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RE^4 Project

REuse and REcycling of CDW materials and structures in energy efficient pREfabricated elements for building REfurbishment and construction

D1.5 Certification frameworks	
Author(s)[1]:	CETMA
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Distribution[2]	PU
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Abstract:	The deliverable D1.5 (Certification framework) belongs to T1.3 (WP1). The scope of this report is to provide a template including all the possible certification issues related to RE^4 final products. The template will be updated according to the outcomes of the Project and then filled in T7.6 (Certification strategies, technical documentation and contribution to standardisation).
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[1] *Just mention the partner(s) responsible for the Deliverable*

[2] *PU: Public, RE: restricted to a group specified by the consortium, CO: Confidential, only for members of the consortium; Commission services always included.*

[3] *Draft, Revised, Final*

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ACRONYMS & ABBREVIATIONS

CDW	Construction and demolition waste
DoA	Description of the Action
DoP	Declaration of Performance
hEN	Harmonised European Standard
hENs	Harmonised European Standards
LCA	Life cycle assessment
LCC	Life cycle cost
OSB	Oriented Strand Boards
RC	Reinforced concrete

1. EXECUTIVE SUMMARY

I. The deliverable D1.5 (Certification framework) belongs to Task 1.3 (Current status on policy measures and regulatory frameworks) of the WP1 (Mapping and analysis of CDW reuse and recycling in prefabricated elements), and it is aimed at identifying all the needed certifications (to be filled in the following task 7.6[4]) of the RE[4] final products.

II. This report is useful for several **stakeholders**: as first, for RE[4]-Project partners involved in the development of the innovative prefabricated building elements, and then for anyone involved in the production of prefabricated elements and in the construction sector in general.

III. The **methodology** used is based on the following steps: 1. Acquisition of information about products to be developed by partners involved in WP3, WP5 and WP6; 2. Acquisition of the output of Deliverable D1.4 about technical regulations and standards for prefabricated elements with or without CDW materials; 3. Definition of the needed certification for the defined products.

IV. The **structure of the report** is composed of the following chapters:

- **Chapter 1** (Executive summary) gives the main points of the report, focusing on the main conclusions of the document.
- **Chapter 2** (Introduction) gives a brief description of RE[4]- Project, summarises the final scope of the deliverable.
- **Chapter 3** offers an **overview of the methodology** used in carrying out this study, describing the used general approach.
- **Chapter 4** defines **final products** to be developed in the project, distinguishing the structural and the non-structural ones. They will be made using different CDW typologies, such as plastic, timber, recycled concrete, etc.
- **Chapter 5** analyses **certification issues** for the defined products. From 1 July 2013, under the Construction Products Regulation 2011 (CPR), it became mandatory for manufacturers to draw up a declaration of performance (DoP) and apply CE marking to any construction products which is covered by a harmonised European standard (hEN) or conforms to a European Technical Assessment (ETA) which has been issued for it, when such a product is placed on the market. The harmonised technical specification for a product defines EEA-wide methods of assessing and declaring all the performance characteristics required by regulations in any Member State which affect the ability of construction products to meet seven basic requirements for construction works. Focusing on the products to be developed in the project, all of them are governed by harmonised technical standards and then, CE marking is obligatory. No specific mention to the use of CDW materials in prefabricated elements are presented

[4] Task 7.6: Certification strategies, technical documentation and contribution to standardisation

in the products harmonised standards. Only in the new version of the EN 13369 governing common prefabricate concrete elements, there is a reference for using recycled aggregates, demonstrating that the European standards are moving towards the awareness that they have not covered the performance of a product *per se*, but taking into account if the materials used are primary or secondary ones.

- **Chapter 6** contains a table with a preliminary list of the **certification needs** for the final products of the project, reporting for each of them the reference harmonised standards and the essential characteristics to investigate. This template will be updated according to the outcomes of the Project and then filled in T7.6 (Certification strategies, technical documentation and contribution to standardisation).
- **Chapter 7** analyses the main **conclusions** of the performed study which can be summarised as follow:
  - RE^4 products are covered by harmonised European standards, except for oriented strand board, therefore for each of them the essential parameters to be included in the Declaration of Performance (DoP) are known;
  - Harmonised European standards do not cover the use of recycled materials from CDW (except for recycled aggregates) in prefabricated elements;
  - The updated version of the **EN 13369:2013** *Common rules for precast concrete products* provides, for the first time, the use of recycled materials from CDW, and particularly, reclaimed crushed and recycled coarse aggregates;
  - RE^4 experience about prefabricated elements with recycled CDW materials should foster the standardisation process for the use of CDW materials in prefabrication.

