CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
3550 N. Central Ave, 2nd floor
Phoenix, AZ, 85012
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

The following file is part of the Walter E. Heinrichs, Jr. Mining Collection

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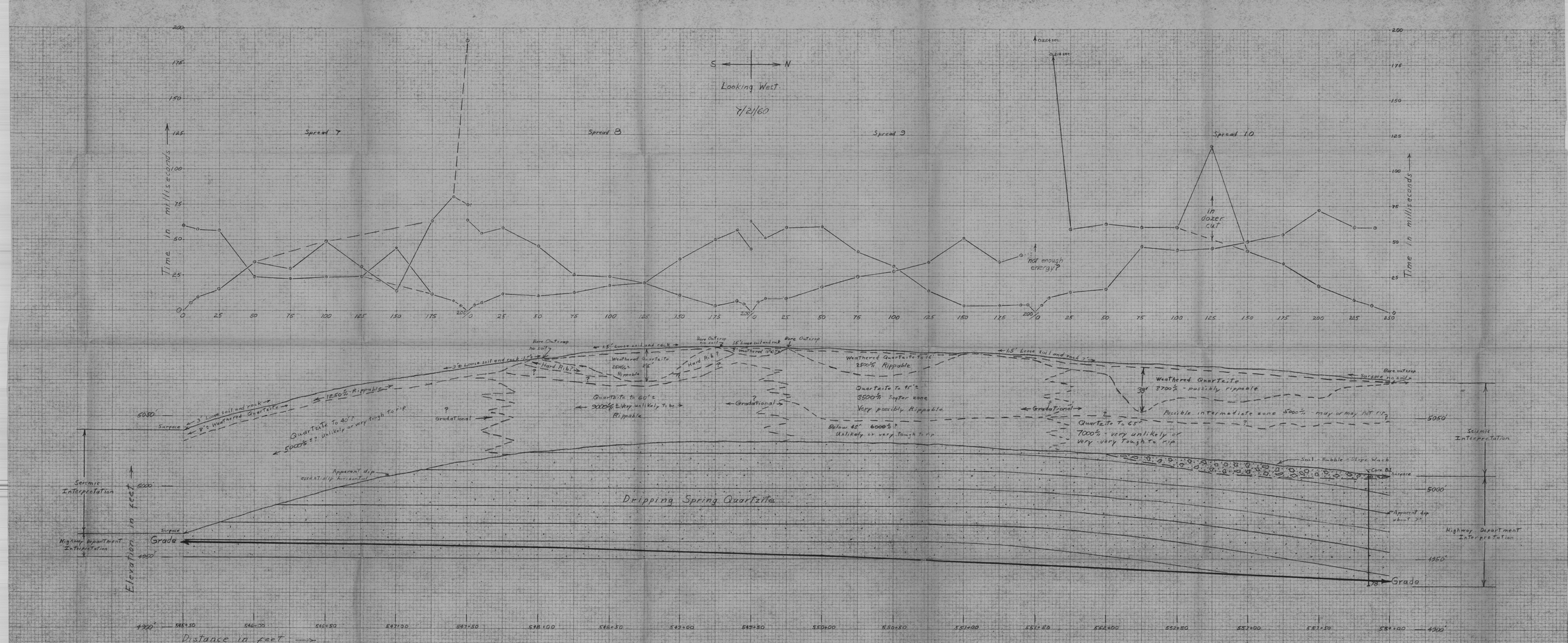

E Profile
Horizontal = Vertical
1" = 25'

Champion Pass — Apache Summit Area
Globe — Show Low Highway
Gila County, Arizona

HEINRICHS GEOEXPLORATION COMPANY
80 WEST CRAIT ROAD
P.O. BOX [illegible] TEL. MA 2-4402
TUCSON, [illegible] ARIZONA

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K&E STANDARD © CROSS SECTION
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July 27, 1960

Mr. Harold Hall, V.P. Engineering
MIN-A-CON Equipment Company
1914 E. Buchanan
Phoenix, Arizona

Mr. Furman Byers, Vice-President
Isbell Construction Company
2808 N. 27th Avenue
Phoenix, Arizona

Mr. Jack DuPont, Chief Engineer
Isbell Construction Company
2808 N. 27 th Avenue
Phoenix, Arizona

Mr. Louis Scott, Chief Geologist
Arizona State Highway Department
1739 W. Jackson
Phoenix, Arizona

DynaMetric, Inc.
2955 East Colorado Blvd.
Pasadena, California

Gentlemen:

In accordance with the joint venture seismic demonstration conducted at Champion Pass - Apache Summit area along proposed new Globe - Show Low state highway alignment on June 20, 1960 and June 21, 1960, we herewith submit to each of you a copy of the results of our interpretation.

Although the results are not as clean cut as we would desire, I believe some definite benefit will be realized. Our average maximum depth of penetration was likely not much over 70 feet, however, with more experience and heavier hammer, and maybe heavier hammer operator too, when necessary, I am sure this could be efficiently extended to 100 feet and, of course, even deeper with caps and primer cord, etc. In any case, there were no indications of major higher velocity increases to any of the cut depths to grade.

Velocity-rippability notes are based on some assumptions and conditions, such as:

1. Diabase seems to be fairly weathered with a strong decomposing tendency which should aid ripping somewhat consistent within reasonable recorded velocity variations. In every case, it should rip.
2. Shale notes are purely on various published experiences elsewhere, as I did not get a good look at the shale exposures. From velocity data only, it would appear to be rippable.
3. Quartzite near surface is quite brittle, seems fairly well laminated and fractured - not massive, all of which often help rippability, even though the velocities might be otherwise too high. Nevertheless, much of the quartzite, and probably the conglomerate, will be either unrippable or extremely tough to rip.
4. Other than the above, most rock less than 4000 feet per second is often found to be rippable, between 4000 feet per second to 6000 feet per second questionable, and above 6000 feet per second very seldom will rip with present available equipment. With heaviest available equipment, the simplest average cut-off point now is to say: below 5000 feet per second may rip and above 5000 feet per second may not rip.
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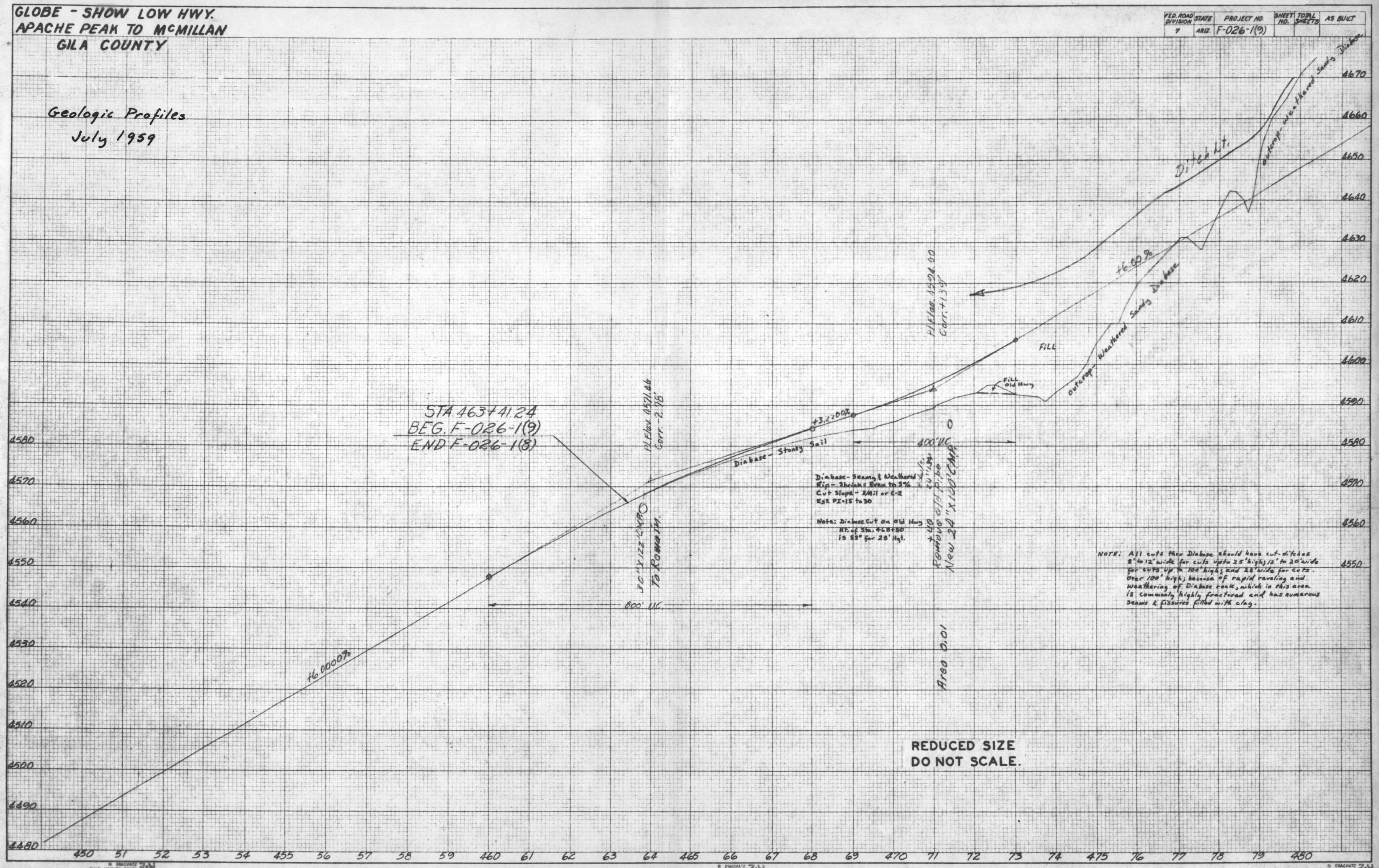
Let us know if there are any questions. On the plotted travel time curves, velocities were purposely left off in case any one wished to apply re-interpretations. For ourselves, we used the original graphs.

