Section

R/B 67/11

Rept.Bk.No. 67/11
G.S. No. 4040

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

ENGINEERING DIVISION

SOUTHERN FREEWAY - LAND FOR QUARRYING

GEOLOGICAL INVESTIGATIONS - PROGRESS REPORT NO. 1

Sections 124, 125 and 137, Hd. Noarlunga

Client: Highways and Local Government Department

by

W.R.P. BOUCAUT
SENIOR GEOLOGIST
ENGINEERING GEOLOGY SECTION

D.M. 1010/68

11th July, 1968.

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INTRODUCTION

A request to investigate an area adjacent to the proposed southern freeway at Darlington, as a source of materials for future freeway construction was received in minute dated 20th June 1968 on HLGD 1959/68 from the Commissioner of Highways.

The proposed area is immediately west of the existing Main South Road (Fig. 1). The Happy Valley Outlet Tunnel runs close to the area and the pipeline from this tunnel is located along the eastern boundary (Fig. 1).

An inspection has been made of surface exposures in the area including excavations for the pipeline, the Main South Road, and for several small quarries which have already been excavated in the area (Fig. 1). Usually less than 100 cu.yds. of material have been removed from these quarries. The geological records of rock conditions in the tunnel during construction, and material in tunnel spoil dumps have also been examined.

REGIONAL GEOLOGY

The proposed area is located on the escarpment of the Eden Fault. The inferred northeast-southwest trending trace of the fault is about ¼ mile to the west. It is one of a number of faults which extend for several hundreds of miles

north of Adelaide. Movement along these faults during and since Tertiary time, have resulted in the formation of the Mount Lofty Ranges (Uplifted Block) and St. Vincent Gulf (Graben). The Mt. Lofty ranges consist of Precambrian rocks of the Adelaide System.

DETAILED GEOLOGY

Topography

The area is located on the crest and sides of a broad ridge which rises about 250ft. above the valleys to the east and west. The area is also dissected by a north-south trending stream entrenched up to 100ft. below thecrest of the main ridge.

The area is heavily grassed for the grazing of stock.

Soil Type

Much of the ground surface in the area is formed of a dark brown clay soil. Exposures in excavations indicate that this soil is usually less than 3ft. thick, and overlies variably weathered rock in situ.

Rock Type

The area is located in Tapleys Hill Slates. In a typical fresh (unweathered) sample this is a strong to very strong rock (Table 1). It is medium to dark grey in colour and is commonly bedded or laminated, giving it a banded appearance.

Geological Defects

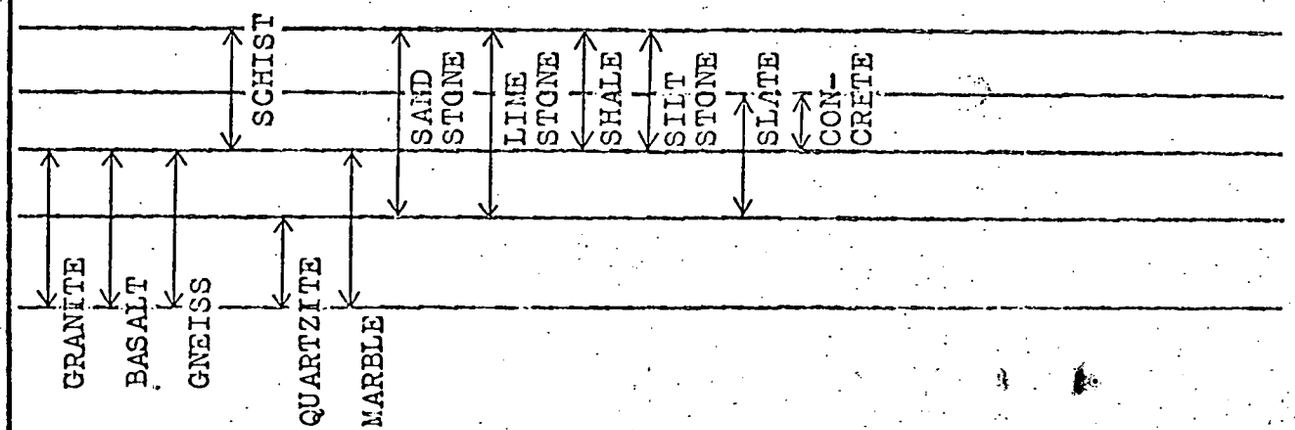
Although the rock in relatively small samples is strong, the actual rock mass as exposed in the excavations and

