Qualification of Seismic Research Facilities in Europe

Maurizio Zola (P&P LMC - Bergamo) – Fabio Taucer (JRC – Ispra)
Summary

- Qualification definition
- Qualification of Conformity Assessment Bodies (CABs)
- Meaning of Qualification for Research Testing Facilities
- The SERIES Project and the NA2 networking Activity
- Issues and obstacles for the qualification of the RTD facilities
- The Road Map towards the qualification of the RTD facilities
- The Common Protocol and its implementation
- The qualification of the RTD facilities
- Standardization of the qualification of the RTD Facilities
Qualification process

Process to demonstrate the ability to fulfill specified requirements (ISO 9000)
Conformity Assessment Bodies
ISO/IEC 17011 - Conformity assessment — General requirements for Accreditation Bodies accrediting Conformity Assessment Bodies

- In the **regulatory** sector the laws are covering the approval of products (including services) for reasons of **safety, health, environmental protection, fraud prevention or market fairness**;
- In the **voluntary** sector systems were set up for conformity assessment and approval, aiming at achieving a **minimum technical level, enabling comparability, and also ensuring competition on equal terms**;
- any product (including services) must be **free to circulate** without having to undergo extensive **re-testing, re-inspection, re-certification**;
- **Conformity assessment bodies (CABs)** can objectively state conformity of products (including services) to specified requirements;
- to know that these **CABs** are competent to perform their tasks an impartial verification is done by authoritative **accreditation bodies**;
- **Peer evaluation** mechanisms have been created at **regional and international levels**, through which assurance is provided that **accreditation bodies and CABs** all operate to globally accepted requirements in an equivalent manner.
Conformity Assessment Bodies

REGULATION (EC) No 765/2008
... setting out the requirements for accreditation and market surveillance ...

- **accreditation** is part of an overall system designed to assess and ensure conformity with the applicable requirements;
- the value of accreditation lies in the fact that it provides an authoritative statement of the technical competence;
- sectoral accreditation schemes could be developed to cover the fields of activity where general requirements for the competence of conformity assessment bodies are not sufficient;
- the European Regulation provides for the recognition of a single organization at European level (EA) who manages a peer evaluation system among national accreditation bodies.
Peer evaluation Bodies

- European cooperation for Accreditation (EA)
- International Laboratory Accreditation Cooperation (ILAC)
- International Accreditation Forum (IAF)
Qualification

1. Management system
2. Technical competence
Certification and Accreditation Standards

- For certification of Quality Management Systems:

- For accreditation of CABs:
  EN ISO/IEC 17025:2005 - General requirements for the competence of testing and calibration laboratories.
Why the Qualification for research facilities?

The qualification is a tool that guarantees the reliability of experimental test results.
Reliability

1. **Repeatability**: experimental activities repeated on the same specimen in the same laboratory lead to the same results

2. **Reproducibility**: experimental activities repeated on the same specimen in different laboratories lead to the same results
Reproducibility and Repeatability

- SAME METHOD → STANDARD TEST PROCEDURES
- DIFFERENT OPERATORS → TRAINING PROCEDURES
- DIFFERENT EQUIPMENT → CALIBRATION
- DIFFERENT LABORATORIES → COMMON MANAGEMENT PROCEDURES
- DIFFERENT OPERATING CONDITIONS → COMMON TESTING SPECIFICATIONS
- DIFFERENT TIMES → CONSTANT TESTING CONDITIONS
SERIES PROJECT GOALS
(Grant Agreement No. 227887)

- Bridge the gap between Europe and US/Japan in experimental seismic engineering.
- Establish protocols and criteria for qualification of RTD infrastructures in earthquake engineering.
- Bring together European countries with high seismicity but no research infrastructures and those with large infrastructures but low seismicity.
- Foster co-operation of labs and teams active in European Earthquake Engineering.
- Provide access to researchers to the most powerful European Infrastructures.
- Collaboration of research infrastructures towards new testing technologies.
SERIES Work Packages

SERIES PROJECT

- Management (MA)
  - WP1/MA1
  - WP2/MA1

- Networking Activities (NA)
  - WP2/NA2
  - WP4/NA3

- Transnational Access (TA)
  - WP5/TA1
  - WP11/TA7

- Joint Research Activities (JRA)
  - WP12/JRA1
  - WP13/JRA2
  - WP14/JRA3
NETWORKING ACTIVITIES

