



European
Commission

Horizon 2020
European Union funding
for Research & Innovation



**Rethinking coastal defence and Green-energy Service infrastructures
through enHancEd-durAbiLiTy high-performance cement-based materials**

WP3. Rethinking structures in aggressive environments XS/XA

2- CMW (Leader) / EO

Lisardo Fort / Cristina Suesta / Pedro Mayorga

Partners participating: PoliMi, NAFEN, RDC, API, Penetron, UPV, TUD, BGU, UM

- **Identification of key design parameters to formulate a Durability Assessment based Design approach for UHDC.**
 - **XS**, durability problems due to corrosion of concrete reinforcements induced by chloride transport.
 - **XA**, durability problems due to concrete and reinforcing steel chemical attacks.
- **Definition of the most representative scenarios for the study of UHDC concrete for its implementation in WP8.**
 - coastal defence, off-shore civil works and facilities serving geothermal energy plants, such as concrete basins
- **Proposal of innovative structure concept for those applications.**

WP objectives

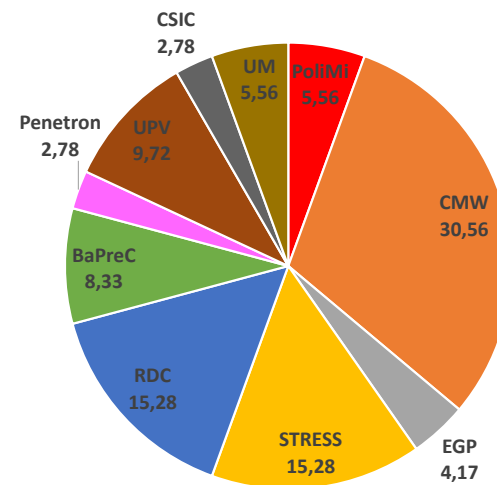
Strategy

- **Review of current state of practice for design and construction of structures under XS/XA exposure and identification and definition of key factors affecting material and structural durability.**
- **Definition of the scenarios in which traditional design approach fails (design governing durability factors out of control or not taken into account).**
- **Circular interaction with WP8, during the overlapping period (12-32), for the formulation and application of DAD approach.**
- **Interaction with others WPs for effective proof-of-concept activity in WP8.**

