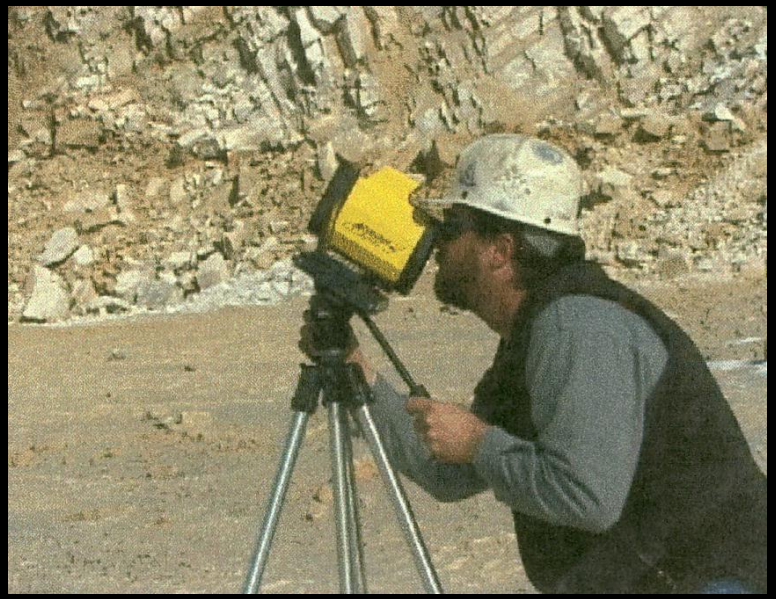
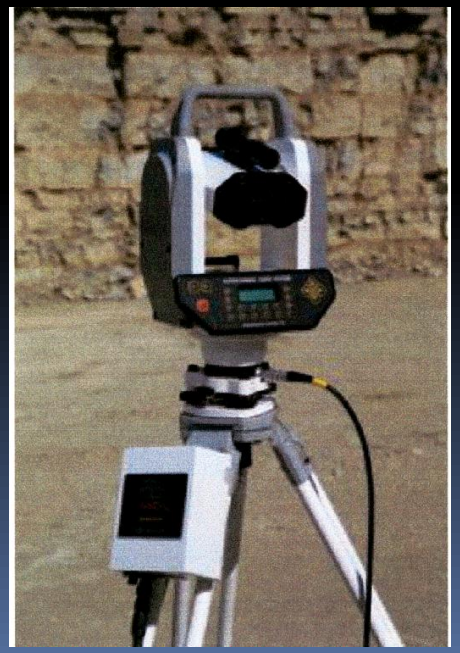
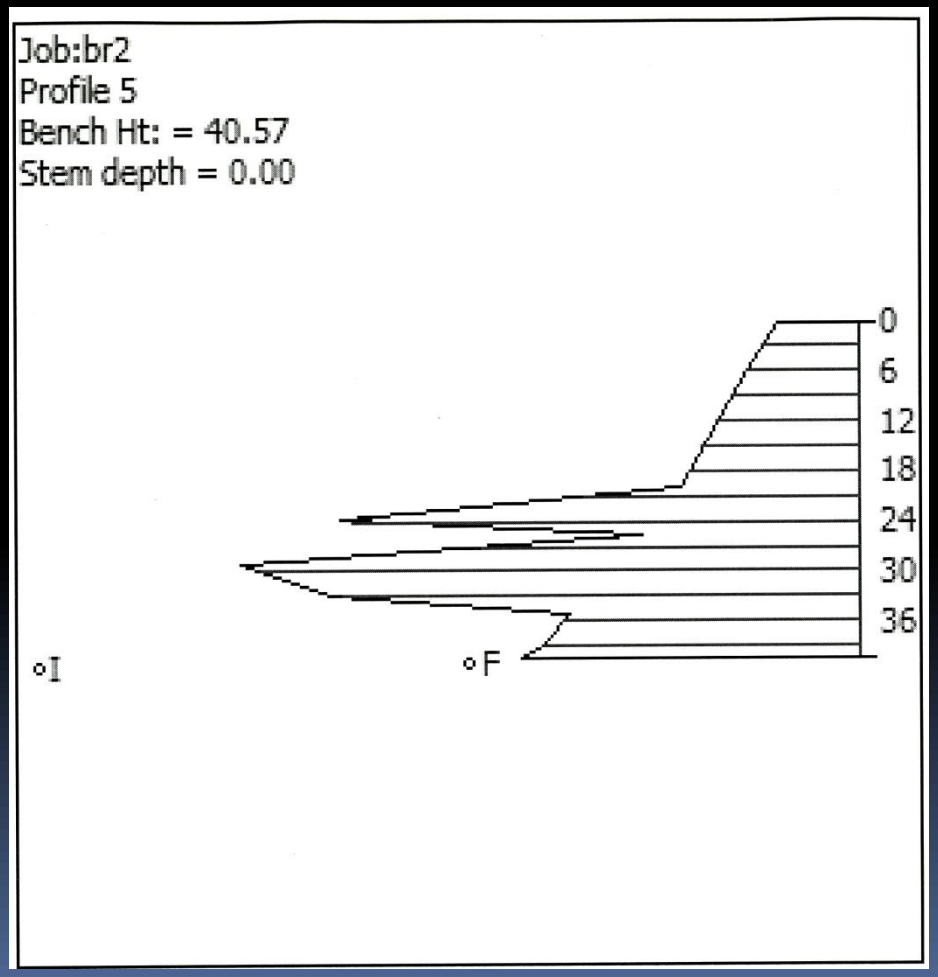
# Laser Profiler & Photogrammetric Technologies





# Limitations of Laser and Photogrammetric Systems

## 1) Dust



# Limitations of Laser and Photogrammetric Systems

2) Direct Sunlight

3) Heavy Snow, Rain, Fog & Cold

4) Reflectivity of Rock (Laser Only)

