REcube
REthink, REvive, Reuse

Transmitting the knowledge for the green regeneration of the European Concrete Heritage

Project number: 2021-1-IT02-KA220-HED-000027628
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Project duration: 36 months, 01-12-2021 to 30-11-2024

REcube PROJECT HANDBOOK

As of March 31st, 2022
(to be updated on a regular basis)

Document stored on the REcube partnership online drive:
REcube - REthink, REvive, REuse, shared folder of the Cooperation Partnership
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01 REcube context and objectives

The REcube: REthink, REvive, REuse – Transmitting the knowledge for the green regeneration of the European Concrete Heritage project will teach a sustainable, integrated and holistic approach to the conservation and renovation of Modern Concrete European Architectural Heritage to master’s students coming from 11 different Architecture and Engineering schools across Europe. Students from a variety of national and cultural backgrounds will participate in an educational programme providing them with knowledge and skills in green heritage-led renovation practices. The EC’s Renovation Wave Strategy notes that the Covid-19 crisis has brought into sharper focus our buildings, their importance for our lives and their fragilities and that some effects may continue in the longer term creating new demands on our architectures and their energy and resource profile, further adding to the need to renovate them deeply and on a massive scale. Thus, in our current circumstances, the regeneration of modern concrete architecture presents itself as a golden opportunity to address our environmental, social and economic crises simultaneously. But there is a lack of best practices in the conservation of modern concrete heritage and in heritage-led renovation of the modern building stock, as initiatives such as the Keeping it Modern programme of the Getty Foundation have recently demonstrated. The modern built environment, and cities in particular, are the locus of both promise and concern. It is time to rethink how we manage and transform the architectures of our recent past, how we can revive and reuse them. REcube’s overall objective is conceiving and transmitting a new sustainable best practice to foster the development of a new mindset in the field of Modern Heritage Regeneration, based on the imminent and highly necessary culture change in the building sector accelerated by the Covid-19 crisis.

02 Introduction and means of communication

The aim of this project handbook is to clearly communicate the tasks, products, scheduled meetings, work load and reporting requirements of the REcube project and to provide a concise overview for the project partnership.

Means of communication:

1. email;
2. phone/whatsapp (WA) groups;
3. online meetings;
4. document repository and exchange.

03 REcube organizational structure

The Project Management Team (PMT) of REcube is composed by Marco di Prisco, Elisabetta Margiotta Nervi and Giulio Zani. Roles and contact details are reported in Table 1. The Project Management Team:

- will track regularly the efforts/overall budget consumption;
- will evaluate and communicate deviations between the budgeted costs and the actual project costs;
- will devise and plan the implementation of corrective actions that will bring the budget back on target;

- will require a formal approval of the Project Steering Committee (PSC) in case where the project budget needs to be considerably revised.

Concerning the control of the project schedule, the PMT:

- will track regularly the evolution of the various activities as defined in the Project Handbook;

- will track project changes, issues and risks, and monitor their impact on the project schedule;

- will devise, agree and implement corrective actions if the schedule status has deviations from the planned schedule (a formal approval of the PSC is requested if the schedule is at risk or considerable delays are foreseen);

- will inform all affected project stakeholders about changes on the project schedule.

To control operations, the PMT will collect monthly reports (based on a common template) from the Partner Organizations, gathering timely information on travel expenses, staff costs/expenditure, deadlines and efforts (working days will be progressively declared in a timesheet). Explanations about possible deviations from the agreed timeline and budget will also be included in those reports.

The PMT will regularly communicate about the project status by issuing a quarterly newsletter, which will include among others, information about the major achievements/results of the past quarter and the planned deliverables/deadlines of the coming quarter. This newsletter will be used to notify the project stakeholders about possible deviations from the planned activities.

The Transnational Project meetings M1, M2, M3 and M4 will also be an opportunity to provide an annual briefing on the project financial and time aspects and of course ad-hoc meetings can always be requested and organized in case of major/critical deviations.

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
<th>email</th>
<th>Mobile phone</th>
<th>WA</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>

On an organizational standpoint, the PMT will work closely with the General Assembly, consisting of the 13 Scientific and technical coordinators appointed by the 13 REcube Partners (see Table 2 and Table 3).

Table 1. REcube Project Management Team

Table 2. List of the REcube Partners

<table>
<thead>
<tr>
<th>Role</th>
<th>Acronym</th>
<th>Full name</th>
<th>Country</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coordinator</td>
<td>PoliMI</td>
<td>Politecnico di Milano</td>
<td>Italy</td>
<td>HEI</td>
</tr>
</tbody>
</table>
04 Contact persons

04.1 Scientific and technical coordinators - Members of the General Assembly

Table 3. List of the REcube scientific and technical coordinators

<table>
<thead>
<tr>
<th>Partner</th>
<th>Name</th>
<th>email</th>
<th>Mobile phone</th>
<th>WA</th>
</tr>
</thead>
<tbody>
<tr>
<td>PoliMI</td>
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<td>Yes</td>
</tr>
</tbody>
</table>

04.2 Dissemination managers

Table 4. List of the REcube dissemination managers

<table>
<thead>
<tr>
<th>Partner</th>
<th>Name</th>
<th>email</th>
<th>Mobile phone</th>
<th>WA</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>
04.3 Financial and administrative representatives

Table 5. List of the REcube financial and administrative representatives

<table>
<thead>
<tr>
<th>Partner</th>
<th>Name</th>
<th>Email</th>
<th>Mobile phone</th>
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<td>+34608999808</td>
<td>Yes</td>
</tr>
</tbody>
</table>

05 Summary of the Work Packages (WP)

For each of the identified work fields of Table 6, a responsible partner is identified and, within each Work Package (WP), a WP Leader is responsible for coordinating the activities with the partners involved. The Coordinator and all the partners P1-P12 are expected to collaborate in different subtasks, as displayed in the Work Breakdown Structure detailed in the following section.

Table 6. REcube Work Packages

<table>
<thead>
<tr>
<th>WP</th>
<th>Title</th>
<th>Lead Partner</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP0</td>
<td>Project Management, dissemination and evaluation</td>
<td>PoliMI</td>
<td>M1 - 36</td>
</tr>
</tbody>
</table>
06 Description of the Work Packages (WP)

Considering 5 main WPs, three of which correspond to the 3 REcube Project Results (WP1-PR1, WP2-PR2, WP3-PR3), the following is the distribution of Task (T) and Subtask (ST) responsibilities among the partners.

