Discussion Session 6

W. A. M. Jones (Inland Revenue Valuation Office) expressed interest in the Deep Navigation Colliery case study presented by Dr Isaac. He asked whether the line of cleat in the coal seam coincided with the slip planes in the roof strata, and what relationship existed between the directions of slip planes and the line of the coal face?

Dr A. K. Isaac (University College, Cardiff) replied that the cleat was not particularly well developed on that face, but where it was developed it was in sympathy with those major slip planes. These planes had a space of the order of 3 m, whereas the cleats were spaced at an interval of a few centimetres. Looking into the face the slip places cut across at about 45° across from main to tailgate. Dr Isaac commented that the precise figures were available should they be requested.

Dr G. Daws (Graham Daws Associates Ltd) directed several questions to Dr Isaac. Firstly, in connection with the use of Bieniawski's rock mass rating (RMR) system, what influence did discontinuity condition play in the calculation of the RMR value? Dr Daws pointed out that he had found considerable differences in the RMR system in fact did take this into account. In terms of the bolting pattern, Dr Isaac referred to his co-author Dr Follington, who had done such work but which was beyond the scope of that paper.

Dr A. K. Isaac replied that the effects of discontinuities on the RMR system are catered for in the revisions of 1985 when the system was adapted from tunnelling to Coal Measures. He personally felt, however, that water was far more important than orientation of discontinuities, as the presence and amount of water had a far greater effect: the RMR system in fact did take this into account. In terms of the bolting pattern, Dr Isaac referred Dr Daws to his co-author Dr Follington, who had done such work but which was beyond the scope of that paper.

Dr G. Daws expressed further interest and invited comments on the orientation of longwall panels with reference to high lateral stress direction, and also on the effectiveness of bolting 12 months after the driving of the gateroad at S3 Betws as opposed to bolting being done as the roadway was being driven.

Dr A. K. Isaac said that in all the situations they had examined there was no dominant lateral stress. With respect to the effectiveness of bolting after a time dependent period, the improvement was significant and subsequent coal productivity rose to target levels.

R. Jeffrey (British Coal) congratulated Drs Isaac and Follington on their paper and endorsed the need for detailed geotechnical assessment in underground design. Studies of in situ stresses underground are of great interest and he was particularly interested in Dr Isaac's comment that at Betws the principal stress was vertical. In the absence of measured data from Betws he wondered how this conclusion regarding the distribution of principal stresses was achieved.

D. R. Reddish (Nottingham University) asked Mr Harrison whether the subsidence model used could be applied to non-rectangular excavations or inclined seams.

V. Harrison (Inland Revenue Valuation Office) replied that the Burton model could be adjusted to reflect variations in the shape of the profile model. Seam gradients were also taken into account to some extent but only as regards displacement of the profile and not distortion of the shape.

C. Knipe (Johnson, Poole & Bloomer) commented on Mr Roscoe's paper in that an analogous situation to St Wilfred's Church existed at Hucknall, Nottingham. At a site for a supermarket the whole ground surface was stripped off over a wide area revealing tension fissures in the Triassic Sandstone over Coal Measures. Measurements of the cumulative width of the cracks agreed exceptionally closely with that predicted by calculations. There was hardly any dilation of the rock mass except that which took place along clearly visible fissures in the ground.

B. N. Whittaker (Nottingham University) referred to Mr Van der Merwe's paper and asked if the author would comment further on the highway experiment he referred to, particularly on how the investigation findings were likely to be used for planning future longwall working.

J. N. Van der Merwe (Sasol Coal) replied that road undermining research was done in an attempt to prove that certain structures could be undermined safely. About 30% of South African coal may be sterilized by surface structures: roads and railways, for example, are not allowed to be undermined using longwall methods. Estimates of the cost of providing by-pass roads to prevent undermining is around R3M: this is not the cost of compensation but rather that incurred in providing alternative routes.

H. Roscoe (Arup Geotechnics) responded to Mr Knipe's comments by pointing out that in the case of St Wilfred's Church ground movements were indicated by cracks in the church walls. It was reasonable to assume that the walls were uncracked before the movements commenced, but unlikely that the fissures in the underlying Magnesian Limestone were initially closed. In general, the widths of fissures in rocks should only be relied on to indicate the magnitude of ground movements if the fissures were observed to be closed before the movements took place.