

## APPLICATION OF CPR 305/2011 TO PRECAST CONCRETE ELEMENTS

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*Summary: This paper introduces the method of implementation of the European Parliament and the Council Construction Products Regulation No. 305/2011 for precast concrete products. The Regulation defines the conditions for placement of construction products in the internal market of the European Union, as well as methods and systems for conformity assessment to demonstrate the continuity of the characteristics of construction products. There are authorities to control the internal market community, in the countries of the European Union, whose main task is to control whether the product and supporting documentation meet the requirements of the Regulation. This work focuses to conformity assessment of precast concrete products in accordance with European harmonized standards. Meeting the requirements of the Regulation and harmonized standards for precast concrete products, the product can be introduced to the EU market.*

*Keywords: CPR Regulation, Precast Concrete Elements, Quality, CE Marking*

### 1. INTRODUCTION

Precast concrete structural elements are designed for load bearing function and transfer of actions to the load bearing soil. They are manufactured in factory conditions and transported to the site by appropriate transport vehicles. Basic ingredients for homogenized concrete mix for production of precast concrete elements are: cement, aggregate, admixtures, water and prestressing and/or reinforcing steel. The quality of cement, aggregate, admixtures, and steel are confirmed by the individual certificates. Harmonized standards of consideration for precast concrete elements are:

- EN 13369:2013: Common rules for precast concrete products;
- EN 13693:2009: Precast concrete products – Special roof elements;
- EN 13224:2011: Precast concrete products – Ribbed floor elements;
- EN 13225:2013: Precast concrete products – Linear structural elements;
- EN 14991:2007: Precast concrete products – Foundation elements;

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Design of precast concrete elements should comply with Eurocodes: EN 1990 - Basis of structural design, EN 1991 – Eurocode 1: Actions on Structures, EN 1992 – Eurocode 2 - Design of concrete structures, and where necessary EN 1997 – Eurocode 7 – Geotechnical Design and EN 1998 - Eurocode 8: Design of structures for earthquake resistance.

## 2. PRECAST CONCRETE ELEMENTS CONFORMITY ASSESSMENT

According to European Parliament and the Council Construction Products Regulation No. 305/2011 (CPR 305/2011), there are two directions to conduct conformity assessment with the relevant requests:

- Obligatory CEN<sup>3</sup>,
- Non - obligatory EOTA<sup>4</sup>.

If the product to be placed on the EU market is covered by harmonized European standard, with the references published in the EU Official Gazette, than CEN methodology is to be used. It is a case with precast concrete elements.

If the product is not covered by the European harmonized standard, then the manufacturer may label its product with CE mark, but to check whether it is covered by the existing European assessment document first.

If product and its intended use have not been covered by a harmonized technical specification, there is an option to put them on the market by submitting the request for European technical assessment to respective body. That body can make European technical assessment document based on the assessment. In this case, assessment conformity procedure can last longer time.

Conformity assessment is conducted by defining values of the characteristics list defined as essential characteristics. Detailed list of characteristics can be find in Annex ZA of the European harmonized standard.

AVCP (Assessment and Verification of Constancy Performances) system requires involvement of notified bodies in some cases. *Table 1*, pending to AVCP system selected, shows the tasks to be made by manufacturer and notified body.

System 2+ is assesment system for the precast concrete products. For example, according to the System 2+ for precast concrete products – Linear structural elements, the tasks of manufacturer and notified body to be performed, according to standard EN 13225:2013 are as follows:

Manufacturer is supposed to:

- ✓ conduct initial type testing<sup>5</sup>;
- ✓ establish and implement factory production control; and
- ✓ conduct further testing of samples taken at the factory.

The selected notified body is to:

<sup>3</sup> European Committee for Standardization

<sup>4</sup> European Organisation for Tehnical Assessment

<sup>5</sup> Initial type testing includes calculation and/or testing

- ✓ conduct initial inspection of factory and of factory production control;
- ✓ conduct continuous surveillance, assessments and approval of factory production control.