06.1 WP0 - Project Management, dissemination and evaluation (Lead PoliMI)

All the Project Partners will be involved in the project management, dissemination and evaluation activities. The first task will be based on reporting forms that will be made available by the Coordinator. Dissemination activities will be arranged according to a detailed REcube dissemination plan, to be formally adopted at the first physical Project meeting M1. All the REcube results will be formally approved by the General Assembly, which will be entitled to authorize the Coordinator to pay the interim and outstanding balance grant installments.

06.2 WP1 - REcube Open Source Online Platform (Lead PLN Project)

WP1/PR1 is the REcube Learning Platform and associated teaching practices, to become (in the sustainability phase) the REcube Digital Academy platform. PR1 will host the learning material needed for the blended-learning teaching and the REcube MOOC (PR2). In the sustainability phase, it will become a hub, consolidating all the produced learning tools and materials for the effective transmission of these best practices within the REcube Digital ACADEMY. The impact of the REcube project results will be amplified through positioning the REcube Digital Community as a hub at the heart of Sustainable Modern Heritage Regeneration. The production of Project Result 1 will be managed according to the following WBS, where PR1 indicates the result, An indicates the n-th activity, STn indicates the n-th Subtask (ST) corresponding to the n-th Knowledge Pillar, Dn indicates the n-th deliverable and Mn indicates the n-th milestone. For each activity and ST, a Task Leader (TL) and a Working Group (WG) are identified.

PR1/A1-Contents of the REcube Academy Learning Platform (Task Leader HCU)

ST1.1.1-General Approach/Strategies (Lead HCU, WG: METU, ICOMOS, BME, Sapienza, PoliTO, UPM, PoliMI)

D1. Knowledge Pillar 1 (due to month 6)

ST1.1.2-Historical Research and Evaluation (Lead Sapienza, WG: PLN Project, ICOMOS Italia, UniNA, METU, HCU)

D2. Knowledge Pillar 2 (due to month 6)

ST1.1.3-Evaluation of the setting: landscape and urban context (Lead ICOMOS Italia, WG: ICOMOS Italia, UniNA, METU)

D3. Knowledge Pillar 3 (due to month 6)
ST1.1.4-Architectural and structural evaluation (Lead UniNA, WG: PLN Project, UniNA, METU, BME, Sapienza, ULB)

D4. Knowledge Pillar 4 (due to month 6)

ST1.1.5-Anthropolical and Sociological evaluation (Lead PLN Project, WG: PLN Project, PoliTO, UniNA, METU)

D5. Knowledge Pillar 5 (due to month 6)

ST1.1.6-Structural/Material Assessment and Analysis Procedures (Lead UPM, WG: TUDelft, Sapienza, PoliTO, UMinho, METU, PoliMI, BME, UPM)

D6. Knowledge Pillar 6 (due to month 6)

ST1.1.7-Structural health monitoring and evaluation (Lead BME, WG: TUDelft, BME, PoliTO, PoliMI)

D7. Knowledge Pillar 7 (due to month 6)

ST1.1.8-Heritage Building Information Modeling HBIM and City Information Modeling CIM (Lead METU, WG: ULB, Sapienza, METU, BME, UniNA, HCU)

D8. Knowledge Pillar 8 (due to month 6)

ST1.1.9-Analysis of possible retrofitting solutions (Lead UMinho, WG: UMinho, PoliMI, UPM, BME, Sapienza, PLN Project, ICOMOS Italia)

D9. Knowledge Pillar 9 (due to month 6)

ST1.1.10-Environmental Performance assessment - Building Physics (Lead PoliMI, WG: UMinho, PoliMI, BME)

D10. Knowledge Pillar 10 (due to month 6)

**PR1/A2-Development of the REcube Academy Learning Platform (Task Leader PoliMI)**

M1. Publication of the REcube Academy online learning platform (due to month 7)

**PR1/A3-Update of the REcube Academy Learning Platform (Task Leader PoliMI)**

Please note that Activity PR1/A1 will require the contribution of all the Participating Organizations (Applicant and P1-P12). Activities PR1/A2 and PR1/A3 will strongly involve researchers and technicians of the METID group of the Politecnico di Milano. It has to be noted that the graphic design, implementation, update and maintenance of the REcube Academy Learning Platform will be managed by the METID Innovation Teaching and Learning Task Force of the PoliMI and is reflected in the PR1 budget as 35 working days of METID researchers and 75 working days of METID technicians (about 20 k€). Note that the REcube Academy Learning Platform, although technically developed by PoliMI through the METID, will be exploited by all the Partners and should not be read as a budget imbalance.

**06.3 WP2 - REcube MOOC (Lead PoliMI)**

WP2/PR2 is the REcube Massive Online Open Course (MOOC), which will become part (in the sustainability phase) of the REcube Digital Academy platform. The course will address 10 different knowledge pillars related to sustainable regeneration of modern concrete architecture with a series of multidisciplinary foci at the nexus between Engineering and Architecture; this is subsequently
made available to a larger public in the project’s sustainability phase. The MOOC also incorporates the recorded Meet the Makers online sessions, where REcube students have the opportunity to interact with world-leading experts sharing their deep commitment to sustainable architectural conservation. The production of Project Result 2 will be managed according to the following WBS, where PR2 indicates the result, An indicates the n-th activity, STn indicates the n-th subtask (ST) corresponding to the n-th Knowledge Pillar, Dn indicates the n-th deliverable and Mn indicates the n-th milestone. For each activity and ST, a Task Leader (TL) and a Working Group (WG) are identified.

