



D8.12 Report on training activities and guidelines development

WP8

Lead Partner: GEO

Partner Contributors: FENIX TNT, IBOX, CEA, AMSolution, RINA-C, ACCIONA, KVAERNER

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Project Acronym	EnDurCrete
Project Title	New Environmental friendly and Durable conCrete, integrating industrial by-products and hybrid systems, for civil, industrial and offshore applications
Grant Agreement n°	760639
Funding Scheme	Research Innovation Action
Call	H2020-NMBP-2017
Topic	NMBP-06-2017 Improved material durability in buildings and infrastructures, including offshore
Starting Date	1 st January 2018
Duration	48 Months

Executive Summary

Training activities in EnDurCrete were planned within the framework of WP8, Task 8.4 Training Activities, to build the capacities of the end-users of EnDurCrete to effectively utilise the project final solutions and products. To this end, technical sheets, instructions and tools relevant for the production, design, application and installation developed during the project have been created and distributed among relevant professionals via videos, webinars and training courses, including an e-Learning platform.

This report presents a summary of the training activities performed within EnDurCrete. It is divided into two main chapters: first, summarising the videos and events including webinars, and second, introducing the e-Learning platform. The majority of the material produced within the training activities has been made publicly available and is accessible online, in particular via the project website, but also on YouTube or other platforms, such as the BuildUp Platform. All the links to this material are provided in this report. They are also being actively disseminated by the consortium.

During the EnDurCrete project, four events have been organised and eight project related videos were released; the final video will be released in the end of November – beginning of December 2021. All the EnDurCrete partners participated to the events and were involved in video creation. The target audience for both the events and videos was wider public, including researchers and specialists from concrete-related fields.

The EnDurCrete e-Learning platform has been developed and launched, and it is accessible on the project homepage. The e-Learning consists of four main modules made up of interactive and engaging training material: (1) Multifunctional coatings for applications on concrete surfaces; (2) Installation instructions; (3) Concrete Corrosion and Prevention and Repair methods; and (4) EHS initiation: First steps on occupational and emergent risk in construction industry. The EnDurCrete e-Learning platform is being promoted by the partners and will be maintained for at least five years after the end of the project. The platform is expected to also help in the further dissemination and exploitation of the EnDurCrete project results.

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1 Introduction

Training activities in EnDurCrete have been planned with a view to supporting the end-users to effectively handle the project solutions and products. To this aim, instructional videos and webinars as well as an online training (e-Learning) platform have been developed and launched. This report presents a summary of the training activities implemented in EnDurCrete. Section 2 is dedicated to the project events and webinars, whereas section 3 provides an overview of the e-Learning platform.

2 Videos and project events

During the EnDurCrete project, **four events have been organised and eight project related videos were released**; the final video will be released in the end of November – beginning of December 2021. All EnDurCrete partners participated in events and were involved in video creation; however, FENIX TNT, as the dissemination partner, led the activities and was the main organiser of events and video production. The target audience for both the events and videos was wide public including researchers and specialists from concrete-related fields.

2.1 Events

EnDurCrete has organised four events including **two workshops** and **two webinars**. Information about these events is presented below. Workshops held during 2019 were face-to-face, whereas webinars had to be held online due to restrictions related to the global COVID-19 pandemic. Webinars showed that significantly more people tend to join online events.

Promotional flyers, presentations, detailed information, and agenda of events are available on the project website: <http://www.endurcrete.eu/>.

2.1.1 B-SMART! COMFORT, SAFETY, SUSTAINABILITY, INNOVATION

The EnDurCrete and ReSHEALience projects organised a common workshop on the topic **‘The concrete construction industry facing durability challenges’**. The workshop was organised within the **B-SMART event** and took place at **MADE EXPO, Milano** on **14th March 2019**.

The event was intended for all operators in the construction sector, with reference to concrete, from material and component producers to construction companies, building and infrastructure managers, and technical and administrative decision makers. The speakers, chosen from among the participants in the research groups involved, provided an updated overview of the most current issues concerning the durability of reinforced concrete structures and infrastructures and the most up-to-date solutions and methodologies to address them at the various technical-operational-decision levels. Table 1 below shows the presented topics and speakers at the workshop.

