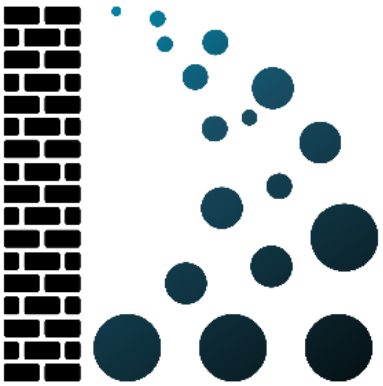
amending the Design criteria of URban defences in LECZs through Composite-modelling of WAVE overtopping under climate change scenarios



DURCWAVE

Horizon 2020
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for Research & Innovation

Project Plan

Project Information

Acronym	DURCWAVE
Title	amending the Design criteria of URban defences in LECZs through Composite-modelling of WAVE overtopping under climate change scenarios
Deliverable	D5.1 – Project Plan
Location(s)	Universitat Politècnica de Catalunya – BarcelonaTech (UPC)
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Social Media	@durcwave_msca
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Document objective

This document is the Project Management Plan document for the project.

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Disclaimer

Document History

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Contents

1 Introduction

1.1 Purpose of the project plan management (PMP)

The DURCWAVE Project Plan Management (PMP) collects and summarize the project baselines and plan, namely: scopes, schedule, cost and human resource management. It is meant as an update of the project proposal, on the date of the project kick-off.

2 Summary of the project

2.1 General scope and scientific objectives

The growth in coastal zone population increases the exposure of large numbers of people and assets to hazards related to climate change. Sea level rise and increased storminess represent major threats to coastal defences preventing the inundation of the hinterlands. This is true especially in low elevation coastal zones (LECZs). Understanding the mechanisms that govern the interaction between overtopping waves and coastal defences to changing climate conditions is of outmost importance to amend the current design criteria of coastal defences. The present project, named "DURCWAVE" (amending the Design criteria of URban defences in LECZs through Composite-modelling of WAVE overtopping under climate change scenarios**), aims to identify new design criteria for wave action by modelling wave overtopping and post-overtopping processes of urban defences** (storm walls, stilling wave basins, buildings along coastal boulevards). To reach these objectives the project will implement a composite-modelling approach, consisting of both physical and numerical modelling. Physical model tests will be carried out in two different wave flume facilities at the host organization (UPC), meanwhile the numerical modelling will be performed through the secondment at the partner organization (UVigo). The mesh-free DualSPHysics model will be used for the scope. The EPR data-driven technique will be used to find new correlations between wave impacts and overtopping flows. **The Action will provide a methodology to help decision-makers to estimate the vulnerability of coastal zones to climate change, by assess the threats for sea frontages and buildings on the coastline**. The project outcomes will trace the path at National and European levels for further extensions from urban defences in LECZs to all kind of coastal defences. Furthermore, a unique numerical model technique to simulate post-overtopping processes and estimate wave loadings on coastal defences will be release open-source for public use.

Specific objectives (SOs) are defined as follows:

1. To study post-overtopping processes by characterising overtopping flows on urban defences.
2. To explore the influence of structural geometries on post-overtopping processes.
3. To relate overtopping flow characteristics to maximum exerted loads.
4. To determine the most appropriate overtopping flow characteristics in terms of design purposes.
5. To define new design criteria for overtopping wave action as upgrade of European Standards.

2.2 Project Work Packages

The project is organised in 5 synergic Work Packages (WPs) that focus on science development (WP1-WP3), dissemination and public engagement (WP4) and project management (WP5). The WPs comprise different tasks and deliverables and defines the milestones. WPs and **specific objectives** defined in §1.1 are tightly coupled (SO1-SO2 with WP1-WP2, SO3-SO4 with WP3, SO5 with WP4). Interaction between WPs is a key aspect of the work plan: WP1 and WP2 cross feed each other, representing the two key components of a composite-modelling, namely PM and NM (see arrows in the Gantt chart); results from each task of WP1 and WP2 are collected and analyzed in WP3, which, in fact, spreads its workload over most of the duration of the Action. **Training activities and transfer knowledge** (i.e. DualSPHysics Users Workshop, workshop on CZ management) are foreseen during the execution of WP1/WP3 and WP2, at the

host and the partner respectively. Dissemination actions are detailed in WP4 (T4.1). Tasks T4.2- T4.3 and work package WP5 foresee punctual actions that are not immediately reflected in the Gantt chart but that will be scheduled at beginning of the project (e.g. drafting a communication plan for T4.2-T4.3) and detailed in the Career Management Plan.

