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Estimating of soils abrasiveness along tabriz metro line 2
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Abstract

Mostly the long tunnels are excavating with tunnel boring machine (TBM).soils and rocks types are important in tunneling with TBM. one of the risks easily overlooked by engineer and contractor alike are the effects of abrasive ground on the costs and schedule of a given project. one of the important parameters in such tunneling is abrasiveness of soils and rocks on TBM cutter heads .several well acknowledged test and prognosis methods already exist for rock , however there is only very limited knowldege available to describe the abrasiveness of soil and its impact on soft ground TBMs. In addition to mineral composition , many other textural features however also influence on abrasivity . there are some methods for estimating of soils and rock abrasiveness. the important mineral of soils and rocks is quartz.

Tabriz metro line 2 tunnel, about 20 km , will be located in alluvial deposits that consist of clay particles to boulders sizes about 50 cm. quartz mineral in soils, cobbles and boulders is the main material in the deposits of this project . for soils the situation is quite different there are only very few fest methods to describe the abrasive characteristic of soils .for estimating abrasiveness of cobbles and boulders CERCHAR test and for estimating abrasiveness of sandy soils, petrography and mineralogy carried out. The CERCHAR tests are showed that the cobbles and boulders are very abrasive.

The earth pressure balance (EPB) shield method is well known in the tunneling world, but there are still unexplained processes which require more understanding. Mineralogy of sandy soils is shown the abrasive mineral (quartz) content is between 5 and 20%. Based on existence classification, the sandy soils are slightly abrasive to abrasive.

This paper will examine approaches to this problem and suggest a new approach based on current project undergoing design .and addition introduction method assigns mint abrasivation soils and rocks , study performed for introduction abrasiveness along Tabriz metro line 2 .

Keywords : *abrasiveness , TBM ,Tabriz metro ,CERCHAR test , mineralogy , NTNU test*

Introduction

The modern world we live in would be very different without these sub terranean constructions.

They are of great importance_ not just in the densely populated regions of the world.

Tunnel excavation using tunnel boring machines (TBM), has become increasingly common in recent years, despite the fact that precise evaluation of certain risks have not kept pace with the use of these machines. Risks easily.

One of the risks easily overlooked by Engineer and Contractor alike are the effects of abrasive ground on the costs and schedule of a given project.Earth pressure balance, or EPB, is a mechanized tunneling method in which spoil is admitted into the tunnel boring machine (TBM) via screw conveyer (cochlea) arrangement which allows the pressure at the face of the TBM to remain balanced without the use of slurry. This has allowed soft, wet, or unstable

ground to be tunneled with a speed and safety not previously possible.

This paper will examine approaches to this problem and suggest a new approach based on a current project undergoing design.

Discussion

Defining wear

It is said that the amount of machinery cutter heads rubbing has important roll in estimating designing and improving the time of project. By primary wear we refer to the expected wear on the excavation tools and surfaces such as drag bits, disc cutters, scrapers and buckets etc. Secondary wear, on the other hand, is an unplanned wear and occurs when the primary wear on the cutting tools described to hold or support the tools in place such as cutting head spokes or cutter mounting saddles and wear on other surfaces not anticipated by the designers and TBM manufacturers. In picture 1 illustrates the drill rubbing before and after repairing.

Abrasively of soils in TBM tunneling

While rocks effects on TBM tunneling are well known, less work has been done on soil abrasiveness and its impacts on soil abrasiveness and its impacts on soil abrasiveness and its impacts on equipment such as cutter heads. The authors describe the different parts of the TBM that can suffer damage and recommend steps to establish regular inspection and maintenance programs for soft ground TBM components. A bar chart shows different weathered granites and the disc cutter consumption associated with different ground conditioning .The authors recommend a more adjective set of measures for soil properties in order to permit TBM projects to be better managed.

