DEPARTMENT OF MINES
SOUTH AUSTRALIA

SOUTH EASTERN FREEWAY

GEOLOGICAL INVESTIGATIONS - PROGRESS REPORT No. 4

BRIDGEWATER-VERDUN SECTION, STA.290 to STA.448

Hundreds Onkaparinga and Noarlunga

Client:- Highways Department

by

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11th August, 1969.

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SUMMARY AND CONCLUSIONS

The Bridgewater-Verdun Section of the South Eastern Freeway is 15,800 ft. long, of which 8,500 ft. will be in cut, and the remainder will be mainly on fill. The maximum depth of cut is about 70 ft. (on the centre line).

Investigations have consisted of geological mapping, trenching and seismic refraction surveys.

Rocks exposed along the route are mainly sandstone (Aldgate Sandstone) and phyllite of the Torrensian Series. Bedding and main cleavage and joint directions strike about northeast-southwest (that is, roughly normal to the freeway) and dip southeast. Several folds and minor flexures have been observed.

It is considered that most of the rocks could be excavated by ripping with some blasting of stronger rocks, likely to be encountered towards the floor of the deeper cuttings. Batters of mainly 1:1 with some steeper angles in less weathered, stronger rocks, are suggested.

INTRODUCTION

Geological investigation of the Stirling-Verdun section of the proposed South Eastern Freeway, was requested in a letter from the Commissioner of Highways dated 29th March, 1966. This report covers the Bridgewater-Verdun portion (STA.290 to STA.448) of that section.

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* Distances along the route are given by stations (one station (STA) being equal to 100 ft.) measured horizontally along the centre line of the carriage ways from a fixed point of origin, e.g. STA.290 is a point 29,000 ft. from the origin. Distances between stations are given in the form STA.290 + 32, which is a point 29,032 ft. from the origin.

In this portion the proposed freeway follows a broad curve, commencing about 0.5 miles west of Verdun township, and continuing southeast to cross the River Onkaparinga about 0.5 miles south of the present main road crossing (Fig. 1). The freeway will have four lanes with a formation width of about 120 ft. Approximately 8,500 feet of the 15,800 ft. long section will be in cut, the remainder mainly on fill. The maximum depth of cut is about 70 ft. (on the centre line).

Previous geological investigations for the freeway have been on the Crafers-Stirling Section (Trudinger, 1965) and on the Stirling-Verdun section as far as Bridgewater (Harris, 1968a). A portion of the Littlehampton-Callington section was also investigated (Fryar, 1968). Construction of the Crafers-Stirling section is at present nearing completion, and construction of the Stirling-Verdun section has commenced.

Geological investigations along the freeway have been aimed at assessing the nature of the materials which will be encountered in the cuttings, in particular to classify the materials for excavation purposes as follows:

..... Material which can be excavated by heavy duty ripper.

..... Material which requires blasting.

It was also required to assess angles at which cutting faces could be made, to ensure permanent stability.

In order to assess these conditions the following work was carried out:

..... Detailed geological mapping of the ground surface along and near the proposed route, and of exposures in existing road, railway, and quarry cuttings nearby (Figs. 3 and 4).

..... Four seismic refraction spreads along or near the major cuttings proposed. (Appendix A).

..... Twelve trenches (TR. 1 to 12), 6 to 8.5 ft. deep, between STA.408 and 435. (Appendix B).

..... Petrographic examinations of selected rock samples (Appendix C).

Advance copies of the following material have been forwarded already to the Commissioner of Highways.

	Date sent
Preliminary results of investigations between STA.351 and STA.358 (Harris, B.M. 1968b).	28th January, 1968
Results of investigations between STA.290 and STA.356.	2nd January, 1969

This report describes in detail the results of all studies and includes the above preliminary results in revised form.

GEOLOGY OF THE REGION

The section investigated is located on the eastern slopes of the Mount Lofty Ranges which rise to more than 2,000 ft. above sea level.

The regional geology of the area is shown on Figure 1 and is based on the Echunga 1 inch = 1 mile Geological Map (S.A. Department of Mines 1954).

Metamorphic and metasedimentary rocks of Proterozoic Age outcrop in the area. These are situated on the eastern limb of a major northeast-southwest trending anticlinal fold. The Clarendon-Ochre Cove fault is a prominent northeast-southwest striking structure forming the western escarpment of the ranges, and its parallel and offshoot faults extend as far east as Verdun.

During Proterozoic times sediments were deposited in a large north-south trending basin called the Adelaide Geosyncline. Later, following Cambrian times, these sediments were folded, metamorphosed to form rocks, and uplifted along north-south faults which cut longitudinally along the major fold axes. A long period of erosion followed. During Tertiary times there was a second period of faulting, and new faults and old re-activated faults uplifted the ranges to their present height.

There is also extensive evidence of lateritisation of the land surface exposed during Tertiary times in the form of any ridges and plateaus capped by lateritic soil and rock. In the freeway area, subsequent erosion of the central upthrown block has exposed the Proterozoic rock in the eastern limb of the major anticlinal fold.

GEOLOGY OF FREEWAY ROUTE

General

The detailed geology along the freeway route is shown in Figures 3 and 4. General notes on the properties of the rocks and on the main structural defects in the rock mass are given in Table 1.

Topography

The uplifted land surface has been dissected by many small streams which flow mainly in moderately sloping valleys, up to 140 ft. deep, between rounded hill tops. The proposed freeway proceeds in a southeasterly direction, crossing the hills and valleys with alternate cut and fill.

Levels along the section range from 1,100 ft. to 1,550 ft. above sea level. Natural slopes are up to 35°, but are mainly gently sloping (up to 10°) along the freeway route.

The Onkaparinga River meanders in a generally south-westerly direction in a broad alluviated valley.

Rock Types

Rock exposures along and near the freeway route are mainly micaceous, feldspathic and quartzitic varieties of quartz sandstone of the Aldgate Sandstone Formation. Some stronger quartzite, and silty and shaly interbeds occur. These are overlain by a younger phyllite-shale sequence. In a few places the sandstone is strengthened markedly by ferruginous cement, deposited during lateritisation in Tertiary times.

The beds have a general northeast-southwest strike and dip to the southeast, with a few folds and minor flexures.

Brief petrographic descriptions of the various rock types are given in Table 1, and the results of detailed petrographic examinations of 4 particular rocks are given in Appendix C.

The rocks exposed in the area are, in their fresh state, variable in strength ranging from very weak to very strong (Tables 1 and 3).

River Onkaparinga Alluvium

East of Verdun township the alluvial flats of the Onkaparinga River are about 800 ft. wide. Numerous outcrops of Aldgate Sandstone occur in the river bed, and it is probable that the alluvium is no more than 15 ft. thick. Downstream however, the flats widen to about 1,800 ft. near the proposed freeway river crossing. Here alluvium is probably much thicker and near the surface consists mainly of highly plastic green-grey clay. Trench 4 dug at the edge of the alluvial flat showed at least 8.5 ft. of alluvium but greater thicknesses could be expected towards the centre of the valley.

Effects of weathering on the rock mass

The rocks have been affected to varying degrees by both mechanical and chemical weathering.

Mechanical weathering is the opening up of joints near a ground surface due mainly to the redistribution of stresses upon removal of overburden, and also the wedging action of roots of vegetation and changes in temperature, etc.

Chemical weathering is the process of chemical decomposition of rocks by the action of groundwaters. These waters obtain access to highly impervious rock substances by travelling along open joints and faults.

TABLE 1

PROPERTIES OF ROCK SUBSTANCES AND STRUCTURAL DEFECTS IN ROCK MASS

Column	1 Petrology	2 Probable properties when fresh	3 Conditions where exposed along route	4 Structural defects in rock mass
Sandstone	Mainly composed of quartz with some mica (muscovite up to 15%), and some feldspar in part, and minor to moderate silica cementation. Medium to very fine-grained with few silty and coarse-grained interbeds. Well bedded or laminated - cross bedded in part. Off white, light grey, or cream, with some yellow and red ferruginous staining. Contains few minor quartz veins.	Rock encountered in floor of railway cuttings and at base of quarries appears weak to strong. Strength of the sandstone is dependent largely on the amount of muscovite and the degree of cementation. Muscovite flakes oriented along foliation planes weaken the rock mass in this direction.	Variable, ranging from weak to strong rock, and it is difficult to assess degrees of weathering. In some feldspathic sandstones the feldspar has decomposed making the rock weak and crumbly.	In general these sandstones are fairly incompetent, and contain numerous small flexures and warps often with associated radial jointing. Two main joint sets divide the rock into tabular blocks, in part. Joint spacing in the thinly bedded and laminated sequences are irregular and range from 0.1 to 1 ft. apart. However, in the thicker beds they are more constant mainly 2 to 3 ft. apart. Joints are all weakly to moderately cemented. A foliation is present in the micaceous sandstone, with preferential splitting along this plane.

TABLE 1

PROPERTIES OF ROCK SUBSTANCES AND STRUCTURAL DEFECTS IN ROCK MASS

Column	1 Petrology	2 Probable properties when fresh	3 Conditions where exposed along route	4 Structural defects in rock mass
Quartzitic sandstone to quartzite	Mainly composed of crystalline quartz. The original shape of the sand grains being partially or wholly obliterated. Mainly grey, weathered to pinkish-brown. White varieties contain feldspar. Generally massive in outcrop. Beds range from 0.2 to 60 ft. thick.	Fresh to slightly weathered rock encountered at depth in railway cuttings appears to be strong to very strong rock.	Moderately to slightly weathered rock in outcrop. Exposures in cuttings show it is moderately weathered for 1 to 2 ft. with slightly weathered rock below. The latter gives a loud ring when struck with geological hammer, and requires hard blows to be broken. The more weathered surface rock can be broken up by moderate blows. In the moderately weathered feldspathic quartzite, feldspar has decomposed giving the rock a white pitted texture.	Two regular joint sets spaced about 1 to 2 ft. apart divide the rock into tabular blocks. These joints are generally strongly cemented. The quartzite is more competent and consequently more jointed than the regular sandstone.
Shale	Laminated and generally fissile claystones and siltstones, consisting mainly of clay minerals, silt size quartz, and some mica. Grey with red and yellow ferruginous staining and banding.	Although not seen in fresh state, elsewhere similar material ranges from weak to medium strong.	Mainly very weak to weak rock as seen in trenches up to 8.5 ft. deep in which the rock is extensively weathered.	In the fissile shale the cleavage is that of the bedding or approximately parallel to it, and the rock splits readily along these planes. In the less fissile shale cleavage is not so well developed. In general there are two main joint sets and joints are generally spaced 0.3 to 3 ft. apart and either weakly cemented or coated with yellow clay.

TABLE 1

PROPERTIES OF ROCK SUBSTANCES AND STRUCTURAL DEFECT IN ROCK MASS

Column	1	2	3	4
	Petrology	Probable properties when fresh	Conditions when exposed along route	Structural defects in rock mass
Phyllite	A micaceous shale with well developed schistosity and fissility. Contains mainly mica, silt size quartz, and clay minerals. Grey to blue grey, with few darker carbonaceous bands. The mica crystals impart a silky sheen to the surface of cleavages (or schistosity).	Ranges from very weak to medium strong rock.	Very weak to weak rock as seen in Trenches 1 and 6 and in nearby cuttings, where the rock is extensively weathered.	Fissile, the cleavage (or schistosity) probably being that of the bedding. The rock splits readily along these planes. Two sets of well defined joints occur with joint spacings mainly 0.3 to 1 ft. apart. These joints are weakly cemented.

Rocks exposed along the route are variable in their degree of weathering. During the initial stages of investigations the products of weathering were defined as set out in Table 2, in which the classification is based on visual estimation of the degree of breakdown of the constituent minerals and the strength of the substance in hand specimens. However, it has been found that this classification is limited in application, particularly for rocks which are already weak in their fresh state, as are some of the sandstones and phyllites in the freeway area. During the freeway investigations it was decided to define the degree of weathering according to the strength of the weathered product, as in the recently proposed classification by Dixon (1969). The terms used are shown in Table 3. Hence in the text of this report and in the portion of Table 4 covering STA.356 to STA.448, terms as in Table 3 are used to define the rock weathering characteristics while in the portion of Table 4 covering STA.290 to 356 (previously despatched to the Commissioner of Highways on 2nd January, 1969), the terms as in Table 2 are used.

The following is an example enabling comparison between the 2 classification types, as applied to a typical sandstone in the freeway area:

Based on Table 2		Based on Table 3	
Fresh		Fresh, medium strong	
Slightly, Moderately, Highly	weathered	Weathered	medium strong, weak, very weak
Completely weathered		Extremely weathered, soil properties.	

Depths of weathered rock below ground surface vary with rock type and the degree of jointing. However in general, the degree of weathering of the rocks decreases, and hence the strength increases, with depth.

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.

TABLE 3
CLASSIFICATION OF ROCK CONDITION AND STRENGTH OF ROCK SUBSTANCE

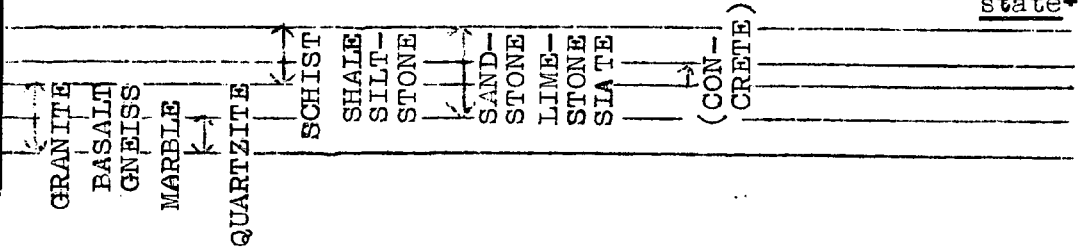
1. ROCK CONDITION TERMS

TERM	ABBREVIATION	DEFINITION
Fresh	(F)	Substance shows no effects of chemical decomposition.
Chemically Decomposed	(D)	Substance is affected by chemical decomposition, but the exact process is not obvious.
Chemically Weathered	(W)	Substance shows effects of chemical decomposition processes which have occurred due to surface and near-surface agencies such as air and groundwater.
Chemically Altered	(A)	Substance shows effects of chemical decomposition processes which have occurred due to plutonic or volcanic fluids.
Extremely (Decomposed	(XD)	Substance has been reduced to material which shows fabric of original rock, but which can be remoulded, i.e. soil substance. (Classified by Unified System).
Extremely (Weathered	(XW)	
Extremely (Altered	(XA)	

2. CLASSIFICATION OF ROCK SUBSTANCES BY UNCONFINED COMPRESSIVE STRENGTH

TERM	ABBREVIATION	UNCONFINED COMPRESSIVE STRENGTH (Kg/sq.cm)	(lb/sq.in)
Very weak	VW	less than 70	less than 1000
Weak	W	70 - 200	1000 - 3000
Medium strong	MS	200 - 700	3000 - 10,000
Strong	S	700 - 1800	10,000 - 25,000
Very Strong	VS	greater than 1800	greater than 25,000

Range of strengths of some common rock substances, in the fresh state*



*Samples of fresh rock tested to Australian Standard, For rocks showing planar anisotropy the long axis of the sample is normal to the fabric planes.

3. EXAMPLES OF USE OF CLASSIFICATION

Geological Name	Rock Condition Term	Strength Term
Granite	Fresh	Strong
Granite	Weathered	Medium Strong
Schist	Fresh	Weak
Schist	Altered	Very Weak

The material in which a seismic velocity range of 3,200 to 8,500 fps. was recorded during the seismic refraction survey (Appendix A) probably corresponds to variably weathered rock, ranging from weak to strong. Material with a velocity range of 6,000 to 14,700 fps. generally recorded near or below the proposed formation levels, is probably weathered to fresh, medium strong to very strong rock.

These seismic results, together with exposures in outcrops, quarries, and cuttings, indicate that in general the sandstone is probably very weak to medium strong to depths of 25 to 100 ft., with medium strong to strong rock below, and that the quartzite and quartzitic sandstone is weathered, medium strong to about 10 ft. and weathered to fresh, strong to very strong below. Trenches and nearby cuttings indicate that the phyllite and shale beyond STA.412 (W-E Road) is a weak to very weak rock to 8.5 ft. or more, but probably becomes a medium strong rock at depth.