**PR2/A1-Design, development and collection of the MOOC contents (TL PLN Project)**

ST2.1.1-Conservation, preservation, maintenance? (METU, ICOMOS, BME)
ST2.1.2-Strategies: When and how to intervene in existing buildings (Sapienza, PoliTO, UPM)
ST2.1.3-Approach: Green Regeneration/Sustainability (Sapienza, BME, PoliMI)
ST2.1.4-Archival survey methodologies (PLN Project, ICOMOS)
ST2.1.5-Documentary evaluation (PLN Project, ICOMOS)
ST2.1.6-Reading the building: Historical analysis materials and construction techniques (UniNA, METU, ICOMOS, HCU)
ST2.1.7-Landscape assessment and interpretation (ICOMOS, UniNA, METU)
ST2.1.8-Urban environment evaluation (ICOMOS, UniNA, METU)
ST2.1.9-Comparative analysis with similar contexts (ICOMOS, UniNA, METU)
ST2.1.10-Information collection, preparing an Integrated Platform for data analysis (PLN Project, UniNA, METU)
ST2.1.11-Refurbishment conception modelling and presentation (BME)
ST2.1.12-Geometric and Photogrammetric survey (Sapienza, ULB, METU, HCU)
ST2.1.13-Material construction analysis (PLN Project, UniNA, METU)
ST2.1.14-Architectural Anthropology (PLN Project)
ST2.1.15-Social research methods and urban space perception (PoliTO, UniNA, METU)
ST2.1.16-Urban project traditions (PoliTO, METU)
ST2.1.17-Territorial visions (PoliTO)
ST2.1.18-Typical pathologies of RC structures (TUDelft, Sapienza)
ST2.1.19-Seismic monitoring and sensor placement (PoliTO, UMinho, METU)
ST2.1.20-Safety and reliability assessments (Sapienza, UMinho, PoliMI)
ST2.1.21-Numerical analysis of crack history and final load bearing capacity (BME, UPM)
ST2.1.22-Fire safety and resistance (BME)
ST2.1.23-Observation of structural defects (TUDelft, BME)
ST2.1.24-Advanced non-destructive testing methods (PoliTO, PoliMI, BME)
ST2.1.25-Massive survey (ULB, Sapienza, METU)
ST2.1.26-Point cloud modeling (Sapienza, METU, BME)
ST2.1.27-Data management and accessibility (UniNA, METU, HCU)
ST2.1.28-FRP/FRCM systems for structural retrofitting (UMinho, PoliMI, UPM)
ST2.1.29-Advanced materials and methods for strengthening existing structures (BME)
ST2.1.30-Alternative solutions to adapt the existing structure without its strengthening (Sapienza, UMinho, PoliMI)
ST2.1.31-Structural strengthening vs. architectural preservation (PoliMI, Sapienza, PLN Project, ICOMOS)
ST2.1.32-Innovative building technologies for high energy efficient envelopes (UMinho, PoliMI, BME)
ST2.1.33-Passive heating and cooling strategies for energy retrofitting (PoliMI, BME)
ST2.1.34-Hygrothermal modelling of constructions (BME)
ST2.1.35-Building energy modelling and simulation (PoliMI, BME)
ST2.1.36-Thermal and visual comfort assessment (PoliMI)
ST2.1.37-Environmental impact assessment of retrofit solutions (BME)

D9. REcube MOOC contents (due month 6)

**PR2/A2-Video recording and editing (TL PoliMI)**

**PR2/A3-Development of the MOOC (TL PoliMI)**

M2. Publication of the MOOC (due month 7)

**PR2/A4-Update of the REcube MOOC (TL PoliMI)**

PR2/A1 and PR2/A2 will require the contribution of all the Partners. PR2/A2 and PR2/A3 will strongly involve researchers and technicians of the METID group of the PoliMI. It has to be noted that the graphic design, implementation, update and maintenance of the MOOC will be managed by the METID and is reflected in the PR2 budget as 35 working days of METID researchers and 75 working days of METID technicians (about 20 k€). Note that the REcube MOOC, although technically developed by PoliMI through METID, will be exploited by all the Partners and the larger grant requested by PoliMI should not be read as a budget imbalance.

06.4 WP3 - REcube Guidelines (Lead ICOMOS Italia)

WP3/PR3 is the REcube Guidelines for Practitioners, to become part (in the sustainability phase) of the REcube Digital Academy platform. PR3 conveys the scientific approach to the green regeneration process, establishing at European and International levels the codification of best practices in the Sustainable Regeneration of Modern Concrete. They will be published in a dedicated *fib* bulletin. The production of Project Result 3 will be managed according to the following WBS, where PR3 indicates the result, An indicates the n-th activity, STn indicates the n-th subtask corresponding to the n-th Knowledge Pillar, Dn indicates the n-th deliverable and Mn indicates the
n-th milestone. For each activity and ST, a Task Leader (TL) and a Working Group (WG) are identified.

**PR3/A1- State of the art (Task Leader HCU)**

D10. State of the art report (due to month 11)

**PR3/A2- Brainstorm reports (Task Leader PLN Project)**

**PR3/A3- Listing and Heritage assessment/prescriptions (Task Leader ICOMOS Italia)**

D11. Proposal of Listing and Heritage assessment prescriptions (due to month 23)

**PR3/A4- Preparation of the REcube Guidelines for Practitioners (Task ICOMOS Italia)**

D12. Draft of the REcube Guidelines for Practitioners (due to month 30)

M3. Publication of the REcube Guidelines for Practitioners as a fib bulletin (due to month 36)

Please note that Activity PR3/A4 will require the contribution of all the partner organizations (applicant and P1-P12).

06.5 WP4 - REcube learning, teaching and training activities (Lead PLN Project)

T4.1 – Contents of the REcube Frontier Workshops (T Lead PLN Project)

ST4.1.1 – Frontier Workshop 1: Pathologies in Reinforced Concrete Structures (Lead TUDelft)

ST4.1.2 – Frontier Workshop 2: HBIM and diagnostic of existing Reinforced Concrete structures (Lead METU)

ST4.1.3 – Frontier Workshop 3: Structural retrofitting of existing Reinforced Concrete Structures (Lead UMinho)

T4.2 – Contents of the REgenerate Workshops (T Lead PoliMI)

ST4.2.1 – REgenerate Workshop 1: Mincio swimming pool (Lead UniNA)

ST4.2.2 – REgenerate Workshop 2: Torino Esposizioni Pavilion (Lead PoliTO)

ST4.2.3 – REgenerate Workshop 3: Municipal Stadium in Florence (Lead Sapienza)

