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Test Methods of Rock for Highway

Engineering

公路工程岩石试验规程

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**PROFESSIONAL STANDARD OF
THE PEOPLE'S REPUBLIC OF CHINA**

**Test Methods of Rock for Highway
Engineering**

JTG E41-2005

**Chief development department: CCC Second Highway Consultants
Co., Ltd.**

**Approval Department: the Ministry of Communications of the
People's Republic of China**

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Announcement of issuing "Test Methods of Cement and Concrete for Highway Engineering" (JTG E 30 - 2005), "Test Methods of Rock for Highway Engineering" (JTG E 41- 2005), "Test Methods of Aggregate for Highway Engineering" (JTG E42- 2005)

"Test Methods of Cement and Concrete for Highway Engineering" (JTG E 30 - 2005), "Test Methods of Rock for Highway Engineering" (JTG E 41- 2005), and "Test Methods of Aggregate for Highway Engineering" (JTG E42- 2005) were issued and implemented from August 1, 2005. "Testing Methods of Concrete for Highway Engineering" (JTJ 053- 94), "Test Methods of Stone Material for Highway Engineering" (JTJ 054-94) and "Test Methods of Aggregate for Highway Engineering" (JTJ 058 - 2000) shall be abolished simultaneously.

"Test Methods of Cement and Concrete for Highway Engineering" (JTG E 30 - 2005) and "Test Methods of Aggregate for Highway Engineering" (JTG E 42 - 2005) were prepared by Ministry of Communications Highway Scientific Research Institute and "Test Methods of Rock for Highway Engineering " (JTG E41- 2005) was prepared by CCC Second Highway Consultants Co., Ltd. right of management and right to interpret of this specification is reserved by the Ministry of Communications and chief development departments are responsible for specific explanation and management.

Organizations concerned are encouraged to collect information and generalize experience in practice to timely find problems and propose revision suggestion in the written form.

Chief development departments of specification (Ministry of Communications Highway Scientific Research Institute, Address: No. 8, West Tucheng Road, Hai Dian District, Beijing; Post Code: 100088; CCC Second Highway Consultants Co., Ltd., Address: No. 498 Yingwu Road, Hanyang District Wuhan; Post Code: 430052), could be used as reference for revision.

Hereby announced

Ministry of Communications of the People's Republic of China

March 3, 2005

Contents

1	General Provisions	1
2	Terms and Symbols	1
2.1	Terms	1
2.2	Symbols	2
3	Physical Property Tests.....	2
T 0201-1994	Simple Petrologic Authentication	3
T 0202-2005	Water Content Test.....	4
T 0203-2005	Density Test	5
T 0204-2005	Bulk Density Test.....	7
T0205-2005	Water Absorption Test.....	10
T0206-2005	Expansion Test.....	12
T0207-2005	Slake Durability Test.....	16
4	Mechanical Property Test	17
T0221-2005	Uniaxial Compressive Strength Test	18
T0222-2005	Uniaxial Compressive Deformation Test	19
T0223-1994	Tensile Splitting Strength Test	22
T0224- 2005	Shear Strength (Straight Snips) Test	23
T0225-1994	Point Resistance Test.....	27
T0226-1994	Rupture strength test	32
5	Long Duration Test.....	34
T0241-1994	Freezing test	34
T0242-1994	Solidness test	35

Foreword

"Test Methods of Stone Material for Highway Engineering" (JTJ 054 - 94) (hereinafter referred to as the original "Specification") was extensively used in highway construction of China and played an important part. Over the years, infrastructure construction of highways are enlarged in scale and geological problems of the highway engineering encountered become more and more complex, so testing technology of geotechnical engineering is needed to be further improved and developed. Reasonably select and use rocks by scientifically testing and evaluating the quality and technical parameters of rocks and looking inside of the mechanical behavior of rocks in complex environment to ensure safe, economical and reasonable engineering.

Highway engineering closely relates with geotechnical engineering, because highway engineering is built on or in the rock-soil or use soil or rock as building materials. But the original "Specification" mainly concerns rock as the building material, the technical property of stones as the building material could be obtained through "Test Methods of Aggregate for Highway Engineering". Internal physical and mechanical properties of the rock to be tested shall be main content of this "Specification", so the original "Specification" is changed by "Test Methods of Rock for Highway Engineering" to meet requirements of highway construction development.

"Test Methods of Rock for Highway Engineering" mainly has two functions: firstly provides parameters and information for engineering geological evaluation in the design stage of exploration survey and subgrade basic design of every kind of engineering; secondly provide criterion for selection of qualified stone used for the solid project in the construction stage. In this revision, the engineering properties of rock mass shall be determined by testing physical and mechanical properties of rocks and carry out on-site test as the condition is ripe.