Illustrates in stance of tunneling by TBM machinery

The most important factor _ not only in EPB tunneling _ is to balance the soil pressure at the cutter head by a counter pressure in the working chamber. To calculate the necessary counter pressure, various face support calculation programs are given, depending also on the soil type in situ .Why using soil condition in EPB tunneling To build up the necessary face support pressure, the soil has to be impermeable against air. Three main closed mode tunneling techniques were developed out of these principle demand:

Air pressure TBM

It is possible to work by air pressure, when the soil itself is nearly impermeable against the air.

Slurry TBM

The working chamber is filled with a betonies suspension, a big air bubble in the top of the working chamber controls the support pressure

EPB TBM

The working chamber is filled with the original soil , the turning cutter head is responsible for creating a homogeneous and impermeable soil paste. To obtain this soil paste, conditioning additives have to be used in most cases _ according to the soil type in situ. Sometimes only water is sufficient, more common is the use of Foam to create a pasty soil and to introduce a certain amount of air to obtain the necessary face support pressure.

The earth pressure balance tunnel boring machine or EPB consists of a cutting chamber located behind the cutter head. This chamber is used to mix the soil + water + foam. It is maintained under pressure by the mucking system. The system consists of a screw conveyor whose speed is controlled so that constant pressure inside the chamber is guaranteed. The material exits the screw conveyor via hatch that can be closed when the TBM is shut down. In TABRIZ metro line 2 EPB methods couldn't results acetyl so we couldn't use this method in vast scale.

Methods of discussion wearing TBM cutter heads

Foam the foam used is surface _ active product (like liquid soap) mixed with water, then with compressed air, in order to obtain micro bubbles of air surrounded by a fine, biodegradable and not readily washable membrane. The mixture resembles shaving cream. When mixed with the excavated soil, the product has the same properties as Bentonitic slurry. It is cased that soil became soft then the amount of TBM tunneling rubbing will decrease with becoming soft of soil

Determine experiments of rubbing in rock and soils.

Vickers test Hardness is a characteristic of a solid material expressing its resistance to permanent deformation. Hardness can be measured on the MOHS scale or various other scales. Some of the other scales used for indentation hardness in engineering—Rockwell, Vickers, and Brielle—can be compared using practical conversion tables. It is important to note that hardness of a material to deformation is dependent on its micro durability or small-scale shear modulus in any direction, not to any rigidity or stiffness properties such as its bulk modulus. Scientists and journalists often confuse stiffness for hardness, and spuriously report materials that are not actually harder than diamond because the anisotropy of their solid cells compromise hardness in other dimensions, resulting in a material prone to spelling and flaking in squeamish or acicular habits in that dimension (e.g. osmium is stiffer than diamond but only as hard as quartz). In other words, a claimed hard material should have similar hardness characteristics at any location on its surface.

MOHS division which illustrated in one table.

Scratch hardness

In mineralogy, hardness commonly refers to a material's ability to penetrate softer materials. An object made of a hard material will scratch an object made of a softer material. Scratch hardness is usually measured on the MOHS scale of mineral hardness. One tool to make this measurement is the accelerometer. In following you can observe some of results obtained from lithotomic studies and the determination of quartz percentage over floating rocks in alluvial deposition.

In stance depth: 10-22 meter

Stone name: conglomerate

Crush _conglomerate to bolder seem 5-7 mm carbonate segmented casing. Average amount quartz 25-30 present .pitcher 2 illustrate the microscopy profile.

CERCHAR abrasiveness test. In the CERCHAR test, a sharp steel indenter (hardness of 200 kg/mm²) of 90° cone angle is applied to the surface of a rock specimen with static force of 70

N. The steel point is then slowly moved on 10mm. this procedure is repeated five times in various direction son the rock surface, always using a fresh steel tip.

The abrasivity of the rock is obtained by measuring with a microscope the resulting wear flat on the steel cone. The unit of abrasivity is defined as a wear flat of 0.1 mm diameter .Picture 4symbolic design from CERCHAR test machine.