5) Pit Access

# Limitations of Laser and Photogrammetric Systems

## 6) Crest – Face – Crest Travel Time

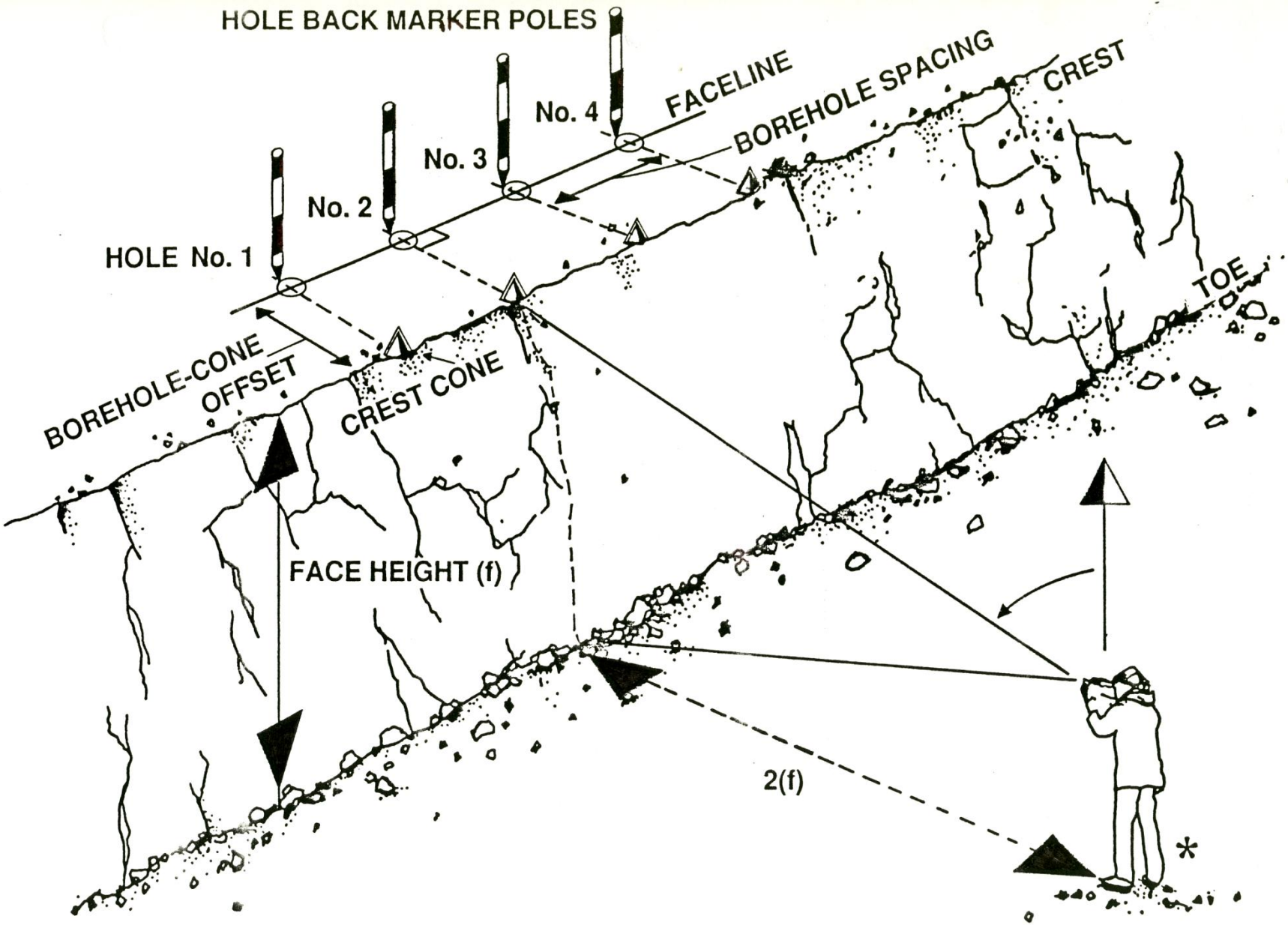
## 7) Spoil Against Face

## 8) Laser Reflection Off Free Face Does Not Distinguish Between Rock or Dirt

# ACCURATE DRILL LOGS ARE STILL NEEDED !!!!

# Laser Profiled Quarry Wall – Designed Burdens Verified

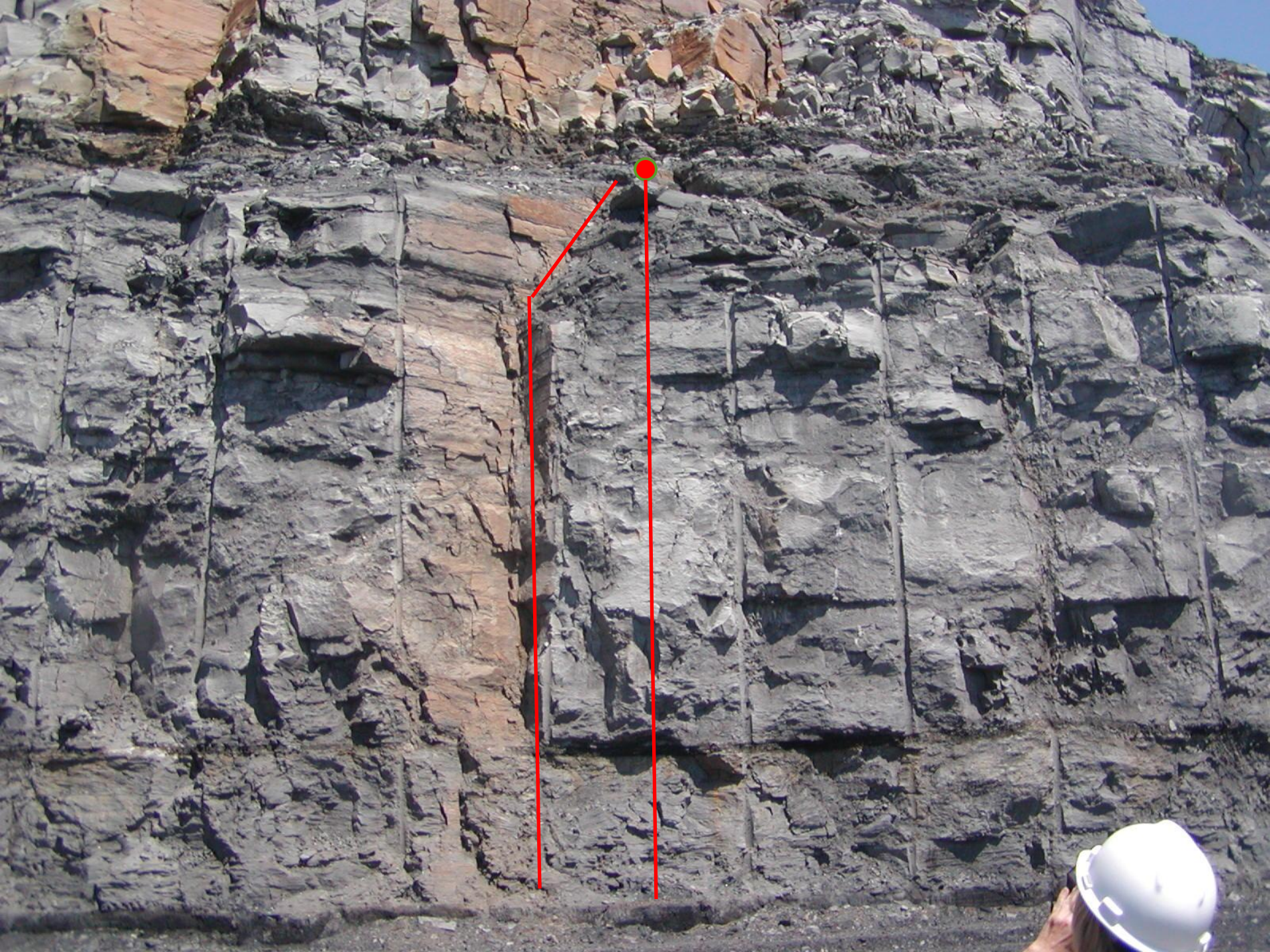
# 2 Dimensional (2D) Laser Profilers




* OBSERVATION POINT

(a) IN TRANSIT WITH BACK MARKER POLE & CREST CONE

(b) APPROXIMATELY TWICE THE FACE HEIGHT IN DISTANCE FROM THE TOE



Burden Values:

| Depth | Burden |
|---|---|
| 0 | 2 |
| 3 | 3.94 |
| 6 | 4.36 |
| 9 | 5.08 |
| 12 | 5.79 |
| 15 | 6.28 |
| 18 | 6.75 |
| 21 | 7.33 |
| 24 | 7.82 |
| 27 | 8.13 |
| 30 | 7.67 |
| 33 | 7.67 |
| 36 | 7.98 |
| 39 | 8.97 |
| 42 | 10.86 |
| 45 | 11.83 |
| 48 | 12.9 |
| 51 | 14.72 |

| | Diff(ft) |
|---|---|
| | |
| | 1.9 |
| | 5.32 |
| | 5.09 |
| | 5.15 |
| | 5.84 |
| | 5.38 |
| | 5.24 |
| | 5.34 |
| | 5.68 |
| | 6.96 |
| | 7.26 |
| | 7.36 |
| | 6.59 |
| | 4.82 |
| | 2.85 |
| | 1.45 |
| | 0.43 |
| **Avg.** | **4.86** |

Burden Values:

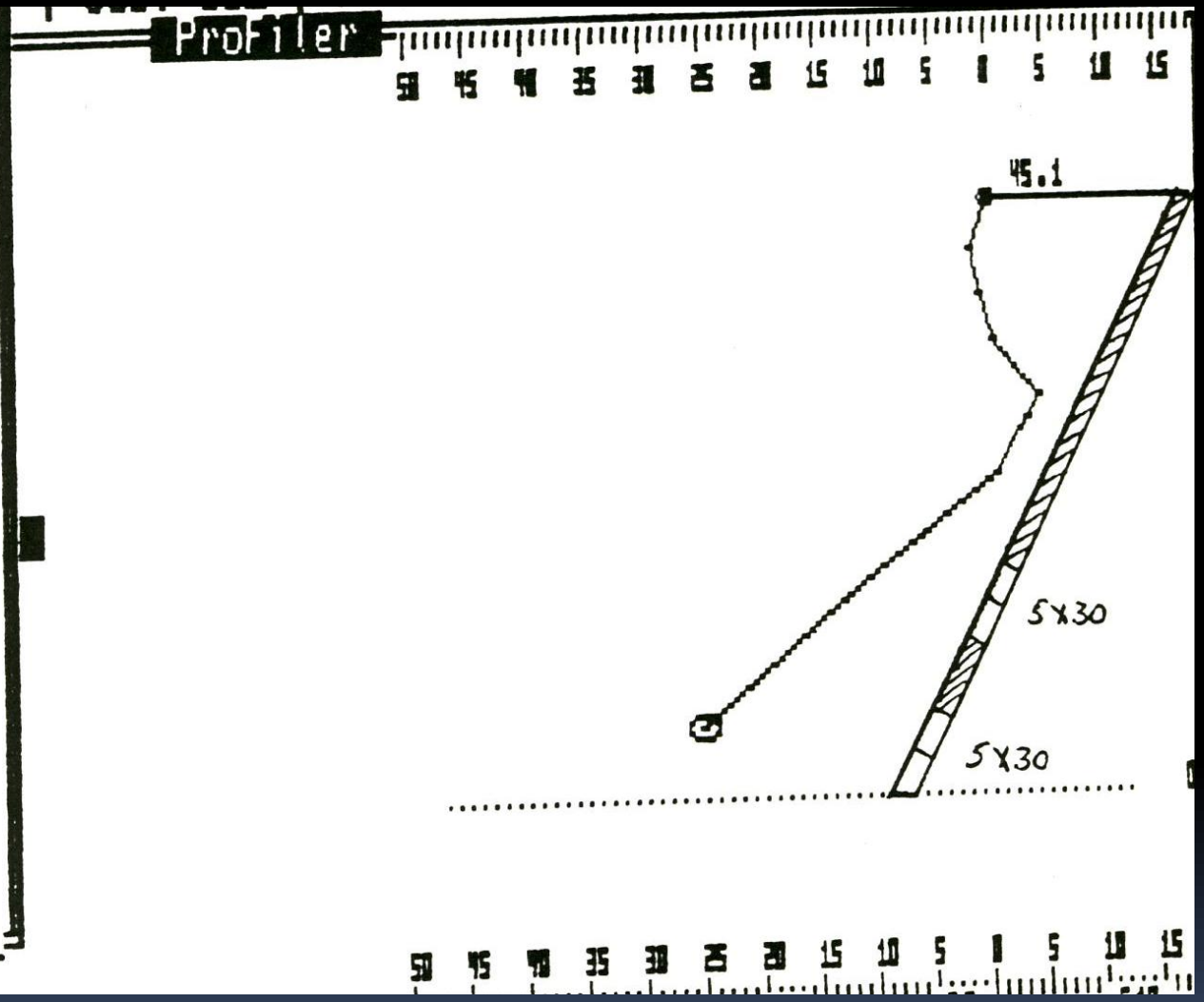
| Depth | Burden |
|---|---|
| 0 | 2 |
| 3 | 5.84 |
| 6 | 9.68 |
| 9 | 10.17 |
| 12 | 10.94 |
| 15 | 12.12 |
| 18 | 12.13 |
| 21 | 12.57 |
| 24 | 13.16 |
| 27 | 13.81 |
| 30 | 14.63 |
| 33 | 14.93 |
| 36 | 15.34 |
| 39 | 15.56 |
| 42 | 15.68 |
| 45 | 14.68 |
| 48 | 14.35 |
| 51 | 15.15 |

