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|--|---------------------------------|---------------|
| Código: A-GL-E01-F03 | Versión: 03 | Página 1 de 2 |
| INSTITUTO DE RECURSOS MINEROS Y ENERGETICOS | | |
| FACULTAD SECCIONAL SOGAMOSO | | |
| LABORATORIO DE SUELOS Y ROCAS | | |
| ENSAYO DE CORTE DIRECTO (Cohesivos, no cohesivos) - Según Joseph E. Bowles - (ASTM D 3080-99) | | |
| DATOS DEL CLIENTE: CORPOCHIVOR | | Consecutivo: |
| NOMBRE: | EMPRESA: | |
| DIRECCION: | CÉDULA: | |
| TELÉFONO: | Fax: | NIT: |
| PROYECTO: ESTUDIO DE AMENAZA Y VULNERABILIDAD MUNICIPIO DE CIENEGA | FECHA: MARZO DE 2013 | E-mail: |
| MUESTRA: API M1 | COORDENADAS: E 1,084,432 | |
| | N 1,090,431 | |

FALLA 1

| DATOS DE LA MUESTRA | | | |
|-------------------------|--------|-------------------------------|----------------|
| Diam. o lado | 6 | Peso Suelo Seco:(gr) | 186.000 |
| Area (cm²): | 36 | Carga Normal :(Kg) | 10.15 |
| Altura (cm) : | 3 | Esfuerzo Normal :(Kg/cm²) | 0.28194 |
| Volumen(cm³): | 108.0 | Peso Unitario Húmedo:(gr/cm³) | 1.97037 |
| Peso Suelo Húmedo:(gr): | 212.80 | Peso Unitario Seco:(gr/cm³) | 1.72222 |

| CONTENIDO DE HUMEDAD | |
|-----------------------|----------------|
| W _{msar} (g) | 212.800 |
| W _{msar} (g) | 186.000 |
| w (%) | 14.4086 |

Constante del anillo de carga kg/div) : 2,166+(lectura*0

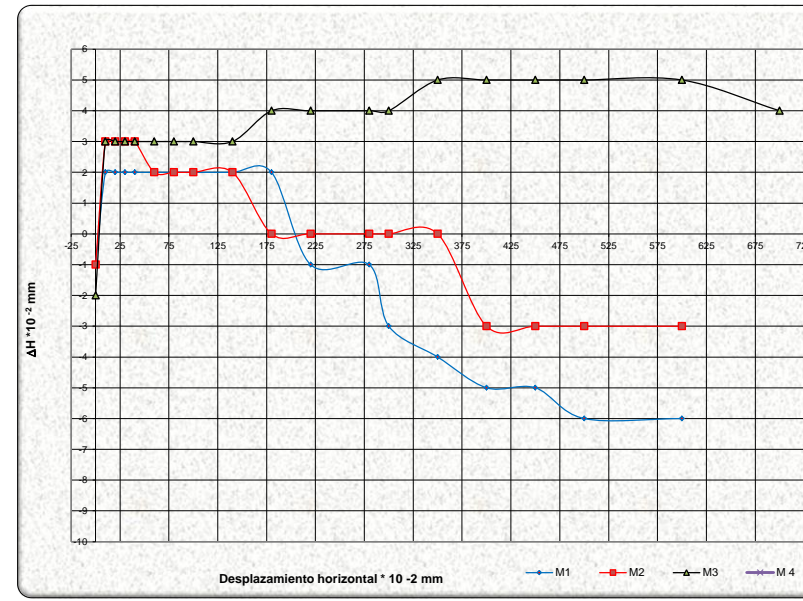
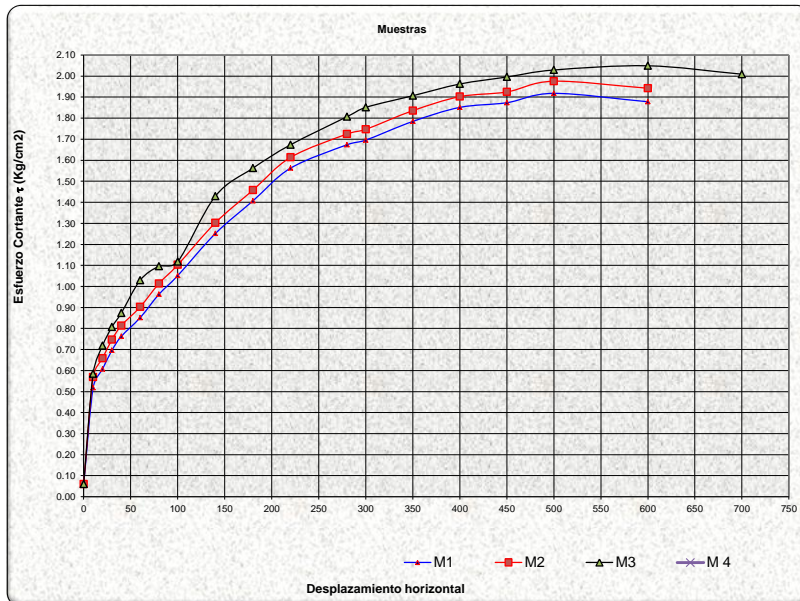
| Anillo de Carga | Deformimetro Hz * 10-4 | Deformimetro Vert * 10-4 | Fuerza Cortante (Kgf) | Esfuerzo Normal σ_n | Esfuerzo Cortante τ | Esfuerzos τ/σ | PROF(m) |
|-----------------|------------------------|--------------------------|-----------------------|----------------------------|--------------------------|-------------------------|---------|
| 0 | 0 | -1 | 2.1660 | 0.2819 | 0.0602 | 0.2134 | 0.90 |
| 206 | 10 | 2 | 18.6460 | 0.2819 | 0.5179 | 1.8370 | |
| 246 | 20 | 2 | 21.8460 | 0.2819 | 0.6068 | 2.1523 | |
| 286 | 30 | 2 | 25.0460 | 0.2819 | 0.6957 | 2.4676 | |
| 316 | 40 | 2 | 27.4460 | 0.2819 | 0.7624 | 2.7040 | |
| 356 | 60 | 2 | 30.6460 | 0.2819 | 0.8513 | 3.0193 | |
| 406 | 80 | 2 | 34.6460 | 0.2819 | 0.9624 | 3.4134 | |
| 446 | 100 | 2 | 37.8460 | 0.2819 | 1.0513 | 3.7287 | |
| 536 | 140 | 2 | 45.0460 | 0.2819 | 1.2513 | 4.4380 | |
| 606 | 180 | 2 | 50.6460 | 0.2819 | 1.4068 | 4.9898 | |
| 676 | 220 | -1 | 56.2460 | 0.2819 | 1.5624 | 5.5415 | |
| 726 | 280 | -1 | 60.2460 | 0.2819 | 1.6735 | 5.9356 | |
| 736 | 300 | -3 | 61.0460 | 0.2819 | 1.6957 | 6.0144 | |
| 776 | 350 | -4 | 64.2460 | 0.2819 | 1.7846 | 6.3297 | |
| 806 | 400 | -5 | 66.6460 | 0.2819 | 1.8513 | 6.5661 | |
| 816 | 450 | -5 | 67.4460 | 0.2819 | 1.8735 | 6.6449 | |
| 836 | 500 | -6 | 69.0460 | 0.2819 | 1.9179 | 6.8026 | |
| 818 | 600 | -6 | 67.6060 | 0.2819 | 1.8779 | 6.6607 | |

FALLA 2

| DATOS DE LA MUESTRA | | | |
|---------------------|--------|-------------------------------|----------------|
| Diam. o lado | 6 | Peso Suelo Seco:(gr) | 191.200 |
| Area (cm²): | 36 | Carga Normal :(Kg) | 20.15 |
| Altura (cm) : | 3 | Esfuerzo Normal :(Kg/cm²) | 0.55972 |
| Volumen(cm³): | 108.0 | Peso Unitario Húmedo:(gr/cm³) | 1.87593 |
| Peso Suelo Húmedo: | 202.60 | Peso Unitario Seco:(gr/cm³) | 1.77037 |

| CONTENIDO DE HUMEDAD | |
|-----------------------|----------------|
| W _{msar} (g) | 202.600 |
| W _{msar} (g) | 176.400 |
| w (%) | 14.8526 |