07 Description of the learning, teaching and training activities

07.1 Year 1: Frontier Workshop 1 + Regenerate Workshop 1

**Frontier Workshop 1 (virtual)**

To implement learning activities in a greener way and sustain an eco-friendly approach as requested by this Erasmus+ call, the Frontier Workshop is an online intensive course on cutting edge topics about pathologies and physics of reinforced concrete structures. Conservation of reinforced concrete...
heritage implies analysing the geometry and preservation state of the reinforcements and construction solutions adopted, most of which evolved rapidly following the development of the Modern Movement construction and design language. This architectural heritage is subject to various forms of alteration and degradation. The scientific community has long been committed to address this ever-evolving problem while dealing with structural and technological issues. This Frontier Workshop will introduce the scientific advances achieved studying concrete in the context of architectural heritage, structural morphology and material. More specifically, learners will study the typical design patterns by Pier Luigi Nervi and how they express structural flow of forces as well as determining Nervi’s prefabrication method as applied to his buildings. The workshop will illustrate scientific advances relating to the study of concrete at the material level and the latest knowledge on pathologies, sustainable treatment and restoration, with particular reference to:

1. history, composition, characteristics, architectural and structural use of concrete
2. structural morphology of the Nervi’s patterns
3. investigation of the flow of forces of Nervi’s patterns
4. interconnections between the prefabricated elements
5. role of design, prefabrication and construction deficiencies
6. service life of reinforced concrete in its natural environment
7. typical pathologies of reinforced concrete structures, concrete ageing/cracking and rebar corrosion
8. consequences, monitoring and treatment of recurring structural deteriorations
9. building physics.

The aim is to provide participating students with a complete overview applying a blend of theoretical knowledge and practical learning. It will be subdivided into (1) lectures and (2) an in-depth analysis of case studies belonging to the Pier Luigi Nervi’s architectural heritage.

WORKSHOP OUTCOMES

The tangible output contributes to Project Result 1 (PR1):

Educational material will be created and assembled by the teachers in preparation of the workshop and subsequently integrated with the students’ homework and the reflection documentation (from teacher evaluations and student feedback), all to be uploaded to the learning platform for the REcube Digital Academy and the REcube Masters Programme.

The intangible outcomes of the Frontier Workshop Activity relate to increased skills and improved abilities, and to knowledge and experience gained by all PARTICIPANTS:

1. Partners’ teachers – those working on the development of the PR1
2. Master level students – participants in the REcube Learning/Teaching/Training Activities (LT TA) for 2022
3. Invited teachers – providers of expert inputs and active contributors to the discussions, intensive classes, methodological and practical workshops during the 2022 LT TA

The interaction of all participants leads to increased awareness about the complexity of reinforced concrete pathologies and building physics. In the sustainability phase of the REcube project, the Workshop results form part of the REcube Digital Academy, transmitting to a wider, international audience the need to adopt new tools enabling new work approaches and attitudes towards the regeneration practices of concrete Modern Heritage. The problems will gain wider recognition and will be introduced to a larger academic, non-academic and general public.
Outcomes will be integrated in the learning activities of the subsequent REgenerate Workshop, when students must implement the knowledge acquired in the Frontier. Content-related, methodological and structural feedback will be integrated in the development of Frontier Workshop 2.

**Regenerate Workshop 1 (physical)**

REcube Project Workshops are intensive face-to-face study programmes based on a case study which will always take place in Lecco on the POLIMI campus, in proximity to the three case study buildings. The REgenerate Workshop 2022 will centre on performing the multifaceted assessment and analysis of a specific concrete architecture, the Mincio Swimming Pool by Pier Luigi Nervi in Milan, to be preserved and repurposed. Learners will evaluate and interpret the different data acquired on the chosen structure and present the problems to be solved as well as the preparatory analysis to be performed before the renovation design.

The workshop comprises:

- A one-day fieldtrip to visit and experience the Mincio swimming pool
- The workshop itself in the Laboratorio Nervi on the POLIMI Campus. There the students will have the possibility to explore and use the material assembled in the Laboratorio Nervi. During the 4 days the students will stay on campus and will work on the preparatory tasks which have to be performed before starting a conservation and reuse process of the case study. They will also perform an exercise based on the contents of the Frontier Workshop 1, to implement the acquired knowledge.

The scientific approach to the REGENERATION PROCESS to be conveyed to the students:

- the work has to be recognized as an asset to be protected, preserved and restored
- pre-evaluation, the analysis of the state of conservation of the building has to be performed
- a compatible function for the building has to be identified
- the recovery process has to be sustainable and “green” in the choice of materials and technical solutions
- once all these elements have been taken into consideration, it is possible to proceed with the planning, in order to achieve the full functionality of the building or structure. The goal is to permit a wide range of compatible functions in order to ensure the best possible future life of the building while respecting its cultural value.

**WORKSHOP OUTCOMES**

The tangible output will contribute to Project Result 1 (PR1):

A series of educational materials will be created and assembled by the teachers in preparation of the workshop and will be subsequently integrated with the students’ presentation and the reflection documentation (teacher evaluations and student feedback). They will be uploaded on the learning platform and will be the basis both for the content of the REcube Digital Academy and of the REcube Masters Programme.

The intangible outcomes of the Frontier Workshop 2 relate to increased skills and improved abilities, and to knowledge and experience gained by all PARTICIPANTS:

1. Partners’ teachers – the actual persons working on the development of the PR
2. Master level students who are participants in the REcube Learning/Teaching /Training Activities (LTTA) for 2022

3. Invited teachers – providers of expert inputs and active contributors to the discussions, intensive classes, methodological and practical workshops during the 2022 LTTA

The interaction of all participants will lead to increased awareness about the value of the proposed regeneration methodology. In the sustainability phase of the REcube project, the Workshop results will be part of the REcube Digital Academy learning content, transmitting to a wider, international audience the need to adopt new work approaches and attitudes towards the green regeneration practices of concrete Modern Heritage (PR1). Moreover, this LTTA will also contribute to Project Result 3 (PR3). Teachers’ experience will contribute to the creation of the REcube Guidelines, the Methodology for the Sustainable Green Regeneration of the Concrete Modern Heritage.

After the workshop, the students will present their project results evaluated by the faculty after 2 months, giving them time for postproduction and finalization. Content-related, methodological and structural feedback will be collected and integrated in the development of REgenerate Workshop 2.

