

GEOCRE  
No:  
30M4-117

SLOPE STABILIZATION STUDY  
THE CASCADE  
HIGHWAY 403 & MOHAWK ROAD  
M.T.C.

VME ASSOCIATES LIMITED  
BLASTING CONTROL CONSULTANTS



# **VME ASSOCIATES LIMITED**

226 GALAXY BOULEVARD,  
REXDALE, ONTARIO  
M9W 5R8  
(416) 675-1100

May 1st, 1978

Ministry of Transportation and Communication,  
Soil Mechanics Section,  
Central Building,  
3rd Floor,  
1201 Wilson Avenue,  
Downsview, Ontario.

Attention: Mr. Ken Selby, P. Eng.  
Supervising Engineer.

re: Report on M.T.C. Contract 76-126  
Lavigne, Ontario  
Our File No: 319/77/90

Dear Sirs:

Further to our telephone conversation this afternoon,  
we are enclosing a copy of our report on M.T.C. Contract No. 76-126,  
as requested.

If you need further assistance, please do not hesitate  
to contact us.

Yours very truly  
VME ASSOCIATES LIMITED



T. H. Yan, P. Eng.  
Associate

THY/ma



# **VME ASSOCIATES LIMITED**

226 GALAXY BOULEVARD,  
REXDALE, ONTARIO  
M9W 5R8  
(416) 675-1100

May 23rd, 1978.

Ministry of Transportation and Communications,  
P.O. Box 5020,  
1182 North Shore Boulevard,  
Hamilton, Ontario.

Attention: Mr. C. R. Robertson,  
District Engineer.

re: Blasting Feasibility Study and Proposal  
Rock Erosion at "The Cascade"  
Hwy 403, East of Mohawk Road  
Our File No: 138/78/54

Dear Sirs:

In accordance with your instructions, we have now completed our study of the feasibility of trimming, scaling and stabilizing by blasting methods, portions of the rock face, in the area known as "the Cascade" on Highway 403, just east of the Mohawk Road exit, in Hamilton, Ontario.

## SCOPE

The purpose of our involvement in this matter was to examine the feasibility of scaling the top portion of "The Cascade" using blasting methods, assessing the potential hazards involved to an existing concrete box culvert below as well as to private and public structures, and to make recommendations for the control of such blasting procedures.

Ministry of Transportation and Communications

SCOPE (cont'd)

In addition, we were instructed to recommend and to discuss the project with qualified and experienced contractors, and to attempt to obtain firm prices from such contractors, for completion of the work on each of the following phases:

- I Removal of blocks at the top of the Waterfall
- II Removal and cleaning of debris from Gully.

SITE VISITS

The writer attended the site initially on April 26th, 1978, accompanied by Mr. Gus Tellier, of Gus Tellier Limited, to discuss the project and to carry out a preliminary first-hand examination of the contract site. This initial site meeting was also attended by your Messrs. M. Scrimshaw and K.G. Selby.

An additional site visit was made by the writer on May 5th, 1978, to discuss the project with representatives from S. McNally and Sons Limited, General Contractors, who had indicated interest in submitting prices for the work.

Subsequent to the site meeting of May 5th, 1978, further discussions were held at the Toronto offices of S. McNally and Sons Limited, on May 12th, 1978.

FEASIBILITY ASSESSMENT

In our opinion there is no doubt that the trimming and scaling of this slope by blasting methods is entirely feasible. This type of scaling is by no means uncommon, but it does require considerable expertise and a specialized range of equipment, specifically including "cages", portable work platforms or baskets



Ministry of Transportation and Communications.

FEASIBILITY ASSESSMENT (cont'd)

which can be suspended over the edge of the slope from above by cranes. Much of the drilling will have to be done by hand-held, air-operated pluggers and drills and consequently the work will not be fast, although it should be appreciably faster than would be the case if blasting methods are not adopted.

The quantities of explosive which will be permitted for use in any operation during this work will be strictly limited, and good wall control will be a prime concern in order to minimize "back-break" and to prevent damage to the adjacent blocks which are to remain. In addition, minimal use will probably be made of millisecond delayed detonation techniques in this instance, to avoid the possibility of "cut-offs".

HAZARDS

The principal exposed hazard is of course the existing Highway 403 and the previously mentioned concrete box culvert. The General Contractor, S. McNally and Sons Limited, will take the necessary precautions to protect the existing concrete culvert by placing 12 x 12 timber on top of the culvert to protect it, should a large block roll down the slope. In addition, they propose to devise a method by which rubber blasting mats will be extended in front of the rock face to be blasted, in order to minimize the potential of fly-rock damage as well as to break the fall or momentum of rocks rolling down the slope.

Ministry of Transportation and Communications.

HAZARDS (cont'd)

Any damage, if likely, to pavement, curbs etc., would be for the owners account, since in their opinion, the Maintenance Department of the M.T.C. in Hamilton would be better geared for such an emergency.

A further hazard which should be considered is that this blasting will necessarily be accompanied by the normal but undesirable side-effects of air concussion (noise) and ground vibration, which may be perceptible at the nearest private residences at the upper level. We are completely confident that at the distances and explosive charge weights involved, these effects will not even approach the intensity levels required to threaten the structural integrity of any of these homes; nevertheless, the possibility that complaints or even invalid claims may be submitted in this regard is not inconceivable, principally due to the exaggerated noise effect which often accompanies this type of "surface" blasting.

For this reason, we recommend that seismic and sound recordings be made during the course of the work, a service which would be included should we be retained to monitor and supervise the blasting operations on a full-time site representation basis.

COST OF PROPOSED WORK

Due to the limited time at our disposal, we have been able to approach only two of the limited number of Contractors who we felt had the necessary expertise to carry out this work satisfactorily.

Ministry of Transportation and Communications

COST OF PROPOSED WORK (cont'd)

One of these Contractors, Gus Tellier Limited, subsequently declined to tender on the project on his own behalf, although he indicated that he would be prepared to do so on a joint venture basis under the auspices of either one of two other Contractors, Alden Construction Limited of Grimsby or Moir Construction Limited of St. Catharines.

S. McNally and Sons Limited, who have carried out comparable work in the recent past, including a slope stabilization project alongside the Sir Adam Beck Generating Station last year, not only have the necessary expertise for this work, but already possess most of the equipment necessary, including the cages which were fabricated for the Sir Adam Beck job. This company has submitted prices as requested by us under the two headings indicated by the guidelines described in an earlier section of this report, and their submission is now appended hereto.

You will note that the anticipated contract price for the removal of rock at the top of "The Cascade" by blasting is a lump-sum price of \$29,982.00, while the anticipated cost of removal of the loose debris from the gully is an additional \$10,658.00, lump-sum.

In addition, it should be noted that the prices do not include the provision of flagmen or the cost of traffic control on the highway during the duration of the contract.

Ministry of Transportation and Communications

COST OF PROPOSED WORK (cont'd)

Although only one firm contract bid has been received so far, we feel that the prices submitted are representative of the order of costs which will be involved in this project. With your approval and if so instructed, after due consideration of this report, we shall proceed to obtain comparable prices on the same basis from two other Contractors, if you so wish, and to report back to you at that time.

So far as blasting control consultation is concerned, we would be prepared to provide a technical field representative at the site on a full-time basis throughout the blasting phase of the work, to approve blasting patterns and procedures, to monitor the seismic and sound effects of the operations, as described earlier, to recommend amendments to existing procedures where indicated and generally to represent the interests of yourselves in this matter.

The cost of monitoring and supervising this work on a continuous medium-term assignment basis, predicated on a minimum of five consecutive working days and involving a field technician equipped with seismic and sound recording instrumentation and including recording film supplies, subsistence and vehicle maintenance and running expense, as well as submission of weekly progress reports, would be an all-inclusive flat fee rate of \$275.00 per day, based on an 8-hour day. Overtime, if required and authorized by the Client's site representative or designated alternate, will be billed at the pro-rated straight time hourly rate of \$34.38 per hour.

Ministry of Transportation and Communications

COST OF PROPOSED WORK (cont'd)

Standby time, due to inclement weather or other conditions beyond our control, will be billed at the normal applicable daily or hourly rate.

In addition, or as an alternative, VME Associates Limited would provide similar service on an intermittent one-day site visit basis for a flat, all-inclusive rate of \$435.00 per day, based on a 10-hour day, including travel portal to portal ex Rexdale, and including a subsequent report.

We also wish to confirm that our fee and expenses up to and including the submission of this proposal, would be of the order of \$400.00.

CLOSURE

We wish to thank you for the opportunity to have worked with you on this project, and we trust that if there is any point in the foregoing which requires further clarification, you will not hesitate to contact us.

Yours very truly,  
VME ASSOCIATES LIMITED



Tony H. Yan, P. Eng.  
Associate

cc: Mr. K. G. Selby,  
Supervising Engineer.

THY/ma

VME ASSOCIATES

Toronto Office  
1544 The Queensway  
Toronto 540, Ontario  
M8Z 1T5

*S. McNally & Sons, Limited*  
*Engineers & Contractors*

Head Office — 1855 Barton St. East  
P.O. Box 3338, Station "C",  
Hamilton, Ontario  
L8H 7L8  
Telex No. 061-8309

May 11, 1978

VME Associates Limited  
226 Galaxy Blvd.  
Rexdale, Ontario  
M9W 5R8

Attention: Mr. Tony Yan

Dear Sir:

Re: Rock Removal Highway 403  
Hamilton, Ontario

Proposal No. 1 - Rock Removal

To remove the loose blocks of rock at the top of the waterfall on Highway 403 as outlined by your Mr. Tony Yan including Supervision, Labour, Plant and Equipment.