Structural defects in the rock mass

The rock mass is weakened by the presence of two main types of structural defects. These are joints and cleavages. The orientation of these defects, where measured, are shown on Figures 3 and 4, and details of their effects on the rock mass are given in Table 1. The overall trends of the major structural defects (joints) are shown in rosette form on Figure 3.

Groundwater

Records of water bores drilled in the area show that water was cut at a minimum depth of 40 ft. below the tops of hills. In gullies, however, some bores flowed at the surface during winter. There is also some record of natural springs in the area. Many valleys are swampy or contain running creeks, the most noticeable of these being near STAS.300 to 315, 385, and 400. In the Bridgewater School water bore which is close to the freeway route, (Fig. 3) water was cut at 40, 140 and 260 ft.,

and the standing water level was measured at 80 ft.

The position of major bores are shown on Figures 3 and 4, together with the depths at which water was cut.

Stability of natural slopes

In general, slopes along the freeway route appear stable, but in a few gullies the surface is hummocky, suggesting some superficial instability. At STA.416 (W-E Road), there is a large mound approximately 100 ft. in diameter which is possibly old slide material. Rock is present on either side of the mound at about 4 ft. depth. Trench 7, excavated 8 ft. into this mound, showed silt, sand and gravel underlain by highly plastic clay. This area at present appears stable but it is possible that further deep seated movements could occur in this vicinity, and earthworks associated with excavations, during periods of rainfall, could increase this possibility.

ASSESSMENT OF EXCAVATION CONDITIONS

Details of the geology and an assessment of the excavation conditions, including rippability, along this section of the freeway are given in Table 4. The cutting depths quoted are on the road centre line. The suggested cutting angles are the steepest advisable in each case.

Excavation

Results from geological mapping, seismic refraction surveys and observations in similar materials elsewhere indicate that most of the material in the proposed cuttings will be rippable, with the exception of some stronger quartzite beds up to a few hundred feet thick which will require blasting. Some observed relationship between seismic velocities and rippability, including results of previous excavation experience along the South Eastern Freeway are shown in Figure 2.

TABLE 4

ASSESSMENT OF GEOLOGICAL CONDITIONS, STA 290 + 00 to STA 448 + 00

W-E ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed Construction	Surface Geology	Sub-surface Exploration	Suggested cutting angles and excavation methods
290+00	299+50	950	Fill	Soil covered. Probably less than 1 ft. thick on the hillsides, becoming thicker in the valley, (possibly up to 6 ft.). Probably overlies sandstone interbedded with occasional shale or schist beds.	None	-
299+50	305+50	600	Cut up to 34 ft. deep	Soil covered. Exposures on a hill to the south-west and in a 100 ft. long road cutting near-by indicate that the soil is less than 1 ft. thick and overlies HW to MW sandstone containing a few generally weaker siltstone-sandstone interbeds, up to 50 ft. wide. The depth of weathering is uncertain but experience in the road cuttings show MW to SW rock below 4 ft. This rock contains two prominent steeply dipping sets of joints spaced from 1-5 ft.	Seismic Traverse No. 1 on this road, gave the following: From (ft.) To (ft.) f.p.s (V_1) 0 10 1,600 (V_2) 10 (25-45) 8,500 (V_3) below (25-45) 13,000 A lower velocity zone V_4= 9,500 f.p.s. occurs between STA302+80 and 303+80 and may correspond to a weaker siltstone bed.	0 to 10 ft. (in the upper soil and weathered rock) 1:1, mainly rippable. below 10 ft. - ¾: 1, blasting probably required.

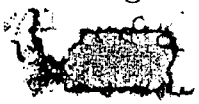
W-E ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed Construction	Surface Geology	Sub-surface Exploration.	Suggested cutting angles and excavation methods
305+38	310+00	450	Fill	Some quartz gravel zones near STA 310 probably represent quartz veins in the sandstones (est. up to 6 ft. thick). Bedding strike obliquely to the freeway, cutting it at 50° to 70° with dips ranging from 40° to 50° southeast.	None	
310+00	316+00	600	Cut up to 15 ft. deep	Soil covered. An adjacent road cutting 4 ft. deep shows a thin soil cover (1 ft. thick) overlying interbedded HW to CW grey siltstone and HW off-white sandstone probably grading to MW to SW rock at depth. The sandstone contains a few quartz veins up to 1.5 ft. thick. The rock grades to lighter coloured sandstone towards STA 316. Generally the bedding strikes cut the freeway at about 65° to the centre line and dips at about 30° southeast, some minor folds may occur at the eastern end of the proposed cut.	None	1:1, mainly rippable May require some blasting at base of cut.

W-E ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed Construction	Surface Geology	Sub-surface Exploration	Suggested cutting angles and excavat methods
316+00	326+50	1050	Fill	Soil cover, with a swampy zone between STA 320 and 327. The soil cover is mainly less than 2 ft. thick, but is probably thicker in the swampy zone. In a nearby road cutting HW offwhite sandstone, becoming MW at 8 to 10 ft., is exposed. It is well bedded and micaceous in part. Fr to SW massive pink brown quartzite outcrops on the top of a nearby ridge, and dips at about 30° southeast. This probably represents the base of an eroded quartzite bed. Beds generally cut the freeway section obliquely at 60° to 90° and dip at 30to 50° south east. The sandstone is locally folded between STA 317 and 321. The rock contains two prominent near vertical sets of joints spaced from 1 to 15 ft. These are weakly cemented in the sandstone but strongly cemented in the quartzite.	None	-

W-E ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed Construction	Surface Geology	Sub-surface Exploration	Suggested cutting angles and excavation methods
326+50	334+50	800	Cut up to 26 ft. deep	Mainly thin soil cover (less than 1 ft.) with a few scattered HW to MW sandstone and SW quartzite boulders. A few small exposures indicate it is probably underlain by light coloured HW to SW sandstone-quartzite. A Fr to SW quartzite band about 20 ft. thick outcrops on the side of a nearby hill and this may cross the freeway near STA330. The quartzites contain two steeply dipping sets of joints spaced from 2 to 10 ft. and strongly cemented. The bedding may vary greatly cutting the freeway at 80° or less. Dips tend to shallow towards the east and range from 35° to 10° south-east, or less. Exposures in a 12 ft. deep railway cutting to the south-west, indicate that minor folding or warping of the sandstone-quartzite might be expected.	None All rock below 15 ft. may require blasting.	1:1, Mainly rippable with the exception of the stronger quartzite beds which may require blasting. 

W-E ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed Construction	Surface Geology	Sub-surface Exploration	Suggested cutting angles and excavation methods
334+50	344+00	950	Cut up to 18 ft. deep	Soil covered. Exposures in a nearby 2 ft. deep road cut and in roadside boulders up to 2 ft. diameter indicate that the soil cover is probably less than 1 ft. thick, overlying HW to SW yellowish, massive sandstone. Bedding is probably near horizontal with minor folds or flexures. A large anticlinal fold is exposed in a 30 ft. deep railway cutting to the southwest. This could be expected near STA 340. Towards STA 343 the bedding should become more constant, cutting the freeway at about 90° with dips of 35° to 45° southeast. The rock at depth probably contains two steeply dipping sets of joints spaced from 1 to 15 ft. apart.	None	0 to 15 ft., 1:1 mainly rippable. Below 15 ft. ¾:1- blasting probably required.

W-E ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed Construction	Surface Geology	Sub-surface Exploration	Suggested cutting angle and excavation methods
350+00	353+00	300	Fill	Mainly soil cover (less than 1 ft. thick) with fragments of HW to MW micaceous sandstone and SW quartzite.	Seismic traverses A, B & C gave the following From (ft) To(ft) f.p.s. V_1 0 (3-5) 1,700 V_2 (3-5) (25-65) 2,000 to 4,000 V_3 (25-65) below 7,500 to 12,000	-
353+00	356+00	300	Cut up to 16 ft. deep	Two nearby railway cuts expose interbedded HW to MW offwhite sandstone and FR to SW grey quartzite (weathered pink-brown). The sandstone is well laminated with prominent cross bedding. It is much weaker than the quartzite. The quartzite beds are 0.5 to 40 ft. thick and increase in number towards the east. They generally form crests of ridges. Joints are spaced up to 3 ft. in the quartzite. Similar conditions should be met in the proposed freeway excavation. The railway cuttings are up to 50 ft. deep with batters at 1:1 and appear stable. Bedding cuts this freeway section obliquely at 60° to 70° and dips at 25° to 40° southeast.		1:1 The sandstone and thinner quartzite beds will be rippable but the thicker quartzite beds may require blasting.

W.E. ROAD

Chainage From	Chainage To	Dist. (ft)	Details of proposed Construction	Surface Geology	Sub-surface Exploration	Suggested cutting Angles and Excavation methods.
356+00	359+00	300	Cut up to 16 ft. deep	Mainly soil cover(less than 1 ft. thick) with fragments of weak micaceous sandstone and strong quartzite. Quartzite outcrops are extensive between STA 357+00 and 361+00. To the north of this section a railway cut about 50 ft. deep exposes well laminated and cross bedded sandstone with quartzite interbeds increasing from 0.5 ft. to 40 ft. thick towards the east. The sandstone is much weaker than the quartzite. Joints are spaced up to 3 ft. in the quartzite. Similar conditions should be met in the proposed freeway excavation. The railway cutting has batters at 1:1 and appears stable. Bedding cuts this freeway section obliquely at about 70° and dips about 40° southeast.	Seismic Traverses A B & C gave the following - From (ft.) To (ft.) fps. V_1 0 3-5 1,700 V_2 3-5 25-65 2,000 to 4,000 V_2 25-65 below 7,500 to 12,000	1:1 The sandstone and thinner quartzite beds will be rippable; beyond about STA357 the thicker quartzite beds will require blasting.

W-E ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed Construction	Surface Geology	Sub-surface Exploration	Suggested cutting Angles and Excavation methods
359+00	367+00	800	Fill	Mainly soil cover (less than 1ft. thick). Bars of fresh, strong quartzite outcrop between STA359 to 361, and scattered weathered, moderately strong quartzite-sandstone outcrops between STA363+00 and 364+00. Exposures in a railway cutting and sandstone quarry to the north can be correlated along bedding strike with the freeway section. These showed medium strong to strong white sandstone with some stronger sandstone - quartzite zones.	None	-

W-E ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed construction	Surface Geology	Sub-surface Exploration	Suggested Cutting Angles and Excavation methods
367+00	384+00	1700	Cut up to 70ft deep	Mainly soil cover (less than 3 ft. thick). Exposures in road cuttings up to 12 ft. deep to the north can be correlated along bedding strikes with the few outcrops along this section. The rock is mainly white sandstone-quartzite, ranging from weathered, medium strong to weathered, very strong quartzite. It contains occasional weak siltstone-sandstone bands, the most notable being about 100 ft. thick and crossing the freeway between about STA 376+00 and 378+00. Joints in the sandstone are mainly spaced 2-3 ft. apart. Bedding cuts the freeway section obliquely at 80° to 90° and dips at 45° to 50° southeast.	Seismic Traverse No. 2 gave the following: From (ft.) To (ft.) fps Eastern end of Traverse V_1 0 5-10 1,400 to 1,800 V_2 5-10 75-100 3,800 V_3 75-100 below 8,000 to 11,500 Western end of Traverse V_1 0 5-10 1,400 to 1,800 V_2 5-10 25 3,200 V_3 25 60-70 4,850 V_4 60-70 below 6,250	1:1 The sandstone-quartzite and siltstone-sandstone and thinner quartzite beds should be rippable but the thicker quartzite will require blasting. Blasting will be required near base of cut.
384+00	385+50	150	Fill	Soil cover. Swampy near STA 384+75. Exposures in nearby road surfaces extrapolated to this part of the freeway section suggest the rock is medium strong offwhite fine grained sandstone with some coarser grained interbeds.	None	-

W-E ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed Construction	Surface Geology	Sub-surface Exploration	Suggested Cutting Angles and Excavation Methods
385+50	398+50	1,300	Cut up to 34 ft. deep	Soil cover probably less than 3 ft. deep in road surfaces to the south (up to 8 ft. below ground surface) can be extrapolated along bedding strike to this section of freeway. The rock is mainly very fine grained laminated sandstone, off-white to pinkish and estimated as mainly medium strong to strong in exposures, becoming weaker and coarser grained towards the east. Joints are generally spaced 4 0.3 to 3 ft. apart. The bedding contains many minor flexures and undulations. Correlation with outcrop to the north and south indicate that some stronger quartzite beds might be expected as far as STA388. Bedding cuts this freeway section obliquely at 70 to 90° and dips at 30 to 50° east.	Seismic Traverse No. 3 gave the following: From (ft.) To (ft.) fps. V_1 0 10 1,800 V_2(a) 10 20 3,250 to 3,750 (recorded at middle of spread only) (b) 10 45 4,200 to 4,750 (recorded at eastern end of spread only.) V_3 (a) 10 50-75 4,100 to 7,500 (b) 20-45 50-75 5,750 to6,000 (recorded at middle and east of spread). V_4 (50-75) below 9,750 to 13,500	1:1 Stronger sandstones rippable to about 15 ft. blasting below. Weaker sandstones mainly rippable with some light blasting near floor of cut.

W-E ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed Construction	Surface Geology	Sub-surface Exploration	Suggested cutting Angles and Excavation Methods
398+50	408+50	1,000	Fill	Soil cover and Onkaparinga River valley alluvium. The alluvium occurs between STA400 and 403 and is swampy. Exposures on the Onkaparinga River bed to the north extrapolated along bedding strike to the freeway section indicate that at depth the rock here is moderately strong coarse grained sandstone possibly ferruginised in part.	Trench 12, 6ft. deep, dug on the freeway line near STA405+00 showed less than 1 ft. of soil over massive weak coarse grained highly weathered sandstone.	-
408+50	435+00	2,650	Cuts up to 35 ft.deep	Soil cover with the exception of a few knobs of strong cemented (ferruginous) sandstone outcropping on hilltops near STA410.	Trenches 1,2,3,5,7,8,9,10 and 11 dug on the freeway line to about 8 ft. depth showed weak sandstone to STA414. Beyond this the rock is weak phyllite and shale. These beds have well developed jointing and cleavage and in places are quite fissile. Joints are spaced 0.1 to 1 ft.apart. Trench 6 situated near STA 420 showed more than 8ft.of highly plastic clay. The mound topography near here suggests this is probably slide material. Bedding in the trenches cuts the freeway section obliquely at 5° to 60° and dips range from 25° to 50° east.	1.5: 1 to 15 ft. 1:1 below. Rippable. Some light blasting near floor of cut.

Chainage From	To	Dist. (ft.)	Details of proposed construction	Surface Geology	Sub-surface Exploration	Suggested cutting angles and excavation methods
408+50 (contd.)	435+00				Seismic Traverse No.4 gave the following: V_1 0 to 10 — 1,100 to 1,700 f.p.s. V_2 10 to 45-80 — 3,200 to 5,600 f.p.s. V_3 45-80 below — 6,000 to 14,700 f.p.s.	
435+00	448+00	1,300	Fill (embankment)	Soil cover with river valley alluvium beyond STA436. This alluvium is swampy in part.	Trench 4 excavated to a depth of 8.5 ft., at the edge of the alluvial valley showed highly plastic clay.	