Table 1: Topics and speakers at the common workshop organised by ReSHEALience AND EnDurCrete projects within the B-SMART! event

Topic	Speaker	Organisation	Project
‘THINK’ AND ‘DESIGN’ THE DURABILITY OF CEMENT MATERIALS: GOING BEYOND THE CURRENT SERVICE LIFE OBJECTIVES			
‘Concept and design’ of durability of cement-based materials: Going beyond the current service life targets	Liberato Ferrara - ReSHEALience project coordinator	Politecnico di Milano, Italy	ReSHEALience project
‘MEASURE’ AND ‘MONITORING’ DURABILITY			
Non-destructive techniques to measure	Gian Marco Revel	Università Politecnica delle Marche, Italy	EnDurCrete project

and monitor the durability of concrete			
Predictive monitoring systems for rebar corrosion assessment in aggressive environments	Maria Cruz Alonso	CSIC, Spain	ReSHEALience /Lorcenis projects
Novel carbon-based additions for self-sensing concretes	Francesca Tittarelli	Università Politecnica delle Marche, Italy	EnDurCrete project
DESIGN WITH DURABILITY: LIFE CYCLE ANALYSIS			
Design with the durability: Life – Cycle Analysis	M. Chiara Caruso	Consorzio STRESS, Italy	ReSHEALience project
‘BUILD DURABILITY’: THE EXPERIENCE AND THE POINT OF VIEW OF THE ‘END-USERS’ AND STAKEHOLDERS			
Reduction of costs through extreme durability concretes: Two successful stories	Esteban Camacho	Research and Development Concretes, Spain	ReSHEALience project
Application of high durability concrete (UHDC) in the industry	Francesco Animato	Enel Green Power, Italy	ReSHEALience project
Development of concrete panels reinforced with technical sensorized fabric	Paolo Corvaglia	RINA Consulting/Tesi System, Italy	EnDurCrete project

The workshop was attended by **50** people.

Link to the speakers’ presentations is available here: <http://www.endurcrete.eu/documents/clustering-activities/made-expo-milano>

Figure 1 shows the photos and the logo of the event.

Figure 1: Photos of the B-SMART! Event



2.1.2 AMANAC WORKSHOP

The workshop entitled ‘What kind of built environment for future generations?’ was organised in **Brussels, Belgium** on **3rd July 2019**. The organizers were the EnDurCrete project, ReSHEALience project, DACOMAT project and AMANAC cluster. The main aim of the event was to introduce to the audience main challenges and needs in construction industry, sustainability and durability of concrete built environment and how the general public and society intent to respond to these trends.

The workshop lasted from 13:00 to 18:00 CET. The detailed agenda with topics is presented in Table 2.

