Section

Rept. Bk. No. 61/166
G.S. No. 3344
D.M. No. 1659/65

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
ENGINEERING DIVISION

GOVERNMENT OFFICES, LOXTON,

INVESTIGATION OF FOUNDATION FAILURE AND REMEDIAL MEASURES

Section 65, Hundred Bookpurnong

- Public Buildings Department -

by

J.P. Trudinger
Geologist
ENGINEERING GEOLOGY SECTION

15th December, 1965.

D.M. 1659/65

DEPARTMENT OF MINES
SOUTH AUSTRALIA

R/B 61/166

GOVERNMENT OFFICES, LOXTON,

INVESTIGATION OF FOUNDATION FAILURE AND REMEDIAL MEASURES

Section 65, Hundred Bookpurnong

- Public Buildings Department -

by

J.P. Trudinger
Geologist
ENGINEERING GEOLOGY SECTION

LIST OF CONTENTS

FIGURE

15th December, 1965.

Rept. Bk. No. 61/166
G.S. No. 3344
D.M. No. 1659/65

Rept. Bk. No. 61/166
G.S. No. 3344
D.M. No. 1659/65

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GOVERNMENT OFFICES, LOXTON,

INVESTIGATION OF FOUNDATION FAILURE AND REMEDIAL MEASURES

Section 65, Hundred Bookpurnong

- Public Buildings Department -

INTRODUCTION

The Government Offices building at Loxton, constructed in 1962, has developed moderate to severe cracking during 1965. The Public Buildings Department is investigating the cause and nature of failure, and possible remedial measures.

The site was inspected on the 28th November, 1965, by Messrs. R. Steel and J. Trudinger (Department of Mines) and A. Dancauskis (Public Buildings Department) and a program of drilling was decided upon.

Drilling commenced on 8th November, 1965, and was completed on 11th November, 1965. Two holes were drilled, to depths of 48 and 36ft. respectively.

NATURE OF BUILDING FAILURE

The building is located on flat ground and is constructed on split foundations seated 4 to 5 ft. below the surface. A concrete path 4ft wide extends around the south-west side of both the Police and Government Offices buildings. Lawn and garden extends between the path and Bookpurnong Road.

The pavement adjacent to the Government Offices building has settled up to 4 inches with respect to the building. A similar settlement of the pavement in front of the Police

Building has occurred. Moderate cracking has affected the inner walls of the Government Offices building near the north-west end, and is apparently due to settlement of the foundations at this end.

It was believed that settlement and cracking is due to collapse of low density near-surface sands on becoming wet. Possible remedial measures under consideration included

1. Strengthening of the sand by chemical grouting,
2. End bearing steel piles jackedinto the soil beneath the building,
3. Reinforced concrete piers cast upon any strong soil or rock horizon.

To assess the effectiveness of these or any other remedial measures it was first necessary to determine the geological succession beneath the building and to determine the engineering properties of the materials present.

Undisturbed samples of the materials were required fo density determination and sealed samples for the measurement of moisture content.

REGIONAL GEOLOGY

The Government Offices are situated in gently undulating country in the Murray Basin. The succession in the area is:

	AGE	FORMATION	MATERIAL
QUATERNARY	Recent	Surface sands. Windblown in part.	Light red-brown calcareous silty sands.
	Pleistocene	Bungunnia Limestone (Lake deposit)	Lenses of limestone or marls may be present.
		Blanchetown Clay (Lake deposit)	Clay bound sand, red-brown.
	Pliocene	Loxton Sands	Sands, poorly graded, micaceous.

SITE GEOLOGY

The positions of the two drill holes are shown on Fig. 1 and the logs are included as Appendix A. Each hole Penetrated from 26 to 28ft. of low density sands.

The sand recovered was extremely calcareous and ranged from damp at the top to wet at depth. There was a slight seepage of water into the hole between 20 and 28ft in Hole 1, but this was not sufficient to cause water to stand in the hole.