2. INTRODUCTION

2.1 Background - RE^4 objectives

The **overall goal of the RE^4-Project** is to promote new technological solutions for the design and development of structural and non-structural pre-fabricated elements with high degree of recycled materials and reused structures from partial or total demolition of buildings. The developed technologies will aim at energy efficient new construction and refurbishment, thus minimizing environmental impacts. The RE^4-Project targets the demonstration of suitable design concepts and building elements produced from CDW in an industrial environment, considering perspective issues for the market uptake of the developed solutions. The technical activities will be supported by LCA and LCC analyses, certification and standardisation procedures, demonstration activities, professional training, dissemination, commercialisation and exploitation strategy definition, business modelling and business plans. The overarching purpose is to develop a RE^4-prefabricated energy-efficient building concept that can be easily assembled and disassembled for future reuse, containing up to 65% in weight of recycled materials from CDW (ranging from 50% for the medium replacement of the mineral fraction, up to 65% for insulating panels and concrete products with medium mineral replacement coupled with the geopolymer binder). The reusable structures will range from 15-20% for existing buildings to 80-90% for the RE^4-prefabricated building concept.

2.2 Scope of the report

The deliverable **D1.5**: **Certification frameworks** belongs to the Task T1.3 of the WP1: *Mapping and analysis of CDW reuse and recycling in prefabricated elements*. **WP1** concerns the need of a baseline study to define a collective outline and to map the current best practices related to various aspects of reuse and recycling of CDW in prefabricated elements (including technological, standardisation issues and policy measures).The specific objectives of WP1 are the following:

- reviewing and mapping the current situation of re-use and recycling of different CDW materials, processes, and technologies, with specific reference to prefabricated elements;
- reviewing the current European legislations regarding CDW in general, specifically the legislations and current situation in the countries of the partners, including costs of landfill disposal;
- providing inputs to feed the Decision support system (DSS) function related to possible end-uses (WP2).

According to the Description of the Action (DoA), the scope of this report is to provide a template including all the possible certification issues related to RE^4 final products. The template will be updated according to the outcomes of the Project and then filled in T7.6 (Certification strategies, technical documentation and contribution to standardisation).

2.3 Structure of the document and contents

In order to fulfil the abovementioned objective, this report is broken down into the following chapters:

- **Chapter 1** (Executive summary) gives the main points of the report, focusing on the main conclusions of the document.
- **Chapter 2** (Introduction) gives a brief description of RE[4]- Project, summarises the final scope of the report.
- **Chapter 3** offers an **overview of the methodology** used in carrying out this study, describing the used general approach.
- **Chapter 4** defines **final products** to develop in the project.
- **Chapter 5** analyses **certification issues** for the defined products.
- **Chapter 6** contains a table with all the **certification needed** for the final product of the project.
- **Chapter 7** analyses the main **conclusions** of the performed study.

3. APPROACH AND ASSESSMENT METHODOLOGY

The goal of this report is the definition of a template including all the possible certification issues related to RE[4] final products. The template will be updated according to the outcomes of the Project and then filled in T7.6 (Certification strategies, technical documentation and contribution to standardisation).

The **methodology** used is based on the following steps:

1. Acquisition of information about products to be developed by partners involved in WP3, WP5 and WP6 (Chapter 4 and 5);

2. Acquisition of the output of Deliverable D1.4 about technical regulations and standards for prefabricated elements with or without CDW materials (Chapter 6);

3. Definition of the certifications needed for the defined products (Chapter 5 and 6).

4. FINAL PRODUCTS DEFINITION

Based on the information acquired by partners involved in WP3, WP5 and WP6, the following prefabricated products (Table 1) have to be developed in the project, distinguishing the structural and the non-structural ones.