TABLE 1

CLASSIFICATION OF CLAY SOILS AND ROCK SUBSTANCES
BY UNCONFINED COMPRESSIVE STRENGTH

	TERM	ABBREVIATION	UNCONFINED COMPRESSIVE STRENGTH (Kg/sq.cm)
SOIL PROPERTIES — Disintergrates, or can be remolded in water	Very soft (clay)	VS	less than 0.25
	Soft "	S	0.25 - 0.5
	Medium "	M	0.5 - 1.0
	Stiff "	St	1.0 - 2.0
	Very Stiff "	V.St.	2.0 - 4.0
	Extremely stiff clay	E.St.	greater than 4.0
Boundary Zone Substances			
ROCK PROPERTIES — Do not disintergrate cannot be remolded, in water	Very weak rock	VWR	less than 70
	Weak "	WR	70 - 200
	Medium Strong "	MSR	200 - 700
	Strong "	SR	700 - 1800
	Very Strong "	VSR	greater than 1800

Range of strengths of some Common Rock Substances, in the Fresh State



outcrops is weakened to varying degrees by geological structures such as those described in Fig. 2 and also by chemical weathering (Table 2).

Bedding

Bedding planes are in many places clearly indicated by banding in the slate but the rock does not show any marked tendency to break preferentially along the bedding planes.

Bedding appears to be variable in strike and dip across the area, probably due to folding but it generally has a shallow dip (less than 35°).

Jointing

The slate is intersected by numerous joints which appear to occur in 3 or 4 definite sets. One set is gently dipping, parallel to the bedding. The joints are spaced from a few inches to 5ft. apart mainly about 6 to 18 inches, and persist for distances of more than 10ft.

Most joints in surface exposures are either slightly open or closed and weakly cemented, but excavation in the tunnel indicates that at depth most joints are closed and strongly cemented with quartz or calcite. However on blasting the rock tends to break along cemented joints in preference to breakage across the fabric.

Cleavage

There is a poorly to well developed cleavage in the slate. It strikes about northeast-southwest and dips 55° to 75° E. Surface outcrop tend to follow the strike of the cleavage. Outcrops generally are of more "massive" bands of rock in which the cleavage is poorly developed and the small quarries in the area have all been developed to follow one of these "massive" bands. The areas of no outcrop (Fig. 1) would appear to correspond to bands in which the cleavage is

TABLE 2

WEATHERING PRODUCTS OF ROCK MATERIALS

TERM	ABBREVIATION ON DRAWINGS	DESCRIPTION
Fresh	Fr.	The rock shows no discolouration, loss of strength, or any other effect due to weathering.
Slightly Weathered	SW	The rock is slightly discoloured, but not noticeably lower in strength than the fresh rock.
Moderately Weathered	MW	The rock is discoloured and noticeably weakened, but 2 inch diameter drill cores cannot usually be broken up by hand, across the rock fabric.
Highly Weathered	HW	The rock is usually discoloured and weakened to such an extent that 2 inch diameter cores can be broken up readily by hand, across the rock fabric. Wet strength usually much lower than dry strength.
Completely Weathered	CW	The rock is discoloured and is entirely changed to a soil, but the original fabric of the rock is mostly preserved. The properties of the soil depend upon the composition and structure of the parent rock.

well developed.

The rock breaks readily to cleavage planes, generally resulting in the formation of "platey" fragments ranging in maximum dimension from a few inches to several feet, depending on the degree of cleavage and the presence of other joints.

Weathering

The products of chemical weathering of the slate are described using the terms defined in Table 2.

The rock exposed in outcrop is generally slightly weathered to fresh. Exposures in excavations and in the tunnel indicate that fresh to slightly weathered rock usually occurs within 10ft. of the ground surface. In the tunnel greater depths of weathering were sometimes encountered adjacent to fault zones, but these were usually minor in extent.

DISCUSSION

Overburden

It is considered that over the proposed area the depth of overburden (soil and weathered rock) would be generally less than 10ft.

Materials

It is considered that the fresh to slightly weathered slate will prove suitable for use as embankment and pavement material. The slate in which cleavage is well developed would probably break up well, but the more "massive" bands would require crushing to reach sizes suitable for pavement material.