Table 1: Assessment and Verification of Constancy Performances System [4]

AVCP Systems	Responsibility	Type of Notified body	Tasks
1+	Notified Body	Product certification Body	Initial Inspection of the FPC System Continuous Surveillance of the FPC system Determination of the product-type Audit testing
	Manufacturer		Factory Production Control and further testing of samples
1	Notified Body	Product certification Body	Initial Inspection of the FPC system Continuous surveillance of the FPC system Determination of the product-type
	Manufacturer		Factory Production Control and further testing of samples
2+	Notified Body	Factory production control certification body	Initial Inspection of the FPC System Continuous Surveillance of the FPC system
	Manufacturer		Factory Production Control and further testing of samples Determination of the product-type
3	Notified Body	Testing laboratory	Determination of the product-type
	Manufacturer		Factory Production Control
4	Manufacturer	No independent Involvement	Factory Production Control Determination of the product-type

### 3. INITIAL TYPE TESTING

The purpose of the type testing is to demonstrate that the product meets the specified requirements. Type testing can be:

- physical type testing – consists in submitting a representative sample of the products and/or of specimens for the relevant laboratory testing;
- type calculation – type calculation is the justification of the relevant properties of the product by calculation;
- a combination of both - physical type testing and type calculation [7].

If manufacturer has an access to relevant calibrated testing equipment, than it can be used for physical type testing. The product cannot be released to the market until the results of the initial type testing show that is in compliance with requirements specified by the relevant standard. Initial type testing must be conducted if any change occurs in product design, concrete mix, type of steel, production method or any other modifications that can have significant effect on the product's characteristics.

### 4. FACTORY PRODUCTION CONTROL

The manufacturer shall establish, document, maintain and implement a factory production control (FPC) system to ensure that the product introduced to the market meets the requirements of EN 13225 and complies with the specified or declared values and with the requirements on technical documentation.

A manufacturer who operates a quality system in accordance with EN ISO 9001:2015 taking in scope specific standard request of products standards EN 13225, can be considered that meets the requirements of the factory production control system.

The factory production control system shall define competence, responsibility and authority of staff involved in it. That system consists of FPC manual, procedures, work instructions and other elements explaining raw material input, production process, production process' control and final product control. The manufacturer must determine the elements that can affect product's compliance to the required technical specification along the production process. Manufacturer needs to plan the production process to adjust the final product to the requirements of EN 12335. Within FPC framework, manufacturer must define inspection/control of raw material equipment, other production process input components, as well as final products. Inspection frequency is designed to create a permanent adjustment to the specified requirements.

Customers' complaints to delivered product or testing results during FPC can point out to the fact that product does not comply to the specific requirements. Manufacturer must undertake all necessary actions to eliminate nonconformity. These actions must be documented and show whether the final product is acceptable, unsatisfactory (to be rejected) or it can be declassified (to be introduced to market as lower class).

Procedure dealing with nonconformity products and complaints related to specific characteristics as well as correction actions taken to eliminate nonconformity must be documented.

### 5. NOTIFIED BODIES

Notified bodies do conformity assessment (third party). EU member states are responsible for their notification to European Commission. Notified bodies shall be competitive for conducting of conformity assessment. Their competence is a subject of oversight by national institutes for accreditation of member states.

Notified bodies are to be independent, impartial and honest. If they do not meet requirements that they are notified for, a member country takes off their notification. Notified bodies operate in market driven conditions, so manufacturer is to select the most

relevant body for its purpose from the notified bodies' list. In the most cases, price and correspondence language are primary criteria for selection of the body.

The list of notified bodies is published in the EU Official Gazette. Until now, there are approximately 1700 notified bodies within the EU for all directives from New Approach that require CE marking.

## 6. DECLARATION OF PERFORMANCE

After the completion of conformity assessment, manufacturer shall make declaration of performance. The model of declaration of performance can be found in CPR No. 305/2011 and the example for the Precast Concrete Elements – Linear Structural Elements is given in *Figure 1*.

Declaration of performance: No. Type of the construction product: Precast concrete products – Linear structural elements		4) Registered trade name Address of the manufacturer LOGO of the company			
1) Unique identification code: 2) Type, serial number:					
3) Intended use or uses of the construction product:					
5) Authorised representative: Name and contact address of the authorised representative if there is					
6) System of assessment and verification of constancy of performance: System 2+					
7) Notified body:					
8) European Technical Assessment:					
9) Declared performance:					
<b>Concrete:</b>		EN 13235:2013			
Compressive strength	$f_{ck} =$			xx [N/mm <sup>2</sup> ]	
<b>Reinforcing steel</b>					
Ultimate tensile strength	$f_{tk} =$			yy [N/mm <sup>2</sup> ]	
Tensile yield strength	$f_{yk} =$	zz [N/mm <sup>2</sup> ]			
10) The product characteristics are in accordance with the above specification The declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.  Signed for and on behalf of the manufacturer by:  ..... (name and function)  ..... (place and date of issue) (signature)					

