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HISTORICAL ROUTE OF THE DEFENSIVE LINES OF TORRES. THE FORTS' CONSTRUCTION TECHNIQUES AND MATERIALS

Veiga, M.R. [a], Silva, A. S. [b], Santos, A.R. [c], Tavares, M. [d.]

Laboratório Nacional de Engenharia Civil (LNEC), Portugal, rveiga@lnec.pt ([a]), ssilva@lnec.pt ([b]), arsantos@lnec.pt ([c]), marthal@lnec.pt ([d])

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Abstract

In the early nineteenth century, Portugal suffered one of the largest military offensives ever held in its territory.
The Portuguese people, with his British Allies, prepared to resist the invasion. Between 1809 and 1811, a complex defensive system was built around Lisbon, called "The Defensive Lines of Torres", which objective was to protect the Portuguese capital during the Third French Invasion. The architecture and the military strategy of this defensive system have turned into a reference of the European history, because it determines the beginning of the defeat of the Napoleonic troops.
This defensive system is composed by 152 fortifications and 85 km of length, organized by two Defensive Lines, at the North of Lisbon, connecting Tagus River to Atlantic Ocean. A vast area of military structures was implemented, including fortifications of massive dimensions, as well as small strongholds, redoubts and batteries.
These military structures had to be built very quickly, using natural resources. The material withdrawn from the ditches excavated around them – earth and stones – was often employed in the forts' construction. However, rigorous plans and selected techniques were used, in order to achieve the strong, durable structures that could be preserved for two hundred years, until nowadays.
Normally, inside the military square there was a powder magazine to store ammunitions, transverses made out of earth from the ditches to protect soldiers from the enemy fire and gun platforms where they manoeuvred the artillery pieces.
The Forts' walls were lifted using military rammed earth, together with stone and possibly agglomerated with lime. The powder magazines and, in some cases, the gun platforms were built in masonry, of stone and lime-earth mortars.
In the scope of a Project to restore the Forts and to enhance the Historical sets, the study of the construction techniques and materials is to be carried out.
Mortars' samples were extracted from four forts of the two Defensive Lines of Torres, three from powder magazines and one from a gun platform. Samples of rammed earth were also collected from several forts.
In the present paper the study of the mortars is presented. The stratigraphy of the applied mortars, their composition and physical characteristics are described and discussed. Conclusions are withdrawn concerning the military construction techniques in those difficult war conditions.