- NA-3: Integrating deep seismic sounding (DSS) data into the EPOS framework
- NA-4: Maintenance, operation, and expansion of the SERIES experimental database and integration into the EPOS framework
- NA-5: Developing standards for the site characterization of strong-motion and seismic stations.

The Virtual Access (VA) activities provide online access to the main European data and products from seismology and engineering seismology. Specifically, these activities include:

- VA-1: Access to earthquake catalog products operated by EMSC
- VA-2: Access to seismic waveform data operated by ORFEUS/KNMI
- VA-3: Access to the European Strong Motion database, the European Archive of Historical Earthquake Data, and the European Database of Seismogenic Faults operated by INGV
- VA-4: Access to earthquake hazard and risk tools and products operated by EFHER/ETHZ
- VA-5: Access to data and products of anthropogenic seismicity by IGPAS

The Scientific Advisory Board was impressed by the breadth of topics covered by the NA and VA activities and wants to emphasize the importance of these projects for science developments and advances far into the future. These efforts can leave a lasting legacy towards supporting research that leads to a better understanding seismic issues across Europe.

The SAB wants to emphasize the critical need to ensure that data from the TA projects be archived in the newly expanded SERIES database. Given the significant funding allocated to the TA projects, the important advances being made, and the global move towards data sharing/publishing across earthquake engineering, there is an expectation that all TA projects contribute their data to the SERIES database for long term preservation and access.

Other specific comments relate to the importance of NA-5 (site characterization for seismic stations) for understanding earthquake ground shaking and the need for providing virtual access to hazard disaggregation as part of VA-4.

Finally, considering the D18.1. Report on access statistics and service provision of VA1-VA5 M16 sent to the SAB by SERA office in October 2018, the SAB notes that the VA projects are making good progress. The only area of concern is that it does not appear that VA-4 (Access to earthquake hazard and risk tools and products operated by EFHER/ETHZ) is planning to provide access to disaggregation of the hazard. This issue was highlighted by the SAB in their presentation at the end of the April 2018 SERA Annual Meeting.

On a broader level, the SAB notes a need for more through coordination and collaboration between the various SERA components.

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