Table 1 – List of products to be developed

Structural elements		
Element	**Typology**	**Material**
Foundation	Plinth	RC with recycled aggregates from CDW
Column	Standard	
	Corner	
Beam	Roof	
	Storey	
Slab	Solid	
	Floor	
	Hollow	
	Single-T	
	Double-T	
Bearing wall panels	Sandwich panels	
Staircase		
Non-structural elements		
Element	**Typology**	**Material**
Insulating panels	plastic panels	Plastic
Lightweight concrete for substrates	screeds	Concrete with recycled aggregates from CDW
	roof insulation	
Lightweight concrete for panels (part of it)	panels for facades	
Thermal Insulation - external application	wood fibre boards	Wood fibres
Inner partition - stud wall type	timber stud construction	Solid timber
	wood fibre lining board	Wood fibres
	acoustic insulation - wood fibre matts	
Timber facade panels	timber frame construction	Solid timber
	thermal insulation infill - wood fibre based	Wood fibres
	oriented strand board	Wood fibres or chips
	weather boarding	Various
Blocks	Standard solid Concrete Blocks	Concrete with recycled aggregates from CDW
Non-bearing wall panels		RC with recycled aggregates from CDW
Extruded elements	Roof tiles	Concrete with recycled aggregates from CDW

As can be seen, the elements will be realised using different CDW typologies, such as plastic, timber, recycled concrete, etc.

5. CERTIFICATION ISSUES

In general, all materials and construction products fall within the **Construction Products Regulation (CPR) 305/2011/EC [1]**, which stipulates that every product, permanently incorporated into a building, is a construction product.
CPR 305 refers to the presence of a **harmonised standard** (hEN) of the product and, in particular, on the possibility of CE marking of a construction product; in the absence of such a standard, an European Technical Opinion (ETA) may be required, otherwise it is not possible to mark CE product. Consequently, for construction products, CE marking is a conditional obligation.
Certain categories of construction, generally non-structural products, can be CE marked with procedures performed by the manufacturer, without the need for certificates.
Many construction products, having to comply with specific national laws, can only be CE marked if they have certifications issued by Notified Body or by special procedures.
Therefore, construction manufacturers have to release the **Declaration of Performance** (**DoP**) for each product intended for market.

Focusing on the products listed in the chapter 4 (Table 1), for all of them CE marking is obligatory. Indeed, in the Table 1 of the Annex IV of the Directive 305/2001/EC, the following product areas are reported: precast normal/lightweight/autoclaved aerated concrete products; structural timber products; wood based panels and elements; building kits; units; and prefabricated elements. Therefore, all the RE^4 products are governed by harmonised technical standards.
Looking at these standards, besides, there is no specific referring to the use of CDW materials for the production of prefabricated elements; therefore, all the products harmonised standards recall to the common European Standard **EN 13369** *Common rules for precast concrete products* which, in the new last version of **2013** [2] provides the use of recycled materials from CDW, and particularly, **reclaimed crushed and recycled coarse aggregates**, whose use is managed in § 4.1.2.2 and Annex Q of the same standard.

This fact demonstrates that, with respect to the seventh requirement of CPR 305/11 "*Sustainable use of natural resources*", the ongoing discussion at EU and national level on covering environmental performance in hENs and the development of horizontal Product Category Rules (PCR) in a European standard, has motivated several technical committees in CEN to assess if and how reliable information on recycled content could be addressed in specific hENs for construction products. Therefore, the European standards are moving towards the awareness that they have not covered the performance of a product *per se* (e.g. structural stability, fire safety, emission of dangerous substances) no matter if the materials used are primary or secondary ones.

No reference was found, instead, at the regulatory level regarding the use of wood waste for the production of prefabricated elements.

6. CERTIFICATION NEEDED FOR THE FINAL PRODUCT

The cross-study of the above-mentioned products to be developed, and of technical regulations outlined in D1.4, has allowed the definition of the relevant reference technical standards and the main parameters to be investigated for each of these products. This information is reported in Table 2. As already mentioned, this table/template will be also used and improved in Task 7.6.

Table 2 – Standard reference and essential characteristic for RE^4 products

Structural elements				
Element	**Typology**	**Harmonised EN standard**	**Essential characteristic**	**Reference standard**
Foundation	Plinth	EN 14991:2007 Precast concrete products — Foundation elements	Concrete compressive strength f_{ck}	EN 13369
			Reinforcing steel ultimate tensile strength f_{tk}	EN 13369
			Reinforcing steel tensile Yield strength f_{yk}	EN 13369
			Mechanical resistance of the element to vertical load and bending moment (design values)	EN 1992-1-1
			Geometrical properties	EN 13369
			Durability	EN 13369
Column	Standard	EN 13225:2013 Precast concrete products — Linear structural elements	Concrete compressive strength f_{ck}	EN 13369
			Reinforcing steel ultimate tensile strength f_{tk}	EN 13369
	Corner		Reinforcing steel tensile Yield strength f_{yk}	EN 13369
			Mechanical resistance of the element to vertical load and bending moment (design values)	EN 1992-1-1

