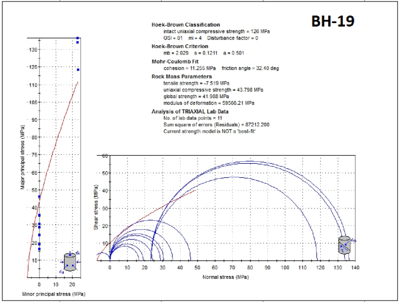


BH-19

Hoek-Brown Classification
intact uniaxial compressive strength = 126 MPa
GSI = 81 mi = 4 Disturbance factor = 0

Hoek-Brown Criterion
mb = 2.029 s = 0.1211 a = 0.501

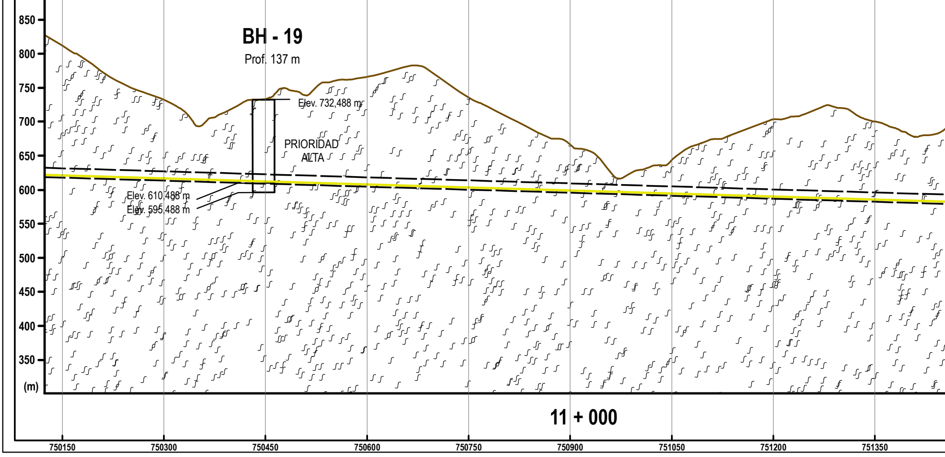
Mohr-Coulomb Fit
cohesion = 11.255 MPa friction angle = 32.40 deg

Rock Mass Parameters
tensile strength = -7.519 MPa
uniaxial compressive strength = 43.798 MPa
global strength = 41.988 MPa
modulus of deformation = 59566.21 MPa

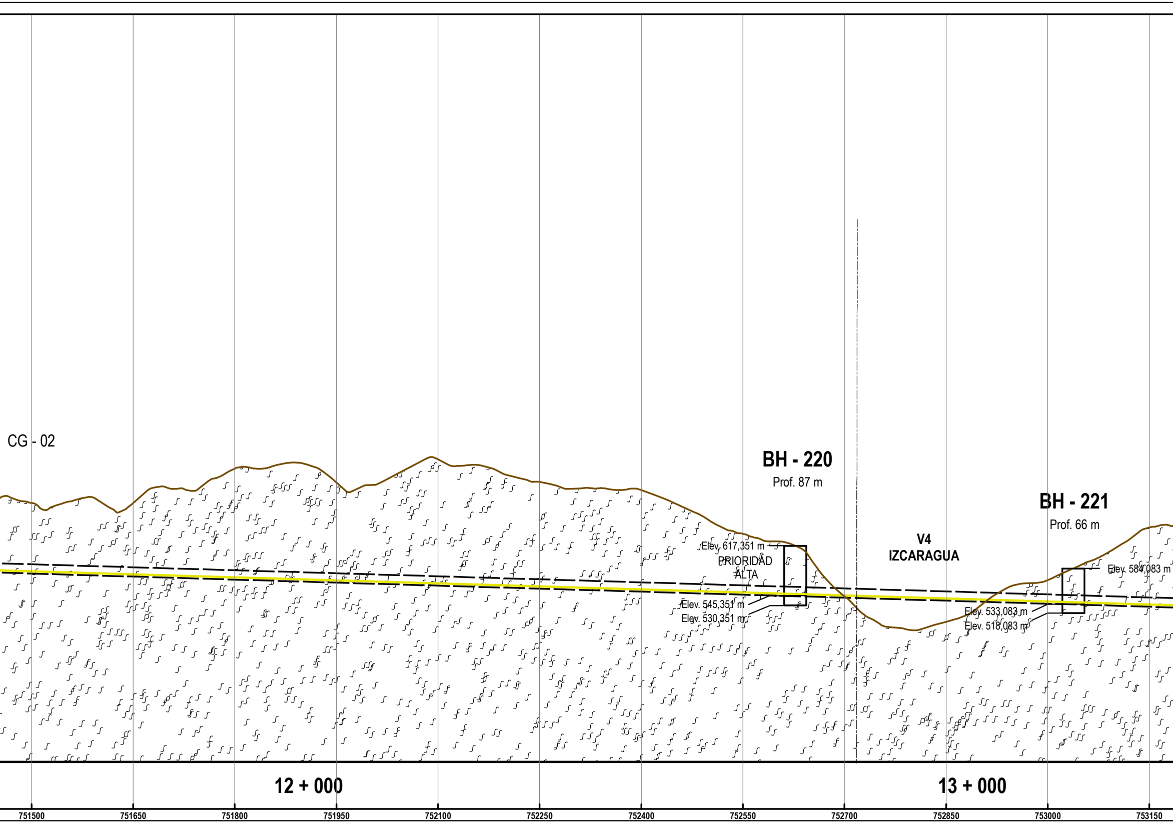
Analysis of TRIAXIAL Lab Data
No. of lab data points = 11
Sum square of errors (Residuals) = 87212.200
Current strength model is NOT a 'best-fit'