ASSESSMENT OF GEOLOGICAL CONDITIONS, STA290+00 TO STA448+00
W-E ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed Construction	Surface Geology	Sub-surface Exploration	Suggested cutting angles and excavation methods
290+00	300+00	1,000	Mostly fill	Soil covered. Probably up to 2ft. of soil overlying sandstone interbedded with occasional shale or schist beds.	None	-
300+00	303+50	350	Cut up to 25ft.deep	Mainly swampy soil and creek alluvium with a few scattered MW to HW sandstone scree fragments. Exposures on a hill to the southwest and in a 100ft. long road cutting nearby, indicate that the soil and alluvium is probably only a few feet thick and overlies CW to MW sandstone containing a few generally weaker siltstone-sandstone interbeds up to 50ft. wide. The depth of weathering is uncertain but exposures in the road cutting show MW to SW rock below 4 ft. This rock contained two prominent steeply dipping sets of joints spaced from 1 to 5ft. apart. Some quartz gravel zones near STA306 probably represent quartz veins in the sandstone (est. up to 6ft. thick). Bedding strikes obliquely to the freeway at 50° to 70° with dips ranging from 40° to 60° southeast.	Seismic Traverse No. 1 on the N-E road gave the following:- From(ft.) To(ft.) f.p.s. (V_1) 0 10 1,600 (V_2^1) 10 (25-45) 8,500 (V_3^2) (25-45) 13,000 A lower velocity zone, V_4 = 9,500 f.p.s. occurs between ST1302+80 and 303+00 and may correspond to weaker siltstone beds.	0 to 10ft. (in the upper soil and weathered rock) 1:1, mainly rippable. Below 10ft., ¾ : 1, blasting probably required.
303+50	310+00	650	Fill		None	-

E-W ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed Construction	Surface Geology	Sub-surface Exploration	Suggested cutting angles and excavation methods
BRIDGEWATER OVERBRIDGE						
310+00	316+00	600	Cut up to 18 ft. deep	Soil covered. An adjacent road cutting 4 ft. deep shows a thin soil cover, (1ft. thick) overlying interbedded, HW to CW grey siltstone and offwhite sandstone, probably grading to MW to SW rock at depth. The sandstone contains a few quartz veins up to 1.5ft. thick. The rock grades to lighter coloured sandstone towards STA313. Generally the bedding strikes obliquely at about 65° to the freeway and dips about 30° south-east; some minor folds may occur at the eastern end of the proposed cut.	None	1:1 Mainly rippable with blasting probably needed at base of cut.
316+00	327+00	1,100	Fill	Soil cover, with a swampy zone between STA320 and 325. The soil cover is mainly less than 2 ft. thick, but is probably thicker in the swampy zone. Sub-surface geology as for E-W Road between STA316+00 and 326+50.	None	-

E-W ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed Construction	Surface Geology	Subsurface Exploration	Suggested cutting angles and excavation methods
327+00	333+00	600	Cut up to 18 ft. deep	Mainly thin soil cover (less than 1 ft) with a few scattered HW to MW sandstone and some SW quartzite fragments. Swampy near STA333 where soil is probably 4 ft. deep or more. A few small exposures indicate it is underlain by light coloured HW to SW sandstone-quartzite. A FR to SW quartzite band about 20 ft. thick outcrops on the side of the nearby hill, and this may cross the freeway between STA327 and 330. The quartzite contains two steeply dipping sets of joints spaced 2 to 10ft. and strongly cemented. The bedding may vary greatly in strike, cutting the freeway at 80° or less. Dips shallow to the southeast and range from 35° to 10° or less. Exposures in a 12 ft. deep railway cutting to the southwest indicate that minor folding or warping of the sandstone-quartzite might be expected.	None	1:1, mainly rippable. Some blasting of stronger quartzite bars.

E-W ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed Construction	Surface Geology	Sub-surface Exploration	Suggested cutting angles and excavation methods
333+00	344+00	1,100	Cut up to 28 ft. deep	Soil covered. Exposures in a nearby 2 ft. deep road cut indicate that the soil cover is probably less than 1 ft. thick, overlying HW to SW, yellow, massive, sandstone, Bedding is probably near horizontal with minor folds or flexures. A large anticlinal fold is exposed in a 30 ft. deep railway cutting to the southwest. This could be expected near STA338. Towards STA344 the bedding should become more constant cutting the freeway at about 90° with dips of 35° to 45° southeast. The rock at depth probably contains two steeply dipping sets of joints, spaced from 1 to 15 ft. apart.	None	0 to 15 ft., 1:1 Mainly rippable. Below 15 ft. ¾:1, blasting probably required.

E-W ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed Construction	Surface Geology	Sub-surface Exploration	Suggested cutting angles and excavation methods.
344+00	352+00	800	Fill or at existing ground surface.	Soil covered. (Probably less than 1 ft. of soil). Exposures in the nearby railway cutting (crossing the freeway near STA350 and up to 15 ft. deep with batter angles 1:1) show the soil to be mainly underlain by whitish-grey sandstone. This is CW to about 8 ft., HW below. Interbedded FR to SW quartzite up to 50 ft. thick can be expected in the vicinity of STAS344 and 346. Bedding cuts the freeway at about 80° to 90° and dips range from 35 to 45° southeast.	None	-

E-W ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of Proposed Construction	Surface Geology	Sub-surface Exploration	Suggested cutting angles and excavation methods
352+00	356+00	400	Cut up to 32 ft. deep	Mainly soil cover (less than 1 ft. thick), with fragments of HW to MW micaceous sandstone and SW quartzite. Two nearby railway cuts expose interbedded HW to MW offwhite sandstone and FR to SW grey pink-brown quartzite. The sandstone is well laminated with prominent cross bedding, but is much weaker than the quartzite. The quartzite beds are 0.5 to 40 ft. thick and increase in number towards the east. They generally form crests of ridges. Joints are spaced 0.5 to 3 ft. and well cemented in the quartzite. Similar conditions should be met in the proposed freeway cut. The railway cuttings are up to 50 ft. deep with batters 1:1 and appear stable. Bedding cuts the freeway section obliquely at 60° to 70° and dips at 25° to 40° southeast.	Seismic traverses A.B. & C. gave the following:- (V_1) From 0 To (3-5) 1,700 fps. (V_2) From (3-5) To (26-65) 2,000 to 4,000 (V_3) From (25-65) To below 7,500 to 12,000	1:1 The sandstone, and thinner quartzite beds will be rippable but the thicker quartzite beds may require blasting.

E-W ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed Construction	Surface Geology	Sub-surface Exploration	Suggested cutting angles and excavation methods
356+00	359+00	300	Cut up to 32 ft. deep	Mainly soil cover (less than 1 ft. thick) with fragments of weak micaceous sandstone and strong quartzite. Quartzite outcrops are extensive between STA356+50 and 359+50. A railway cutting to the north of this freeway section exposes weak to medium strong sandstone interbedded with strong grey to pink-brown quartzite. The sandstone is well laminated and cross bedded but is much weaker than the quartzite. The quartzite interbeds increase from 0.3ft. to 40ft. thick towards the east. Joints are spaced up to 3ft. in the quartzite. Similar conditions should be met in the proposed freeway cut. The railway cutting is up to 50 ft. deep with batters at 1:1 and appears stable. Bedding cuts this freeway section obliquely at about 50° to 60° and dips about 40° to 80° southeast.	Seismic Traverses A,B & C gave the following:- From (ft.) To (ft.) fps. V_1 0 3-5 1,700 V_2 3-5 25-65 2,000 to 4,000 V_3 25-65 below 7,500 to 12,000	1:1 The sandstone and thinner quartzite beds will be rippable but towards the east the thickening quartzite beds will probably require blasting.
359+00	366+00	700	Fill	Mainly soil cover (less than 1 ft. thick). Sub-surface geology is generally the same as for W-E road between STA359+00 and 367+00	None	-

E-W ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed Construction	Surface Geology	Sub-surface Exploration	Suggested cutting angles and Excavation methods.
366+00	381+00	1,500	Cut up to 70 ft. deep	As for W-E road between STA 367+00 and 384+00	Seismic Traverse No.2 as for W-E road between STA 367+00 and 384+00.	1:1 The sandstone - quartzite, siltstone sandstone, and thinner quartzite beds, should be rippable but the thicker quartzite beds will require blasting. Blasting will probably be required near base of cut.
381+00	384+00	300	Fill	All soil cover - swampy near STA382+50. Exposures in nearby road surfaces extrapolated to this part of the freeway section suggests the rock is medium strong offwhite fine grained sandstone with some coarser grained interbeds.	None	-

E-W ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed Construction	Surface Geology	Sub-surface Exploration	Suggested cutting angles and excavation methods
384+00	397+00	1,300	Cut up to 66 ft. deep	All soil cover (less than 3 ft. deep). Subsurface geology as for W-E road between STA385+00 and 398+50.	Seismic Traverse No.3 as for W-E road between STA 385+00 and 398+00.	1:1 to 50 ft. ¾:1 below Mainly rippable to about 50 ft. Below this blasting of stronger bands may be required. Stronger quartzitic interbeds may require blasting above this depth.
397+00	408+00	1,100	Fill	Mainly soil cover and Onkaparinga River valley alluvium with the exception of a few knobs of strong ferruginised sandstone outcropping near STA405+00 and 401+00, and is swampy in part. Exposures in the Onkaparinga River bed to the north extrapolated along bedding strike to this freeway section indicate that at depth the rock here is moderately strong coarse-grained sandstone possibly ferruginised in part.	Trenches 11 and 12 each 6ft. deep dug on the freeway line near STA408+00 showed less than 1ft. of soil covering weak sandstone, coarse grained.	-
408+00	421+00	1,300	Cut up to 35ft. deep	Soil covered	Trenches 1,2,5,7,8,9 and 11, dug on the freeway line to a depth of about 8ft. showed weak sandstone to STA410+00. Beyond this the rock is weak phyllite and shale. These beds have well developed jointing and	1.5:1 to 20 ft. 1:1 below. Rippable.

E-W ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed Construction	Surface Geology	Sub-surface Exploration	Suggested cutting angles and excavation methods
408+00 (contd)	421+00	1,300	Cut up to 35 ft. deep	Soil covered	cleavage and in places are fissile. Joints are spaced 0.1 to 1 ft. apart. Trench 6, 8 ft. deep, located near STA 418+00, showed highly plastic clay. The mound topography in this area suggests this is probably slide material. Bedding cuts this freeway section obliquely at 5° to 40° and dips range from 25° to 50° east. Seismic Traverse No. 4 as for W-E road between STA 408+50 and 435+00.	
421+00	422+50	150	Fill	Soil cover (less than 4ft): Extrapolation between Trenches 1 and 2 suggests that the underlying rock is weak phyllite and shale.	Seismic Traverse No.4 as for W-E Road between STA 408+50 and 435+00.	
422+50	431+50	900	Mostly cut up to 20ft. deep	Soil cover. An excavation 1,000 ft. to the northeast exposes 10 ft. depth of weak grey phyllite. This could probably be correlated along a bedding strike to this freeway section.	Trenches 2 and 3 (up to 65 ft. deep) showed 1 to 3ft. of soil overlying yellow brown shale, weathered, to weak to very weak.	1:1 Rippable

E-W ROAD

Chainage From	Chainage To	Dist. (ft.)	Details of proposed Construction	Surface Geology	Sub-surface Exploration	Suggested cutting angles and excavation methods
431+50	448+00	1,650	Fill (embankment) 6	Soil cover underlain by weak shale, with river valley alluvium beyond STA434+00. This alluvium is swampy in part.	Trench 4 excavated to a depth of 8.5 ft., at the edge of the alluvial valley showed highly plastic clay.	-

Cutting Angles

Bedding and fold axes generally strike at about right angles to the freeway centre line. Although measured bedding dips are variable, the strike orientation will generally favour stability in the excavation batters. Fold axes generally plunge at a shallow angle (less than 30°) to the west, and some minor instability may occur in batters on the east side of the freeway due to sliding out along bedding planes near the crests and troughs of folds.

Drainage

It is considered that groundwater inflows will occur into excavations, but most should decrease or cease soon after excavation. Springs are also likely in completed batters, during periods of wet weather. These springs would probably be associated with local permeable zones such as crushed and/or weathered seams. These springs may require local "dental" treatment to improve drainage and prevent erosion of soil material forming the seams, which could otherwise lead to major instability on the batter.

J H Fryar per JMM.

J.H. FRYAR
GEOLOGIST
ENGINEERING GEOLOGY SECTION

JHF:JMM
11.8.69

REFERENCES

DIXON, H.W., 1969. Decomposition Products of Rock Substances - Proposed Engineering Geological Classification. Paper presented to Rock Mechanics Symposium, The Institution of Engineers, and The Australian Institute of Mining and Metallurgy, Sydney, February, 1969.

FRYAR, J.H., 1968. South Eastern Freeway, Geological Investigations, Progress Report No. 3, Littlehampton-Callington Section, STA 85+00 to STA 197+00. Dept. of Mines Rept. Bk. No. 67/33.

HARRIS, B.M., 1968a. South Eastern Freeway, Geological Investigations, Progress Report No. 2, Stirling-Hahndorf Section, STA 180 to STA 290. Dept. of Mines Rept. Bk. No. 66/13.

_____, 1968b. Minute to Chief Geologist, dated 24th January, 1968. Dept. of Mines Docket No. 1219/65.

S.A. DEPARTMENT OF MINES 1954. Geological Atlas, 1 Mile Series (1:63,360) Echunga Sheet.

TRUDINGER, J.P., 1965. Geological Investigation Progress Report July 1965. Proposed South East Freeway, Crafers-Stirling Section, STA 53 to STA 180.

APPENDIX A

REPORTS ON SEISMIC REFRACTION SURVEYS AND PROPOSED ROAD CUTTINGS

by

I.S. ROWAN
GEOPHYSICIST
EXPLORATION GEOPHYSICS SECTION

and

by

B.G. RISELY
GEOPHYSICIST
EXPLORATION GEOPHYSICS SECTION

APPENDIX A

SOUTH EASTERN FREEWAY, BRIDGEWATER - VEDDUN SECTION
SEISMIC REFRACTION SURVEY OF PROPOSED ROAD CUTTINGS

by

I.S. ROWAN
GEOPHYSICIST
EXPLORATION GEOPHYSICS SECTION

INTRODUCTION

The survey was carried out as part of the continued investigations of the South Eastern Freeway route.

The field work was supervised by B.G. Risely and the results reduced and interpreted by I.S. Rowan.

SURVEY PROCEDURES

An S.I.E. P.19 recorder with 12 channels was used. Spread length was 300 ft. with a geophone interval of 30 ft. The method used in reduction of results was that of Hawkins (1960)

RESULTS AND INTERPRETATION

Location of traverses is shown on Figures 3 and 4 of the report.

Plans No. S7302 and S7033 show the sub-surface velocity profiles as derived from time distance plots and Hawkins system.

On all traverses the surface layer of soils or completely weathered rock is represented by velocities in the range 1100 fps to 1800 fps. This has a thickness of up to 10 ft. and is easily rippable.

Beneath the surface layer the velocity profiles for each traverse are examined separately below.

Traverse 1

The velocity recorded of 8500 fps probably represents moderately weathered rock. It suggests that the rippability is marginal and dependent upon orientation of defects within the rock mass. Some harder bands could be encountered. Beneath the material of velocity 8500 fps some material may be encountered with a velocity of 9500 fps or 13000 fps. This would probably represent unweathered material which would not be rippable.

Traverse 2

Between the surface layer and the profile of the proposed road 3 velocities varying from 3200 fps to 4850 fps were recorded. These are representative of weathered rock which should be rippable. It should be noted however that relatively narrow stronger sandstone bands which were observed in outcrop were not detected by the seismic method and could be difficult to rip during construction. At one point in the cut unweathered material represented by a velocity of 8000 fps to 10,000 fps could be encountered. It is not likely that this material could be ripped.

Traverse 3

Over much of the traverse the velocities ranging from 3250 fps to 6000 fps indicate weathered rocks which should be rippable. Over spread 4 a higher velocity of 6200 fps to 7500 fps was recorded. This could be indicative either of a different degree of weathering or a differing rock type. At some places along the excavations materials with a velocity of 9750 fps and 13500 fps may be encountered. These may represent unweathered material which it is not possible to rip.

Traverse 4

Velocities varying from 3200 fps to 5600 fps are detected. They appear to correspond to changes from 6000 fps to 11300 fps at depth. All material encountered in this profile should be rippable.

CONCLUSIONS

All spreads show variable intermediate and high speed refractor velocities. In some cases the lateral variation in intermediate velocities can be associated with a similar lateral variation in the presumed unweathered material beneath it. In other cases the intermediate velocity is apparently controlled by the depth of weathering.

Some thin, high speed, sandstone outcrops in this area have not been mapped by this technique thus some caution should be used when assessing rippability.

REFERENCES

HAWKINS, L.V. 1961. The Reciprocal Method of Routine Shallow Seismic Investigations. Geophysics V 26 p.806-819.