WP1: Physical modelling of post-overtopping processes (8 persons-months, split in two workloads of 4 persons-months). *The main goal of WP1 is to improve the understating of the interaction mechanism between overtopping waves and urban defences by means of small and large scale model tests*. Average overtopping discharges, individual overtopping volumes, overtopping flow velocities and wave loads on walls/buildings will be measured and analysed. Tested wave conditions will be based on foreseen climate change and SLR scenarios. WP1 comprises the following tasks: *T1.1)* bibliography survey and test set-up preparation (installation, materials, instrumentation); *T1.2)* small scale tests in CIEMito on different structural layouts with fixed bed; *T1.3)* large scale tests in CIEM with mobile bed: this task will be performed after a proper discussion on the composite-modelling as results from T1.1 and T2.1 and will offer further knowledge on the phenomenon under study (scale effects, influence of mobile bed on wave loading). At the end of each task a progress report will be delivered (D1.1-D1.3).

WP2: Numerical model development and application to new case studies through secondment (6 persons-months). *The objectives of WP2 are: i) to improve further DualSPHysics model as numerical tool for coastal engineers; ii) to extend the case studies modelled during WP1*. WP2 is structured as follows: *T2.1)* validation of DualSPHysics model against results from T1.2 and extensions to different layouts and wave conditions as preliminary work for T1.3; *T2.2)* implementation of higher order wave theories in DualSPHysics and optimization of coupling techniques with wave propagation models (i.e. SWASH); *T2.3)* numerical simulation of real cases from coastal engineering using prototype-dimensions thanks to the parallel power computing of GPUs. At the end of each task a progress report will be delivered (D2.1-D2.3). D2.3 will also comprise the release of the new code implementations in open access and related guidelines.

WP3: Integration PM and NM data (5 persons-months). *Through WP3, data from WP1 and WP2 will be collected and interpreted*. WP3 is organized as follows: *T3.1)* collection and parametrization of all results from PM and NM; *T3.2)* results analysis employing the EPR data-driven technique to relate overtopping flow characteristics to maximum tolerable loads and to establish new design criteria for wave overtopping of urban defences *(D3.1)*.

WP4: Dissemination and public engagement (3 persons-months). *Through WP4, Dr. Altomare will disseminate, exploit and communicate the project outcomes*. WP4 is organized as follows: *T4.1)* dissemination of the project results through the submission of at least 3 papers to peer-reviewed international journals (*D4.2* on project methodology, main objectives and first results from T1.2; *D4.6* on NM development and application as results of WP2; *D4.7* on the major project results and analysis, therefore foreseen to be submitted prior to the final report of the Action), 3 conference presentations (*D4.3-D4.5)* and newsletters (*D4.1)*; communication and outreach activities including *interpersonal* ones (*T4.*2: school visits, lab visits, museums, hands-on activities, participation to European Researchers' Night and activities promoted by MCAA) and *one-way* activities (*T4.3*: internet, social media, press release). As the

project results are expected to contribute to European standards, a proposal to amend the existing Eurocodes will be drafted and forwarded to CEN/TC250 (*D4.8*) at the end of the Action.