| Anillo de Carga | Deformimetro Hz * 10-4 | Deformimetro Vert * 10-4 | Fuerza Cortante (Kgf) | Esfuerzo Normal σ_n | Esfuerzo Cortante τ | Esfuerzos τ/σ | PROF(m) |
|-----------------|------------------------|--------------------------|-----------------------|----------------------------|--------------------------|-------------------------|---------|
| 0 | 0 | -1 | 2.1660 | 0.5597 | 0.0602 | 0.1075 | 0.90 |
| 229 | 10 | 3 | 20.4860 | 0.5597 | 0.5691 | 1.0167 | |
| 269 | 20 | 3 | 23.6860 | 0.5597 | 0.6579 | 1.1755 | |
| 309 | 30 | 3 | 26.8860 | 0.5597 | 0.7468 | 1.3343 | |
| 339 | 40 | 3 | 29.2860 | 0.5597 | 0.8135 | 1.4534 | |
| 379 | 60 | 2 | 32.4860 | 0.5597 | 0.9024 | 1.6122 | |
| 429 | 80 | 2 | 36.4860 | 0.5597 | 1.0135 | 1.8107 | |
| 469 | 100 | 2 | 39.6860 | 0.5597 | 1.1024 | 1.9695 | |
| 559 | 140 | 2 | 46.8860 | 0.5597 | 1.3024 | 2.3268 | |
| 629 | 180 | 0 | 52.4860 | 0.5597 | 1.4579 | 2.6048 | |
| 699 | 220 | 0 | 58.0860 | 0.5597 | 1.6135 | 2.8827 | |
| 749 | 280 | 0 | 62.0860 | 0.5597 | 1.7246 | 3.0812 | |
| 759 | 300 | 0 | 62.8860 | 0.5597 | 1.7468 | 3.1209 | |
| 799 | 350 | 0 | 66.0860 | 0.5597 | 1.8357 | 3.2797 | |
| 829 | 400 | -3 | 68.4860 | 0.5597 | 1.9024 | 3.3988 | |
| 839 | 450 | -3 | 69.2860 | 0.5597 | 1.9246 | 3.4385 | |
| 862 | 500 | -3 | 71.1260 | 0.5597 | 1.9757 | 3.5298 | |
| 847 | 600 | -3 | 69.9260 | 0.5597 | 1.9424 | 3.4703 | |



| | | |
|---|---------------|---|
| Código: A-GL-E01-F03 | Versión: 03 | Página 2 de 2 |
| INSTITUTO DE RECURSOS MINEROS Y ENERGETICOS FACULTAD SECCIONAL SOGAMOSO LABORATORIO DE SUELOS Y ROCAS | | |
| ENSAYO DE CORTE DIRECTO (Cohesivos, no cohesivos) - Según Joseph E. Bowles - (ASTM D 3080-99) | | |
| DATOS DEL CLIENTE: CORPOCHIVOR | | Consecutivo: |
| NOMBRE: | | EMPRESA: |
| DIRECCION: | | NIT: |
| TELÉFONO: | | E-mail: |
| PROYECTO : ESTUDIO DE AMENAZA Y VULNERABILIDAD MUNICIPIO DE CIENEGA | | FECHA: MARZO DE 2013 |
| MUESTRA | API M1 | COORDENADAS: E 1,084,432 N 1,090,431 |

L.S.R.

| DATOS DE LA MUESTRA | | | |
|---------------------|--------------------|--------|--|
| 3 | Diam. o lado | 6 | Peso Suelo Seco : 184.900 |
| | Area (cm²): | 36 | Carga Normal :(Kg) 30.15 |
| | Altura (cm) : | 3 | Esfuerzo Normal :(Kg/cm²) 0.83750 |
| | Volumen(cm³): | 108.0 | Peso Unitario Húmedo:(gr/cm³) 1.95741 |
| | Peso Suelo Húmedo: | 211.40 | Peso Unitario Seco:(gr/cm³) 1.71204 |

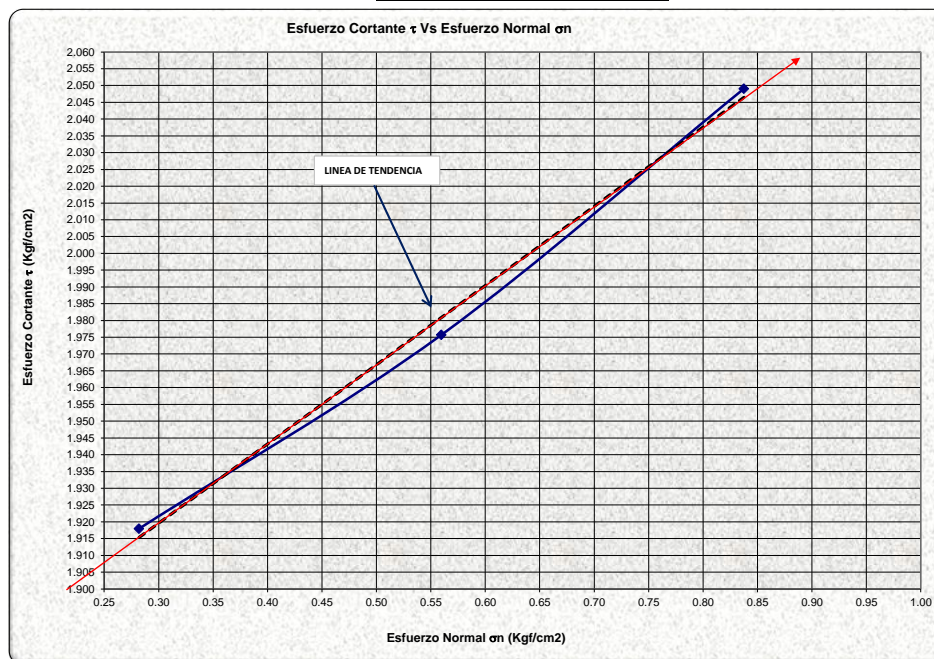
| CONTENIDO DE HUMEDAD | |
|------------------------|----------------|
| W _{mojar} (g) | 211.400 |
| W _{seco} (g) | 184.900 |
| w (%) | 14.3321 |

| Anillo de Carga | Deformimetro Hz * 10-4 | Deformimetro Vert * 10-4 | Fuerza Cortante (Kgf) | Esfuerzo Normal σn | Esfuerzo Cortante τ | Esfuerzos τ/σ | PROF(m) | |
|-----------------|------------------------|--------------------------|-----------------------|--------------------|---------------------|---------------|---------|------|
| | | | | | | | 0.90 | 0.90 |
| 0 | 0 | -2 | 2.1660 | 0.8375 | 0.0602 | 0.0718 | | |
| 236 | 10 | 3 | 21.0460 | 0.8375 | 0.5846 | 0.6980 | | |
| 296 | 20 | 3 | 25.8460 | 0.8375 | 0.7179 | 0.8572 | | |
| 336 | 30 | 3 | 29.0460 | 0.8375 | 0.8068 | 0.9634 | | |
| 366 | 40 | 3 | 31.4460 | 0.8375 | 0.8735 | 1.0430 | | |
| 436 | 60 | 3 | 37.0460 | 0.8375 | 1.0291 | 1.2287 | | |
| 466 | 80 | 3 | 39.4460 | 0.8375 | 1.0957 | 1.3083 | | |
| 476 | 100 | 3 | 40.2460 | 0.8375 | 1.1179 | 1.3349 | | |
| 616 | 140 | 3 | 51.4460 | 0.8375 | 1.4291 | 1.7063 | | |
| 676 | 180 | 4 | 56.2460 | 0.8375 | 1.5624 | 1.8655 | | |
| 726 | 220 | 4 | 60.2460 | 0.8375 | 1.6735 | 1.9982 | | |
| 786 | 280 | 4 | 65.0460 | 0.8375 | 1.8068 | 2.1574 | | |
| 806 | 300 | 4 | 66.6460 | 0.8375 | 1.8513 | 2.2105 | | |
| 831 | 350 | 5 | 68.6460 | 0.8375 | 1.9068 | 2.2768 | | |
| 856 | 400 | 5 | 70.6460 | 0.8375 | 1.9624 | 2.3432 | | |
| 871 | 450 | 5 | 71.8460 | 0.8375 | 1.9957 | 2.3830 | | |
| 886 | 500 | 5 | 73.0460 | 0.8375 | 2.0291 | 2.4228 | | |
| 895 | 600 | 5 | 73.7660 | 0.8375 | 2.0491 | 2.4466 | | |
| 877 | 700 | 4 | 72.3260 | 0.8375 | 2.0091 | 2.3989 | | |

GRAFICA ESFUERZO NORMAL Vs ESFUERZO CORTANTE

| Muestra | Esfuerzo Normal σn | Esfuerzo cortante τ |
|---------|--------------------|---------------------|
| 1 | 0.2819 | 1.9179 |
| 2 | 0.5597 | 1.9757 |
| 3 | 0.8375 | 2.0491 |

PROF(m) 0.90



| | |
|----------------------------------|---------------------------|
| Cohesión (C) = | 1,9075 Kg/cm ² |
| Ángulo de fricción interna (φ) = | 13,278836 ° |

TANG φ = 0.13111 0.236
 0.55556 13.278836 °



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INSTITUTO DE RECURSOS MINEROS Y ENERGETICOS
 FACULTAD SECCIONAL SOGAMOSO
 LABORATORIO DE SUELOS Y ROCAS

ENSAYO DE CORTE DIRECTO (Cohesivos, no cohesivos) - Según Joseph E. Bowles - (ASTM D 3080-99)