- Telepresence and geographically distributed testing → Very large virtual European research laboratory.
- Wide sharing of data and knowledge through web portal and distributed database, to live and grow after the end of SERIES.
- Common European standards, protocols and qualification criteria for similar research infrastructures.
- Training of technical and research personnel.
NA2 TEAM

10 Countries
15 Partners
Goal

Development of a Common Protocol for the qualification of earthquake engineering research infrastructures in Europe.
- **Task NA2.1**: Evaluation and impact of qualification of experimental facilities in Europe
  - Draw-up & Circulation of questionnaires
  - Analysis of data and Issue of Task Report

- **Task NA2.2**: Assessment of testing procedures and standards requirements
  - Draw-up & Circulation of questionnaires on testing procedures.
  - Analysis of responses and Issue of Final Report

- **Task NA2.3**: Criteria for instrumentation and equipment management
  - Draw-up & Circulation of questionnaires on instrumentation and equipment management.
  - Analysis of responses and Issue of Final Report

- **Task NA2.4**: Development and implementation of a common protocol for qualification
  - Draft of a Common Protocol for Qualification with Specific Technical Requirements for On-site Testing, Shaking Table Testing, Reaction Wall Testing, Data Acquisition and Processing
ISSUES

• Qualification of a research and technological development (RTD) infrastructure in earthquake engineering implies a process different from the qualification of a Conformity Assessment Body:
  • The design and execution of a research is not of a repetitive nature
  • The field of research is primarily determined by the problem
• International or European Standards dealing with certification or accreditation are not specifically devoted to the RTD laboratories.
• Lack of International or European standard or regulation requesting the qualification of RTD infrastructures.
• Lack of international recognition of the large capacities and associated human resources of the European RTD infrastructures.
OBSTACLES

- Lack of specific Standards for the qualification of RTD infrastructures;
- Lack of specific Standards covering RTD seismic testing;
- Lack of specific Standards covering special seismic testing with multi-axial large shaking tables, quasi-static and pseudo-dynamic techniques or hybrid experimental & mathematical modelling techniques;
- Lack of a qualification-oriented mentality of the high level management of the RTD infrastructures;
- Underestimation by the laboratory staff of the benefits of an official qualification of the RTD infrastructures;
- Reduced investment capabilities of RTD infrastructures.


3. Identification of Specific Technical Requirements (STR) for the RTD seismic testing;

4. Identification of Specific Technical Requirements relevant to documentation and data sharing to guarantee repeatability and reproducibility of test results with the development of a Common European Database;

5. Issue of a draft Common Protocol for the qualification with respect to the Management and Technical General Requirements;

6. Drafting of RTD specific testing procedures;

7. Implementation on a voluntary basis of the draft Common Protocol in some SERIES laboratories;

After the completion of the first two points of the road map it was recognized that:

- the **general management requirements** of EN ISO/IEC 17025 are suitable also for the management of RTD infrastructures, and
- the same conclusion can be drawn for the suitability of the **general technical requirements** of EN ISO/IEC 17025 for the RTD infrastructures, but not for the requirements of clause 5.4.2, selection of methods.

To overcome this situation, in accordance with EA 2/15, **Specific Technical Requirements for the RTD seismic testing** were identified with reference to the requirements of clauses 5.4.3, 5.4.4 and 5.4.5 of EN ISO/IEC 17025.

This choice will lead to the **qualification with “flexible scope”** of the RTD infrastructures.
Protocol for the Qualification

1. **Common Protocol** for the qualification giving the Management and Technical General Requirements

2. **Check list** for the audits (Annex 01)

3. **Specific Technical Requirements** for:
   - On-site Testing (Annex 02)
   - Shaking Table Testing (Annex 03)
   - Reaction Wall Testing (Annex 04)
   - Data Acquisition and Processing (Annex 05)
Implementation of the draft Common Protocol for Qualification

The following Partners participated to the peer tests to implement the Common Protocol for the Qualification on a voluntary basis:

- reaction wall
  - JRC
  - UNITN
- shaking table
  - CEA
  - NTUA
  - UNAP
  - IZIIS
  - EUCENTRE
- on site testing
  - UNITN
After the completion of the peer tests three activities of the RTD Facilities were identified:

- Research Engineering Activities
- Measurement Activities
- Research Testing Activities
Research Engineering Activities

- general specifications for the research
- design and planning of the research
- test specifications
- supervision of experimental research activities
- mathematical modeling
- experimental data processing
- design of the experimental rig
- research reporting.