07.2 Year 2: Frontier Workshop 2 + Regenerate Workshop 2

Frontier Workshop 2 (virtual)

To implement learning activities in a greener way and sustain an eco-friendly approach as requested by this year’s Erasmus+ call, this Frontier Workshop is an online intensive course on cutting edge topics about HBIM and Diagnostics of Existing Reinforced Concrete Structures. It forms the framework for theoretical discussions and practical implementations of built heritage knowledge and information management, focusing on reinforced concrete structures and employing the latest advances in the field. The goal is to provide a better understanding of the HBIM model, as a valid and reliable tool, to be used in the process of knowledge acquisition and analysis of the built works, supporting the progressive and deep understanding of an architectural heritage artefact and the design process aimed at its conservation and enhancement.

The workshop aims to accomplish this overall task by pursuing three focal tracks:

1. The theoretical background for HBIM and implementation strategies: This focuses on the concept of information modelling for the management of built heritage.
2. Practical implementation of data and information gathering with a focus on (a) capturing and analysing 3D survey data, (b) on microstructural and non-destructive analyses, (c) material science, (d) on-site measurements, (e) representation techniques including VR and AR: This track aims to provide parallel exercises on the practical issue of data and information gathering for HBIM.
3. Integration of survey data with knowledge-based assets for the management of information through life: This third track will be the exercise for the integration of survey data with knowledge-based assets.

WORKSHOP OUTCOMES

The tangible output will contribute to Project Result 1 (PR1):

A series of educational materials will be created and assembled by the teachers in preparation of the workshop and will be subsequently integrated with the students’ homework and the reflection documentation composed by the teachers’ evaluations and students’ feedback. They will be uploaded on the learning platform and will be the basis both for the content of the REcube Digital Academy and of the REcube Masters Programme.
The intangible outcomes of the Frontier Workshop 2 will be related to the increased skills and improved abilities, and to the knowledge and experience gained by all PARTICIPANTS in the workshop:

1. Partners' teachers – _the actual persons working on the development of the PR_
2. Master level students who are participants in the REcube Learning/Teaching /Training Activities (LTTA) for 2023
3. Invited teachers – providers of expert inputs and active contributors to the discussions, intensive classes, methodological and practical workshops during the 2023 LTTA

The interaction of all participants will lead to a generally increased awareness about the value of the HBIM processes. In the sustainability phase of the REcube project, the Workshop results will be part of the REcube Digital Academy learning content, transmitting to a wider, international audience the need of adopting new tools enabling new work approaches and attitudes towards the green regeneration practices of concrete Modern Heritage. HBIM will gain wider recognition and will be introduced to a larger academic, non-academic and general public.

The outcomes of this Frontier Workshop will be integrated in the learning activities of the subsequent REgenerate Workshop about the Torino Esposizioni Building, when the students will receive the task of implementing the knowledge acquired in the Frontier. Content-related, methodological and structural feedback will be collected and will be integrated in the further development of the Frontier Workshop 3.

**Regenerate Workshop 2 (physical)**

**AIMS and DESCRIPTION**

REcube Project Workshops are intensive face-to-face study programmes based on a case study which will always take place in Lecco on the POLIMI campus, in proximity to the three case study buildings. The REgenerate Workshop 2023 will centre on performing the multifaceted assessment and analysis of a specific concrete architecture, the Torino Esposizioni Pavillion by Pier Luigi Nervi in Turin, to be preserved and repurposed. Learners will evaluate and interpret the different data acquired on the chosen structure and present the problems to be solved as well as the preparatory analysis to be performed before the renovation design.

The workshop comprises:

- A one-day fieldtrip to visit and experience the Torino Esposizioni Pavillion.
- The workshop in the Laboratorio Nervi on the POLIMI Campus. There the students will explore and use the material assembled in the Laboratorio Nervi. During the 4 days the students will stay on campus and will work on the preparatory tasks which have to be performed before starting a conservation and reuse process of the case study. They will also perform an exercise based on the contents of the Frontier Workshop 2, to implement the acquired knowledge.

The scientific approach to the **REGENERATION PROCESS** to be conveyed to the students:

- the work has to be recognized as an asset to be protected, preserved and restored
- pre-evaluation, the analysis of the state of conservation of the building has to be performed
- a compatible function for the building has to be identified
- the recovery process has to be sustainable and “green” in the choice of materials and technical solutions
• once all these elements have been taken into consideration, it is possible to proceed with the planning, in order to achieve the full functionality of the building or structure. The goal is to permit a wide range of compatible functions in order to ensure the best possible future life of the building while respecting its cultural value.

WORKSHOP OUTCOMES

The tangible output will contribute to Project Result 1 (PR1):

A series of educational materials will be created and assembled by the teachers in preparation of the workshop and will be subsequently integrated with the students’ presentation and the reflection documentation (teacher evaluations and student feedback). They will be uploaded on the learning platform and will be the basis both for the content of the REcube Digital Academy and of the REcube Masters Programme.

The intangible outcomes of the Frontier Workshop 2 relate to increased skills and improved abilities, and to knowledge and experience gained by all PARTICIPANTS:

1. Partners’ teachers – the actual persons working on the development of the PR
2. Master level students who are participants in the REcube Learning/Teaching /Training Activities (LTTA) for 2023
3. Invited teachers – providers of expert inputs and active contributors to the discussions, intensive classes, methodological and practical workshops during the 2023 LTTA

The interaction of all participants will lead to increased awareness about the value of the proposed regeneration methodology. In the sustainability phase of the REcube project, the Workshop results will be part of the REcube Digital Academy learning content, transmitting to a wider, international audience the need to adopt new work approaches and attitudes towards the green regeneration practices of concrete Modern Heritage (PR1). Moreover, this LTTA will also contribute to Project Result 3 (PR3). Teachers’ experience will contribute the creation of the REcube Guidelines, the Methodology for the Sustainable Green Regeneration of the Concrete Modern Heritage.

After the workshop, the students will present their project results evaluated by the faculty after 2 months, giving them time for postproduction and finalization. Content-related, methodological and structural feedback will be collected and integrated in the development of REgenerate Workshop 3.

