ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 08, Issue, 07, pp.21717-21719, July, 2018

ORIGINAL RESEARCH ARTICLE OPEN ACCESS

METHOD OF EXECUTION OF THE CABLE-STAYED CURTAIN: A STUDY OF THE CONTAINMENT OF VILA SÃO BENTO IN BELO HORIZONTE

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ARTICLE INFO

Article History:
Received 11st April, 2018
Received in revised form
19th May, 2018
Accepted 26th June, 2018
Published online 30th July, 2018

Key Words:
Containers, Reinforced Curtain, Reinforced Concrete, Tie Rods.

ABSTRACT

Containment structures are structures designed to contain a mass of soil, or urban terrain, resisting buoyancy of land and water, structural loads and any other stresses induced by adjacent structures or equipment. The construction works almost always involve containment structures, which are present in projects of roads, bridges, stabilization of slopes, plumbing, sanitation, meters etc. There are several types of containment that are designed for different needs and goals, one of which is the wire curtain. The wire curtain, one of the most modern containment methods, is a reinforced concrete structure that works in conjunction with prestressed steel rods. By analyzing this structure better, it is possible to evaluate its advantages and disadvantages, to understand its execution process, and to determine for which type of work this structure is better designated. In this present research we intend to delve into the wire curtain of the São Bento village in Belo Horizonte, which is on the threshold of rupture.

Citation: ***Mateus Bravo de Aguiar and Tiago Luiz da Costa*****, 2018.** "Method of execution of the cable-stayed curtain: a study of the containment of vila são bento in belo horizonte", *International Journal of Development Research*, 8, (07), 21717-21719.

INTRODUCTION

Rolled curtains are reinforced concrete structures that work in conjunction with tie rods, which can be made up of stringers or monobarra. It is a technique that consists in the execution of a curtain of containment along with the drilling, application, injection and the protention of rods. These rods, besides being made of steel resistant to corrosion, are also covered by materials that make it difficult to deteriorate, they have long lengths and their fixation implies the use of drills. This type of containment can be of provisional character (subsolos) or definitive. Its application is recommended for cuts in lands with great load to be contained or soil that presents little resistance to its stability, are also very used in the containment of slopes and construction of subsoils. In addition, the reinforced curtain is commonly compared to stapled soil, the two techniques apply to soil reinforcement and their similarities are both conceptual and practical, however, one of the main differences is in the constructive method, since the stapled soil, in this regard, becomes more advantageous because it is considerably more economical, because it uses equipment that is lighter and more productive, and can adapt to local conditions.

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In the case of stapled soo, EHRLICH (1996) states that shear stresses and bending stresses may be significant and depend on the type of soil mass movement, slope and stiffness of the staple. In a wire curtain containment design, it is necessary to specify the extent of the reinforced concrete wall, the amount and depth of the tie rods, the free and anchored section sizes, the wall frame, the concrete strength and the cement grout. The design of the curtain will obey the needs raised in the study of the massif to be contained, determining its geometric characteristics, such as height and length. In sections of cut, the execution should, whenever possible, be placed by means of preformed plates supported by the rods and provided with waiting irons for later complementation of the curtain with filling between the shaped concrete plates "in loco" (JOPPERT JUNIOR, 2007). For good adhesion between the concrete parts of the curtain, the splice must be bevelled and the existing part must be applied. In landfills, irregular or unstable embankments that require ready concreting, concreting "in loco" part of the curtain and later executing the risers in some cases the curtain can be completely prefabricated (JOPPERT JUNIOR, 2007). The rod-to-frame attachment assembly (anchor plate, washers, shims and nuts) must be protected against corrosion by a concrete casing molded on site or made of a pre-cast housing filled with mortar or cement paste. Prior to the execution of this protection it is indicated the injection