WP 3 timeline: M1-M32

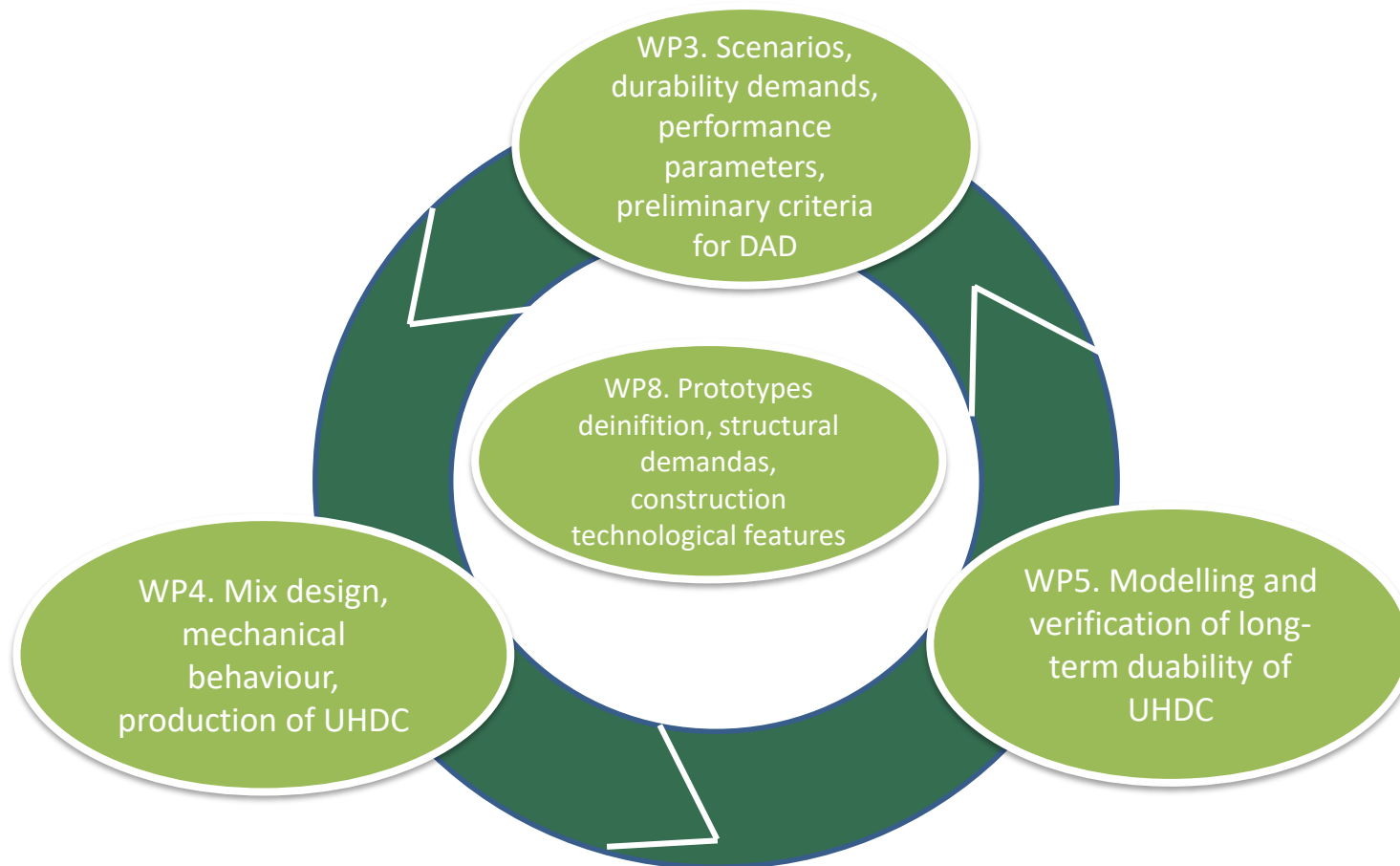
	Leader	Task	Year 1				Year 2				Year 3			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
3.1	CMW	Critical review of current design and state of art for structures in XS and XA conditions	1-4											
3.2	CSIC	Definition of scenarios and of durability demands and performance parameters	2-6											
3.3	STRESS	Preliminary criteria for Durability Assessment based Design			7-32									
3.4	RDC	Definition of novel structural concepts and details for intended UHDC application scenarios with reference to pilot applications				10-24								

PARTICIPANT	PM	%
PoliMi	4	5,56
CMW	22	30,56
EGP	3	4,17
STRESS	11	15,28
RDC	11	15,28
BaPreC	6	8,33
Penetron	2	2,78
UPV	7	9,72
CSIC	2	2,78
UM	4	5,56
TOTAL	72	100



WP3 EFFORT
72 PM
10 BENEFICIARIES

Expected interactions within WPs



Task 3.1. Critical review of current design and state of art for structures in XS and XA conditions

Partners: **CMW (+LTP EO)**, EGP, BraPreC, Penetron

Timing M1- M4


Collection and analysis of case-study data provided by the industrial partners about durability concrete pathologies for the applications of interest, in order to establish the key factors for durability depending on the application:

- type of structure currently in their production/property/management portfolio and data including age, dimensions, initial concrete characteristics, current design details.
- exposure environment characteristics (XS/XA conditions).
- pathology description and related measurements (transport of ions, temperature, hydrostatic pressure, drying-wetting cycles, freeze-thaw cycles, erosive actions, chemical/biological attack).
- frequency and type of maintenance actions with related costs.

CMW (EO)	EGP	BaPreC	Penetron
Dock construction	Geothermal plants	Precast elements, harbour services, coastal defence	Underground structures

Task 3.2. Definition of scenarios and of durability demands and performance parameters

Partners: **CSIC, UPV, CMW (+LTP EO), RDC (+LTP IDIFOR), EGP, UM** **Timing M2-M6**

INPUT: data collected in Task 3.1  Identification and definition of the scenarios for the implementation of UHDCs: exposure conditions, type of structure, required application (new/retrofitting).