07.3 Year 3: Frontier Workshop 3 + Regenerate Workshop 3

Frontier Workshop 3 (virtual)

This final Frontier Workshop is an online intensive course on cutting edge topics about structural retrofitting of existing reinforced concrete structures. The course aims to provide participants with methodological criteria and guidelines regarding issues of structural conservation, for the reuse and enhancement of concrete structures. These criteria and guidelines take into account on one hand the extraordinary international relevance and fame of Pier Luigi Nervi's iconic works of twentieth-century structural architecture and the need for their valorisation, and the meta-design choices of the feasibility study for their reuse. At the same time, they strive to connect with the most advanced international level of debate and knowledge on the issues of analysis and restoration of contemporary architectural heritage structures. Referring to both the evolution of knowledge and the corresponding regulatory references developed in recent years in the international precoding and coding locations for ordinary reinforced concrete and ferrocement structures, the workshop:

1. introduces causes of structural deficiency and common diagnostic techniques
2. introduces materials with strengthening capabilities
3. explores the potentialities of advanced cement- and polymer-based composite materials for the structural strengthening of reinforced concrete buildings
4. introduces design approaches for structural strengthening complying with the architectural value, based on the surface application of strengthening layers, the reduction of non-structural masses or the introduction of new supplementary and legible structural systems.

Each workshop day covers both theoretical and practical aspects, being subdivided into: (1) dedicated to the explanation of the subjects and concepts; (2) devoted to the application of the subjects and concepts to representative situations (possibly with the support of testing laboratories) and (3) targeting the application of the subjects and concepts to a simple case study preliminarily assigned to the students.

WORKSHOP OUTCOMES

The tangible output will contribute to the Project Result 1 (PR1):

A series of educational materials will be created and assembled by the teachers in preparation of the workshop and will be subsequently integrated with the students’ homework and the reflection documentation composed by the teachers’ evaluations and students’ feedback. They will be uploaded on the learning platform and will be the basis both for the content of the REcube Digital Academy and of the REcube Masters Programme.

The intangible outcomes of the Frontier Workshop Activity will be related to the increased skills and improved abilities, and to the knowledge and experience gained by all PARTICIPANTS:

1. Partners’ teachers – the actual persons working on the development of the PR
2. Master level students who are participants in the REcube Learning/Teaching /Training Activities (LTTA) for 2024
3. Invited teachers – providers of expert inputs and active contributors to the discussions, intensive classes, methodological and practical workshops during the 2024 LTTA

The interaction of all participants will lead to a generally increased awareness about the complexity of reinforced concrete structures. In the sustainability phase of the REcube project, the Workshop results will be part of the REcube Digital Academy learning content, transmitting to a wider, international audience the need of adopting new work approaches towards the regeneration practices of concrete Modern Heritage. The sustainable retrofitting of reinforced concrete heritage will gain wider recognition and will be introduced to a larger academic, non-academic and general public.

The outcomes of this Frontier Workshop will be integrated in the learning activities of the subsequent REgenerate Workshop about the Artemio Franchi Stadium, when the students will receive the task of implementing the knowledge acquired in the Frontier.

Regenerate Workshop 3 (physical)

REcube Project Workshops are intensive face-to-face study programmes based on a case study which will always take place in Lecco on the POLIMI campus, in proximity to the three case study buildings. The REgenerate Workshop 2024 will centre on performing the multifaceted assessment and analysis of a specific concrete architecture, the Artemio Franchi Stadium by Pier Luigi Nervi in Florence, to be preserved and repurposed. Learners will evaluate and interpret the different data acquired on the chosen structure and present the problems to be solved as well as the preparatory analysis to be performed before the renovation design.
The workshop comprises:

- A one-day fieldtrip to visit and experience the Artemio Franchi Stadium.
- The workshop in the Laboratorio Nervi on the POLIMI Campus. There the students will explore and use the material assembled in the Laboratorio Nervi. During the 4 days the students will stay on campus and will work on the preparatory tasks which have to be performed before starting a conservation and reuse process of the case study. They will also perform an exercise based on the contents of the Frontier Workshop 3, to implement the acquired knowledge.

The scientific approach to the REGENERATION PROCESS to be conveyed to the students:

- the work has to be recognized as an asset to be protected, preserved and restored
- pre-evaluation, the analysis of the state of conservation of the building has to be performed
- a compatible function for the building has to be identified
- the recovery process has to be sustainable and “green” in the choice of materials and technical solutions
- once all these elements have been taken into consideration, it is possible to proceed with the planning, in order to achieve the full functionality of the building or structure. The goal is to permit a wide range of compatible functions in order to ensure the best possible future life of the building while respecting its cultural value.

WORKSHOP OUTCOMES

The tangible output will contribute to Project Result 1 (PR1):

A series of educational materials will be created and assembled by the teachers in preparation of the workshop and will be subsequently integrated with the students’ presentation and the reflection documentation (teacher evaluations and student feedback). They will be uploaded on the learning platform and will be the basis both for the content of the REcube Digital Academy and of the REcube Masters Programme.

The intangible outcomes of the Frontier Workshop 3 relate to increased skills and improved abilities, and to knowledge and experience gained by all PARTICIPANTS:

1. Partners’ teachers – the actual persons working on the development of the PR
2. Master level students who are participants in the REcube Learning/Teaching /Training Activities (LTTA) for 2024
3. Invited teachers – providers of expert inputs and active contributors to the discussions, intensive classes, methodological and practical workshops during the 2024 LTTA

The interaction of all participants will lead to increased awareness about the value of the proposed regeneration methodology. In the sustainability phase of the REcube project, the Workshop results will be part of the REcube Digital Academy learning content, transmitting to a wider, international audience the need of adopting new tool enabling new work approaches and attitudes towards the green regeneration practices of concrete Modern Heritage (PR1). Moreover, this LTTA will also contribute to Project Result 3 (PR3) of the Project. The experience the teachers will gather will contribute the creation of the REcube Guidelines, the Methodology for the Sustainable Green Regeneration of the Concrete Modern Heritage.

After the workshop, the students will present their project results evaluated by the faculty after 2 months, giving them time for postproduction and finalisation.
09 Project meetings and multiplier events

09.1 Transnational Project Meetings

In addition to the first virtual meeting (M0), four Transnational Partner Meetings (TPMs) are foreseen during the project lifetime in order to discuss the progress of the project, manage any issues and to plan next steps:

M1: Physical Kick-Off meeting in Lecco, Italy (tentative February/March 2022)

M2: Second meeting in Rome, Italy (first/second week of September 2022)

M3: Third meeting in Veszprém, Hungary (September 2023)

M4: Final meeting in Brussels, Belgium (September 2024)

The people participating at the transnational project meetings will be the Lead Partner as well as key persons responsible for the project management from all partner organisations (i.e. the Project Representatives). Additionally, and depending on the issues to be discussed during the meeting, other project stakeholders from partner institutions and associated partners will participate. The results of all partner meetings will be available as minutes and distributed to the project partners.