DEPARTMENT OF MINES — SOUTH AUSTRALIA

SOUTH EASTERN FREEWAY
STIRLING-VERDUN SECTION
RESULTS OF
SEISMIC TRAVERSES 1&2

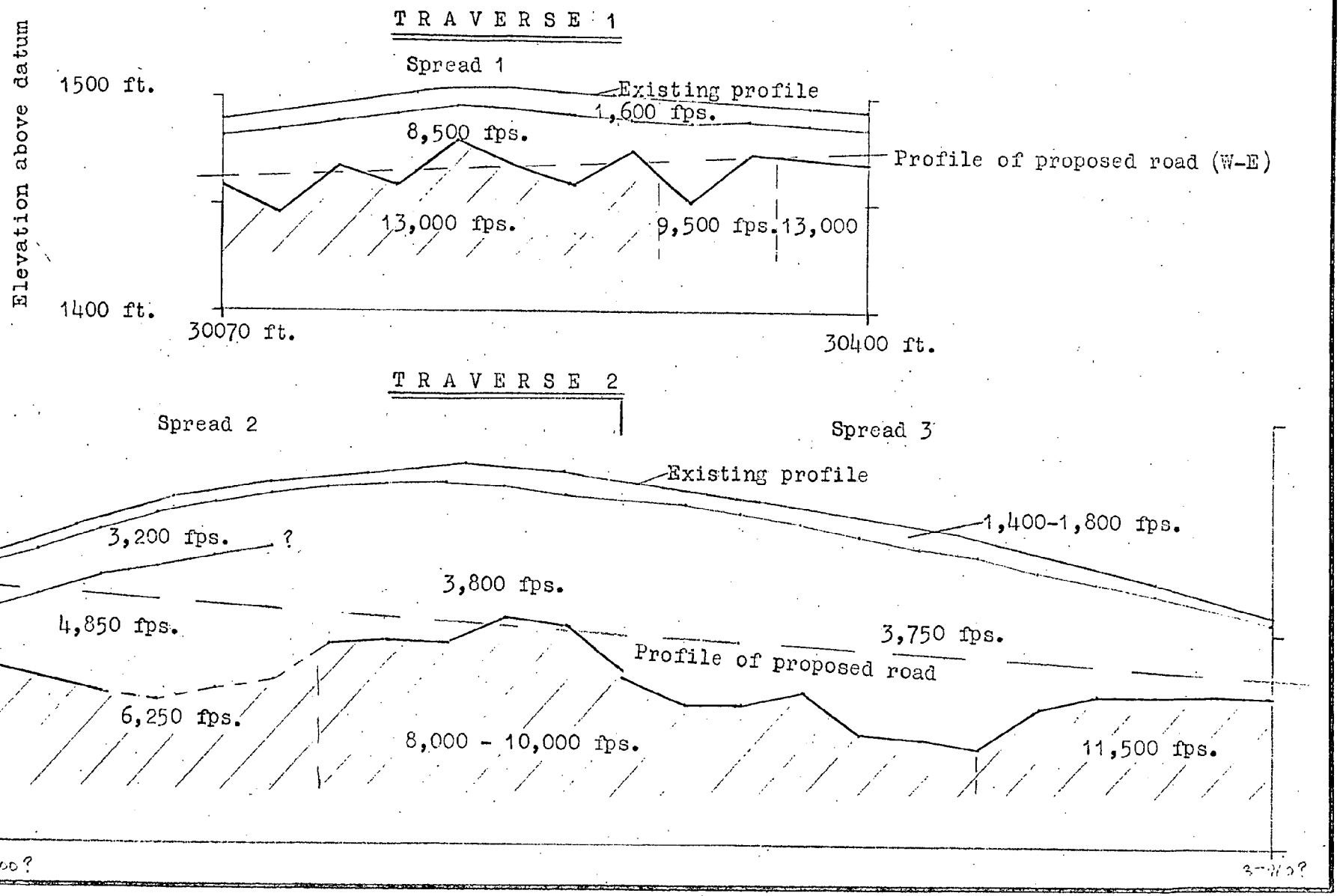
Drn. IR
Tcd.
Chd.
Exd.

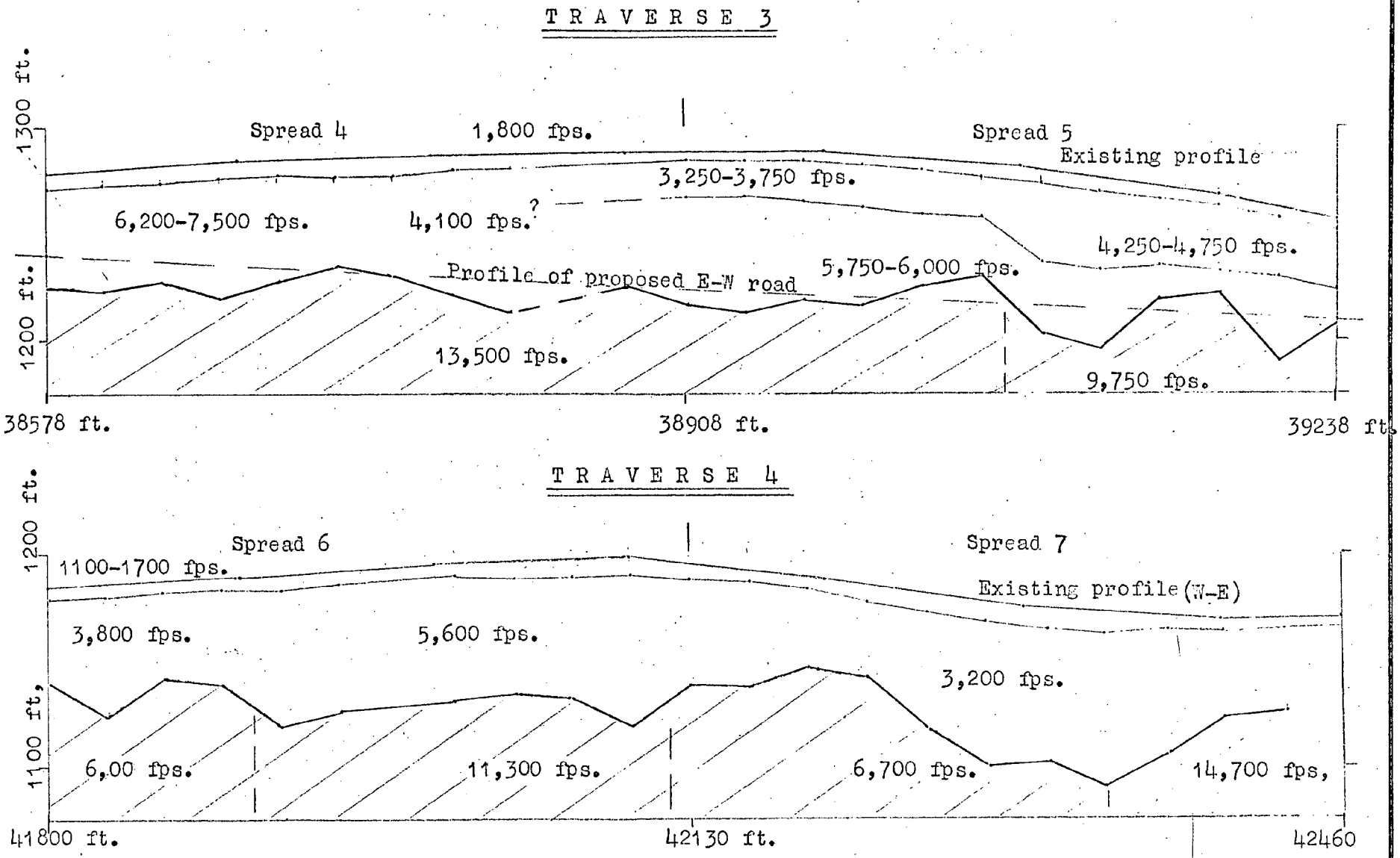
Geophysicist

SCALE: 1 cm. = 25 ft.

No 7
S7032

DATE: 18/11/68





DEPARTMENT OF MINES — SOUTH AUSTRALIA

Geophysicist

Drn. IR | Trd. | Ckd. | Exd.

SOUTH EASTERN FREEWAY
STIRLING-VERDUN SECTION
RESULTS OF
SEISMIC TRAVERSES 3&4

SCALE: 1 cm. = 25 ft.

Ha 7

S7033

DATE: 19/11/68

SOUTH EASTERN FREEWAY, BRIDGEWATER - VERDUN SECTION
SEISMIC REFRACTION SURVEY OF PROPOSED ROAD CUTTINGS

by

B.G. RISELY
GEOPHYSICIST
EXPLORATION GEPHYSICS SECTION

INTRODUCTION

At the request of the Highways Department a shallow seismic refraction survey was conducted over part of the proposed South Eastern Freeway route near Bridgewater in order to determine the depth and nature of the bedrock and the nature of the overburden. This information was required for calculating embankment slopes and thus determining what property will have to be acquired.

The field work was carried out on 28th November, 1967 under the direction of J.P. Hayes, Technician. Three 300 ft. spreads were completed using the S.I.E P19 12 channel recording equipment. The survey site was on the side of a hill sloping northwards and covered with scrub. Spreads A and B were parallel to the side of the hill while Spread C crossed Spread A almost at right angles, extending from the top of the slope down into a small valley (Plan No. 67-867).

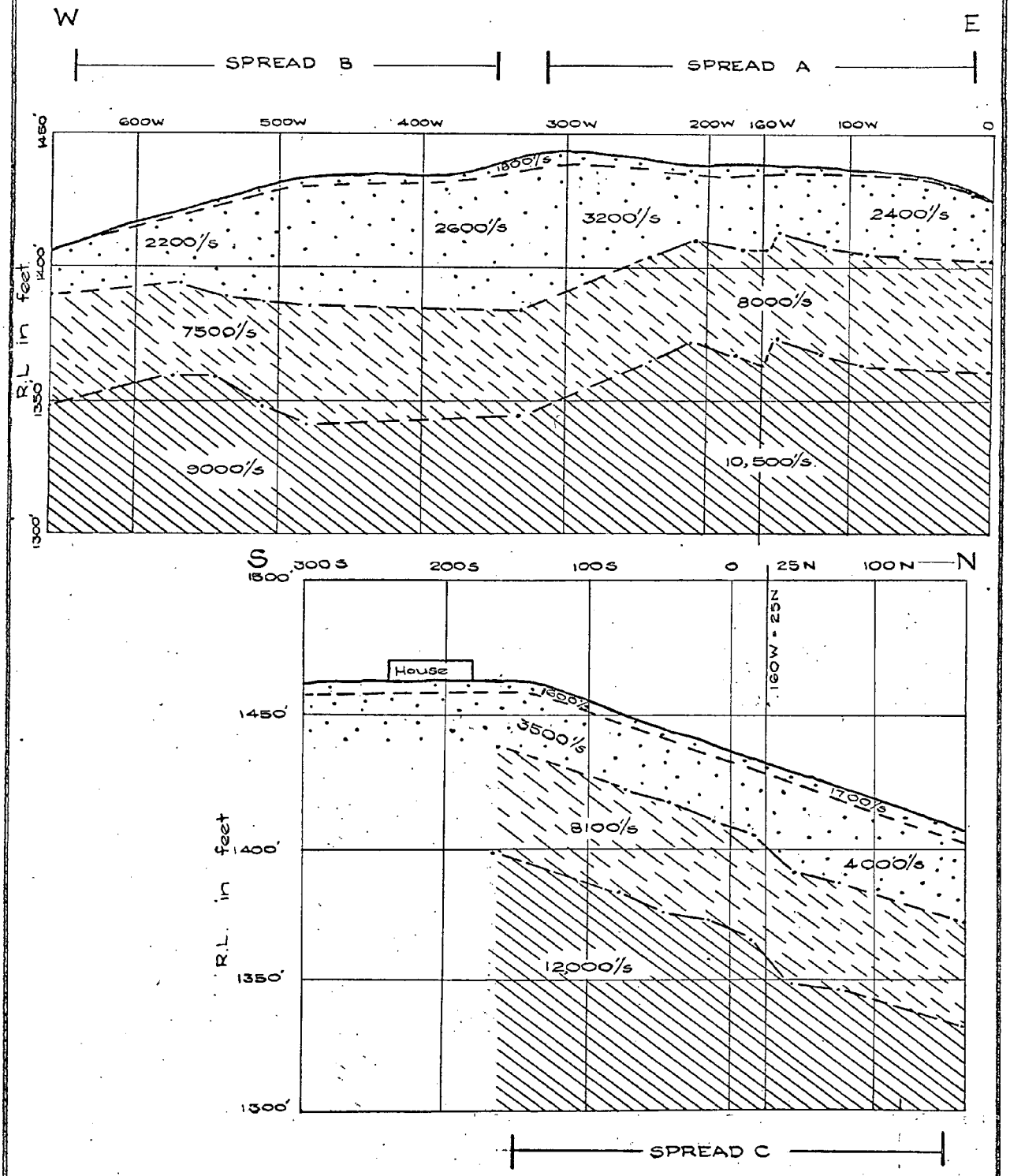
RESULTS AND INTERPRETATION

The quality of the records was poor making timing difficult and time consuming in many cases. The poor quality may have been due to the small charges used in some holes because of the proximity of houses.

The results are presented as elevation profiles in Plan No. S6300 and as an elevation fence diagram in Plan No. S6301. These show that weathered bedrock with an average

velocity of 7900 fps is overlain by two layers which have been grouped together and called "overburden". The uppermost layer is a thin "seismic weathering" layer with a maximum thickness of approximately $5\frac{1}{2}$ ft. and an average velocity of 1700 fps. This overlies a layer with an average velocity of 3000 fps. The minimum depth to weathered bedrock is approximately 11 ft. at the western end of Spread B and the maximum depth approximately 37 ft. at the eastern end. Eastwards from Spread B the depth decreases again to an average value of 18 ft. which remains fairly constant over the eastern two-thirds of Spread A. Going down-hill along Spread C the depth generally increases from approximately 17 ft. to 24 ft. The thickness of the weathered bedrock was found to be fairly constant over Spreads B and C with an average value of 39 ft. and a deviation from the mean of $\pm$ 4 ft. A velocity of approximately 10,500 fps was determined for the underlying unweathered bedrock. The existence of the weathered bedrock layer was difficult to detect in the records as the apparent velocity was very close to the apparent velocity of the bedrock. Record overlap was such that only the depths beneath the centre 4 or 6 geophones of the spreads could be determined, in addition to the depth beneath the shot holes As the weathered bedrock was not picked up with the western shots of Spread A the depths beneath the geophones could not be determined directly. Instead, the depths were calculated by assuming a thickness of 39 ft. for the weathered bedrock which was the average value from Spreads B anc C and appeared to remain fairly constant within $\pm$ 4 ft. This gave a depth of 26 ft. at 160W which agreed reasonably well with the interpolated value of 31 ft. at the same point at the middle of Spread C, considering the expected accuracy of the refraction method and the fact that depths were interpolated at the cross over point from geophones 15 ft. away.

For surveys of this type without drilling control, the depth estimates are generally considered to have a mean error within $\pm$10% with a standard deviation within $\pm$10-15%. With the difficulties encountered with the weathered bedrock layer the accuracy in this survey is not expected to be better than this.



Overburden.

Weathered Bedrock.

Unweathered Bedrock.

SCALE:
Horizontal – 1" = 100 feet.
Vertical – 1" = 50 feet.

For location of Spreads see Drawing No. 67-867.

