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DEPARTMENT OF MINES
SOUTH AUSTRALIA

Sr. Warden

RB 57/49

Report on

# GROUND VIBRATIONS FROM QUARRY BLASTING

## BRIDGE QUARRIES

## MURRAY BRIDGE

by

L. L. Mansfield
Inspector of Mines & Quarries

R. A. Love
Assayer & Assistant Manager StateBatteries

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ABSTRACT

The monitoring, with a vibrograph and seismograph, of blasting at the quarry on Section 66, Hundred Mobilong, at Murray Bridge has been carried out since early May following a petition to the Hon. Minister of Mines from nearby residents alleging damage to adjacent houses. No blasts monitored have had sufficient amplitude to cause any damage to the houses nearby.

INTRODUCTION

Early in August 1962 Mr. Petrowski called at the office and intimated his intention to reopen the old Council Quarry to fulfil a contract for ballast with the South Australian Railways. He requested that vibrograph tests be taken of what he considered would be normal blasting operations, so that there would be no likelihood of his operations damaging nearby houses or annoying the residents. On the 6th August, 1962, 7 holes each containing 12 plugs of gelignite were fired simultaneously. The vibrograph was set up on the verandah of Hancock's residence approximately 500 feet from the quarry and the result was an amplitude less than .00025 which is barely perceptible. Petrowski was informed he could increase his charges quite considerably without any fear of damage.

HISTORY

This quarry, when the working face was opposite the shacks on the river front was the subject of complaints in 1951, both of noise and flying stones and the use of explosives was prohibited on 19.11.51 after stones had been thrown through and on the roofs of shacks. Mr. Petrowski opened up fresh faces where there was no possibility of flyrock damaging the shacks.

Quarry Industries operated a quarry across the river from Petrowski's from 1957 to 1960. Complaints of damage and noise were numerous and many vibrograph records were taken with results of low amplitudes unlikely to do damage.

A limit of 50 lb. gelignite per hole was ordered and an inspection of alleged damage was made by Mr. Dancauskis of the then Architect-in-Chief's Department. D.M. 458/56.

It would appear that the location of the quarries in relation to the residential area of South Murray Bridge is such that the noise of blasting is concentrated or magnified to induce more "startle reaction" than encountered elsewhere.

THE PETITION TO THE HON. THE MINISTER OF MINES

On receipt of the petition forwarded through the Member for Murray, Mr. S.A. Bywaters, the co-writer, Inspector Mansfield visited the town on 9.5.63 and interviewed as many of the complainants as were home. The person who initiated the petition has since left the district and the purchaser of his house had no complaints whatsoever. Most of the people interviewed did not know whether blasting had affected their houses and were happy to be assured that there was no possibility of damage to foundations by any charges likely to be fired in the quarry.

The complainants from two homes knew that the blasting had caused cracks, one refused to show the investigating officer the cracks until informed the refusal would be mentioned in the report, and the husband of this woman suggested I was being paid by Petrowski when I refused his demand that I close the quarry.

Petrowski was informed of the petition and instructed to let the Mining Branch know when he proposed to fire holes so they could be monitored, to avoid firing one or two holes at a time and to organise his quarrying so that about 6 holes could be fired at a visit of the monitoring officer.

REPORT BY STRUCTURAL ENGINEER, PUBLIC BUILDINGS DEPARTMENT

On 17th May, Mr. Dankauskis of the Public Buildings Department accompanied the writer to Murray Bridge and inspected 10 of the buildings in closest proximity to the quarry and occupied by complainants and saw one blast monitored.

Mr. Dankauskis reports as follows: (DM 270/51)

"The above 10 inspected residences give a good cross section for all petitioners who signed the letter to the Chief Secretary .... generally the soil in Murray Bridge area is not stable, but it is expanding and contracting due to the change of moisture. Therefore the walls in a number of the houses are cracking (see "Murray Valley Standard" Friday's newspaper, June 22nd 1962).

Conclusion:

1. The topsoil is expanding and contracting due to the change of moisture.
2. A number of residences are constructed on the sloping ground, therefore different characteristics exist under foundations and differential settlements can be expected.
3. In most places which were inspected, the cracking of walls took place before the quarry was in operation.
4. The vibrograph did not register any amplitude of vibration due to blasting.