Structural elements				
Element	**Typology**	**Harmonised EN standard**	**Essential characteristic**	**Reference standard**
Beam	Roof		Resistance to fire (for load bearing capacity)	EN 13369
			Geometrical properties	EN 13369
	Storey		Durability against corrosion	EN 13369
			Dangerous substances	Depending on national regulations
Slab	Solid	EN 13747:2005+A2:2010 Precast concrete products — Floor plates for floor systems	Concrete compressive strength f_{ck}	EN 13369
			Reinforcing steel ultimate tensile strength f_{tk}	EN 13369
	Floor		Reinforcing steel tensile Yield strength f_{yk}	EN 13369
			Mechanical resistance (design values)	EN 1992-1-1
	Single-T		Resistance to fire (for load bearing capacity)	EN 13369
			Geometrical properties	EN 13369
	Double-T		Durability	EN 13369
			Airborne sound insulation and impact noise transmission	EN 13369
	Hollow	EN 1168:2005+A3:2011 Precast concrete products — Hollow core slabs	Concrete compressive strength f_{ck}	EN 13369
			Reinforcing steel ultimate tensile strength f_{tk}	EN 13369
			Reinforcing steel tensile Yield strength f_{yk}	EN 13369
			Mechanical resistance (design values)	EN 1992-1-1

Structural elements				
Element	**Typology**	**Harmonised EN standard**	**Essential characteristic**	**Reference standard**
			Resistance to fire (for load bearing capacity)	EN 13369
			Geometrical properties	EN 13369
			Durability	EN 13369
			Airborne sound insulation and impact noise transmission	EN 13369
Bearing wall panels	Sandwich panels	EN 14992:2007+A1:2012 Precast concrete products — Wall elements	Concrete compressive strength f_{ck}	EN 13369
			Reinforcing steel ultimate tensile strength f_{tk}	EN 13369
			Reinforcing steel tensile Yield strength f_{yk}	EN 13369
			Mechanical resistance (design values)	EN 1992-1-1
			Resistance to fire	EN 13369
			Geometrical properties	EN 13369
			Durability	EN 13369
			Acoustic insulation parameter	EN 13369
			Thermal resistance R_c	EN 13369
Staircase		EN 14843:2007 Precast concrete products — Stairs	Concrete compressive strength f_{ck}	EN 13369
			Reinforcing steel ultimate tensile strength f_{tk}	EN 13369
			Reinforcing steel tensile Yield strength f_{yk}	EN 13369
			Mechanical resistance (design values)	EN 1992-1-1
			Resistance to fire	EN 13369
			Geometrical properties	EN 13369

Structural elements				
Element	**Typology**	**Harmonised EN standard**	**Essential characteristic**	**Reference standard**
			Durability against corrosion	EN 13369
			Impact noise transmission	EN 13369
			Safety in use	EN 13369

Non-structural elements				
Element	**Typology**	**Harmonised EN standard**	**Essential characteristic**	**Reference standard**
Insulating panels	plastic panels	EN 13163:2012+A1:2015 Thermal insulation products for buildings — Factory made expanded polystyrene (EPS) products — Specification	Thermal Conductivity	
			Reaction to Fire	EN 13501-1
			Dimensional stability in 70°	
			Geometrical properties	
			Characteristic Strength: Bending, Compression, Tensile Strength Perpendicular To faces	EN 12086
			Long Term Water Absorption by Partial Immersion	EN 12088
			Long Term Water Absorption by Total Immersion	EN 12087
		EN 13164:2012+A1:2015 Thermal insulation products for buildings — Factory made extruded polystyrene foam (XPS) products — Specification	Thermal resistance	
			Reaction to fire	
			Compressive strength	
			Water permeability	
			Water vapour permeability	
			Durability of reaction to fire against heat, weathering, ageing/degradation	
			Thermal resistance	

Non-structural elements				
Element	**Typology**	**Harmonised EN standard**	**Essential characteristic**	**Reference standard**
		EN 13165:2012+A2:2016 Thermal insulation products for buildings — Factory made rigid polyurethane foam (PU) products — Specification	Reaction to fire	
			Durability of reaction to fire against heat, weathering, ageing / degradation	
			Dimensional stability under specified temperature and humidity condition	
			Deformation under specified compressive load and temperature conditions	
			Compressive strength	
Lightweight concrete for substrates	screeds	EN 1520:2011 Prefabricated reinforced components of lightweight aggregate concrete with open structure with structural or non-structural reinforcement	Compressive strength (of concrete)	
			Density	
			Mechanical resistance	
			Loadbearing capacity (only for floor application)	
			Detailing	
	roof insulation		Drying shrinkage (in end use conditions)	
			Durability against freeze-thaw (only for exposed applications) – not for facades	
			Reaction to fire (in the end use conditions)	
Lightweight concrete for panels (part of it)	panels for facades		Resistance to fire (in the end use conditions) – only for facades	
			Thermal resistance	