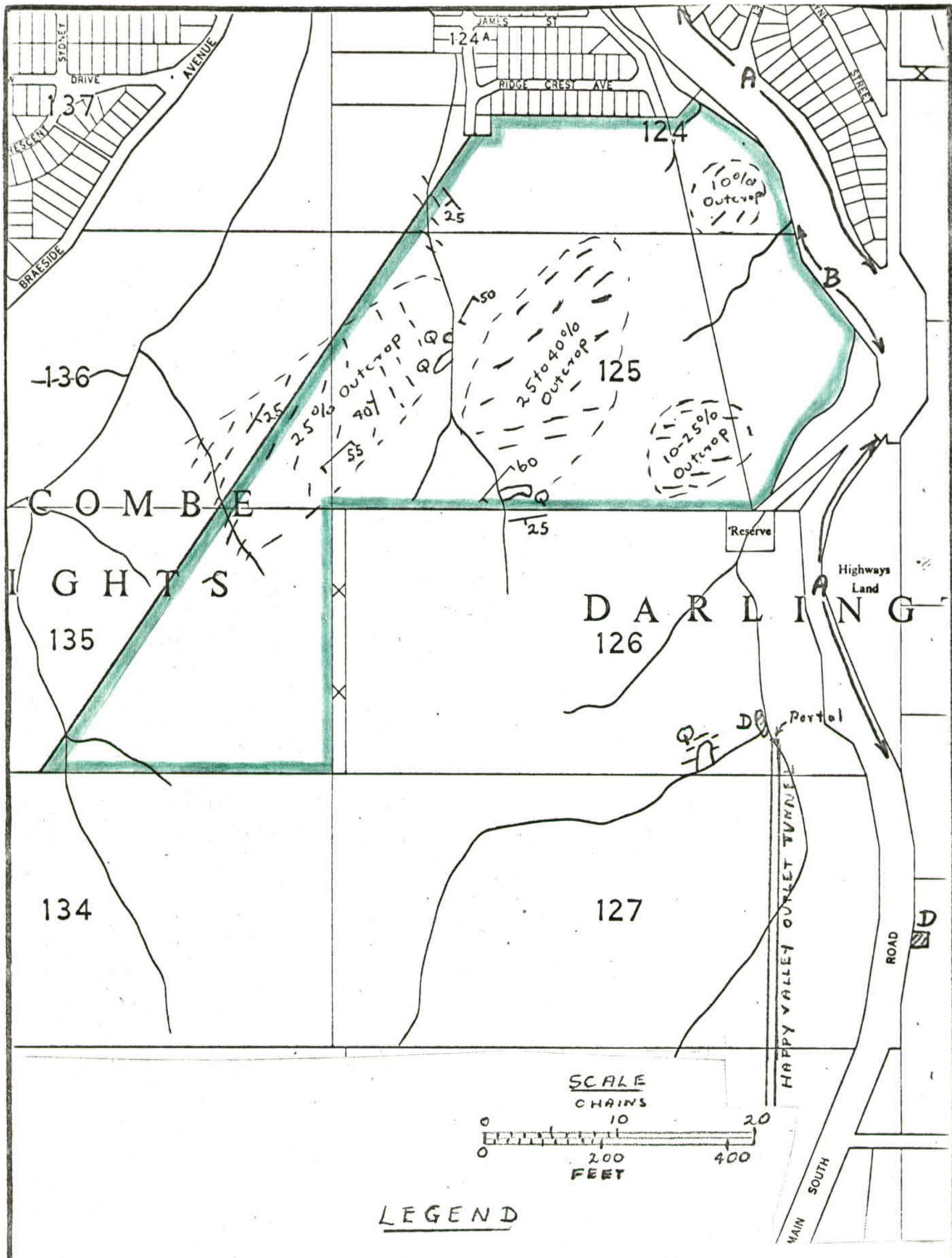
It is considered that the slate would generally not be suitable for concrete aggregate, due to its tendency to break into very platey fragments.

FURTHER INVESTIGATIONS

Material excavated from the tunnel has been dumped at two locations near the downstream portal (Fig. 1). The fresh slate in these dumps would be similar to that which would be excavated in the proposed quarry area, and these dumps could be examined in further detail, and tested to determine their suitability for various engineering purposes.

WRPB:CG
11.7.1968

W.R.P. BOWMAN
SENIOR GEOLOGIST
ENGINEERING GEOLOGY SECTION



LEGEND

TAPLEYS HILL SLATE

PROPOSED AREA FOR QUARRYING.

35 — Strike and dip of Bedding

55 — Strike and dip of Cleavage.