It is evident from a closer inspection of the offending pieces of rock that certain portions of the rock on both the east and west sides may have to be removed at the same time; we have therefore taken this into consideration in preparing our price.

As mentioned by Mr. Yan at our site meeting, there would be delays in the operation owing to traffic problems; we have tried to provide for a delay factor in our price to deal with this.

All for the Lump Sum of \$29,982.00

It is our understanding that traffic control would be provided by the M.T.C. at no cost to us; we have not therefore made any provision for this in our quotation. Any damage to pavement, curbs, etc., would be for the owners account.

continued-----



VME Associates Limited  
226 Galaxy Blvd.  
Rexdale, Ontario  
M9W 5R8

Brief Description of Method -

Proposal No. 1

The work would be performed using a Groves Crane or equivalent, with an appropriate boom length for the operation from which a man-basket would be attached for the workmen similar to the one used at the Sir Adam Beck Generating Station - Rock Cliff Stabilization Program, which proved to be successful.

Drilling would be carried out using a compressor and hand air operated pluggers and drills.

controlled blasting techniques would be used to remove the rock.

An attempt would be made to drill for the blasting from the front face in towards the cliff face thereby breaking the blocks into smaller pieces. However, as there are some unknown factors involved, a certain amount of flexibility must be allowed and decisions made as the work proceeds.

continued-----

VME Associates Limited  
226 Galaxy Blvd.  
Rexdale, Ontario  
M9W 5R8

Proposal No. 2 - Cleaning Debris from Gully

Remove the existing loose rock and generally clean out the gully including debris caused by removal of the rocks at the top of the water-fall. The extent of our cleaning would be approximately from the rock face to a point adjacent to the corrugated steel pipe situated on the rock ledge near the flat area to the base culvert inlet.

At the flat area adjacent to the base culvert inlet, we have only allowed for minor clean-up; the large pieces of rock at the sides would be left in place.

All for the Lump Sum of \$10,658.00

Continued-----



VME Associates Limited  
226 Galaxy Blvd.  
Rexdale, Ontario  
M9W 5R8

Brief Description of Method -

Proposal No. 2

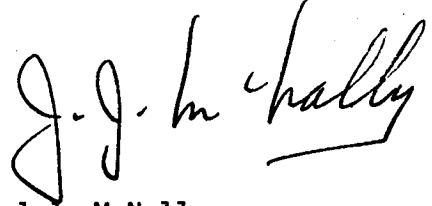
The work would be performed by using mostly hand labour to remove the rocks to a point where it could be picked up by machine and loaded onto trucks for disposal.

Owing to the varying sizes of the pieces of rock some minor blasting may have to be used to assist in the handling process.

We request traffic control as required for the progress of the work.

Yours truly,

S. McNALLY & SONS LIMITED

A handwritten signature in dark ink, appearing to read "J.J. McNally", with a stylized flourish at the end.

J.J. McNally  
President

JJM:jf

September 13th, 1977.

Miller Paving Limited,  
Box 250,  
Unionville, Ontario,  
L3R 2V3

Attention: Mr. Jack Willoughby

re: Blast Monitoring, Control & Consultation  
M. T. C. Contract 76-126, Lavigne, Ontario  
Our File Number: 319/77/90

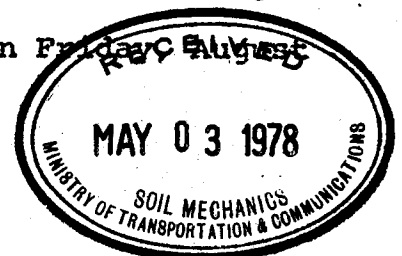
Dear Sirs:

We wish to report on the results of seismic monitoring services carried out by this company during the entire blasting operations recently completed in a formerly restricted area of the above referenced contract.

SITE VISIT

In accordance with instructions received from your representative, Mr. J. Willoughby, the writer travelled to the site on Monday, August 22nd, 1977, and met with your site representative, Mr. H. Crysler, who informed us that blasting operations would commence on the following morning.

The writer attended the site each day during the work week of August 22nd, 1977, for the purpose of witnessing and recording a series of blasting operations which was completed on Friday, August 26th, 1977.



Miller Paving Ltd.

INSTRUMENTATION

The instrument provided for seismic monitoring was a VME portable 3-component Velocity Recorder, Model E, using direct print film in the camera unit to permit immediate preliminary analysis and interpretation of the results obtained in the field.

MONITORING RESULTS

As recommended in our report dated August 17th, 1977, all seismic monitoring was carried out continuously at a distance of approximately 50 feet south of each blasting operation. The monitoring site in each case was in the general direction of the area of the sensitive subsoil on which much of the adjacent causeway was built. Each blasting operations was designed to produce vibration levels with an intensity not to exceed our recommended limiting criterion of 1.33 inches per second peak particle velocity.

Photocopies of the pertinent extracts from each of the nineteen seismic recordings obtained, together with details of the blasting and monitoring for all blasting operations concerned, are attached to this report as Appendices Ia to Is, inclusive.

We are also including, as Appendix II, two additional seismic recordings taken on the causeway, near the north end of the existing bridge, of ground vibrations produced by passing truck traffic, and a typical production blast at your more distant construction quarry respectively.

Miller Paving Ltd.

CONSIDERATION OF RESULTS

Please note that three of the blasting operations did produce vibration levels slightly in excess of our "target" limiting value of 1.33 inches per second peak particle velocity at a distance of 50 feet. On each such occasion, the results were immediately reported to the blasting crew so that changes in loading and/or shot design would be made for the next succeeding blasting operation to ensure a reduction in the vibration side effects.

CLOSURE

We wish to thank you for the opportunity to have assisted you on this assignment. Should you have any questions concerning the contents of this report, or if we can be of further service in this matter, please do not hesitate to contact us.

Yours very truly,  
VME ASSOCIATES LIMITED



Prepared by: Robert T. Booren, P. Eng.