Summary:

The cracking of the walls, in the above inspected residences is not by the effects of the quarry blasting, but by some other reasons."

EVIDENCE OF CRACKING WALLS BEFORE QUARRY STARTED OPERATION

Murray Valley Standard 22nd June, 1962

Mr. Dankauskis referred to the above in his report. A Report of a meeting of the Murray Bridge Corporation appeared under large headlines in the local paper.

"Corporation Concern over Trust Home Cracks"

Murray Bridge Corporation decided this week to seek a conference with officials of the S.A. Housing Trust, to discuss the repair of cracked walls in many of the Trust's rental homes in the town.

In his fortnightly report, the Mayor (Mr. E.W. Deecke)

said cracks in walls were a very real problem in many of the Trust's rental homes and he had received reports of this from many tenants recently.

At his suggestion Cr. R. Mathews moved successfully that the conference be called.

In support of the motion Cr. B.O. Reu said he had recently been in a Trust rental home and had been able to look straight through a wall from one room to the next.

After reports of other Council business the paper continued -

"Quarry worry"

Cr. Shepherdson said he had been approached in recent weeks by many Murray Bridge South residents who were extremely concerned over a rumour that the old quarry, in the vicinity of Leslie Street was to be reopened very soon.

The residents were concerned on three points - possible danger to homes due to blasting; danger to children who could wander into the quarry area; and the dust nuisance.

One ratepayer had found if the quarry was re-opened a special loading would be applied to his household insurance premium, he said.

The Mayor commented that the matter deserved very serious consideration. The area near and in Leslie St. was seeing rapid development of housing. Little could be done at present however as the Corporation had no sure knowledge of proposals for the use of the quarry.

Cr. Parasiers moved, successfully that a close watch be kept on developments at the quarry and that the Town Clerk fully investigate the Council's powers in this regard.

Survey:

A Departmental surveyor mapped the quarry margins and the relationship to the houses nearby.

RECORD OF VIBROGRAPH & SEISMOMETER TESTS

Two Instruments were used to measure movement of houses caused by the blasting in Bridge Quarries at Murray Bridge South. The Cambridge Universal Vibrograph records only one component at a time and is usually set up to register the longitudinal component.

The Sprengnether Seismograph records the three components, Longitudinal, Transverse and Vertical. The resultant amplitude of these three components is quoted in the table of results. From this figure and the frequency of movement in cycle per second, a ratio of gravity is arrived at. This is a good indication of the likelihood of damage being caused to structures.

From work done by the U.S. Bureau of Mines and published in their Bulletin No. 442 there is a table setting out the safe caution and damage zones for blasting vibrations in terms of Gravity.

The highest figure recorded at Murray Bridge was for the Shot monitored on record 824A with a ratio of gravity of .018, - this is only onefifth of the upper limit of the safe zone which is .1 of gravity.

The table in Bulletin 442 has been confirmed by experimental work in other countries and is conservative. The Department of Mines has done a little work on this aspect as opportunities have offered and found that the tables are conservative, i.e. there would be no likelihood of damage at the upper limit of the safe zone.

It is considered that there is no likelihood of structural damage to the houses in the area by any blasts likely to be used in this quarry.

The residents in the area appear to have associated noise with blast damage. This is the usual experience for most of the

blasting complaints investigated by the Department of Mines. Some of the complainants' allegations were quite ridiculous and one was quite insulting in his allegations that we were siding with the quarry operator and would not give an adverse report on the blasting operations.