DATOS DEL CLIENTE: CORPOCHIVOR Consecutivo: _____

NOMBRE: _____ EMPRESA: _____

DIRECCION: _____ CÉDULA: _____ NIT: _____

TÉLEFONO: _____ Fax: _____ E-mail: _____

PROYECTO: ESTUDIO DE AMENAZA Y VULNERABILIDAD MUNICIPIO DE CIENEGA FECHA: MARZO DE 2013

MUESTRA: S1M2 COORDENADAS: E 1,084,637 N 1,090,471

FALLA 1

| DATOS DE LA MUESTRA | | | |
|------------------------|--------|-------------------------------|---------|
| Diam. o lado | 6 | Peso Suelo Seco (gr) | 165.000 |
| Area (cm²) | 36 | Carga Normal :(Kg) | 10.15 |
| Altura (cm) | 3 | Esfuerzo Normal :(Kg/cm²) | 0.28194 |
| Volumen (cm³) | 108.0 | Peso Unitario Húmedo:(gr/cm³) | 1.88241 |
| Peso Suelo Húmedo (gr) | 203.30 | Peso Unitario Seco:(gr/cm³) | 1.52778 |

| CONTENIDO DE HUMEDAD | |
|------------------------|---------|
| W _{rms+e} (g) | 203.300 |
| W _{rms+e} (g) | 165.000 |
| w (%) | 23.2121 |

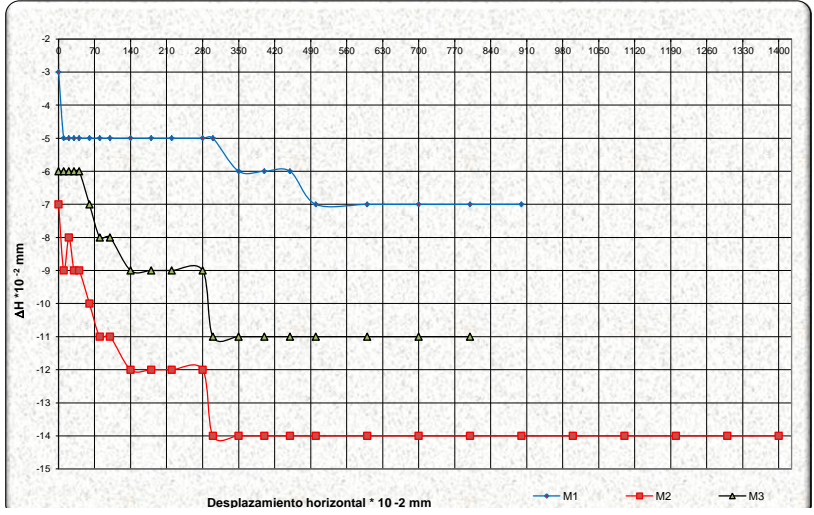
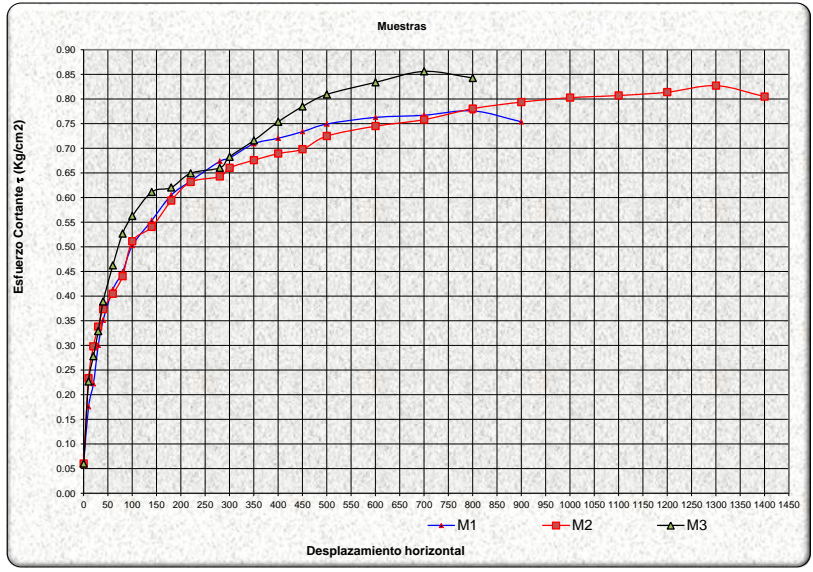
FALLA 2

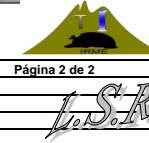
| DATOS DE LA MUESTRA | | | |
|---------------------|--------|-------------------------------|---------|
| Diam. o lado | 6 | Peso Suelo Seco (gr) | 191.200 |
| Area (cm²) | 36 | Carga Normal :(Kg) | 20.15 |
| Altura (cm) | 3 | Esfuerzo Normal :(Kg/cm²) | 0.55972 |
| Volumen (cm³) | 108.0 | Peso Unitario Húmedo:(gr/cm³) | 1.89361 |
| Peso Suelo Húmedo: | 204.51 | Peso Unitario Seco:(gr/cm³) | 1.77037 |

| CONTENIDO DE HUMEDAD | |
|------------------------|---------|
| W _{rms+e} (g) | 204.510 |
| W _{rms+e} (g) | 163.560 |
| w (%) | 25.0443 |

| Anillo de Carga | Deformimetro Hz * 10-4 | Deformimetro Vert * 10-4 | Fuerza Cortante (Kgf) | Esfuerzo Normal ̑n | Esfuerzo Cortante t | Esfuerzos t/̑ | PROF(m) |
|-----------------|------------------------|--------------------------|-----------------------|--------------------|---------------------|---------------|---------|
| 0 | 0 | -3 | 2.1660 | 0.2819 | 0.0602 | 0.2134 | |
| 52 | 10 | -5 | 6.3260 | 0.2819 | 0.1757 | 0.6233 | |
| 73 | 20 | -5 | 8.0060 | 0.2819 | 0.2224 | 0.7888 | |
| 108 | 30 | -5 | 10.8060 | 0.2819 | 0.3002 | 1.0646 | |
| 131 | 40 | -5 | 12.6460 | 0.2819 | 0.3513 | 1.2459 | |
| 159 | 60 | -5 | 14.8860 | 0.2819 | 0.4135 | 1.4666 | |
| 175 | 80 | -5 | 16.1660 | 0.2819 | 0.4491 | 1.5927 | |
| 199 | 100 | -5 | 18.0860 | 0.2819 | 0.5024 | 1.7819 | |
| 222 | 140 | -5 | 19.9260 | 0.2819 | 0.5535 | 1.9632 | |
| 245 | 180 | -5 | 21.7660 | 0.2819 | 0.6046 | 2.1444 | |
| 258 | 220 | -5 | 22.8060 | 0.2819 | 0.6335 | 2.2469 | |
| 276 | 280 | -5 | 24.2460 | 0.2819 | 0.6735 | 2.3888 | |
| 279 | 300 | -5 | 24.4860 | 0.2819 | 0.6802 | 2.4124 | |
| 292 | 350 | -6 | 25.5260 | 0.2819 | 0.7091 | 2.5149 | |
| 297 | 400 | -6 | 25.9260 | 0.2819 | 0.7202 | 2.5543 | |
| 303 | 450 | -6 | 26.4060 | 0.2819 | 0.7335 | 2.6016 | |
| 310 | 500 | -7 | 26.9660 | 0.2819 | 0.7491 | 2.6567 | |
| 316 | 600 | -7 | 27.4460 | 0.2819 | 0.7624 | 2.7040 | |
| 318 | 700 | -7 | 27.6060 | 0.2819 | 0.7668 | 2.7198 | |
| 322 | 800 | -7 | 27.9260 | 0.2819 | 0.7757 | 2.7513 | |
| 312 | 900 | -7 | 27.1260 | 0.2819 | 0.7535 | 2.6725 | |

