UR1987_29

1987/29. Foundation investigations at Kings Car Park, Argyle Street, Hobart.

D. J. Sloane

Abstract

Diamond drilling investigations at Kings Car Park, Argyle Street, Hobart, indicate that Triassic sandstone bedrock underlies the site at a moderately uniform depth. The diamond-drill holes indicate that the depth to good quality sandstone is between 5.5 m and 6.1 m.

From a depth of 2.4 m from the ground surface to bedrock level is a layer of dolerite and Permian mudstone boulders and pebbles in a sandy clay matrix. The boulders may be up to 0.5 m in diameter and the boulder density may increase towards the southern corner of the building. Fill, sand and gravel with some pebbles, and sandy clay overlie the boulder layer.

A grain bin was reported to have been excavated to approximately 2.4 m on the site. Drilling indicates that this depth of excavation was probably easily attained by hand digging, before the 'boulder layer' was encountered. It is therefore suggested that the foundations of the steel columns within the building may only extend to this depth.

INTRODUCTION

At the request of consultant engineers Johnstone, McGee and Gandy Pty Ltd, investigations were conducted at Kings Car Park, Argyle Street, Hobart. Redevelopment of the site has been proposed and therefore some idea of the existing foundation conditions was required. The steel supporting columns within the building are founded on sandstone slabs but below this level the foundation conditions are uncertain. Redevelopment will possibly involve removal of some of the existing columns, strengthening and underpinning of the remaining columns, and the construction of a concrete deck for first-floor car parking.

PREVIOUS INFORMATION

The site was considered to be underlain by Triassic sandstone. The depth to *in situ* bedrock was unknown. Information from the Royal Hobart Hospital site, on the opposite side of Argyle Street to the north, indicated that sandstone was approximately four metres below street level. An old grain bin originally extended to a depth of 2.4 m adjacent to a small laneway entrance to the building off Liverpool Street. Bedrock level was therefore considered to be below this depth in this area. The foundation information from the Hobart City Council Argyle Street car park showed that foundation levels were at varying depths, possibly to six metres below floor level adjacent to the southern corner of Kings Car Park. It also appeared that the meandering course of the old Hobart Rivulet may intersect this southern corner of Kings Car Park.

The anticipated conditions at the site were that a buried stream channel and associated sediments may exist at the southern corner of the site. Triassic sandstone bedrock was expected to underlie the entire site at varying depth. Bedrock was expected to be at a depth of approximately six metres in the southern corner, shelving upwards to a depth of about four metres near Argyle Street and about three metres adjacent to the entrance laneway on the northern side.

