Section

DEPARTMENT OF MINES
SOUTH AUSTRALIA

ENGINEERING AND SOILS GEOLOGY SECTION
GEOLOGICAL SURVEY

REPORT ON SITE EXAMINATION

LOWER NORTH-EAST ROAD, PARADISE.

for

South Australian Brewing Co. Ltd.

by

S. Robson,
Geologist.

11th March, 1965.

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DEPARTMENT OF MINES
SOUTH AUSTRALIA

REPORT ON SITE EXAMINATION
LOWER NORTH-EAST ROAD, PARADISE.
for
South Australian Brewing Co. Ltd.

INTRODUCTION

A site examination has been carried out for the South Australian Brewing Co. Ltd., for a proposed hotel on Lower North-East Road, Paradise.

The examination was requested by the applicant on 30th September, 1964.

Two test holes were dug to a depth of 6 feet (Holes 1 and 2) and both have been geologically logged.

This report describes the results of the logging and discusses the foundation characteristics of the materials encountered.

SOILS SHOWN IN TEST HOLES

Soils at the site are alluvial clays and represent essentially type RB3, the dominant soil type of the Urrbrae Association, as mapped within the Adelaide area.

A thin sand horizon 1 foot thick overlies red-brown clay which is coarsely structured and shows mainly vertical fissuring. Below 2.5 feet the clay contains abundant lime up to 30% of the total volume in parts, decreasing to less than 10% near the base of the test holes. The profile is also very sandy below 2.5 feet.

FOUNDATION CHARACTERISTICS

The sandy horizon from the surface to 1 foot is quite compacted but unsuitable for foundations of the proposed building.

Below 1 foot, and extending to 2.5 feet below surface, the red-brown clay is noticeably structured and is subject to severe seasonal swelling and shrinking movements due to reaction of the clay minerals present when water is absorbed or evaporated. These movements can produce strong forces and the vertical component at the surface can be as much as 1.5 inches. Failure in shallow footings of inadequate strength is quite common.

Underlying the red-brown clay are limey clays which would be subject to less severe movements of the same nature.

Compressive strength (qu) values obtained by Soiltest Penetrometer range from 0.75 tons/sq.ft. at a depth of 2 feet in

the red-brown clay to >4.5 tons/sq.ft. in the lower, more limey and sandy clays. Most consistent figures between 3.5 and 4.5 tons/sq.ft. were obtained at approximately 5 feet below ground surface in both test holes. At this depth, a marked increase in the sand fraction and decrease in lime is noted.

FOOTING CHARACTERISTICS

It is suggested that footings would be best seated at least 5 feet below ground surface. At this depth, shrinking and swelling movements would be much smaller than at the surface and bearing capacity should be higher, especially during wet periods.

GROUNDWATER

No groundwater was struck in the test holes. Records from a nearby bore indicate a groundwater table at about 60 feet below ground surface.

A temporary perched water table is likely to occur during the winter period, the maximum depth of wetting probably extending to approximately 7 feet below surface.

GENERAL RECOMMENDATIONS

All surplus surface water, downhill drainage, roof run-off etc., should be carried well away from the footings in properly constructed drains of adequate capacity. Lawns and gardens should be kept well clear of the foundation area to prevent damage resulting from overwatering.

A wide concrete, or heavy asphalt paving completely surrounding the building will minimise soil moisture variations beneath the footings.

If a concrete paving is used it should be bonded to the footing by means of a bitumastic compound.

The suggestions regarding types of footings are intended as a guide to the foundation characteristics of soils at the site. Alternative designs are not necessarily excluded by the suggestions made in this report.

S. Robson pp DBS

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SR:EMD
11.3.65

APPENDIX A

DATA ON SOIL TYPE RB3

SOIL TYPE RB3

The following soils data is reproduced from Department of Mines Bulletin No. 32: The Soils and Geology of Adelaide and Suburbs, by G. D. Aitchison, R. C. Sprigg and G. W. Cochrane.

The information is offered as a general guide and may not apply in all respects to the soil examined.

For a full discussion the reader is referred to Bulletin 32 and to other publications quoted therein.