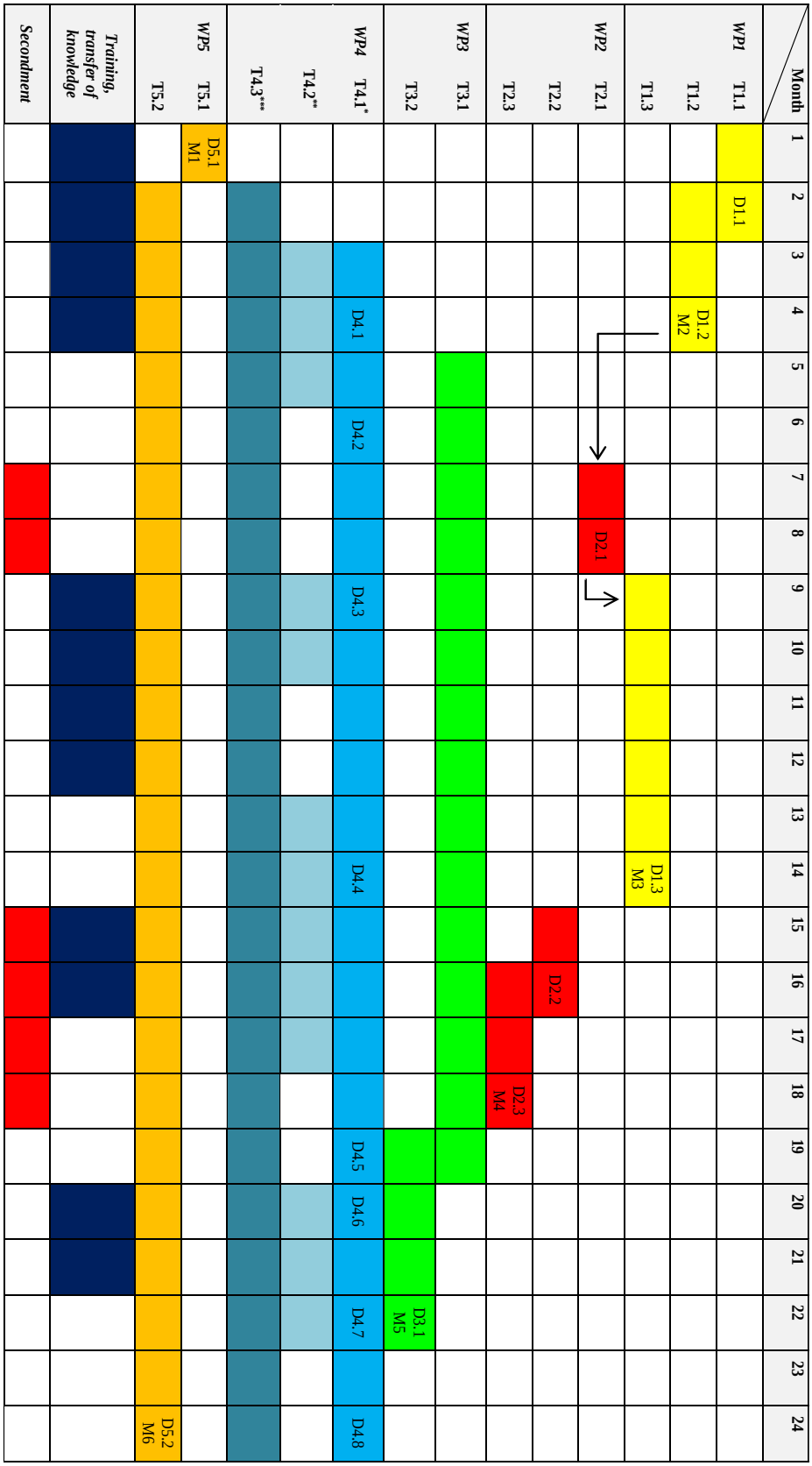
WP5: Project Management (2 persons-months). WP5 comprises a preliminary phase right after Dr. Altomare's arrival to the host including administrative tasks, accommodation, equipment and consumables acquisition. A kick-off activity is foreseen at the very beginning to adjust the planning accounting for national holidays, days off and any other constrains in time that can affect the execution of the project *(T5.1*). A project plan document will be edited accordingly (*D5.1*). Controlling activities, periodic meetings, project budget management and risk management are part of WP5 (*T5.2*), which will include as deliverable the minutes of periodic meetings and the editing of the final report of the Action (*D5.2*) to be submitted to the Research Executive Agency (REA).