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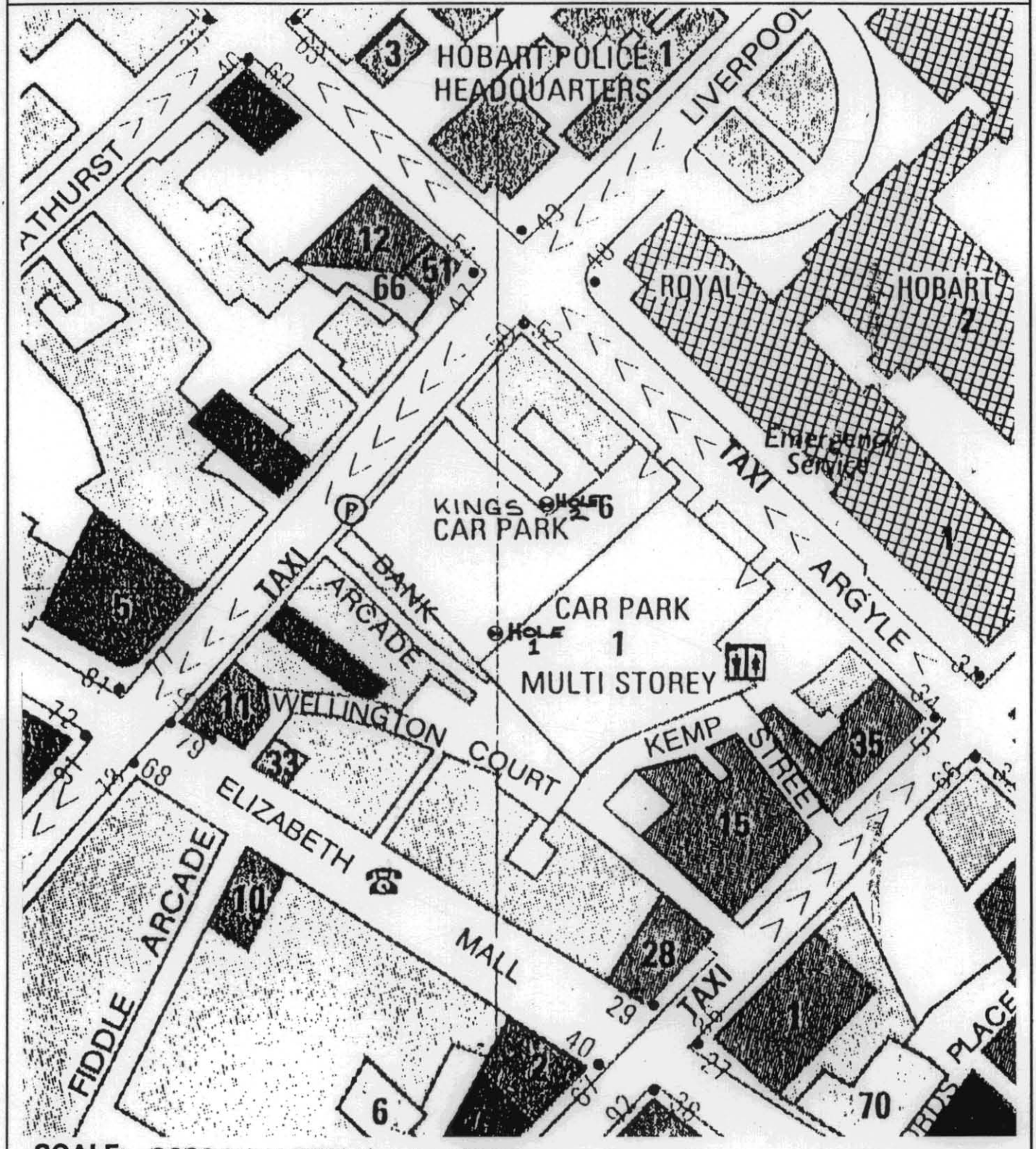
SITE PLAN

5 cm

OWNER: KINGS CAR PARK STREET/ROAD: ARGYLE STREET GEOLOGIST: D.J. SLOANE

SUBURB: TOWN/CITY: HOBART DATE: 16-06-87



SCALE: APPROXIMATELY 1 : 1,500

Convex break of slope (profile form:)	NA — Suitable area for building
Concave break in slope (profile form:)	NA — Suitable area for septic outfall
Ridge crest	
Gully	16° — Slope angle and direction

RESULTS OF DIAMOND DRILLING

Two NQ triple-tube diamond-drill holes were drilled at the positions indicated on the site plan (fig. 1). The drill logs are appended to this report. Hole 1 encountered approximately 2.4 m of sand and medium to coarse gravel with some pebbles, overlying a deposit of dolerite and Permian mudstone pebbles and boulders in a brown sandy clay (SC) matrix. The boulder size is not strictly indicated by the core samples and may vary up to 0.5 m in diameter. Triassic sandstone bedrock was encountered at 5.5 m from the concrete floor level of the building. The sandstone showed bedding with a dip of 10° from the horizontal, and two closely bedded, extremely weathered sections were encountered, approximately 15 mm in thickness. These weathered sections had a high muscovite mica content.

Hole 2 encountered fill and possibly sandy clay to a depth of two metres. Brown, high plasticity (CH) clay was sampled between 2.0 m and 2.5 m. Below 2.5 m dolerite and Permian mudstone pebbles and boulders were encountered. The matrix of this pebble and boulder layer is considered to be a sandy clay, and the boulder density is not as high as that encountered in Hole 1. Observation of the drilling rate indicated that sandy clay layers are probably present towards the base of this boulder layer, in the approximate positions indicated on the drill log. Massive Triassic sandstone occurs at a depth of 6.1 m from the ground surface. The thickness of weathering at the top of the sandstone is uncertain, as core recovery was low and only a trace of pale green clayey sand was recovered.