# Advantages of 2D Laser Systems

## 1) Mobility

| Height | Depth | Burden |
|---|---|---|
| 45.1 | 0.0 | 17.0 |
| 42.5 | 3.0 | 16.6 |
| 39.9 | 6.0 | 15.2 |
| 37.3 | 9.0 | 13.0 |
| 34.7 | 12.0 | 10.5 |
| 32.1 | 15.0 | 6.7 |
| 29.5 | 18.0 | 4.0 |
| 26.9 | 21.0 | 4.0 |
| 24.3 | 24.0 | 4.4 |
| 21.7 | 27.0 | 6.7 |
| 19.1 | 30.0 | 8.9 |
| 16.5 | 33.0 | 11.2 |
| 13.9 | 36.0 | 13.3 |
| 11.3 | 39.0 | 15.2 |
| 8.7 | 42.0 | 17.1 |
| 6.1 | 45.0 | 19.0 |
| 5.7 | 45.5 | 19.3 |

HER02001.IVL



# Advantages of 2D Laser Systems

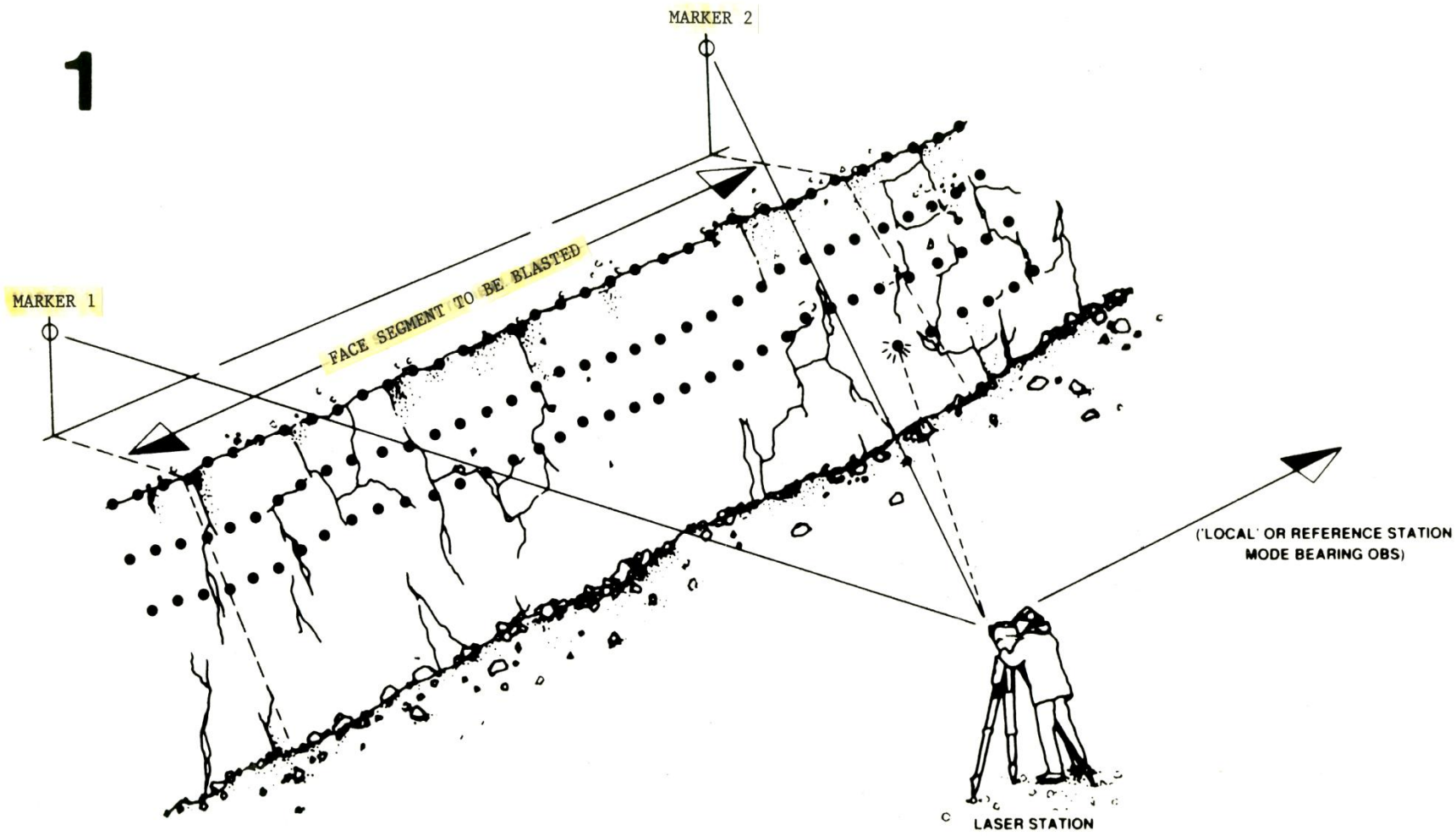
1) Mobility

2) Lower Cost $4,000 - $8,000

3) Easier Training Than 3D Profiler

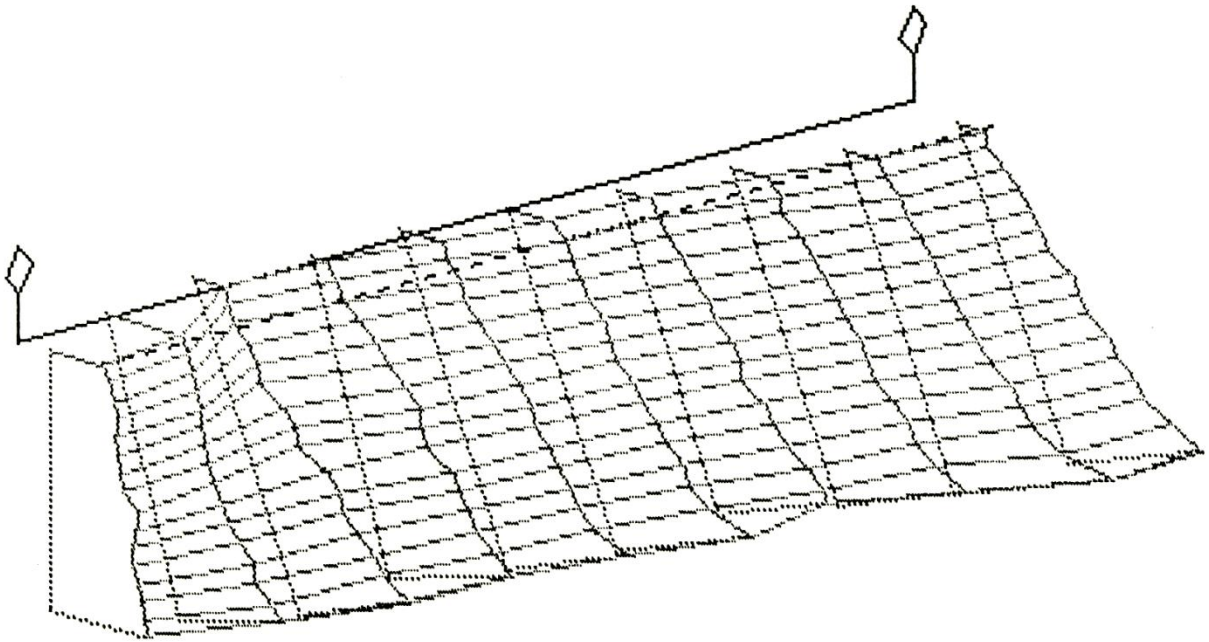
4) Quicker Processing (Data Collector On Bench)

