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Case study

Restoration and preservation of the reinforced concrete poles of fence at the former Auschwitz concentration and extermination camp

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ABSTRACT

The objective of this study was to assess the present state of the reinforced concrete poles of fence at the former Auschwitz I and Auschwitz II-Birkenau concentration and extermination camp. The poles were subjected to renovation about 10 years ago. After this time some deficiencies of applied renovation method were noticed. Cracks appeared between fresh and original part of concrete cover. Analysis of the reasons of these failures was performed and a modification of used restoration method was proposed to overcome this deficiency. The modification consists in application of sacrificial anodes mounted outside the pole, in soil and inside the concrete cover.

1. Introduction

Fences, consisting of concrete poles and barbed wire are a visual symbol of death camps created during World War II by Nazi Germany (Fig. 1). KL Auschwitz was the largest of the concentration and extermination camps. This memorial for the tragic events of World War II and a symbol of the Holocaust and Nazi German crimes is a warning to the world and should be preserved as intact as possible for the future generations. This area is now the Auschwitz-Birkenau State Museum, which is visited annually by over 1.5 million people from all over the world [2]. The museum consists of two distinct areas: Auschwitz I (the older part, founded in 1940) and Auschwitz II-Birkenau (founded in 1942), located at a distance of about 3 km from each other and situated in or near the town Oswiecim. The whole area of the former camp Auschwitz is ca. 200 ha. This area was surrounded and divided by a fencing system, which has been connected to the electrical high voltage and guarded by sentries on the watchtowers [13]. After more than 70 years of exposure the former concentration and extermination camps Auschwitz I and Auschwitz II-Birkenau, need assessment of the current state of buildings, ruins and other elements included in order to undertake the necessary comprehensive maintenance. In particular, this applies to the reinforced concrete poles of fences. A comprehensive and systematic approach to their renovation to prevent progressive degradation was undertaken at the end of the twentieth century [13]. As the aim was to restore them using the principles of minimum necessary intervention, they were difficult to perform and required the participation of many people with different specializations. About 3000 poles were renovated. Currently, it has been over 10 years since the completion of this work. It was decided to review the status of these poles to gather experience and possibly correct methods used. There are still poles requiring renovation (Fig. 2).

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Fig. 1. A fragment of fence and barrack in the former Auschwitz II—Birkenau.

2. Mechanism of destruction

The results of conducted study showed that the primary cause of the destruction of the reinforced concrete poles is the process of carbonation and high humidity of environment due to high levels of groundwater. As a result of these phenomena, the environment of the concrete cover becomes close to neutral, which leads to corrosion of steel reinforcement [1,4,10,5]. Because steel corrosion products occupy several times larger volume (up to 6 times [7]) than consumed steel, disintegrating stresses arise which cause cracks and the loosening of concrete cover (Fig. 3). It has been found that the presence of adverse ions (chlorides, sulfates) in the environment was minor and did not affect the degradation process.

3. Used method of restoration and preservation

There is scarcity of the repair methods of historic reinforced concrete structures damaged by carbonation inducted corrosion [8,3,15,9,6,11]. The approach selected for restoration and preservation of the reinforced concrete pillars consisted in cleaning of the exposed bare reinforcement from corrosion products using abrasive methods. Then such prepared rebar was protected with an organic coating and finally the missing concrete layer was substituted with a fresh mortar. Fig. 4 illustrates an exemplary pillar restored using the above technology. Unfortunately, after 10 years of atmospheric exposure

Fig. 2. Some poles need still renovation.