Below the near-surface sand was a band about 9ft thick of red-brown clay-bound sand which was moist to wet. Poorly graded Loxton sands occurred underlying the clayey sand.

FOUNDATION CHARACTERISTICS

Low values of N (blows per foot, Standard Penetration Test) were obtained for tests made in the surface sands in both holes.

In both the clay-bound sands and the underlying Loxton sands values of N from 17 to 42 were obtained indicating that these materials are medium to dense.

CONCLUSIONS

If remedial action is considered necessary the clay-bound sands should be capable of supporting reinforced concrete piers for jacking as at Loxton High School (Ref. 1).

If further cracking is to be prevented, then artificial watering should not be carried out near the building and surface drainage should be improved.

The 1 to 2 inch gap between the building and the concrete pavement should be sealed to prevent easy penetration of run-off from the building walls during storms.

J.P. Trudinger
Geologist
ENGINEERING GEOLOGY SECTION

JPT:DLH
15/12/1965.

REFERENCE

Trudinger J.P. 1965 — Loxton High School, Investigation of Foundation Failure and Remedial Measures. Dept. of Mines S.A. Rept. Bk. No. 61/156 G.S. No. 3336 DM 1580/65.

APPENDIX A

Logs of Drill Holes

The holes were sampled using straight, thin-walled open tubes, 2ft in length and 2½ inches inside diameter. The tubes were pushed into the soil using hydraulic pressure from a diamond drill. Using a hydraulic core pusher the core was extruded directly into plastic bags which were sealed to preserve the moisture content.

Samples were also taken using Standard Penetration Equipment and 6 inch lengths of core were removed for laboratory determinations of density.

Undisturbed samples were also obtained using 6 inch long thin walled tubes.

HOLE NO.	DEPTH (ft)	REFERENCE NO.
1	48	S4903
2	36.5	S4904

DEPARTMENT OF MINES - SOUTH AUSTRALIA

LOG OF PERCUSSION DRILL HOLE

HOLE NO. 1

SHEET 1 OF 1

PROJECT **GOVERNMENT OFFICES, LOXTON** Hirer **P.B. Dept.**

LOCATION **WEST CORNER** Sec **65** Hd **Bookpurnong**

FEATURE **FOUNDATION** Depth **48 ft** R.L.

SOIL TYPE GEOLOGICAL DESCRIPTION	CASING R.L. (FEET)	DEPTH (FEET)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME	CONSISTENCY Rel. DENSITY	MOISTURE CONTENT	WATER LEVELS	PENETRATION DATA BLOWS PER FOOT 10 20 30 40 / HYDRAULIC PRESSURE 200 400 600 800 (lb/sq. in)
Windblown sand Calcareous "B" horizon, with calcrete fragments Moderately cemented	NX	10		SM	SAND, poorly graded fine to coarse grained, excess silty fines, light red-brown. Contains lime disseminated throughout and in concentrated patches between 4.5 and 7ft. Generally slight dry strength. Grains up to 3mm.	Loose	H Damp		15 blows 3 blows 5 blows 36 blows
QUATERNARY		20			Few cemented nodules up to 15mm. Becoming more clayey with depth	Very loose	Moist		
							Wet	Slight Seepage	
Sand is mainly rounded quartz grains		30		SC CL	SAND, poorly graded, coarse grained, excess clay (30 to 40%), red-brown. High dry strength. Grains up to 3mm.	Dense			18 blows 17 blows
Sand is mainly rounded quartz grains; with some fines occurring as coatings on grains		40		SP	SAND, poorly graded, medium to coarse grained, light brown, some clay fines near top. Slight dry strength. Grains mostly 1 to 2mm., few up to 5mm.	Dense	M Damp		20 blows 17 " 17 " 18 " 20 " 22 " 44 blows
PLIOCENE Loxton Sands					END OF HOLE 48ft.				