The main revised contents:

- In the bulk density test, quantity accumulating method and parameter calculation of the percentage of porosity are added; delete the content of percentage of porosity test listed in the original "Specification".
- in the test of water absorption, water absorption test and water absorption under saturated test are put together and difference of the water-absorbed condition is emphasized.
- In the test of uniaxial compressive strength, add mechanical property tests for cylinder specimens with height-diameter ratio of 2 and 70mm× 70mm× 70mm cube specimens and test and parameter calculation of the softening coefficients.
- Simplify 3 methods used for rock "compression resistant static modulus of elasticity test".
- The test method of shear strength of rock is changed from adjustable angle plate shearing into straight shearing.
- Includes rock expansion test and slake durability test.
- Deletes abrasion tests, which appear in "Test Methods of Aggregate for Highway Engineering".
- Deletes technical standards of stones for highway engineering.

CCC Second Highway Consultants Co., Ltd. is responsible for explanation of this regulation. Organizations concerned are encouraged to generalize experience in use and any complaints and suggestion could be delivered to CCC Second Highway Consultants Co., Ltd. by letter; address: No. 498 Yingwu Road, Hanyang District Wuhan; Post Code: 430052; Tel., Fax:

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1 General Provisions

1.0.1 This regulation is prepared to unify the test methods of rocks for highway engineering

1.0.2 This standard is applicable to rock test for engineering of subgrades, pavements, bridges and culverts and tunnels in highway engineering.

1.0.3 Instruments used for test in this regulation shall be proved as qualified by relevant national detection mechanisms and meet requirements in this regulation.

1.0.4 Test subject of rock shall have geological representatives and test content, test methods and technical specifications shall meet basic requirements and characteristics of exploration survey, design and construction of the highway engineering. Test for stress and deformation of rock mass shall be carried out according to relevant current national standards.

2 Terms and Symbols

2.1 Terms

2.1.1 Rock

Mineral assemblage formed in a certain mode with all kinds of geological actions and it is main substance to make up lithosphere and mantle of the earth.

2.1.2 Water content

It is the ratio between the water of rock sample lost in baking to the constant quantity at 105 ~ 110 and the dry quality of the specimen and the ratio is represented by percentage.

2.1.3 Density

Under specified conditions, quality of the unit volume of the dried mineral matter (excluding volume of open and closed voids).

2.1.4 Gross volume density

Under specified condition, the mass of the dried rock including unit volume solid material in the pore.

2.1.5 Percentage of porosity

The percentage of the rock pore bulk to the bulk volume of rock (including pore volumes)

2.1.6 Water absorption

Under specified conditions, the ratio between the maximum water absorption quality of the rock sample and the quality of the dried rock specimen and it shall be represented by percentage.

2.1.7 Water absorption under saturated

On the constraining condition, the ratio between the maximum water absorption quality of the rock sample and the quality of the dried rock specimen and it shall be represented by percentage.

2.1.8 Softening coefficient

The ratio between the uniaxial compressive strength in the saturation state and the uniaxial compressive strength in the dry state of specimens

2.1.9 Uniaxial compressive strength

The ultimate stress for rock specimens to keep from damage, while resisting the single-axle pressure

2.1.10 Modulus of elasticity

The ratio between stress and strain of rock specimens within the elastic limit

2.1.11 Poisson's ratio

The ratio between the transverse strain and longitudinal strain of rock specimens under axial force

2.1.12 Splitting strength

The maximum crushing stress bore by rock specimens, which are pressed by symmetrical and uniform vertical axial pressure

2.1.13 Shearing strength

The ultimate shearing stress of rock specimens on the shear plane

2.1.14 Point loading strength index

The applied load rock specimens at the time of compression fracture in the point load test divided by the quadrate of space between two coneheads

2.1.15 Folding strength

The ultimate flexural capacity of rock specimens generated from flexural to fracture

2.1.16 Frost resistance

At the saturation state, the performance of repeat freezing and thaw resistance of rock samples

2.2 Symbols

Symbols	Meaning	symbols	Meaning	
w	Water ratio	n	Percentage of porosity	
m	Specimen (or sample) mass	w _a	Water absorption	
V	Sample piece volume	w _{sa}	Water absorption under saturated	
A	Specimen area	K _w	Water saturation coefficient	
H(h)	Specimen height (thickness)	V _H	Axial free expansion ratio	
ρ_t	Density (grain density)	V _D	Radial free expansion ratio	
ρ_0	Bulk volume (block) density	Natural density	V _{HP}	Sidewise restraint expansion ratio
ρ_s		Saturated density	P _s	Swelling pressure
ρ_d		Dry density	I _d	Disintegration-proof index
R	Uniaxial compressive strength	φ	friction angle	
K _p	Softening coefficient	I _s	Uncorrected point loading strength index	
E	Elastic modulus	I _{s(50)}	Corrected point loading strength index	
μ	Poisson's ratio	I _{a(50)}	Anisotropic index of point resistance	
σ_t	Splitting strength	R _b	Rupture strength	
τ	Take shear stress	L	Weight loss rate of freeze thawing	
σ	Direct stress	K _f	Freeze thawing coefficient	
\mathcal{E}	Strain	Q	Weight loss rate of sodium sulfate soaking	
c	Cohesion force			

3 Physical Property Tests

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