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October 1, 1960

Min-A-Con Equipment
1914 E. Buchanan
Phoenix, Arizona

Attention:Mr. Harold Hall

Dear Mr. Hall,

Enclosed is a letter report on a Seismic Investigation, Cameron-Navajo Bridge Highway Project of the Royden Construction Co., Coconino County, Arizona. Included also is a blue line map showing the velocity plots and interpretation as well as a complete copy of all data for Royden Construction Co. in addition is your copy of the Arizona State Highway Plan & Profile dossier for the Cameron - Navajo Bridge Project.

I hope you find the report satisfactory. I know our geophysicist found the problem quite straight forward after he managed to track down all the malfunctions.

Walt has been down in Mexico for the past week, however when he returns I am sure he would be interested, as I will, in any comments you may have.

Very truly yours,

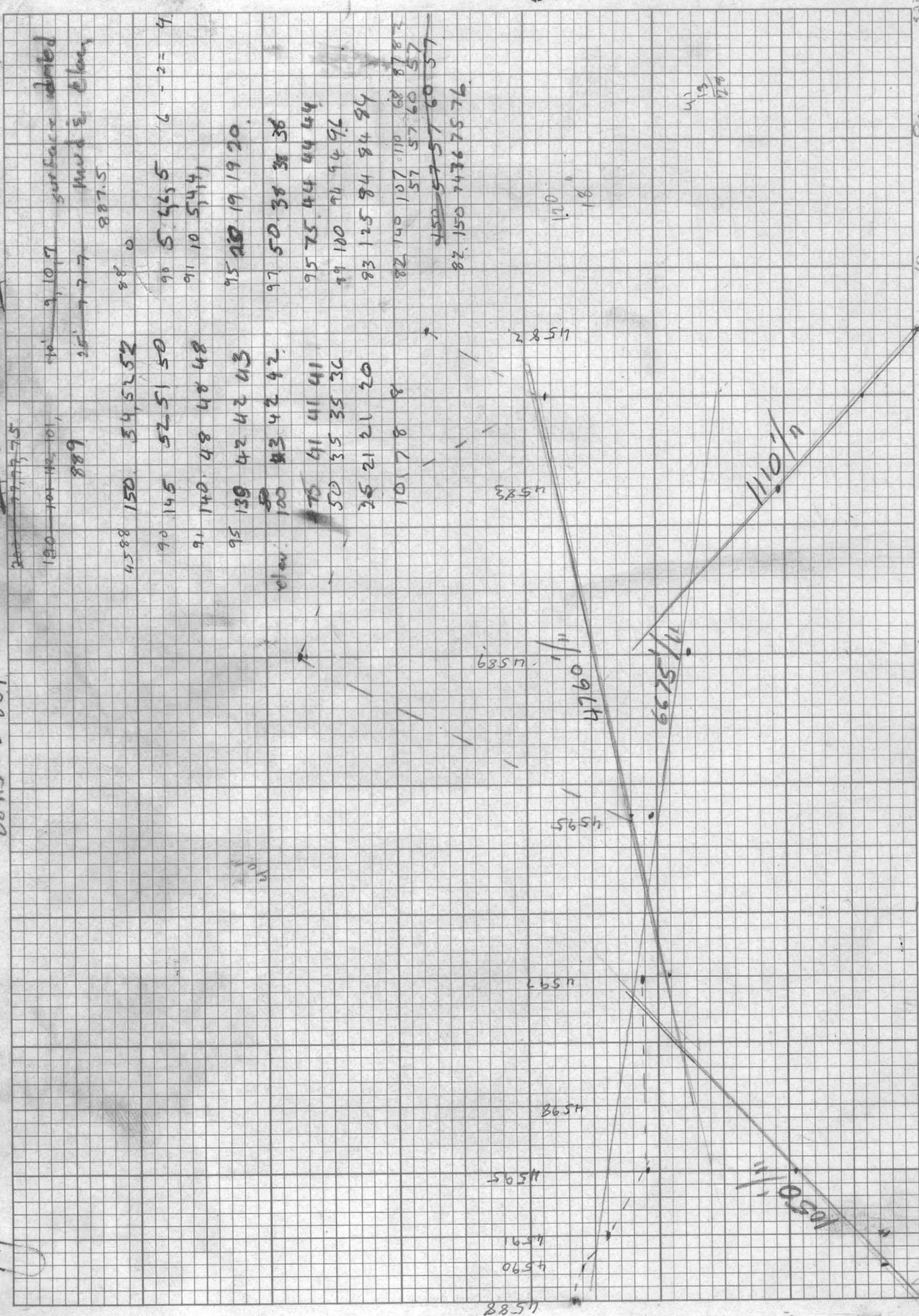
E. Grover Heinrichs
HEINRICH'S GEOEXPLORATION COMPANY

EGH/gh

26/Sept/60

Minacon Cameron Sp 41 889 901
887.5 → 889

2



surface dated
Hand E. E. E.