STANDARD PENETRATION TESTS — OPEN TUBE SAMPLES

TYPE OF SAMPLE	HYDROLOGY	CONSISTENCY	REL. DENSITY	MOISTURE
Open Tube	Water cut	VS-Very Soft	VL-Very Loose	H-Humid
Sealed Tube	Static level	S-Soft	L-Loose	D-Damp
S.P.T.	Supply	F-Firm	C-Compact	M-Moist
Slush pump	Analysis (p.p.m)	St-Stiff	D-Dense	W-Wet
Casing NX	← Water level. (Date)	VSt-Very Stiff	VD-Very Dense	S-Saturated
		H-Hard		

Plant No. 24 — Logged J.P.T.

Type Mindrill — Date 11 Nov '65

Driller Jansen — Drawn J.P.T.

Started 8 Nov '65 — Traced DHS

Finished 9 Nov '65 — Checked

PLAN No S4903 J65

Vertical Scale 1 in = 10 ft.

DEPARTMENT OF MINES - SOUTH AUSTRALIA

LOG OF PERCUSSION DRILL HOLE

HOLE NO. 2

SHEET 1 OF 1

PROJECT GOVERNMENT OFFICES LOXTON

LOCATION POLICE BUILDING NORTH-WEST SIDE Hund. PUBLIC BUILDINGS

FEATURE FOUNDATION Depth 36·5 ft R.L. Sec 65 Hd. Bookpurnong

SOIL TYPE GEOLOGICAL DESCRIPTION	CASING R.L. (FEET)	DEPTH (FEET)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME	CONSISTENCY REL. DENSITY	MOISTURE CONTENT	WATER LEVELS	PENETRATION DATA: BLOWS/FOOT	PENETRATION DATA: HYDRAULIC PRESSURE (lbs/sq in)
Windblown Sand.	NX	10		SM	SAND, poorly graded, fine to coarse grained, excess silty fines, light red-brown. Grains up to 2mm. Moderate dry strength. Lime disseminated throughout.	Very Loose	Damp / Moist		4 blows; 3 blows; 5 blows; 4 blows; 7 blows	200 400 600 800
QUATERNARY		20				Loose	Wet	No Water Met.		
Sand is mainly quartz grains, well-rounded		30		SC	SAND, poorly graded, medium to coarse grained, excess clay (30%), red-brown. Grains up to 3mm. High dry strength.	Compact				
Quartz, subrounded				SP	SAND, poorly graded, medium to coarse grained, some clay, brown. Grains up to 5mm.	Dense	D Moist		26 blows; 20 blows; 18 blows	
					END OF HOLE. 36·5 ft.					

STANDARD PENETRATION TESTS

OPEN TUBE SAMPLES

TYPE OF SAMPLE	HYDROLOGY	CONSISTENCY	REL. DENSITY	MOISTURE
Open Tube	Water cut	VS-Very Soft	VL-Very Loose	H-Humid
Sealed Tube	Static level	S-Soft	L-Loose	D-Damp
S.P.T.	Supply	F-Firm	C-Compact	M-Moist
Slush pump	Analysis (p.p.m.)	St-Stiff	D-Dense	W-Wet
Casing NX	← Water level (Date)	VSt-Very Stiff	VD-Very Dense	S-Saturated
		H-Hard		

Plant No. 24 — Logged J.P.T.

Type Mindrill — Date 11 Nov. '65

Driller Jensen — Drawn J.P.T.

Started 10 Nov '65 — Traced J.P.T.

Finished 11 Nov '65 — Checked

PLAN No. S4904 / 165

Vertical Scale 1 in = 10 ft.