We will look forward to keeping in touch with progress and further correlation of data and results.

Very truly yours,

Walter E. Heinrichs Jr.
President & General Manager

WEH/pr


GLOBE - SHOW LOW HWY.
APACHE PEAK TO McMILLAN
GILA COUNTY
FED. ROAD DIVISION 7
STATE ARIZ.
PROJECT NO. F-026-1(9)
SHEET NO.
TOTAL SHEETS
AS BUILT
Geologic Profiles
July 1959
STA. 463+41.24
BEG. F-026-1(9)
END F-026-1(8)
Pl Elev. 4571.46
Corr. -2.98'
Pl Elev. 4594.00
Corr. +1.39'
+3.2200%
+6.0000%
+6.00%
Diabase - Stony Soil
Diabase - Seamy & Weathered
Rip - Shrink: Even to 5%
Cut Slope - 3/4:1 or C-2
Est. PI=15 to 30
Note: Diabase Cut on Old Hwy
Rt. of Sta. 468+50
is 53° for 25' Hgt.
Fill
Fill Old Hwy
Ditch Lt.
outcrop - weathered Sandy Diabase
outcrop - Weathered Sandy Diabase
400' UC
800' UC
30" x 122' CMP
To Remain.
Remove old Pipe
New 24" x 100' CMP
Area 0.01
NOTE: All cuts thru Diabase should have cut-ditches 8' to 12' wide for cuts up to 25' high; 12' to 20' wide for cuts up to 100' high; and 25' wide for cuts over 100' high; because of rapid raveling and weathering of Diabase rock, which in this area is commonly highly fractured and has numerous seams & fissures filled with clay.
REDUCED SIZE
DO NOT SCALE.
4480
4490
4500
4510
4520
4530
4540
4550
4560
4570
4580
4590
4600
4610
4620
4630
4640
4650
4660
4670
450
51
52
53
54
455
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57
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59
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475
76
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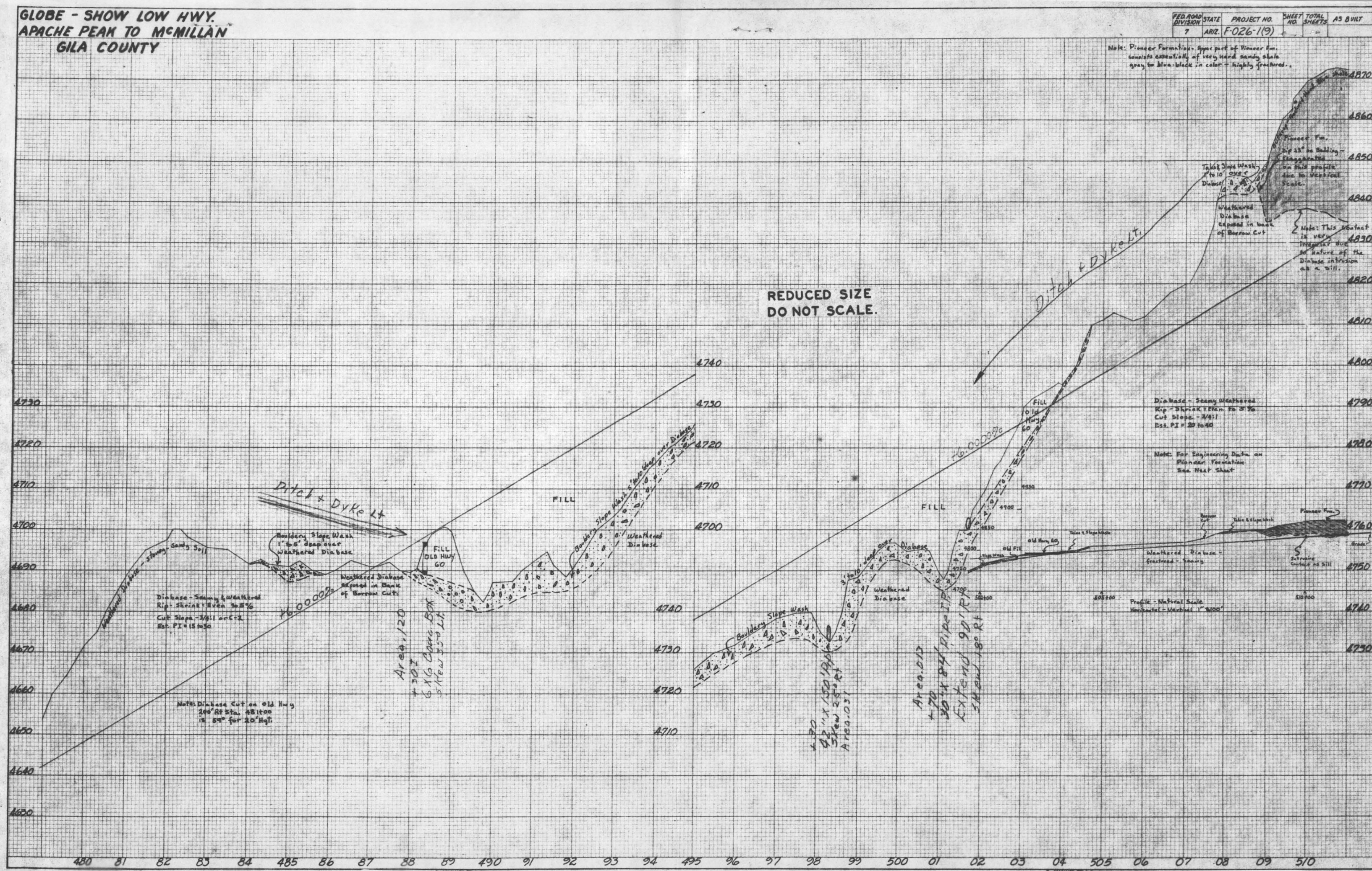
78
79
480


GLOBE - SHOW LOW HWY.
APACHE PEAK TO McMILLAN
GILA COUNTY
FED. ROAD DIVISION 7
STATE ARIZ.
PROJECT NO. F-026-1(9)
SHEET NO.
TOTAL SHEETS
AS BUILT
Note: Pioneer Formation - Upper part of Pioneer Fm. consists essentially of very hard sandy shale gray to blue-black in color - highly fractured.
REDUCED SIZE
DO NOT SCALE.
Ditch + Dyke Lt.
Ditch + Dyke Lt.
Pioneer Fm.
Dip 23° on Bedding - Exaggerated on this profile due to vertical Scale.
Talus & Slope Wash 1' to 10' over Diabase
Weathered Diabase exposed in bank of Borrow Cut
Note: This contact is very irregular due to nature of the Diabase intrusion as a sill.
Diabase - Seamy Weathered
Rip - Shrink - Even to 5%
Cut Slope - 3/4:1
Est. PI = 20 to 40
Note: For Engineering Data on Pioneer Formation See Next Sheet
Weathered Diabase - Stoney - Sandy Soil
Boulderg Slope Wash 1' to 5' deep over Weathered Diabase
Weathered Diabase exposed in Bank of Borrow Cut
Diabase - Seamy & Weathered
Rip - Shrink - Even to 5%
Cut Slope - 3/4:1 or C-2
Est. PI = 15 to 30
Note: Diabase Cut on Old Hwy 200' Rt Sta. 481+00 is 59° for 20' Hgt.
FILL
FILL OLD HWY 60
Boulderg Slope Wash 5' to 10' deep over Diabase
Weathered Diabase
Area .120
+30 I
6 x 6 Conc. Box
Skew 35° Lt.
+6.0000%
FILL
FILL
Old Hwy 60
Old Fill
Talus & Slope Wash
Weathered Diabase - fractured - Seamy
Pioneer Fm.
Intrusive Contact as Sill
Profile - Natural Scale
Horizontal - Vertical 1" = 100'
Boulderg Slope Wash
3' to 10' deep over Diabase
Weathered Diabase
+30
42" x 150' Pipe
Skew 25° Rt
Area .031
Area .013
+70
30" x 84' Pipe I.P.
Extend 90' Rt
Skew 18° Rt
4870
4860
4850
4840
4830
4820
4810
4800
4790
4780
4770
4760
4750
4740
4730
4720
4710
4700
4690
4680
4670
4660
4650
4640
4630
480
81
82
83
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485
86
87
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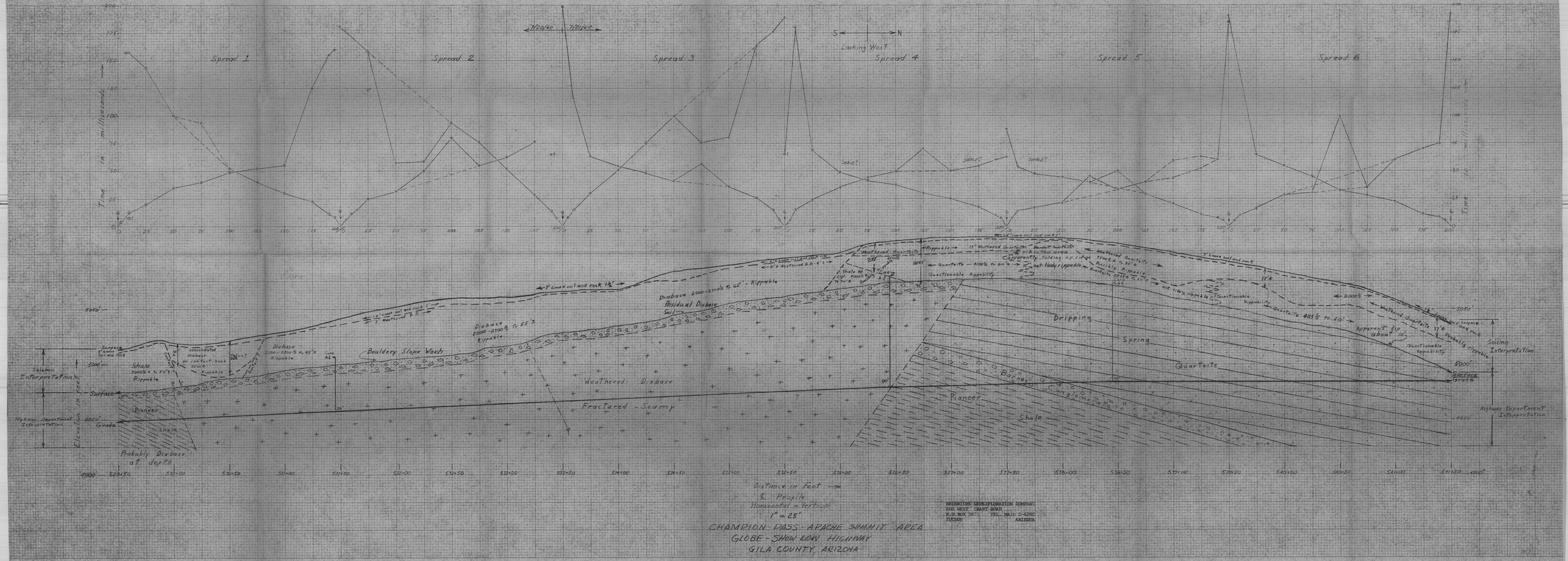