| Anillo de Carga | Deformimetro Hz * 10-4 | Deformimetro Vert * 10-4 | Fuerza Cortante (Kgf) | Esfuerzo Normal ̑n | Esfuerzo Cortante t | Esfuerzos t/̑ | PROF(m) |
|-----------------|------------------------|--------------------------|-----------------------|--------------------|---------------------|---------------|---------|
| 0 | 0 | -7 | 2.1660 | 0.5597 | 0.0602 | 0.1075 | |
| 78 | 10 | -9 | 8.4060 | 0.5597 | 0.2335 | 0.4172 | |
| 107 | 20 | -8 | 10.7260 | 0.5597 | 0.2979 | 0.5323 | |
| 125 | 30 | -9 | 12.1660 | 0.5597 | 0.3379 | 0.6038 | |
| 141 | 40 | -9 | 13.4460 | 0.5597 | 0.3735 | 0.6673 | |
| 155 | 60 | -10 | 14.5660 | 0.5597 | 0.4046 | 0.7229 | |
| 171 | 80 | -11 | 15.8460 | 0.5597 | 0.4402 | 0.7864 | |
| 203 | 100 | -11 | 18.4060 | 0.5597 | 0.5113 | 0.9134 | |
| 216 | 140 | -12 | 19.4460 | 0.5597 | 0.5402 | 0.9651 | |
| 240 | 180 | -12 | 21.3660 | 0.5597 | 0.5935 | 1.0603 | |
| 257 | 220 | -12 | 22.7260 | 0.5597 | 0.6313 | 1.1278 | |
| 262 | 280 | -12 | 23.1260 | 0.5597 | 0.6424 | 1.1477 | |
| 270 | 300 | -14 | 23.7660 | 0.5597 | 0.6602 | 1.1795 | |
| 277 | 350 | -14 | 24.3260 | 0.5597 | 0.6757 | 1.2072 | |
| 283 | 400 | -14 | 24.8060 | 0.5597 | 0.6891 | 1.2311 | |
| 287 | 450 | -14 | 25.1260 | 0.5597 | 0.6979 | 1.2469 | |
| 299 | 500 | -14 | 26.0860 | 0.5597 | 0.7246 | 1.2946 | |
| 308 | 600 | -14 | 26.8060 | 0.5597 | 0.7446 | 1.3303 | |
| 314 | 700 | -14 | 27.2860 | 0.5597 | 0.7579 | 1.3541 | |
| 324 | 800 | -14 | 28.0860 | 0.5597 | 0.7802 | 1.3938 | |
| 330 | 900 | -14 | 28.5660 | 0.5597 | 0.7935 | 1.4177 | |
| 334 | 1000 | -14 | 28.8860 | 0.5597 | 0.8024 | 1.4335 | |
| 336 | 1100 | -14 | 29.0460 | 0.5597 | 0.8068 | 1.4415 | |
| 339 | 1200 | -14 | 29.2860 | 0.5597 | 0.8135 | 1.4534 | |
| 345 | 1300 | -14 | 29.7660 | 0.5597 | 0.8268 | 1.4772 | |
| 335 | 1400 | -14 | 28.9660 | 0.5597 | 0.8046 | 1.4375 | |





| | | |
|---|-------------|---|
| Código: A-GL-E01-F03 | Versión: 03 | Página 2 de 2 |
| INSTITUTO DE RECURSOS MINEROS Y ENERGETICOS FACULTAD SECCIONAL SOGAMOSO LABORATORIO DE SUELOS Y ROCAS | | |
| ENSAYO DE CORTE DIRECTO (Cohesivos, no cohesivos) - Según Joseph E. Bowles - (ASTM D 3080-99) | | |
| DATOS DEL CLIENTE: CORPOCHIVOR | | EMPRESA: _____ |
| DIRECCION: _____ | | NIT: _____ |
| TELÉFONO: _____ | | E-mail: _____ |
| PROYECTO: ESTUDIO DE AMENAZA Y VULNERABILIDAD MUNICIPIO DE CIENEGA | | FECHA: MARZO DE 2013 |
| MUESTRA | S1M2 | COORDENADAS: E 1,084,637 N 1,090,471 |

| DATOS DE LA MUESTRA | | | |
|---------------------|--------|-------------------------------|----------------|
| Diam. o lado | 6 | Peso Suelo Seco : | 165.800 |
| Area (cm²): | 36 | Carga Normal :(Kg) | 30.15 |
| Altura (cm) : | 3 | Esfuerzo Normal :(Kg/cm²) | 0.83750 |
| Volumen(cm³): | 108.0 | Peso Unitario Húmedo:(gr/cm³) | 1.93796 |
| Peso Suelo Húmedo: | 209.30 | Peso Unitario Seco:(gr/cm³) | 1.53519 |

| CONTENIDO DE HUMEDAD | |
|-----------------------|----------------|
| W _{mhr.} (g) | 209.300 |
| W _{msh.} (g) | 165.800 |
| w (%) | 26.2364 |

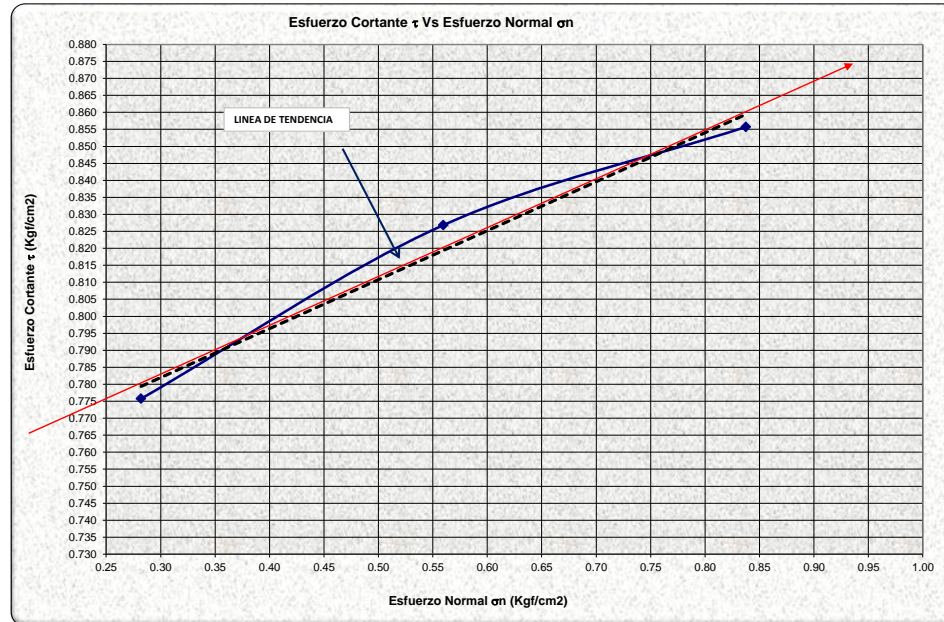
| Anillo de Carga | Deformimetro Hz * 10-4 | Deformimetro Vert * 10-4 | Fuerza Cortante (Kgf) | Esfuerzo Normal σn | Esfuerzo Cortante τ | Esfuerzos τ/σ |
|-----------------|------------------------|--------------------------|-----------------------|--------------------|---------------------|---------------|
| 0 | 0 | -6 | 2.1660 | 0.8375 | 0.0602 | 0.0718 |
| 75 | 10 | -6 | 8.1660 | 0.8375 | 0.2268 | 0.2708 |
| 98 | 20 | -6 | 10.0060 | 0.8375 | 0.2779 | 0.3319 |
| 121 | 30 | -6 | 11.8460 | 0.8375 | 0.3291 | 0.3929 |
| 148 | 40 | -6 | 14.0060 | 0.8375 | 0.3891 | 0.4645 |
| 181 | 60 | -7 | 16.6460 | 0.8375 | 0.4624 | 0.5521 |
| 210 | 80 | -8 | 18.9660 | 0.8375 | 0.5268 | 0.6291 |
| 226 | 100 | -8 | 20.2460 | 0.8375 | 0.5624 | 0.6715 |
| 248 | 140 | -9 | 22.0060 | 0.8375 | 0.6113 | 0.7299 |
| 252 | 180 | -9 | 22.3260 | 0.8375 | 0.6202 | 0.7405 |
| 265 | 220 | -9 | 23.3660 | 0.8375 | 0.6491 | 0.7750 |
| 270 | 280 | -9 | 23.7660 | 0.8375 | 0.6602 | 0.7883 |
| 280 | 300 | -11 | 24.5660 | 0.8375 | 0.6824 | 0.8148 |
| 295 | 350 | -11 | 25.7660 | 0.8375 | 0.7157 | 0.8546 |
| 312 | 400 | -11 | 27.1260 | 0.8375 | 0.7535 | 0.8997 |
| 326 | 450 | -11 | 28.2460 | 0.8375 | 0.7846 | 0.9368 |
| 337 | 500 | -11 | 29.1260 | 0.8375 | 0.8091 | 0.9660 |
| 348 | 600 | -11 | 30.0060 | 0.8375 | 0.8335 | 0.9952 |
| 358 | 700 | -11 | 30.8060 | 0.8375 | 0.8557 | 1.0218 |
| 352 | 800 | -11 | 30.3260 | 0.8375 | 0.8424 | 1.0058 |

| | |
|---------|------|
| PROF(m) | 2.70 |
|---------|------|

GRAFICA ESFUERZO NORMAL Vs ESFUERZO CORTANTE

| Muestra | Esfuerzo Normal σn | Esfuerzo cortante τ |
|---------|--------------------|---------------------|
| 1 | 0.2819 | 0.7757 |
| 2 | 0.5597 | 0.8268 |
| 3 | 0.8375 | 0.8557 |

| | |
|---------|------|
| PROF(m) | 2.70 |
|---------|------|



| | | |
|---|---------------------------------|----------------------------------|
| Cohesión (C) = | 0,775 Kgf/cm² | TANG φ = 0.08000 0.144 |
| Ángulo de fricción interna (φ) = | 8,1942 ° | 0.55556 8,1942 ° |

L.S.R.