Composition and Characteristics

Location of sample -	Soil Pit-Arboretum - Waite Institute					
Soil No.	12,721	12,722	12,723	12,724	12,725	12,726
Depth, in.	0-7	7-13	13-30	30-35	35-45	45-69
Reaction, pH	5.7	6.0	6.6	7.2	8.6	8.5
Total soluble salts, per cent	0.062	0.080	0.070	0.079	0.096	0.132
Chlorides, as NaCl, per cent	0.023	0.043	0.033	0.039	0.040	0.059
Mechanical analysis -	B	B	B	B	B	B
Coarse sand	4	2	1	1	1	1
Fine sand	41	40	17	25	22	24
Silt	33	32	15	26	31	36
Clay	20	25	65	48	34	36
Consistence -						
Liquid limit	-	--	-	-	-	-
Plastic limit	-	-	-	-	-	-
Plasticity index	-	-	-	-	-	-
Total exchange capacity -						
(a) m.e., per cent	-	-	-	-	-	-
(b) m.e., per cent	-	-	-	-	-	-

Location of sample	Waite Institute (Arboretum) - Sec. 268, Hd. Adelaide						
Soil No.	17,184	17,185	17,186	17,187	17,189	17,190	17,191
Depth, in.	0-4	4-10	10-14	14-22	22-30	32-47	47-60
Reaction, pH	6.0	6.2	6.6	7.0	7.3	8.6	8.5
Total soluble salts, per cent	0.012	0.007	0.008	0.011	0.012	0.046	0.058
Chlorides, as NaCl, per cent	0.004	0.004	0.003	0.003	0.003	0.006	0.022
Calcium carbonate, per cent	0	0	0	0	0.01	9.6	3.7
Mechanical analysis -							
analysis -	C	C	C	C	C	C	C
Coarse sand	3	3	3	1	0	0	1
Fine sand	44	46	39	19	22	28	27
Silt	30	31	25	13	22	27	33
Clay	17	17	31	66	55	35	36
Loss on solution	4	2	2	3	3	10	5
Loss on ignition, per cent.	5	3	4	7	7	8	6
Organic carbon, per cent.	1.9	0.8	-	0.7	-	-	-
Exchangeable cations -							
Calcium, m.e. per cent	5.0	-	-	13.9	-	-	-
Magnesium	1.2	-	-	8.3	-	-	-
Potassium	0.7	-	-	2.0	-	-	-
Sodium	0.1	-	-	0.5	-	-	-
Total metal ions	7.0	-	-	24.7	-	-	-
Total exchange capacity -							
(a) m.e. percent	10.6	-	-	24.6	-	-	-

Soil Type RB3 (Contd.)

Location of sample	Waite Institute (Field Station)				
Soil No.	F9S	F9	F10	F11	F12
Depth, in.	0.3	12	24	48	72
Reaction, pH	-	7.4	7.5	8.6	8.7
Total soluble salts, per cent	-	0.022	0.017	0.059	0.052
Chlorides, as NaCl, per cent	-	0.009	0.007	0.015	0.013
Mechanical analysis -	-	A	A	A	A
Coarse sand	-	3	1	1	1
Fine sand	-	37	8	22	32
Silt	-	33	39	29	28
Clay	-	27	52	48	39
Consistence -					
Liquid limit	-	26	75	51	49
Plastic limit	-	16	28	20	30
Plasticity index	-	10	46	31	30
Total exchange capacity.-					
(a) m.e., per cent	-	9	26	22	21
(b) m.e., per cent	-	35	51	47	53

NOTE -

(1) Mechanical Analysis -
A = Hydrometer method (vide C.S. Piper: "Soils and Plant Analysis," 1942).
B = Pipette method (vide C.S. Piper: "Soils and Plant Analysis," 1942).
C = Plummet Method (vide J.T. Hutton: C.S.I.R.O, Division of Soils, Tech. Memo. 7/50).

(2) Total Exchange Capacity -
(a) m.e., per cent = Milligram equivalents per 100 grams of soil.
(b) m.e., per cent = Milligram equivalents per 100 grams of clay.

Observed Seasonal Moisture Changes and Consequent Volume Changes.

1.	Maximum depth (D) of significant seasonal wetting and drying in the profile .....ft.	$7 < D < 9$
*2.	Maximum depth of significant shrinkage and swelling movements in the profile .....ft.	7^{ϕ}
ϕ3.	Vertical movements within the soil profile -	
	At surface .. .. in.	1.5
	1ft. below surface .. .. in.	1.4
	2ft. below surface .. .. in.	1.1
	3ft. below surface .. .. in.	0.6
	4ft. below surface .. .. in.	0.4

* Movements less than 0.1 in. are not considered significant.
ϕ Estimated depth - Based on extrapolated direct measurements.
ϕ Measured relative to datum 6 ft. below surface.

Soil Type RB3 (Contd.)