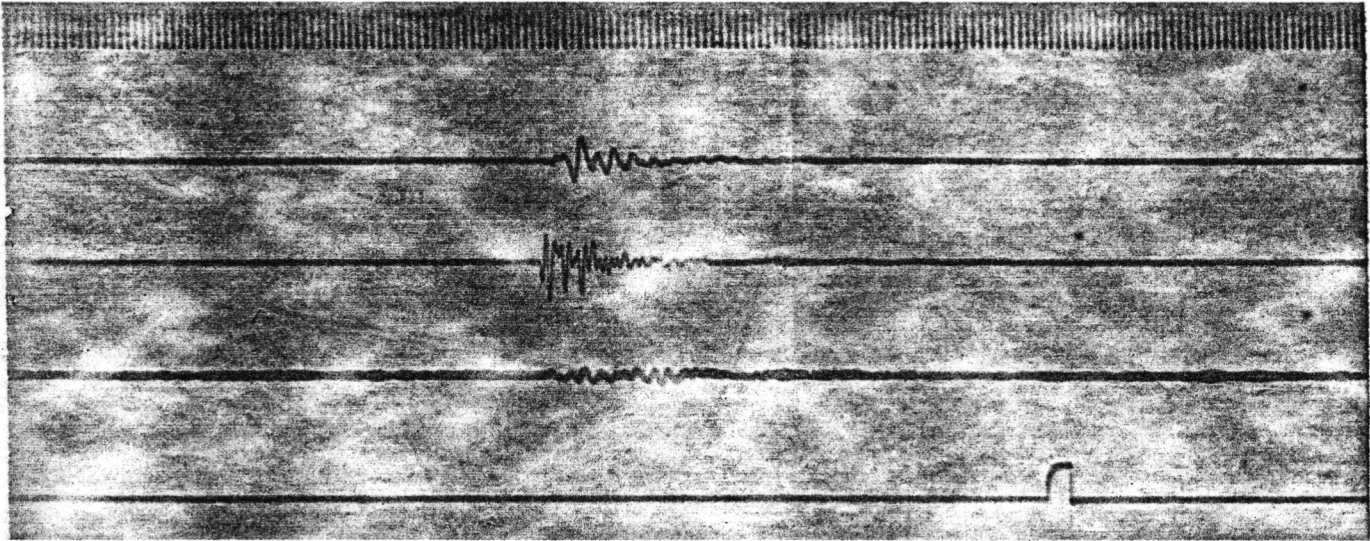


Approved by: A. Lance McAnuff, P. Eng.  
Specialist - Explosives and Blasting

RTB/ma

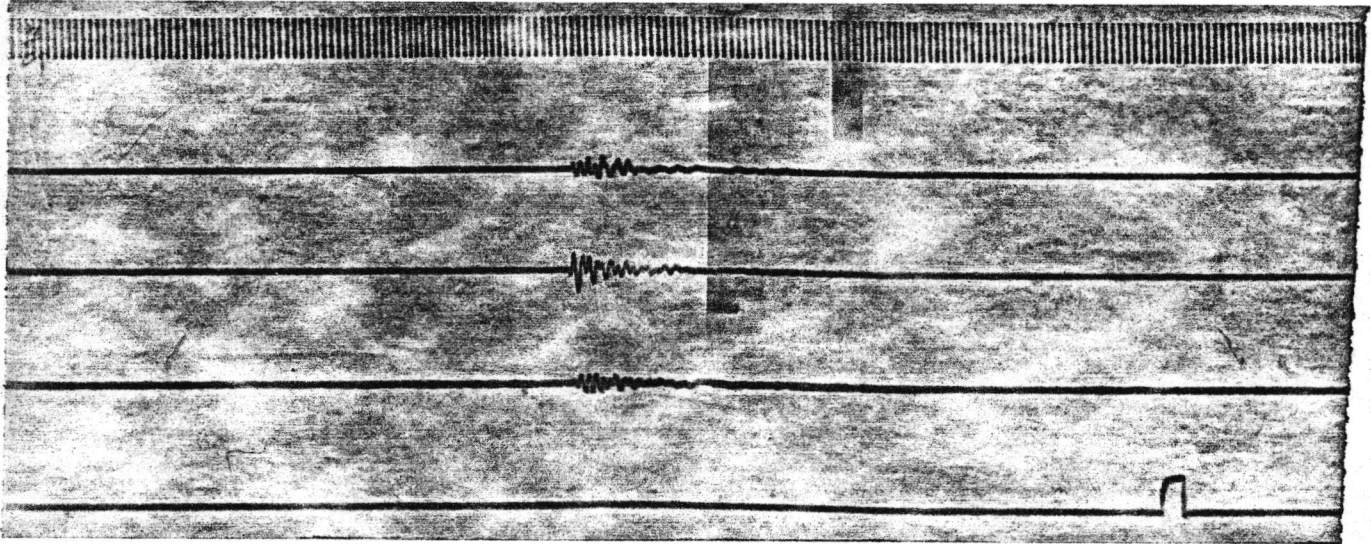
**APPENDICES Ia to Is**

APPENDIX Ia



Recording No: 1  
Date and Time: August 23rd, 1977; 9.03 a.m.  
Blast Location: Sta. 594+95 - 595+00  
Instrument Position: 594+45  
Distance: 50 feet  
Blast Detail: 30 pounds total explosive in 12 holes  
7.5 pounds maximum per delay period.  
Gain Switch: 4.0  
  
Peak Particle Vel: 1.30 in/sec.

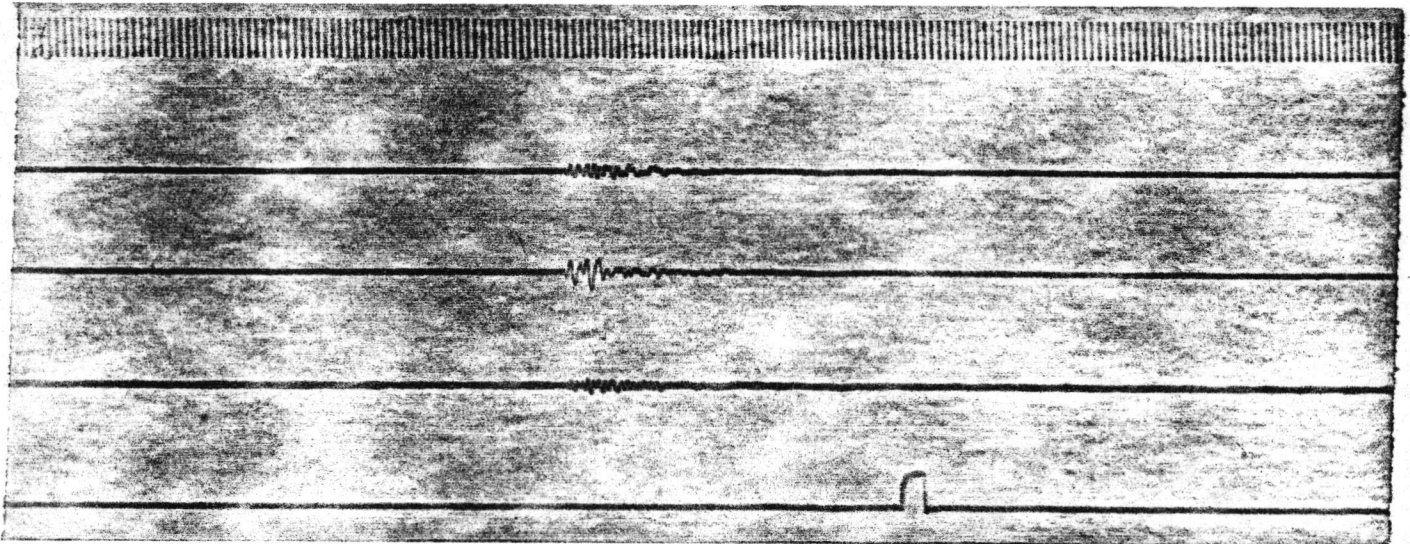
APPENDIX 1b



Recording No: 2  
Date and Time: August 23rd, 1977; 10.12 a.m.  
Blast Location: Sta. 594+95 - 595+00  
Instrument Position: 594+45  
Distance: 50 feet  
Blast Detail: 10 pounds total explosive in 5 holes;  
6 pounds maximum per delay period.  
Gain Switch: 4.0

Peak Particle Vel: 0.80 in/sec.

APPENDIX Ic

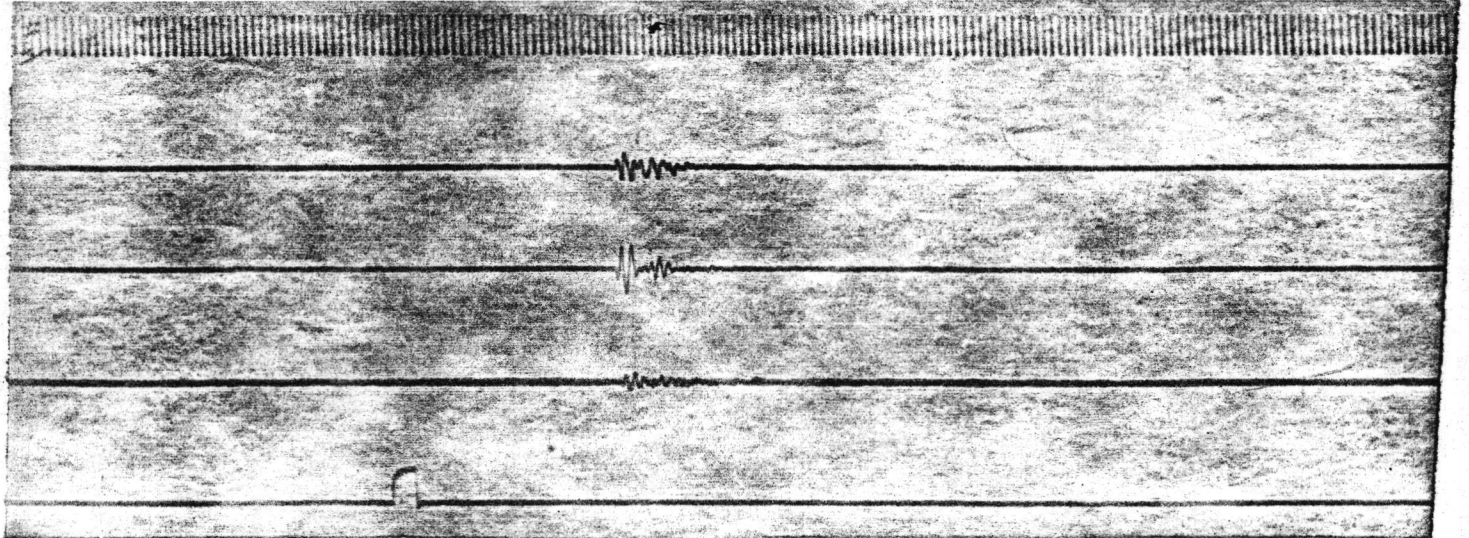


Recording No: 3  
Date and Time: August 23rd, 1977; 10.54 a.m.  
Blast Location: Sta. 595+00 - 595+05  
Instrument Position: 594+50  
Distance: 50 feet  
Blast Detail: 10 pounds total explosive in 6 holes;  
7 pounds maximum per delay period.  
Gain Switch: 4.0

Peak Particle Vel: 0.70 in/sec.



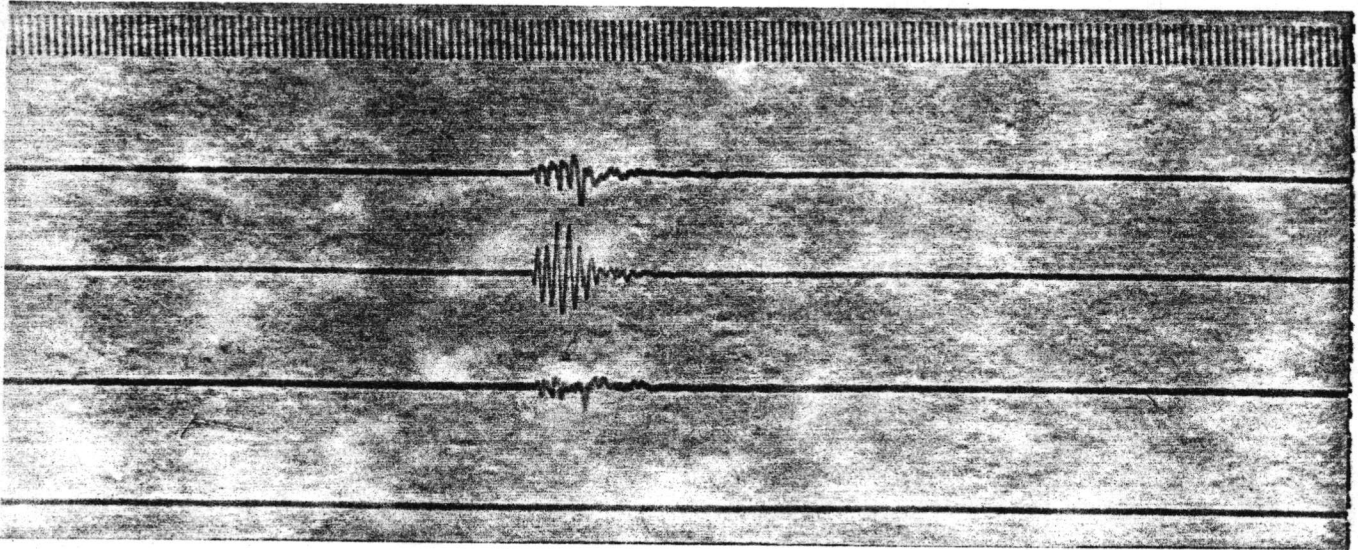
APPENDIX Id



Recording No: 4  
Date and Time: August 23rd, 1977; 11.52 a.m.  
Blast Location: Sta. 595+00 - 595+05  
Instrument Position: 594+50  
Distance: 50 feet  
Blast Detail: 8 pounds total explosive in 5 holes;  
3 pounds maximum per delay period.  
Gain Switch: 4.0

Peak Particle Vel: 0.95 in/sec.