## C A M B R I D G E  U N I V E R S A L  V I B R O G R A P H

| Record No. | Date | Location | Details of Blast | Amplitude | Comment |
|---|---|---|---|---|---|
| 769 | 10.8.62 | Mrs. Hancocks House. 500 ft. from Blast | 7 holes with 7 lbs. Gelignite in each. Instantaneous firing. | Less than .00025" | Safe |
| 811 | 17.5.63 | No. 15 Monash Ave. Mr. Grinell. 900 ft. from Blast. | 6 holes 19 feet deep 6 feet spacing and burden. 0-5 E.S.D. Detonators. 40 lbs. A.N.F.O. 4 lbs. Gelignite per hole | .00025" | Safe |
| 812 | 17.5.63 | No. 15 Monash Ave. Mr. Grinell. 900 ft. from Blast. | 2 holes 19 feet deep. 6 ft. spacing and burden. Instantaneous by cordtex. 40 lbs. A.N.F.O. 4 lbs. A.N. 60 per hole. | .0005" | Safe |
| 813 | 30.5.63 | Mrs. Hancock's house. 500 ft. from Blast. | 3 holes 20 ft. 6 spacing up to 10 ft. burden on toe Cordtex with one relay 50 lbs. A.N.F.O. 4 lbs. Gelignite per hole. | Less than .00025" | Safe |
| 814 | 30.5.63 | Mrs. Hancock's house. 500 ft. | 2 holes 20' deep. 6 ft. spacing and burden. Instantaneous. 40 lbs. A.N.F.O. 4 lbs A.N.60 per hole. | Barely perceptible | Safe |
| 823 | 31.7.63 | No. 4 Leslie St. Mr. McKenzie. 800 ft. | 7 holes. 24' deep. 6 ft. spacing and burden. Instantaneous. 50 lbs. explosive per hole | Less than .0005" | Safe |
| 824 | 22.8.63 | No. 4 Leslie St. Mr. McKenzie. 900 ft. | 7 holes. 20 ft. deep. 6 ft. spacing and burden. Instantaneous. 41 lbs. explosive per hole. | .0005" | Safe |
| 825 | 27.8.63 | No. 4 Leslie St. Mr. McKenzie. 900 ft. | 8 holes. 23 ft. deep. 6 ft. spacing 7 ft. burden Cordtex one relay. 48 lbs. explosive per hole | .00025" | Safe |
| 826 | 27.8.63 | No. 4 Leslie St. Mr. McKenzie. 800 ft. | 4 holes 10 ft. deep. 5 ft. spacing and burden Instantaneous. 10 lbs. explosive per hole | No movement recorded. | Safe |
| 827 | 2.9.63 | No. 4 Leslie St. Mr. McKenzie. 900 ft. | 8 holes 20 ft. deep. 6 ft. spacing and burden Cordtex one relay. 44 lbs. explosive per hole. | .0005" | Safe |
| 828 | 2.9.63 | No. 4 Leslie St. Mr. McKenzie. 800 ft. | 5 holes 24 ft. deep. 6 ft. spacing and burden Cordtex one relay. 35 lbs. explosive per hole. | Barely perceptible. | Safe |

## S P R E N G N E T H E R  S E I S M O G R A P H

| Record No. | Date | Location | Details of Blast | Frequency cycles per sec. | Cumulative Amplitude | Ratio of Gravity | Comment |
|---|---|---|---|---|---|---|---|
| 811A | 17.5.63 | No. 15 Monash Ave. Mr. Grinell. 900 ft. from Blast. | 6 holes 19 ft. deep. 6 ft. spacing and Burden. C-5 Electric Dets. 44 lbs explosive each hole. | 10 | .00086" | .0086 | Safe |
| 812A | 17.5.60 | No. 15 Monash Ave. Mr. Grinell. 900 ft. from Blast. | 2 holes 19 ft. deep. 6 ft. spacing and burden. Instantaneous. 44 lbs. explosive each hole. | 10 | .0015" | .015 | Safe |
| 824A | 22.8.63 | No. 4 Leslie St. Mr. McKenzie. 900 ft. from Blast. | 7 holes 20 ft. deep. 6 ft. spacing and burden Instantaneous. 41 lbs. explosive per hole. | 8 | .0029" | .018 | Safe |
| 825A | 27.8.63 | No. 4 Leslie St. Mr. McKenzie. 900 ft. from Blast. | 8 holes 23 ft. deep. 6 ft. spacing and burden. Cordtex one relay 48 lbs. explosive per hole. | 8 | .0011" | .007 | Safe |
| 826A | 27.8.63 | No. 4 Leslie St. Mr. McKenzie. 800 ft. from Blast. | 4 holes 10 ft. deep. 5 ft. spacing and burden. Instantaneous. 10 lbs. explosive per hole. | - | too small to measure | - | Safe |
| 827A | 2.9.63 | No. 4 Leslie St. Mr. McKenzie. 900 ft. from Blast. | 8 holes 20 ft. deep. 6 ft. spacing and burden. Cordtex one relay 44 lbs explosive per hole. | 7 | .0017" | .0083 | Safe |
| 828A | 2.9.63 | No. 4 Leslie St. Mr. McKenzie. 800 ft. from Blast. | 5 holes 24 ft. deep. 6 ft. spacing and burden. Cordtex. one relay 35 lbs. explosives per hole. | 8 | .00086" | .0055 | Safe |