Major principal stress (MPa)
130
120
110
100
90
80
70
60
50
40
30
20
10
0
10
20
Minor principal stress (MPa)
Shear stress (MPa)
60
50
40
30
20
10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
Normal stress (MPa)

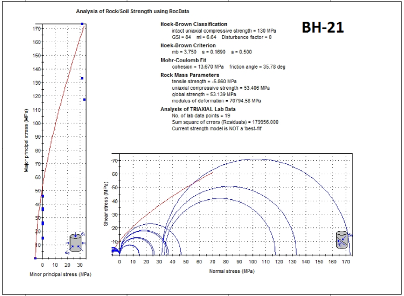
	Parámetros		
M. LABORATORIO	Perforación	Nomenclatura	BH-19
	Profundidad (m)	P	(85.90-102.00)
	Porosidad n (%)	n	1.52
	Absorción A (%)	A	0.58
	P. Unitario húmedo (gr/cm³)	ρh	2.64
	P. Unitario seco (gr/cm³)	ρs	2.63
MACIZO ROCOSO	Resistencia a la compresión (MPa)	σc	43.798
	Resistencia a la tracción (MPa)	σt	-7.519
	Cohesión (MPa)	C	11.255
	Angulo de fricción (deg)	Φ	32.40
	Abrasividad cerchar	-	Alta
	Resistencia I.S.M.R	-	Moderada



O
950
900
850
800
750
700
650
600
550
500
450
400
350
(m)
BH - 19
Prof. 137 m
Elev. 732,488 m
PRIORIDAD ALTA
Elev. 610,488 m
Elev. 595,488 m
11 + 000
750150
750300
750450
750600
750750
750900
751050
751200
751350


CG - 02
BH - 220
Prof. 87 m
Elev. 617,351 m
PRIORIDAD
ALTA
Elev. 545,351 m
Elev. 530,351 m
V4
IZCARAGUA
BH - 221
Prof. 66 m
Elev. 584,083 m
Elev. 533,083 m
Elev. 518,083 m
12 + 000
13 + 000
751500
751650
751800
751950
752100
752250
752400
752550
752700
752850
753000
753150

	Parámetros		
	Perforación	Nomenclatura	BH-21
M. LABORATORIO	Profundidad (m)	P	(163.93-165.51)
	Porosidad (%)	N	1.63
	Absorción (%)	A	0.61
	P. Unitario húmedo (gr/cm³)	ρh	2.71
	P. Unitario seco (gr/cm³)	ρs	2.70
MACIZO ROCOSO	Resistencia a la compresión (MPa)	σc	53.406
	Resistencia a la tracción (MPa)	σt	-5.86
	Cohesión (MPa)	C	13.670
	Angulo de fricción (deg)	Φ	35.78
	Abrasividad cerchar	-	Alta
	Resistencia I.S.M.R	-	Moderada