2.3 Milestones

Six Milestones have been identified along with the WPs. The milestones are conceived to link the WPs or to encompass the activities of each WP. The milestones are listed as follows: conclusion of T5.1 and project plan editing *(M1)*; finalization of experimental tests in CIEMito and in CIEM *(M2-M3);* novel implementations in DualSPHysics code and training on GPU computing and post-processing techniques at UVigo *(M4)*; finalization of data processing and analysis *(M5)*; submission of the final report of the Action to REA *(M6)*.

2.4 Project Schedule

The following Gantt chart illustrates the project schedule including WPs, Milestones, trainings and secondment.



*dissemination and exploitation activities

**interpersonal communication and outreach activities

***one-way communication and outreach activities

3 Project Management

The project has a total duration of 24 months and will be performed at Universitat Politècnica de Catalunya – BarcelonaTech (UPC). Controlling activities, periodic meetings, project budget management and risk management are foreseen, which will include as deliverable the minutes of periodic meetings and the editing of the final report of the Action to be submitted to the Research Executive Agency (REA).

3.1 Cost / Budget

The use of both large- and small-scale wave facilities and numerical modelling will reduce costs and increase effectiveness of the project. The mobility allowance and the research, training and networking costs (19,200€+15600€) are estimated sufficient to cover all activities, including dissemination and public engagement, and the secondment. Resources available at LIM/UPC will be also mobilized, if necessary, to perform the PM in accordance with the work packages.

3.2 Human resources

Main researcher working on DURCWAVE project is Dr. Corrado Altomare, with complete dedication to the project as established in the project Grant Agreement. Dr. Altomare will be supported, aided and supervised by Prof. Xavier Gironella, official supervisor of the Action at the host institution. The planned experimental campaigns will involve Joaquim Sospedra, technician head at the Maritime Engineering Laboratory of UPC (host). Three researchers will be involved during the secondment: Dr. Alejandro Crespo, Dr. José Domínguez and Prof. Moncho Gomez-Gesteira.

3.3 Risk management

The project success relies on: the strong expertise and the high quality of facilities of LIM/UPC; the experience of the supervisor on wave structure-interaction and the partner's expertise in numerical modelling and informatics; the 10-year research experience of Dr. Altomare in coastal engineering. Meetings will take place every two weeks, with the supervisor at the host and the one at the partner during the secondment, to follow up the execution of the project and to monitor unforeseen risks. The European Projects Office of UPC will assist Dr. Altomare with all financial and administrative tasks. The model constructions will be carried out by LIM/UPC technical staff. Possible risks and mitigation measures have been evaluated (**Errore. L'origine riferimento non è stata trovata.** following table). The use of two experimental facilities is a strong guarantee for the normal progress of the project in case one of them results temporary out-of-work.

Description of the risk	Proposed mitigation measure
One of the two experimental facilities at UPC is temporary out-of-work and it is not possible to carry out the tests	If CIEM not available: CIEMito will be used If CIEMito not available: wave flume at UdC (A CORUÑA) will be used
Delays in some of the main milestones or deliverable due to unforeseen changes (e.g. instrumentation malfunctioning)	Risk monitoring and control will be address every 2 weeks and, if required, path will be created to respond the specific risk or delay
Not possible to validate or verified all novel functionalities in DualSPHysics.	Only developments where the likelihood for successful validation is sufficiently high have been selected. A rigorous validation procedure will be followed for each task.

GPU cluster at UVigo is out-of-work	Desktop pc with embedded GPU is provided to the candidate to carry out the NM. In alternative, Barcelona Supercomputing Centre can be used as partly managed by UPC.
Project delivers poor quality outputs	Monitoring the progress of WPs against the project schedule. Involvement of international experts for project review when necessary.