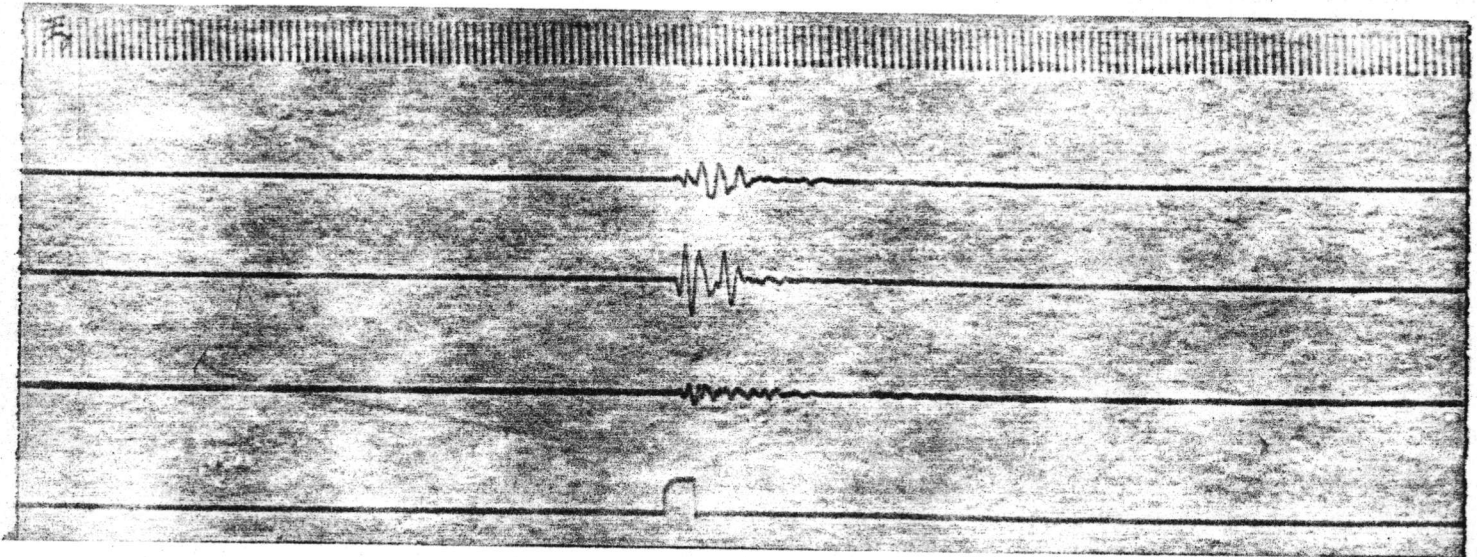
APPENDIX Ie



Recording No: 5  
Date and Time: August 23rd, 1977; 1.30 p.m.  
Blast Location: Sta. 595+05 - 595+10  
Instrument Position: 594+55  
Distance: 50 feet  
Blast Detail: 8 pounds total explosive in 4 holes;  
6.5 pounds maximum per delay period.  
Gain Switch: 4.0

Peak Particle Vel: 1.80 in/sec.

APPENDIX If



Recording No: 6

Date and Time: August 23rd, 1977; 2.05 p.m.

Blast Location: Sta. 595+10 - 595+13

Instrument Position: 504+60

Distance: 50 feet

Blast Detail: 10 pounds total explosive in 4 holes;  
5 pounds maximum per delay period.

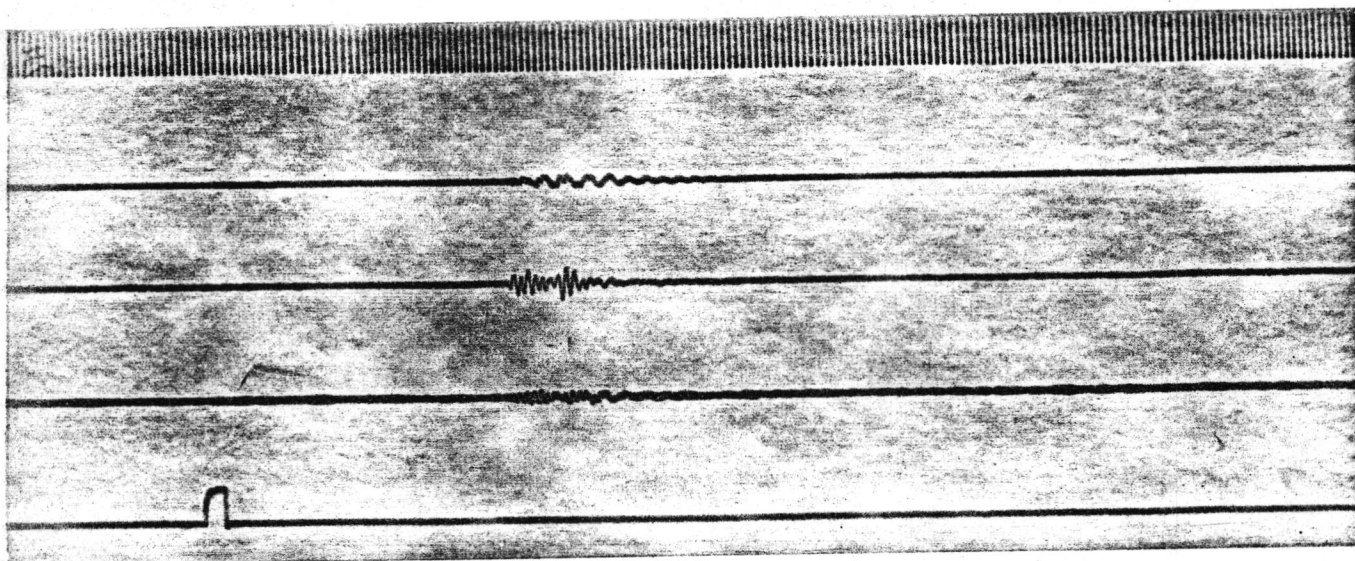
Gain Switch: 4.0

Peak Particle Vel: 1.40 in/sec.



APPENDIX Ig



Recording No: 7

Date and Time: August 24th, 1977; 8.26 a.m.

Blast Location: Sta. 595+05 - 595+10

Instrument Position: 504+55

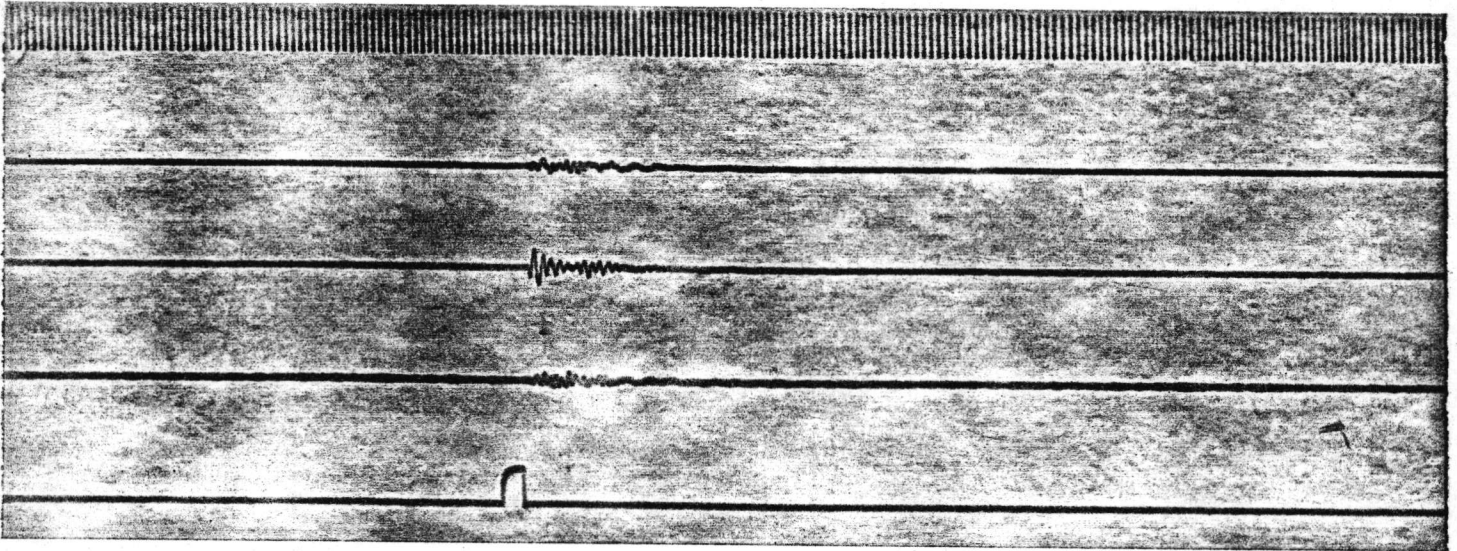
Distance: 50 feet

Blast Detail: 10.75 pounds total explosive in 4 holes;  
3.75 pounds maximum per delay period.

