

SAFETY IN SERVICES OF EXCAVATION OF DITCHES

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1 INTRODUCTION AND OBJECTIVES

In the works accomplished in ditches happen, frequently, serious and fatal accidents owed mainly to landslides with consequent buried. For this, it is necessary to adopt measures to guarantee the workers' safety, taking into account, mainly, the group of efforts about the sheet pile walls (SPW).

This paper has as objective discusses and to propose safe solutions for the design and the execution of SPW in ditches destined to the installation of underground nets (water supply, telephony, gas, sewer, pluvial water, among others).

2 SOME DATA ABOUT THE ACCIDENTS IN THIS INDUSTRY

Collapse and buried are the main and more evident risks in works of opening of ditches. As noted before, for instance, mentioned by Pfeil (1987) concerning a serious accident happened in the construction of the subway of Berlin, Germany. In this case the excavations were taken to a larger depth than the programmed, arriving close to the base of vertical profiles that sustained the struts internally (the ditch had width of 21m). Like this, the bases of the vertical profiles were practically free, allowing its vertical displacement in the ascending sense, causing the fail of the struts and the consequent collapse of the SPW causing the 19 workers' death.

More recently, the paper of Gawryszewski, Mantovanini and Liung (1998) concerning the fatal accidents of the work happened in 1995 in the State of São Paulo, it points that 8.2% of those of the Industry of Construction site refer the buries.

The Ministries of the Precaution and Social Attendance (MPAS) and of the Labor and Employ (MTE) have presented the Statistical Annual of the Accidents of Work 2000 in 2002, a specific document for Occupational Safety and Health.

To know where is the danger is an important tool to plan and to supervise the work, although one cannot forget that the data do not include the workers' total universe, but, just those covered by the Insurance Accidents of the Work and with the due of jobs registered in their respective companies, as pointed in Proteção (2002).

To be aware of the consequences to take initiatives to avoid the accidents is very important, because they are very expensive. It is a bad business for companies, workers, government and society as a completely.

In the public side, the information should improve the development of public politics, especially of the areas Work, Health and Precaution. In the private field, the government believes that the numbers still reveal the knowledge of risk factors in the work little known, aiding the companies analyze it their administration politics in safety and health.

The accidents and the occupational diseases open expressive holes in the public safes. In world level, they drain for that grate, 4% of the sum of the "Gross Domestic Product" (GDP) of the nations. In Brazil, in agreement with Welfare Department (National Institute of the Social Insurance), the losses for occupational accidents and diseases corrode 2,2% of GDP, the equivalent to R\$ 23,6 billion.

Cases of buries are observed in several companies of sanitation of the country. The main reason for the occurrence of such accidents is the absence of the systems of contention of the soil. The main allegation of the contractors is that the installation of the SPW is been long, cluttering the continuity of the work and delaying the conclusion work. Evidently, this does not proceed, therefore it should not justify the absence or precariousness of safety's measures in function of economical factors and/or of production.

According to data of Proteção (2004), in the year 2000 they happened 33 deaths in Brazil in the section of sanitation, being most for buried. The work contracts between enterprises that has the main to indicate workers between then is happening in this industry systematically, in general, takes to the precarização of safety's conditions and health in the work, in fact, as it is typical in other economical sections in that this phenomenon is appearing in Brazil. The section of sanitation is considered so problematic in the country that in 2004 the Ministry Labor and Employ prioritized the inspection in this activity in 6 states of the federation, besides Federal District.

Finally, it fits to highlight that the indexes of work accidents in excavation in the industry of the building site are elevated in Brazil. According to data of INSS, as Annual previously mentioned, the economical activity of perforation and execution of destined foundations the building site was put in 14th place among the existent 560, considering frequency, gravity and costs of the work accidents in the period 1997-1999. Other data reveal that the buries is, beside falls and electrocution, among the main types of fatal work accidents happened in the Industry of Construction. There is at the country, several actions in the justice of the work against employers, engineers and masters of works making responsible them with civil and criminal laws for work accidents happened in these activities.

