A Model between Dynamic and Static Moduli of Limestone in Asmari Geological Formation based on Laboratory and In-situ Tests

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Extended Abstract

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Introduction

It is very important to have knowledge on the rock deformation modulus when designing geotechnical structures and modeling oil reservoirs. In general, there are two destructive or static and non-destructive or dynamic methods for determining the rock deformation modulus, but considering the time and cost of destructive methods proportionate to the depth, it is more common to make use of non-destructive approaches. The outcrops of Asmari Formation are widely spread in the west and southwest of Iran, and many engineering projects have been constructed or are being studied on this formation. Therefore, it is of great importance to study on the geomechanical characteristics of this formation. Presentation of empirical relations regarding the relationship between static and dynamic moduli, with respect to the studies carried out in other parts of the world and the dispersion and independence of studies done on Asmari Formation due to its large extent on one hand and the importance of this formation in terms of oil and development civil projects on the other hand, necessitate presenting a comprehensive criterion resulted from all studies carried out on Asmari Formation which can express the relationship between the static and

dynamic moduli. This paper represents the relationship between the dynamic and static moduli of the site using the moduli obtained by the down-hole geophysical method and the static moduli obtained by the intact rock test results of Ghalajeh tunnel located in Asmari Formation in Ilam province. Then, a comprehensive relation is presented to express the relationship between static and dynamic modulus by studying the previous researches and criteria on this formation.

Material and methods

Two sets of tests were conducted to determine the relationship between static and dynamic moduli in the Ghalajeh tunnel. First, a uniaxial compression strength test was performed on 13 cores taken from three boreholes to compute the elasticity modulus in accordance with ISRM standard. Then, down-hole test was conducted on two boreholes such that to determine the dynamic modulus using compressive and shear wave velocities. Seismographic apparatus of ABEM RAS 24 as well as three-component down-hole geophones were utilized in order to plot the seismic profile. After the performing the tests, the dynamic modulus of deformation was calculated using the velocity of P-waves and the density of the host rock.

Discussion and Conclusions

By conducting in-situ static and dynamic laboratory tests on Ghalajeh Tunnel project and determining the values of the static and dynamic deformation moduli, a relation was presented between them. Then, taking into consideration the previous models studied in Asmari Formation, a comprehensive criterion was presented for wider use in the mentioned formation. Given the root mean square error (*RMSE*) and variance account for (*VAF*), the values predicted using the proposed comprehensive model have acceptable accuracy. In the interim, the correction factor between dynamic and static moduli in Asmari Formation was between 0.8 and 2.4. The results show that, in general, the relationship between static and dynamic moduli is linear up to a certain range (static modulus of 100 *MPa*) and then it has a power trend.

Keywords: Static modulus, Dynamic modulus, Asmari formation, Ghalajeh tunnel

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