09.2 Multiplier Event E1 (Lead Sapienza)

Organised by the LP and SAPIENZA, the first REcube Multiplier Event will take place in Rome, during the 14th fib PhD Symposium 5-7 Sept. 2022, a highly respected scientific meeting, connecting young researchers with high-profile scientists in the following fields related to Concrete: innovation in materials & structures, construction technology, structural analysis & design, durability & life assessment, sustainability & life cycle assessment and monitoring & structural assessment.
1. Within the Symposium a presentation will be made on the REcube project, its scopes and attained results downstream of the first two LTTAs, complemented by an exhibition of the students’ material resulting from the first REgenerate workshop, displayed on the premises.

2. The REcube project will also offer Symposium participants a privileged insight in the conservation plan for the Flaminio Stadium in Rome, developed by two REcube partners, SAPIENZA and PLN Project Foundation, with a presentation of the conservation plan objectives and a private guided tour of Pier Luigi Nervi’s iconic Olympic structure. The tour will also be filmed and streamed on the REcube Vimeo channel, available for all students enrolled in the REcube programme, any absent members of the partnership and the general public.

The AIM of the multiplier event is:

- TO START THE PARTICIPATORY DISCUSSION on REcube objectives and first results between the project’s participants and the scientific community.

- TO COLLECT RELEVANT FEEDBACK from outside the partnership to integrate it in the further development and finalization phase of the PRs. The aim is to receive a first validation for PR3, the REcube Guidelines, the methodology being applied both in the REgenerate Workshop, the results of which are presented at the Symposium, and to the content of the Flaminio Stadium Conservation Plan. The feedback will be obtained by the evaluation of the recordings both the presentation during the symposium and the presentation of the Flaminio Stadium Conservation Plan + the ensuing Q&As as well as by a questionnaire distributed to attendees.

SAPIENZA as hosting institution has been chosen carefully: with the completion of the Flaminio Stadium Conservation Plan, Sapienza University has gained invaluable expertise in the sustainable concrete heritage regeneration approach that will be codified in the REcube Guidelines, leading the scientific discussion in Italy. One of the most prestigious and oldest universities in Europe, SAPIENZA also boasts well-established connections with multiple European academic institutions, professional and citizenship organisations, as well as other relevant stakeholder groups and individual actors.

TARGET GROUPS at the first REcube Multiplier Event:

- Participants in the 14th fib PhD Symposium, young researchers in civil and structural engineering interested in cutting edge concrete technologies.

- REcube project participants: all higher education learners and teachers from the partner and associated partner institutions, including the invited teachers from outside the consortium

- SAPIENZA enrolled Architecture and Engineering students

- SAPIENZA faculty members

- National and international guests from other higher education organisations and research institutions (part of fib and SAPIENZA networks)

WORK SCHEDULE

The LP and SAPIENZA are responsible for the preparation of the general framework for the REcube participation in the fib Symposium and for the preparation and implementation of the Multiplier Event.

PREPARATION phase includes (1) insertion of the REcube presentation in the fib PhD Symposium programme (also choosing the REcube lecturer) and its preparation, highlighting in it the actual state of the project outcomes (Project Results 1,2,3) (2) preparation of the Regenerate Workshop results exhibition and its setting up on the SAPIENZA premises (3) preparation of the presentation of the
Flaminio Stadium Conservation Plan and of the visit to the building (4) preparation of the questionnaire for the collection and evaluation of feedback from the attendees.

IMPLEMENTATION phase includes (1) presentation of REcube and its preliminary outcomes (PR1,2,3) within the fib Symposium (2) opening the exhibition about the first REgenerate workshop Day 1 of the Symposium (3) presentation of the Flaminio Stadium Conservation Plan and site visit (4) collecting feedback / documenting.

AFTER the event the collected data and feedback will be (1) evaluated according to the preliminary prepared methodological framework (2) reflected in the context of the REcube project goals (3) integrated in the preparation phase of the addressed PRs (REcube Guidelines for Practitioners). The responsibilities within the POST-PROCESSING phase of the event will be distributed according to the thematic scope of the collected data and in relation to the addressed project results: PR1-lead POLIMI; PR2-lead POLIMI; PR3-lead ICOMOS.

09.3 Multiplier Event E2 (Lead BME)

The European Capital of Culture program is one of the European Union's most important cultural programs, highlighting Europe's cultural richness, diversity and common cultural features within Europe. In 2023 Veszprém on Lake Balaton in Hungary will be the European Capital of Culture. In this framework, an intermediary conference about the achievement and results of the REcube partnership will be organized at the Petőfi Theatre in Veszprém, the first European theatre to be built with a reinforced concrete structure in 1908. The ME will be organized by the LP and the Budapest University of Technology and Economics (BME) with the active involvement of the fib and the Getty Keeping it Modern Initiative, associate partners of the REcube project.

The Recube event will last two days:

1. As in the occasion of the first Multiplier Event, an exhibition of the students’ material resulting from the second REgenerate workshop, displayed on the premises of the congressional activities, the Petőfi Theatre. The exhibition will be connected also to the architecture and history of this building, presenting an exercise specifically conducted by the students participating in the 2023 REgenerate Workshop on the juxtaposition between this pioneering work in reinforced concrete and the futuristic Torino Esposizioni Pavilion by Pier Luigi Nervi.

2. The conference will focus on the first day on the architectural and the second day on the engineering aspects of green concrete heritage regeneration. The Getty Keeping it Modern Initiative will assist the organisers by providing insight in some of the most interesting and challenging regeneration projects in recent time, which will be presented during the sessions. The conference’s output will be used to improve the content of the REcube MOOC, which will be “fed” with the case studies presented in Veszprém in its “Meet the Makers” section. Feedback from the collective discussions will serve for the ongoing preparation of the REcube Guidelines. The conference will be streamed on the REcube Vimeo channel.