CONCLUSIONS

It appears that the Triassic sandstone bedrock underlying the site may be moderately uniform in depth. The diamond-drill holes indicate that the depth to good quality sandstone is between 5.5 m and 6.1 m. A layer of dolerite and Permian mudstone boulders and pebbles in a sandy clay matrix extends from a depth of 2.4 m from the ground surface to bedrock level. From examination of core samples, and from experience elsewhere, some of the boulders may be up to 0.5 m in diameter. Indications are that the boulder density may be higher near the southern corner of the building, towards the old Hobart Rivulet site. The upper sand and gravel with some pebbles, encountered in Hole 1 and extending to a depth of 2.4 m, are considered to be stream sediments associated with the old Hobart Rivulet.

The clay and assumed sandy clay sampled in Hole 2 to a depth of 2.5 m are remarkably accordant with the depth of sand and gravel sediments encountered at the top of Hole 1. It is therefore considered that near the southern corner of the building, the upper clay and sandy clay has been eroded by the Rivulet down to the top of the 'boulder layer' and subsequently replaced by Rivulet sediments.

It is interesting to note that the original grain bin was reported to have been excavated to approximately 2.4 m depth. This depth of excavation was probably comparatively easily attained by hand digging, before the 'boulder layer' was encountered. A similar situation has been observed by the author at the old MTT bus depot site. It is therefore suggested that the steel column foundations may only extend to this depth.

[18 June 1987]

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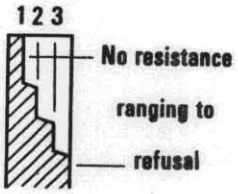
EXPLANATION SHEET FOR ENGINEERING LOGS

Borehole and excavation log

Penetration



Water

22 Jan, 80 Water level on date shown.

Water inflow.

Water outflow.

Notes - samples and tests

U50	Undistributed sample 50mm diameter.
D	Disturbed sample.
N	Standard penetrometer blow count for 300mm.
N*	SPT + sample.

Material classification

Based on Unified Soil Classification System.

In Graphic Log materials are represented by clear contrasting symbols consistent for each project.

Moisture content

D	Dry, looks and feel dry.
M	Moist, no free water on hand when remoulding.
W	Wet, free water on hand when remoulding.
LL	Liquid limit.
PL	Plastic limit.
PI	Plasticity Index.

eg. M > PL – Moist, moisture content greater than the plastic limit.

Consistency

		hand penetrometer (kPa)
VS	Very soft.	< 25
S	Soft.	25 – 50
F	Firm.	50 – 100
St	Stiff.	100 – 200
VSt	Very stiff.	200 – 400
H	Hard.	> 400
Fb	Friable.	

Notes: X on log is test result

— is range of results.

Density index

		%
VL	Very loose.	0 – 15
L	Loose.	15 – 35
MD	Medium dense.	35 – 65
D	Dense.	65 – 85
VD	Very Dense	85 – 100

Cored borehole log

Case - lift

Casing used.

Barrel withdrawn.

Fluid loss

No loss

50% loss

100% loss.

Lugeons

Lugeon units (μL) are a measure of rock mass permeability. For a 46 to 74mm diameter borehole 1 Lugeon is defined as a rate of loss of 1 litre per metre per minute. 1 Lugeon is roughly equivalent to a permeability of 1×10^{-4} mm/sec.

Graphic log

No core.

Rock substances represented by clear, contrasting symbols consistent for each project.

Weathering

Fr	Fresh.
SW	Slightly weathered.
HW	Highly weathered.
EW	Extremely weathered.

Strength

		point load strength index $I_{s\,(50)}$ (MPa)
EL	Extremely low.	< 0·03
VL	Very low.	0·03 – 0·1
L	Low.	0·1 – 0·3
M	Medium.	0·3 – 1
H	High	1 – 3
VH	Very high.	3 – 10
EH	Extremely high.	>10

Note: X on log is test result.

Significant defects

Significant defects shown graphically.

Joint.

Sheared zone.

Crushed seam.

Infill seam.

Extremely weathered seam.