CHAMPION-PASS-APACHE SUMMIT AREA
GLOBE-SHOW LOW HIGHWAY
GILA COUNTY, ARIZONA

HEINRICHS GEOEXPLORATION COMPANY
808 WEST GRANT ROAD
P.O. BOX 5671 TEL. MAIN 2-4202
TUCSON ARIZONA

FED. ROAD DIVISION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
7	ARIZ.	F-026-1(9)			

GLOBE - SHOW LOW HWY.
APACHE PEAK TO McMILLAN
GILA COUNTY

Description of Rock Formations:

Diabase - Seamy & Weathered

Pioneer Fm - Very hard sandy shale - gray to blue-black in color - highly fractured.

Barnes Conglomerate - 15' to 35' thick - rounded pebbles & cobbles of Quartzite in matrix of Arkosic S.S. - Gray color

Dripping Spring Quartzite - medium-grained, gray to light brown color - Quartzite in laminated beds from 1" to 8' in thickness

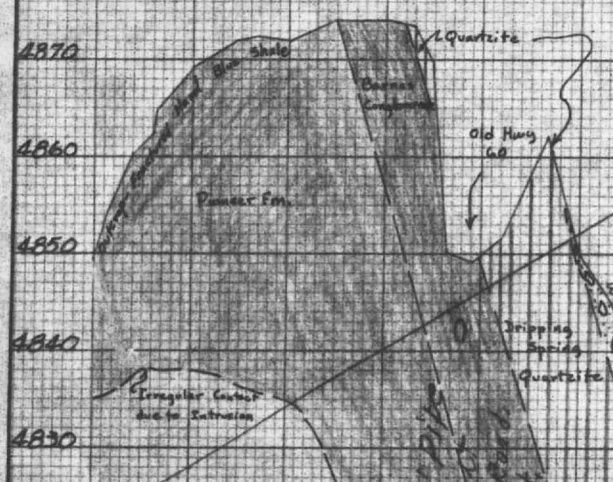
Engineering Properties of Rock Formations

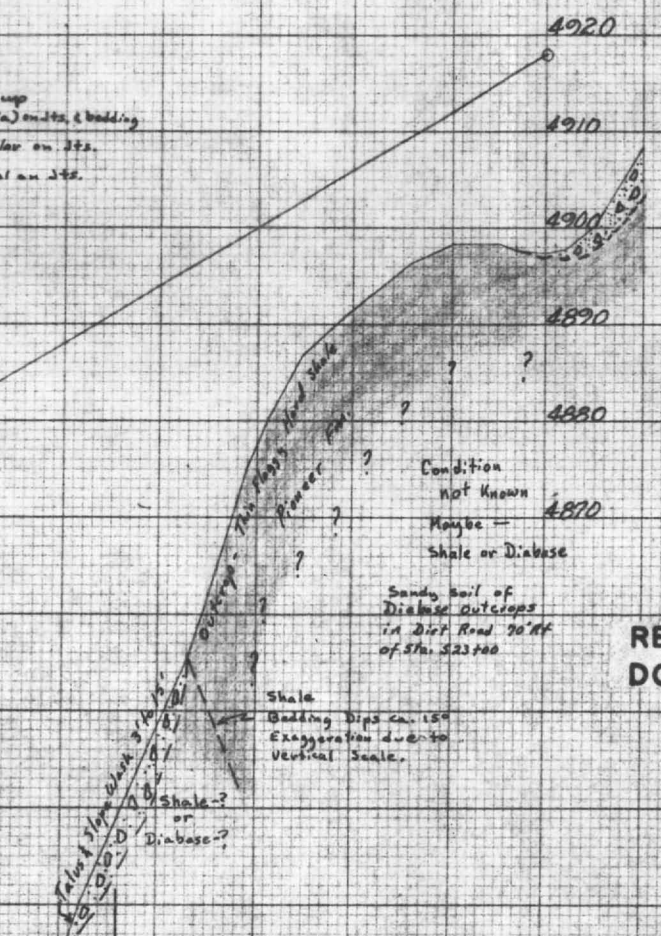
Weathered Diabase: Rip - Shrink Even to 5% - Cut Slope = ¾:1 - Est. PI = 20 to 40 - Chunky (less than 6" dia) becomes soap

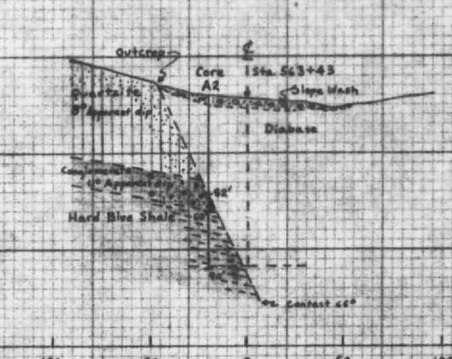
Pioneer Shale Fm: Shoot - Swell 20-25% - Cut Slope = ¾:1 or ½:1 - Est. PI = 5 to 15 - Blocky & Slabby (6" to 2' dia) on dip & bedding

Barnes Conglomerate: Shoot - Swell 20% - Cut Slope = ½:1 or ¾:1 - Est PI = 5 to 10 - Blocky (1' to 3' dia) irregular on Jts.

Dripping Spring Quartzite: Shoot - Swell 20-25% - Cut Slope = ½:1 - Est PI = N.P. to 10 - Blocky (6" to 8' dia) cubical on Jts.



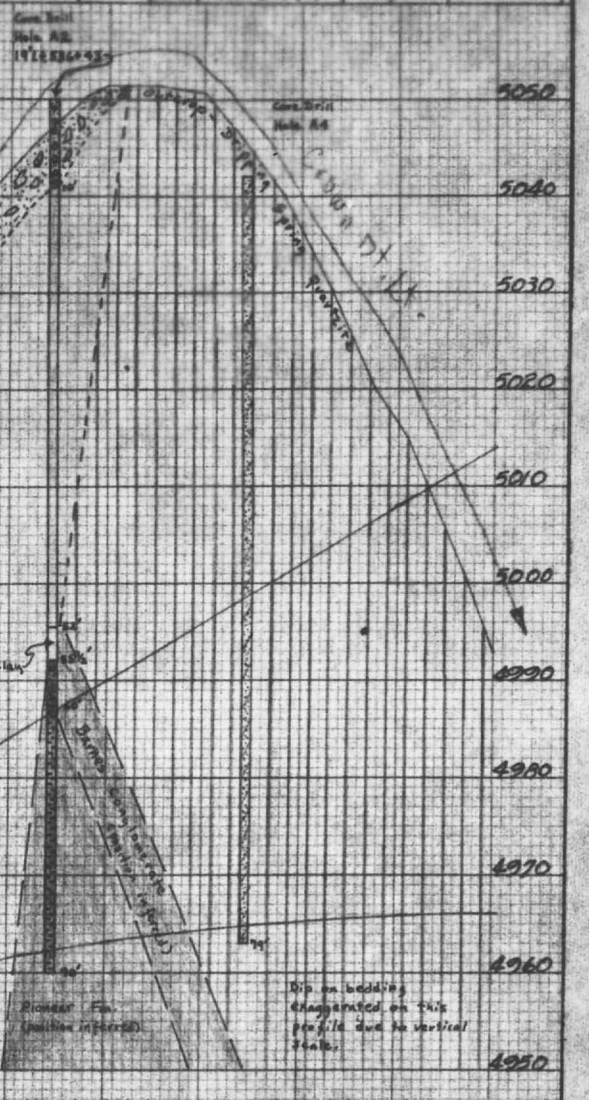




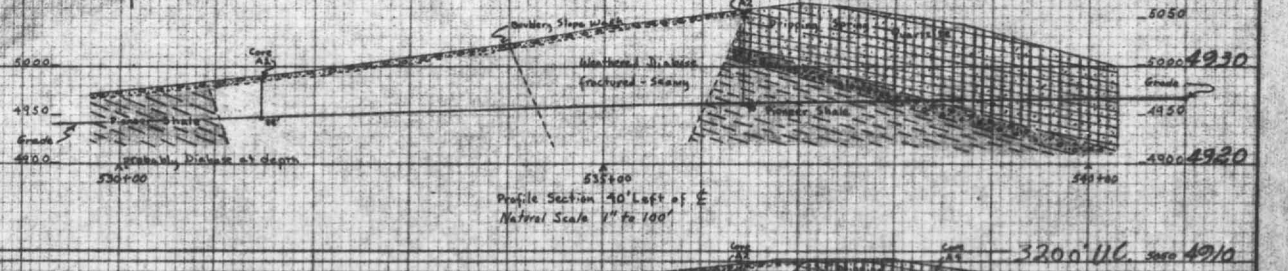
Note: Log data shown for Core Holes No.'s A1 & A4 based on driller's interpretation. The writer has not seen these cores.

