UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

TECHNICAL LETTER: AREA-12 - 4

AVERAGE PHYSICAL PROPERTIES OF TUFF IN THE VICINITY OF GROUND ZERO, U12g.01 TUNNEL, NEVADA TEST SITE, NYE COUNTY, NEVADA

By

W. L. Emerick, R. P. Snyder,
and D. L. Hoover

January 11, 1963

These data are preliminary and should not be quoted without permission.

Prepared by the Geological Survey for the U. S. Atomic Energy Commission.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Federal Center, Denver 25, Colorado

Technical Letter
Area-12 - 4
January 11, 1963

Mr. James E. Reeves, Manager
Nevada Operations Office
U.S. Atomic Energy Commission
P. O. Box 1676
Las Vegas, Nevada

Dear Mr. Reeves:

Transmitted herewith are two copies of:

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Sincerely yours,

F. N. Houser
Program Supervisor
Nevada Test Site

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Introduction

Two previous Technical Letters on the U12g.01 tunnel, Technical Letter: Area-12 - 1, and Technical Letter: Area-12 - 1, Supplement 1, gave brief summaries of the geology; descriptive data on the tunnel; X-ray, chemical, and semiquantitative spectrographic analyses; and physical properties determinations of samples collected in the U12g.01 tunnel and ground zero area.

Physical Properties

Table 1 of this report gives the average physical, elastic, sonic, and magnetic properties of the tuffs from the base of Tunnel Bed 3 upward to the surface of Rainier Mesa. The physical properties averages on the table were compiled from sample data of the various lithologic units and subunits obtained from tunnels U12g, U12e, U12b, and U12p, drill holes, and outcrops, and were presented primarily to represent the lithologic environment in the U12g.01 tunnel. The average figures shown in

Table 1.--Average physical properties of tuff overlying, underlying, and at ground zero, U12g.01 tunnel, Nevada Test Site, Nye County, Nev.

/Compiled by R. P. Snyder, D. L. Hoover, and W. L. Emerick/

Unit and subunit	Thickness of unit or subunit (feet)	Porosity (percent)	Dry bulk density (g/cc)	Natural State bulk density (g/cc)	Grain density (g/cc)	Water content by volume (g/cc)	Water content (percent by weight)	Percent saturation	Shore hardness	Unconfined compressive strength (psi)	Young's modulus (10^6 lb/in^2)	Modulus rigidity (10^6 lb/in^2)	Poisson's ratio	Longitudinal velocity (ft/sec)	Transverse velocity (ft/sec)	Magnetic susceptibility (10^{-6} cgs units)
Tpr (formerly TOS_8)---------	400±	20.4	1.93	2.19	2.42	-	-	-	-	-	2.61	1.12	0.143	9,614	5,934	463.2
Tps (formerly TOS_7)---------	700±	40.0	1.41	1.76	2.35	0.266	15.9	-	-	-	.98	.43	.138	7,400	4,797	164.3
Tigl (formerly TOS_5)---------	82±	40.8	1.37	-	2.31	-	-	-	-	-	-	-	-	-	-	254.8
$Tilt_4H$----------	80±	35.8	1.54	1.72	2.40	-	-	-	25	3,219	.96	.40	.197	7,293	4,483	121.6
$Tilt_4G$ (Ground zero)---------	70±	30.8	1.72	1.96	2.49	.229	11.8	74.2	32	7,761	1.46	.61	.198	8,502	5,138	562.7
$Tilt_4F$----------	30±	36.6	1.54	1.85	2.34	-	22.1	-	30	4,357	.97	.42	.183	7,210	4,526	124.9
$Tilt_4E$----------	30±	29.9	1.64	1.94	2.34	-	16.8	-	30	8,120	1.19	.50	.178	7,859	4,854	177.7
$Tilt_4D$----------	8	37.3	-	1.89	2.40	-	20.3	-	-	-	-	-	-	-	-	-
$Tilt_4C$----------	10±	35.5	1.54	1.90	2.40	-	19.3	-	28	4,700	1.07	.44	.202	7,624	4,650	123.2
$Tilt_4B$	3	35.6	1.47	1.85	2.34	-	19.1	-	29	3,950	.90	.41	.111	6,764	4,477	72.6
$Tilt_4A$	15															
$Tilt_3D$----------	60±	32.3	1.64	1.96	2.43	-	16.6	-	32	6,925	1.36	.58	.170	7,880	4,880	216.3
$Tilt_3BC$---------	112±	34.5	1.42	1.77	2.18	-	-	-	30	4,950	.93	.40	.179	6,373	3,941	145.4
$Tilt_3A$----------	28±	29.8	1.76	2.06	2.51	-	-	-	24	6,760	1.83	.80	.146	8,195	5,267	169.8

the table are preliminary in nature and it is expected that many of them will be revised slightly in the future by additions and refinements in analyses, and in sample grouping and selection. Complete physical properties determinations for some units and subunits are not yet available, or, because of the physical nature of the rock they are impossible to determine.

The average physical properties given in Table 1 cover an approximate total thickness of units and subunits overlying ground zero, including subunit G of Tunnel Bed 4 in which ground zero is located, of 1,330 feet, and an approximate total thickness of underlying units and subunits of 300 feet.

The table was designed to show at a glance the relationship between the various tuff units composing the stratigraphic section at Rainier Mesa in the vicinity of the U12g tunnel system and their average physical properties. It shows the differences in these average unit physical properties and shows that the tuff rocks in this stratigraphic section are not a homogeneous group.

The inherent value of a composite table of average physical properties, such as Table 1, encompassing all of the lithologic units related to a shot point in a tunnel, lies in its usefulness and pertinence as a source of data for many calculations of a pre- and postshot nature. The weighted average physical properties for spheres of rock of various radii can be calculated by using the averages on Table 1 in conjunction with the stratigraphic and structural features in the vicinity of the shot point.