

1980/34. Bridgewater causeway seismic reflection survey

R.G. Richardson
D.E. Leaman

Abstract

A high resolution seismic reflection survey along 300 m of the Bridgewater causeway has shown the maximum depth of fill along the traverse to vary from 7 to 12 m. This agrees with penetrometer tests and revised estimates of the volume of fill forming the causeway. The very soft sediments into which the fill has sunk extend to a depth of at least 26 m along the same line.

INTRODUCTION

At the request of the Department of Main Roads, a high resolution seismic reflection traverse was recorded along 300 m of the Bridgewater causeway [EN183670] to locate the base of the causeway fill. Advantage was taken of closure of the bridge to facilitate recording, as traffic vibrations preclude recording at other times. The traverse was recorded along the southern side of the highway with the first shot point (SPN 1; fig. 1) 300 m east of the railway crossing lights, and the last shot point (SPN 60) at the railway crossing lights. The shot interval was five metres with channel 1 five metres east of the shot, producing a four-fold pull-along coverage. To ensure high-frequency data, charges consisting of two detonators were used in conjunction with a nominal recording pass band of 250 Hz to 500 Hz.

RESULTS

First arrival data show a single velocity of about 400 m/s for off-sets up to 120 m. CDP velocity stacks and gathers indicate no interval velocities higher than 1600 m/s to a two-way time of 250 msec, but this may be influenced by the short spread length.

The reflection time section (fig. 1) shows a large number of reflections. The first horizontal reflector (reflector D) at a two-way time of about 140 msec probably represents the base of the soft mud. Overlying this reflector are a number of dipping reflectors showing stream channeling to the east (low SPN) and river flat deposition with only minor channeling to the west. If a consistent velocity of 400 m/s is assumed throughout the section the reflector depths are;

Reflector	Depth (m)	
	SPN 9	SPN 41
A	4	5
B	11	7
C	18	19
D	27	28
E	32	35

Reflector B is the shallowest reflector to show channeling and thus must lie at or below the base of the fill. The maximum depth of the fill must vary between seven metres in the west and twelve metres in the east.