The TARGET GROUPS addressed at the public participatory workshop will be:

1) teachers, researchers and REcube Alumni from the REcube project network, i.e. the REcube Talent Community

2) master, doctorate and post-doctorate students and researchers predominantly from Hungary but also from other European countries

3) young researchers from practice, industry and business
4) teachers and researchers from the project consortium and from other higher education institutions and research institutions

5) other stakeholders from the non-academic sector: public authorities, professional and citizenship organisations, industry and business

WORK SCHEDULE

POLIMI as LP and BME as the hosting institution are responsible for the preparation and implementation of the conference.

PREPARATION phase includes (1) setting up of the conference programme (panel sessions, keynote lectures, accompanying activities), (2) contacting the keynote speakers (3) distribution the event invitation to all addressed target groups, (4) preparation of the presentation of the project outcomes (Project Results: PR1, PR2, PR3), (5) preparation of the panel sessions, (6) preparation of the guidelines for the conference proceedings, (7) arrangement of the methodological framework for the collection and evaluation of feedback during the conference, (8) preparation of the Regenerate Workshop results exhibition and its setting up on the Petőfi Theatre premises.

IMPLEMENTATION phase of the conference is preceded by opening the exhibition about the second REgenerate workshop on the first day of the Symposium and includes the following points: (1) presentation of the project and its outcomes (PR1,PR2,PR3), (2) opening session plus discussion and keynote lecture, (3) panel sessions, (4) closing session plus public discussion and keynote input, (5) conduction of the accompanying activities, (6) collection and documentation of the conference feedback.

The POST-PROCESSING of the conference consists of (1) evaluation of the collected feedback and of the conference as a whole, (2) integration of the evaluation in the finalizing process of the intellectual outputs and their fine-tuning before publishing, (3) arranging and finalizing of the conference proceedings, (4) publishing of the conference proceedings on the REcube Digital Academy platform, (5) dissemination of the proceedings to all target groups and the libraries of the participating institutions.

The responsibilities within the POST-PROCESSING phase of the event will be distributed on the one hand, according to the thematic scope of the collected data and in relation to the addressed project results: PR1- lead POLIMI; PR2- lead POLIMI; PR3- lead ICOMOS. On the other hand, BME will be responsible for the conference proceedings and POLIMI for their dissemination to all target groups.

09.4 Multiplier Event E3

The final REcube Multiplier Event will take place in Brussels, at the heart of Europe. The OVERALL AIM is to disseminate project outcomes and the Project Results (PR1,2,3) to a broader scientific and professional audience for wider recognition of the project topic and its outcomes. It will be a conclusive moment of critical evaluation of the REcube project and specifically on the core PR – the Methodology for the sustainable conservation assessment and implementation of Modern concrete architecture – presented in the REcube Guidelines for practitioners. The inclusion of a larger academic and non-academic audience in the final discussion of the project results allows for the justification of the results and the introduction of final adjustments for final fine-tuning before the launch of the REcube Digital Academy and publishing of the REcube Guidelines in the fib Bulletin, ensuring the sustainability of the project.
The two-day final conference will be hosted by the Université Libre de Bruxelles (ULB) and divided in several panel sessions related to the 10 thematic areas of the REcube Knowledge Pillars presented in the REcube MOOC. There will be at least two keynote lectures from leading experts in the field of sustainable modern heritage conservation and green regeneration of the modern built environment at the opening and final sessions of the conference. In the single panel sessions, young researchers and professionals both from the project consortium and outside, will have the opportunity to present their research work. The afternoon of the second day will be dedicated to the presentation of REcube Guidelines for Practitioners (PR3). The final REcube conference will be streamed on the REcube Vimeo channel; the conference proceedings will be made publicly available at the REcube Digital Academy platform (PR1).

TARGET GROUPS will be:

1) teachers, researchers and REcube Alumni from the REcube project network, aka the REcube Talent Community

2) master, doctorate and post-doctorate students and researchers predominantly from Belgium and the Netherlands but also from other European countries

3) young researchers from the practice, industry and business

4) teachers and researchers from the project consortium and from other higher education institutions and research institutions

5) other stakeholders from the non-academic sector: public authorities, professional and citizenship organisations, industry and business

WORKING SCHEDULE

POLIMI as LP and ULB as hosting institution are responsible for the preparation and implementation of the final REcube conference.

PREPARATION phase includes (1) setting up of the conference programme (panel sessions, keynote lectures, accompanying activities) (2) contacting the keynote speakers (3) preparation of an open call for conference contributions and papers (including the criteria for the selection of the candidates) (4) distribution of the open call and event invitation to all addressed target groups (5) preparation of the presentation of project outcomes (Project Results: PR1, PR2, PR3) (6) evaluation of the delivered applications for the conference and selection of panel contributors (7) preparation of panel sessions, (8) preparation of guidelines for the conference proceedings (9) arrangement of the methodological framework for the collection and evaluation of feedback during the conference.

IMPLEMENTATION phase includes: (1) presentation of the project and its outcomes (PR1, PR2, PR3) (2) opening session plus discussion and keynote lecture (3) panel sessions (4) closing session plus public discussion and keynote input (5) conduction of the accompanying activities (6) collection and documentation of the conference feedback.

POST-PROCESSING of the conference consists of (1) evaluation of the collected feedback and of the conference as a whole (2) integration of the evaluation in the finalizing process of the intellectual outputs and their fine-tuning before publishing (3) arranging and finalizing conference proceedings (4) publishing conference proceedings on the REcube Digital Academy platform (5) dissemination of proceedings to all target groups and the libraries of participating institutions.

Responsibilities within the POST-PROCESSING phase of the event will be distributed according to the thematic scope of the collected data and in relation to the addressed project results: PR1-lead
POLIMI; PR2-lead POLIMI; PR3-lead ICOMOS. ULB will be responsible for conference proceedings and POLIMI for dissemination.

10 List of acronyms

LTTA: Learning Teaching Training Activities
LP: Leading Partner
M: Transnational Meeting
P: Partner
PA: Partnership Agreement
PC: Project Coordinator
PMO: Project Management Office
PMT: Project Management Team
PR: Project Results
PSC: Project Steering Committee
RDM: REcube Dissemination Manager
RDO: REcube Dissemination Officer
ST: Subtask
T: Task
WA: WhatsApp
WBS: Work Breakdown Structure
WG: Working Group
WP: Work Package