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DETERMINATION OF SOIL DEFORMATION MODULUS USING THE STATIC AND DYNAMIC CIRCULAR PLATE LOAD TEST[***]

Abstract

The increase in mining activity in the Bor basin in recent years has also required the construction of new mining facilities. The construction of numerous embankments and dams, as parts of these facilities, required a constant control of compaction the coarse-grained and fine-grained materials from which they were built. The compaction check was performed using the static and dynamic circular plate test. The results of measurement and correlation of static and dynamic deformation modulus for multiple types of materials, used during construction, are presented.

Keywords: *circular plate test, deformation modulus, mining facilities*

1 INTRODUCTION

In situ geomechanical tests include checking the deformation modulus with a static and dynamic circular plate. Verification of the achieved compaction on the construction site is done in accordance to the technical specifications of the works, and it is based on the individual tests at a certain distance, certain area or depending on the amount of installed material. Standard tests of soil compaction, based on domestic technical regulations, are carried out according to the standard SRPS U.B1.046: 1968. Standard tests of soil compaction, on the basis of domestic technical regulations, are carried out according to the standard SRPS U.B1.046: 1968, which determines the static modulus of soil elasticity M_s. For this method of testing, it is necessary to provide a massive counter load for the load on plate, which significantly complicates the performance of experiment itself. In domestic practice, a non-standardized experiment with a dynamic circular plate (with a free-falling weight) has been used lately. A dynamic deformation modulus was obtained (E_{vd}) as a test result. The advantage of this method is on mobility of the testing device, and access to all parts of the facilities, as well as the fast measurement without the need for counterweight.

2 FIELD INVESTIGATIONS

In the field, at the locations planned for the construction of buildings, embankments or hydro-technical facilities, the tests were performed first with a static circular plate (Figure 1), and then a compaction control, on the same material, was

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tested by the multiple dynamic circular plate tests (Figure 2).

The largest number of measurements was performed on the coarse-grained soil composed of crushed andesite, as the most dominant by-product of mining. The second tested embankment material consisted of a mixture of dusty-clay material and crushed stone, suitable for the construction of embankments, and can be found in the large quantities in near-surface parts of the terrain around Bor.

Figure 1 *Performing a test using the static load plate*

Figure 2 *Performing a dynamic plate load test (light falling weight device)*

3 CORRELATIONS OF THE TEST RESULTS

Recommended correlations relationships, according to the Austrian regulation, of dynamic (E_{vd}) and static (M_s) soil modulus, which can be used for different types of materials, are as follows:

- Cohesive soils
  $E_{vd} \leq 30$ MPa – $M_s = 1{,}75(E_{vd} - 10)$
- Granular soils
  – $E_{vd} \leq 30$ MPa – $M_s = 1{,}16E_{vd}$
  – $E_{vd} > 30$ MPa – $M_s =$
  $1{,}42\ (E_{vd} - 30) + 35$

Simultaneously with the tests of determining the modulus of soil elasticity for the most commonly used materials that were installed, the correlations, shown in Figure 3 and Figure 4, were obtained. Tests were performed for a wide range of required compaction conditions and construction stages.

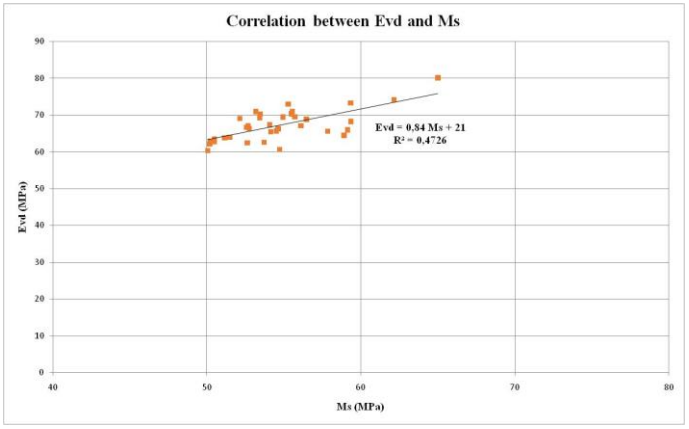

Figure 3 *E_{vd} - M_s correlations for crushed andesite material*

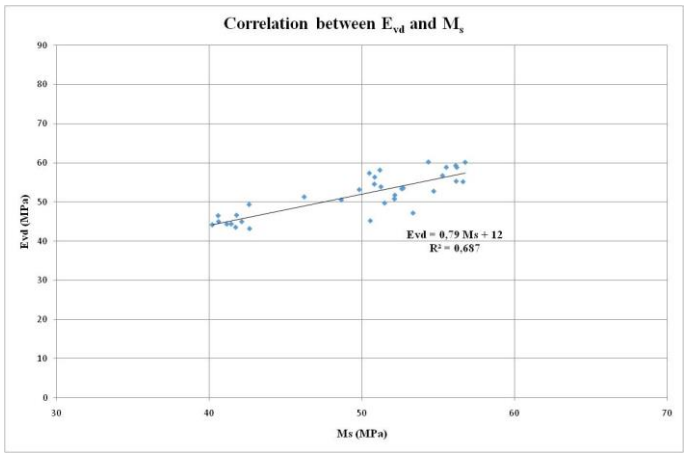

Figure 4 *E_{vd} - M_s correlations for mixed clay-stone material*

4 CONCLUSION

A large number of simultaneous measurements, i.e. checks of compaction the static and dynamic modulus of elasticity, were carried out on the most common materials used in construction the new mining facilities in Bor and its surroundings. The results of these parallel experiments and correlations of the obtained values for E_{vd} and M_s, can be considered sufficiently competent for these materials in further checking the compaction of these materials, because their use for similar purposes will continue in the future, and geomechanical practice will in the future strive to standardize the method with light falling weight device.

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