Non-structural elements				
Element	**Typology**	**Harmonised EN standard**	**Essential characteristic**	**Reference standard**
			Direct airborne sound insulation index	
			Release of dangerous substances	
			Rigidity of joints	
Thermal Insulation - external application	wood fibre boards	EN 13171:2012+A1:2015 Thermal insulation products for buildings — Factory made wood fibre (WF) products — Specification	Reaction to fire	EN 13501-1
			Release of dangerous substances to the indoor environment	
			Acoustic absorption index	EN ISO 354/A1
			Impact noise transmission index (for floors)	
			Direct airborne sound insulation index	
			Continuous Glowing combustion	
			Thermal resistance	EN 12667
			Water permeability	EN 1609
			Water vapour permeability	EN 12086
			Compressive strength	EN 826
			Durability of reaction to fire against heat, weathering, ageing/degradation	
			Durability of thermal resistance against heat, weathering, ageing/degradation	
			Tensile/Flexural strength	
			Durability of compressive strength against ageing/degradation	
			Geometrical properties	

Non-structural elements				
Element	**Typology**	**Harmonised EN standard**	**Essential characteristic**	**Reference standard**
Inner partition - stud wall type	timber stud construction	EN 13986:2004+A1:2015 Wood-based panels for use in construction — Characteristics, evaluation of conformity and marking	Characteristic strength: bending, compression, tension, panel shear, planar shear	EN 310
			Mean stiffness: bending, compression, tension, panel shear, planar shear	EN 310
			Density	EN 323
			Bonding quality/durability	EN 314-1
			Biological durability	EN 317
			Reaction to fire class	EN 13501-1
	wood fibre lining board		Release of formaldehyde class	
			Water vapour permeability	EN ISO 12572
			Airborne sound insulation	EN ISO 140-3
			Sound absorption	EN ISO 354
			Thermal conductivity	EN 12664
			Release (content) of Pentachlorophenol (PCP)	
	acoustic insulation - wood fibre matts	EN 13169:2012+A1:2015 Thermal insulation products for buildings — Factory made expanded perlite board (EPB) products — Specification	Thermal resistance conductivity	
			Reaction to fire	
			Durability resistance against heat conductivity, weathering, aging/degradation	
			Compressive strength	
			Tensile strength/bending	
			Water permeability	

Non-structural elements				
Element	**Typology**	**Harmonised EN standard**	**Essential characteristic**	**Reference standard**
Timber facade panels	timber frame construction	EN 13986:2004+A1:2015 Wood-based panels for use in construction — Characteristics, evaluation of conformity and marking	Characteristic strength: bending, compression, tension, panel shear, planar shear	EN 310
			Mean stiffness: bending, compression, tension, panel shear, planar shear	EN 310
			Density	EN 323
			Bonding quality/durability	EN 314-1
			Biological durability	EN 317
			Reaction to fire class	EN 13501-1
			Release of formaldehyde class	
			Water vapour permeability	EN ISO 12572
			Airborne sound insulation	EN ISO 140-3
			Sound absorption	EN ISO 354
			Thermal conductivity	EN 12664
			Release (content) of Pentachlorophenol (PCP)	
	thermal insulation infill - wood fibre based	EN 13171:2012+A1:2015 Thermal insulation products for buildings — Factory made wood fibre (WF) products — Specification		
	oriented strand board weather boarding	EN 300:2006 Oriented Strand Boards (OSB) - Definitions, classification and specifications (NO hEN)	Characteristic strength: bending, compression, tension, panel shear, planar shear	EN 310
			Mean stiffness: bending, compression, tension, panel shear, planar shear	EN 310