Gain Switch: 4.0

Peak Particle Vel: 0.60 in/sec.

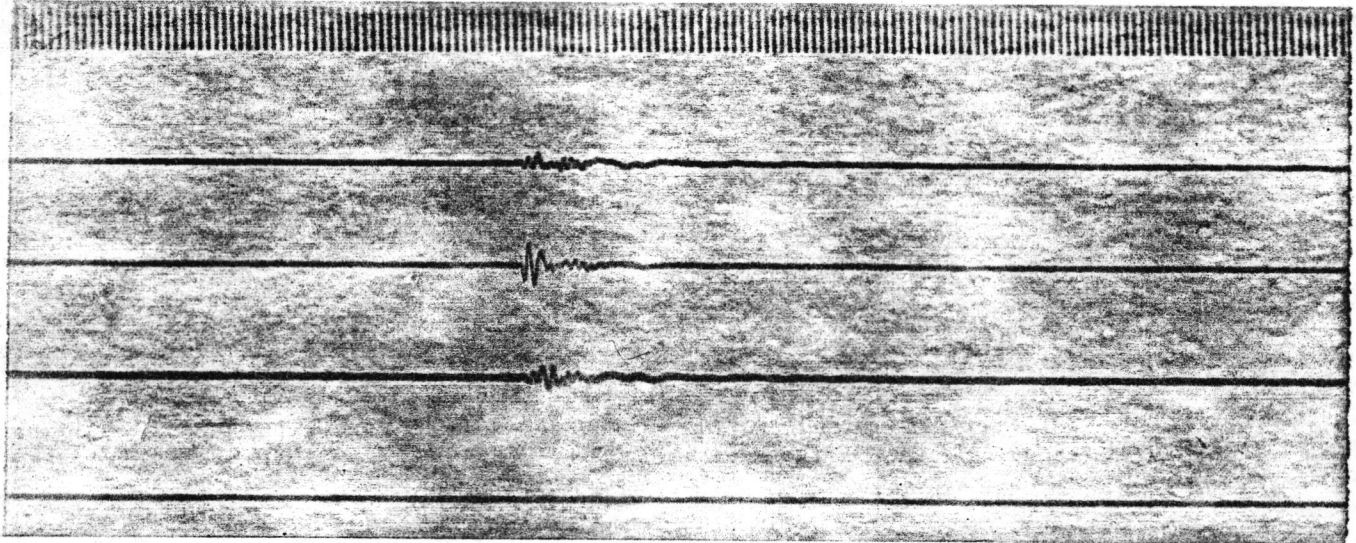
APPENDIX 1h



Recording No: 8  
Date and Time: August 23th, 1977; 9.28 a.m.  
Blast Location: Sta. 595+15 - 595+20  
Instrument Position: 594+65  
Distance: 50 feet  
Blast Detail: 19.5 pounds total explosive in 5 holes;  
7.5 pounds maximum per delay period.  
Gain Switch: 4.0

Peak Particle Vel: 0.70 in/sec.

APPENDIX Ii

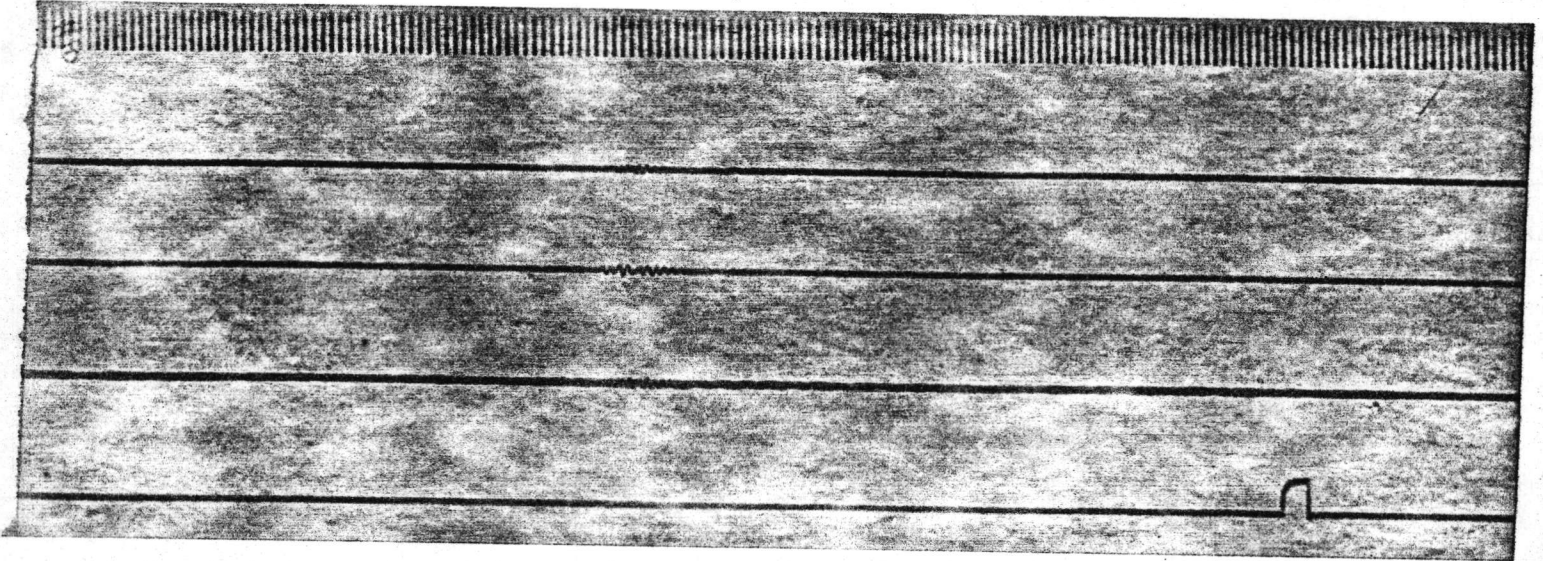


Recording No: 9  
Date and Time: August 24th, 1977; 11.11 a.m.  
Blast Location: Sta. 595+15 - 595+20  
Instrument Position: 594+65  
Distance: 50 feet  
Blast Detail: 15 pounds total explosive in 7 holes;  
7 pounds maximum per delay period.  
Gain Switch: 4.0

Peak Particle Vel: 0.80 in/sec.



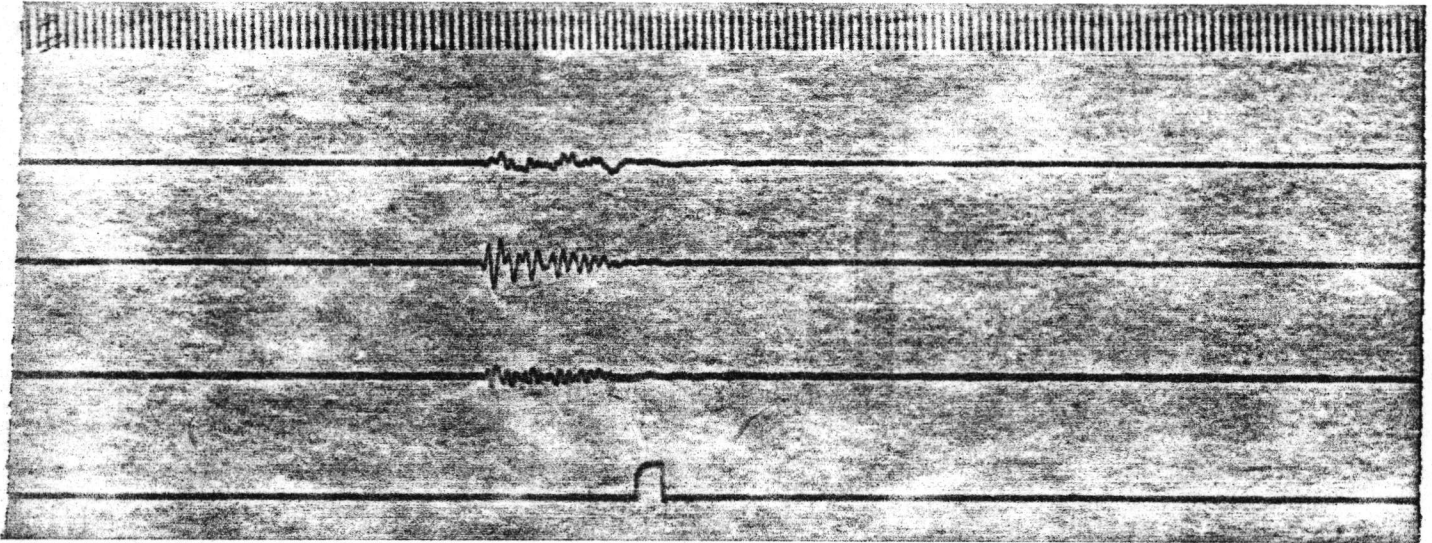
APPENDIX Ij



Recording No: 10  
Date and Time: August 24th, 1977; 11.43 a.m.  
Blast Location: Sta. 595+20 - 595+25  
Instrument Position: 594+70  
Distance: 50 feet  
Blast Detail: 5 pounds total explosive in 2 holes;  
3 pounds maximum per delay period.  
Gain Switch: 4.0

Peak Particle Vel: 0.20 in/sec.