- Definition of the objective Key Performance Durability Indicators and target values for each scenario, to be considered for the UHDC material and structural design in DAD.
- Feed input to WP4 and WP5: definition of scenario-tailored UHDC functionalities, depending on durability demands and obtainable by incorporating nano-fibres, cellulose nano-crystals or self-healing admixtures.

UP, CSIC	CMW (EO) RDC (+IDIFOR)	EGP	BaPreC	UM
Leaders, global assessment and conclusions from data provided by industrial partners	Docks, caissons, offshore structures	Geothermal plants, Water tanks, collection basins, pipes, mud-setting tanks	Precast for breakwater, harbour services and coastal defence,	Retrofitting of r/c infrastructures in open sea environment

Task 3.3. Preliminary criteria for Durability Assessment based Design

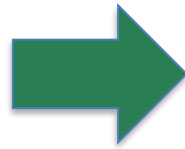
Partners: **STRESS (+LTP DAPP), Timing M7-M32**

- **Formulation of the framework for Durability Assessment based Design approach, adopting as governing parameters:**
 - definition of the durability performance demands
 - end-user requirements

The innovative design concept:

Allowable level of damage

Based on passive protection intended level



Acceptable level of damage

Based on self-repair ability of material/structure depending on incorporated functionalities

STRESS (+DAPP)	CMW (+LTP EO), EGP, BraPreC, UM, RDC, PoliMi
Preliminary analysis of scenarios defined in Task 3.2. Structural modelling at macroscale	Contextualization to the applications of interest

OUTPUT: to task 3.4 and WP8 to validate and update the methodology.

Task 3.4. Definition of novel structural concepts and details for intended UHDC application scenarios with reference to pilot applications

Partners: **RDC (+LTP IDIFOR)**, CMW (+LTP EO), EGP, STRESS BraPreC, UM, UPV **Timing M10-M24**

- **Definition of new structural design concepts in the framework of the DAD approach defined as above, for the intended UHDC application scenarios with reference to planned pilot applications.**
- **Design properties of UHDC mixes with enhanced functionalities, received as input from WP4, will be exploited to achieve better structural durability and longer lifetime.**

CONTINUOUS FEEDBACK and interaction with WP4, WP5, WP7 and WP8.

RDC (+IDIFOR)	CMW+EO, EGP, BaPreC and UM	UPV, STRESS
Leader, global assessment	Pilot activities	Interaction with W4, WP7/WP8

Deliverables and Milestones

Leader	Task	M 1	M 2	M 3	M 4	M 5	M 6	M 7	M 8	M 9	M 10	M 11	M 12	M 13	M 14	M 15	M 16	M 17	M 18	M 19	M 20	M 21	M 22	M 23	M 24	M 25	M 26	M 27	M 28	M 29	M 30	M 31	M 32	M 33	M 34	M 35	M 36		
CMW	Critical review of current design and state of art for structures in XS and XA conditions				D2.1																																		
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RDC	Definition of novel structural concepts and details for intended UHDC application scenarios with reference to pilot applications																								D2.4														

M2.1

M2.1

Deliverables

D 3.1 - Definition and description of the scenarios for WP7 pilots (M4) CMW

D 3.2 - Definition of key durability parameters for each scenario (M6) – CSIC/UPV

D 3.3 - DAD methodology description (M18, update M32) – STRESS (DAPP)

D 3.4 - Definition of new solutions: redesigned structures based on functionalized UHDCs for the intended application scenarios (preliminary design) (M24) - RDC

Milestones

MS 3 - Holistic approach to material and structure concept and design for UHCD applications via DAD (M24 – update M32) – fulfilling SO2

Coordination in WP3

- Mailing list with all task leaders and partners
- **Start activities at M1** – First meeting to be proposed during kick-off meeting
- **Skype meetings every 1 Month:** progress work review and contingencies respect WP



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