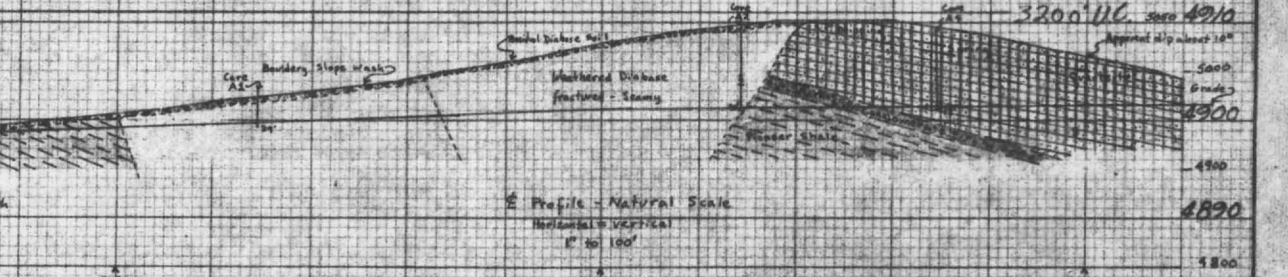
JDIII
9-15-59

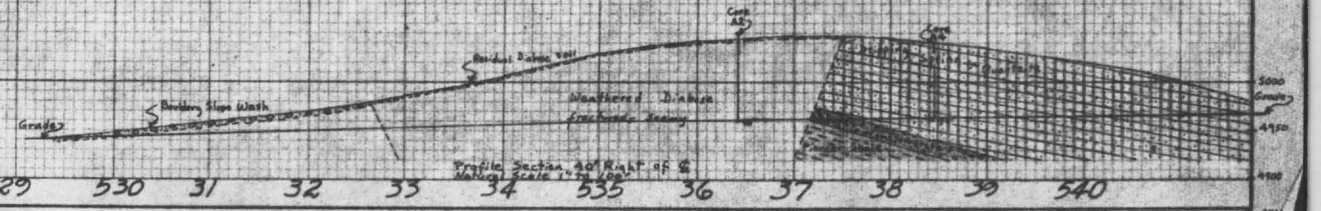
REDUCED SIZE
DO NOT SCALE.



Note: This profile is schematic only, because the drill hole data has been projected on to the ℄ plane. For true representation of the geologic conditions, see natural scale profiles below.

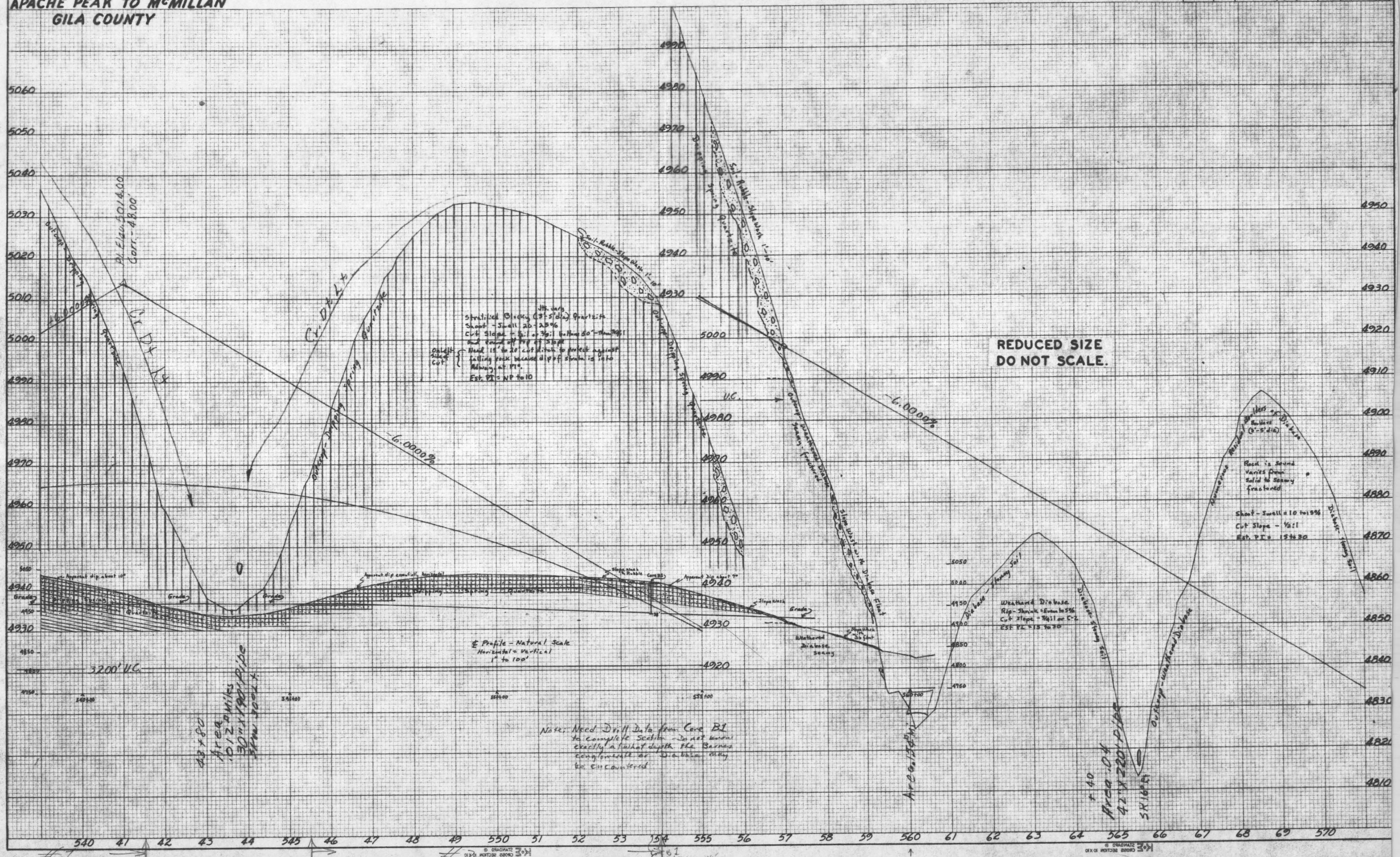






GLOBE - SHOW LOW HWY.
APACHE PEAK TO McMILLAN
GILA COUNTY

FED. ROAD DIVISION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
7	ARIZ.	F-026-1(9)			



GLOBE - SHOW LOW HWY.
APACHE PEAK TO McMILLAN
GILA COUNTY

FED. ROAD DIVISION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
7	ARIZ.	F-026-1(9)			

REDUCED SIZE
DO NOT SCALE.

Diabase - Streamy Soil

Diabase - Boulders on surface

Weathered Diabase - Rock may be buried at depth - fractured - Seamy

Rip - (Maybe to Short some) Shrink & Swell - Extra
Est PT = 15 to 30
Cut Slope - 3/4:1

Diabase - Streamy Soil

-6.0000 %

Diabase - Sandy Soil

Sandy Soil with Diabase Float

Area 0.19 30" Pipe x 190'

Diabase - Sandy Soil

Sandy Soil with Diabase Float

Area 1.26 49

Wash Alluvium - Sandy with Boulders 1'-3' deep over Diabase

Mixed Alluvium and Slope Wash

Weathered Granite

Granite

Fault (See Air Photo No. 1-9-6)

Alluvium & Slope Wash

Wash Boulders Alluvium

Weathered Diabase

Granite

Fault - Location inferred

6.0000 %

Highly Weathered Diabase Sandy - loose boulders Breaks rip

Rip - Shrink - 10 to 15%
Cut Slope - 1:1
Est. PT = 15 to 40

Apparent Contact of Pediment Gravels

Sandy Soil - Diabase Float

Slope wash - Diabase and Granite

Depth inferred

Weathered Diabase Sandy - Unweathered Spheroidal Boulders of Weathering Boulders are hard 2' to 4' in diameter

Rip - (May have to shoot some)
Shrink - Even to 5%
Est. PT = 15 to 30
Cut Slope - 3/4:1

Depth inferred

Slope wash - Diabase and Granite

Weathered Granite - Partly Disintegrated

Irregular intrusive contact of Diabase into "Granite"

Sandy Soil with Diabase Float and Diabase Boulders

Slope wash with Diabase Float and Sandy Soil

PI Elev. 4660.00
Curve # 11.19'

4660+00

1000' V.C.

