REHABILITATION OF “VADU CRISULUI” RAILROAD BRIDGE PILE

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ABSTRACT

The extensive rehabilitation works of transportation infrastructure are required by the increase of the traffic intensity in respect to speed and safety issues. Moreover, important damages are developed as consequences of local instability or a landslide activity in the zone of interest. When developing projects of road rehabilitation involving the increase of the traffic lanes, the landslide risk is increased and thus mitigation measures are necessary to consider. There are active measures and passive measures, and strongly orientated to protect the risk elements against life threat and property loss. This paper presents design and rehabilitation project for Vadu Crisului railway bridge pile.

Keywords: grouting, railroad, bridge pile

INTRODUCTION

Railroad bridge of Vadu Crisului which is a part of the 300 Magistral Railroad Bucuresti – Episcopia Bihor has three spans. It is a bridge which supports the transport of citizens and goods too. Considering the fact that the bridge piles were in a advanced serviciability state and the Cris river affected the foundations of the pile, began to appear some cracks. This was very important because there was possibility to be created a danger situation about the safe of the traffic. There appeared differentiated sttlements. The execution works were made following the ST 015-1997, „Technical specification for restoration by obturation and sealing of soil-structure interaction for civil, social, cultural and industrial buildings”, which refers at the existent structures and the specific works for all structres being in sercice state.

MATERIALS AND METHODS

1. Jet-Grouting

The subsurface soils, being natural deposits, tend to introduce unexpected variability in the subsoil that is not revealed by the soil exploration or during construction [1].

There are a variety of types of piles ranging from concrete, which is cast in place (also called drilled shafts or caissons) or precast, to steel H-sections driven to sound rock [2].

Developments in jet grouting techniques in recent years gave the possibility of using it as one remedy alternative. According to, the basic concept was propounded in Japan in 1965 by the large-scale water jet being utilized in coal mine excavation [3]. However it is only since the early 1980’s that the jet grouting have approached its full economic and operational potential as ground treatment. The jet grouting can be defined according to the ASCE Geotechnical Engineering Division Committee on Grouting as a “technique utilizing a special drill bit with horizontal and vertical high speed water jets to excavate alluvial soils and produce hard impervious columns by pumping grout through the horizontal nozzles that jets and mixes with foundation material as the drill bit is withdrawn”. [4]

The success of using grout in sandy layers is approved, but it is a doubtful solution in soft clay. Some recent advances in the field of grouting for tunneling in soft clay are recorded [5].
Base grouting is the technique that is to provide cement grout injection from the bottom tip of the constructed piles. The grout material will be delivered through the installed grout pipe to the bottom of the pile where a set of Tube-a-Manchette (TAM) is installed.

The base grouting takes care of possible disturbance at the pile tip caused by the drilling operation or accumulation of bentonite sediment. The process of base grouting compresses the loosened pile tip and improves the end bearing [6].

There are many situations in which the foundation block in our case the bridge pile can suffering degradations through cracking the concrete element. The consolidation and rehabilitation of a bridge pile with cracks can be made with grout injection method. The execution phases of this technology are:

- cleaning of the cracks if they are full of soil;
- drilling a hole;
- injection with a cement water suspension.

In Figure 1 there is shown the technology of grouting, in many cases there are a lot of similarities with the classical jet-grouting method.

For the preparing of the grouting fluid it is used a mixer-shaker combination with electrical engines because of different speed necessary for the fluid injection and its quantity too. Then there is a piston pump that can deliver pressures up to 100 bar and maximum flow needs. The injection is made through a pipe fitted with nozzles with different shapes called packers.

Sometimes it is necessary to control and verify the flow and pressure injected in order not to compromise the adjacent works. Figure 3 shows the way to control and verify the injection fluid.
2. Case study

Vadu Crișului City is located in the northwestern part of Romania, in Bihor County - the eastern railway Oradea - Cluj-Napoca and E60 (DN1) Oradea - Cluj-Napoca at a distance of 50 km from Oradea 100 km from Cluj-Napoca. The village is situated at the exit from a sector Crișului narrow gorges, marking the southeastern Vad Depression „golf” between Padurea Craiului and Plopisului mountains (Figure 4).

The railroad Oradea-Cluj-Napoca is an important part of national railroads and a international railway lines too. On this railroad there is a lot of freight traffic. In figure 5 is presented the height profile of the track

The execution project was the consolidation of the railway bridge km 605 + 859, line 300 between Suncuius and Vadu Crișului stations. (Figure 6).
The existing situation of the railway bridge pile is shown in figure 7.

The rehabilitation of Vadu Crisului railway bridge was foundation repair and protection of piles with gabions, grout injections in pile II, repairing bearings with special mortar [7]. This operation of the grout injections was made in phases of execution. Execution details are shown in Figure 8.

Figure 9 shows the details for execution of self-drilling anchors R32.
The consolidation details for the injection of railway bridge pile are shown in Figure 10 with all the execution phases [8].

Fig. 9. Details for execution of self-drilling anchors

Fig. 10. Phases of injection consolidation technology
CONCLUSIONS

Rehabilitation of the constructions in general are very important for the good and safety life in order that our work must be done in the best conditions. The practice of building operations often need interventions in problems of soil-structure interaction (foundations, deep basements, underground storage tanks) due to the emergence over time deficiencies caused by either faulty initial conception or execution, or changes operation during construction.

REFERENCES

1. MORALES M.T. Ono (2004), Settlement of a light pier supported on large diameter bored piles remediated by jet grouting Proceedings : Fifth International Conference on Case Histories in Geotechnical Engineering, New York , April 13-17.
4. USAMA, A. MORSY (2002), Repair of damietta bridge foundations using micro-piles:A case study Annual Conference of the Canadian Society for Civil Engineering, Montreal, Quebec, Canada, June 5-8.
7. *** (1987), C 149-87 Technical instructions on procedures to remedy the defects of concrete and reinforced concrete elements.