# 3 Dimensional (3D) Laser Profilers




***'LOCAL' OR 'ABSOLUTE' SINGLE STATION MODE***

● · OBSERVATION TO ROCKFACE



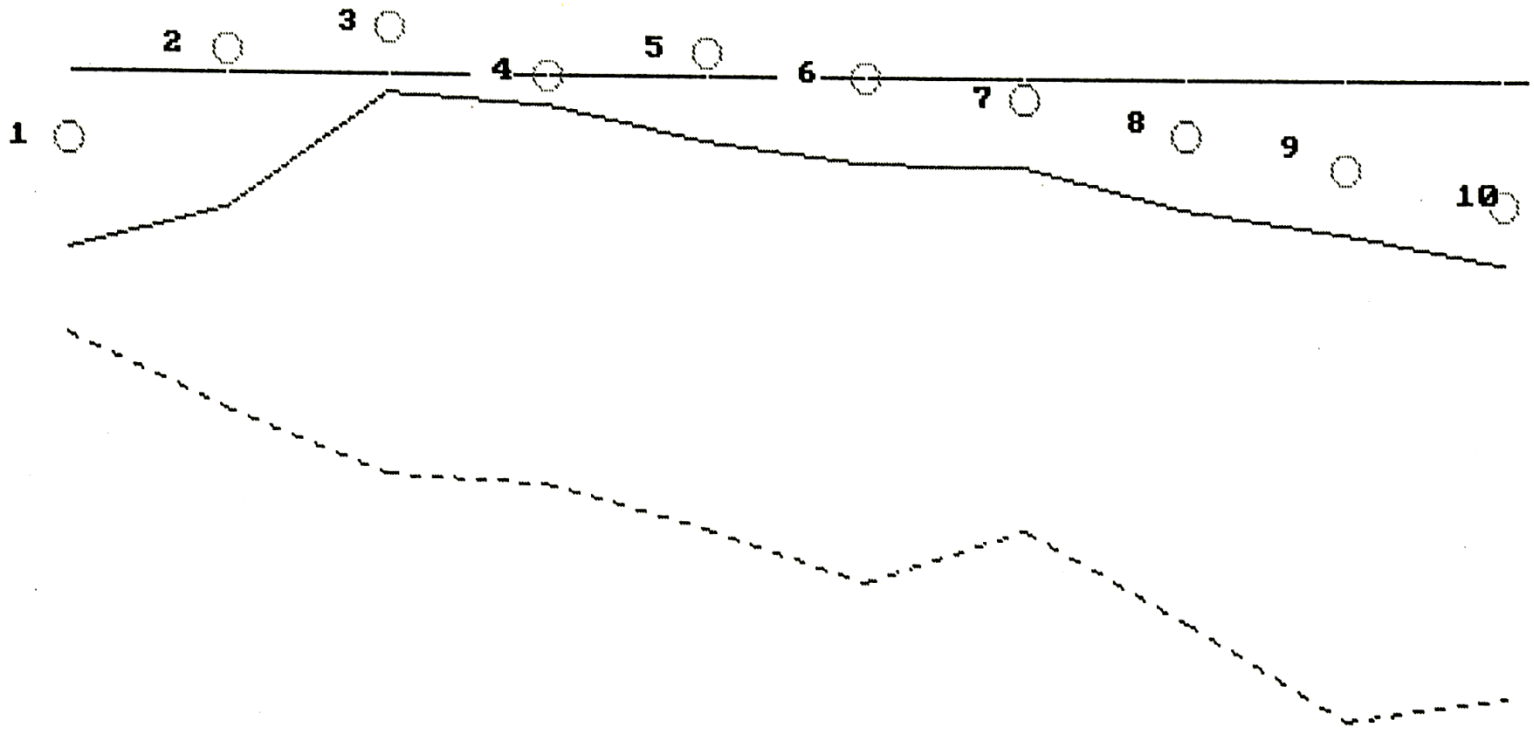
||| MDL |||
FACE3D V4.00
(c) 1993 MDL

File : ML1
Face : 01
Date : 122199
Holes: 10

Vol.: 4072
Ton.: 9082

CLIENT:

SITE:




WAFER SECTION PLOT

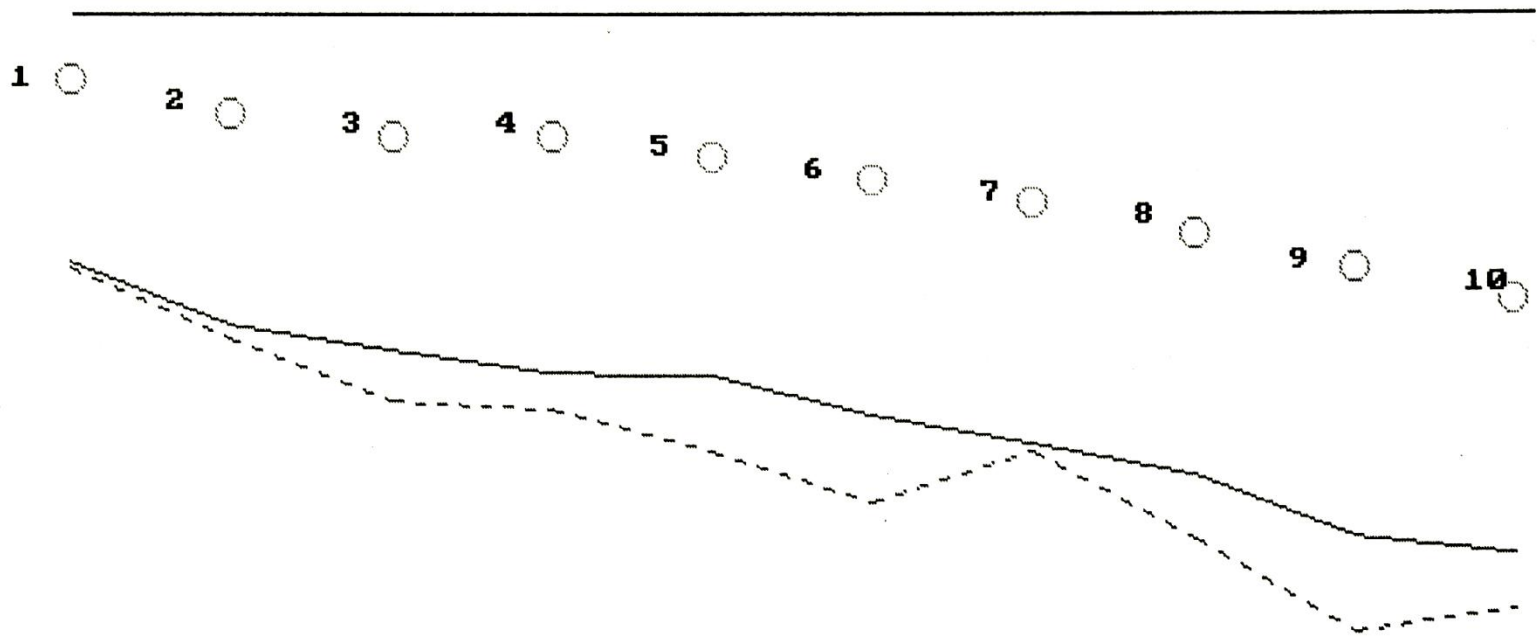
CLIENT:

Com SITE:

DATE:122199
FACE:ML1

Quarryman(R) System
Measurement Devices Limited
Aberdeen AB23 8EW, UK
Copyright 1993 - MDL

Wafer cut at 0 ft below crest.




WAFER SECTION PLOT

CLIENT:Hall Explosives Com SITE:

DATE:122199
FACE:ML1

Quarryman(R) System
Measurement Devices Limited
Aberdeen AB23 8EW, UK
Copyright 1993 - MDL

Wafer cut at 42 ft below crest.

Details of Intended Boreholes Page 1

Face Name ML1 Face Number 01 Survey Date 122199

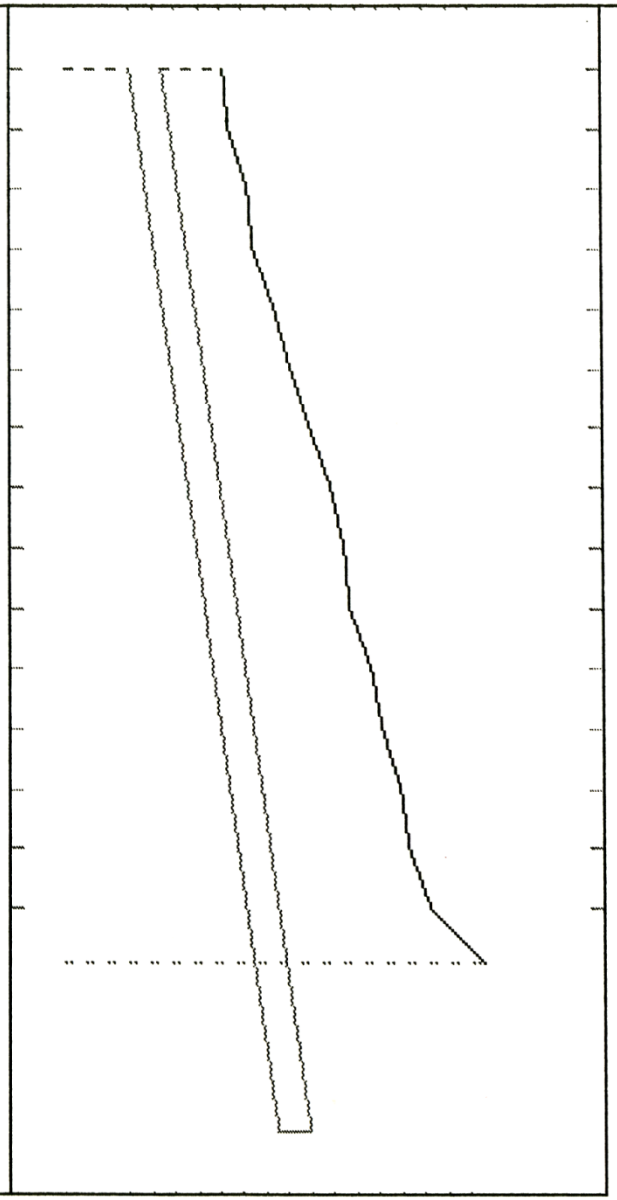
All angles in degrees. All measurements in feet
Profiles have been edited