4575+00

Apparent Contact of Pediment Gravels

Weathered Diabase - Sandy

Weathered Diabase - Boulderous

Grades

Slope wash

Irregular intrusive contact inferred

Outcrop of Weathered Diabase

Weathered Diabase

5650+00

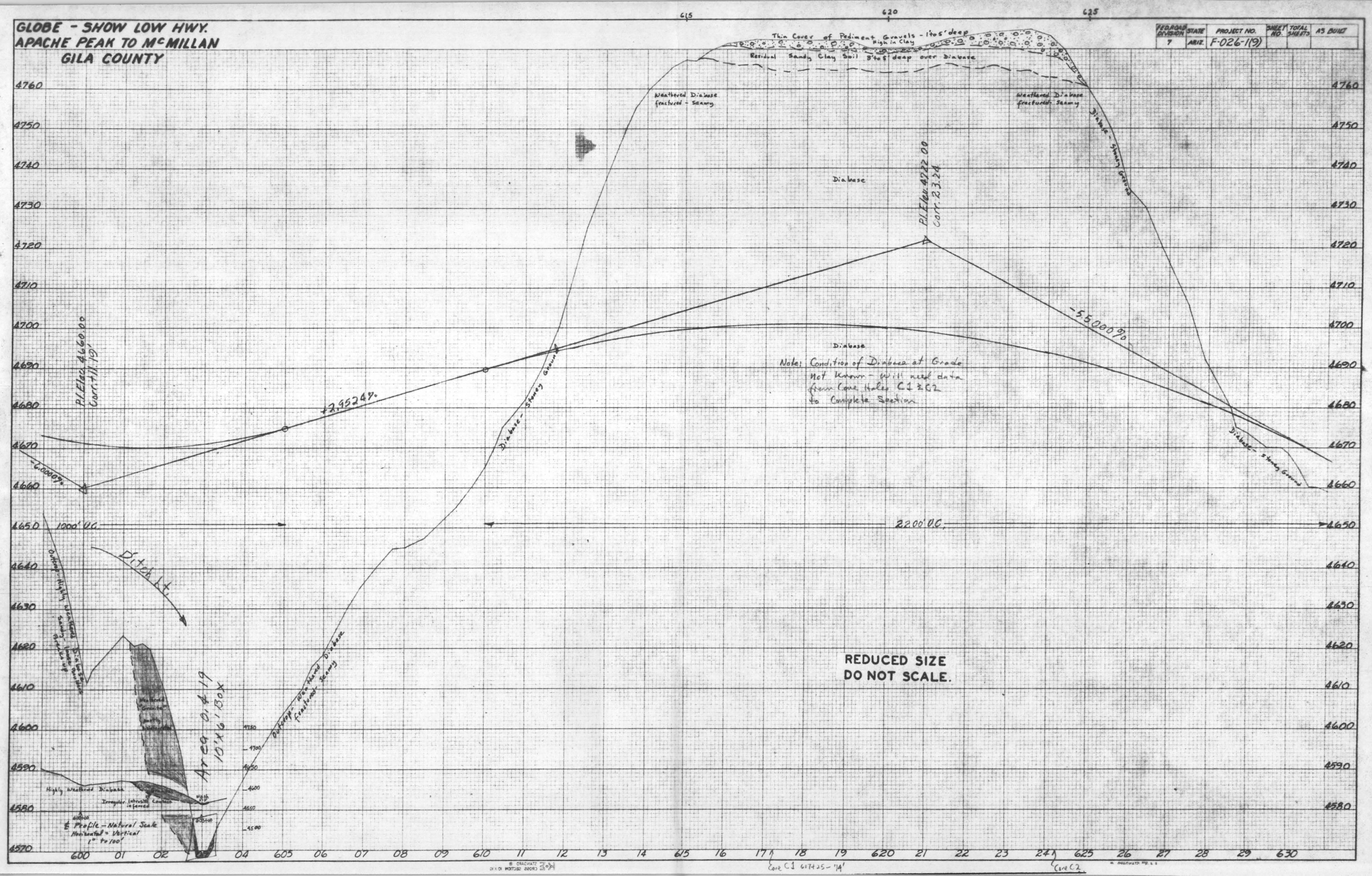
5750+00

6000+00

℄ Profile - Natural Scale
Horizontal = Vertical
1" to 100'

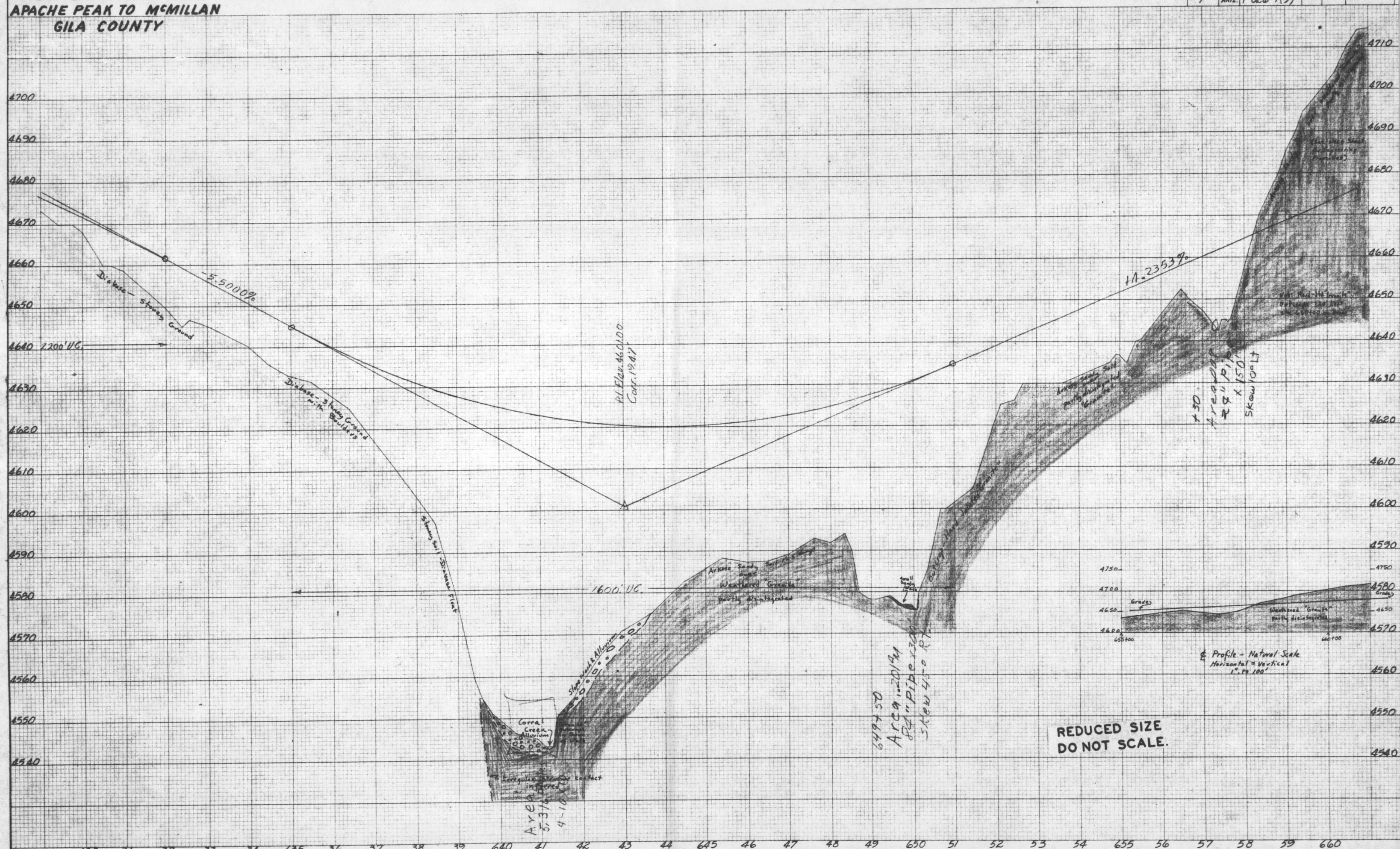
4900 4890 4880 4870 4860 4850 4840 4830 4820 4810 4800 4790 4780 4770 4760 4750 4740 4730 4720 4710 4700 4690 4680 4670 4660 4650 4640 4630 4620 4610

570 71 72 73 74 575 76 77 78 79 580 81 82 83 84 585 86 87 88 89 590 91 92 93 94 595 96 97 98 99 600


GLOBE - SHOW LOW HWY.
APACHE PEAK TO McMILLAN
GILA COUNTY
FED.ROAD DIVISION 7
STATE ARIZ.
PROJECT NO. F-026-1(9)
SHEET NO.
TOTAL SHEETS
AS BUILT
Thin Cover of Pediment Gravels - 1 to 5' deep
High in Clay
Residual Sandy Clay Soil 3' to 5' deep over Diabase
Weathered Diabase fractured - Seamy
Diabase
Diabase - Stoney Ground
P.I. Elev. 4722.00
Corr. 23.24
-5.5000%
+2.9524%
-6.0000%
P.I. Elev. 4660.00
Corr. +11.19'
Note: Condition of Diabase at Grade Not Known - Will need data from Core Holes C1 & C2 to Complete Section
1000' V.C.
2200' V.C.
Ditch Lt.
Area 0.419
10'x6' Box
Highly Weathered Diabase
Irregular Intrusive Contact inferred
℄ Profile - Natural Scale
Horizontal = Vertical
1" to 100'
Core C1 617+25 - 74'
Core C2
REDUCED SIZE
DO NOT SCALE.

FED. ROAD DIVISION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
7	ARIZ.	F-026-1(9)			

GLOBE - SHOW LOW HWY.
APACHE PEAK TO McMILLAN
GILA COUNTY



℄ Profile - Natural Scale
Horizontal = Vertical
1" = 100'

REDUCED SIZE
DO NOT SCALE.

GLOBE - SHOW LOW HWY.
APACHE PEAK TO McMILLAN
GILA COUNTY

FED. ROAD DIVISION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
7	ARIZ.	F-026-1(9)			

REDUCED SIZE
DO NOT SCALE.

Note: Condition of Diabase at Grade not known. Will need data from Core Hole D1 to complete section

Core D1 - 680+25 - 60 feet

E Profile - Natural Scale
Horizontal & Vertical
1" to 100'

GLOBE - SHOW LOW HWY.
APACHE PEAK TO McMILLAN
GILA COUNTY

FED ROAD DIVISION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
7	ARIZ	F-026-1(9)			

Profile - Natural Scale
Horizontal = Vertical
1" to 100'

Weathered Diabase
fractured - Seamy
Shoot (May Rip Some)
Swell - 15%
Cut Slope ½:1
Est. PI = 10 & 25

Short - Swell - 20%
Cut Slope ½:1
Est. PI = NP - 10

Hard Dense - fine grained Blue Diabase

Shoot this Section
Swell - 20 to 25%
Cut Slope - will Stand ½:1
Est. PI = NP - 5

Rip this section
(May want to shoot some)
Shrink - 10 to 15%
Cut Slope - will Stand ½:1
Est. PI = 15 to 30

Shoot this section
Swell - 20 - 25%
Cut Slope - Will Stand ½:1
Est. PI = NP - 5

Rip this section
(May want to shoot some)
Shrink - 10 to 15%
Cut Slope - will Stand ½:1
Est. PI = 15 to 30

Rip this Section
Shrink - 15 to 20%
Cut Slope - will Stand ½:1
but need 12' wide cut ditch
to catch cuttings - Easily
eroded - material thin-bedded
Est. PI = over 30+
High in Clay

Contact inferred
(See Cut - Old Hwy 60
150' Right Sta. 715+00)

691+42
Area 0.017
30" Pipe x 160'
3:1 Slope

695+85
Area 0.007
24" Pipe x 170'

Area 0.942
10 x 6 Box

700
30" x 60' Right
24" x 46' Lt.
Outlet Ditches
10 C.Y. Drop Exc.
20 C.Y. Struct. Exc.