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ENGINEERING LOG – CORED BOREHOLE

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borehole no. 1
sheet 1 of 1

project KINGS CAR PARK location ARGYLE ST, HOBART

co-ordinates
R.L.
inclination VERTICAL
bearing

drill type GEMCO
drill method NQTT
drill fluid WATER

hole commenced 16/6/'87
hole completed 16/6/'87
drilled by D.W.
logged by DJS.
checked by

drilling information						rock substance				rock mass defects	
case-lift	fluid loss	water	notes % RECOVERY	lugeons 0.3 1 3 10 30 100	metres R.L. / depth	graphic log	substance description (rock type: grain characteristics, colour, structure, minor components.)	weathering	strength EL VL L M H VH EH	defect spacing mm. 30 100 300 1000 3000	defect description (thickness, type, inclination, planarity, roughness, coating.) significant / general
			3		0 / 1 / 2		CORE LOSS. Assumed gravel, sand, fill.				ASSUMED SAND, GRAVEL, SOME PEBBLES, TRACE BOULDERS QUATERNARY(?) SEDIMENTS ASSOCIATED WITH HOBART RIVULET
			67		2.4		Dolerite, mudstone fragments to 50mm				'BOULDER LAYER' DOLERITE, PERMIAN MUDSTONE PEBBLES & BOULDERS TO 0.5m(?) DIAMETER IN SANDY CLAY (SC) MATRIX
					2.7		CORE LOSS				
			50		3.0 / 3		Dolerite, bioturbated mudstone fragments and core to 60mm dia.				
							CORE LOSS				
			20		3.5		Dolerite core & fragments to 100mm				
							CORE LOSS				
			27		4		Dolerite, mudstone frags. to 40mm				
					4.4		CORE LOSS				
			45		5		Dolerite, mudstone core and frags. to 120mm.				
					5.4		CORE LOSS				
							Dolerite fragments or broken core to 150mm. Trace brown sandy clay (SC) matrix?				TOP OF SANDSTONE
			100		6		SANDSTONE. Grey-green. some yellow-brown iron staining. Medium-fine grained. Muscovite mica on bedding planes	SW			TRIASSIC SANDSTONE BEDROCK 10° Bedding planes dip. Separation on drilling? as indicated. 15mm EW seam. 15mm EW seam. (ML)
					7.0 / 7		END. REQUIRED DEPTH				
					8						

5 cm

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borehole no. 2
sheet 1 of 1

ENGINEERING LOG – CORED BOREHOLE

project KINGS CAR PARK location ARGYLE ST., HOBART

co-ordinates
R.L.
inclination VERTICAL
bearing

drill type GEMCO
drill method NQTT
drill fluid WATER

hole commenced 16/6/'87
hole completed 16/6/'87
drilled by DW
logged by DJS.
checked by

drilling information						rock substance				rock mass defects	
case-lift	fluid loss	water	notes	lugeons 0.3 1 3 10 30 100	metres R.L. / depth	graphic log	substance description: rock type: grain characteristics, colour, structure, minor components.	weathering	strength EL VL L M H VH EH	defect spacing mm. 30 100 300 1000 3000	defect description: thickness, type, inclination, planarity, roughness, coating. significant / general
					0		CONCRETE				FILL, CLAY, SANDY CLAY. QUATERNARY ?
					1		CORE LOSS				
					1.4						
					2		Brick frags.				
					2.5		CLAY. CH. Brown. High plasticity some medium quartz sand.				
					2.9		Trace dol. boulder frag. to 65mm				'BOULDER LAYER' DOLERITE, PERMIAN MUDSTONE PEBBLES & BOULDERS. SANDY CLAY MATRIX ? SOME SANDY CLAY(?) LAYERS
					3		CORE LOSS				
							Dolerite, mudstone core frags. to 50mm				
							CORE LOSS				
					3.9		Dolerite, mudstone, bioturbated mudstone core frags. to 100mm				
					4.0						
					4		CORE LOSS – MISLATCH				
							Assumed sandy clay horizons. Rapid drilling				
					5						
					5.4		Dolerite frags to 80mm				
							CORE LOSS				
					6.1		Dolerite frags to 70mm				ASSUMED TOP-WEATHERED BEDROCK
					6		CLAYEY SAND. SC. Pale green	EW			
							SANDSTONE. Grey-green. Medium-fine grained. Massive. Minor yellow-brown iron staining.	SW			TRIASSIC SANDSTONE BEDROCK
					7.0	7	END. REQUIRED DEPTH				

5 cm