

SESSION 2: HOUSE FOUNDATIONS/SETTLEMENT

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BEHAVIOUR AND DESIGN OF HOUSING SLABS ON FILLING
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Paper by J.E. Holland and D.J. Cimino

This paper was presented by Mr C.E. Lawrance on behalf of the authors

Dr P.J. Moore raised a number of questions and invited the authors to reply. Is there an advantage in placing the slabs in the wet season or perhaps between seasons? Do post-tensioned slabs perform better than the standard slabs recommended by Swinbourne? Why do the cables bend downward at the corners of the slab?

Mr Lawrance replied that it was better to place the slab on a wet site but no evidence was, as yet, available to recommend placing the slabs between seasons. It was also too early to judge whether post-tensioned slabs performed better than standard slabs. The cables were turned down at the corners for geometric considerations to avoid the corner chipping off.

Prof P.W. Taylor made the observation that post-tensioned slabs are not widely used in NZ. He noted the lack of compaction given to residential filling in Australian cities and concluded that this would not occur in New Zealand because of the stricter codes of practice concerned with fill compaction. Mr Lawrance replied that the additional cost of compaction far exceeded the expense associated with locating and designing for soft spots.

Mr G.L. Evans referred to fig.4 which implies that roof water merely falls on the ground. This could be very serious in affecting edge settlement - what roof water collection is done in Australia? Would prestressed slabs be suitable over old rubbish filled areas 3-5m deep for light industrial buildings and house slabs?

Mr Lawrance replied that all roof water runoff is collected and transported to stormwater drains, and the use of pre-stressed slabs on the sites given could possibly be successful. However, a full site investigation would have to be undertaken to determine the required parameters for rigid slab design.

Mr B. Clegg asked about the testing methods used in Texas, that are mentioned in the paper. This testing is described as 'reasonably expensive' and in the next sentence as 'a most promising technique ... for Australian climatic conditions and

clays'. From whose point of view? The client? Who pays? Mr Lawrance, in reply, said that the particular soil testing technique is to be used in determining the stated parameters for a general clay classification. It is not anticipated that this method will be used for individual housing allotments.

Paper by J.E. Holland and C.E. Lawrance

Dr J. Moore raised the question of what defines a soft spot and in Tables I and II, how was the soft spot diameter determined? Was it estimated from settlement observation on the finished slab or was it predicted after the initial site investigation? Was the added expense of additional boreholes to determine soft spot diameter justified? Mr Lawrance defined a soft spot as a localised area of settlement causing loss of support. The soft spot diameters were determined from site investigation, although in many cases they were assumed. He felt the added expense of additional investigation was frequently more than compensated for in the construction cost of slab over pier design.

Mr D.P. McNicholl related the following experience with house foundations in areas affected by mining subsidence and previously placed uncompacted fill at Warrington New Town in the United Kingdom.

1. Extent of Problem

Warrington New Town has an area of 7,000 hectares. At time of designation 1,000 ha. were derelict or covered with fill and about 1,750 ha. likely to be affected by coal mining subsidence.

2. Foundations in Mining Areas

In mining areas great care was taken to design houses with simple forms and with limited block lengths because of the expected lateral strain. Design guides were issued to deal with the articulation of sewers and services and special house foundations were designed. A heavy RC ring beam catered for the travelling vertical movements and withdrawal of support. Lateral movement was accommodated by a permanent lateral buffer to the ring beams and by a thick granular sub-base. There was also a sliding layer between the ring beam and RC floor slab.

3. Foundations in Filled Areas

The Risley Royal Ordnance Factory is 400 ha. in extent and was built in less than 18 mths in 1939-40. Large volumes of peat and glacial materials were removed and fill imported to form a regular site. The munitions buildings varied between 10 sq. metres and 5,000 sq. metres in floor area. Some sewers and foundations were 4 m. deep. The factory was demolished in the early '70s. Very extensive development is taking place, and there are considerable foundation problems. The site ground conditions can be idealised as three types:

- i) Original subsoil
- ii) The levelled filled site formed in 1940
- iii) Zones affected by recent demolition with soft spots up to 4 m. deep.

The loose areas could not be accurately plotted though extensive site investigations gave statistical information for estimating and design.

The foundation method used, a ground replacement technique, involved excavating down to bearing level beneath load bearing walls and replacement by compacted granular material (often crushed demolition material from the site) in battered trenches wide enough for mechanical compaction plant. Conventional strip footings were then laid. Conventional floor slabs were placed after proof loading. Nearly 2,000 houses had been constructed.

Further details are given in the following references:

McNicholl, D.P. and Crook, J.M. (1977)
The monitoring of ground movements due to deep coal mining and their implications on large scale development at Warrington New Town (1977); Conference on large ground movements and structures, Cardiff, UWIST & I Struct. E.

Wilde, P.M. and Crook, J.M. (1979)
Problems and solutions in developing large areas of filled ground at Warrington New Town; Symposium on the engineering behaviour of industrial and urban fill; Midlands Geotechnical Society

Paper by D. Raisbeck

Dr P.J. Moore asked about the estimation of primary and secondary settlement from laboratory tests. The effect of disturbance on m_v was also queried. Mr Raisbeck replied that v consolidation was basically secondary for the stress range P_0 - P_c . He explained how the regional and structure-related settlements were separated with the aid of a close grid of survey pins used to monitor regional settlement over a wide area.

Mr G. Salt commented on the use of the disturbed m_v value and asked whether tectonic and erosion processes could cause in situ m_v values. Mr Raisbeck suggested that tectonic disturbances showed up in the unloading cycle of laboratory tests as a greater change in slope of the line.