Código: A-GL-E01-F03 Versión: 03 Página 1 de 2

INSTITUTO DE RECURSOS MINEROS Y ENERGETICOS
 FACULTAD SECCIONAL SOGAMOSO
 LABORATORIO DE SUELOS Y ROCAS

ENSAYO DE CORTE DIRECTO (Cohesivos, no cohesivos) - Según Joseph E. Bowles - (ASTM D 3080-99)

DATOS DEL CLIENTE: CORPOCHIVOR Consecutivo: _____

NOMBRE: _____ EMPRESA: _____

DIRECCION: _____ CÉDULA: _____ NIT: _____

TELÉFONO: _____ Fax: _____ E-mail: _____

PROYECTO: ESTUDIO DE AMENAZA Y VULNERABILIDAD MUNICIPIO DE CIENEGA FECHA: MARZO DE 2013

MUESTRA: S1M4 COORDENADAS: E 1,084.637 N 1,090.471

FALLA 1

| DATOS DE LA MUESTRA | | | |
|------------------------|--------|-------------------------------|---------|
| Diam. o lado | 6 | Peso Suelo Seco (gr) | 177.100 |
| Area (cm²) | 36 | Carga Normal :(Kg) | 10.15 |
| Altura (cm) | 3 | Esfuerzo Normal :(Kg/cm²) | 0.28194 |
| Volumen (cm³) | 108.0 | Peso Unitario Húmedo:(gr/cm³) | 1.93194 |
| Peso Suelo Húmedo (gr) | 208.65 | Peso Unitario Seco:(gr/cm³) | 1.63981 |

| CONTENIDO DE HUMEDAD | |
|-------------------------|---------|
| W _{rmh±r} (g) | 208.650 |
| W _{rmas±r} (g) | 177.100 |
| w (%) | 17.8148 |

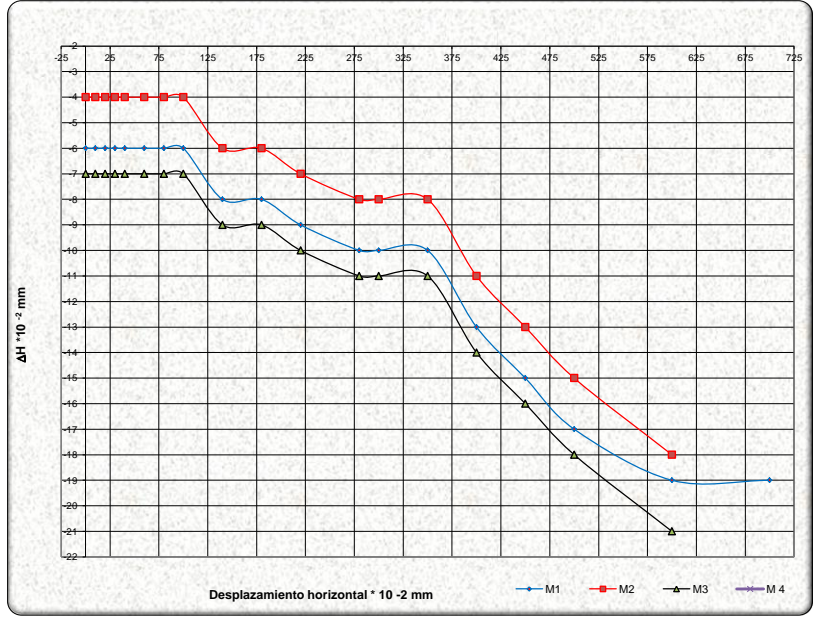
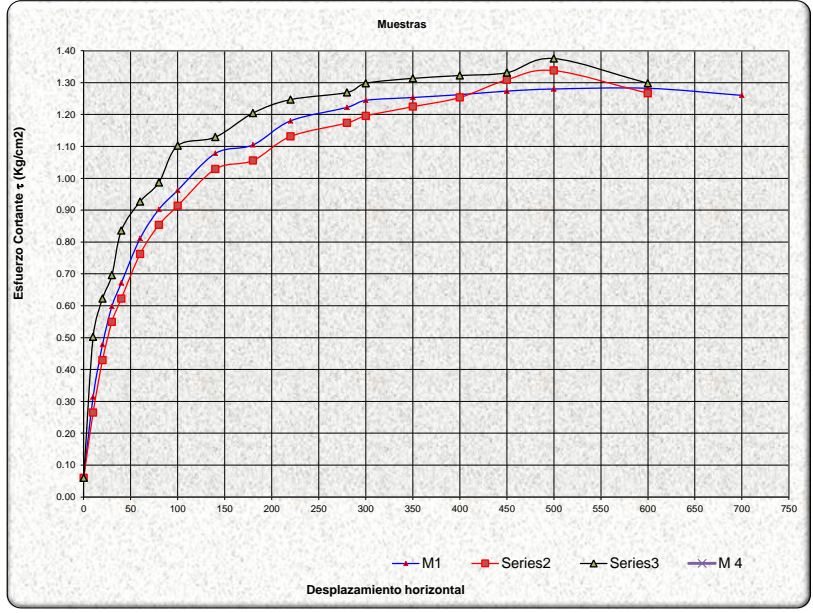
FALLA 2

| DATOS DE LA MUESTRA | | | |
|---------------------|--------|-------------------------------|---------|
| Diam. o lado | 6 | Peso Suelo Seco (gr) | 191.200 |
| Area (cm²) | 36 | Carga Normal :(Kg) | 20.15 |
| Altura (cm) | 3 | Esfuerzo Normal :(Kg/cm²) | 0.55972 |
| Volumen (cm³) | 108.0 | Peso Unitario Húmedo:(gr/cm³) | 1.91852 |
| Peso Suelo Húmedo: | 207.20 | Peso Unitario Seco:(gr/cm³) | 1.77037 |

| CONTENIDO DE HUMEDAD | |
|-------------------------|---------|
| W _{rmh±r} (g) | 207.200 |
| W _{rmas±r} (g) | 174.200 |
| w (%) | 18.9437 |

| Anillo de Carga | Deformimetro Hz * 10-4 | Deformimetro Vert * 10-4 | Fuerza Cortante (Kgf) | Esfuerzo Normal ̄n | Esfuerzo Cortante t | Esfuerzos τ/σ | PROF(m) |
|-----------------|------------------------|--------------------------|-----------------------|--------------------|---------------------|-------------------------|---------|
| 0 | 0 | -6 | 2.1660 | 0.2819 | 0.0602 | 0.2134 | |
| 114 | 10 | -6 | 11.2860 | 0.2819 | 0.3135 | 1.1119 | |
| 188 | 20 | -6 | 17.2060 | 0.2819 | 0.4779 | 1.6952 | |
| 242 | 30 | -6 | 21.5260 | 0.2819 | 0.5979 | 2.1208 | |
| 275 | 40 | -6 | 24.1660 | 0.2819 | 0.6713 | 2.3809 | |
| 338 | 60 | -6 | 29.2060 | 0.2819 | 0.8113 | 2.8774 | |
| 379 | 80 | -6 | 32.4860 | 0.2819 | 0.9024 | 3.2006 | |
| 406 | 100 | -6 | 34.6460 | 0.2819 | 0.9624 | 3.4134 | |
| 458 | 140 | -8 | 38.8060 | 0.2819 | 1.0779 | 3.8233 | |
| 470 | 180 | -8 | 39.7660 | 0.2819 | 1.1046 | 3.9178 | |
| 504 | 220 | -9 | 42.4860 | 0.2819 | 1.1802 | 4.1858 | |
| 523 | 280 | -10 | 44.0060 | 0.2819 | 1.2224 | 4.3356 | |
| 533 | 300 | -10 | 44.8060 | 0.2819 | 1.2446 | 4.4144 | |
| 537 | 350 | -10 | 45.1260 | 0.2819 | 1.2535 | 4.4459 | |
| 541 | 400 | -13 | 45.4460 | 0.2819 | 1.2624 | 4.4774 | |
| 546 | 450 | -15 | 45.8460 | 0.2819 | 1.2735 | 4.5168 | |
| 549 | 500 | -17 | 46.0860 | 0.2819 | 1.2802 | 4.5405 | |
| 550 | 600 | -19 | 46.1660 | 0.2819 | 1.2824 | 4.5484 | |
| 540 | 700 | -19 | 45.3660 | 0.2819 | 1.2602 | 4.4696 | |