DEPARTMENT OF MINES — SOUTH AUSTRALIA

	Drn. B.R.	SOUTH – EASTERN FREEWAY SEC. 107. HD. ONKARARINGA. SEISMIC REFRACTION PROFILES.	SCALE: As Shown.
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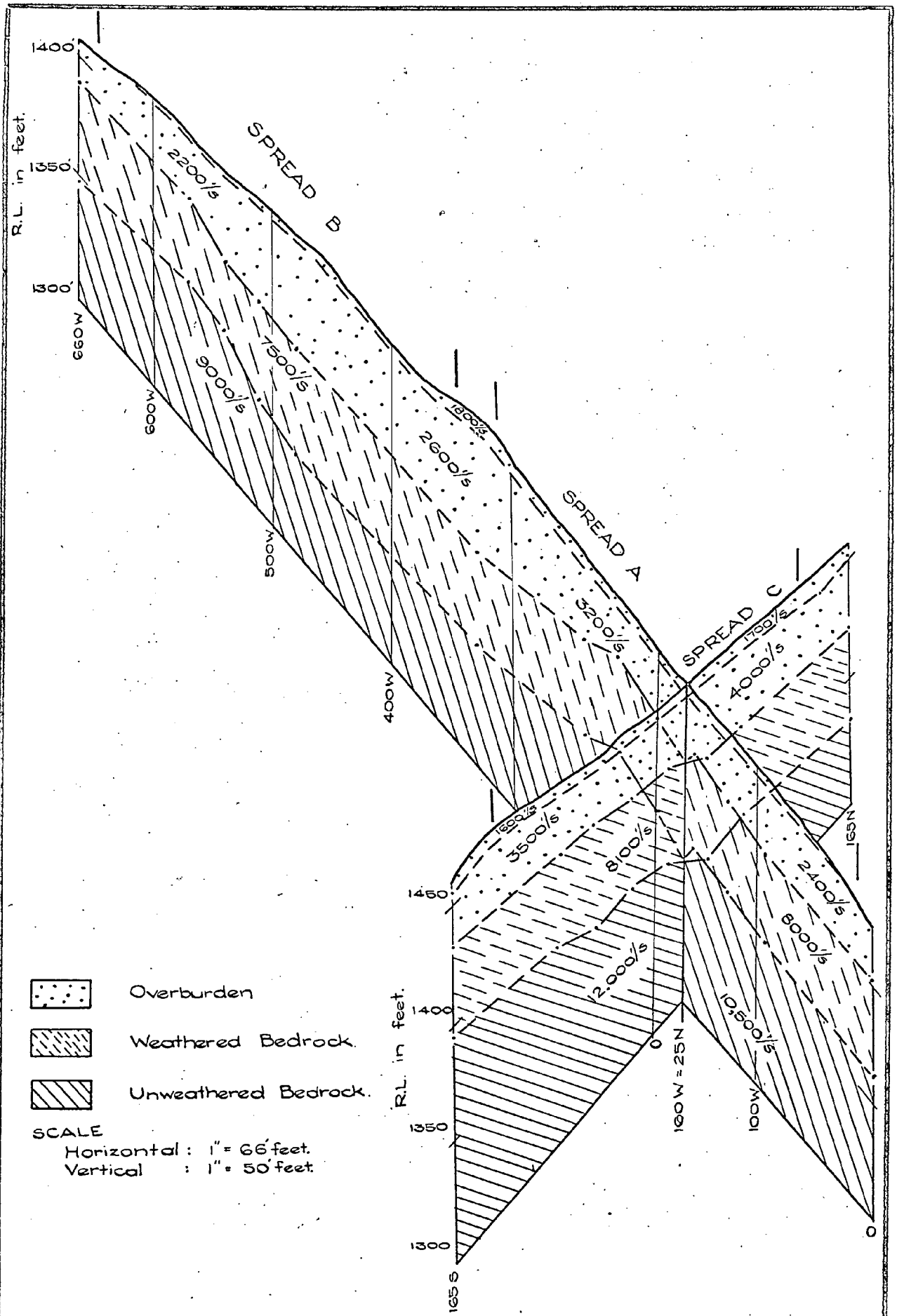
	Ckd. L.V.W.		DATE: 21-12-67
	Exd.		



DEPARTMENT OF MINES — SOUTH AUSTRALIA

	Drn. BR Tcd. AMcD Ckd. I.V.W. Exd.	SOUTH-EASTERN FREEWAY SEC. 107. HD. ONKAPARINGA SEISMIC REFRACTION FENCE DIAGRAM.	SCALE: As SHOWN S 6301 Ha 7 DATE: 21-12-67

APPENDIX B

LOGS OF TRENCHES AND EXPLANATORY NOTES

APPENDIX B

LOGS OF TRENCHES AND EXPLANATORY NOTES

In the section of the freeway between STA.400 and the Onkaparinga River (STA.445), there are few rock exposures, and in order to determine the nature of the material underlying the topsoil, 12 trenches (TR1 to TR12) from 6 to 8.5 ft. deep were excavated using a truck mounted, "Gradell" back-hoe. The location of the trenches are shown on Figure 4 of this report and detailed logs are included in this appendix.

All trenches except TR4 exposed rock within a few feet of the ground surface and the rock type hatchings and boundaries shown on Figure 4 are based on the exposures in the trenches.

DEPARTMENT OF MINES SOUTH AUSTRALIA

TRENCH NO 1

LOG OF TRENCH (NE FACE)

PROJECT SOUTH-EASTERN FREEWAY . BRIDGEWATER-VERDUN SECTION

LOCATION NEAR STA. 420 (W-E ROAD) . SECTION 3930 HUNDRED NOARLUNGA

LANDFORM. TOP OF QUARRY

RELIEF MODERATE . Direction of fall. NE

MICRORELIEF GENTLE

DRAINAGE External . . . Internal . . . Surface Absorption .

SURFACE VEGETATION Type .

SAMPLE NUMBER	SOIL/ROCK HORIZON	R.L (Feet) DEPTH (Feet)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME. Unified Soil Classification U.S.B.R. Earth Manual 1st Ed. Rev 1963	OTHER GEOLOGICAL / PEDOLOGICAL DESCRIPTION	SOIL/ROCK STRUCTURE	WATER LEVEL	MOISTURE CONTENT	Consistency Compactness Rel. Density	SOILTEST PENETROMETER UNITS * 1 2 3 4
P8/69	RECENT SOIL COVER	1		ML	SILT SOIL, low plasticity. SANDY. Light-grey.	Sandy loam topsoil	granular	TRENCH DRY	H		
		2		CH	CLAY SOIL, high plasticity. Green-grey, red and yellow mottled.				≏ PL	F to St	
	PROTEROZOIC TORRENSIAN SERIES	3		MH or ROCK	SILT SOIL, medium to high plasticity. Sandy.	Completely weathered surface of phyllite or schist.	Bedding — cleavage is still apparent.		D	ESTIMATED - MEDIUM STRONG TO WEAK TO VERY WEAK ROCK	
		4									
		5		R O C K	ROCK, blue-grey to blackish-grey.	Rock is Mica-schist or phyllite Possibly carbonaceous in part. Bright Sheen in cleavage-bedding plane. Finely laminated.	Well developed cleavage and/or bedding. Fissile in this plane strikes 355°N.W. Dips 50°N.E. Joint Sets: ① Strike N100°E or N80°W dips 65°S.W, ② N140°W or N40°E dips 60°S.E. Joints spaced 1-6 inches apart, and coated with yellow illite.			
		6	J1 J2 J2 J1								
		7									
		8			BASE OF TRENCH 8 Ft.						

REMARKS

NOTE

Represents cleavage and/or bedding trace.

Relationships of Joint sets. (J2 J1)

* These values refer to clay soils only and provide an indication of their consistency.

CLASSIFICATION		CONSISTENCY CLAY	COMPACTNESS SILT	RELATIVE DENSITY SAND	MOISTURE CONTENT	ENGINEERING GEOLOGY SECTION
Great Soil Group	7 May 67 Water level (date)	VS — Very Soft	Ls — Loose	VL — Very Loose	H — Humid	PLANT Trencher TYPE GRADEL
Subgroup		S — Soft	MC — Moderately Compact	L — Loose	D — Damp	DRILLER
REFERENCE		F — Firm	C — Compact	MD — Medium Dense	M — Moist	START 6th FEB 69
Fuller	WC ▶ Water cut	St — Stiff	VC — Very Compact	D — Dense	W — Wet	FINISH "
Map		V. St — Very Stiff		VD — Very Dense	S — Saturated	LOGGED J. H. F.
Photo		H — Hard			LL — Liquid Limit	DATE 6th FEB 69
					PL — Plastic Limit	TRACED S.V.E.
						CHECKED

SHEET 1 OF 1 DRG No S7324 H04

PF No 1710 MB

DEPARTMENT OF MINES SOUTH AUSTRALIA

TRENCH NO 2

LOG OF TRENCH (E FACE)

PROJECT SOUTH-EASTERN FREEWAY . BRIDGEWATER-VERDUN SECTION

LOCATION NEAR STA. 424 (W-E ROAD) SECTION 331.8 HUNDRED NOARLUNGA

LANDFORM. HILLSLOPE

RELIEF MODERATE Direction of fall. E

MICRORELIEF GENTLE

DRAINAGE External Internal Surface Absorption

SURFACE VEGETATION Type

SAMPLE NUMBER	SOIL/ROCK HORIZON	R.L (Feet) / DEPTH (Feet)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME (Unified Soil Classification USBR Earth Manual 1st Ed. Rev 1963)	OTHER GEOLOGICAL / PEDOLOGICAL DESCRIPTION	SOIL/ROCK STRUCTURE	WATER LEVEL	MOISTURE CONTENT / Consistency Compactness Rel. Density	SOILTEST PENETROMETER UNITS * 1 2 3 4
	RECENT SOIL COVER	1		ML	SILT SOIL low plasticity: Sandy. Pale grey brown.	Sandy loam topsoil.	Granular	TRENCH DRY	H / MC to Ls.	
	PROTEROZOIC TORRENSIAN SERIES	2		CH and ML	CLAY SOIL, high plasticity. Red brown, contains 10% yellow SILT SOIL pockets, low plasticity, increasing to about 50% and up to 8 c.m.'s long.	SILT pockets are completely weathered SILTSTONE			≥ PL / F to St	
		3		ROCK	ROCK:- grey, red and yellow mottled and banded with up to 20% red brown highly plastic. CLAY SOIL pockets in upper part.	ROCK is highly to completely weathered siltstone or shale (CW)	Cleavage-bedding is predominant structure. Strikes:- North-South, dip 45° east		D / Weak to very weak rock	
		4				Quartz vein up to 4 cms. thick. (CW)				
		5				Red and yellow mottling and bonding is due to ferriginous staining. (HW-CW)	Fissile — splits along this plane.			
		6			BASE OF PIT 6.5Ft.					
		7							Estimated	
		8								

REMARKS NOTE Represents cleavage and/or bedding trace

* These values refer to clay soils only and provide an indication of their consistency.

CLASSIFICATION		CONSISTENCY (CLAY)	COMPACTNESS (SILT)	RELATIVE DENSITY (SAND)	MOISTURE CONTENT	ENGINEERING GEOLOGY SECTION
Great Soil Group	Water level (date) 7 May 67	VS — Very Soft	Ls — Loose	VL — Very Loose	H — Humid	PLANT Trenchar TYPE GRADEL
Subgroup	WC ▷ Water cut	S — Soft	MC — Moderately Compact	L — Loose	D — Damp	DRILLER START 6th FEB 69 FINISH
REFERENCE		F — Firm	C — Compact	MD — Medium Dense	M — Moist	LOGGED J H F
Fuller		St — Stiff	VC — Very Compact	D — Dense	W — Wet	DATE 6th FEB '69
Map		V. St — Very Stiff		VD — Very Dense	S — Saturated	TRACED S.V.E.
Pin no		H — Hard			LL — Liquid Limit	CHECKED
					PL — Plastic Limit	SHEET 1 OF 1. DRG No S 7325 Hag

FT N° 6110 RD

DEPARTMENT OF MINES SOUTH AUSTRALIA

TRENCH NO 3

LOG OF TRENCH (NE FACE)

PROJECT SOUTH-EASTERN FREEWAY . BRIDGEWATER - VERDUN SECTION

LOCATION NEAR STA. 426 (E-W ROAD) . SECTION 3318 HUNDRED NOARLUNGA

LANDFORM. HILLSLOPE

RELIEF MODERATE Direction of fall S.W

MICRORELIEF GENTLE

DRAINAGE External . Internal . Surface Absorption .

SURFACE VEGETATION Type .

SAMPLE NUMBER	SOIL/ROCK HORIZON	R.L (Feet) DEPTH (Feet)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification USBR Earth Manual 1st Ed. Rev 1963	OTHER GEOLOGICAL / PEDOLOGICAL DESCRIPTION	SOIL/ROCK STRUCTURE	WATER LEVEL	MOISTURE CONTENT	Consistency Compactness Rel. Density	"SOILTEST" PENETROMETER UNITS * 1 2 3 4
	RECENT SOIL COVER	1		ML	SILT SOIL, low plasticity. Sandy. Pale brown.	Sandy loam	Granular	TRENCH DRY	H	Ls.	
				CH	CLAY SOIL. high plasticity. Red brown contains numerous silty pockets (yellow) up to 2cm. size.				≥PL	F/St	
	PROTEROZOIC TORRENSIAN SERIES	2		R O C K and CH	ROCK - yellow brown grey and red brown with numerous CLAY and SILT SOIL laminae throughout.	Rock is SILTSTONE or SHALE, highly and completely weathered. to CLAY and SILT SOIL in part.	Very fissile along well developed cleavage and/or bedding plane Strike N10°E Dip 30°S.E.		D	Weak to very weak rock	
		3			← Dark blue grey band	← Probably carbonaceous schist.					
		4									
		5									
		6			BASE OF TRENCH 6 Ft.					Estimated.....	
		7									
		8									

REMARKS NOTE Represents cleavage and/or bedding trace

* These values refer to clay soils only and provide an indication of their consistency.

CLASSIFICATION		CONSISTENCY (CLAY)	COMPACTNESS (SILT)	RELATIVE DENSITY (SAND)	MOISTURE CONTENT	ENGINEERING GEOLOGY SECTION
Great Soil Group .	Water level (date) 7 May 67	VS — Very Soft	Ls — Loose	VL — Very Loose	H — Humid	PLANT TYPE Trencher GRADEL
Subgroup .	WC ▶ Water cut	S — Soft	MC — Moderately Compact	L — Loose	D — Damp	DRILLER .
REFERENCE		F — Firm	C — Compact	MD — Medium Dense	M — Moist	START 6th FEB '69
Fuller .		St — Stiff	VC — Very Compact	D — Dense	W — Wet	FINISH .
Map .		V. St — Very Stiff		VD — Very Dense	S — Saturated	LOGGED J. H. F.
Photo .		H — Hard			LL — Liquid Limit	DATE 6th FEB '69
					PL — Plastic Limit	TRACED S. V. E.
						CHECKED .
						SHEET 1 OF 1
						DRG No S7326 H99

PF 119 6110 NB

DEPARTMENT OF MINES SOUTH AUSTRALIA

TRENCH NO 4

LOG OF TRENCH (NE FALL)

SOUTH-EASTERN FREEWAY

PROJECT BRIDGEWATER – VERDUN SECTION

LOCATION NEAR STN. 435 (E-W ROAD) SECTION 3814 OR 3318 HUNDRED NOARLUNGA

LANDFORM EDGE OF RIVER ONKAPARINGA FLATS

RELIEF GENTLE Direction of fall. SE

MICRORELIEF V. GENTLE

DRAINAGE External Internal Surface Absorption

SURFACE VEGETATION Type

SAMPLE NUMBER	SOIL/ROCK HORIZON	R.L. (Feet) DEPTH (Feet)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification U.S.B.R. Earth Manual 1st Ed. Rev 1963	OTHER GEOLOGICAL / PEDOLOGICAL DESCRIPTION	SOIL / ROCK STRUCTURE	WATER LEVEL	MOISTURE CONTENT	Consistency Compactness Rel. Density	SOILTEST PENETROMETER UNITS * 1 2 3 4
	RECENT SOIL COVER	1		ML	SILT SOIL, low plasticity. Grey.	Sandy loam		TRENCH DRY	H	Ls	
				ML	SILT SOIL, low plasticity. Pale brown.	Numerous root fragments up to 6 inches diameter.	Granular				
	RECENT RIVER ONKAPARINGA ALLUVIUM	2		CH MH	CLAY SOIL, high plasticity. Silty and sandy in upper part.	Alluvium			PL	F	
		3		CH	Green-grey or grey, red and yellow mottled.						
		4									
		5									
		6			← End of mottling.						
		7								Estimated ...	
		8									

REMARKS

BASE OF TRENCH 8·5 FT.

* These values refer to clay soils only and provide an indication of their consistency.

CLASSIFICATION		CONSISTENCY (CLAY)	COMPACTNESS (SILT)	RELATIVE DENSITY (SAND)	MOISTURE CONTENT	ENGINEERING GEOLOGY SECTION
Great Soil Group	Water level (date) 7 May 67	VS — Very Soft	Ls — Loose	VL — Very Loose	H — Humid	PLANT TRENCHER
Subgroup	WC ▶ Water cut	S — Soft	MC — Moderately Compact	L — Loose	D — Damp	TYPE GRADELL
REFERENCE		F — Firm	C — Compact	MD — Medium Dense	M — Moist	DRILLER
Fuller		St — Stiff	VC — Very Compact	D — Dense	W — Wet	START 6 Feb '69
Map		V. St — Very Stiff		VD — Very Dense	S — Saturated	FINISH " "
Para		H — Hard			LL — Liquid Limit	SHEET 1 OF 1
					PL — Plastic Limit	

LOGGED J.H.F

DATE 6 Feb '69

TRACED AMcD

CHECKED L.V.W.

