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Constructive Constraints regarding the Stabilization of Slopes near Active Railway Tracks – Case Studies

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Abstract

The stabilization of slopes near active railway tracks adds a few more constructive restraints regarding the choice and design of the subsequent stabilization methods, whether for the need to make compatible the stabilization works with the railway traffic or by need to eliminate additional risks, such as train hits or electrocution. These factors strongly influence the choice of the stabilization methods and the construction processes and phasing, with (not always clear) implication on the total cost of the contract.

In this article, it is presented some case studies, referring to recently developed stabilization works and projects, on active railway lines, looking to highlight the main associated constraints and their respective implications in terms of the prescribed solutions.

Keywords: Slope Stability, Stabilization Methods, Active Railway Tracks, Safety Risks

1 Introduction

The stabilization of slopes near active railway tracks endue great specificity, whether it is for the additional safety risks involved, both for workers and trains, or by need to make the stabilization works compatible with the railway traffic and infrastructure.

For safety purposes, when planning any sort of work near railways, it must be considered the railway traffic and the possible presence of mechanically tensioned overhead contact lines. Regarding the physical constraints, it must be assured that these elements (railway traffic and infrastructure) are duly accounted on choosing construction processes and estimating work productivity. Therefore, it is essential that designers bear these factors in mind, since they pose several implications not only on designing the stabilization solution but also on evaluating budgets and execution time.

In this article, it is highlighted the main constraints and related implications of working near active railway lines, both at designing and contracting level, based on recent stabilization works and projects.

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Hence, we start by pointing out specific risk factors related with these works and, afterwards, briefly describing the primary associated limitations.

2 Risk Factors

Regarding the Portuguese railway infrastructure, both the safety railway parameters and the respective safety measures, to which all works developed on or near active railway tracks must comply, are laid down on and regulated by "Instrução de Exploração Técnica nº 77 – IET 77" (Instituto da Mobilidade e dos Transportes Terrestres, IP, 2009).

In this chapter, we propose to resume the prescripts of this standard, summarizing the critical risk factors as well as the consequential possible safety measures.

2.1 Railway Traffic

When planning an intervention on or near an active railway track, it must be pursuit the elimination of any risk for workers or equipment of being hit by trains. According to IET 77, this risk is related to:

- The maximum design layout speed of the track in the area – the weight of this factor is related not only with the reduction on reaction time, but also with the increase on the suction effect generated by the passing train;
- The distance between workers and the element signaling approaching trains;
- The type and quantity of human and material resources associated with the works – heavy machinery will require a broader demobilization timespan;
- The nature of the intervention - this factor is deeply related with the previous, in the sense that it influences the time needed to demobilize equipment and personnel;
- The distance between the working area and the nearest safety zone.

Considering these parameters, IET 77 defines a risk zone boundary - Figure 1, inside of which there is an effective risk of being hit by a moving train. As so, one or several of the safety measures presented in Table 1 should be ensured. Table 1 also resumes the main advantages and limitations of each of these measures.

2.2 Overhead Contact Line

Another serious risk related to working on or near active railways is the risk of electrocution, considering that a great extent of the Portuguese railway network is mechanically tensioned to 25 kV - Figure 3 (the equivalent to a medium voltage power line, hanging at about 6 m from the ground).

According to IET 77, over a 2 m radius from the tensioned wire (risk zone C in Figure 1), there is a high risk of electrocution. If there is a need to overrun this risk boundary, then all works must be performed during a power break period, which is only possible when the railway traffic is suspended.

In Figure 4 the execution of micro-piles near a railway track is presented. Due to the overhead contact line's proximity, as well as the reduced available space on the embankment platform, there was the need to employ lighter machinery and, consequentially, smaller metallic reinforcement (both in diameter and in length).

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