Rock Berm Lt.
or Type A BK. Prot.

Channel Change Lt.
20' x 5' D x 250' L

10' 10' 20'

Wash or Arroyo

Ordovician Hard Fractured Diabase

Diabase - Seamy Ground

Weathered Diabase Seamy

Hard Fractured Blue Diabase Seamy

Dense Blue Diabase

Altered Gray Diabase

Linear Seamy Diabase

Contact inferred
Old Hwy 60 Cut
150' Right Sta. 715+00

REDUCED SIZE
DO NOT SCALE.

STANDARD ® CROSS SECTION 10 X 10

690 91 92 93 94 695 96 97 98 99 700 01 02 03 04 705 06 07 08 09 710 11 12 13 14 715 16 17 18 19 720

4690 4680 4670 4660 4650 4640 4630 4620 4610 4600 4590 4580 4570 4560 4550 4540 4530 4520 4510 4500

July 27, 1960

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MIN-A-CON Equipment Company
1914 E. Buchanan
Phoenix, Arizona

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Isbell Construction Company
2808 N. 27th Avenue
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Mr. Louis Scott, Chief Geologist
Arizona State Highway Department
1739 W. Jackson
Phoenix, Arizona

DynaMetric, Inc.
2955 East Colorado Blvd.
Pasadena, California

Gentlemen:

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Although the results are not as clean cut as we would desire, I believe some definite benefit will be realized. Our average maximum depth of penetration was likely not much over 70 feet, however, with more experience and heavier hammer, and maybe heavier hammer operator too, when necessary, I am sure this could be efficiently extended to 100 feet and, of course, even deeper with caps and primer cord, etc. In any case, there were no indications of major higher velocity increases to any of the cut depths to grade.

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5. Unfortunately, we have not yet had the opportunity to inspect the core and soil samples in Phoenix.

Let us know if there are any questions. On the plotted travel time curves, velocities were purposely left off in case any one wished to apply re-interpretations. For ourselves, we used the original graphs.

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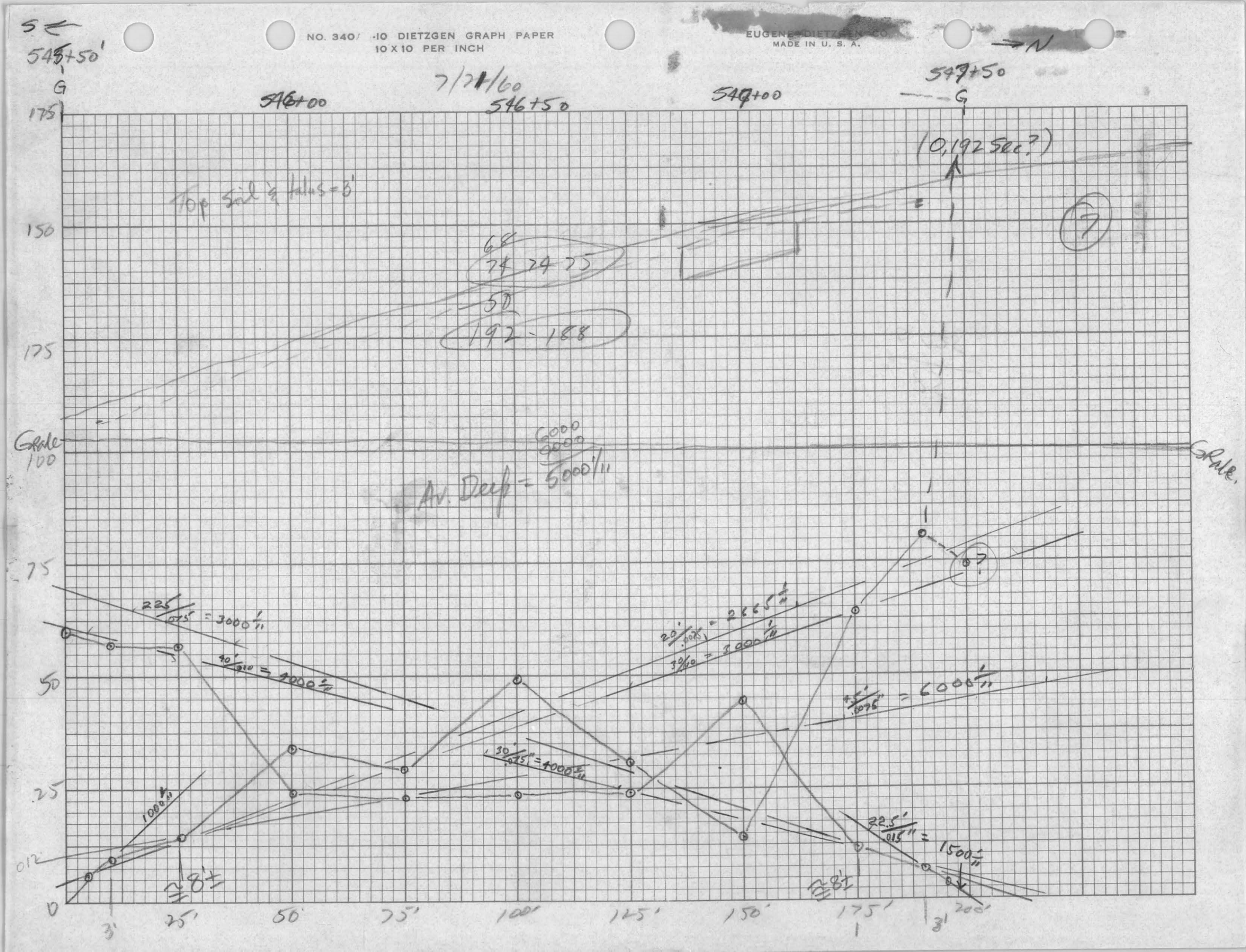
Very truly yours,