4588	150	54,5252	88 0	887.5
90	145	52,5150	90	5,455
91	140	48,4848	91	10,544
95	139	42,4243	95	20,191920
100	100	43,4242	97	50,383838
105	100	41,4141	95	75,444444
110	100	35,3536	99	100,949496
115	100	21,2120	93	125,848484
120	100	7,88	82	140,107,110,68,87,82
				57,57,60,57
				450,57,57,60,57
				82,150,74,76,75,76

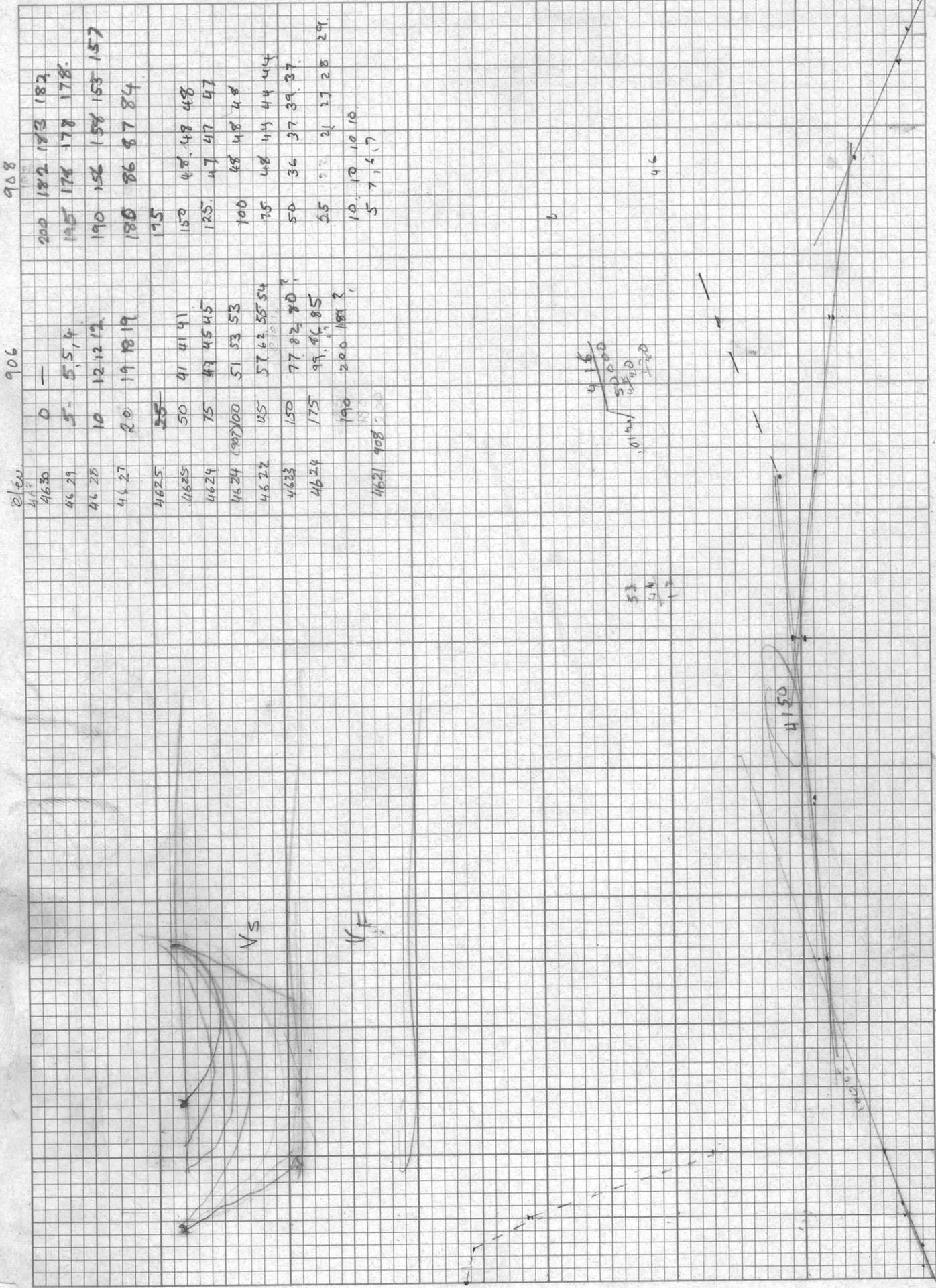
Handwritten annotations on the drawing include:
 4595, 4590, 4591, 4594, 4595, 4597, 4598, 4599, 4600, 4601, 4602, 4603, 4604, 4605, 4606, 4607, 4608, 4609, 4610, 4611, 4612, 4613, 4614, 4615, 4616, 4617, 4618, 4619, 4620, 4621, 4622, 4623, 4624, 4625, 4626, 4627, 4628, 4629, 4630, 4631, 4632, 4633, 4634, 4635, 4636, 4637, 4638, 4639, 4640, 4641, 4642, 4643, 4644, 4645, 4646, 4647, 4648, 4649, 4650, 4651, 4652, 4653, 4654, 4655, 4656, 4657, 4658, 4659, 4660, 4661, 4662, 4663, 4664, 4665, 4666, 4667, 4668, 4669, 4670, 4671, 4672, 4673, 4674, 4675, 4676, 4677, 4678, 4679, 4680, 4681, 4682, 4683, 4684, 4685, 4686, 4687, 4688, 4689, 4690, 4691, 4692, 4693, 4694, 4695, 4696, 4697, 4698, 4699, 4700, 4701, 4702, 4703, 4704, 4705, 4706, 4707, 4708, 4709, 4710, 4711, 4712, 4713, 4714, 4715, 4716, 4717, 4718, 4719, 4720, 4721, 4722, 4723, 4724, 4725, 4726, 4727, 4728, 4729, 4730, 4731, 4732, 4733, 4734, 4735, 4736, 4737, 4738, 4739, 4740, 4741, 4742, 4743, 4744, 4745, 4746, 4747, 4748, 4749, 4750, 4751, 4752, 4753, 4754, 4755, 4756, 4757, 4758, 4759, 4760, 4761, 