3 DISIGN OF THE SPW

It is known that there are a lot of uncertainties in the determination of the stiffness and resistance of the soil, because this material - differently of others as concrete, steel and wood - presents, in general, a high heterogeneity. Due to these conditions, the establishment of the safety of the structural members requests more attention, with consequent alterations of safety's coefficients. The several mechanisms of rupture of the contention should be approached, such as the general rupture, the bottom rupture, the piping and, with larger emphasis, the fail due to efforts high applicants in the members of the SPW. The displacements in the proximities of the ditch that can promote issues in the neighboring constructions are also discussed. For so much, it is necessary that the method of calculation of the contention adopted is adapted to the load and the stipulated requirements of the construction, according to Tacitano (2005).

4 CONSTRUCTIVE METHODS AND EXECUTION OF THE CONTENTIONS

The Norm 3214/78 that regulates Occupational Safety and Health of the Consolidation of the Laws of the Work (main outline of the labor legislation in Brazil), in its NR-18 - Conditions of Safety and Environment of Work in the Industry of the Construction, treats in the safety's item 18.6 in excavations, foundations and dismount of rocks. The recommendations below are based on this norm, in the Real no. 1627/97 of Spain that disposes about the establishment of safety's minimum conditions in the execution of ditches Ordain, as well as in the accumulated experience for the authors' inspection in this service type.

Besides the design aspects previously mentioned, constructive requirements should be observed so that the works of excavation of ditches if they process inside of acceptable conditions. Like this, when the depth of a ditch reaches 1.25m or plus, it is convenient to brace her, or to respect the natural slope angles; it should be avoided the accumulation of dug material and equipments close to the border of the ditches, and in the case of this not to be possible, it should be taken the precautions that impede the sliding of the walls and the fall in the ditch of such materials; as general norm, it should stay a distance of approximately half of the depth free from load and circulation of vehicles; when the depth of a ditch is same or upper to 2m should be protected their borders with a guard-body or appropriate signaling; in case of flood of ditches, it is indispensable the meticulous and detailed revision before restarting the works, should leave the water no foreseen as soon as possible to avoid the destabilization of the ditch or slope; it should be revised the state of the cuts and slopes to regular intervals in the cases in that they can receive accidental pressures of vehicles, pneumatic hammers etc.; it should be disposed of at least a portable stairway for each work team, which should pass in 1 meter the surface of the ditch; she should not install inside ditches machines worked by motors the explosion that generate gases as the carbon monoxide, unless they are provided of necessary instruments for its exhaustion; the workers that work inside ditches should be properly informed through instructions of safety of the work and of necessary measures of protection for each specific risk; the contentions should be reviewed when beginning the work day and when they happen work interruptions of more than one day or atmospheric alterations as rains; and it is recommended that the ornament of the contention passes in a small passage the border of the ditch, so that it serves as a baseboard, avoiding the fall of objects and materials in its interior.

In general, the contentions or some parts of them are removed when they stop being necessary, beginning for the below part of the cut. In every way, the procedures of filling with earth should previously be plan, being taken the same precautions of the excavation phase.

Fang (1991) alerts that should be reminded that the planner of contention structures usually has little control about the execution of work. The pressures of the soil are affected for a lot of conditions, and it is not to smallest of them the constructive method the quality of the involved manual work. If the deformations of the contention structure are not them foreseen, great pressures of soil changes can happen. Lack of appropriate inspection procedures and leadership can result in disconformities in displacement or incorrect location of certain members and inappropriate sequences of work.

5 CONCLUSIONS

The local organ of Ministry of Labor and Employ (MTE) in the São Paulo State is acting with rigidity in this section. Together with Public Prosecution Service of the Work, a Term of Adjustment of Conduct was established up between these organs and SABESB (Company of Basic Sanitation of the State of São Paulo) so that Occupational Safety and Health norms are observed in the services in ditches. The companies for her contracted they should also follow these norms.

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