APPENDIX Ik



Recording No: 11  
Date and Time: August 24th, 1977; 1.44 p.m.  
Blast Location: 595+25 - 595+35  
Instrument Position: 594+75  
Distance: 50 feet  
Blast Detail: 19 pounds total explosive in 11 holes;  
5 pounds maximum per delay period.  
Gain Switch: 4.0

Peak Particle Vel: 1.00 in/sec.

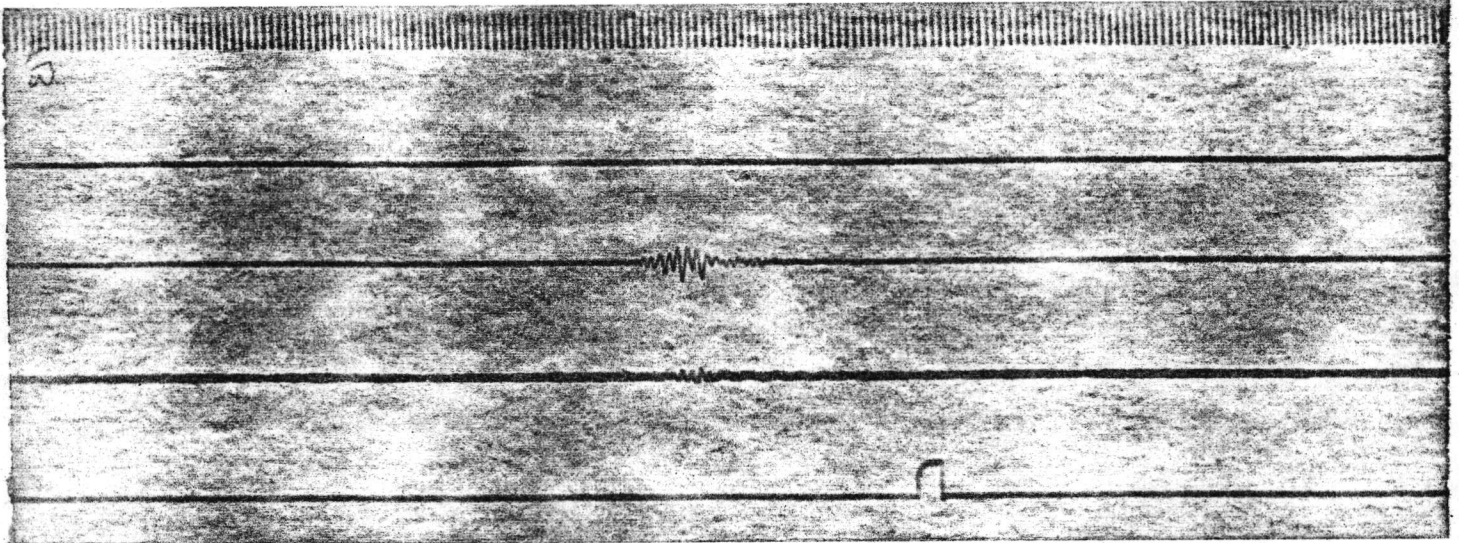


APPENDIX IL

Recording No: 12  
Date and Time: August 24th, 1977; 2.31 p.m.  
Blast Location: Sta. 595+25 - 595+35  
Instrument Position: 594+75  
Distance: 50 feet  
Blast Detail: 18.5 pounds total explosive in 9 holes;  
4.5 pounds maximum per delay period.  
Gain Switch: 4.0

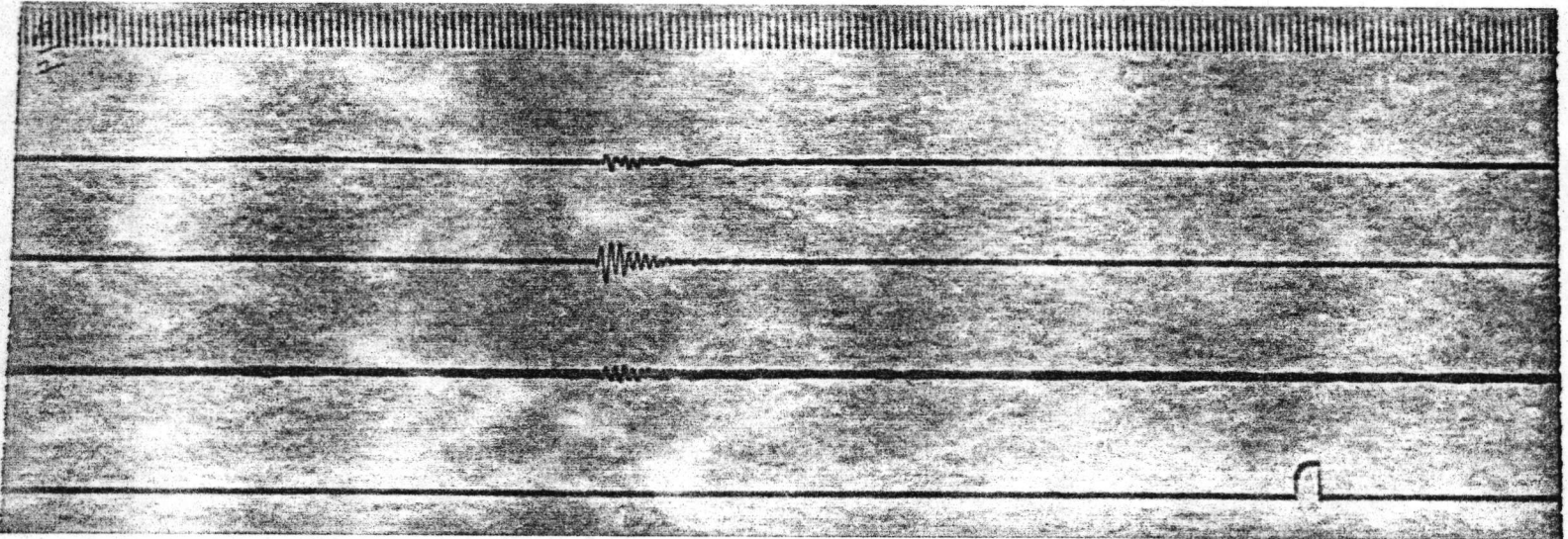
Peak Particle Vel: 0.40 in/sec.

APPENDIX Im



Recording No: 13  
Date and Time: August 24th, 1977; 3.50 p.m.  
Blast Location: Sta. 595+35 - 595+50  
Instrument Position: 594+85  
Distance: 50 feet  
Blast Detail: 18 pounds total explosive in 11 holes;  
6.5 pounds maximum per delay period.  
Gain Switch: 4.0  
  
Peak Particle Vel: 0.70 in/sec.

APPENDIX In

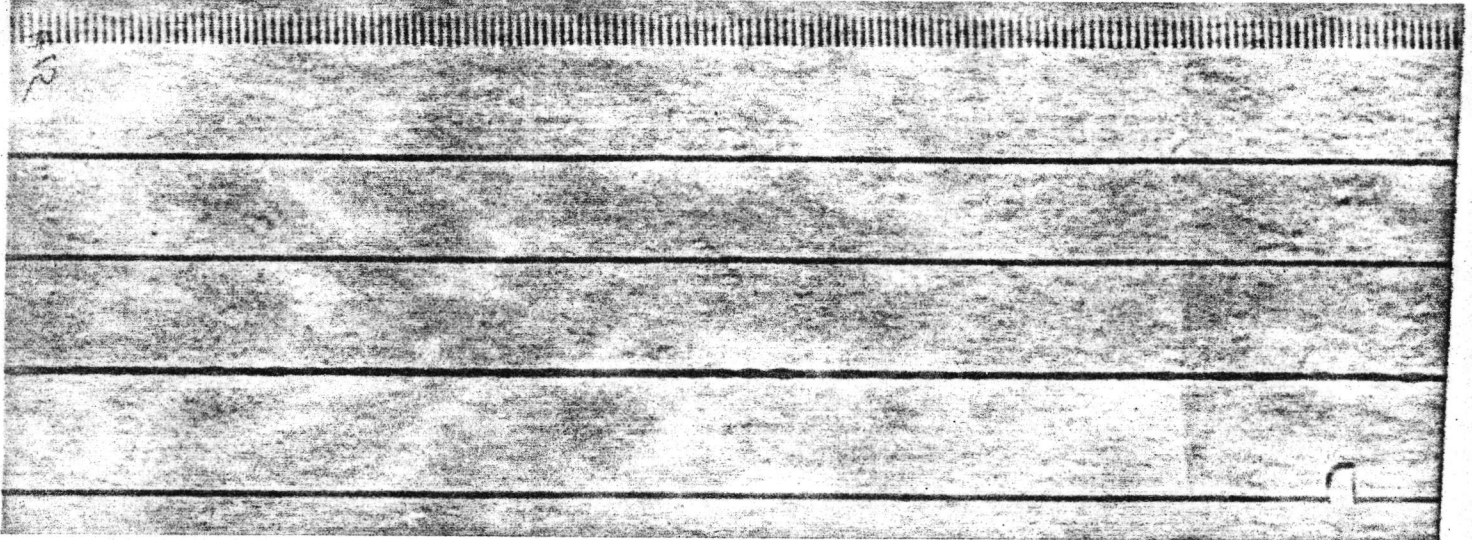


Recording No: 14  
Date and Time: August 24th, 1977; 4.48 p.m.  
Blast Location: Sta. 595+50 - 595+55  
Instrument Position: 595+00  
Distance: 50 feet  
Blast Detail: 17 pounds total explosive in 13 holes;  
4 pounds maximum per delay period.  
Gain Switch: 4.0

Peak Particle Vel: 0.80 in/sec.