The Research Engineering Activities are developed in three steps:

1. general study of the problem and identification of the research activities needed
2. supervision of the experimental activities
3. experimental data processing, results interpretation and final reporting
Measurement Activities

These activities are performed in accordance to standard or internal methods.
Research Testing Activities

- The experimental testing activities are performed by following a test specification issued by the research engineer.
- The research testing activities are concluded by issuing the test report.
- The test report should include the raw data and pre-processed data.
THE WAY TO THE QUALIFICATION

The qualification of the research testing facilities may be achieved:

• for Research Engineering Activities by the certification of the Management System after ISO 9001;
• for Measurement Activities by the accreditation of the Laboratory after ISO/IEC 17025;
• for Research Testing Activities by the accreditation of the Laboratory after ISO/IEC 17025 with flexible scope.
As far as the operation of the Research Testing Laboratories after ISO/IEC 17025 with flexible scope

1. the Laboratory (Supplier of tests) should receive a Testing Specification
2. issued by the Research Engineer (Customer)
3. and the Specific Technical Requirements (Annexes to the Common Protocol) should be applied.
Common Protocol for the Qualification

CONTENTS

1. Scope
2. General Management Requirements
3. General Technical Requirements
4. Specific Technical Requirements
5. References
6. Annexes (1 to 5)
Common Protocol for the Qualification

REFERENCES

1. COMMISSION OF THE EUROPEAN COMMUNITIES – SERIES: SEISMIC ENGINEERING RESEARCH INFRASTRUCTURES FOR EUROPEAN SYNERGIES - Grant Agreement Number 227887.
2. Grant agreement No. 227887 for: SERIES - SEISMIC ENGINEERING RESEARCH INFRASTRUCTURES FOR EUROPEAN SYNERGIES – Annex I: “Description of Work”.
5. ISO/IEC 17025:2005 - General requirements for the competence of testing and calibration laboratories.
7. EA-2/15 - EA Requirements for the Accreditation of Flexible Scopes.
Annex 01 – Check List for the Performance of the Audit to the Research Testing Facilities

**SECTIONS**
1. To address the issues and the remarks relevant to the qualification of the Research Infrastructures.
2. To address the audit performance.
3. To address the current state of certification, accreditation, and management procedures within the Facility. This is a preliminary evaluation.
4. To address the current state of the Facility’s management system.
5. To address the current state of the Facility’s general technical procedures.
6. To identify the specific test procedures that are applied.
Annex 01 – Check List for the Performance of the Audit to the Research Testing Facilities

APPLICATIONS

• Sections 1 through 4 apply to research engineering activities

• Sections 1 through 5 apply to measurement activities

• Sections 1 through 6 apply to research testing activities.
Specific Technical Requirements for Seismic Research Tests (Annex 02 – 05)

CONTENT

- Introduction
- 1. Scope
- 2. Specimen to be tested
- 3. Parameters/quantities and relevant ranges
- 4. Apparatus and equipment
- 5. Reference documents
- 6. Environmental conditions
- 7. Description of the test setup
- 8. Methods of test
- 9. Criteria for approval
- 10. Data management
- 11. Uncertainty management
- 12. Repeatability evaluation
REFERENCES

1. ISO 2041 Vibration and Shock – Vocabulary
2. ISO/IEC 17025:2005 - General requirements for the competence of testing and calibration laboratories.
3. EN IEC 60068-2-47 (1999) Environmental testing - Part 2: Test methods - Mounting of components, equipment and other articles for vibration, impact and similar dynamic tests
6. EN IEC 60068-2-64 (1993) Environmental testing - Part 2-64: Tests - Test Fh: Vibration, broad-band random (digital control) and guidance
STANDARDIZATION ACTIVITY

1. The Common Protocol was presented to the Laboratory Committee of EA (European cooperation for Accreditation) in Oslo on Sept. 19th, 2012

2. The Common Protocol was presented to the 1st International Conference of ERNCIP (European Reference Network for Critical Infrastructure Protection) in Ispra on Dec. 13th, 2012

3. Contacts are in progress with CEI (Italian Electro-technical Committee) for the presentation of the Common Protocol and its Technical Annexes together with UNI (Italian Standardization Body) at CEN for consideration as starting proposal for the development of standards.
Thank you
Work in progress