NOTE. A=Left Marker, B=Right Marker.
-ve Offset=Towards Face, +ve Offset=Away From Face
Average burden does not include stemmed area

Offsets: Left Marker 15.0 Right Marker 15.0

| Hole No | Distance Along AB | Offset From AB | Hole Ang | Hole Depth | (Sub Drill) | Bench Height | Min Bur | Depth of Min Bur | Avg Burden | Stem. Depth |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.0 | -6.0 | 0.0 | 44.5 | 0.0 | 44.6 | 11.5 | 12.0 | 14.8 | 12.0 |
| 2 | 18.0 | 2.0 | 15.0 | 51.0 | 5.2 | 44.4 | 12.9 | 27.0 | 15.2 | 12.0 |
| 3 | 36.0 | 4.0 | 20.0 | 56.5 | 8.0 | 45.4 | 6.3 | 12.0 | 13.2 | 12.0 |
| 4 | 54.0 | 0.0 | 15.0 | 53.0 | 6.3 | 45.1 | 6.5 | 12.0 | 15.2 | 12.0 |
| 5 | 72.0 | 2.0 | 20.0 | 56.5 | 8.9 | 44.8 | 8.1 | 12.0 | 15.0 | 12.0 |
| 6 | 90.0 | 0.0 | 20.0 | 57.0 | 9.9 | 44.5 | 9.0 | 12.0 | 15.8 | 12.0 |
| 7 | 108.0 | -2.0 | 20.0 | 54.5 | 7.7 | 44.1 | 7.8 | 12.0 | 14.5 | 12.0 |
| 8 | 126.0 | -5.0 | 20.0 | 57.0 | 9.4 | 44.5 | 8.7 | 12.0 | 15.3 | 12.0 |
| 9 | 144.0 | -8.0 | 20.0 | 58.0 | 11.3 | 44.0 | 7.7 | 12.0 | 16.2 | 12.0 |
| 10 | 162.0 | -11.0 | 20.0 | 57.5 | 9.5 | 45.1 | 7.4 | 12.0 | 15.2 | 12.0 |

| Dep. | Bur. | PF 1 | PF 2 |
|---|---|---|---|
| 0.0 | 7.9 | | |
| 3.0 | 7.4 | | |
| 6.0 | 7.3 | | |
| 9.0 | 8.4 | | |
| 12.0 | 8.1 | 1.11 | 0.79 |
| 15.0 | 9.1 | 1.25 | 0.89 |
| 18.0 | 10.3 | 1.40 | 1.00 |
| 21.0 | 11.2 | 1.53 | 1.09 |
| 24.0 | 12.2 | 1.67 | 1.19 |
| 27.0 | 13.5 | 1.85 | 1.32 |
| 30.0 | 14.2 | 1.95 | 1.39 |
| 33.0 | 14.2 | 1.94 | 1.38 |
| 36.0 | 15.0 | 2.05 | 1.46 |
| 39.0 | 15.8 | 2.16 | 1.54 |
| 42.0 | 16.3 | 2.23 | 1.59 |
| 45.0 | 17.2 | 2.35 | 1.67 |
| 48.0 | 17.4 | 2.38 | 1.69 |
| 51.0 | 18.6 | 2.53 | 1.81 |
| 54.0 | 21.6 | 2.95 | 2.10 |
| 56.6 | 24.6 | 3.35 | 2.39 |
| Prod. | Dia. | 6.25 | 6.25 |
| Prod. | Dens | 0.82 | 1.15 |



(c) 1994 MDL
Face3D V4.00

Profile Parameters

10 profiles
No BoreTrak
Burden Int 3 ft

Prof. No 5

Hole Dep 56.6ft
Subdrill 8.9ft
Bench Ht 44.8ft
Hole Diam 6.3in

Burdens :
Minimum 8.1ft
Maximum 24.6ft
Average 15.0ft

Stemming 12.0ft

Along AB 72.0ft
Offset 2.0ft

Vol. 421.0Cu.
Mass 939.0t

Borehole Position
5028.1East.
5180.0North.
546.7Elev.

Explosives

1=ANFO
2=Blend

Vt. Tick Int 3ft
Hz. Tick Int 3ft

Press F1 for profile 2
Press F2 to view a different profile
Press F3 to print all
Press F10 to exit.