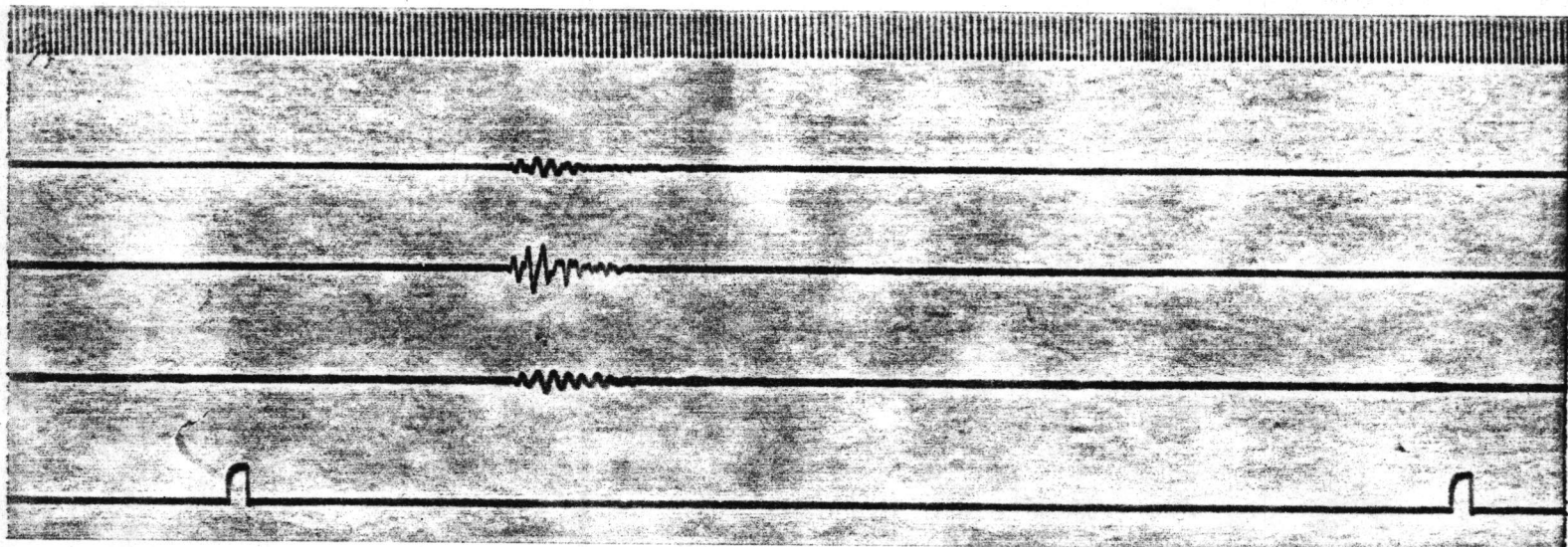
APPENDIX Io



Recording No: 15  
Date and Time: August 24th, 1977; 6.10 p.m.  
Blast Location: 595+80 - 596+10  
Instrument Position: 595+30  
Distance: 50 feet  
Blast Detail: 18 pounds total explosive in 15 holes;  
4 pounds maximum per delay period.  
Gain Switch: 4.0

Peak Particle Vel: Less than 0.20 in/sec.

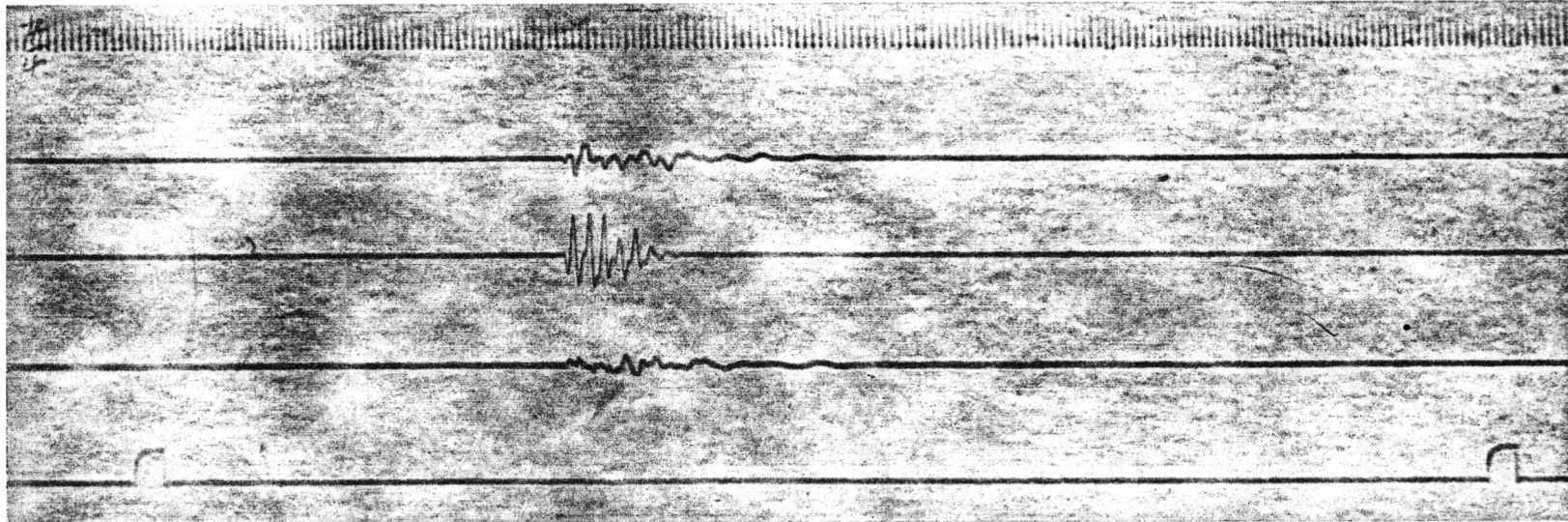
APPENDIX Ip



Recording No: 16  
Date and Time: August 25th, 1977; 7.52 a.m.  
Blast Location: Sta. 595+80 - 596+10  
Instrument Position: 595+30  
Distance: 50 feet  
Blast Detail: 7.5 pounds total explosive in 7 holes;  
2.5 pounds maximum per delay period.  
Gain Switch: 4.0

Peak Particle Vel: 0.90 in/sec.

APPENDIX Iq

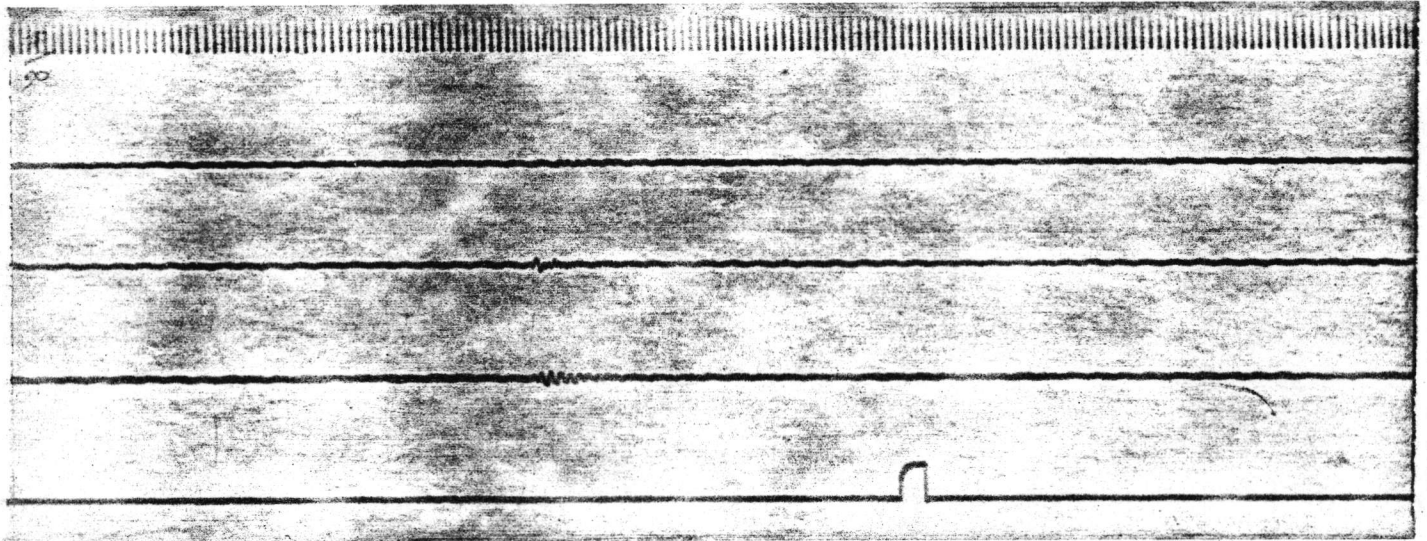


Recording No: 17  
Date and Time: August 25th, 1977; 4.34 p.m.  
Blast Location: Sta. 595+85 - 595+90  
Instrument Position: 595+35  
Distance: 50 feet  
Blast Detail: 20 pounds total explosive in 4 holes;  
5 pounds maximum per delay period.  
Gain Switch: 4.0

Peak Particle Vel: 1.50 in/sec.