Table 2: Agenda of the AMANAC workshop

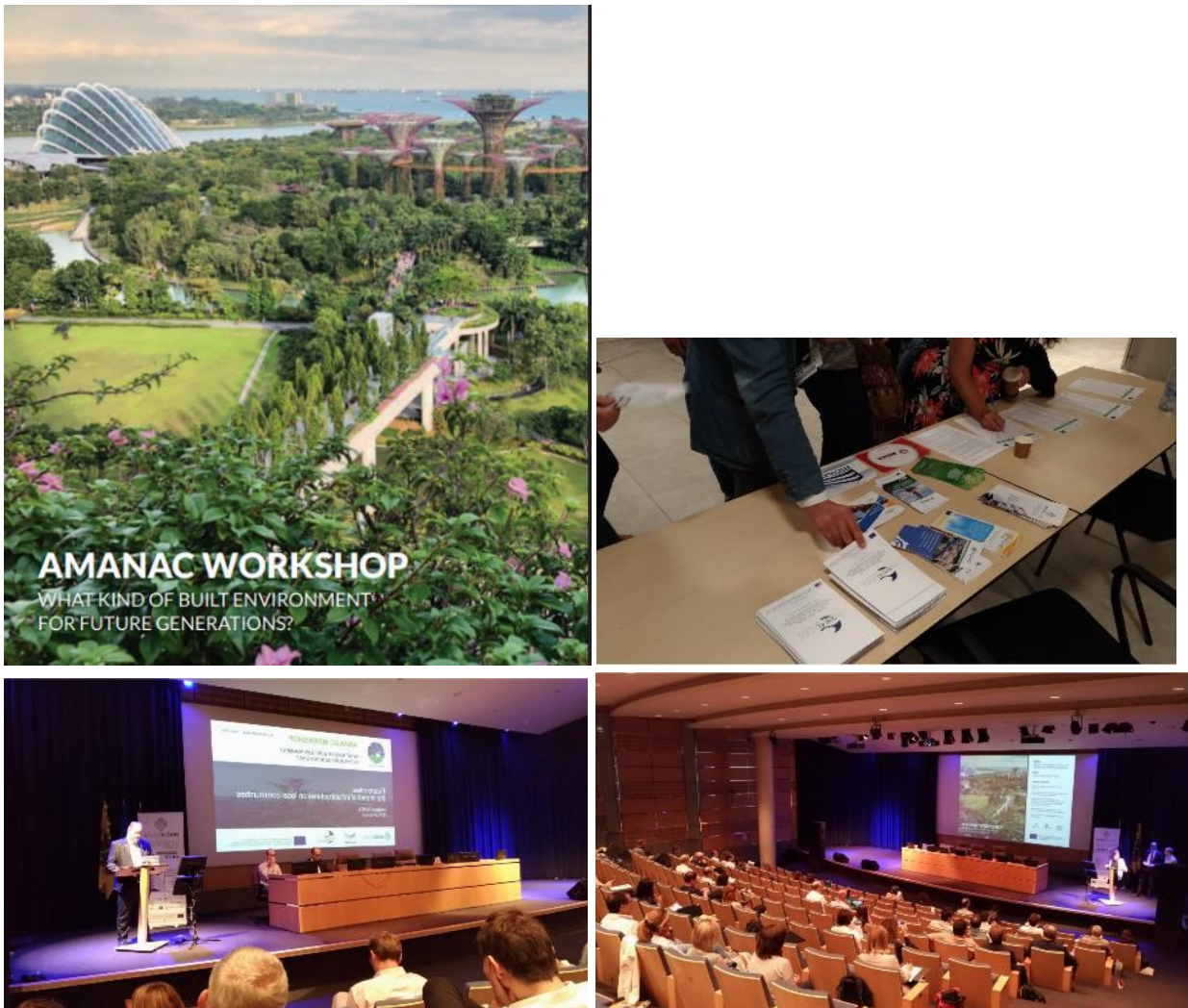
Topic	Speaker	Organisation/position	Length
PART 1: 13:00 – 13:35			
SUSTAINABLE CONSTRUCTIONS: EUROPEAN PROJECTS			
Welcome to the workshop	Olga Rio	EC Officer	15
Joint general presentation from the project coordinators about the complementary concepts of ReSHEALience and EnDurCrete, enlarged to the perspectives of DACOMAT	Arnaud Muller, Liberato Ferrara, Jens Kjær Jørgensen	Project coordinators	20
PART 2: 13.35-15.15			

WHAT ARE THE CHALLENGES AND NEEDS FOR THE ACTORS IN THE CONSTRUCTION INDUSTRY?			
Perspectives from cement and concrete producers	Marco Francin	Buzzi Unicem	15
Perspectives from a chemical company	Emanuel Gallucci	SIKA	15
Perspective from a construction company	Vera Agullo Jose	ACCIONA	15
Perspectives from precast companies	Edoardo Segù Esteban Camacho	Nuova Tesi System Research and Development Concretes	25
Perspectives from 3Dprinter companies	Alban Mallet Venkatesh Nerella	X-TREE TUDresden	30
PART 3: 15.30-16.30			
MAKING THE PROFESSIONALS AWARE OF THE SOLUTIONS FOR DURABLE STRUCTURES			
Construction steps management: the role of BIM in the digital transition of the construction industry	Domenico Asprone	University of Napoli	30
Architects – Implementation of new solutions	-	VITO	30
PART 4: 16.30-17.30			
WHAT ARE THE RESPONSIBILITIES OF THE INSTITUTIONS AND THE SOCIETY REPRESENTATIVES			
Future cities: the impact of infrastructures on local communities	Philippe Fonta	CEO of SCRUM consult, former WBSCD Managing Director	30
Certification / standardization bodies / policy makers	Christophe Muller	VDZ	30
DISCUSSIONS: 17.30			
Developing solutions that last 100 years	-	-	-

The workshop was attended by **40** people.