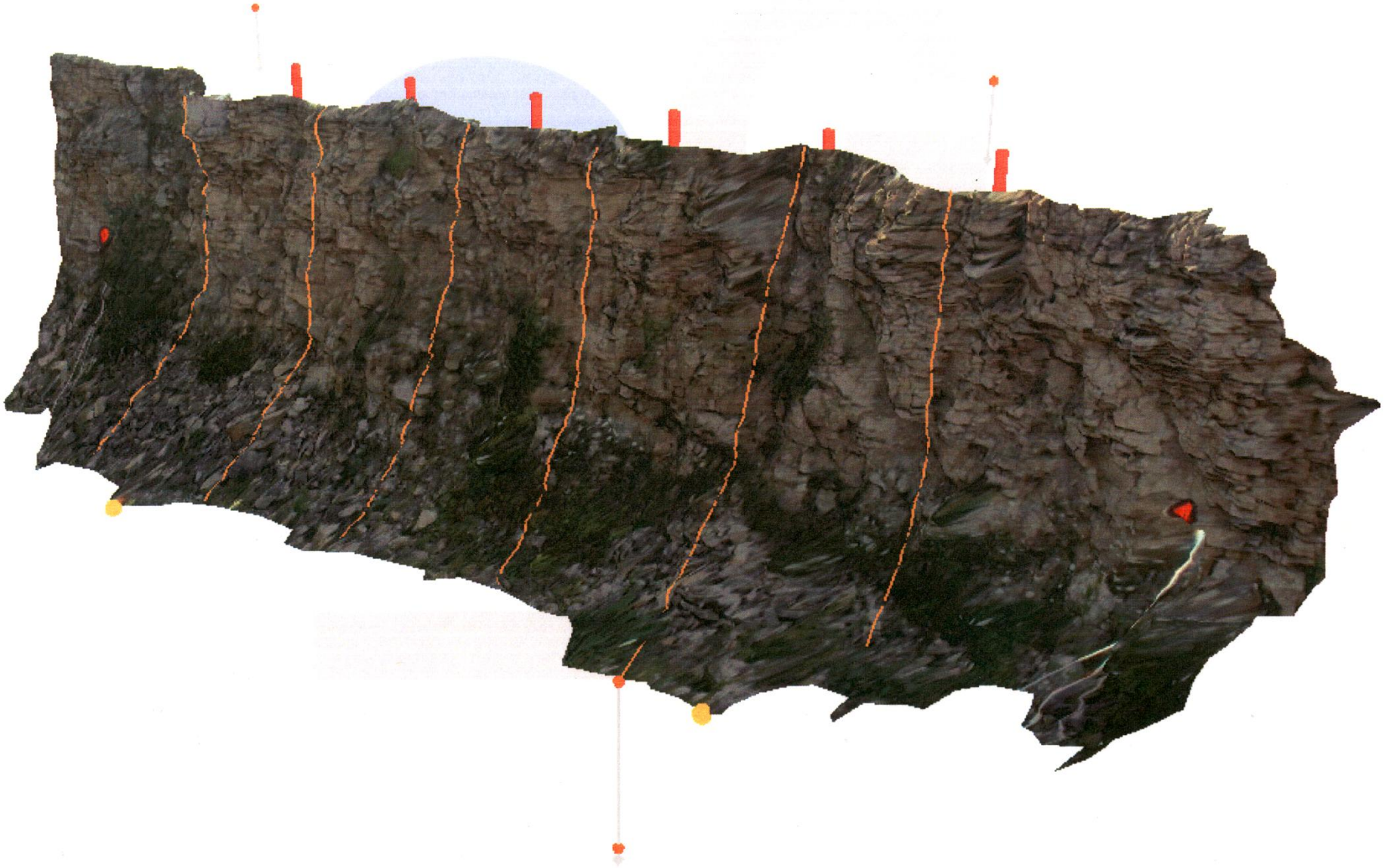
# Advantages of 3D Laser Systems

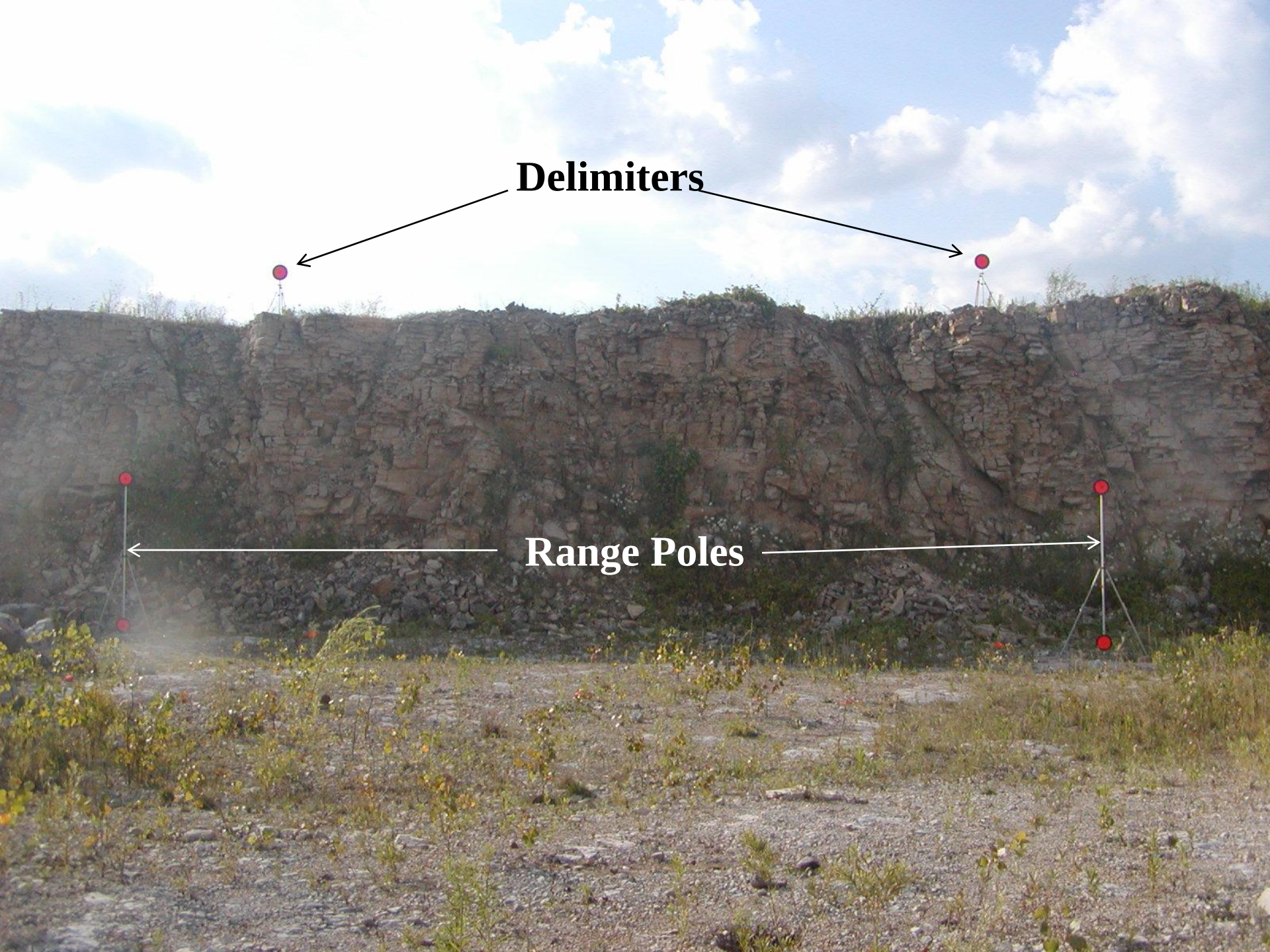
1) More Detailed Information

2) Equipment Located Outside Immediate Pit Area

3) Integration of Borehole Deviation (BoreTrak) Measurements

# Photogrammetric Systems

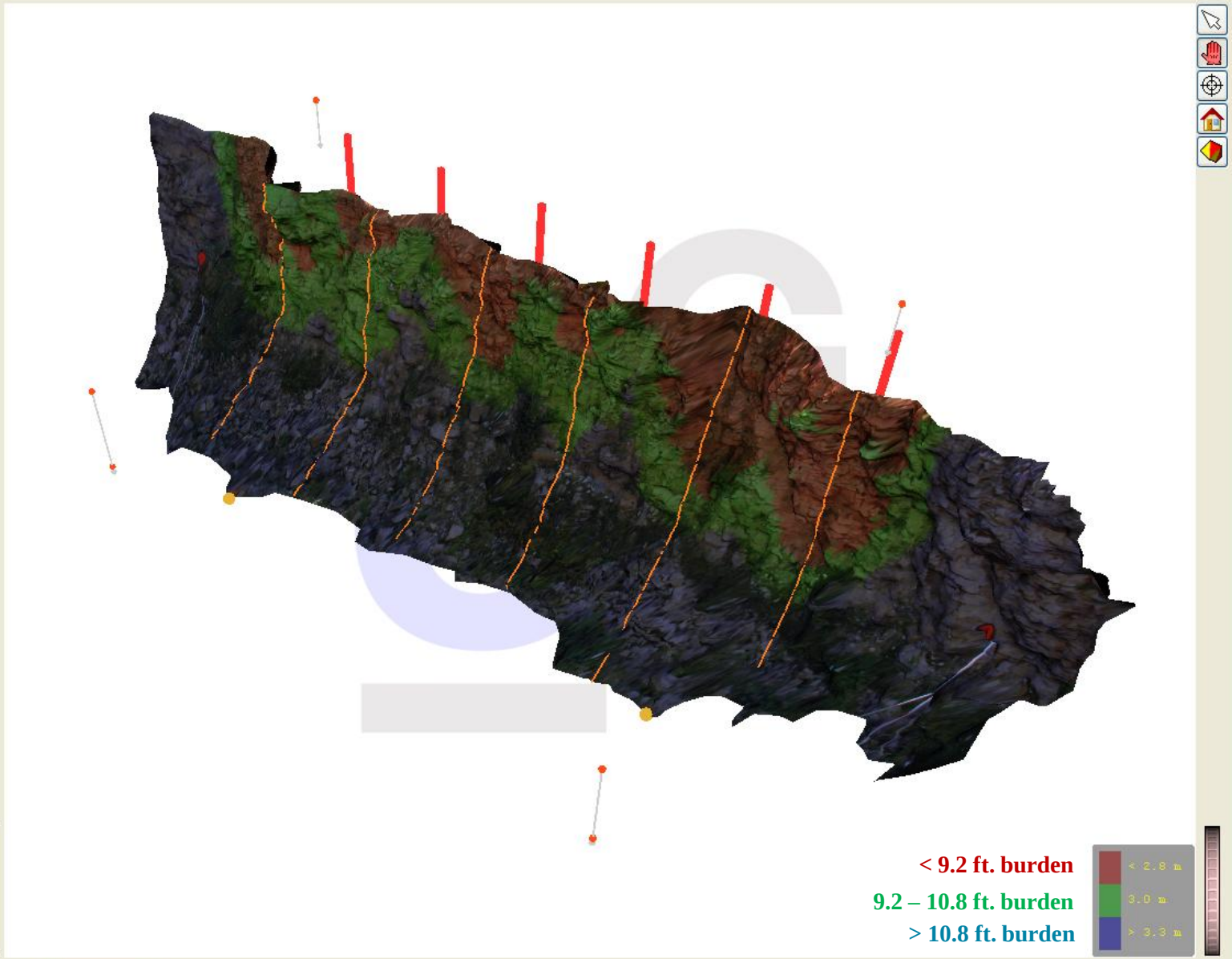



Delimiters
Range Poles

Nikon

BMX BlastPlanner - C:/Photos/Blastmetrix/OSM test1/073108 18rm/merged/073108 18rm.jm3