Walter E. Heinrichs Jr.
President & General Manager

WEH/pr



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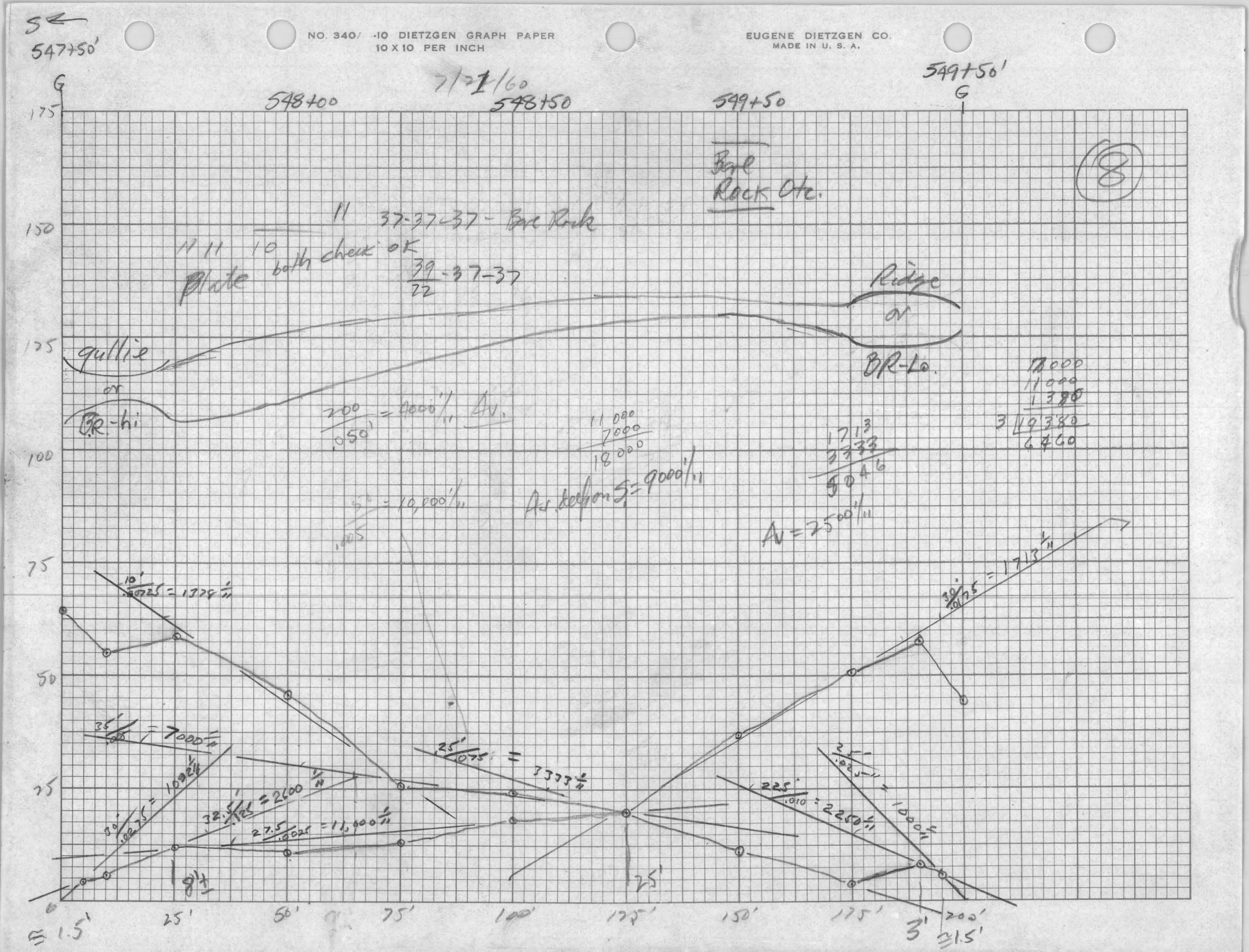
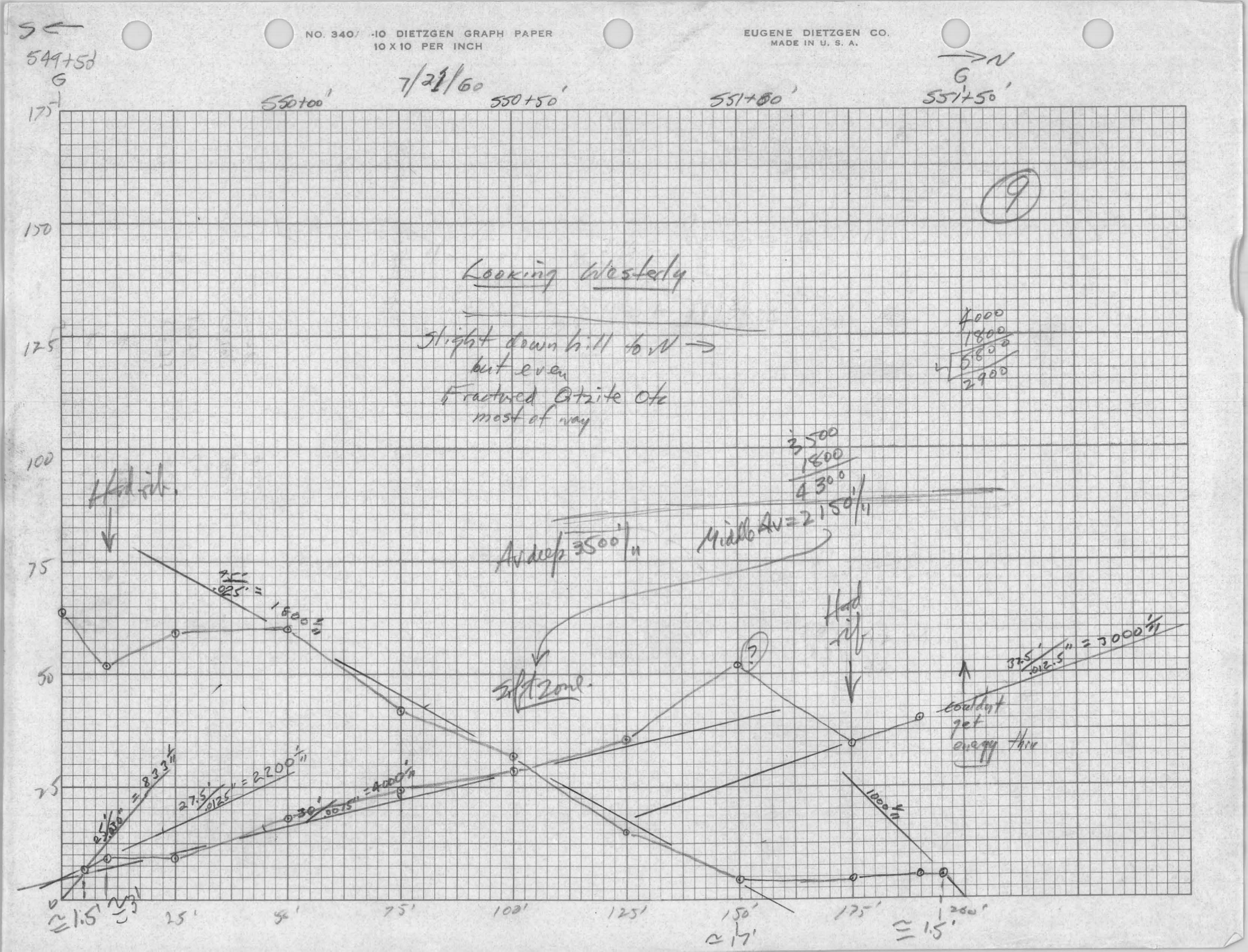
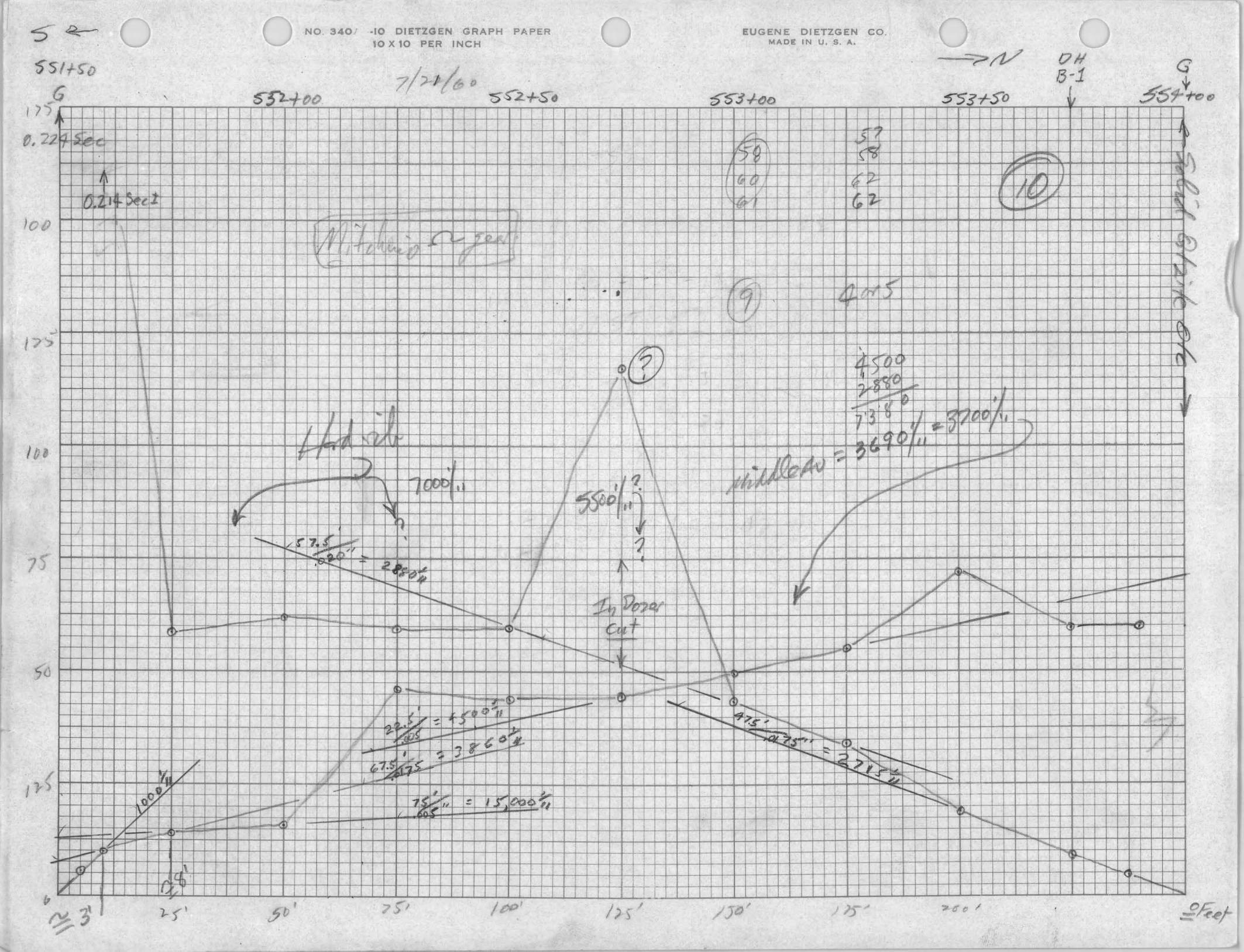
S
N
545+50'
546+00
546+50
547+00
547+50
7/21/60
(0,192 Sec?)
Top Soil & talus = 3'
68
74 74 75
50
192 - 188
Grade
Av. Deep = 5000'/"
6000
9000
225/.075" = 3000'/"
40'/.010" = 4000'/"
20'/.0075" = 2665'/"
30'/.010" = 3000'/"
45'/.0075" = 6000'/"
30'/.075" = 4000'/"
1000'/"
22.5'/.015" = 1500'/"
≅8'±
≅8'±
0
25
50
75
100
125
150
175
200
3'
25'
50'
75'
100'
125'
150'
175'
200'