Figure 2 shows the photos and the promotional flyer of the event.

Figure 2: Photos and promotional flyer of the AMANAC workshop



The promotional flyer is available at:

http://www.endurcrete.eu/files/EnDurCrete_AMANAC%20workshop_flyer%20with%20agenda_final.pdf

More photos of the AMANAC workshop are available at:

<http://www.endurcrete.eu/gallery/amanac-workshop>

Link to the speakers' presentations is available here: <http://www.endurcrete.eu/documents/clustering-activities/amanac-workshop-2019>

2.1.3 Webinar

Webinar entitled '**Towards greener and more durable concrete**' took place on **7th October 2020 online** from 12:00 to 13:30 CET. The webinar was organised by the EnDurCrete and ReSHEAlience projects and co-hosted by BuildUp. **130 people** joined the webinar. At the event, speakers talked about developing environmentally friendly and highly durable concrete, showed to the audience videos from demonstration sites in real conditions, testing, casting and more. The goal of the event was to deliver appealing interactive content. Table 3 shows the agenda of the event.

Table 3: Agenda of the webinar ‘Towards greener and more durable concrete’

Time	Topic
12:00 - 12:05	Welcome and introduction of speakers
12:05 - 12:15	A word from the Project Officer
12:15 - 12:20	EnDurCrete project introduction
12:20 - 12:25	ReSHEALience project introduction
12:25 - 12:35	Casting of EnDurCrete elements
12:35 - 12:50	ReSHEALience demo sites 1
12:50 - 13:05	EnDurCrete demo site - Krk Bridge
13:05 - 13:20	ReSHEALience demo sites 2
13:20 - 13:30	Q & A

Figure 3 shows the promotional flyer of the webinar.

Figure 3: Promotional flyer of the webinar ‘Towards greener and more durable concrete’




Link to the recorded webinar: https://www.youtube.com/watch?v=gm9LE7_5AVw

Link to the press release on Build Up about the event is available here: <https://www.buildup.eu/en/node/60350>

2.1.4 Final event

Webinar entitled ‘**Looking into the future of eco-friendly and durable concrete**’ was held by the EnDurCrete project in cooperation with the ReSHEALience project and co-hosted by BuildUp. The webinar was presented as the final event of the EnDurCrete project. Therefore, the primary goal of the event was to demonstrate the EnDurCrete project objectives, concept, and achievements. The event took place on **10th November 2021**, from 11:00 to 13:00 CET. 187 people registered for the webinar, and **106** people attended it. Figure 4 shows the agenda of the webinar, whereas Figure 5 demonstrates the promotional flyer.

Figure 4: Agenda of the final event




10th of November 2021

11.00 - 13.00 CET


ONLINE EVENT

AGENDA


TIME	TOPIC	PARTNERS
11:00 - 11:05	Introduction to the webinar	FENIX TNT
11:05 - 11:15	Introduction to the project, goals, challenges	HC
Presentation of the Endurcrete project results		
11:15 - 11:55	Cement	HC
	Concrete & Admixtures	HC
	Nanoclay	IBOX
	Carbon based additions	UNIVPM
	Textile	RINA
	Coating	AMS
11:55 - 12:00	BREAK	
12:00 - 12:20	Demo sites	INFRAPLAN
12:20 - 12:40	Reshealience project	RESHEALINCE
Q&A		
12:40 - 13:00	Health and safety of the technologies	CEA, VITO
	Prevalidation of technologies in the laboratory	ZAG, NTNU
	Modelling of durability over 100 years	RINA, CEA
	Life-cycle assessment	GEO