4762, 4763, 4764, 4765, 4766, 4767, 4768, 4769, 4770, 4771, 4772, 4773, 4774, 4775, 4776, 4777, 4778, 4779, 4780, 4781, 4782, 4783, 4784, 4785, 4786, 4787, 4788, 4789, 4790, 4791, 4792, 4793, 4794, 4795, 4796, 4797, 4798, 4799, 4800, 4801, 4802, 4803, 4804, 4805, 4806, 4807, 4808, 4809, 4810, 4811, 4812, 4813, 4814, 4815, 4816, 4817, 4818, 4819, 4820, 4821, 4822, 4823, 4824, 4825, 4826, 4827, 4828, 4829, 4830, 4831, 4832, 4833, 4834, 4835, 4836, 4837, 4838, 4839, 4840, 4841, 4842, 4843, 4844, 4845, 4846, 4847, 4848, 4849, 4850, 4851, 4852, 4853, 4854, 4855, 4856, 4857, 4858, 4859, 4860, 4861, 4862, 4863, 4864, 4865, 4866, 4867, 4868, 4869, 4870, 4871, 4872, 4873, 4874, 4875, 4876, 4877, 4878, 4879, 4880, 4881, 4882, 4883, 4884, 4885, 4886, 4887, 4888, 4889, 4890, 4891, 4892, 4893, 4894, 4895, 4896, 4897, 4898, 4899, 4900, 4901, 4902, 4903, 4904, 4905, 4906, 4907, 4908, 4909, 4910, 4911, 4912, 4913, 4914, 4915, 4916, 4917, 4918, 4919, 4920, 4921, 4922, 4923, 4924, 4925, 4926, 4927, 4928, 4929, 4930, 4931, 4932, 4933, 4934, 4935, 4936, 4937, 4938, 4939, 4940, 4941, 4942, 4943, 4944, 4945, 4946, 4947, 4948, 4949, 4950, 4951, 4952, 4953, 4954, 4955, 4956, 4957, 4958, 4959, 4960, 4961, 4962, 4963, 4964, 4965, 4966, 4967, 4968, 4969, 4970, 4971, 4972, 4973, 4974, 4975, 4976, 4977, 4978, 4979, 4980, 4981, 4982, 4983, 4984, 4985, 4986, 4987, 4988, 4989, 4990, 4991, 4992, 4993, 4994, 4995, 4996, 4997, 4998, 4999, 5000.