SUMMARY & CONCLUSIONS

(1) The possibility of damage to houses occurring from the blasting at Bridge Quarries is negligible. To avoid objections from residents the Quarry operator has been advised to limit his shots to 200 lbs. of explosive per delay and cover his cordtex (detonating fuse) with about 6" of earth to cut down the noise from primary blasts.

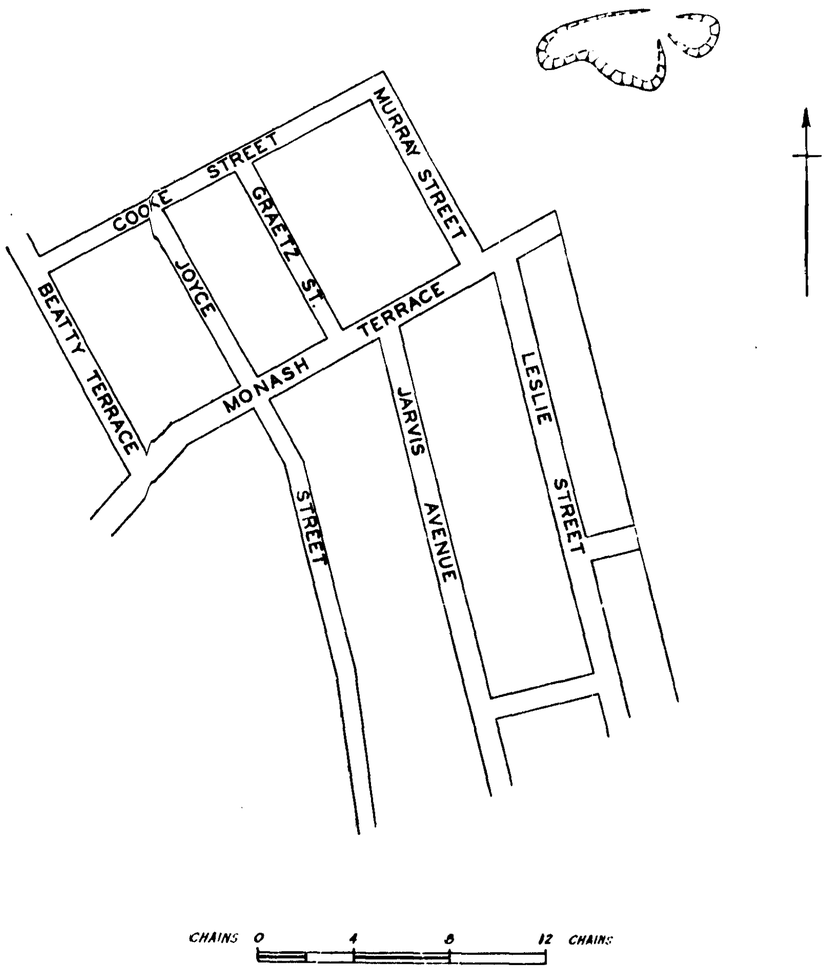
(2) The investigation by the Public Buildings Department structural engineer showed that the cracking of walls was due to differential settlement of the foundations owing to the buildings being on sloping ground or on soil with differing characteristics and that the cracks had occurred before the start of the quarry.