CO-ORGANIZER



CLUSTER PROJECT



MODERATOR



MORE INFO:    www.endurcrete.eu

Figure 5: Promotional flyer of the final event



The flyer features the endurcrete logo at the top left. The event title is "FINAL EVENT LOOKING INTO THE FUTURE OF ECO-FRIENDLY AND DURABLE CONCRETE". The date and time are "10th of November 2021, 11.00 - 13.00 CET ONLINE EVENT". Three circular icons represent the roles: "BUILD UP CO-ORGANIZER", "RESHEALIENCE CLUSTER PROJECT", and "FENIX.TNT MODERATOR". A "Partners" section at the bottom lists logos for: ams, RINA, KVERNER, vito, acciona, i-Box, UNIVERSITA POLITECNICA DELLE MARCHE, ZAG, cea, info plus learning, FENIX.TNT, NTNU, TesiSystem, GEONARDO, HEIDELBERGCEMENT Group, and Jika. Social media icons and the website www.endurcrete.eu are also present.

The event received **positive feedback from the EnDurCrete project monitor.**

Link to the press release on Build Up about the event is available here:

<https://www.buildup.eu/en/node/61765>

Link to the promo materials of the event including the presentation is available here:

<http://www.endurcrete.eu/documents/meetings-and-events/final-event>

Link to the recorded webinar: <https://www.youtube.com/watch?v=lyfuVOgFVse>

2.2 Videos

The EnDurCrete project has released **8 videos** including two videos of above-mentioned webinars. The following subchapters provide details of the project videos such as aims, number of views, release dates.

2.2.1 Promo video

Figure 6: Thumbnail of the promotional video



The promo video was published on **26th April 2019**. So far, the video has **640 views**. The aim of the promo video is to promote the EnDurCrete project to the wide public, present its objectives, concept, partners and other details. Video lasts 2 minutes 59 seconds.

Link to the video: <https://www.youtube.com/watch?v=Jfgom15vUsg&t=5s>

2.2.2 Video 'Concrete panels'

Video on the topic 'Concrete panels' was published on **15th July 2019** and has **346 views**. The goal of the video is to show the development and installation process of concrete panels in the EnDurCrete project. Video lasts 2 minutes and 1 second.

Link to the video: https://www.youtube.com/watch?v=aF_Mktp3iq4

Figure 7: Thumbnail of the video 'Concrete panels'



2.2.3 Video 'Concrete samples'

Figure 8: Thumbnail of the video 'Concrete samples'



Video 'Concrete samples' aims to show to the public how concrete samples look like. The video was released on **19th August 2019** and it has **335** views. Video lasts for 47 seconds.

Link to the video: https://www.youtube.com/watch?v=73vZn_aQlv8

2.2.4 Video 'Load test'

Figure 9: Thumbnail of the video 'Load test'



Video 'Load test' aims to demonstrate how load tests on concrete panels in the EnDurCrete project were conducted. The video lasts for 1 minute 31 seconds. It was published on **19 September 2019** and has **213** views. Link to the video: <https://www.youtube.com/watch?v=35rdEJP82EU>

2.2.5 Video 'Demo site Krk bridge'

Figure 10: Thumbnail of the video 'Demo site Krk bridge'



Video ‘Demo site Krk bridge’ aims to demonstrate the installation process of EnDurCrete elements at the Krk bridge in Croatia. Krk bridge one of the project demonstration sites. The video was published on **30th October 2020** and has **175 views**. The video lasts 1 minute 12 seconds.

Link to the video: https://www.youtube.com/watch?v=xPL_WsPL5T0

2.2.6 Video ‘Casting elements’

Figure 11: Thumbnail of the video 'Casting elements'



Video ‘Casting elements’ provides an overview of the casting process of EnDurCrete elements at the Nuova Tesi System facility. The video was published on **6th November 2020** and has **136 views**. The video lasts 4 minutes 18 seconds.

Link to the video: <https://www.youtube.com/watch?v=DoQarF5wBjw>

2.2.7 Video of the webinar 'Towards greener and more durable concrete'

Figure 12: Thumbnail of the video 'Towards greener and more durable concrete'



The video is a recording of the webinar, which was organized by the EnDurCrete project. The video was published on **16th October 2020** and has **249** views. The video length is 1 hour 30 minutes 21 seconds.