File Edit View Help



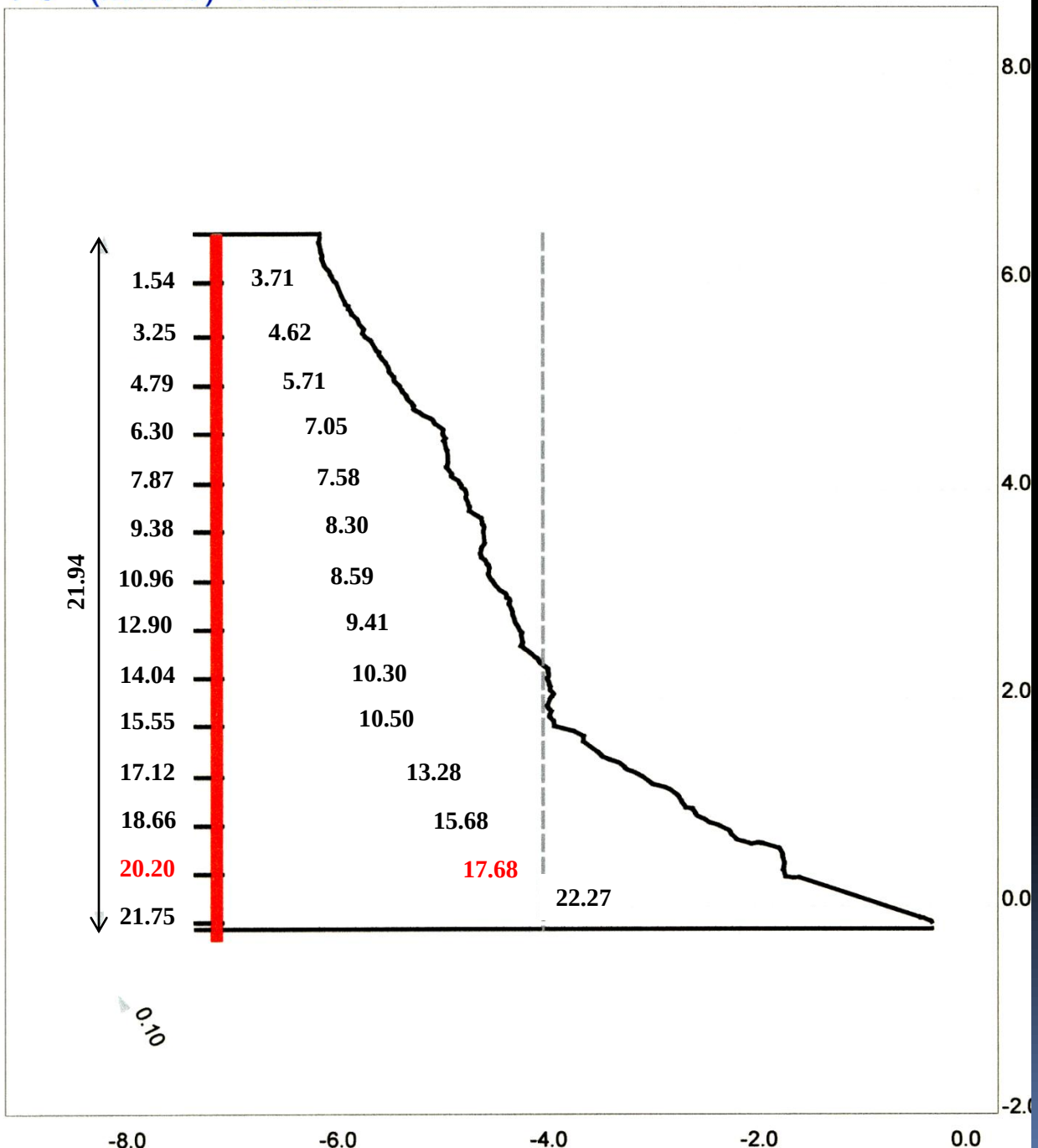

- Warrensburg
  - Delimiter
    - Left Delimiter
    - Right Delimiter
  - Planes
    - Face Plane
    - Floor Level Plane
    - Left Border Plane
    - Right Border Plane
    - Top Level Plane
  - Plane Marker
  - Drillpattern
    - Borehole 1-1
    - Borehole 1-2
    - Borehole 1-3
    - Borehole 1-4
    - Borehole 1-5
    - Borehole 1-6