| Anillo de Carga | Deformimetro Hz * 10-4 | Deformimetro Vert * 10-4 | Fuerza Cortante (Kgf) | Esfuerzo Normal ̄n | Esfuerzo Cortante t | Esfuerzos τ/σ | PROF(m) |
|-----------------|------------------------|--------------------------|-----------------------|--------------------|---------------------|-------------------------|---------|
| 0 | 0 | -4 | 2.1660 | 0.5597 | 0.0602 | 0.1075 | |
| 92 | 10 | -4 | 9.5260 | 0.5597 | 0.2646 | 0.4728 | |
| 166 | 20 | -4 | 15.4460 | 0.5597 | 0.4291 | 0.7666 | |
| 220 | 30 | -4 | 19.7660 | 0.5597 | 0.5491 | 0.9809 | |
| 253 | 40 | -4 | 22.4060 | 0.5597 | 0.6224 | 1.1120 | |
| 316 | 60 | -4 | 27.4460 | 0.5597 | 0.7624 | 1.3621 | |
| 357 | 80 | -4 | 30.7260 | 0.5597 | 0.8535 | 1.5249 | |
| 384 | 100 | -4 | 32.8860 | 0.5597 | 0.9135 | 1.6321 | |
| 436 | 140 | -6 | 37.0460 | 0.5597 | 1.0291 | 1.8385 | |
| 448 | 180 | -6 | 38.0060 | 0.5597 | 1.0557 | 1.8862 | |
| 482 | 220 | -7 | 40.7260 | 0.5597 | 1.1313 | 2.0211 | |
| 501 | 280 | -8 | 42.2460 | 0.5597 | 1.1735 | 2.0966 | |
| 511 | 300 | -8 | 43.0460 | 0.5597 | 1.1957 | 2.1363 | |
| 524 | 350 | -8 | 44.0860 | 0.5597 | 1.2246 | 2.1879 | |
| 537 | 400 | -11 | 45.1260 | 0.5597 | 1.2535 | 2.2395 | |
| 562 | 450 | -13 | 47.1260 | 0.5597 | 1.3091 | 2.3388 | |
| 575 | 500 | -15 | 48.1660 | 0.5597 | 1.3379 | 2.3904 | |
| 543 | 600 | -18 | 45.6060 | 0.5597 | 1.2668 | 2.2633 | |



| | | |
|---|---------------|---|
| Código: A-GL-E01-F03 | Versión: 03 | Página 2 de 2 |
| INSTITUTO DE RECURSOS MINEROS Y ENERGETICOS FACULTAD SECCIONAL SOGAMOSO LABORATORIO DE SUELOS Y ROCAS | | |
| ENSAYO DE CORTE DIRECTO (Cohesivos, no cohesivos) - Según Joseph E. Bowles - (ASTM D 3080-99) | | |
| DATOS DEL CLIENTE: CORPOCHIVOR | | EMPRESA: _____ |
| NOMBRE: _____ | | Consecutivo: _____ |
| DIRECCION: _____ | CÉDULA: _____ | NIT: _____ |
| TELÉFONO: _____ | Fax: _____ | E-mail: _____ |
| PROYECTO : ESTUDIO DE AMENAZA Y VULNERABILIDAD MUNICIPIO DE CIENEGA | | FECHA: MARZO DE 2013 |
| MUESTRA | S1M4 | COORDENADAS: E 1,084,637 N 1,090,471 |

| DATOS DE LA MUESTRA | | | |
|---------------------|--------------------|--------|---------------------------------------|
| 3 | Diam. o lado | 6 | Peso Suelo Seco : 174.400 |
| | Area (cm²): | 36 | Carga Normal :(Kg) 30.15 |
| | Altura (cm) : | 3 | Esfuerzo Normal :(Kg/cm²) 0.83750 |
| | Volumen (cm³): | 108.0 | Peso Unitario Húmedo:(gr/cm³) 1.91528 |
| | Peso Suelo Húmedo: | 206.85 | Peso Unitario Seco:(gr/cm³) 1.61481 |

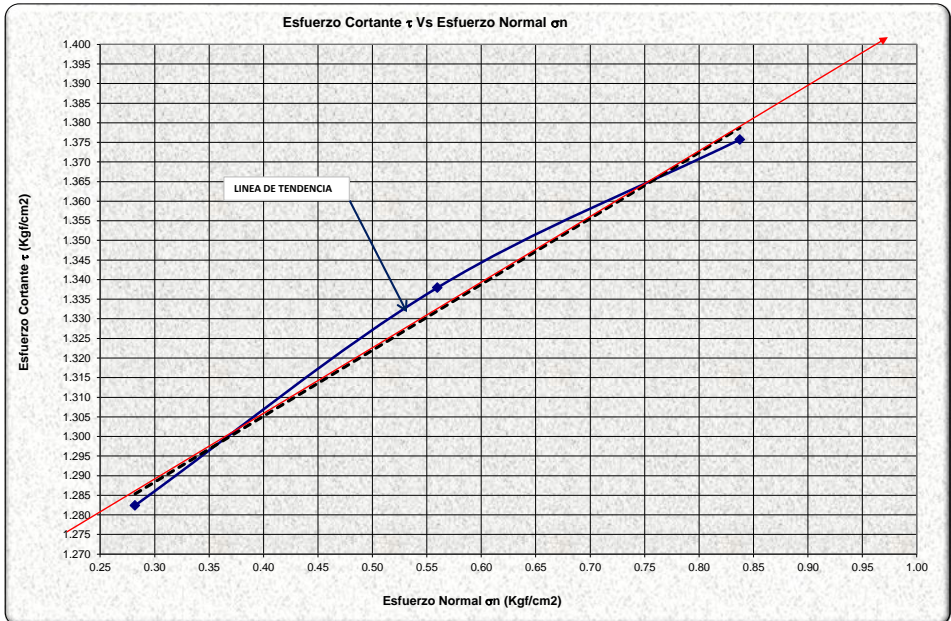
| CONTENIDO DE HUMEDAD | |
|----------------------|----------------|
| W _{mh} (g) | 206.850 |
| W _{ms} (g) | 174.400 |
| w (%) | 18.6067 |

| Anillo de Carga | Deformimetro Hz * 10-4 | Deformimetro Vert * 10-4 | Fuerza Cortante (Kgf) | Esfuerzo Normal σn | Esfuerzo Cortante τ | τ/σ | PROF(m) |
|-----------------|------------------------|--------------------------|-----------------------|--------------------|---------------------|--------|---------|
| | | | | | | | |
| 0 | 0 | -7 | 2.1660 | 0.8375 | 0.0602 | 0.0718 | 4.75 |
| 199 | 10 | -7 | 18.0860 | 0.8375 | 0.5024 | 0.5999 | |
| 253 | 20 | -7 | 22.4060 | 0.8375 | 0.6224 | 0.7432 | |
| 286 | 30 | -7 | 25.0460 | 0.8375 | 0.6957 | 0.8307 | |
| 349 | 40 | -7 | 30.0860 | 0.8375 | 0.8357 | 0.9979 | |
| 390 | 60 | -7 | 33.3660 | 0.8375 | 0.9268 | 1.1067 | |
| 417 | 80 | -7 | 35.5260 | 0.8375 | 0.9868 | 1.1783 | |
| 469 | 100 | -7 | 39.6860 | 0.8375 | 1.1024 | 1.3163 | |
| 481 | 140 | -9 | 40.6460 | 0.8375 | 1.1291 | 1.3481 | |
| 515 | 180 | -9 | 43.3660 | 0.8375 | 1.2046 | 1.4383 | |
| 534 | 220 | -10 | 44.8860 | 0.8375 | 1.2468 | 1.4888 | |
| 544 | 280 | -11 | 45.6860 | 0.8375 | 1.2691 | 1.5153 | |
| 557 | 300 | -11 | 46.7260 | 0.8375 | 1.2979 | 1.5498 | |
| 564 | 350 | -11 | 47.2860 | 0.8375 | 1.3135 | 1.5684 | |
| 568 | 400 | -14 | 47.6060 | 0.8375 | 1.3224 | 1.5790 | |
| 572 | 450 | -16 | 47.9260 | 0.8375 | 1.3313 | 1.5896 | |
| 592 | 500 | -18 | 49.5260 | 0.8375 | 1.3757 | 1.6427 | |
| 557 | 600 | -21 | 46.7260 | 0.8375 | 1.2979 | 1.5498 | |

GRAFICA ESFUERZO NORMAL Vs ESFUERZO CORTANTE

| Muestra | Esfuerzo Normal σn | Esfuerzo cortante τ |
|---------|--------------------|---------------------|
| 1 | 0.2819 | 1.2824 |
| 2 | 0.5597 | 1.3379 |
| 3 | 0.8375 | 1.3757 |

PROF(m) 4.75



| | | |
|---|--------------------------------|----------------------------------|
| Cohesión (C) = | 1,280 Kg/cm² | TANG φ = 0.09333 0.168 |
| Ángulo de fricción interna (φ) = | 9,5366 ° | 0.55556 9,5366 ° |

Código: A-GL-E01-F03 Versión: 03 Página 1 de 2

INSTITUTO DE RECURSOS MINEROS Y ENERGETICOS
 FACULTAD SECCIONAL SOGAMOSO
 LABORATORIO DE SUELOS Y ROCAS

ENSAYO DE CORTE DIRECTO (Cohesivos, no cohesivos) - Según Joseph E. Bowles - (ASTM D 3080-99)