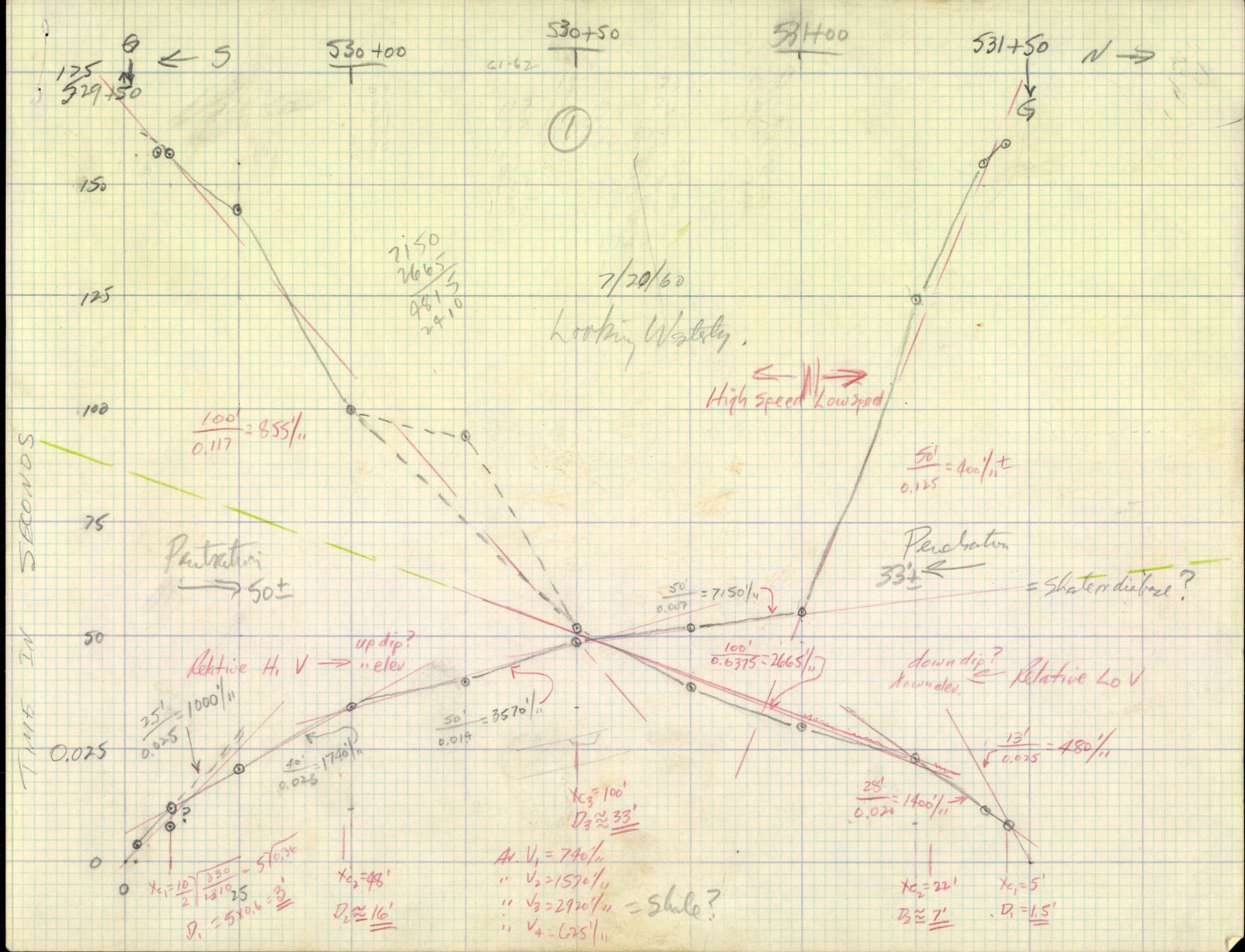
S
547+50'
NO. 340/ -10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH
EUGENE DIETZGEN CO.
MADE IN U. S. A.
7/21/60
548+00
548+50
549+50
549+50'
G
175
150
125
100
75
50
25
0
Bare Rock Etc.
8
37-37-37 - Bare Rock
both check ok
39/22 - 37-37
Plate
Ridge or BR-Lo.
gullie or BR-hi
200/.050' = 4000'/" Av.
11 000
7000
18 000
Av. deflection S = 9000'/"
1713
3333
5046
Av = 2500'/"
17000
11000
1380
3 | 19380
6460
10'/.00725 = 1378 1/"
30'/.0175 = 1713 1/"
35'/.005 = 7000 1/"
30'/.0275 = 1092 1/"
32.5'/.125 = 2600 1/"
27.5/.0025 = 11,000 1/"
25'/.075 = 3333 1/"
225'/.010 = 2250 1/"
25'/.025 = 1000 1/"
8'±
25'
≅ 1.5'
25'
50'
75'
100'
125'
150'
175'
200'
3'
≅ 1.5'



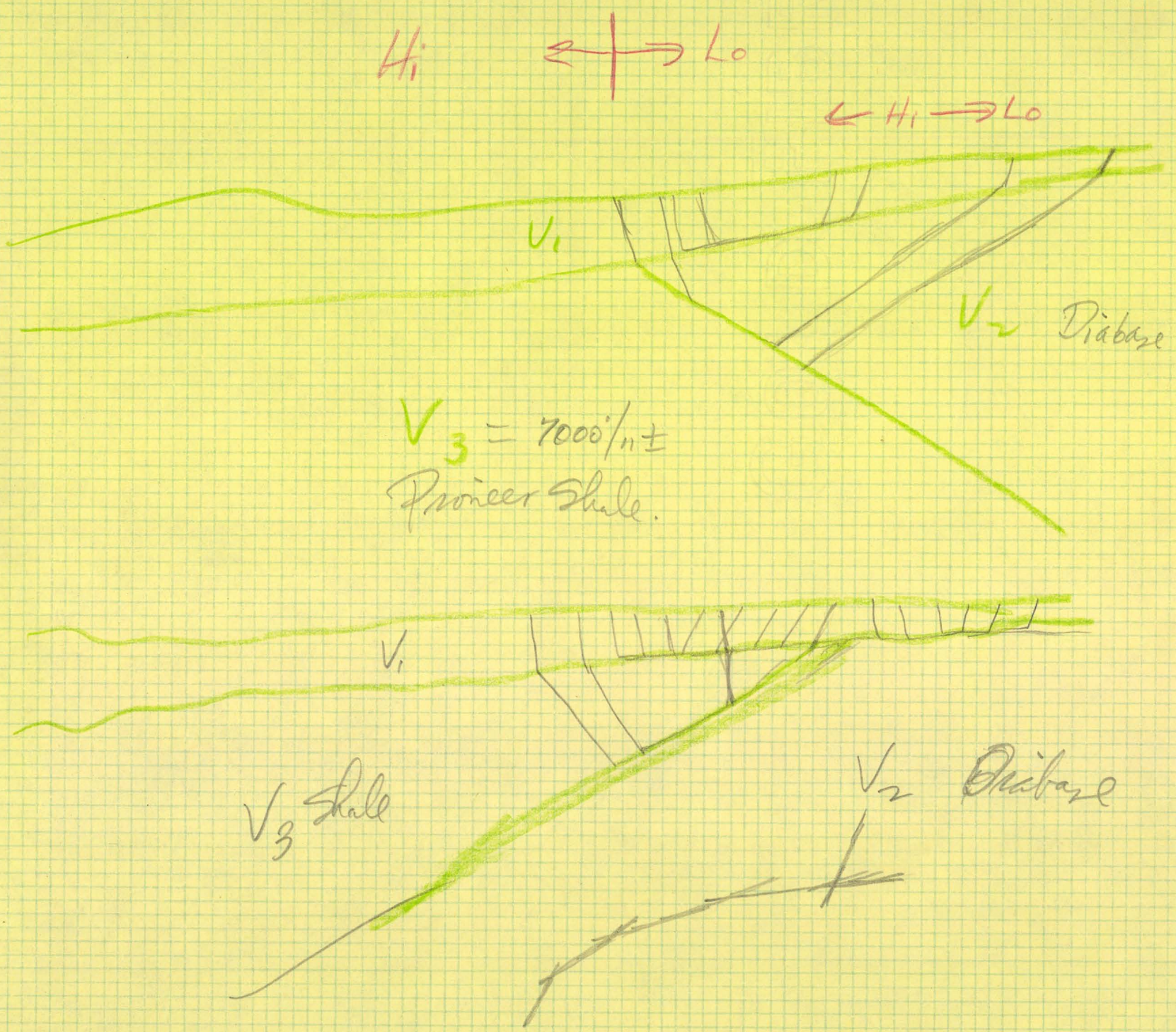
NO. 340/ -10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH
EUGENE DIETZGEN CO.
MADE IN U. S. A.
S ←
549+50
G
7/21/60
550+00'
550+50'
551+00'
→ N
G
551+50'
9
Looking Westerly
Slight down hill to N →
but even
Fractured Qtzite Otc
most of way
4000
1800
5800
2900
3500
1800
4300
Hard rib.
Av deep 3500'/"
Middle Av = 2150'/"
45'/.025' = 1800'/"
Soft zone.
Hard rib
?
37.5'/.012.5" = 3000'/"
couldn't get energy thru
25'/.030" = 833'/"
27.5'/.0125" = 2200'/"
30'/.0075" = 4000'/"
1000'/"
175'
150
125
100
75
50
25
0
≅1.5'
25'
50'
75'
100'
125'
150'
175'
200'
≅17'
≅1.5'



NO. 340/ -10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH
EUGENE DIETZGEN CO.
MADE IN U. S. A.
551+50
7/21/60
552+00
552+50
553+00
553+50
554+00
DH B-1
G
0.224 Sec
0.214 Sec
Mitchell Ω gear
Hard rib
7000'/"
5500'/"
In Dozer Cut
middle Av = 3690'/" = 3700'/"
4500
2880
7380
57.5'/.020" = 2880'/"
22.5'/.005 = 4500'/"
67.5'/.0175 = 3860'/"
75'/.005" = 15,000'/"
47.5'/.0175" = 2715'/"
1000'/"
Solid Glyzite Ore
0 Feet



G
S
530+00
530+50
531+00
531+50
N
G
175
529+50
150
125
100
75
50
0.025
0
TIME IN SECONDS
7150
2665
4815
2410
7/20/60
Looking Westerly.
High speed
Low speed
100'/0.117 = 855'/"
50'/0.125 = 400'/" ±
Penetration
33' ±
= Shaler or diabase?
Penetration
50 ±
50'/0.007 = 7150'/"
100'/0.0375 = 2665'/"
Relative H. V
up dip?
" elev
down dip?
down elev.
Relative Lo V
25'/0.025 = 1000'/"
40'/0.023 = 1740'/"
50'/0.014 = 3570'/"
13'/0.025 = 480'/"
28'/0.020 = 1400'/"
Xc3 = 100'
D3 ≈ 33'
Av. V1 = 740'/"
" V2 = 1570'/"
" V3 = 2920'/"
" V4 = 625'/"
= Shale?
Xc1 = 10/2 √(830/2310) = 5√0.36
D1 = 5×0.6 = 3'
Xc2 = 48'
D2 ≈ 16'
Xc2 = 22'
D2 ≈ 7'
Xc1 = 5'
D1 = 1.5'


Hi
Lo
Hi
Lo
V1
V2 Diabase
V3 = 7000'/n±
Pioneer Shale.
V1
V3 Shale
V2 Diabase