Compression Tests

	Tests made at end of summer drying cycle					
	1950			1951		
Depth	Water content	Compressive strength	pF (approx.)	Water content	Compressive strength	pF (approx.)
in.	percent	p.s.i.		percent	p.s.i.	
0- 18.	6.9±1.5	83±50	4.2	6.8±0.6	67± 11	4.2
18- 36.	17.8±1.0	87±18	4.2	22.9±0.4	87± 12	4.2
36- 60.	14.3±0.4	106±25	4.2	15.5±0.2	86± 11	4.2
60- 84	13.5±0.5	74±18	4.2	13.7±0.7	76± 7	4.2
84-108	17.2±0.7	128±36	-	12.6±0.7	73± 4	-
108-104	20.4±0.1	134±10	-	18.6±1.3	73± 25*	-

	Tests made at end of winter wetting cycle		
	1950		
Depth	Water content	Compressive strength	pF (approx.)
in.	percent	p.s.i.	
0- 18	18.0±0.7	44±33	< 2.5
18- 36	31.7±1.0	21± 3	< 2.5
36- 60	22.7±1.2	36± 55	2.5
60- 84	15.8±1.2	106±21	2.5
84-108	15.6±1.5	87±14	-
108-132	19.3±0.3	85±14	-
132-150	20.5±0.2	49±20*	-

Note - Values quoted are means and standard errors.

*Two tests only.

APPENDIX B

LOGS OF TEST HOLES

TEST PIT No. 1

CO-ORDINATES E .....

N .....

GEOLOGICAL SECTION TESTPIT 1 (EAST SIDE)

GEOLOGICAL DESCRIPTION	R.L.	DEPTH FEET	LOG	GROUP SYMBOL	GROUP NAME AND DESCRIPTION	qu
Topsoil, some organic material including grass rootlets.		0		SM	**SAND** excess silty fines, pale grey-brown, fine grained, few sub angular pebbles up to 0·05 ft. humid, dense; becoming yellow brown and very sandy below 0·75 ft.	
Red brown clay with prismatic structure and nutty to granular sub structure with moderate to bright sheens on structural units, some decomposed organic matter.		1		CH	**CLAY SOIL** medium to high plasticity, red brown, mainly vertical fissuring; damp, stiff to very stiff.	1·5 to 2·5 0·75 to 2·0 3·0
Limey "C" horizon showing nutty structure, moderate sheens on units, downward illuviation of lime in sand fraction.		2 3		CL	**CLAY SOIL** low plasticity, abundant sandy particles, some silty fines, brown, green mottled, lime approx 20-30% soil in soft patches and hard irregular fragments; damp, stiff to very stiff.	2·25 to 3·25 to 3·5 4·5
Vague nutty structure dull sheens, no fissuring		4 5		CL	**CLAY SOIL** low plasticity excess sand, dark red-brown, green mottled, few sub-rounded pebbles up to 0·05 ft across; damp, very stiff.	3·5 to 3·75 3·5 to 4·5
		6	BASE OF PIT 6 FEET			

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CHECKED	CHIEF GEOLOGIST	DATE 2nd Dec 64. DRAWING No. 5417

TEST PIT No. 2

CO-ORDINATES E .....

N .....

GEOLOGICAL SECTION TEST PIT 2 (WEST SIDE)

GEOLOGICAL DESCRIPTION	R.L	DEPTH FEET	LOG	GROUP SYMBOL	GROUP NAME AND DESCRIPTION	qu
Top organic soil, disturbed by cultivation.		1		SP	**SAND** poorly graded, medium grained, few silty fines, dark brown, little organic matter; moist moderately loose; pale brown in bottom 0.3 ft.	
Red-brown "B" horizon with granular structure, moderate to bright sheens.		2		CL	**CLAY SOIL**, low to medium plasticity, slightly sandy red-brown, slight grey mottling; damp, very stiff; some roots up to 0.1 ft. across.	2.0 2.0 3.5 >4.5
Limey "C" horizon with ill defined nutty structure; dull sheens, some colluvial quartz in top 0.1 ft.		3 4 5		CL	**CLAY SOIL** low plasticity abundant sand particles, yellow-brown to pale cream, hard lime fragments up to 0.05 ft. across and soft lime patches; a few pebbles up to 0.03 ft across, lime approx. 20-30 % of soil in upper 2.0 ft, decreasing to < 10% near base; damp, very stiff to hard.	>4.5 >4.5
		6	BASE OF PIT 6 FEET			

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