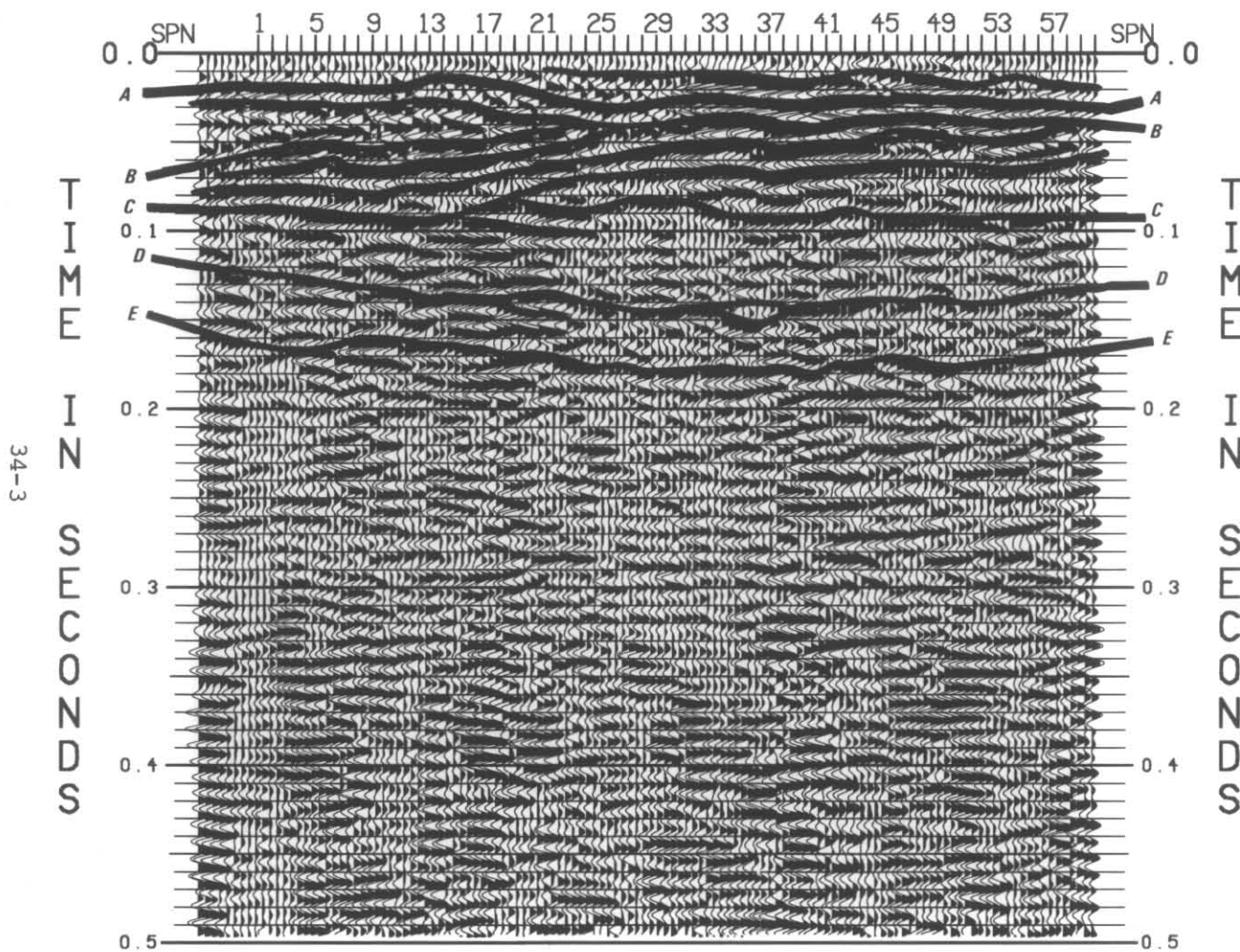
Information supplied by the Department of Main Roads includes an historical report that the causeway contains approximately 1 800 000 t of

fill. Assuming that the causeway is, on average, 16 m wide, that the fill has an angle of repose of 30° and a density of 2.0 t/m^3 , a conservative estimate of the average depth of fill is 23 m. This is inconsistent with results from the seismic survey.

The difficulty of transporting materials when the causeway was built suggests that the fill used probably came from the quarry at the western end of the causeway. The volume of this quarry is approximately $60\,000 \text{ m}^3$ and, with additional material from the road cutting behind the Lyell Highway, suggests a maximum volume of fill of about $150\,000 \text{ m}^3$. Assuming an angle of repose of 30° as before, the average depth of fill would be seven metres. If an angle of repose of 60° is used, the depth of fill would be ten metres. These depths are consistent with those from the seismic data and with penetrometer tests performed by the Department of Main Roads.

Although the maximum depth of the fill varies from 7 to 12 m, and is defined by reflector B, the traverse gives little information on the nature of the materials below the fill. Additional velocity information could be obtained by shooting an expanding spread, but would require the closure of both lanes of the Midland Highway in suitable weather to allow recording to take place.

[30 September 1980]



RECORDING PARAMETERS

1. INSTRUMENT-DHR 1632
 2. 8 TRACE-1FOLD
 3. SPREAD-OFF END 40M.
 4. 6X28HZ. PHONES-TRACE
 5. GROUP INTERVAL-5M
 6. SAMPLE RATE-1/4MSEC.
 7. SOURCE-DYNAMITE
 8. SHOT DEPTH-0.4METRES
- JANUARY 1980

PROCESSING PARAMETERS

1. VELOCITY FILTERING
 2. TVS-.8SEC. GATES
 3. NMO
 4. TVF=64-160HZ. BANDPASS
 5. TVS-.8SEC. GATES
 6. DIPFILTER
 7. FILM 50CM-SEC. 5TR-CM.
- G.S.I. SYDNEY JULY 1980

Figure 1. Bridgewater seismic reflection survey SP1 - SP61.