BH-21

Analysis of Rock/Soil Strength using RocData

Hoek-Brown Classification
intact uniaxial compressive strength = 130 MPa
GSI = 84 mi = 6.64 Disturbance factor = 0

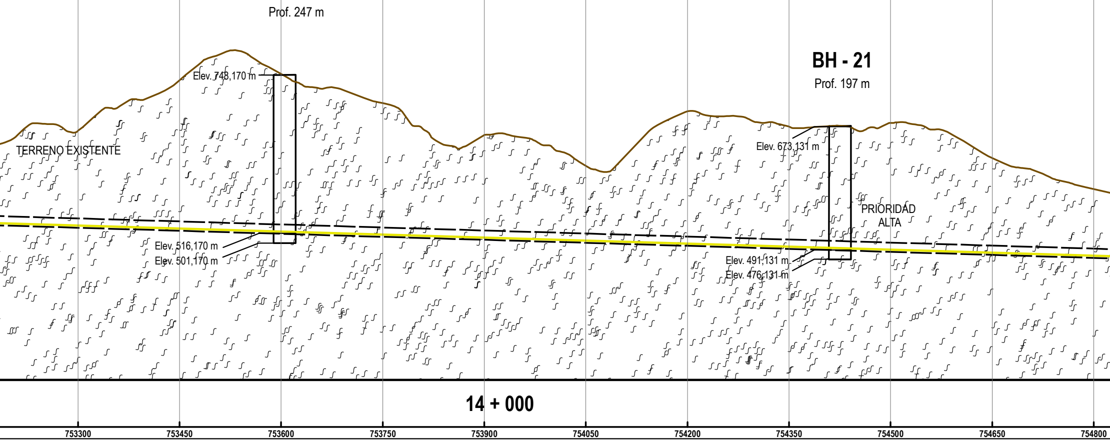
Hoek-Brown Criterion
mb = 3.750 s = 0.1690 a = 0.500

Mohr-Coulomb Fit
cohesion = 13.670 MPa friction angle = 35.78 deg

Rock Mass Parameters
tensile strength = -5.860 MPa
uniaxial compressive strength = 53.406 MPa
global strength = 53.139 MPa
modulus of deformation = 70794.58 MPa

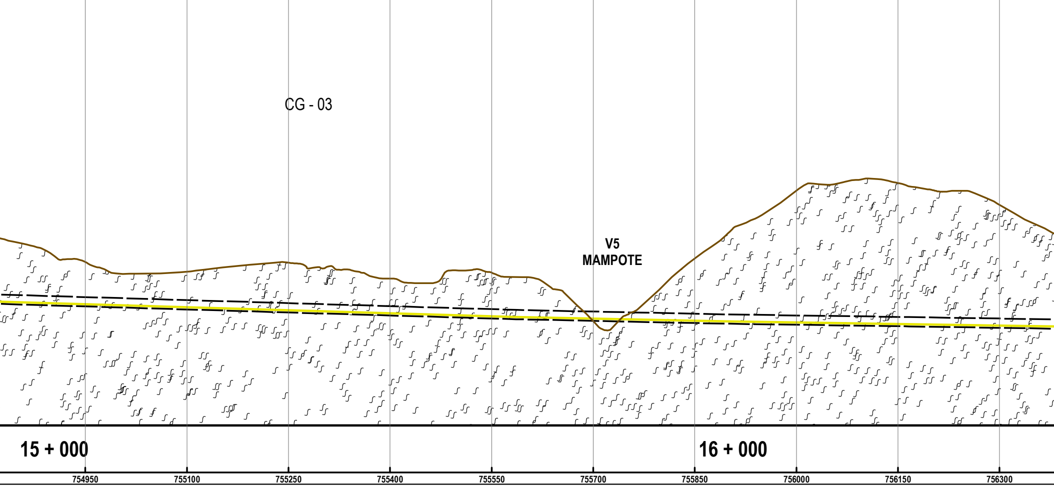
Analysis of TRIAXIAL Lab Data
No. of lab data points = 19
Sum square of errors (Residuals) = 179956.000
Current strength model is NOT a 'best-fit'