Q QUARRY

D TUNNEL SPOIL DUMP

A EXCAVATION FOR MAIN SOUTH ROAD

B EXCAVATION FOR PIPELINE

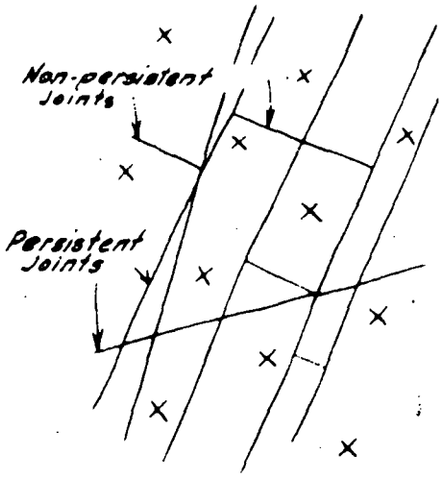
FIG 1

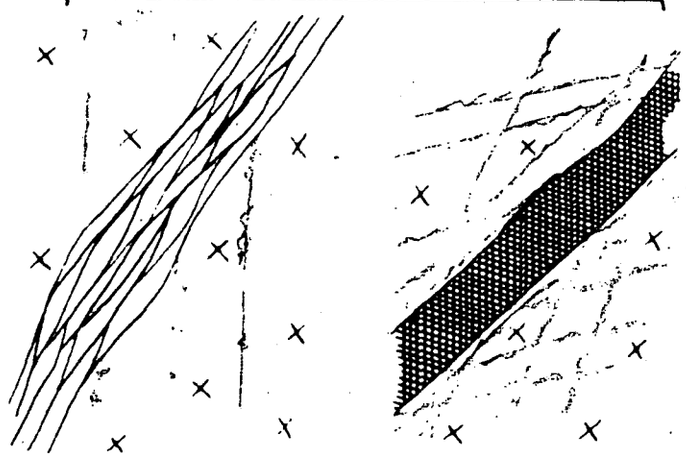
DEPARTMENT OF MINES — SOUTH AUSTRALIA

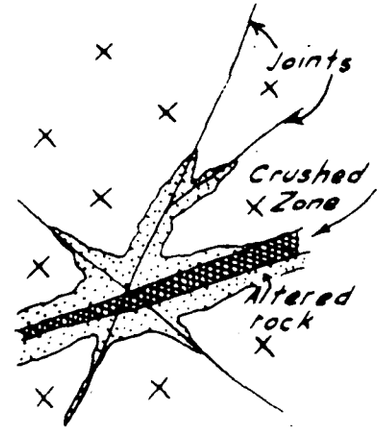
ENGINEERING GEOLOGY SECTION	Drn. MRPB	SOUTHERN FREEWAY	SCALE: As Shown
	Tcd.	LAND FOR QUARRYING	S 6685 Hag
M.R.P. Bocaut GEOLOGIST	Ckd.	LOCALITY AND GEOLOGICAL PLAN	DATE: 11 July '68
	Exd.		

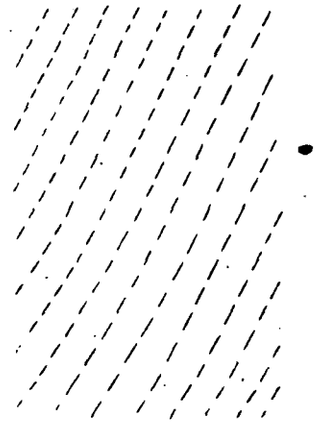
COMMON DEFECTS IN UNWEATHERED ROCKS

FAULTS









JOINTS

Planar fractures or cracks persistent or non-persistent, formed due to tension or shearing The joint surfaces may be rough, smooth or slickensided. Joints may be open or tightly closed, coated or uncoated and strongly or weakly cemented. Common cements include calcite and quartz. common coatings include chlorite, limonite, clay and pyrites.

SHEARED ZONE

Planar zone of closely spaced, nearly parallel joints, usually slightly curved and intersecting to give thin, platy or wedge-shaped joint blocks. The joint surfaces are slickensided and in most cases, chlorite or clay coated. Rock behaviour depends mainly upon the types of joint coatings, degree of separation of joints, and water content & pressure.

CRUSHED ZONE

Planar zone of soft, unconsolidated material, consisting usually of small rock fragments in a clayey matrix The rock has been mechanically disintegrated, but not necessarily chemically decomposed.

ALTERED OR DECOMPOSED ZONE

Irregular zones in which the rock is softened due to chemical alteration. Biotite commonly alters to chlorite, and felspars to clay minerals. The alteration is usually caused by the circulation of mineralized water through joints, sheared zones, or crushed zones.

BEDDING, CLEAVAGE, SCHISTOSITY OR FOLIATION

Planes of relative weakness along which rock may break in preference. This type of planar anisotropy results in a wide range of shear strengths and elastic moduli for a particular rock, depending upon the direction of applied stress.

FIG 2.

S.A. DEPARTMENT OF MINES

COMMON DEFECTS IN UNWEATHERED ROCK

Drn. D.H.S.
Tcd. A.W.
Ckd. P.D.A.
Exd.

Passed

Approved
Director

D.M.
Req.

Scale Not to Scale
S3622
MG
Date 24-3-64