Department of Mechanical Engineering and Aeronautics
Laboratory of Technology and Strength of Materials

Aggelopoulos Andreas, A.M:246495

Diploma Thesis:

"The contribution of Shot Blasting to the corrosion"

Supervisor professor : Charis Apostolopoulos

University of Patras

September 2022

1.Technological Problem: Corrosion of reinforcement affects mechanical properties and therefore the durability and functionality of reinforced concrete structures. Some of the consequences of corrosion in rebar are the loss of its mass and, by extension, the reduction of its nominal cross-section, the local development of damage which manifests itself in the form of pitting and leads to the degradation of the material, as well as the drop in its mechanical performance , which also implies a drop in its originally predicted lifetime.

2.Object of Subject: The aim of this thesis is to improve the resistance of biphasic steel class B500c against corrosion, using the shot blasting method. The method is tested on both bare and encased concrete specimens. Shot blasting appears as a promising method, as it removes any impurities and corrosion initiation from the surface of the material, without changing its chemical composition, while also achieving a lower degree of corrosion damage, both in terms of mass loss and in terms of the geometric characteristics of the stitches as well as better mechanical properties.

3.Experimental Procedure: The laboratory corrosion experiments were carried out on bare and embedded steel specimens. Some samples from each category were subjected to shot blasting, in order to remove any impurities from their outer surface, surface condensation of the steel material, a fact linked to the reduction of its corrosion rate. In order to determine the mechanical properties of the corroded samples, the samples were then subjected to mechanical tensile tests. For the purposes of this thesis, 60 samples were prepared, Φ12mm, length 480-500mm, steel class B500c.

4. Research Findings:

- **The Shot blasted specimens showed a higher corrosion resistance than the reference specimens, both in the case of bare and embedded ones.**
- **Smaller pinhole depths were recorded by the shot blasted specimens, compared to the reference specimens, which was attributed to the surface densification of the steel brought about by shot blasting.**
- **The process of applying the selected shot blasting resulted in an improvement of the mechanical behavior of the steel.**
- **The presence of air bubbles at the interface of steel and concrete favors faster penetration of the corrosive agent.**
- **The mechanical performance index Q_D of the shot blasted samples outperforms that of the bare reference samples at all exposure times.**

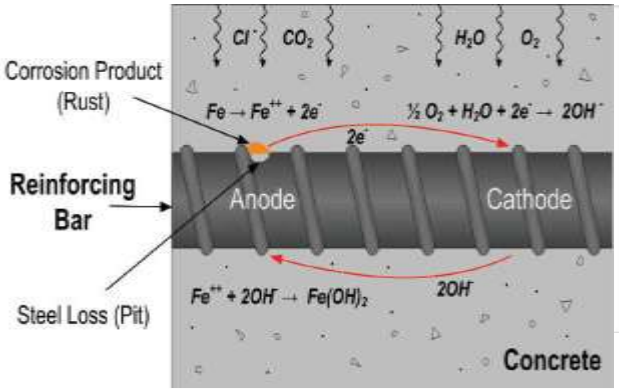

Fig.1: Representation to corrosion of steel reinforcing bar

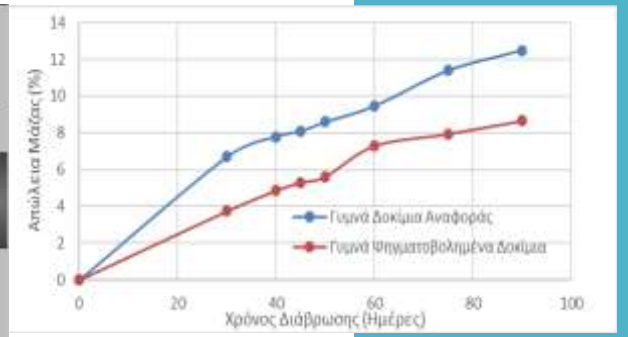

Fig.2: Diagram of mass loss (%) in relation to the time of exposure of the samples to corrosion (days) for the bare samples (reference and shot blasted).