LCPC abrasivity

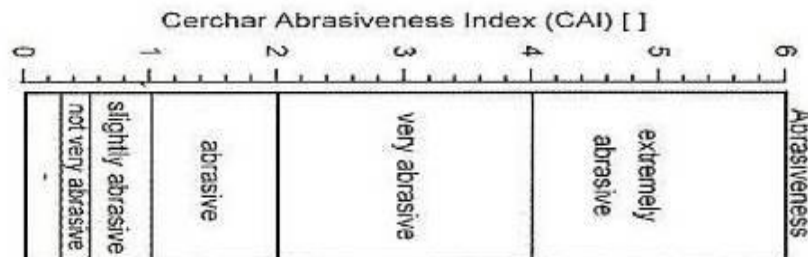
The abrasivity test of the laboratories des points et chaussées consists in measuring the weight loss of a steel plate rotating at 4500rpm for 5 minutes in 500g of rock which was previously crushed pieces of 4_6.3 mm diameter. The metal plate (25*20*5) presents a ROCK well hardness B 60_75.in the pincher 3 show symbolic LCPC test.

Conclusion:

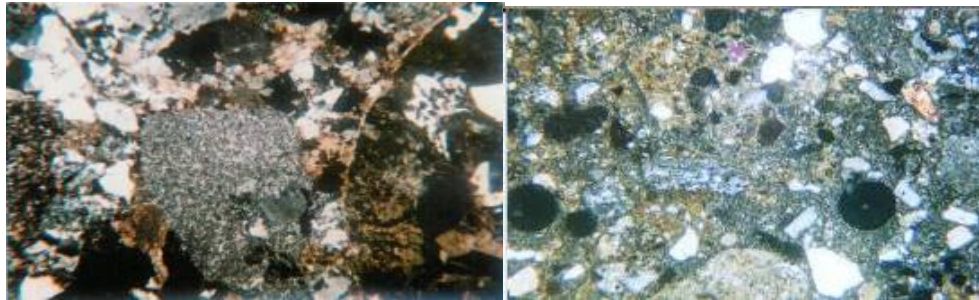
Sandy deposits of line 2 TABRIZ metro containing plenty of stone, boulders which comprising of rubbing potentiality over cutter heads implements. Thesevolcano derived from Sahand mountains and are igneous. in addition to we can utter that they are arranged in very rubbing part of tunneling in TBM machinery. this mineral are one of the hardstand the most rubbing of sandy soils in case of studding quartz the amount of quartz in soils is estimated between 5-25 percent. To decrease amount of rubbing in this cutting implements we can use FOAM specially in residential regions we use from .and recently with using of covering from artis _rubbing sheets over cuter heads and also with altering of cutting angle the amount of rubbing can be decreased .

table1:Classification of minerals occur according mohs

DIYAMOND	CRONDOM	TOPAZ	QAUARTZ	ORTOZ	APATIT	FLUORITE	CALSIT	GYPSE	TALK
10	9	8	7	6	5	4	3	2	1



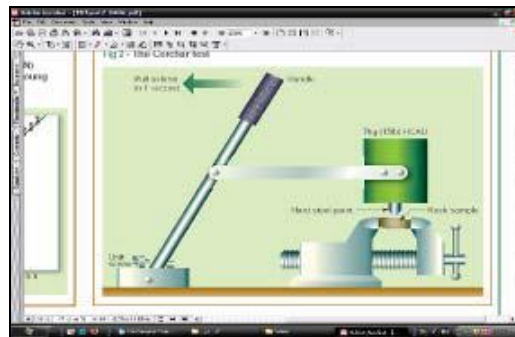
Picther1: The amount of rubbing can be decreased



Pitcher 2: with carbonate cement the 10 depth boring



Picher4: Symbolic design LCPCtest



picher3: Symbolic design from cerchar test

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