DATOS DEL CLIENTE: CORPOCHIVOR Consecutivo: _____

NOMBRE: _____ EMPRESA: _____
 DIRECCION: _____ CÉDULA: _____ NIT: _____
 TELÉFONO: _____ Fax: _____ E-mail: _____
 PROYECTO: ESTUDIO DE AMENAZA Y VULNERABILIDAD MUNICIPIO DE CIENEGA FECHA: MARZO DE 2013

MUESTRA S2M1 COORDENADAS: E 1.084,422 N 1.090,367

FALLA 1 DATOS DE LA MUESTRA

| | | | |
|------------------------|--------|-------------------------------|---------|
| Diam. o lado | 6 | Peso Suelo Seco (gr) | 181.200 |
| Area (cm²) | 36 | Carga Normal :(Kg) | 10.15 |
| Altura (cm) | 3 | Esfuerzo Normal :(Kg/cm²) | 0.28194 |
| Volumen (cm³) | 108.0 | Peso Unitario Húmedo:(gr/cm³) | 2.00648 |
| Peso Suelo Húmedo (gr) | 216.70 | Peso Unitario Seco:(gr/cm³) | 1.67778 |

CONTENIDO DE HUMEDAD

| | |
|------------------------|---------|
| W _{rms+e} (g) | 216.700 |
| W _{rms+e} (g) | 181.200 |
| w (%) | 19.5916 |

FALLA 2 DATOS DE LA MUESTRA

| | | | |
|--------------------|--------|-------------------------------|---------|
| Diam. o lado | 6 | Peso Suelo Seco (gr) | 191.200 |
| Area (cm²) | 36 | Carga Normal :(Kg) | 20.15 |
| Altura (cm) | 3 | Esfuerzo Normal :(Kg/cm²) | 0.55972 |
| Volumen (cm³) | 108.0 | Peso Unitario Húmedo:(gr/cm³) | 1.89630 |
| Peso Suelo Húmedo: | 204.80 | Peso Unitario Seco:(gr/cm³) | 1.77037 |

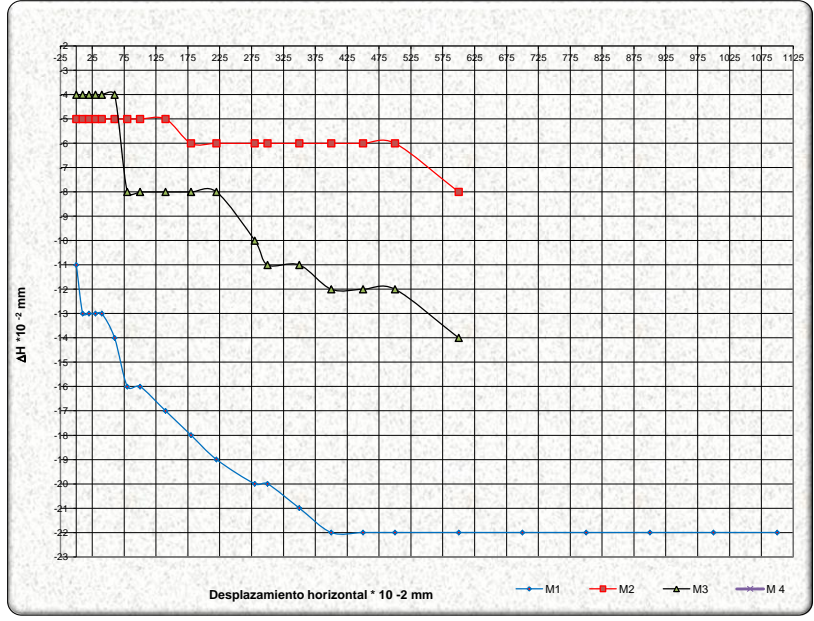
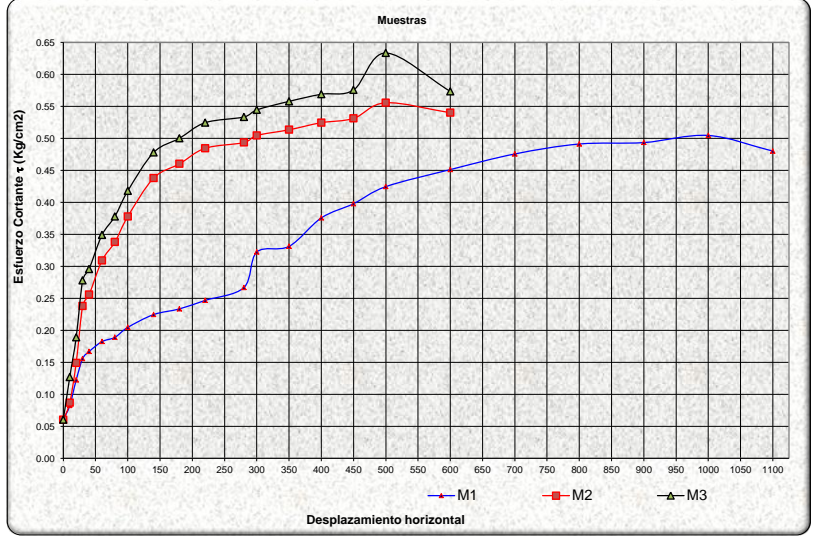
CONTENIDO DE HUMEDAD

| | |
|------------------------|---------|
| W _{rms+e} (g) | 204.800 |
| W _{rms+e} (g) | 167.900 |
| w (%) | 21.9774 |

Constante del anillo de carga kg/div) : 2.166+(lectura*0.0)

| Anillo de Carga | Deformimetro Hz * 10-4 | Deformimetro Vert * 10-4 | Fuerza Cortante (Kgf) | Esfuerzo Normal ̄n | Esfuerzo Cortante t | Esfuerzos τ/σ | PROF(m) |
|-----------------|------------------------|--------------------------|-----------------------|--------------------|---------------------|---------------|---------|
| 0 | 0 | -11 | 2.1660 | 0.2819 | 0.0602 | 0.2134 | 1.80 |
| 10 | 10 | -13 | 2.9660 | 0.2819 | 0.0824 | 0.2922 | 1.80 |
| 28 | 20 | -13 | 4.4060 | 0.2819 | 0.1224 | 0.4341 | 1.80 |
| 43 | 30 | -13 | 5.6060 | 0.2819 | 0.1557 | 0.5523 | 1.80 |
| 48 | 40 | -13 | 6.0060 | 0.2819 | 0.1668 | 0.5917 | 1.80 |
| 55 | 60 | -14 | 6.5660 | 0.2819 | 0.1824 | 0.6469 | 1.80 |
| 58 | 80 | -16 | 6.8060 | 0.2819 | 0.1891 | 0.6705 | 1.80 |
| 65 | 100 | -16 | 7.3660 | 0.2819 | 0.2046 | 0.7257 | 1.80 |
| 74 | 140 | -17 | 8.0860 | 0.2819 | 0.2246 | 0.7967 | 1.80 |
| 78 | 180 | -18 | 8.4060 | 0.2819 | 0.2335 | 0.8282 | 1.80 |
| 84 | 220 | -19 | 8.8860 | 0.2819 | 0.2468 | 0.8755 | 1.80 |
| 93 | 280 | -20 | 9.6060 | 0.2819 | 0.2668 | 0.9464 | 1.80 |
| 118 | 300 | -20 | 11.6060 | 0.2819 | 0.3224 | 1.1434 | 1.80 |
| 122 | 350 | -21 | 11.9260 | 0.2819 | 0.3313 | 1.1750 | 1.80 |
| 142 | 400 | -22 | 13.5260 | 0.2819 | 0.3757 | 1.3326 | 1.80 |
| 152 | 450 | -22 | 14.3260 | 0.2819 | 0.3979 | 1.4114 | 1.80 |
| 164 | 500 | -22 | 15.2860 | 0.2819 | 0.4246 | 1.5060 | 1.80 |
| 176 | 600 | -22 | 16.2460 | 0.2819 | 0.4513 | 1.6006 | 1.80 |
| 187 | 700 | -22 | 17.1260 | 0.2819 | 0.4757 | 1.6873 | 1.80 |
| 194 | 800 | -22 | 17.6860 | 0.2819 | 0.4913 | 1.7425 | 1.80 |
| 195 | 900 | -22 | 17.7660 | 0.2819 | 0.4935 | 1.7503 | 1.80 |
| 200 | 1000 | -22 | 18.1660 | 0.2819 | 0.5046 | 1.7898 | 1.80 |
| 189 | 1100 | -22 | 17.2860 | 0.2819 | 0.4802 | 1.7031 | 1.80 |