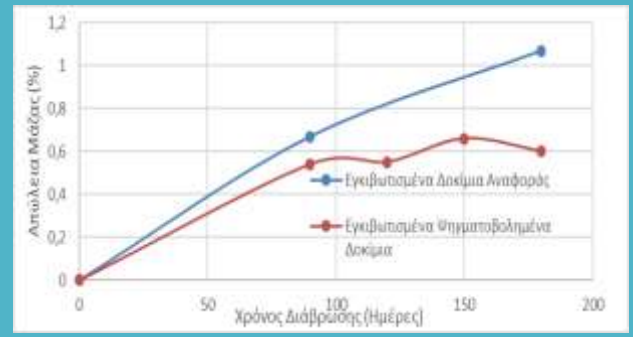

Fig.3: Diagram of mass loss (%) in relation to the time of exposure of the specimens to corrosion (days) for the encased specimens (reference and shot blasted).

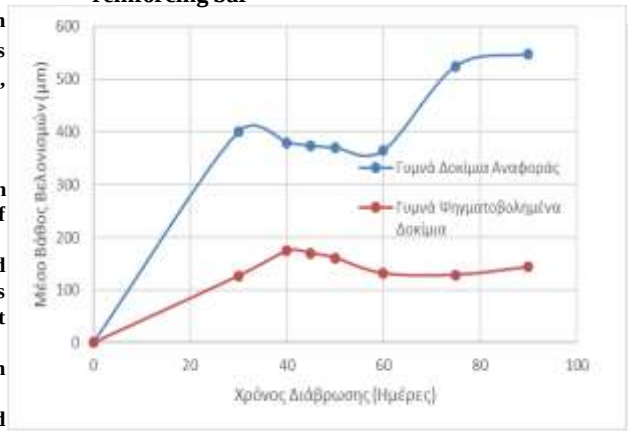

Fig.4: Diagram of average puncture depth of bare reference and shot blasted specimens.

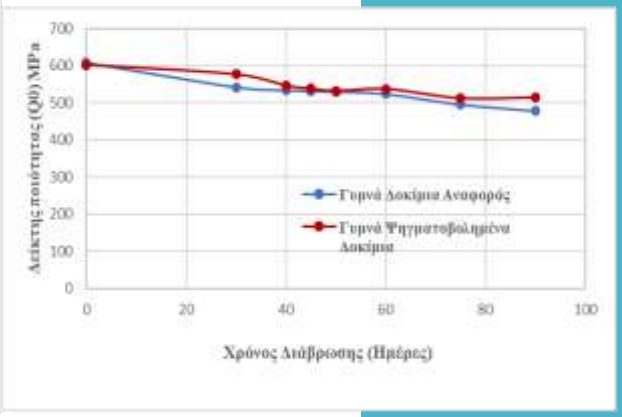

Fig.5: Change in quality index Q_0 vs corrosion time (days) for reference and shot blasted specimens.

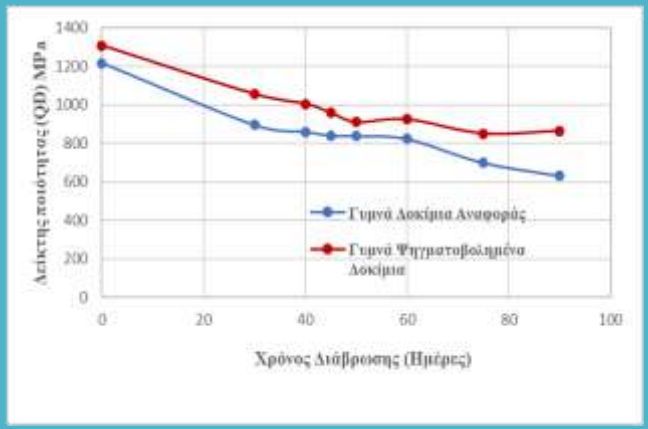

Fig.6: Change in quality index Q_D vs corrosion time (days) for reference and shot blasted specimens.