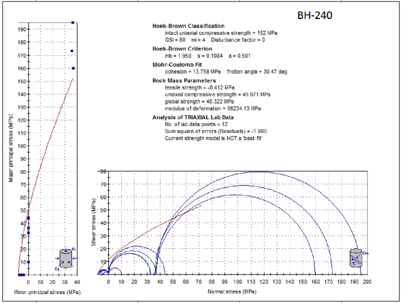
Major principal stress (MPa)
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
10
20
30
Minor principal stress (MPa)
Shear stress (MPa)
70
60
50
40
30
20
10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
Normal stress (MPa)



BH - 230
Prof. 247 m
Elev. 748,170 m
TERRENO EXISTENTE
Elev. 516,170 m
Elev. 501,170 m
BH - 21
Prof. 197 m
Elev. 673,131 m
PRIORIDAD
ALTA
Elev. 491,131 m
Elev. 476,131 m
14 + 000
753300
753450
753600
753750
753900
754050
754200
754350
754500
754650
754800

		Parámetros	
M. LABORATORIO			
	Perforación	Nomenclatura	BH-240
	Profundidad (m)	P	(185.34-189.31)
	Porosidad (%)	N	1.7
	Absorción (%)	A	0.64
	P. Unitario húmedo (gr/cm³)	ρh	2.70
	P. Unitario seco (gr/cm³)	ρs	2.68
MACIZO ROCOSO	Resistencia a la compresión (MPa)	σc	49.971
	Resistencia a la Tracción (MPa)	σt	-8.412
	Cohesión (MPa)	C	13.758
	Angulo de fricción (deg)	Φ	30.47
	Abrasividad cerchar	-	Alta
	Resistencia I.S.M.R	-	Moderada


CG - 03
V5
MAMPOTE
15 + 000
16 + 000
754950
755100
755250
755400
755550
755700
755850
756000
756150
756300



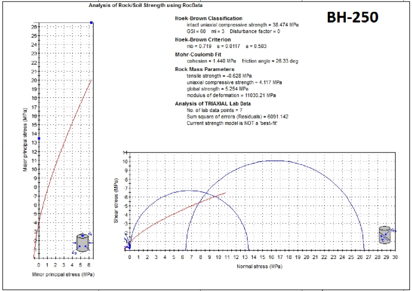
Hoek-Brown Classification
intact uniaxial compressive strength = 152 MPa
GSI = 80 mi = 4 Disturbance factor = 0

Hoek-Brown Criterion
mb = 1.958 s = 0.1084 a = 0.501

Mohr-Coulomb Fit
cohesion = 13.758 MPa friction angle = 30.47 deg

Rock Mass Parameters
tensile strength = -8.412 MPa
uniaxial compressive strength = 49.971 MPa
global strength = 48.322 MPa
modulus of deformation = 56234.13 MPa

Analysis of TRIAXIAL Lab Data
No. of lab data points = 12
Sum square of errors (Residuals) = -1.000
Current strength model is NOT a 'best-fit'



Analysis of Rock/Soil Strength using RocData

Hoek-Brown Classification
intact uniaxial compressive strength = 38.474 MPa
GSI = 60 mi = 3 Disturbance factor = 0

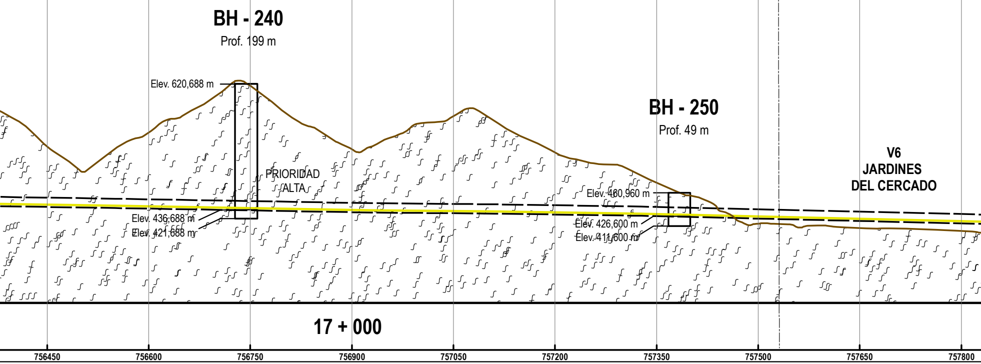
Hoek-Brown Criterion
mb = 0.719 s = 0.0117 a = 0.503