Link to the video: https://www.youtube.com/watch?v=gm9LE7_5AVw

2.2.8 Video of the webinar 'Looking into the future of eco-friendly and durable concrete'

The video is a recording of the webinar and final event of the EnDurCrete project, which was organized by the EnDurCrete project. The video was published on **10th November 2021** by BuildUp and has so far **28 views**. The video length is 1 hour 30 minutes 21 seconds.

Link to the video: <https://www.youtube.com/watch?v=lyfuVOgFVsE>

2.2.9 Final video of the project

The final video of the project will be released in the end of November – beginning of December 2021. Its main goal will be to demonstrate the developed project technologies and achievements.

3 Training Courses

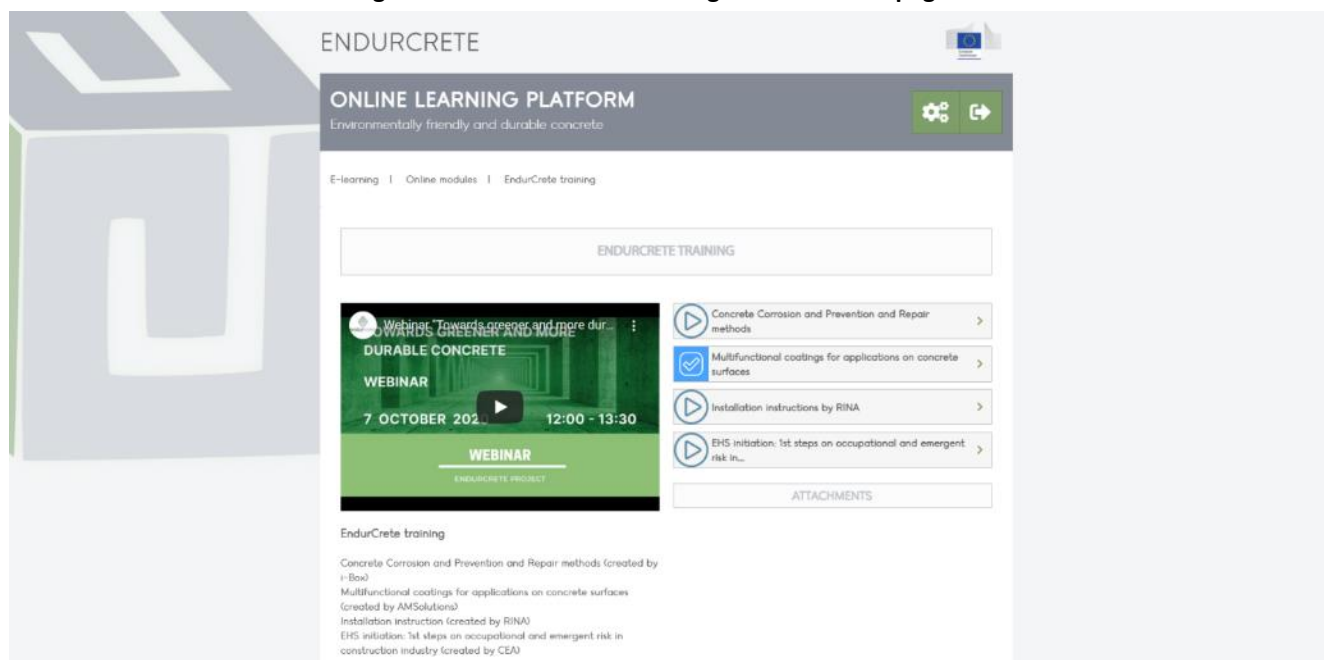
3.1 Concept and structure

GEO, in collaboration with IBOX, AMSOLUTIONS and RINA, developed four specific training courses on new and greener concrete:

1. Multifunctional coatings for applications on concrete surfaces
2. Installation instructions
3. Concrete Corrosion and Prevention and Repair methods
4. EHS initiation: First steps on occupational and emergent risk in construction industry

The training material has been published on the project homepage under the “Training” menu and hosted on the e-Learning Platform developed and maintained by Geonardo. It can be accessed upon free registration at <http://www.endurcrete.eu/training>.

