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ERRATA for *Technical Manual for Design and Construction of Road Tunnels—Civil Elements*, 2010 Edition

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Dear Customer:

Recently, we were made aware of some technical revisions that need to be applied to the *Technical Manual for Design and Construction of Road Tunnels—Civil Elements,* 2010 edition.

The full errata can be downloaded from AASHTO's online bookstore at:

http://downloads.transportation.org/DCRT-1-Errata.pdf

AASHTO staff sincerely apologizes for any inconvenience to our readers.

Page	Existing Text	Corrected Text
Chapter 6		
6-13	Table 6.3.6-1 header in Column 1 reads: Rock Mass Deformation Modulus (MPa)	Revise text to read: Rock Mass Deformation Modulus (GPa, unless otherwise noted)
6-13	Table 6.3.6-1 ** table note reads: ** *D* is a factor that depends upon the degree of disturbance due to blast damage and stress relaxation. It varies from 0 for undisturbed in situ rock masses to 1 for very disturbed rock masses. Guidelines for the selection of *D* are presented in Table 6.3.6-2.	Insert new sentence to read: ** *D* is a factor that depends upon the degree of disturbance due to blast damage and stress relaxation. It varies from 0 for undisturbed in situ rock masses to 1 for very disturbed rock masses. Guidelines for the selection of *D* are presented in Table 6.3.6-2. The equation calculates E_m in MPa, instead of GPa.
6-13	The equation on the second row in Table 6.3.6-1 reads: $E_m = 15\log_{10} Q$	Revise equation to read: $E_m = 25\log_{10} Q$
6-13	The equation on the third row in Table 6.3.6-1 reads: $E_m = \sqrt{\frac{\sigma_{ci}}{100} \times 10^{\frac{GSI-10}{40}}}^{\,*}$	Revise equation to read: $E_m = \sqrt{\frac{\sigma_{ci}}{100}} \times 10^{\frac{GSI-10}{40}\,*}$
6-13	The equation on the fourth row in Table 6.3.6-1 reads: $E_m = 100000\left[\frac{1-D/2}{1+e^{((75+25D-GSI)/11)}}\right]^{**}$	Revise equation to read: $E_m = 100000\left[\frac{1-D/2}{1+e^{((75+25D-GSI)/11)}}\right]^{**}$ (MPa)

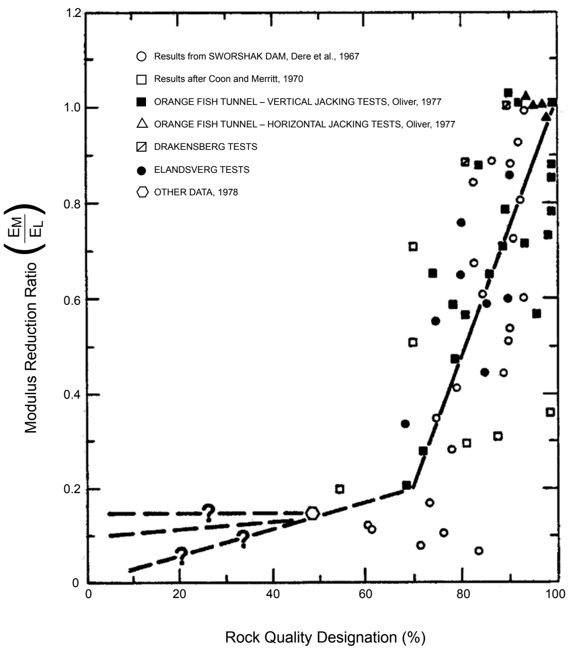


Figure 6.3.6-1—Correlation between RQD and Modulus Ratio (Bieniawski, 1984)

Based on back analyses of a number of case histories, several methods have been propounded to evaluate the in situ rock mass deformation modulus based on rock mass classification. The methods are summarized in Table 6.3.6-1.

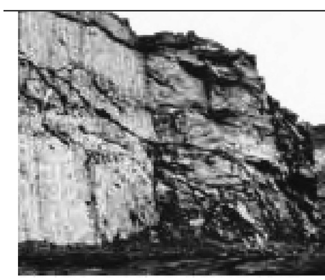
Table 6.3.6-1—Estimation of Rock Mass Deformation Modulus Using Rock Mass Classification

Rock Mass Deformation Modulus (GPa, unless otherwise noted)	Reference
$E_m = 10^{\frac{RMR-10}{40}}$	Serafin and Pereira (1983)
$E_m = 25\log_{10} Q$	Barton et al. (1980), Grimstad and Barton (1993)
$E_m = \sqrt{\frac{\sigma_{ci}}{100}} \times 10^{\frac{GSI-10^{*}}{40}}$	Hoek and Brown (1997)
$E_m = 100000\left[\frac{1-D/2}{1+e^{((75+25D-GSI)/11)}}\right]^{**}$ (MPa)	Hoek and Diederichs (2006)
$E_m = 2RMR - 100$ for $RMR \geq 50$	Bieniawski (1978)
$E_m = E_i/100\left[0.0028RMR^2 + 0.9\exp(RMR/22.82)\right],\ E_i = 50GPa$	Nicholson and Bieniawski (1990)
$E_m = 0.1(RMR/10)^3$	Read et al. (1999)

* *GSI* represents Geological Strength Index. The value of *GSI* ranges from 10, for extremely poor rock mass, to 100, for intact rock. ($GSI = RMR_{76} = RMR_{89} - 5 = 9\text{Log}_e Q + 44$).

** *D* is a factor that depends upon the degree of disturbance due to blast damage and stress relaxation. It varies from 0 for undisturbed in situ rock masses to 1 for very disturbed rock masses. Guidelines for the selection of *D* are presented in Table 6.3.6-2. The equation calculates E_m in MPa, instead of GPa.

Table 6.3.6-2—Estimation of Disturbance Factor, *D*

Appearance	Description of Rock Mass	Suggested Value
	Excellent quality-controlled blasting or excavation by TBM results in minimal disturbance to the confined rock mass surrounding a tunnel.	D = 0
	Mechanical or hand excavation in poor quality rock masses (no blasting) results in minimal disturbance to the surrounding rock mass. Where squeezing problems result in significant floor heave, disturbance can be severe unless a temporary invert, as illustrated in Column 1, is placed.	D = 0 D = 0.5 No invert
	Very poor quality blasting in a hard rock tunnel results in severe local damage, extending 2 or 3 m, in the surrounding rock mass.	D = 0.8
	Small-scale blasting in civil engineering slopes results in modest rock mass damage, particularly if controlled blasting is used as illustrated in Column 1. However, stress relief results in some disturbance.	D = 0.7 Good blasting D = 1.0 Poor blasting
	Very large open-pit mine slopes suffer significant disturbance due to heavy production blasting and also due to stress relief from overburden removal. In some softer rocks excavation can be carried out by ripping and dozing, and the degree of damage to the slope is less.	D = 1.0 Production blasting D = 0.7 Mechanical excavation