

INVESTIGATION OF PRECAST CONCRETE ELEMENTS IN TERMS OF DURABILITY

O. DEACONU¹

Abstract: *This study refers to several prefabricated reinforced concrete, components derived from decommissioning of industrial buildings owned by the company PREFEA SA Brasov. The study looked at various issues that may affect or influence the durability of precast under normal conditions of use.*

Key words: *durability of precast, diagnosis, alkalinity.*

1. Introduction

Investigation refers to several prefabricated reinforced concrete. These elements could be studied on the decommissioning of production halls belonging to SC PREFEA SA Brasov. All investigated items are reinforced concrete poured prefabricate.

The company was founded in 1949 as the IMC Brasov (Enterprise Building Materials), the current SC PREFEA SA Brasov was taken over in 1997 by the group of companies PRESCON by converting itself both structurally and conceptually. SC PREFEA S. A. Brasov is a company with a tradition of civil and industrial concrete construction having as main of activity the production of precast concrete and prestressed concrete.

The company has as implementation priorities precast products, design and manufacture prefabricated, patterns of metal elements, assimilation and approval of new products and equipment necessary for the precast industry.

The company is among the first companies in Romania that produced

prefabricated of reinforced concrete elements, many of the methods of producing prefabs are prototypes.

The company produces a diverse range of items from precast concrete as well prestressed for example: concrete walls, concrete columns, beams, roof, foundations, breaded, floors, roof elements, walls of tanks, reinforced concrete elements for roads, slabs carriageways and non-roadway, beams with adherent string of pre-stressed concrete highway bridges, road pavements, joints beams with extended grip slab finishing cast reinforcement for bridges, concrete curbs etc.

Research has been done with the support of director Ioan Adam and under the guidance Prof. PhD. Eng. Popaescu Augustine.

2. Elements under Investigation

According to the document: "I.M.C. BRAŞOV 30 years of 1949-1979" that the company produces prefabricated elements since 1949 thus some prefabricated elements analysed have a service life of over 60 years.

¹ Department of Civil Engineering, Faculty of Constructions, University *Transilvania* of Braşov.



Fig. 1. *Image of time shots demolishing from the prefabricated workshop.*



Fig. 2. *Image before demolishing from the reinforcement workshop*

In this paper the above-mentioned are described a number of elements such as: peron type columns, caissons, concrete trusses, skylights, etc. Also there are references to some resistance components

belonging the prefabricated production workshop (fig. 1), hall was installed during 1950 - 1952 (62 years) like columns, prestressed beams and caissons and other elements belonging the roof workshop of

reinforcement (fig. 2), hall built between 1952 and 1953 (60 years) like prestressed trusses and skylights. In fig. 1 can be seen the conditions are very good for the prestressed beams and connection of it with the column. Reinforcements from the prestressed beams are in very good condition, without rust (fig. 3).



Fig. 3. *Reinforcement of prestressed beams*

In fig. 4 we can see good state of caissons with low corroded reinforcement at the bottom of plates.



Fig. 4. *Surface element type ECP*

In fig. 5 is observed a reinforcement column in very good condition, without rust. At the workshop roof of reinforcement can be observed prefabricated caissons and truss reinforced concrete both in a very good condition of conservation (Fig. 6).

In fig. 7 is observed strands from soles truss as well non prestressed reinforcement are in a state without degradation.



Fig. 5. *Column type peron*



Fig. 6. *The roof of workshop of reinforcement*



Fig. 7. *Stranded wire from soles truss*

Blockage strands have only one started rusting generally having good time behaviour (fig. 8).



Fig. 8. Reinforcement blockage for prestressing

The sheath for strands did not show any degradation as can be seen from fig. 9.



Fig. 9. Reinforcement sheath

From the performed research on the precast concrete elements revealed that these have behaved very well over time.

Good behaviour while precast elements were driven by quality and good compaction of the concrete, so it was made a proper waterproofing. Therefore after more than 60 years concrete has kept alkalinity and reinforcement embedded in concrete shows no signs of corrosion.

These depend on the composition of

concrete (cement dosage, water / cement ratio) and transport systems within the material (pores, microcracks, cracks, voids, segregation).

In the cases analysed structural embodiments has been favourable, that: size sections of concrete elements (columns and beams) were chosen properly, were used reinforcements with diameters attractive.

Were consisted a few shortfalls as example: the reinforcement of resistance is smooth, therefore without an adhesion of or proper cooperation, insufficient coverage at the bottom reinforcement with concretes at caissons, non-satisfying the blocking thorons protection.

The phenomenon of carbonation of concrete is the key factor in triggering the reinforcement corrosion and is therefore particularly important to determine the depth to where the concrete section is compromised of this phenomenon

Determination of the depth of degradation was applied in-situ concrete. Method of treating the concrete with an alcoholic solution of phenolphthalein concentration 1% and could determine the degree of carbonation.

Concrete carbonation is determined by sprinkling with 1% phenolphthalein solution concentration on fresh broke. Phenolphthalein have turning range of the colour from colourless (pH = 8.3) to red violet (pH = 10.5). Alkalinity is characterized by a high pH, so in areas where concrete has not lost the alkalinity, that no carbonation, it will be intensely coloured after sprinkling with phenolphthalein.

All items tested with alcoholic solution of phenolphthalein were stained red violet (fig. 10).

If it is found that the concrete has lost alkalinity (do not turn red violet) the procedure is repeated on the layers check about 5 mm thick to concrete healthy.

Test may be performed per powdery material produced by the drilling concrete with demolition equipment.



Fig. 10. *Alkaline concrete in all beam section*

The depth of penetration of chloride ions is determined by applying on the broken concrete a fresh solution of silver nitrate 1%.

Opalescence solution shows the presence of chloride ions in concrete.

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4. Conclusions

This study sought to outline the issues that can affect or influence the durability of a precast normal use, both those located inside and those outside of located under influence of weather.

The reinforcement protection against corrosion depends on the compactness, the quality and thickness of the coating, on the one hand and on the other hand cracking. Compactness and quality of coverage are achieved by controlling the maximum

water / cement ratio and minimum cement content.

They can be associated with a minimum strength of concrete classes.

Concrete composition affects both reinforcement and concrete strength protection to aggressive chemical attack.

Good behaviour over time from both precast concrete point of view and from the point of view of corrosion of reinforcement were favoured by high alkalinity and especially the permeability of concrete.

Ensuring durability and safety in exploited structures depends on the primary measures that reinforced concrete protection (constructive composition, concrete cover, etc.) and secondary (corrosion protection applied on concrete and reinforcement) and a design for sustainability.

Maintenance and risk of damage to the structures are permanent and very important problem of the users.

The most common cases of degradation caused by aggressive media and therefore most worrying situation in terms of sustainability and safety in operation meet the reinforced concrete structures in the chemical industry in particular.

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