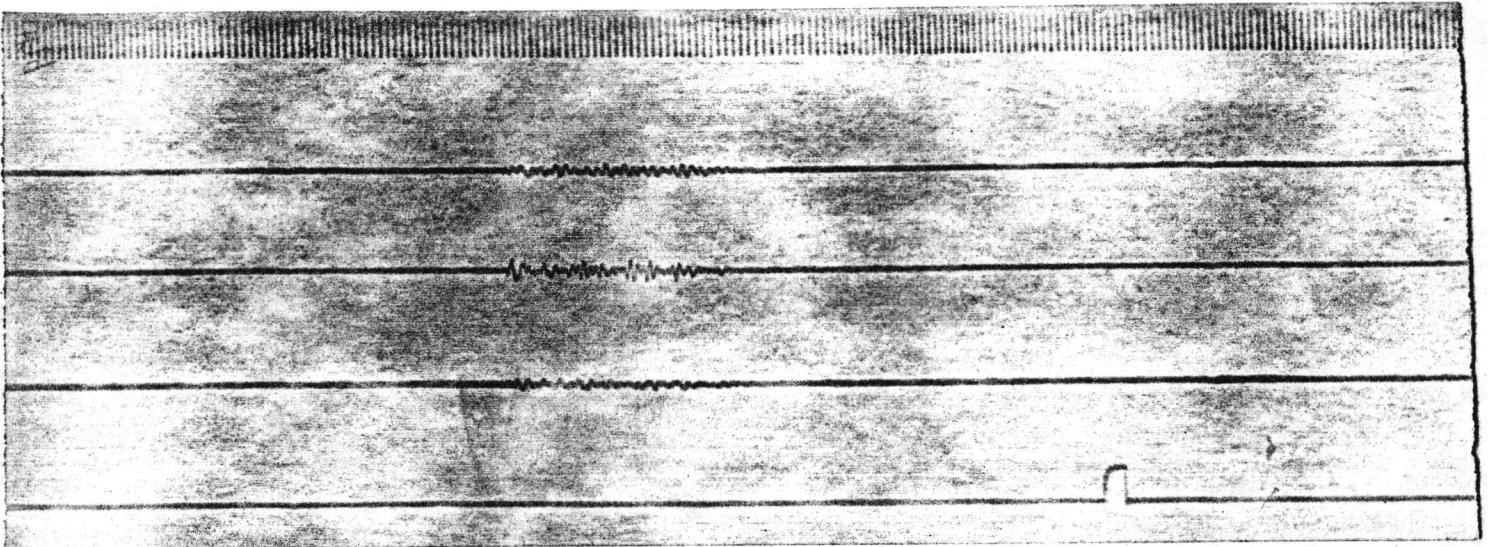
APPENDIX Ir



Recording No: 18  
Date and Time: August 26th, 1977; 7.54 a.m.  
Blast Location: Sta. 595+65 - 595+70  
Instrument Position: 596+20  
Distance: 50 feet  
Blast Detail: 2.5 pounds total explosive in 2 holes;  
2.5 pounds maximum per delay period.  
Gain Switch: 4.0

Peak Particle Vel: 0.30 in/sec.

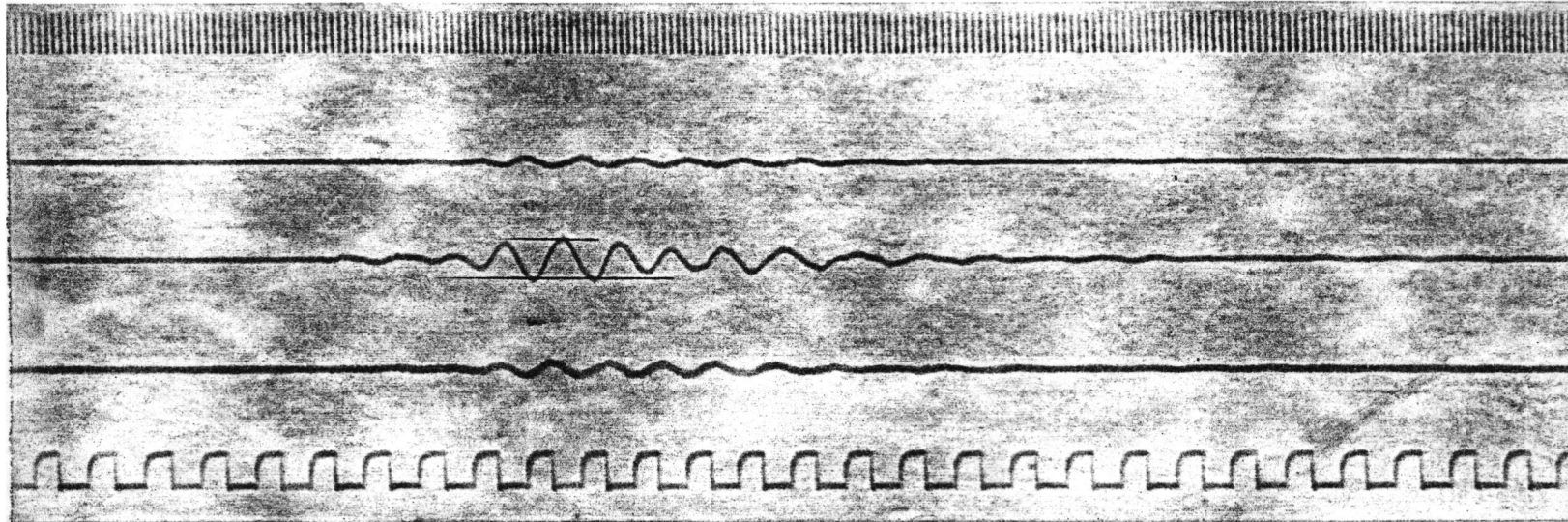
APPENDIX Is



Recording No: 19  
Date and Time: August 26th, 1977; 11.45 a.m.  
Blast Location: Sta. 595+95 - 594+95  
Instrument Position: 596+15  
Distance: 50 feet  
Blast Detail: 29 pounds total explosive in 24 holes;  
3.5 pounds maximum per delay period.  
Gain Switch: 4.0  
  
Peak Particle Vel: 0.45 in/sec.

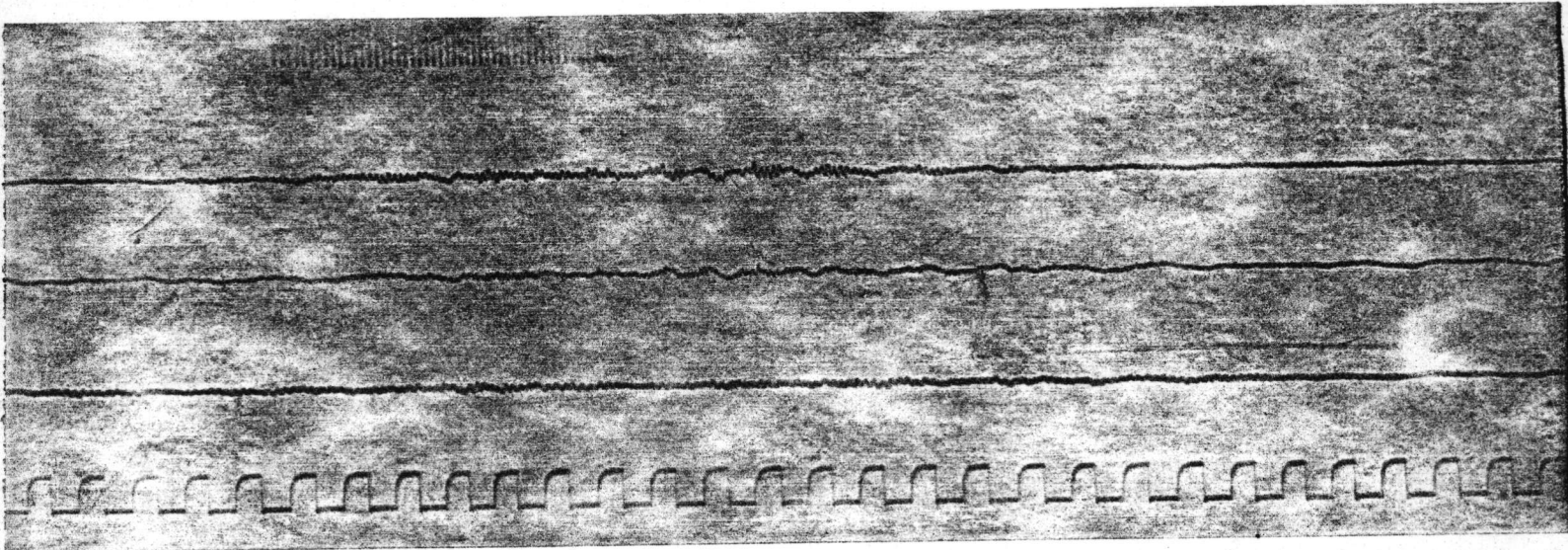


## APPENDIX II



Recording No: Quarry blast  
Date and Time: August 25th, 1977.  
Blast Location: Quarry  
Instrument Position: 585+00  
Distance: Approximately 1900 feet  
Blast Detail: 7000 pounds total explosive in 100 holes;  
845 pounds maximum per delay period.  
Gain Switch: 0.25

Peak Particle Vel: 0.05 in/sec.



Date and Time: August 25th, 1977, 2.00 p.m.

Vibration Source: Passing ruck

Instrument Position: Sta. 585+00

Distance: 10 feet

Gain Switch: 0.25

Peak Particle Vel: 0.022 in/sec.