of complementary cement of rod for total involvement of the same, after protension (JOPPERT JUNIOR, 2007). The curtains can be closed completely or with windows, the latter possible in very cohesive terrains or reinforcements of existing walls. The closed type curtain must contain drainage holes, in special cases deep drains may be necessary. (JOPPERT JUNIOR, 2007). In the case of pretensioning for pre-existing structures, it must be checked in each case whether the structure is able to withstand undamaged the protension force of the tie rod assembly. Expansion joints shall be provided for curtain sections extending over 12 m in accordance with the design detail. The rods are held straight and the loads applied to them are strictly axial, and special anchorage pieces are provided in the curtain (JOPPERT JUNIOR, 2007). These design data are dimensioned according to drillings and percussion drilling tests (SPT), which assist in the design of the rods. The geological recognition obtained through the survey is very important, since it allows to recognize if a certain type of containment is the most suitable for the enterprise that will be executed, besides the previous and future viability of knowing the behavior of the soil when receiving weight or load. The Hanging Curtains are used in road and railway works, on roads or train lines that cross saws or quite uneven reliefs. To overcome the topography, cuts are made in the terrain, and the slopes resulting from these cuts are contained by the wire-bound curtains. This containment structure is also widely adopted in landslides where there is a need to contain slopes.

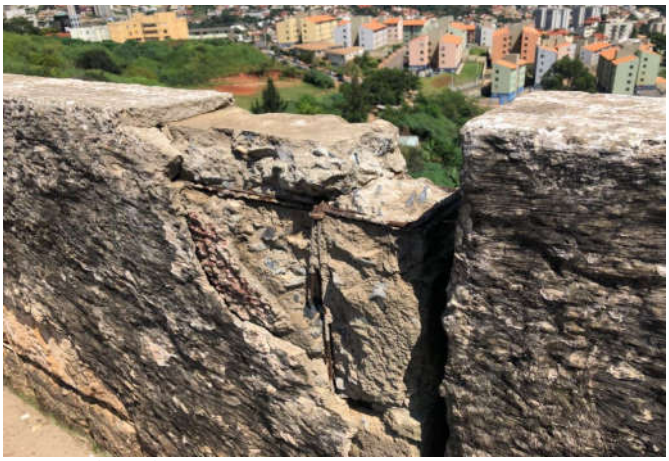
MATERIALS AND METHODS

With heavy precipitation occurring in the city of Belo Horizonte, several slopes and slopes are at imminent risk of ruin. Moreover, with the lack of planning and lack of awareness of the population, problems can be encountered in containment structures, such as the cable-stayed curtain (Figure 1) on Belo Horizonte Avenue. This containment of Belo Horizonte has an imminent risk of collapse, since the structure is deteriorating (Figure 2) due to poor execution, and the lack of geotechnical knowledge during the planning phase, generating errors that aggravated this containment. For the execution of this type of containment, the perforation of the rods is initially executed. The tie rods are linear elements capable of transmitting tensile stresses to the curtain. In the geotechnical applications of the rods, the end which lies outside the ground is the anchoring head and the end which is buried is known as the anchored portion and is called the anchoring length or bulb.

The lifter is designed considering the type of soil and the overload on it. In the case under study, the single rod was used, which is a solid metallic rebar. The diameters of the rods vary between 25 mm and 32 mm, having a slope angle of 15 degrees. The rod is accompanied by a PVC pipe with a diameter of one inch and after its insertion, the process of injecting a commotion syringe on the tie rod begins. As the injection is made the anchoring bulb forms, which region becomes the most stable of the soil and starts to fix the containment system, "pulling" the trapped curtain against the ground. The free section of the tie rod should be isolated from the cement grout injection, as this passage passes through the more unstable region of the soil, and there may be small deformation of the tie rod in place. The study rod shows 10 meters of anchoring bulb and 10 meters of free stretch. In addition to the tie rods, the sluts are also made, which are face drains to release the water. In its execution, a PVC pipe is placed inside the ground thus avoiding water retention inside the cable-stayed curtain.

Source: Author unknown, 2018.

Figure 1. Cable Curtain



Source: Author unknown, 2018.

