

Seismic survey on gravel deposits along the Eastern Outlet Road, Hobart.

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A seismic survey was undertaken in areas of possible gravel deposits bordering the northern side of the Eastern Outlet Road between Warrane and Tunnel Hill.

Four seismic spreads were fired using the Geospace GT2A seismograph with 12 geophones spaced at 3 or 7.5 m intervals. Six further spreads were undertaken using the Bison signal enhancement seismograph. The locations of these spreads are in the numbered areas shown on Figure 2 of Unpublished Report 1973/21.

The seismic velocity layers evident in these spreads with the calculated depth to their interfaces and a suggested geological interpretation are given in Tables 1 and 2.

In all the spreads the surface material (soil, sand, silt and gravel) showed as a persistent slow layer with V_0 velocities of 305-610 m/s. The unweathered hard rock of Permian siltstone showed as a fast layer with V_2 velocities of 3350-3650 m/s. Velocities of more than 1800 m/s and ranging to 2400 m/s probably represent weathered siltstone with tight joints.

The geological interpretation is ambiguous in the intermediate range of velocities (1200-1800 m/s). As can be seen from Bison Spreads 2 and 4, weathered well-jointed Permian siltstone with open joints gave velocities as low as 1500 m/s. Equally, the sediments collectively termed 'cemented gravels' in the two tables gave a wide range of velocities from 1400-1800 m/s in Bison Spreads 3 and 4 which were carried out on top of and close to exposures of these sediments. This situation is to be anticipated in such sediments which appear to be mainly gravel but the amount of sand and silt associated with the gravel varies considerably. The degree of compaction and cementation is also variable.

The travel time curves show that seismic velocities for most of the spreads are irregular and stepped. These curves also show that the velocity layers for the spreads have strong slopes. All this makes the interpretation difficult and depth calculations are only approximate.

No seismic velocity difference is apparent between the cemented gravels and weathered open and well-jointed Permian siltstone. It appears unlikely that the geological boundary coincides with seismic velocity layers, and drilling will be required for control. The seismic survey indicates that the rock profile of the Permian siltstone will be stepped and very irregular, probably caused by stepping in the benches of the Permian siltstone. Cemented gravel of varying thickness will occur on these rock benches. In places the gravel may be very thick (>9 m) whereas elsewhere it is probably absent.

RECOMMENDATIONS

At least two drill holes should be located in area 4 where the Geospace Spreads 3 and 4 and Bison Spread 1 were carried out. At least one drill hole should be sited in each of the remaining areas.

REFERENCE

THREADER, V.M. 1973. Gravel deposits along the Eastern Outlet Road, Hobart. Unpubl.Rep.Dep.Mines Tasm. 1973/21.

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Table 1. GEOSPACE GT2A SEISMIC SPREADS

Spread No.	Area No.	Direction of Spread	Surface material	Seismic Velocity Layers (m/s)	Geological Interpretation of the Layers	Calculated Interface Depths (m)	Slope Direction	Rock Profile	Comments
1	1	N-S	Surface sand	V ₀ 425-610 V ₁ 1800-2750 V ₂ 3350-3650	Surface sand and gravel etc. Weathered Permian siltstone. Unweathered Permian siltstone.	V ₀ /V ₁ 1-2.4 V ₁ /V ₂ Not calculated	Shallowing to north.	Stepped and irregular	Possibility of 1800 m/s and 2400 m/s layers at north end of spread. Interface depth of these two layers ranging from 3-7 m.
2	1	E-W	Surface sand	V ₀ 365-490 V ₁ 1200-1675 V ₂ 3350	Surface sand and gravel. Weathered Permian siltstone and, or, cemented gravels Unweathered Permian siltstone.	V ₀ /V ₁ 1-2.1 V ₁ /V ₂ Not calculated	Sloped. Shallowing slightly to west.	Stepped	Layer of 2400 m/s appears only at east end of spread, at depth of 3.6 m. This layer possibly differentiates between gravels and unweathered Permian rocks.
3	4	E-W	Surface sand and gravel	V ₀ 610-760 V ₁ 1500-2400 V ₂ 3350	Surface sand and gravel. Cemented gravels and, or weathered Permian siltstone. Unweathered Permian siltstone.	V ₀ /V ₁ 2.4-4.3 V ₁ /V ₂ 6-15	Sloped. Shallowing to east.	Stepped	Higher V ₀ velocity in this spread is result of the distance between S.P. and geophone. Bison Spread 1 at this locality shows V ₀ to be 305 m/s.
4	4	E-W	Surface sand and gravel	V ₀ 760-1370 V ₁ 1800-2400 V ₂ >3350	Sand and gravel. Weathered Permian siltstone. Unweathered Permian siltstone.	V ₀ /V ₁ 3.6-6 V ₁ /V ₂ Not calculated	Sloped. Shallowing to west.	Very stepped.	Surface sand and gravel and cemented gravel appear as one layer. Very little evidence of 1800-2400 m/s layer at west end of spread.