Spred 806 ← 906

23/Sept/60 Minacou

Cameron

1



4620	0	—	906	908
4621	5	5.5	—	—
4622	10	12.12	—	—
4623	20	19.18	—	—
4624	35	—	—	—
4625	50	19.18	—	—
4626	75	4.5	—	—
4627	100	5.3	—	—
4628	125	5.7	—	—
4629	150	7.7	—	—
4630	175	9.9	—	—
4631	190	20.0	—	—
4632	200	—	—	—

200	182	181	182	182
195	176	178	178	178
190	156	158	158	158
180	86	87	84	84
175	—	—	—	—
150	48	48	48	48
125	47	47	47	47
100	48	48	48	48
75	48	48	48	48
50	36	37	39	37
25	21	21	21	21
10	10	10	10	10
5	5	5	5	5

$\frac{0.00}{0.1H}$
 $\frac{0.25}{0.25H}$
 $\frac{0.51}{0.51H}$

806

906

906

Minacou
Cameron

27/Sept/60

Sp#4

1012 - 1014

	1012	1014
4738	0	200 49, 49, 49
	5 3, 3, 3	195 45, 44, 44
	15 19, 9, 9	185 47, 46, 46
4737	25 11, 12, 13	175 39, 39, 39
4734	Down 50 21, 20, 20	150 30, 31, 31
4740	up 75 30, 32, 33	125 39, 32, 39, 39
4742	up 100 33, 34, 33	100 28, 26, 25
4743	Down 125 43, 42, 43, 34	75 20, 20, 20
	up 150 48, 49, 49	50 19, 20, 20
4737	Down 175 49, 50, 48	25 17, 14, 17
38	185 80, 79, 79	15 15, 14, 12
32	195 47, 48, 49	5 23, 14
4730	200 51, 47, 47	0

surface at 1012 thinly laminated ss outcrop. decomp.
1014 downhill is more massive ss. o.c.

Minacon Cummer

27/Sept/60

SP 25

1028-1030

1028

1029

4730	200	57
4728	195	58
4725	180	57
4718	150	41
4721	180	38
4722	100	34
4718	75	27
4717	50	26
4712	25	21
4710	15	17
4709	5	6
4707		

5	3,3	5
20	14,15	21
50	28,28,27	40
70	37,35,35	45
100	38,38	46
125	39,42,39	51
150	43,42,43	56
175	44,45,46	62
185	47,46,47	67
195	NG	