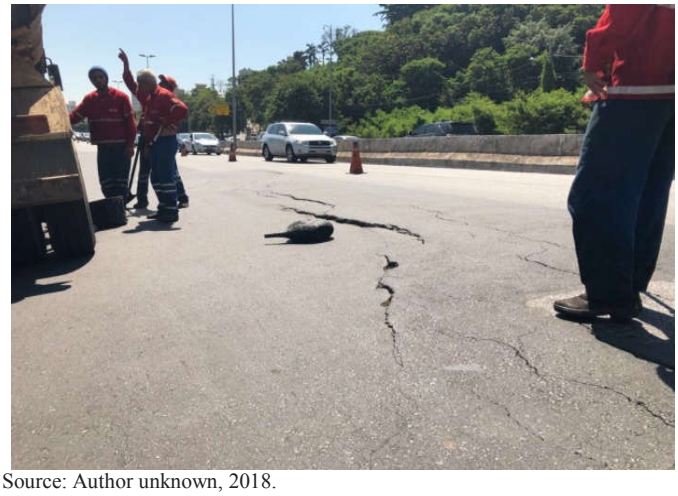
Figure 2. Stabilized curtain destabilization

Source: Photograph of local residents, 2018

Figure 3. Residences downstream of the cable-stayed curtain

After the rods and sluts are executed, the assembly of the frame and the concreting of the reinforced curtain are started. This process must be carried out according to the design, following the steel, mold and concrete considerations. Finally, it is necessary to execute the protension of the tie rods, closing the head of the tie rods. The designer in question opted for the

anchor plate instead of the anchor block. This plate is where the steel is trapped and is also responsible for transferring loads from the tie rod to the reinforced concrete curtain.



Source: Author unknown, 2018.

Figure 4. Break-point imminence of equilibrium point

The backing plate is to be executed in order to distribute the stresses in the structure and is constituted by one or more metal sheets. The wedge of degree guarantees the necessary inclination of the tie rod. Finally, the mortar helmet is a wooden mold that receives mortar, the last execution being the head of the rod and the work.

RESULTS AND DISCUSSION

The Parrot Street Curtain presents serious problems: a very large boot behind the curtain that was made during the execution period, so that the slope downstream of the curtain has acquired a greater overhead by pulling the curtain in the opposite direction (tipping). A further aggravation of the problem was the invasion by the population (Vila São Bento), where there are residences leaning against the curtain itself (Figure 3). When the tipping occurs, is when the curtain leaves its equilibrium point (Figure 4) it will be a matter of time for the final flow, where the wall will be flowing surface below once. At the time of the breaking of this wall, erosion and a rupture will occur in the form of wedge. This wedge will occupy entirely the trail of those who go up the highway and part of who descends. This wedge will have a gigantic dimension, since this wall is 12 meters high.

On the other side of the curtain there is another unstable slope with no restraint on the ascent to the Belvedere, being formed of phyllite, at the time of the shape of the wedge may have greater erosion. Inwardly the wedge of the slope may be forming, so it is necessary that the civil defense is removing the population of the place so that there are no fatalities. The tensioned curtain presented has the advantage of obtaining a longer life, with the possibility of application without the need to cut beyond what is necessary; with them it is possible to overcome great heights; does not provide high tensions at the base; its rods actively work due to the pretension, withstand efforts with a minimum of displacements of the structure being that all the rods are tested individually, which provides a certainty as to the quality of the execution. It is able to withstand high load loads, containing slopes with great heights. They can be used in a variety of situations, such as the containment of slopes or landfills and containment of rock blocks. The disadvantage is that, with the movement of the massif, the variations of temperature and the eventual infiltration of water behind the massif, the concrete can crack and cause infiltration and leakage. Concrete can also rupture due to higher loads, since the higher the load, the greater the chances of causing rupture, and it is important to note that the protension load increases with depth, in case it could be observed in the curtain under study.

Conclusion

With the study in question, it can be observed that the cable-stayed curtain as well as all other types of restraints, such as: slopes, retaining wall, stapled soil, among others, present their advantages and disadvantages. It can be concluded that this method of execution was used because it is used in situations where the stress levels are extremely high, and in places where it is desired to build a rigid and indescribable structure, emphasizing that this construction required equipment, labor and materials that have always been in accordance with current specifications and standards.

REFERENCES

Joppert Junior, I. 2007. Foundations and Containers in Buildings: Total Quality Editora PINI, São Paulo, 221p.

Ehrlich, Maurício. 2002. Mini-Course Solo Stapled. Support: ABMS - Brazilian Association of Soil Mechanics - Bahia Regional Nucleus, December.

Guimarães, Kauê Pereira. 2015. Rolled curtains: study of pathologies and their causes. 2015.

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