| Anillo de Carga | Deformimetro Hz * 10-4 | Deformimetro Vert * 10-4 | Fuerza Cortante (Kgf) | Esfuerzo Normal ̄n | Esfuerzo Cortante t | Esfuerzos τ/σ | PROF(m) |
|-----------------|------------------------|--------------------------|-----------------------|--------------------|---------------------|---------------|---------|
| 0 | 0 | -5 | 2.1660 | 0.5597 | 0.0602 | 0.1075 | 1.80 |
| 12 | 10 | -5 | 3.1260 | 0.5597 | 0.0868 | 0.1551 | 1.80 |
| 40 | 20 | -5 | 5.3660 | 0.5597 | 0.1491 | 0.2663 | 1.80 |
| 80 | 30 | -5 | 8.5660 | 0.5597 | 0.2379 | 0.4251 | 1.80 |
| 88 | 40 | -5 | 9.2060 | 0.5597 | 0.2557 | 0.4569 | 1.80 |
| 112 | 60 | -5 | 11.1260 | 0.5597 | 0.3091 | 0.5522 | 1.80 |
| 125 | 80 | -5 | 12.1660 | 0.5597 | 0.3379 | 0.6038 | 1.80 |
| 143 | 100 | -5 | 13.6060 | 0.5597 | 0.3779 | 0.6752 | 1.80 |
| 170 | 140 | -5 | 15.7660 | 0.5597 | 0.4379 | 0.7824 | 1.80 |
| 180 | 180 | -6 | 16.5660 | 0.5597 | 0.4602 | 0.8221 | 1.80 |
| 191 | 220 | -6 | 17.4460 | 0.5597 | 0.4846 | 0.8658 | 1.80 |
| 195 | 280 | -6 | 17.7660 | 0.5597 | 0.4935 | 0.8817 | 1.80 |
| 200 | 300 | -6 | 18.1660 | 0.5597 | 0.5046 | 0.9015 | 1.80 |
| 204 | 350 | -6 | 18.4860 | 0.5597 | 0.5135 | 0.9174 | 1.80 |
| 209 | 400 | -6 | 18.8860 | 0.5597 | 0.5246 | 0.9373 | 1.80 |
| 212 | 450 | -6 | 19.1260 | 0.5597 | 0.5313 | 0.9492 | 1.80 |
| 223 | 500 | -6 | 20.0060 | 0.5597 | 0.5557 | 0.9929 | 1.80 |
| 216 | 600 | -8 | 19.4460 | 0.5597 | 0.5402 | 0.9651 | 1.80 |



| | | |
|---|-------------|---|
| Código: A-GL-E01-F03 | Versión: 03 | Página 2 de 2 |
| INSTITUTO DE RECURSOS MINEROS Y ENERGETICOS FACULTAD SECCIONAL SOGAMOSO LABORATORIO DE SUELOS Y ROCAS | | |
| ENSAYO DE CORTE DIRECTO (Cohesivos, no cohesivos) - Según Joseph E. Bowles - (ASTM D 3080-99) | | |
| DATOS DEL CLIENTE: CORPOCHIVOR | | EMPRESA: Consecutivo: |
| DIRECCION: NOMBRE: | | NIT: |
| TELÉFONO: CÉDULA: Fax: | | E-mail: |
| PROYECTO : ESTUDIO DE AMENAZA Y VULNERABILIDAD MUNICIPIO DE CIENEGA | | FECHA: MARZO DE 2013 |
| MUESTRA | S2M1 | COORDENADAS: E 1,084,422 N 1,090,367 |

| DATOS DE LA MUESTRA | | | |
|---------------------|--------|-------------------------------|---------|
| Diam. o lado | 6 | Peso Suelo Seco : | 166.800 |
| Area (cm²): | 36 | Carga Normal :(Kg) | 30.15 |
| Altura (cm) : | 3 | Esfuerzo Normal :(Kg/cm²) | 0.83750 |
| Volumen(cm³): | 108.0 | Peso Unitario Húmedo:(gr/cm³) | 1.87963 |
| Peso Suelo Húmedo: | 203.00 | Peso Unitario Seco:(gr/cm³) | 1.54444 |

| CONTENIDO DE HUMEDAD | |
|-----------------------|----------------|
| W _{mhr.} (g) | 203.000 |
| W _{msh.} (g) | 166.800 |
| w (%) | 21.7026 |

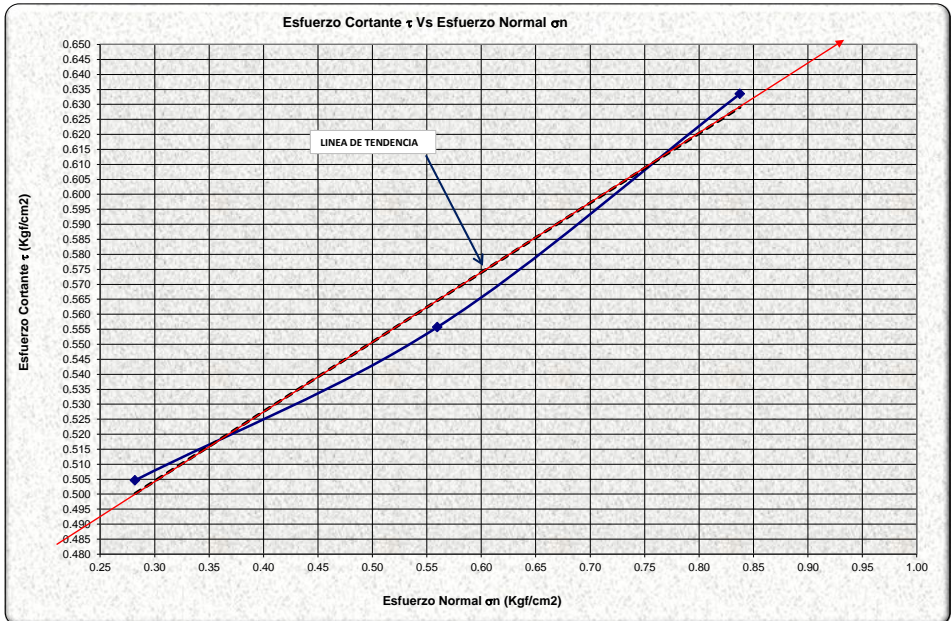
| Anillo de Carga | Deformimetro Hz * 10-4 | Deformimetro Vert * 10-4 | Fuerza Cortante (Kgf) | Esfuerzo Normal σn | Esfuerzo Cortante τ | τ/σ |
|-----------------|------------------------|--------------------------|-----------------------|--------------------|---------------------|--------|
| 0 | 0 | -4 | 2.1660 | 0.8375 | 0.0602 | 0.0718 |
| 30 | 10 | -4 | 4.5660 | 0.8375 | 0.1268 | 0.1514 |
| 58 | 20 | -4 | 6.8060 | 0.8375 | 0.1891 | 0.2257 |
| 98 | 30 | -4 | 10.0060 | 0.8375 | 0.2779 | 0.3319 |
| 106 | 40 | -4 | 10.6460 | 0.8375 | 0.2957 | 0.3531 |
| 130 | 60 | -4 | 12.5660 | 0.8375 | 0.3491 | 0.4168 |
| 143 | 80 | -8 | 13.6060 | 0.8375 | 0.3779 | 0.4513 |
| 161 | 100 | -8 | 15.0460 | 0.8375 | 0.4179 | 0.4990 |
| 188 | 140 | -8 | 17.2060 | 0.8375 | 0.4779 | 0.5707 |
| 198 | 180 | -8 | 18.0060 | 0.8375 | 0.5002 | 0.5972 |
| 209 | 220 | -8 | 18.8860 | 0.8375 | 0.5246 | 0.6264 |
| 213 | 280 | -10 | 19.2060 | 0.8375 | 0.5335 | 0.6370 |
| 218 | 300 | -11 | 19.6060 | 0.8375 | 0.5446 | 0.6503 |
| 224 | 350 | -11 | 20.0860 | 0.8375 | 0.5579 | 0.6662 |
| 229 | 400 | -12 | 20.4860 | 0.8375 | 0.5691 | 0.6795 |
| 232 | 450 | -12 | 20.7260 | 0.8375 | 0.5757 | 0.6874 |
| 258 | 500 | -12 | 22.8060 | 0.8375 | 0.6335 | 0.7564 |
| 231 | 600 | -14 | 20.6460 | 0.8375 | 0.5735 | 0.6848 |

| | |
|---------|------|
| PROF(m) | 1.80 |
|---------|------|

GRAFICA ESFUERZO NORMAL Vs ESFUERZO CORTANTE

| Muestra | Esfuerzo Normal σn | Esfuerzo cortante τ |
|---------|--------------------|---------------------|
| 1 | 0.2819 | 0.5046 |
| 2 | 0.5597 | 0.5557 |
| 3 | 0.8375 | 0.6335 |

| | |
|---------|------|
| PROF(m) | 1.80 |
|---------|------|



| | | |
|---|---------------------------------|----------------------------------|
| Cohesión (C) = | 0,493 Kgf/cm² | TANG φ = 0.12889 0.232 |
| Ángulo de fricción interna (φ) = | 13,0611556 ° | 0.55556 13,0611556 ° |