Appendix 5-3

Coal Pillar Safety Factor Calculations

COAL PILLAR SAFETY FACTORS

Methods used to calculate coal pillar safety factors appear in Appendix 12-1. An Average uniaxial compressive strength (C_p) of 1821 psi (Appendix 14-9), and an overburden pressure gradient (S_v) of 1 psi per foot of overburden are used in calculation of pillar safety factors in the Neico State Leases.

EQUATIONS:

Pillar Strength (C_p): $C_p = C\ (.778 + .222\ (W/H))$

C = Coal Uniaxial Compressive Strength
W = Width of Pillar
H = Height of Pillar

Recovery Factor (R): $R = A_o/A_t$

A_o = Area of Entry
A_t = Total Area

Safety Factor (F.S.): $F.S. = C_p\ (1-R)/S_v$

S_v = Vertical Stress = 1 psi/foot of overburden

CALCULATIONS:

Lease ML-21569 (T15S-R6E-Sec36):

SEC 36, NW SW SW (Mine Room)

Criteria:
H = 8 feet
S_v = 1900 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

$C_p = 1821(.778+.222(60/8)) = 4449$ psi
$R = 20(80+140)/80x160 = .34$
$F.S. = 4449(1-.34)/1900 = 1.55$

Lease ML-21569 (T15S-R6E-Sec36) Continued:

SEC 36, NW NW SW (Mine Room)

Criteria:
H = 8 feet
S_v = 2000 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/8)) = 4449 psi
R = 20(80+140)/80x160 = .34
F.S. = 4449(1-.34)/2000 = 1.47

SEC 36, SW NW (Mine room)

Criteria:
H = 7 feet
S_v = 1900 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/7)) = 4882 psi
R = 20(80+140)/80x160 = .34
F.S. = 4882(1-.34)/1900 = 1.70

SEC 36, SW SW NE (Mine room)

Criteria:
H = 8 feet
S_v = 1200 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/8)) = 4449 psi
R = 20(80+140)/80x160 = .34
F.S. = 4449(1-.34)/1200 = 2.45

SEC 36, SW SE (Mine main entry)

Criteria:
H = 8 feet
S_v = 1500 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/8)) = 4449 psi
R = 20(80+140)/80x160 = .34
F.S. = 4449(1-.34)/1500 = 1.96

SEC 36, NE NE NE (Mine main entry)

Criteria: H = 6.25 feet
S_v = 800 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/6.25)) = 5298 psi
R = 20(80+140)/80x160 = .34
F.S. = 5298(1-.34)/800 = 4.37

SEC 36, SE SE NE (Mine main entry)

Criteria: H = 8 feet
S_v = 700 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/8)) = 4449 psi
R = 20(80+140)/80x160 = .34
F.S. = 4449(1-.34)/700 = 4.19

SEC 36, NE SE SE (Mine main entry)

Criteria: H = 8 feet
S_v = 1650 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/8)) = 4449 psi
R = 20(80+140)/80x160 = .34
F.S. = 4449(1-.34)/1650 = 1.78

SEC 36, SE SW (Mine main entry)

Criteria: H = 8 feet
S_v = 1600 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/8)) = 4449 psi
R = 20(80+140)/80x160 = .34
F.S. = 4449(1-.34)/1600 = 1.84

SEC 36, NW NW NW (Mine main entry)

Criteria: H = 6 feet
S_v = 1700 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/6)) = 5459 psi
R = 20(80+140)/80x160 = .34
F.S. = 5459(1-.34)/1700 = 2.12

Lease ML-21568 (T16S-R6E-Sec2):

SEC 2, NE NW NW (Mine main entry)

Criteria: H = 8 feet
S_v = 1500 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/8)) = 4449 psi
R = 20(80+140)/80x160 = .34
F.S. = 4449(1-.34)/1500 = 1.96

SEC 2, NE NE NW (Mine main entry)

Criteria: H = 8 feet
S_v = 2100 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/8)) = 4449 psi
R = 20(80+140)/80x160 = .34
F.S. = 4449(1-.34)/2100 = 1.39

SEC 2, NE NW NE (Mine main entry)

Criteria:
H = 8 feet
S_v = 1400 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/8)) = 4449 psi
R = 20(80+140)/80x160 = .34
F.S. = 4449(1-.34)/1400 = 2.10

SEC 2, NE NE NE (Mine main entry)

Criteria:
H = 8 feet
S_v = 1200 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/8)) = 4449 psi
R = 20(80+140)/80x160 = .34
F.S. = 4449(1-.34)/1200 = 2.45

SEC 2, NW SW (Mine room)

Criteria:
H = 8 feet
S_v = 1500 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/8)) = 4449 psi
R = 20(80+140)/80x160 = .34
F.S. = 4449(1-.34)/1500 = 1.96

SEC 2, NE SW (Mine room)

Criteria:
H = 8 feet
S_v = 2100 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/8)) = 4449 psi
R = 20(80+140)/80x160 = .34
F.S. = 4449(1-.34)/2100 = 1.39

SEC 2, NW SW (Mine main entry)

Criteria: H = 8 feet
S_v = 1400 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/8)) = 4449 psi
R = 20(80+140)/80x160 = .34
F.S. = 4449(1-.34)/1400 = 2.1

SEC 2, NE SE (Mine main entry)

Criteria: H = 8 feet
S_v = 1500 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/8)) = 4449 psi
R = 20(80+140)/80x160 = .34
F.S. = 4449(1-.34)/1500 = 1.96

SEC 2, SW SW (Mine main entry)

Criteria: H = 8 feet
S_v = 2100 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/8)) = 4449 psi
R = 20(80+140)/80x160 = .34
F.S. = 4449(1-.34)/2100 = 1.39

SEC 2, SW SW SE (Mine main entry)

Criteria: H = 8 feet
S_v = 1900 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/8)) = 4449 psi
R = 20(80+140)/80x160 = .34
F.S. = 4449(1-.34)/1900 = 1.55

SEC 2, SE SE SE (Mine main entry)

Criteria:
H = 8 feet
S_v = 1400 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/8)) = 4449 psi
R = 20(80+140)/80x160 = .34
F.S. = 4449(1-.34)/1400 = 2.10

SEC 2, SE SE (Mine room)

Criteria:
H = 8 feet
S_v = 1900 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/8)) = 4449 psi
R = 20(80+140)/80x160 = .34
F.S. = 4449(1-.34)/1900 = 1.55

SEC 2, SE SE NW (Mine room)

Criteria:
H = 8 feet
S_v = 2150 psi
C = 1821 psi
W = 60 feet
Pillar length = 140 feet
Pillar centers = 80 and 160 feet

C_p = 1821(.778+.222(60/8)) = 4449 psi
R = 20(80+140)/80x160 = .34
F.S. = 4449(1-.34)/2150 = 1.37