DRG No. S 7158 Ha 9

F.T. No 6710 188

DEPARTMENT OF MINES · SOUTH AUSTRALIA

TRENCH NO 5

LOG OF TRENCH (E FACE)

SOUTH-EASTERN FREEWAY

PROJECT BRIDGEWATER – VERDUN SECTION

LOCATION NEAR STN 434 (W-E ROAD) SECTION 3318 HUNDRED NOARLUNGA

LANDFORM. ON HILLSLOPE

RELIEF MODERATE Direction of fall. S.E

MICRORELIEF VERY GENTLE

DRAINAGE External Internal Surface Absorption

SURFACE VEGETATION Type

SAMPLE NUMBER	SOIL/ROCK HORIZON	R.L (Feet) DEPTH (Feet)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification USBR Earth Manual 1st Ed. Rev 1963	OTHER GEOLOGICAL / PEDOLOGICAL DESCRIPTION	SOIL / ROCK STRUCTURE	WATER LEVEL	MOISTURE CONTENT	Consistency Compactness Rel. Density	*SOILTEST PENETROMETER UNITS * 1 2 3 4
	RECENT SOIL COVER	1		ML	SILT SOIL, low plasticity. Pale brown.	Numerous root fragments	Granular	TRENCH DRY	≤ PL	st	
		2		CH	CLAY SOIL, high plasticity, containing yellow patches of rock (est. 20%) Red brown.	Rock patches are highly weathered shale-(siltstone)					
	PROTEROZOIC TORRENSIAN SERIES	3		ROCK AND CH	ROCK: Pink, brown and yellow banded with some red brown highly plastic clay soil in pockets. (up to 20%)	Highly weathered to completely weathered shale.	Very fissile. Well developed cleavage and/or bedding Strike N10°W Dip 30°NE				
		4			Red and yellow stained bands.	Highly weathered shale. Staining is due to Iron.	Fissile.				
		5								weak to very weak rock.	
		6			BASE OF TRENCH 6FT						
		7								Estimated ...	
		8									

REMARKS

NOTE: Represents Cleavage trace and/or bedding trace.

* These values refer to clay soils only and provide an indication of their consistency.

CLASSIFICATION		CONSISTENCY CLAY	COMPACTNESS SILT	RELATIVE DENSITY SAND	MOISTURE CONTENT	ENGINEERING GEOLOGY SECTION
Great Soil Group	Water level (date) 7 May 67	VS — Very Soft	Ls — Loose	VL — Very Loose	H — Humid	PLANT TRENCHER LOGGED J.H.F.
Subgroup	WC ▶ Water cut	S — Soft	MC — Moderately Compact	L — Loose	D — Damp	TYPE GRADELL DATE 6 Feb '69
REFERENCE		F — Firm	C — Compact	MD — Medium Dense	M — Moist	DRILLER TRACED AMcD
Fuller		St — Stiff	VC — Very Compact	D — Dense	W — Wet	START 6 Feb '68 CHECKED L.V.W.
Map		V. St — Very Stiff		VD — Very Dense	S — Saturated	FINISH
Photo		H — Hard			LL — Liquid Limit	SHEET 1 OF 1 DRG No. S 7159 Ha9
					PL — Plastic Limit	

PF N° 6110 MB

DEPARTMENT OF MINES SOUTH AUSTRALIA

TRENCH NO 6

LOG OF TRENCH (E FACE)

SOUTH-EASTERN FREEWAY

PROJECT BRIDGEWATER – VERDUN SECTION

LOCATION NEAR STN. 417 (W-E ROAD) SECTION 82 HUNDRED NOARLUNGA

LANDFORM. HILLSLOPE, ON 100FT WIDE MOUND

RELIEF MODERATE Direction of fall. NE

MICRORELIEF GENTLE

DRAINAGE External Internal Surface Absorption

SURFACE VEGETATION Type

SAMPLE NUMBER	SOIL/ROCK HORIZON	R.L (Feet) DEPTH (Feet)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification U.S.B.R Earth Manual 1st Ed. Rev 1963	OTHER GEOLOGICAL PEDOLOGICAL } DESCRIPTION	SOIL / ROCK STRUCTURE	WATER LEVEL	MOISTURE CONTENT	Consistency Compactness Rel Density	SOILTEST PENETROMETER UNITS * 1 2 3 4
	TOPSOIL	1		ML	SILT SOIL, low plasticity. Sandy. Grey-brown.	Sandy loam			H	MC to Ls	
	RECENT SLOPEWASH DEPOSIT	2		SC SM	SAND, excess fines (est 20%) Yellow brown, red mottled in lower part. Fine grained.	Sand is quartz				D	
				GW	GRAVEL, well graded in sandy matrix. Est. up to 30% sand. Yellow brown with pink-brown and white gravel fragments	Gravel fragments are ferruginous quartzite quartz, and sandstone, up to 6cm. size and are angular			D	D MD	
		3		CH	CLAY SOIL, high plasticity. Est 30% fine grained sand. Yellow brown, pink-red mottled.	"Slopewash" Deposit Possibly result of landslide					
		4		CH	CLAY SOIL, high plasticity khaki.			TRENCH DRY	≥PL to >PL	F to S	
		5									
		6									
		7								Estimated ...	
		8									

REMARKS

BASE OF TRENCH 8FT

* These values refer to clay soils only and provide an indication of their consistency.

CLASSIFICATION	CONSISTENCY CLAY	COMPACTNESS SILT	RELATIVE DENSITY SAND	MOISTURE CONTENT	ENGINEERING GEOLOGY SECTION
Great Soil Group	VS — Very Soft	Ls — Loose	VL — Very Loose	H — Humid	PLANT TRENCHER
Subgroup	S — Soft	MC — Moderately Compact	L — Loose	D — Damp	TYPE GRADELL
REFERENCE	F — Firm	C — Compact	MD — Medium Dense	M — Moist	DRILLER
Fuller	St — Stiff	VC — Very Compact	D — Dense	W — Wet	START 7 Feb 69
Map	V. St — Very Stiff		VD — Very Dense	S — Saturated	FINISH
Photo	H — Hard			LL — Liquid Limit	LOGGED J.H.F
Water level (date) 7 May 69				PL — Plastic Limit	DATE 7 Feb 69
WE					TRACED AMcD
Water Ext					CHECKED L.V.W.
					SHEET 1 OF 1 DRG No S 7160 Hag

PF N° 6110 MB

DEPARTMENT OF MINES SOUTH AUSTRALIA

TRENCH NO 7

SOUTH-EASTERN FREEWAY LOG OF TRENCH (NE FACE)

PROJECT BRIDGWATER-VERDUN SECTION

LOCATION NEAR STN 418 (W-E ROAD) SECTION 82 HUNDRED NOARLUNGA

LANDFORM. HILLSLOPE

RELIEF MODERATE Direction of fall. N.E

MICRORELIEF GENTLE

DRAINAGE External Internal Surface Absorption

SURFACE VEGETATION Type

SAMPLE NUMBER	SOIL/ROCK HORIZON	R.L. (Feet) DEPTH (Feet)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification U.S.B.R. Earth Manual 1st Ed. Rev 1963	OTHER GEOLOGICAL / PEDOLOGICAL DESCRIPTION	SOIL/ROCK STRUCTURE	WATER LEVEL	MOISTURE CONTENT	Consistency, Compactness, Rel. Density	SOILTEST PENETROMETER UNITS * 1 2 3 4
	RECENT SOIL COVER	0		ML	SILT SOIL, low plasticity. Grey.	Sandy loam Contains numerous roots		TRENCH DRY	Ls		
		1		SC SM	SAND, excess fines (est. 20%). Fine grained. Pale grey brown.	Sand is quartz			MD		
		2		CH	CLAY SOIL, high plasticity. Green grey, red and yellow mottled.				A PL	F	
	PROTEROZOIC TORRENSIAN SERIES	3		MH OR ROCK	SILT SOIL, medium to high plasticity. Contains patches of original HW rock. Grey yellow mottling predominant. Some red mottling also.	Completely weathered surface of phyllite or schist.	Original cleavage and/or bedding of rock is distinguish-able.			C	
		4									
		5		ROCK	Light grey yellow stained. Few dark grey bands.	Rock is phyllite or mica schist Bright sheen on cleavage planes.	Bedding and/or cleavage pre-dominant Strike N 5° E Dip 48° SE Jointed at base Joint Strike N 50° E Dip 48° NW		D	Very weak rock	
		6									
		7				Dark grey bands may be Carbonac-eous and are stronger than the surround ing phyllite.					
		8									

REMARKS

BASE OF TRENCH 8FT.

NOTE: Represents cleavage and/or bedding trace

* These values refer to clay soils only and provide an indication of their consistency.

CLASSIFICATION		CONSISTENCY CLAY	COMPACTNESS SILT	RELATIVE DENSITY SAND	MOISTURE CONTENT	ENGINEERING GEOLOGY SECTION
Great Soil Group	Water level (date) 7 May 67	VS — Very Soft	Ls — Loose	VL — Very Loose	H — Humid	PLANT TRENCHER LOGGED J. H. F
Subgroup	WC Water cut	S — Soft	MC — Moderately Compact	L — Loose	D — Damp	TYPE GRADELL DATE 6 Feb '69
REFERENCE		F — Firm	C — Compact	MD — Medium Dense	M — Moist	DRILLER TRACED AMcD
Fuller		St — Stiff	VC — Very Compact	D — Dense	W — Wet	START 6 Feb '69 CHECKED L.V.W.
Map		V. St — Very Stiff		VD — Very Dense	S — Saturated	FINISH " "
Photo		H — Hard			LL — Liquid Limit	SHEET 1 OF 1 DRG No. S 7161 Ho9
					PL — Plastic Limit	

PF N° 6110 MB

DEPARTMENT OF MINES SOUTH AUSTRALIA

TRENCH NO 8

LOG OF TRENCH (NE FACE)

PROJECT SOUTH-EASTERN FREEWAY BRIDGEWATER-VERDUN SECTION

LOCATION STN. 415 (W-E ROAD) SECTION 82 HUNDRED NOARLUNGA

LANDFORM. HILLSLOPE

RELIEF MODERATE Direction of fall. N E

MICRORELIEF GENTLE

DRAINAGE External Internal Surface Absorption

SURFACE VEGETATION Type

SAMPLE NUMBER	SOIL/ROCK HORIZON	R.L. (Feet) DEPTH (Feet)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification U.S.B.R. Earth Manual 1st Ed. Rev 1963	OTHER GEOLOGICAL PEDOLOGICAL DESCRIPTION	SOIL/ROCK STRUCTURE	WATER LEVEL	MOISTURE CONTENT	Consistency Compactness Rel. Density	"SOILTEST" PENETROMETER UNITS * 1 2 3 4
	RECENT SOIL COVER	0		ML	SILT SOIL, low plasticity. Grey brown.	Sandy loam. Numerous root fragments		TRENCH DRY	H	V Ls	
		1		SC SM	SAND, excess silt and clay fines (est. 20%). Pale brown. Est 15% GRAVEL at base.	Gravel fragments are sandstone and siltstone up to 4 cm. size.				L	
		2		MH-CH	SILT SOIL, high plasticity. Red brown, yellow mottled.				D	C	
	PROTEROZOIC TORRENSIAN SERIES	3									
		4		MH to ROCK	SILT SOIL, medium plasticity. Yellow brown, red and grey mottled. Contains numerous lumps of rock material.	SILT is completely weathered siltstone fragments.	Remnant cleavage and/or bedding still visable			Mainly weak to very weak	
		5									
		6		ROCK AND MH	ROCK; light grey red and yellow banded. Contains numerous patches of SILT SOIL, medium plasticity (est. up to 40%)	Highly to completely weathered finely laminated siltstone. Weak to very weak with few patches of medium strong rock at base of trench.	Bedding is the dominant structure Strike N145°W Dip 25°SE				
		7									
		8									

REMARKS BASE OF TRENCH 8FT

NOTE: Represents trace of bedding.

* These values refer to clay soils only and provide an indication of their consistency.

CLASSIFICATION		CONSISTENCY CLAY	COMPACTNESS SILT	RELATIVE DENSITY SAND	MOISTURE CONTENT	ENGINEERING GEOLOGY SECTION
Great Soil Group	Water level (date) 7 May 67	VS — Very Soft	Ls — Loose	VL — Very Loose	H — Humid	PLANT TRENCHER LOGGED J.H.F.
Subgroup	WC ▶	S — Soft	MC — Moderately Compact	L — Loose	D — Damp	TYPE GRADELL DATE 6.Feb'69
REFERENCE	Water cut	F — Firm	C — Compact	MD — Medium Dense	M — Moist	DRILLER TRACED AMcD
Fuller		St — Stiff	VC — Very Compact	D — Dense	W — Wet	START 6 Feb'69 CHECKED. L.V.W.
Map		V. St — Very Stiff		VD — Very Dense	S — Saturated	FINISH " "
Photo		H — Hard			LL — Liquid Limit	SHEET 1 OF 1 DRG No S 7162 Ha9
					PL — Plastic Limit	

PF N° GHO 146

DEPARTMENT OF MINES SOUTH AUSTRALIA

TRENCH NO. 9

LOG OF TRENCH (N.E. Face)

PROJECT SOUTH-EASTERN FREEWAY BRIDGEWATER-VERDUN SECTION

LOCATION NEAR STN. 413 (W-E ROAD) SECTION 82 HUNDRED NOARLUNGA

LANDFORM. HILLSLOPE

RELIEF MODERATE Direction of fall. E

MICRORELIEF GENTLE

DRAINAGE External Internal Surface Absorption

SURFACE VEGETATION Type

SAMPLE NUMBER	SOIL/ROCK HORIZON	R.L (Feet) DEPTH (Feet)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification U.S.B.R. Earth Manual 1st Ed. Rev 1963	OTHER GEOLOGICAL / PEDOLOGICAL DESCRIPTION	SOIL/ROCK STRUCTURE	WATER LEVEL	MOISTURE CONTENT	Consistency Compactness Rel. Density	SOILTEST PENETROMETER UNITS * 1 2 3 4
	RECENT SOIL COVER	1		ML	SILT SOIL, low plasticity. Contains 10-20% sand and gravel throughout.	Gravel is mainly sandstone fragments up to 5 cm size. Sandy loam with numerous root fragments.	Granular	Trench Dry	H	LS	
		2		SC-SM	SAND, excess fines (est. 40%) Pale brown. Fine grained.					MD	
				GW	GRAVEL, well graded in sand matrix. Est. 40% SAND Light brown.	Gravel is angular. Sandstone and quartzite fragments up to 8 cm. size.					
		3		MH-SM	SILT SOIL, medium plasticity sandy. Est. up to 50% fine grained sand increasing with depth. Yellow green and red mottled.		Bedding is dominant structure and dips to the SE Some red-brown clay infill along irregular joints.		D	v. weak	
	PROTEROZOIC TORRENSIAN SERIES ALDGATE SANDSTONE	4		ROCK or SP	ROCK offwhite to pale grey, red and yellow banded Weathered to SAND, SILT mixture. In part, SAND is poorly graded with little or no fines and is fine grained.	Banding reflects the bedding. Rock is SANDSTONE weakly cemented and very crumbly				weak	
		5									
		6									
		7									
		8									

REMARKS

Bedding trace in the Sandstone

Irregular Joints.

* These values refer to clay soils only and provide an indication of their consistency.

CLASSIFICATION		CONSISTENCY (CLAY)	COMPACTNESS (SILT)	RELATIVE DENSITY (SAND)	MOISTURE CONTENT	ENGINEERING GEOLOGY SECTION
Great Soil Group	Water level (date) 7 May 67	VS — Very Soft	Ls — Loose	VL — Very Loose	H — Humid	PLANT TRENCHER
Subgroup	WC ✕	S — Soft	MC — Moderately Compact	L — Loose	D — Damp	TYPE GRADELL
REFERENCE	Water cut	F — Firm	C — Compact	MD — Medium Dense	M — Moist	DRILLER
Fuller		St — Stiff	VC — Very Compact	D — Dense	W — Wet	START 7 FEB '69
Map		V. St — Very Stiff		VD — Very Dense	S — Saturated	FINISH " " "
Photo		H — Hard			LL — Liquid Limit	LOGGED J.H.F.
					PL — Plastic Limit	DATE 7. FEB. '69
						TRACED R.A.J.
						CHECKED E.B.T.
						SHEET 1 OF 1
						DRG No S7166 Ha9

PF N° 6110 MB

DEPARTMENT OF MINES SOUTH AUSTRALIA

TRENCH NO 10

LOG OF TRENCH (N.E. face)

PROJECT SOUTH EASTERN FREEWAY BRIDGEWATER – VERDUN SECTION.