Table 2. BISON SEISMIC SPREADS

Spread No.	Area No.	Direction of Spread	Surface material	Seismic Velocity Layers (m/s)	Geological Interpretation of the Layers	Calculated Interface Depths (m)	Slope Direction	Rock Profile	Comments
1	4	E-W	Gravel	V ₀ 335 V ₁ 1675 V ₂ 2100-2400	Surface sand and gravel. Cemented gravel and, or, weathered Permian siltstone. Jointed unweathered Permian siltstone.	V ₀ /V ₁ 1-2 V ₁ /V ₂ 2.4-3		Stepped	Spread located near Spreads 3 and 4 of Geospace instrument.
2	1	E-W	Permian siltstone	V ₀ 550 V ₁ 1500-2400	Soil and thin surface sand and gravel. Weathered jointed Permian siltstone.	V ₀ /V ₁ 0.5		Stepped and irregular	Spread above an exposed Permian rock bench with <30 cm of capping gravel.
3	1	E-W	Gravel	V ₀ 550 V ₁ 1675 V ₂ 2400	Sand and surface soil and gravel. Cemented gravel. Jointed Permian siltstone.	V ₀ /V ₁ 2 V ₁ /V ₂ 5.2-5.5		Stepped	Spread on top of a cutting with 3 m of gravel exposed.
4	3 Between proposed drill holes A and B	E-W	Gravel	V ₀ 550-610 V ₁ 1200-1500 V ₂ >3000	Surface sand etc. Cemented gravel and, or, weathered Permian siltstone. Unweathered Permian siltstone.	V ₀ /V ₁ 0.8-2.4 V ₁ /V ₂ 8.5-10	Sloped. Shallowing to west.	Stepped	2.4-3 m of gravels exposed in culvert at eastern end of this spread.
5	3 West of proposed drill hole D	E-W	Gravel	V ₀ 610-850 V ₁ 1200-1500 V ₂ 3350-4250	Gravel and surface sand. Cemented gravel and, or, weathered Permian rocks. Unweathered Permian siltstone.	V ₀ /V ₁ 0.9-1.8 V ₁ /V ₂ 4.5-7.6	Sloped. Shallowing to west.	One step evident	Jointed and weathered Permian siltstone bench exposed near western end of spread.
6	3 East of proposed drill hole D	E-W	Gravel	V ₀ 610 V ₁ 1370 V ₂ 1675-2100	Sand and gravel. Gravel Weathered Permian siltstone and, or, gravel.	V ₀ /V ₁ 0.9-1.5 V ₁ /V ₂ 5.5-6.4	Shallowing to east	One step evident	This spread is interpreted as containing 3 layers but the 1370 m/s layer may be the same as 1675-2100 m/s layer. If this is the case the V ₁ /V ₂ interface would be 2.4-3.3 m