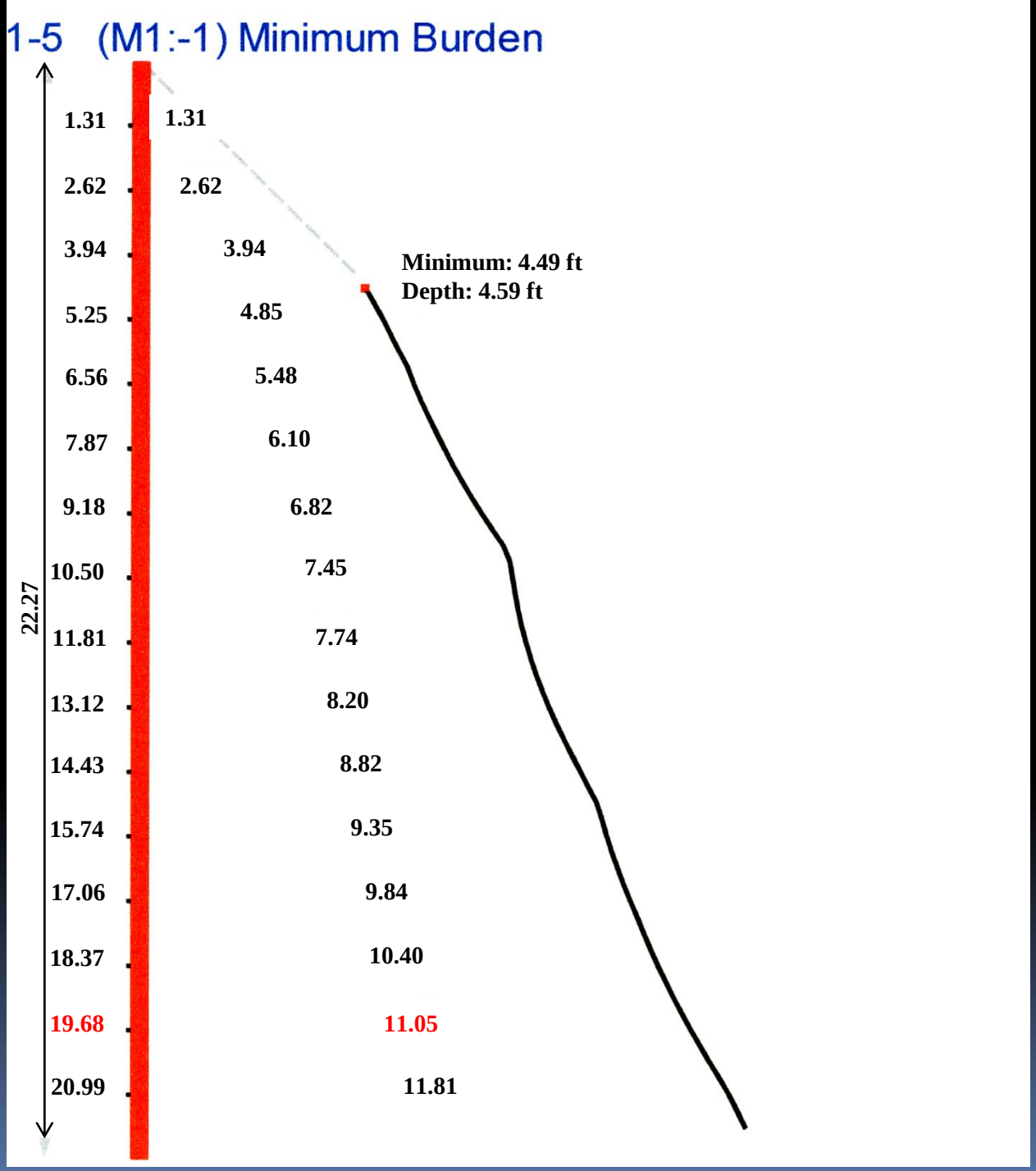
Rotx Roty

Zoom

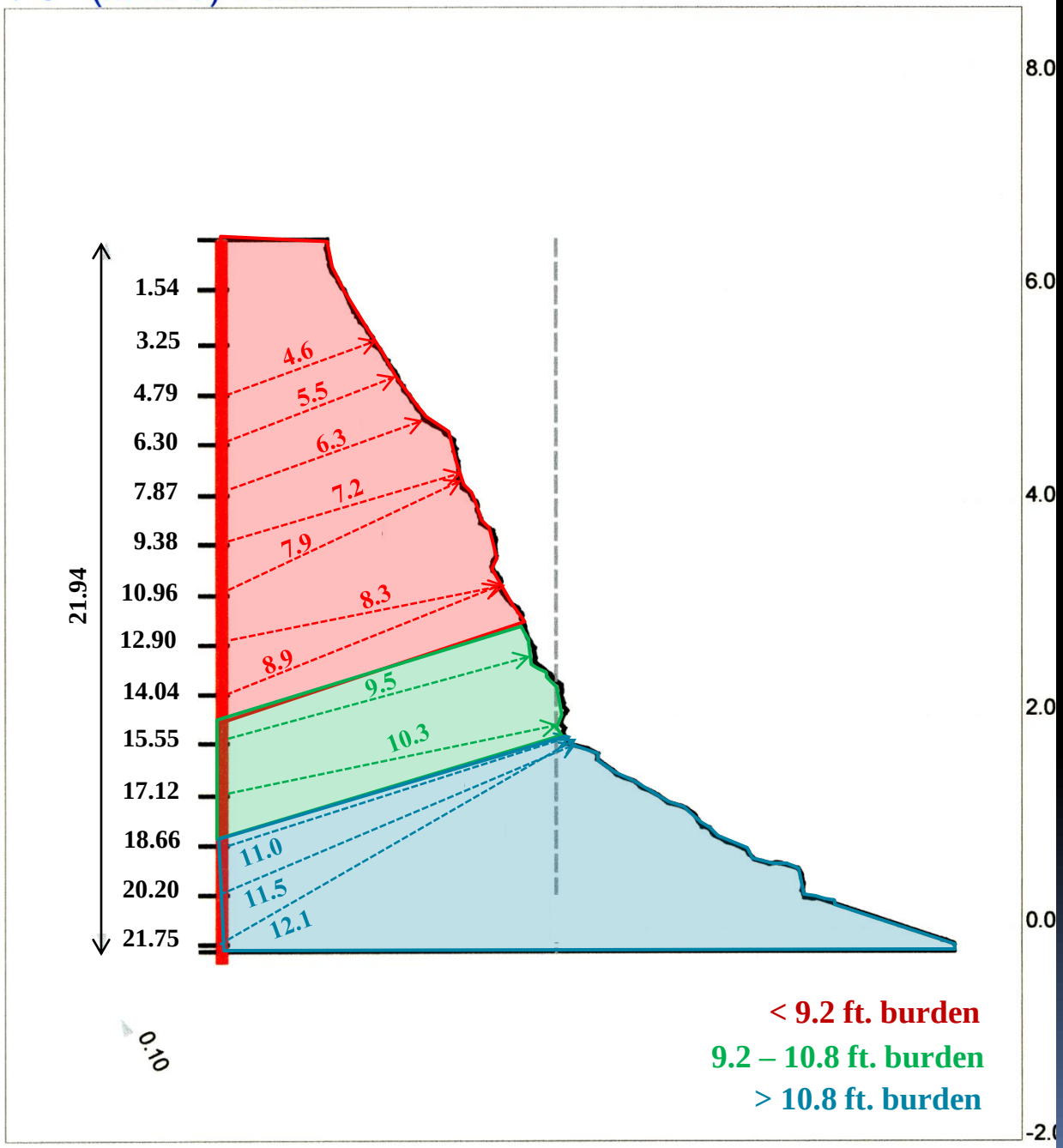
start BMX BlastPlanner - C:... 12:18 PM

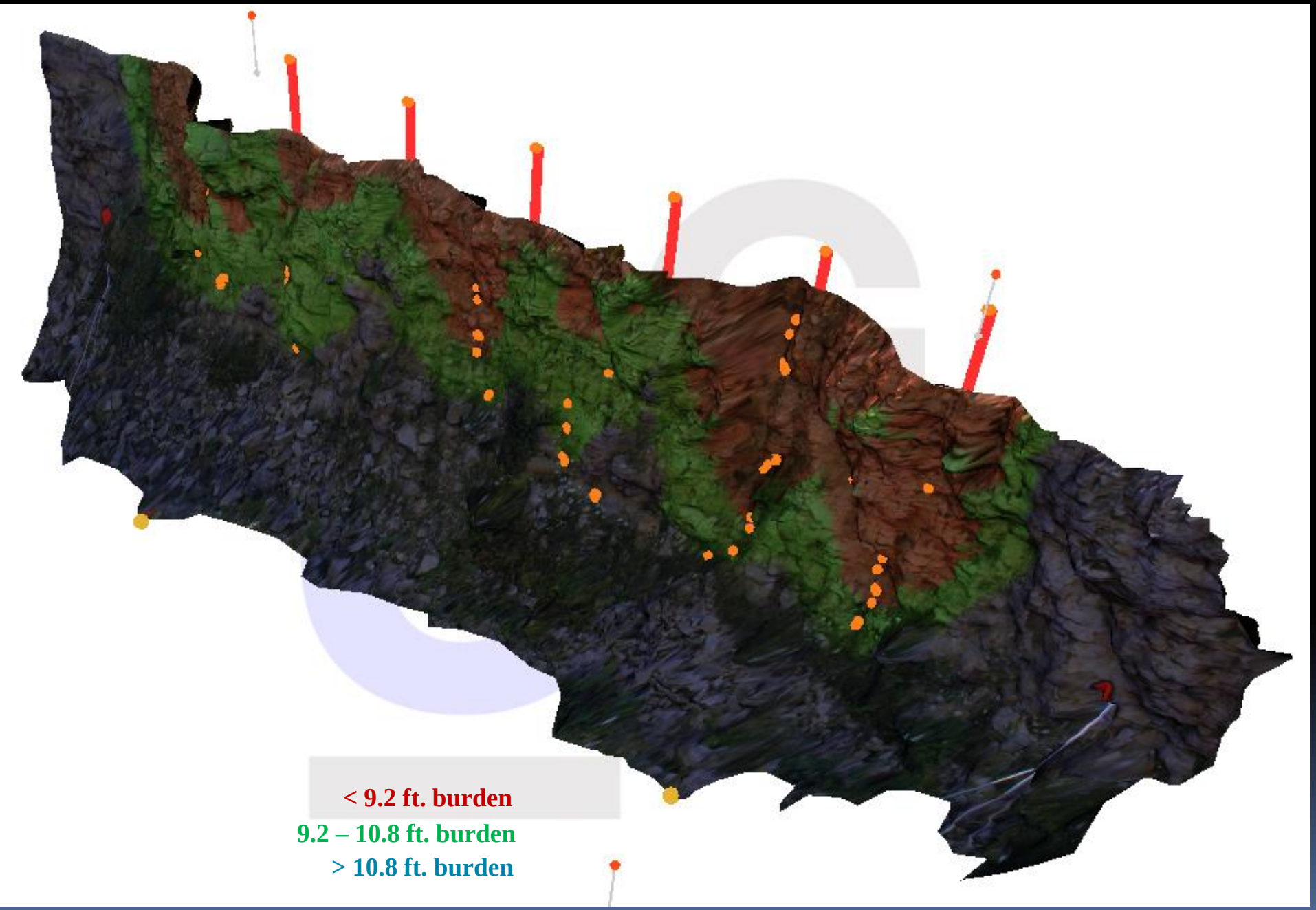
# 1-5 (M1:70) Profile



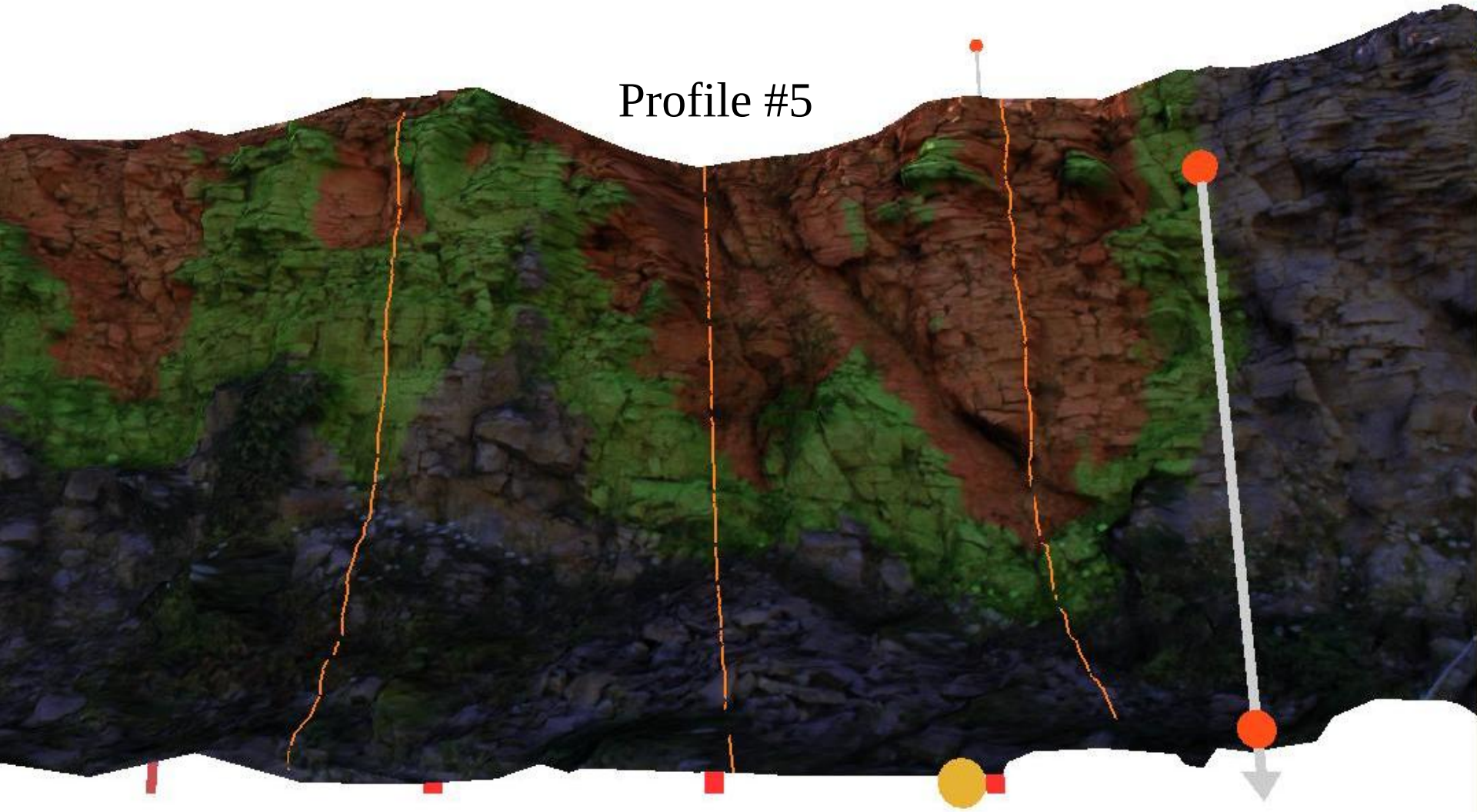

1-5 (M1:-1) Minimum Burden
22.27
1.31
2.62
3.94
5.25
6.56
7.87
9.18
10.50
11.81
13.12
14.43
15.74
17.06
18.37
19.68
20.99
1.31
2.62
3.94
4.85
5.48
6.10
6.82
7.45
7.74
8.20
8.82
9.35
9.84
10.40
11.05
11.81
Minimum: 4.49 ft
Depth: 4.59 ft

# 1-5 (M1:70) Profile




< 9.2 ft. burden
9.2 – 10.8 ft. burden
> 10.8 ft. burden

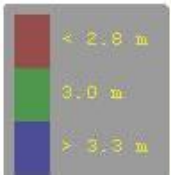
# Profile #5



**< 9.2 ft. burden**

**9.2 – 10.8 ft. burden**

**> 10.8 ft. burden**



## OEB Scale Check- Hole 5

| Profile Depth | Min. Burden |
|---|---|
| 3 | 3.25 |
| 5 | 4.60 |
| 8 | 6.30 |
| 9 | 7.20 |
| 11 | 7.90 |
| 13 | 8.30 |
| 14 | 8.90 |
| 16 | 9.50 |
| 17 | 10.30 |
| 20 | 11.50 |

## Photogrammetric – Hole 5

| Profile Depth | Min. Burden |
|---|---|
| 3 | 2.62 |
| 5 | 4.85 |
| 8 | 6.10 |
| 9 | 6.82 |
| 11 | 7.45 |
| 13 | 8.20 |
| 14 | 8.82 |
| 16 | 9.35 |
| 17 | 9.84 |
| 20 | 11.05 |

THANK YOU