Figure 13: EnDurCrete e-Learning Platform Homepage



The e-Learning platform is a separate Learning Management System (LMS) based on *nStructor*, the custom LMS solution developed by Geonardo, available under the subdomain <https://endurcrete.geonardo.com>, hosted on Geonardo’s IT infrastructure. *nStructor* also serves as a multilanguage content management system providing features that allow administrators to update its content. As an LMS, *nStructor* handles registrations to the e-learning platform. After a successful registration, users become Members of the platform and can access the interactive e-learning content. The visitor front end is an HTML5 web application using a responsive layout, which guarantees that the application is efficiently scaled and displayed well on every device, including tablets and smartphones. The project website visual guideline has been applied to the e-learning platform.

As introduced above, the EnDurCrete e-learning course is divided into four ‘modules’: (1) Multifunctional coatings for applications on concrete surfaces (AMSOLUTIONS); (2) Installation instructions (RINA-C); (3)

Concrete Corrosion and Prevention and Repair methods (IBOX) (4) EHS initiation: First steps on occupational and emergent risk in construction industry (CEA).

Two of the four modules have been divided into a number of thematic ‘chapters’. Chapters include individual pages with different types of content such as animations and text. RINA-C Training is divided into 3 and EHS Training is divided into 5 Chapters.

3.2 Development and launch

Development of the e-learning platform has been led by GEO. Preparatory work started in June 2020 with discussions amongst the partners to define the structure, scope and content of the training taking into account the material to be used and the end-users’ needs. IBOX, AMSOLUTIONS, RINA-C and CEA developed and provided the content (text, structure, images and illustrations) for the modules to GEO in PPT format. GEO transformed the PPT files to e-Learning material and launched it in Autumn 2021.

The images below (Figure 14) show examples from the different chapters of the e-Learning platform, including the different approaches used for the presentation of the content developed by the partners.

The EnDurCrete e-Learning platform is being promoted by the partners and will be maintained for at least five years after the end of the project. The platform is expected to also help in the further dissemination and exploitation of the EnDurCrete results.