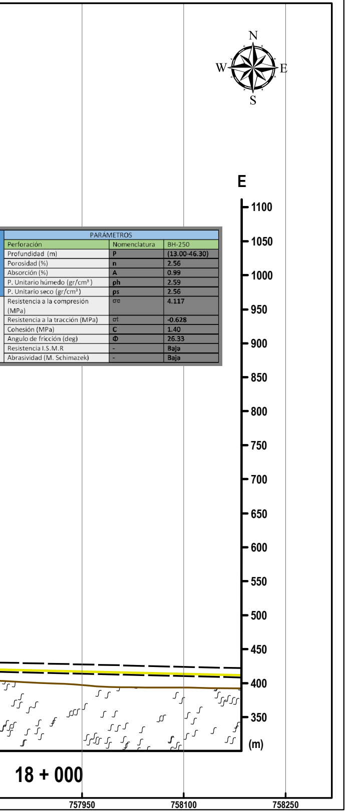
Mohr-Coulomb Fit
cohesion = 1.440 MPa friction angle = 26.33 deg

Rock Mass Parameters
tensile strength = -0.628 MPa
uniaxial compressive strength = 4.117 MPa
global strength = 5.254 MPa
modulus of deformation = 11030.21 MPa

Analysis of TRIAXIAL Lab Data
No. of lab data points = 7
Sum square of errors (Residuals) = 6091.142
Current strength model is NOT a 'best-fit'

M. LABORATORIO
MACIZO ROCOSO
CG - 04


BH - 240
Prof. 199 m
Elev. 620,688 m
PRIORIDAD ALTA
Elev. 436,688 m
Elev. 421,688 m
BH - 250
Prof. 49 m
Elev. 460,960 m
Elev. 426,600 m
Elev. 411,600 m
V6
JARDINES
DEL CERCADO
17 + 000
756450
756600
756750
756900
757050
757200
757350
757500
757650
757800


N
W
E
S
E
1100
1050
1000
950
900
850
800
750
700
650
600
550
500
450
400
350
(m)
18 + 000
757950
758100
758250

PARÁMETROS		
Perforación	Nomenclatura	BH-250
Profundidad (m)	**P**	**(13.00-46.30)**
Porosidad (%)	**n**	**2.56**
Absorción (%)	**A**	**0.99**
P. Unitario húmedo (gr/cm^3)	**ρh**	**2.59**
P. Unitario seco (gr/cm^3)	**ρs**	**2.56**
Resistencia a la compresión (MPa)	σc	**4.117**
Resistencia a la tracción (MPa)	σt	**-0.628**
Cohesión (MPa)	**C**	**1.40**
Angulo de fricción (deg)	**Φ**	**26.33**
Resistencia I.S.M.R	-	**Baja**
Abrasividad (M. Schimazek)	-	**Baja**

UNIVERSIDAD CENTRAL DE VENEZUELA
FACULTAD DE INGENIERÍA
ESCUELA DE GEOLOGÍA, MINAS Y GEOFÍSICA
DEPARTAMENTO DE GEOLOGÍA
TRABAJO ESPECIAL DE GRADO

MODELO GEOMECÁNICO

LEYENDA

- Topografía
- Límite entre secciones
- Tdr
- Anillos del túnel
- Perforaciones
- Esquisto de Las Mercedes

ESCALA GRÁFICA VERTICAL Y HORIZONTAL 1:5.000

100 50 0 100 200 300 m

Realizado por:
Carlos Elías Oliveros C.I. 18.322.146
Carlos Eduardo Oliveros C.I 18.322.145

Caracas, mayo de 2.014