TABLE 1 CLASSIFICATION OF ROCK TYPES FOR EXPLOSIVES SAFETY SITING OF UNDERGROUND MAGAZINES			
ROCK PROPERTIES			
STRENGTH CLASS	MASS DENSITY, kg/m^3	IN-SITU SEISMIC VELOCITY, c m/sec	IMPEDANCE FACTOR $\rho \cdot c \times 10^{-6}$ kg/m^2 -sec
WEAK	< 2250	< 3,400	< 7.50
MODERATELY STRONG	2250 - 250	3,400 - 4,600	7.50 - 11.50
STRONG	> 2500	> 4,600	> 11.50

TABLE 2 CLASSIFICATION OF ROCK TYPES FOR DESIGN AND CONSTRUCTION OF UNDERGROUND MAGAZINES			
SYSTEM VALUES			
STRENGTH CLASS	RQD	RMR	Q
WEAK	< 50	< 40	< 5
MODERATELY STRONG	50 - 80	40 - 70	5 - 50
STRONG	> 80	> 70	> 50

ROCK CLASSIFICATION TABLES:

The tables were developed to provide definitions of the classification of rock types for siting, design and construction of underground magazines per Chapter 9 of the referenced safety standard, DOD 6055.9-STD.

1. Rock Classification for Safety Siting.

   a. The rock classifications are used to determine the chamber separation and ground shock distances based on shock impedance as a basis for classifying weak, moderately strong, and strong rock.

   b. The basic rock type and approximate density can be determined from local rock outcrops and from rock cores taken from an exploratory drill hole.

   c. Seismic velocities are established from a seismic survey of the area.

2. Rock classification for Design and Construction of Underground Magazines.

   a. A geologic investigation must be conducted to acquire information on rock properties and the local geologic structure of a proposed underground magazine site for developing detailed designs and construction planning.

   b. The geologic conditions (particularly the orientation, spacing and frequency of the joints and bedding planes that control the shape and size of rock blocks) serve as a basis for classifying the rock, for determining rock loads on steel set supports or concrete reinforcement elements, for determining shotcrete thickness and for selecting the support system itself. The frequency of joints and fractures and their characteristics will affect the stability of an excavation, and the requirement for structural reinforcement of the rock to increase stability.

   c. The Rock Mass Rating (RMR) or the Q System is used for classification of weak, moderately strong, and strong rock at all proposed sites for design and construction of underground magazines.

   d. Rock Quality Designation (RQD) is an engineering classification system for rock based on the number of fractures (or joints) per meter of a length of rock core.

US Army Corps of Engineers

Symbol	Description	Date	Approved	Symbol	Description	Date	Approved

Designed by: WAW
Dwn by: RLA
Ckd by:
Reviewed by:
Submitted by:
Date: 15 NOV 96
Rev.
Design file no. 83065
Drawing code: DEF 421-80-04
File name: WWUNDG4.DGN
Plot date:
Plot scale:

U. S. ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE
HUNTSVILLE, ALABAMA

DEFINITIVE DRAWINGS
UNDERGROUND AMMUNITION STORAGE FACILITY
ROCK CLASSIFICATION TABLES

Sheet reference number:
G - 4
Sheet of

WWUNDG4.DGN