LOCATION NEAR STN. 409 (E-W ROAD) SECTION 82 HUNDRED NOARLUNGA

LANDFORM. HILLSLOPE

RELIEF MODERATE Direction of fall. N.W.

MICRORELIEF GENTLE

DRAINAGE External Internal Surface Absorption

SURFACE VEGETATION Type

SAMPLE NUMBER	SOIL/ROCK HORIZON	R.L. (Feet) DEPTH (Feet)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification U.S.B.R. Earth Manual 1st Ed. Rev 1963	OTHER GEOLOGICAL / PEDOLOGICAL DESCRIPTION	SOIL / ROCK STRUCTURE	WATER LEVEL	MOISTURE CONTENT	Consistency Compactness Rel. Density	SOILTEST PENETROMETER UNITS * 1 2 3 4
	RECENT SOIL COVER	1		ML	SILT SOIL, low plasticity. Brown to pale brown.			Trench Dry	H	Ls	
				ML	SILT SOIL, low plasticity. Light brown. Sandy (est. up to 30%)					Ls	
		2		MH to ROCK	SILT SOIL, high plasticity, very sandy, containing lumps of ROCK throughout. Yellowish-green, red-brown mottled.	SILT and SAND is the product of complete weathering of SANDSTONE. Remnant bonding visible at depth.			D	C	
	PROTEROZOIC TORRENSIAN SERIES – ALDGATE SANDSTONE	3		ROCK	ROCK, pale grey, red-brown and yellow banded. Weathered to SAND, very fine grained in part, no fines.	ROCK is SANDSTONE, weakly cemented.	Some red-brown clay infills irregular joints. Bedding is the dominant structure. Dips E. Numerous flexures are apparent in the SANDSTONE			Weak to v. weak	
		4									
		5			← Strong band	← Strong quartzite band up to 8" thick.					
		6									
		7									
		8									

REMARKS

Bedding trace

Clay infilled irregular joints.

* These values refer to clay soils only and provide an indication of their consistency.

CLASSIFICATION		CONSISTENCY (CLAY)	COMPACTNESS (SILT)	RELATIVE DENSITY (SAND)	MOISTURE CONTENT	ENGINEERING GEOLOGY SECTION
Great Soil Group	Water level (date) 7 May 67	VS — Very Soft	Ls — Loose	VL — Very Loose	H — Humid	PLANT TRENCHER
Subgroup	WC Water cut	S — Soft	MC — Moderately Compact	L — Loose	D — Damp	TYPE GRADELL
REFERENCE		F — Firm	C — Compact	MD — Medium Dense	M — Moist	DRILLER
Fuller		St — Stiff	VC — Very Compact	D — Dense	W — Wet	START 7 FEB. '69
Map		V. St — Very Stiff		VD — Very Dense	S — Saturated	FINISH
Photo		H — Hard			LL — Liquid Limit	LOGGED J.H.F.
					PL — Plastic Limit	DATE 7 FEB. '69
						TRACED R.A.J.
						CHECKED E.B.T.

SHEET 1 OF 1 DRG No S7167 Ha9

PF N° 6110 MB

DEPARTMENT OF MINES SOUTH AUSTRALIA

TRENCH NO 11

LOG OF TRENCH (N.E. face)

PROJECT SOUTH EASTERN FREEWAY . BRIDGEWATER - VERDUN SECTION

LOCATION NEAR STN. 409 (W.-E. ROAD.) SECTION 82 HUNDRED NOARLUNGA

LANDFORM. HILLSLOPE

RELIEF MODERATE Direction of fall W

MICRORELIEF GENTLE

DRAINAGE External Internal Surface Absorption

SURFACE VEGETATION Type

SAMPLE NUMBER	SOIL/ROCK HORIZON	R.L (Feet) DEPTH (Feet)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification U.S.B.R · Earth Manual 1st Ed. Rev 1963	OTHER GEOLOGICAL PEDOLOGICAL DESCRIPTION	SOIL/ROCK STRUCTURE	WATER LEVEL	MOISTURE CONTENT	Consistency Compactness Rel. Density	SOILTEST PENETROMETER UNITS * 1 2 3 4
P11/69	RECENT SOIL COVER	1		ML	SILT SOIL, low plasticity. Grey brown.			trench dry	H	Ls	
				SC-SM	SAND, excess fines (est. 40%) and GRAVEL (est. 10%) Fine grained. Pale brown.	Gravel is angular sandstone, fragments up to 4 cm. size.					
	PROTEROZOIC TORRENSIAN SERIES - ALDGATE SANDSTONE	2		SP and ROCK	ROCK is yellow brown, red and white mottled. This occurs as lumps within SAND, no fines, medium to coarse grained Contains about 5% red-brown highly plastic CLAY SOIL patches up to 10 cm. diam. throughout	Rock is SANDSTONE, completely weathered in part to quartz SAND White mottled patches represent instained feldspathic sandstone Very weakly cemented	Bedding is the dominant structure and dips at 20-40° S.E.		D	weak to very weak rock	
		3									
		4									
		5									
		6			Few lumps of medium strong sandstone at depth	Remnant bedding visible at depth.					
		7									
		8									

REMARKS

Base of trench 8·5 ft.

Bedding trace.

* These values refer to clay soils only and provide an indication of their consistency.

CLASSIFICATION		CONSISTENCY CLAY	COMPACTNESS SILT	RELATIVE DENSITY SAND	MOISTURE CONTENT	ENGINEERING GEOLOGY SECTION
Great Soil Group	Water level (date) 7 May 67	VS — Very Soft	Ls — Loose	VL — Very Loose	H — Humid	PLANT TRENCHER
Subgroup	WC ▶	S — Soft	MC — Moderately Compact	L — Loose	D — Damp	TYPE GRADELL
REFERENCE	Water cut	F — Firm	C — Compact	MD — Medium Dense	M — Moist	DRILLER
Fuller		St — Stiff	VC — Very Compact	D — Dense	W — Wet	START 7 FEB. 69
Map		V. St — Very Stiff		VD — Very Dense.	S — Saturated	FINISH " " "
Photo		H — Hard			LL — Liquid Limit	LOGGED J.H.F.
					PL — Plastic Limit	DATE 7 FEB. 69
						TRACED R.A.J.
						CHECKED E.B.T.

SHEET 1 OF 1 DRG No. S7168 Ha9

FF N° 6110 145

DEPARTMENT OF MINES SOUTH AUSTRALIA

LOG OF TRENCH

TRENCH NO 12

PROJECT SOUTH EASTERN FREEWAY BRIDGEWATER – VERDUN SECTION.

LOCATION NEAR STN. 405 (W-E ROAD) SECTION 82 HUNDRED NOARLUNGA

LANDFORM. CREST OF RIDGE

RELIEF MODERATE Direction of fall N.E.

MICRORELIEF GENTLE

DRAINAGE External Internal Surface Absorption

SURFACE VEGETATION Type

SAMPLE NUMBER	SOIL/ROCK HORIZON	R.L. (Feet) DEPTH (Feet)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification U.S.B.R Earth Manual 1st Ed. Rev 1963	OTHER GEOLOGICAL PEDOLOGICAL DESCRIPTION	SOIL/ROCK STRUCTURE	WATER LEVEL	MOISTURE CONTENT	Consistency Compactness Rel. Density	SOILTEST PENETROMETER UNITS * 1 2 3 4
	RECENT SOIL COVER	1		ML	SILT SOIL, low plasticity sandy grey.			TRENCH DRY	H	LS	
				SC-SM	SAND, excess fines (est. up to 30%) Fine grained light brown	SAND is quartz				D	
	PROTEROZOIC TORRENSIAN SERIES ALDGATE SANDSTONE	2		SP to ROCK	SAND no fines, coarse grained containing lumps of rock. Yellow brown to orange.	SAND is completely weathered SANDSTONE, lumps are weakly cemented highly weathered SANDSTONE.	Bedding dips E		D	Weak to very weak	
		3				Bedding barely visible at depth.					
		4									
		5									
		6			Base of Trench 6 ft.					Estimated	
		7									
		8									

REMARKS

NOTE ⁘ Represents trace of bedding

* These values refer to clay soils only and provide an indication of their consistency.

CLASSIFICATION		CONSISTENCY CLAY	COMPACTNESS SILT	RELATIVE DENSITY SAND	MOISTURE CONTENT	ENGINEERING GEOLOGY SECTION
Great Soil Group	Water level (date) 7 May 67	VS — Very Soft	Ls — Loose	VL — Very Loose	H — Humid	PLANT TRENCHER
Subgroup	WC Water cut	S — Soft	MC — Moderately Compact	L — Loose	D — Damp	TYPE GRADELL
REFERENCE		F — Firm	C — Compact	MD — Medium Dense	M — Moist	DRILLER
Fuller		St — Stiff	VC — Very Compact	D — Dense	W — Wet	START 7 FEB. '69
Map		V. St — Very Stiff		VD — Very Dense	S — Saturated	FINISH
		H — Hard			LL — Liquid Limit	LOGGED J.H.F.
					PL — Plastic Limit	DATE 7. FEB. '69
						TRACED R.A.J.
						CHECKED L.V.W.
						SHEET 1 OF 1 DRG No. S7169 Ha 9

APPENDIX C

PETROGRAPHIC DESCRIPTION OF ROCK SAMPLES

by

Australian Mineral Development
Laboratories

APPENDIX C

PETROGRAPHIC DESCRIPTION OF ROCK SAMPLES

Four rock samples, representative of exposures along the freeway, were submitted to the Australian Mineral Development Laboratories for a petrographic analysis. A microscopic examination of thin sections cut from the samples was carried out, and results are contained in this appendix.

Sample: P8/69: TR1: TS.22732

Location:
Verdun area.

Rock Name:
Argillite

Hand Specimen:

A light olive grey (5Y 7/1), slightly foliated argillite.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	35-50
Feldspar	10-25
Muscovite	2
Sericite	15
Other clay	20
Opaques (?carbonaceous)	2
Iron oxides	1
Tourmaline	Trace

The rock consists of scattered small clastic quartz and feldspar grains and muscovite flakes in a fine-grained recrystallised sericite-rich matrix.

The grain size of the quartz and feldspar (microline chiefly) is 0.01 to 0.1 mm and muscovite is commonly up to 0.2 mm or more long. Iron oxides occur in small concentrations about 1 mm across, sparsely scattered through the rock. The amount of feldspar present in the rock is difficult to determine because of the fine grain size and the similarity to quartz. What there is is apparently all detrital.

The sericite and mica show a marked alignment, part of which is sedimentary and related to an irregularly lenticular compositional layering and part of which is a tectonically produced cleavage. A little of the quartz has recrystallised and forms small "spots" only a little larger than the grain size of the rock, consisting of quartz mosaics. No other metamorphic effects are apparent.

Sample: P10/69: TS 22734

Location:

Near top of Germantown Hill, just east of Verdun.

Rock Name:

Protoquartzite

Hand Specimen:

A yellowish grey (5Y8/1) massive quartzite with small flecks of white clay.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	90
Muscovite	Trace
Tourmaline	Trace
Clay	10
Sericite	Trace

The rock is an even-grained granular aggregate of quartz between 0.15 to 0.5 mm, the texture still largely reflecting that of the original sandstone. Cementation has been effected by pressure solution and secondary overgrowths, and as a result of the fairly intensive action of these processes the intergranular boundaries are now very complex and sutured. In a few instances the original grain shape can be seen picked out by a layer of dust-like inclusions; these show that most of the grains were subrounded or rounded. Much of the quartz is severely strained with undulose extinction. Muscovite flakes and blue-green tourmaline occur as detrital grains in trace amount, and also as small inclusions within a few of the quartz grains. The clay occurs as granular aggregates similar in size to the quartz grains. Sericite, where it occurs, generally lines the clay-filled pores, and also shows a tendency to be aligned throughout the rock, showing that this rock may have undergone incipient to low-grade metamorphism, like the nearby argillites.

Sample: P9/69: TS 22733

Location:

Southeast of Verdun near base of Aldgate sandstone

Rock Name:

Ferruginous orthoquartzite or sandy ironstone

Hand Specimen:

A brownish-grey (5YR 4/1), massive, coarse ferruginous sandstone.

Thin Section:

An optical estimate of the constituents gives the following:

		%
Framework :	Quartz	60
Cement :	Goethite	40

The rock has an irregularly granular texture consisting mainly of grains of undulose quartz with intergranular opaque material.

The quartz has a grain size of 0.3 to 1.0 mm, and though the grain shapes have been apparently modified by secondary overgrowths and corrosion since deposition, it appears that they were subrounded to well rounded. Many of the quartz grains show considerable strain, and many have been affected by pressure solution. The goethite cement occupies nearly all interstices, though a little pore space remains in various parts of the specimen. The cement has penetrated the quartz grains along irregular veins, and in some of the grains has picked out the original grain boundaries.

The impression is gained from examination of the thin section that some of the quartz has been mobilised by pressure solution, and that a further amount may have been mobilised as a result of the corrosion by the goethite.

Sample: P11/69: TR11: TS 22735

Location:

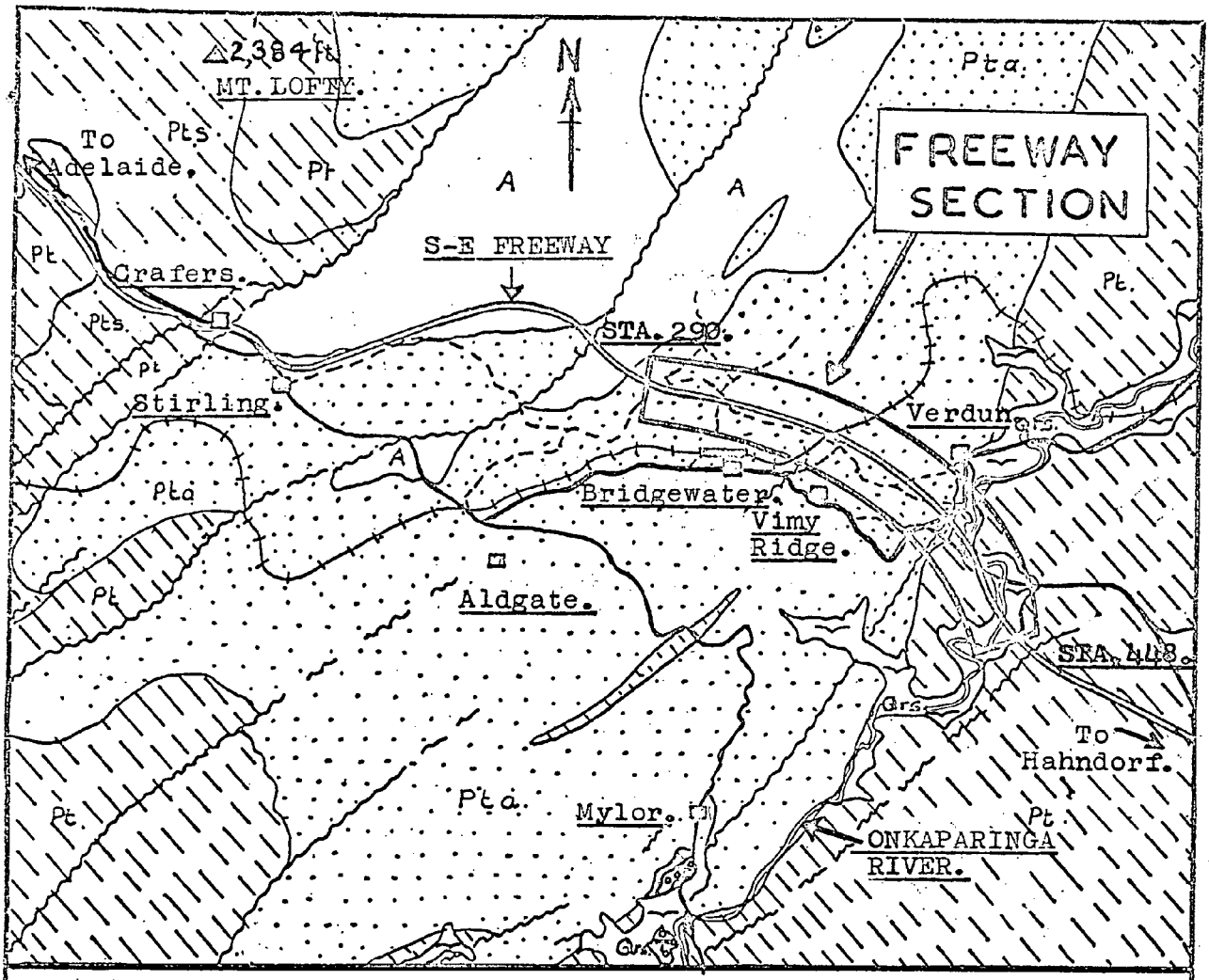
At 8 ft. depth in trench near P9/69.

