

MICROPILES UMBRELLA AND GROUTING INJECTION TREATMENT IN SUBWAY TUNEL – OTTAWA LIGHT RAIL TRAIN
PROPERTY: OLRT CONSTRUCTORS
GENERAL CONTRACTOR: ELLIS DON, SNC LAVALIN, DRAGADOS CANADA JOINT VENTURE
JOB SPECIALITY: MICROPILES

INTRODUCTION

The new Confederation Line of the Ottawa Light Rail Train it's the Project reference in the infrastructures expansion with an underground urban mining tunnel of 2.5 km large who cross de Downtown of the City from West to East parallel to the Ottawa river and connecting the main activity cores of the City , helping to fluid the traffic at the surface. 3 new underground stations will permit the access to the trains.

SCOPE OF WORK

The Works of SITECANADA will focused in the drill installation and grouting of a Micropile umbrella in both portals West and East , to permit the beginning of the mining tunnel excavation, and also a grouting treatment in the front of the East tunnel where the combination of a singular geotechnical profile and soil instability made urgent the necessary improvement with a consolidation treatment.

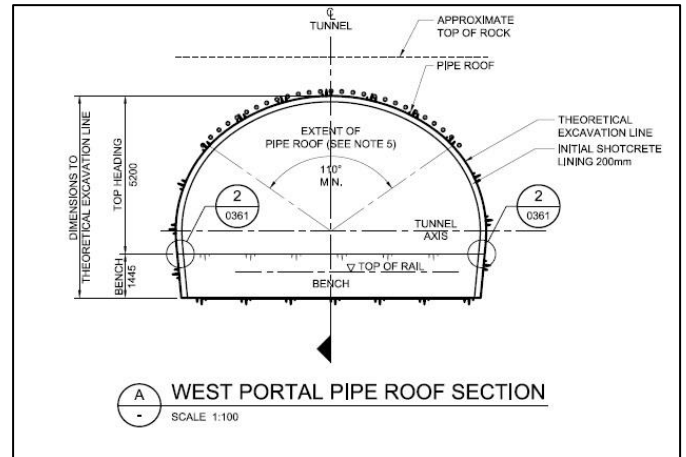


PG-115 drilling the umbrella of micropiles inside the tunnel.

The machine used as a Casagrande PG-115, made for this type of tunneling, with a range to height of around 6,5 meters, with a 18 meters mast moved with a pair of hydraulic jacks , turns very easy all the movements, like put in place of the machine, automatic change of rod bars with a carousel and all that with an improvement of precision in the orientation and elevation of each borehole.

Comacchio MC-1200 hydraulic drill rig as also used to support the drilling Works at East portal.

The work begins by the West portal when we drill limestone with medium hardness disposed in horizontal stratified strip levels with small thickness and a little bit fractured.



Umbrella of Micropiles at West Portal.

In the other hand in the East portal there are a contact between a clay soil and a limestone competent rock.

WEST PORTAL

The work begins with the drilling and installation of 27 micropiles for the tunnel starting section umbrella. The reinforcement of the this micropiles as made with 32 m large API N80 steel casing of 88.9 mm diameter.

The drilling diameter as 148 mm and has been made with 6 " DTH Hammer.

The grout used have a W/C ratio of 0.5 with a maximum pressure of 5 bar and average intake of 750 Kg of cement by drilled micropile.

EAST PORTAL

The East portal seems to be a challenge. The initial design complains only one micropile umbrella with 31 units of 26 meters long, starting in clay soils with sheet pile wall as a frontal shoring and with the possibility to find some rock soil on the shoulder of the tunnel.

After the excavation of this umbrella we need to execute a second and a third umbrella with grouting valves in advance.

Once finished the grouting through the third umbrella micropile valves, a grid of sleeve pipes has been installed before starting the excavation to support the front of the tunnel and to permit an easier and safety excavation.

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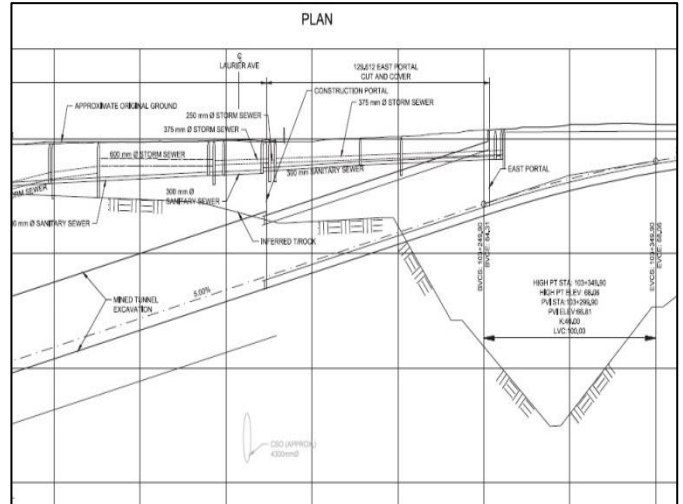
Umbrella of Micropiles at East Portal.

The reinforcement used for the micropiles as \varnothing 88.90 mm API N-80 steel pipes. The first, second and third umbrella have 26.00, 30.00 y 18.50 meters long each one.

To drill on the East portal, different tools and drilling processes has been used adapted to the different geology and specifications of the Engineering . Self drilling process with water in the clay soils. DTH Hammer in the gravels, rocks and glacial blocks. Chevrons and casing in loose soils.

The production rounds the 90 meters / day drilling with water and air pressure at the same time.

Once time finished the umbrella, SITECANADA as responsible to survey the advance of the excavation with a campaign of horizontal prospection boreholes between 25 and 30 meters nearest of the top of the tunnel to anticipate any change in geological favorable conditions.



Cross Section of the tunnel in the East Portal. It's possible to see the singularity of the Geology and the contact zone.

QUANTITIES

UMBRELLA OF MICROPILES	
2,162.00	M.L Micropiles of 148 mm drilling diameter and reinforcement with API N80 steel tube of 88.9mm diameter with Es of 500 Mpa. Equipped with grouting valves
70.79	Tn. Portland Cement grouted in umbrella installation
48.46	Tn. Portland Cement grouted in soil treatment injections with double packer trough the micropiles valves
FRONTAL TREATMENTS	
287.00	M.L Sleeve pipes drilled and installed ϕ 63 mm with valves each 0.5 m.
28.10	Tn. Portland Cement grouted in soil treatment injections with double packer trough the sleeve pipes.
20.50	M.L of destructive proof test with 86 mm diameter with grouting of ring space and / or drainage