Figure 14: Examples of EnDurCrete e-Learning Chapters

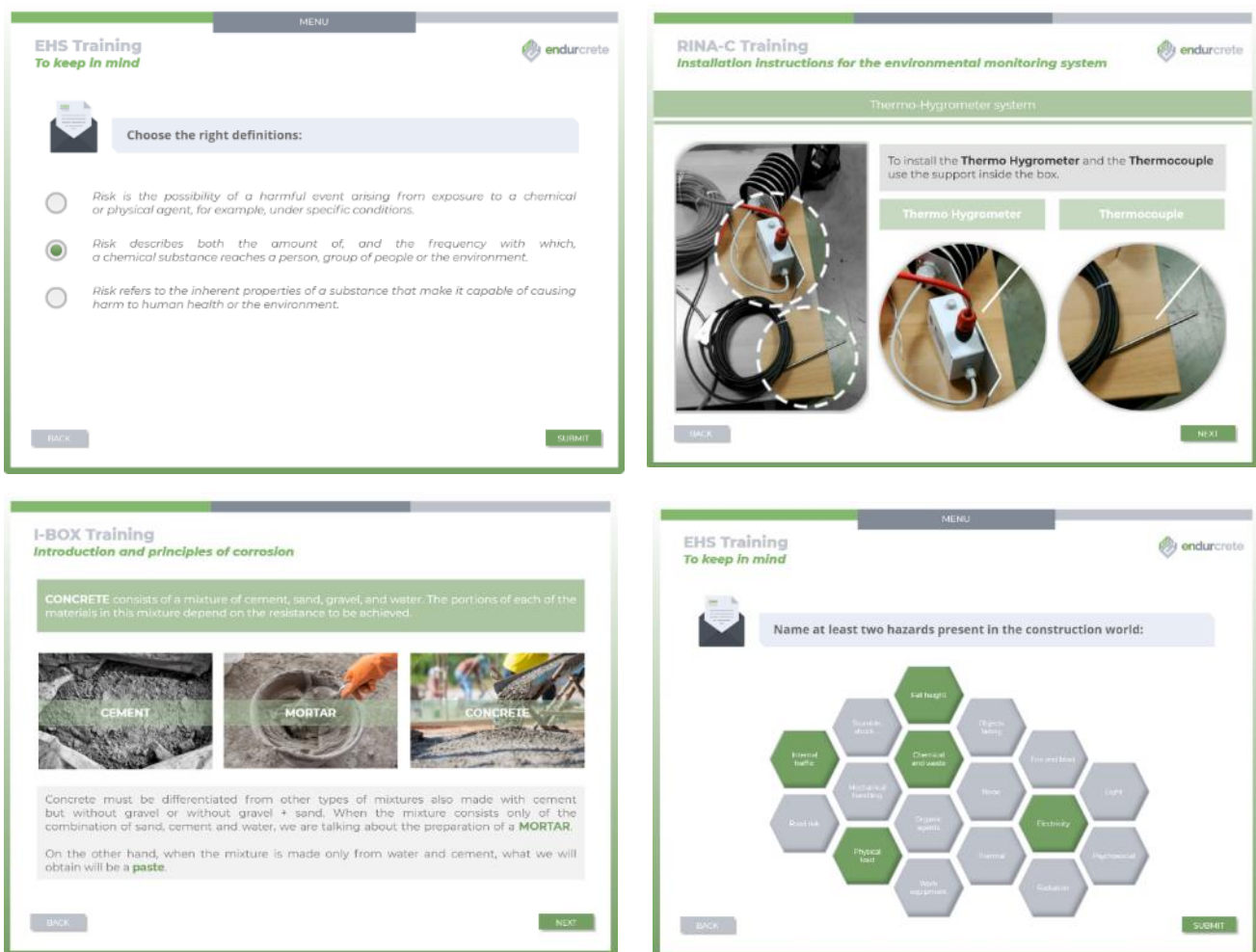




Figure 14: Examples of EnDurCrete e-Learning Chapters (cont'd.)

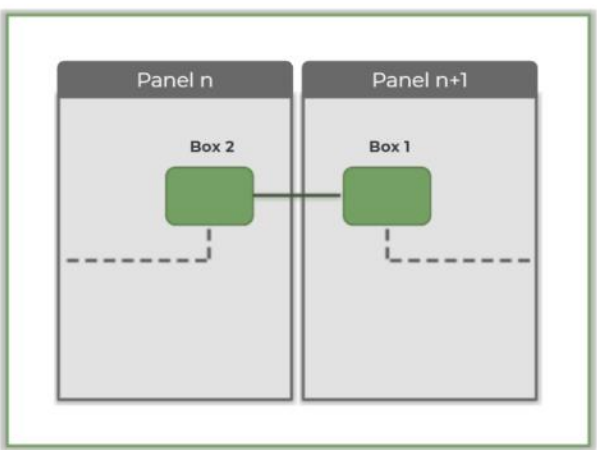
RINA-C Training

Instructions for optical connections between two consecutive panels



8. Install a cable duct from Box 2 of Panel n to Box 1 of Panel n+1





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AMS Training


The multi-functionality of the coating

More specifically, the coatings will exhibit:

A
B
C

Self-cleaning activity, that means the ability of the coating to remove the dirt from its surface through water falling. The self-cleaning activity of the coating was achieved by integrating TiO₂ nanoparticles in the coating's formulation.

Titanium dioxide (TiO₂) is a material known for its self-cleaning properties. When TiO₂ is irradiated by sunlight, it reacts with water and generate hydroxyl radicals, which react with organic molecules that are adsorbed on the surface and break them down. Moreover, through the hydrophilic properties of TiO₂, when it rains, water washes out the TiO₂ surface and this way removes dust and dirt.



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4 Conclusions

To facilitate an effective uptake of the new solutions developed in the EnDurCrete project, specific training activities were conceived delivered within the framework of Task. 8.4 of WP8. These activities have included four events, including workshops and webinars, as well as eight videos. An e-Learning platform with four specific training courses has also been developed and launched.

All the material available online – namely the webinar recording, videos and the e-Learning platform – serves as a project legacy and can be visited by the relevant stakeholders and end-users during and beyond the end of the project. The e-Learning platform, specifically targeted at a more technical audience, will be maintained for at least five years after the project will be closed.

To this end, the consortium will continue in its efforts to disseminate the training material to the relevant target groups to maximise their use and for the eventual exploitation of EnDurCrete results.