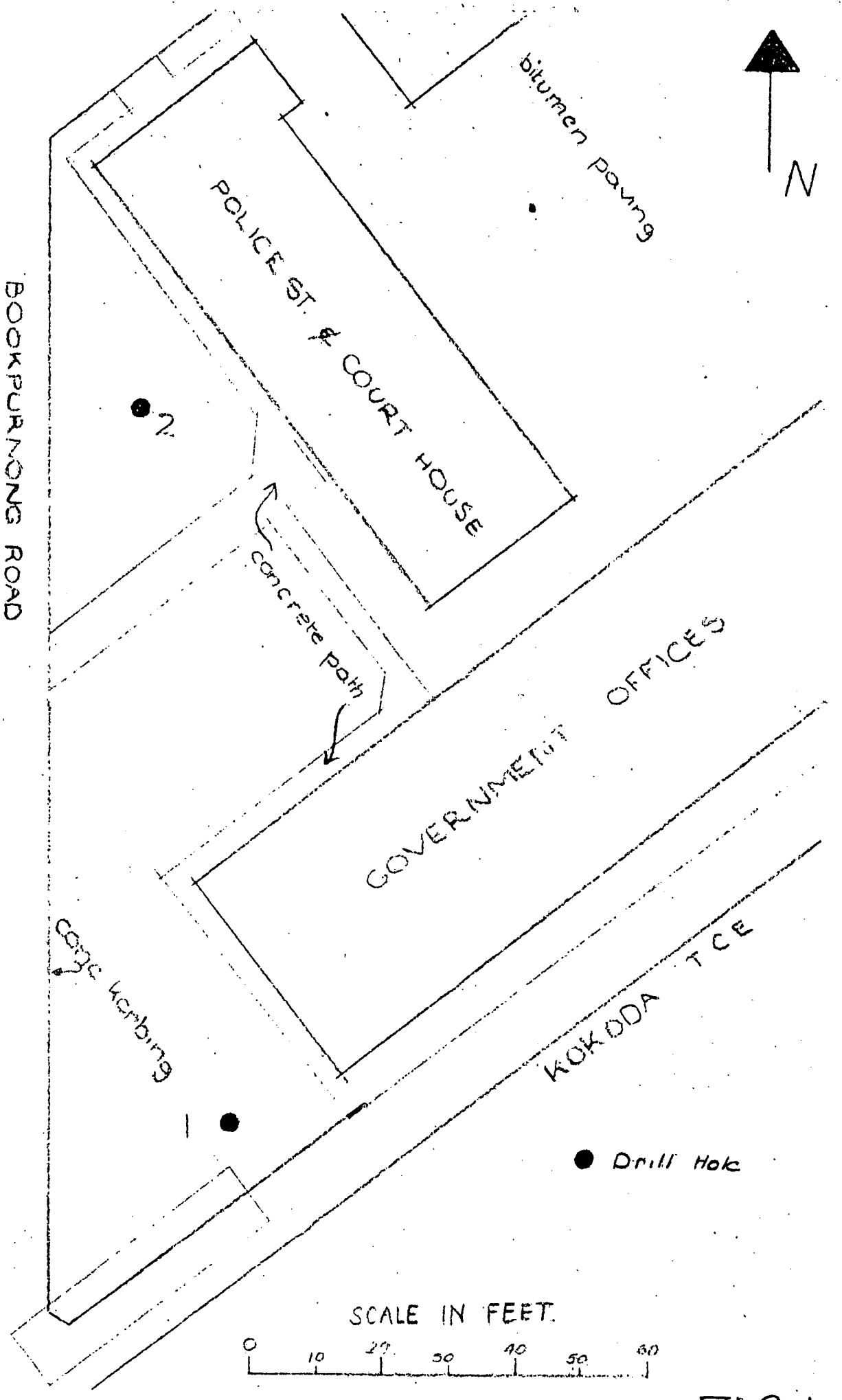

FIG. 1.

DEPARTMENT OF MINES — SOUTH AUSTRALIA

J.P. Lindsay	Drn.	GOVT OFFICES LOXTON	SCALE: 1in = 20ft.
	Tcd. J.P.B.		S4898 J65
	Ckd. JP	Foundation Exploration	DATE: 9 Dec '65
	Exd.		