Rock Name:

Argillaceous orthoquartzite

Hand Specimen:

A pale yellowish-orange (10YR 8/4), very friable sandstone.



L E G E N D.

RECENT.

Qrs. — Alluvial flood plain deposit.

TERTIARY.

T — Freshwater gravels and sandstones.

Faults

Roads

Railway

Freeway Route.

PROTEROZOIC
ADELAIDE SYSTEM
Torrensian Series.

Pts. — Stonyfell Quartzite.

Pt. — Phyllites immediately overlying Aldgate Sandstone. Carbonaceous in part.

Pta. — Aldgate Sandstone- Principally sandstone, with quartzite and sandy and silty shale interbeds.

ARCHEAN.

A. — Schists, schistose phyllites, and schistose gneises.

FIG. 1

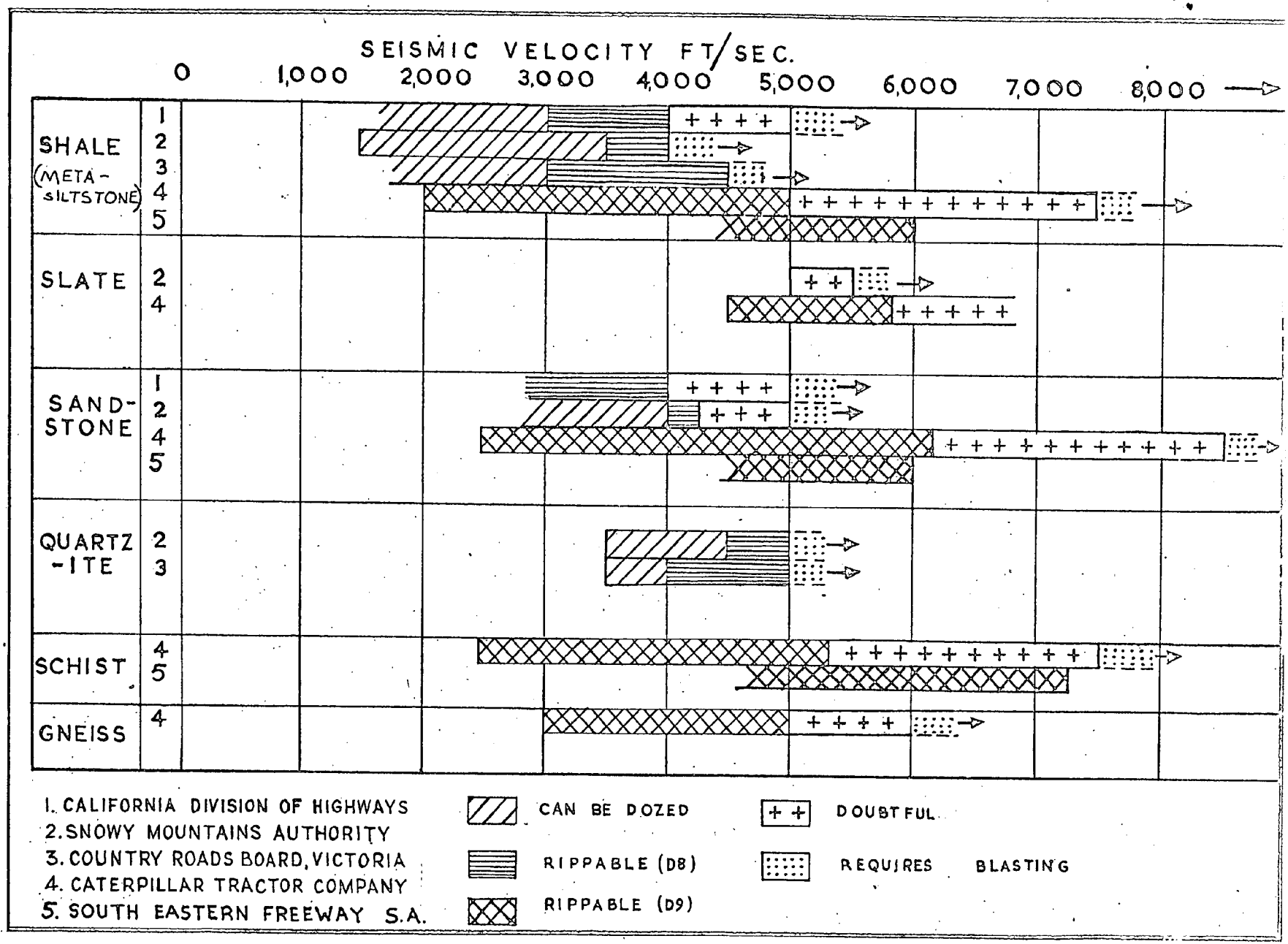
S C A L E

Miles 0 1 2 3

Kilometres 1 2 3 4

DEPARTMENT OF MINES — SOUTH AUSTRALIA

ENGINEERING GEOLOGY SECTION.	Drn. JHF. Tcd. JHF. Ckd. Exd.	SOUTH-EASTERN FREEWAY. BRIDGEWATER- VERDUN SECTION. REGIONAL PLAN.	SCALE: as shown. S 7127 Ha 7. DATE: Feb. '69.



DEPARTMENT OF MINES — SOUTH AUSTRALIA

ENGINEERING GEOLOGY SECTION

DIRECTOR OF MINES

Drn. NRL

Tcd. N.R.L

Chkd. TRS

Exd.

SEISMIC VELOCITIES AND EXCAVATION EXPERIENCE

S4406

M.G.

DATE: 22 June 65

SCALE: Not to Scale

FIG. 2

TRIM - LINE

ROSETTE
- SHOWING ORIENTATION AND DENSITY OF JOINT SYSTEMS

N
E
S
W

529500 FT.E
530000 FT.E
530500 FT.E
531000 FT.E
531500 FT.E
532000 FT.E
532500 FT.E
533000 FT.E
533500 FT.E
534000 FT.E
534500 FT.E
2028500 FT.N
2028000 FT.N
2027500 FT.N
2027000 FT.N
2026500 FT.N
2026000 FT.N
2025500 FT.N
2025000 FT.N
2024500 FT.N
527000 FT.E

To Coney Gully

Sandstone. Weak - medium strong. Few minor flexures expected.

Sandstone weak to medium strong. Possible folding and flexures in this vicinity.

W-E ROAD

E-W ROAD

OLD MT BARKER ROAD

Sandstone floaters

Bore flows in winter.

Weak to medium strong sandstone. White, yellow and red banded.

Strong, light grey quartzite - pink-brown in outcrop.

Strong off-white sandstone boulders. Massive.

Numerous flexures.

Massive ferruginous quartzite outcrop. Strong to very strong.

Strong

Quartzite boulders

Sandstone floaters.

Weak sandstone band

Mainly medium strong in outcrop. Probably grades to very strong at depth. Fine to medium grained, off white to light grey banded and laminated.

Weak to very weak white and yellow laminated sandstone

Plunges ~ 30°.

Numerous flexures. Weak - medium strong sandstone overlies strong quartzite in base of cut

shallow plunge.

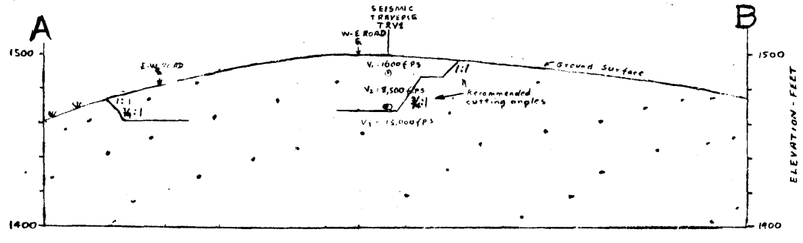
Strong to very strong white quartzite in core of anticline, weak yellow sandstone on the limbs

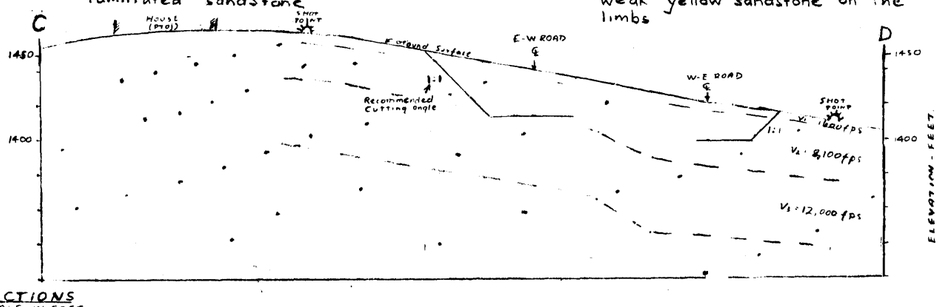
Weak offwhite sandstone with strong light coloured quartzite interbeds. Quartzite becomes more frequent towards the east. Sandstone is cross-bedded in part

SPC
SPB
SPA
TRV 1
A
B
C
D
WC 90 ft.

BRIDGEWATER - CAREY GULL
TRENDOUTH
SHANNON
FIELDING
MANTON
ALDGATE
RAILWAY

SECTIONS
SCALE IN FEET
40 0 40 80 120





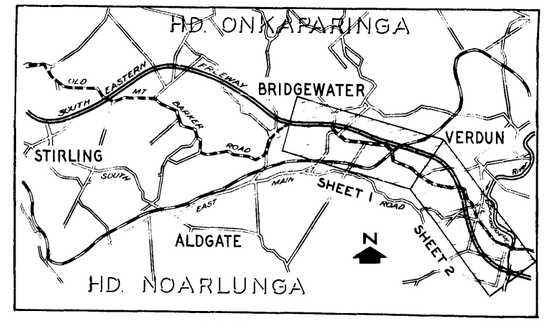
PLAN
SCALE IN FEET
200 0 200 400 600 800 1000
100 0 100 200 300
SCALE IN METRES

FIG. 3
SHEET 1 OF 2

DEPARTMENT OF MINES — SOUTH AUSTRALIA

SOUTH - EASTERN FREEWAY
BRIDGEWATER - VERDUN SECTION
STATION 290+00 TO STATION 361+00
GEOLOGICAL PLAN

ENGINEERING GEOLOGY SECTION	GEOLOGIST	DRN J.H.F.	SCALE: As shown
		TCD. T.P.S.	69-274
		CKD. I.V.W.	Hg 749
DIRECTOR OF MINES	SENIOR GEOLOGIST	EXD.	DATE: 14 Feb 1969



LOCALITY PLAN

LEGEND

SOIL AND ROCK TYPES

RECENT
- TOPSOIL (Mainly sand clay mixture)
- ALLUVIUM - Gravel - sand - clay

PROTEROZOIC — ADELAIDE SANDSTONE FORM.
- SANDSTONE
- QUARTZITE
- QUARTZITE - SANDSTONE
- SILTSTONE - SANDSTONE - Interbedded
- PHYLLITE
- SHALE
- QUARTZ FRAGMENTS - VEINS?

- 35 BEDDING
- JOINT } showing strike and dip
- CLEAVAGE
- SYNCLINE } showing plunge
- ANTICLINE
- APPROX. / INFERRED } GEOLOGICAL BOUNDARY
- TR1 TRENCH No1
- SEISMIC REFRACTION TRAVERSE
- SWAMPY GROUND
- WG Bore ● WATER BORE - water cut at 90ft depth

SANDSTONE QUARRY

Medium strong.

Strong white coarse grained, quartzitic sandstone to quartzite.

Weak, micaceous sandstone outcrop. Quartz floaters. Minor vein quartz in this area.

Weak, Yellow to red-brown siltstone to very fine grained sandstone. Weathered to red-brown clay soil to 2 ft or more. Possibly very strong at depth.

Strong, white quartzite-sandstone bars.

In general, medium strong to strong, white, medium to coarse grained sandstone — quartzite, with some stronger quartzitic interbeds and a few fine grained sandstone — siltstone interbeds. Variably weathered.

Fine to very fine grained Strong. Offwhite, laminated. Numerous flexures. <2ft. soil cover. Few sandstone floaters. Beds vary from cmpt. to 2ft thick. Thicker beds jointed. Joints mainly 1 ft. apart.

Coarse to fine grained, weak sandstone. Yellow to yellow-orange, massive and crumbly to 8·5 ft. or more.

Joints 1 to 6 ins apart.

Weak, Yellow-brown and red-brown shale, and dark grey to light grey phyllite. Very fissile in part.

Strong, ferruginous sandstone-quartzite outcrops.

Suspected slide material.

Building excavation with 15 ft batter stable at about 25°. Up to 7 ft soil cover.

Chicken Farm.

Orchards.

Mainly green-grey highly plastic clay soil.

Quartz veins up to 2 ft. thick in vicinity of TR3.

E-W ROAD

W-E ROAD

SOUTH-EAST MAIN ROAD

TO WOODSIDE

TO BRIDGEWATER

Onkaparinga River

Tennis courts

DAM

TR1 TR2 TR3 TR4 TR5 TR6 TR7 TR8 TR9 TR10 TR11 TR12 TRV1 TRV2 TRV3 TRV4

535500 FT.E 536000 FT.E 536500 FT.E 537000 FT.E 537500 FT.E 538000 FT.E 538500 FT.E

2025500 FT.N 2025000 FT.N 2024500 FT.N 2024000 FT.N 2023500 FT.N 2023000 FT.N 2022500 FT.N 2020000 FT.N 2019500 FT.N 2019000 FT.N

SECTIONS

SCALE IN FEET

40 0 40 80 120

E — F

E-W ROAD STA 375+75. SEISMIC TRAVERSE 2. W-E ROAD STA 377+20.

Recommended cutting angle 1:1

V_1 = 1,400 - 1,900

V_2 = 3,800 fps.

V_3 = 8,000 - 10,000 fps.

ELEVATION - FEET

G — H

E-W ROAD STA 388+15. SEISMIC TRAVERSE 3. W-E ROAD STA 390+5.

Recommended cutting angle 1:1

V_1 = 1,600 fps

V_2 = 4,100 fps

V_3 = 13500 fps

ELEVATION - FEET

I — J

TR7 (PROJ.) TR1 TR2 (PROJ.)

E-W ROAD STA 420+40. SEISMIC TRAVERSE 4. W-E ROAD STA 418+40.

Recommended cutting angles 1·5:1 to 20 ft., 1:1 below

Recommended cutting angles 1·5:1 to 15 ft., 1:1 below

V_1 = 1,100 - 1,700 fps

V_2 = 5,600 fps

V_3 = 11,300 fps.

ELEVATION - FEET

PLAN

SCALE IN FEET

200 0 200 400 600 800 1000

100 0 100 200 300

SCALE IN METRES

FIG. 4

SHEET 2 OF 2

DEPARTMENT OF MINES — SOUTH AUSTRALIA

SOUTH-EASTERN FREEWAY
BRIDGEWATER-VERDUN SECTION
STATION 361+00 TO STATION 446+00
GEOLOGICAL PLAN

ENGINEERING GEOLOGY SECTION	J.H. Fryar GEOLOGIST	DRN. J.H.F.	SCALE: As shown.
		TCD. T.P.S.	69-275 Ha 7+9
	W.R. Stewart SENIOR GEOLOGIST	CHD. L.V.W.	
DIRECTOR OF MINES		EXD. [illegible]	DATE: 20 Feb 1969