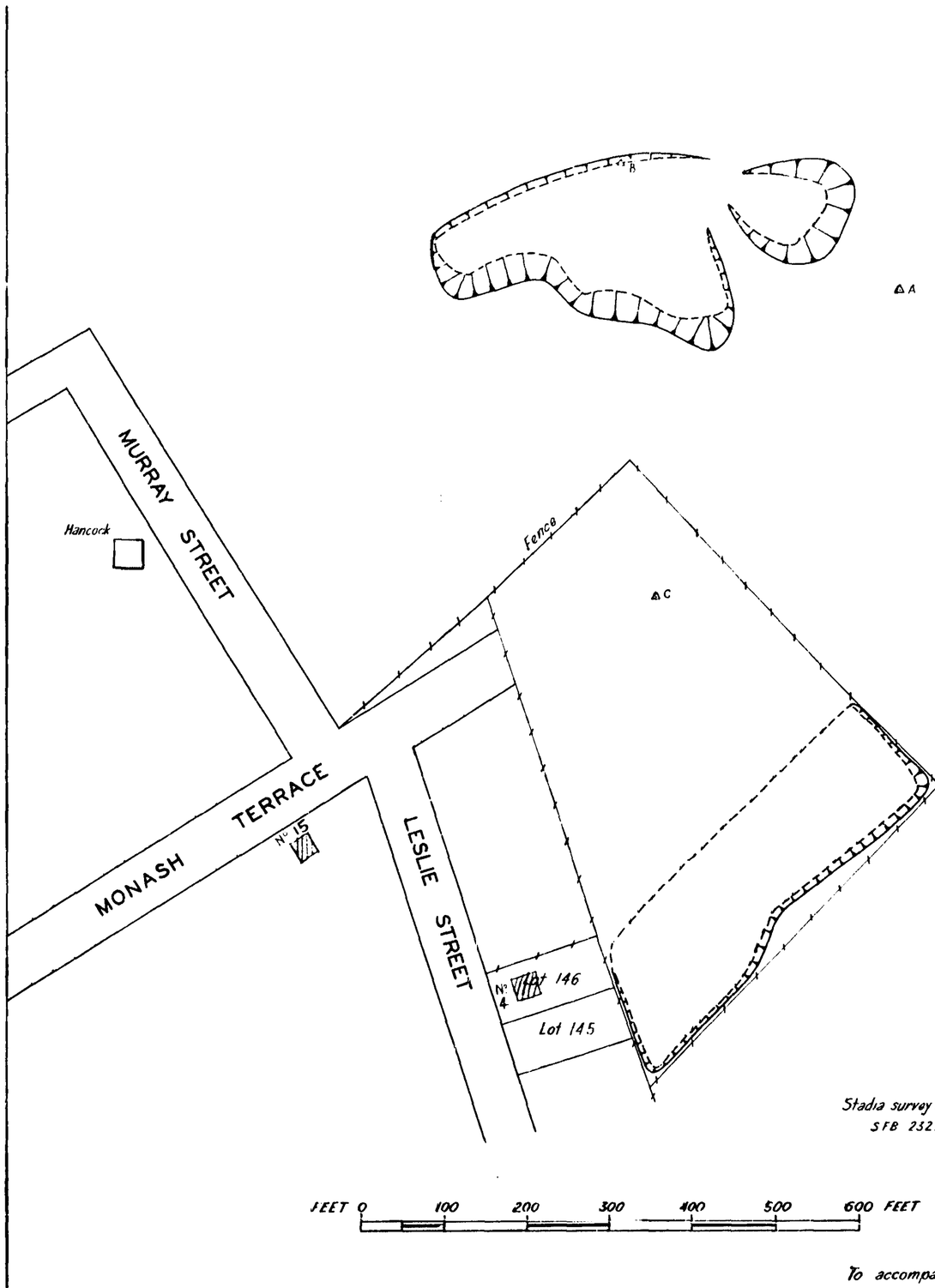
(3) The matter of houses cracking had been considered by council before the quarry started.

L. L. Mansfield
INSPECTOR OF MINES & QUARRIES

R.A. Love
ASSAYER & ASSISTANT MANAGER STATE BATTERIES

LLM&RAL:AGK
17/9/63




Stadia survey by B Frost 14·5·63
SFB 232.

To accompany report by L L Mansfield

# S.A. DEPT. OF MINES

PIOTROWSKI'S QUARRY—MURRAY BRIDGE
LOCALITY PLAN

| Associated Drawing | No. | No. | Amendment | Exd. | Date |
|---|---|---|---|---|---|
| | | | | | |

Req. No.
D.M.
Compiled from

| Approved | Passed |
|---|---|
| Director of Mines | |

Drn. B F
Tcd.
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Exd.

Scale : 63·502
Date 15·5·63 HbB