Non-structural elements				
Element	**Typology**	**Harmonised EN standard**	**Essential characteristic**	**Reference standard**
			Density	EN 323
			Bonding quality/durability	EN 314-1
		EN 13986:2004+A1:2015 Wood-based panels for use in construction — Characteristics, evaluation of conformity and marking	Biological durability	EN 317
			Reaction to fire class	EN 13501-1
			Release of formaldehyde class	
			Water vapour permeability	EN ISO 12572
			Airborne sound insulation	EN ISO 140-3
Blocks	Standard solid Concrete Blocks	EN 15435:2008 Precast concrete products — Normal weight and lightweight concrete shuttering blocks — Product properties and performance	Sound absorption	EN ISO 354
			Thermal conductivity	EN 12664
			Release (content) of Pentachlorophenol (PCP)	
			Mechanical strength	
			Acoustic absorption index	
			Thermal resistance	
			Durability	
			Geometrical properties	
Non-bearing wall panels		EN 14992:2007+A1:2012 Precast concrete products — Wall elements	Concrete compressive strength f_{ck}	EN 13369
			Reinforcing steel ultimate tensile strength f_{tk}	EN 13369
			Reinforcing steel tensile Yield strength f_{yk}	EN 13369
			Mechanical resistance (design values)	EN 1992-1-1
			Resistance to fire	EN 13369
			Geometrical properties	EN 13369
			Durability	EN 13369

Non-structural elements				
Element	**Typology**	**Harmonised EN standard**	**Essential characteristic**	**Reference standard**
			Acoustic insulation parameter	EN 13369
			Thermal resistance R_c	EN 13369
Extruded elements	Roof tiles	EN 490:2011+A1:2017 Concrete roofing tiles and fittings for roof covering and wall cladding. Product specifications	Mechanical resistance	EN 491
			External fire performance	96/603/EC EN 13501-1
			Reaction to fire	96/603/EC EN 13501-1
			Water impermeability	EN 491
			Dimensional variation	EN 491
			Durability freeze-thaw	EN 491
			Release of dangerous substances	

7. CONCLUSIONS AND RECOMMENDATIONS

The aim of this document is to define the relevant reference technical standards and the main parameters to be investigated for each of the products to be developed in the project.

It is a starting point and a guideline for the design (WP3), development and characterisation (WP5 and WP 6) of the products to be developed in the project; the template will be updated according to the outcomes of the Project and then filled in T7.6 (Certification strategies, technical documentation and contribution to standardisation).

Information and data collected in this study, drive to some general conclusions:

- according to the **Construction Products Regulation (CPR) 305/2011/EC**, CE marking is a conditional obligation for construction products which is covered by a harmonised European standard (hEN) or conforms to a European Technical Assessment (ETA), and construction manufacturers have to release the **Declaration of Performance** (**DoP**) for each product intended for market;
- with respect to the seventh requirement of CPR 305/11 "Sustainable use of natural resources", the European standards are moved towards the awareness that they have not covered the performance of a product *per se*, but taking into account if the materials used are primary or secondary ones. An example is the updated version of the EN 13369:2013 *Common rules for precast concrete products* which, for the first time, provides the use of recycled materials from CDW, and particularly, **reclaimed crushed and recycled coarse aggregates**;
- the products to be developed in the project are covered by harmonised European standards, a part from the oriented strand board; indeed the innovation in RE^4 products is in the constituent materials based mainly on recycled materials from CDW;
- technical standards about prefabricated concrete elements refer mainly to the standards EN 13369 for determining essential characteristics required for CE marking. Therefore, as the updated version of EN 13369: 2013 defines the use of recycled aggregates for the production of prefabricated elements, for RE^4 precast concrete products it will be possible to draw up a DoP document according to the legal criteria. However, it should be noted that for the products that will be developed in the project it is expected that the quantities of recycled aggregates form CDW will be higher than that currently allowed by the above-mentioned standard; therefore, particular attention should be paid to the verification of limit value of the performance requirements;
- as far as the other typologies of prefabricated elements are concerned, at present no product standard has been adapted to the seventh requirement of CPR 305/11, with the use of raw materials for recycling. Therefore, the development of design products would require a special study to ensure compliance with regulatory limits, or it could provide a valid support for regulatory adaptation by introducing the possibility of using recycled raw materials;

- specific technical standards regulating the oriented strand board (and the weather boarding) is not harmonised, therefore with the aim to develop a DoP of the final products, it has to refer to the harmonised standard for wood based panels;
- since there are no standards covering the use of recycled materials from CDW (except for recycled aggregates) in prefabricated elements, their use is not widespread among manufacturers of prefabricated elements. However, RE^4 experience about prefabricated elements with recycled CDW materials should foster the standardisation process for the use of CDW materials in prefabrication.

REFERENCES

[1] REGULATION (EU) No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011R0305&qid=1495802871618&from=EN;

[2] EN 13369:2013 Common rules for precast concrete products

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