Figure 1. Declaration of Performance<sup>6</sup>

<sup>6</sup> Made by authors according CPR No. 305/2011, Annex III

The EU Declaration of Performance is the document in which the manufacturer states that the product satisfies the essential requirements of the applicable legislation. The Declaration of Performance must be kept for ten years from the date of placing the product on the market. The Declaration of Performance must be drawn up in one of the official languages of the EU. The EU Member States may require that the EU declaration of performance is translated into their official language or languages [9].

### 7. CE MARKING AND LABELLING

Producer can label CE mark using three methods. The following information shall be added to the CE marking symbol in the affixed label:

- ✓ identification number of the certification body;
- ✓ name or identifying mark and registered address of the manufacturer;
- ✓ the last two digits of the year in which the marking is affixed;
- ✓ number of the factory production control certificate;
- ✓ reference to EN 13225 with the date of the version;
- ✓ description of the product: generic name and intended use; and
- ✓ Information on relevant essential characteristics of the product [6].

Manufacturer can use simplified CE mark. Simplified CE mark should look like shown in *Figure 2*.

<b>CE</b>	
AnyCo Ltd, PO Bx21, B-1050	Name and registered address of the manufacturer.
45PJ76	Identification number of unit.
13	Last two digits of the year in which the marking was affixed
0123-CPR-456IGH	Number of the FPC certificate
EN 13225:2013	Number of dated version of standard

*Figure 2. Example of simplified label [6]*

*Figure 3* shows the label with geometric data and material characteristics.

 0035		
AnyCo Ltd, PO Bx21, B-1050  Address  15  0123-CPR-456IGH		
EN 13225:2013 Linear precast concrete structural element COLUMN (for structures)		
Concrete:		
Compressive strength	$f_{ck} =$	[N/mm <sup>2</sup> ]
Reinforcing steel:		
Ultimate tensile strength	$f_{tk} =$	[N/mm <sup>2</sup> ]
Tensile yield strength	$f_{yk} =$	[N/mm <sup>2</sup> ]
<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 2px solid green; border-radius: 15px; width: 150px; height: 80px; margin-right: 20px;"></div> <div> <p>Series C0</p> <p>Type 400*500*6 000</p> </div> </div>		
For detailing and durability see Technical Information		

Figure 3. Example of CE marking with Method 1 for columns [6]

There are two other methods determining what a label should look like that can be found in Annex ZA of EN 13225:2013.

### 8. CONCLUSION

Annual turnover of the products with the CE mark in the EU market is around 1,500 billion euros. According to some unofficial estimates, Bosnia and Herzegovina exports products with the CE mark to the EU market in the value of around 15 million euros. CE marking is a "passport for the product" that can enter the EU market. This label confirms that the product meets the minimum safety requirements set by the legislator. However, whether the product will be accepted by the market depends on many other factors, such as the attractiveness of the product (whether the product is made based upon the results of relevant research and development of technology), unit price, delivery timeframe, and others. Research and development of technology are the main reasons why the most successful countries in the world market invest the most in research and development.

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## ПРИМЈЕНА CPR 305/2011 НА БЕТОНСКЕ ПРЕФАБРИКОВАНЕ ЕЛЕМЕНТЕ

**Резиме:** У овом раду представљен је начин имплементације Регулative Европског парламента и Савјета о грађевинским производима број 305/2011 за префабриковане бетонске производе. Регулative дефинише услове за пласман грађевинских производа на унутрашње тржиште Европске уније, као и начине и системе оцјењивања усклађености за демонстрацију сталности карактеристика грађевинских производа. У државама Европске уније, постоје органи за надзор над унутрашњим тржиштем заједнице, чији је основни задатак да контролишу да ли производ и пратећа документација уз тај производ одговарају захтјевима Регулative. У овом раду фокус је стављен на оцјењивање усклађености префабрикованих бетонских производа у складу са европским хармонизованим стандардима. Задовољавањем захтјева Регулative и хармонизованих стандарда за префабриковане бетонске производе, производ може бити извезен на тржиште Европске уније.

**Кључне ријечи:** Регулative, префабриковани бетонски производи, квалитет, СЕ ознака