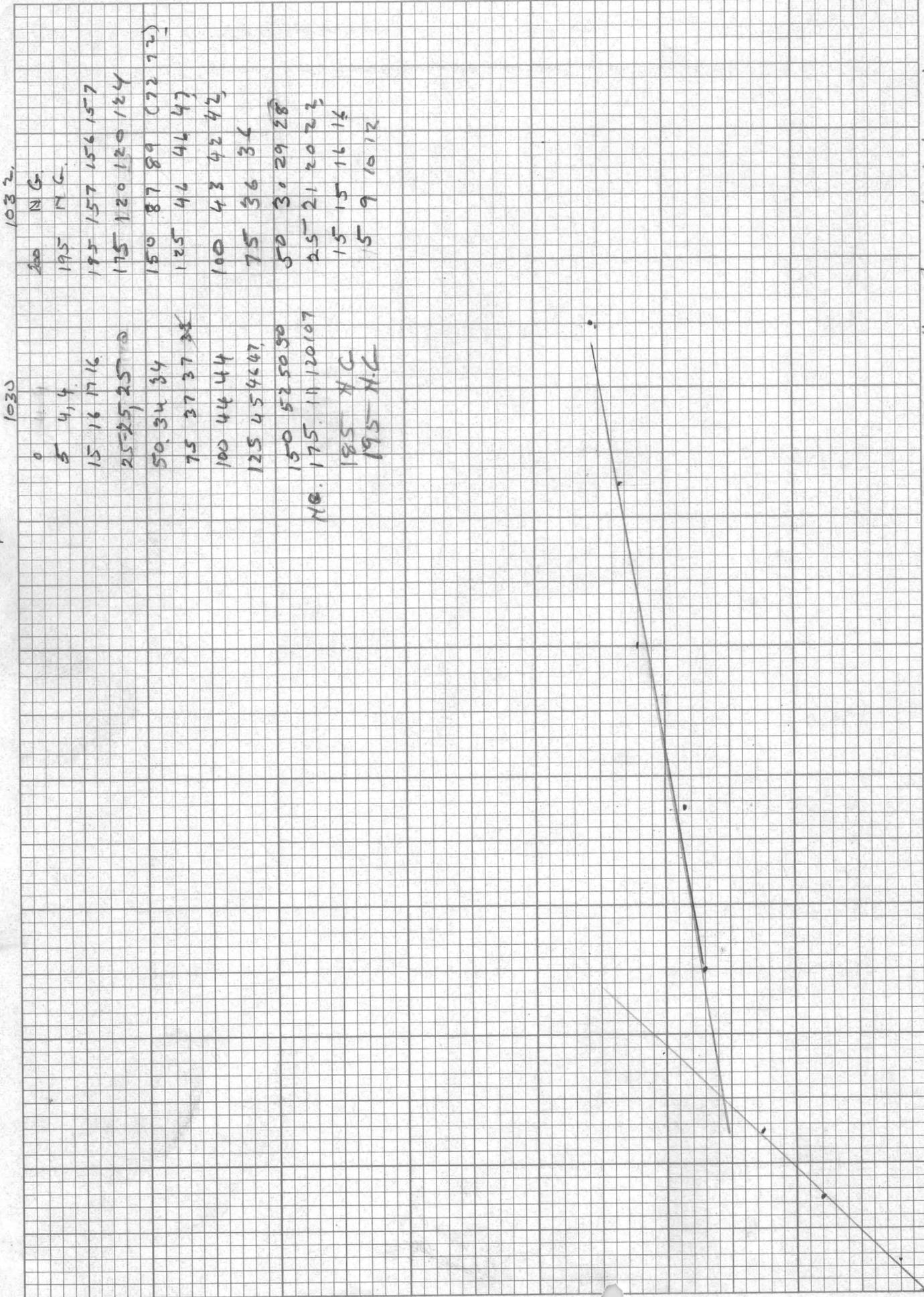
1027
150
125

21/Sept/60

Mina

1030-1032 Sept 27, 60

Sp # 6



9011-11011 SPDS 27/22

1106

11011

200 40,39
 195 36,37,36
 185 34 33,37
 175 28 28 28
 150 28 28 28
 125 25 25 25
 100 25 24 25 24
 75 22 21 22 22
 50 14 15 15 16 15
 25 9 9 9
 15 6,7,6,7
 5 3,4,5,

5 7,7,7
 15 13,13,13
 25 15,15,14
 50 18 18 18
 75 21 21 21
 100 26 26 25
 125 31 30 30 29
 150 31 30 31 30
 175 29 30 31 30
 195 54 53
 195 H.C.

110/110

October 1, 1960

Min-A-Con Equipment
1914 E. Buchanan
Phoenix, Arizona

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Very truly yours,


E. Grover Heinrichs
HEINRICHS GEOEXPLORATION COMPANY

EGH/gh

September 30, 1960

Mr. Harold Hall, Vice President, Engineering
Min-A-Con Equipment Company
1914 East Buchanan
Phoenix, Arizona

Gentlemen:

From September 24 through September 27, 1960, Heinrichs Geoexploration Company conducted seismic investigations at certain proposed road cut locations approximately 17 miles north of Cameron, Arizona on U.S. Highway 89, at the request of Min-A-Con Equipment Company. The purpose of this work was to determine the rippability of the material to be cut to grade.

The map accompanying this letter shows our interpretation of the data. Studies have been made and an empirical relationship has been determined between seismic wave velocities and rippability of rock. These studies indicate that sandstones with velocities up to 6200 ft. per second are normally rippable. Above 6200 ft. per sec. there is some question as to the rippability. On the cuts at the following State Highway Department location survey numbers, 887.5 to 889, 899 to 901, and 906 to 908 there is little question as to rippability of the material to grade. The cut from Location 1012 to 1014 is probably entirely rippable to grade with the possible exception of a small quantity of more massive sandstone at about Location 1013.5. The cut from Location 1028 to 1030 is again probably entirely rippable although the rock appears to be considerably more massive than at the previously mentioned cuts. A thin, high velocity bed capping the relatively soft massive bed between 1030 and 1032 complicated the investigation to some degree. The cut from Location 1104 to 1106 is the most questionable as to rippability. The sandstone appears to be soft but very massive with little decomposed material on top.

In summary it is our opinion that the cuts examined are entirely rippable with possible questionable exceptions as above noted.

Very truly yours,
HEINRICHS GEOEXPLORATION COMPANY

Franklin A. Seward Jr.

Franklin A. Seward,
Geophysical Engineer

FAS:jh

SEISMIC INVESTIGATIONS

for

MIN-A-CON EQUIPMENT CO.

on the
Royden Highway Construction Project
Coconino County, Arizona

by

HEINRICHS GEOEXPLORATION CO.
P. O. Box 5671 Tucson, Ariz.

H Scale---1" = 20'

---<---velocity interface

