Opinions on most significant tunnelling techniques during the 25 years of WORLD TUNNELLING.

For some of us living and tunnelling in Norway, and also for those venturing much further afield, it was important to have an early glimpse of 'the Norwegian Method of Tunnelling' (NMT) presented in your WT pages in 1992. Although this was a multi-author and multi-company contribution, it of course raised eyebrows and protest from those who could not be included. This article was squarely founded on the remarkable properties of robotically applied steel-fibre reinforced shotcrete S(fr), which had been carefully tested and commercially applied since 1978. It was also focussed on how to select thickness (and bolt spacing) via Q-system logging.

The key concept presented in these particular WT 1992 pages was what has become more and more known as 'single shell' tunnelling, to contrast NMT from the 'double-shell' tunnelling represented by NATM. Already there was some 12-14 years commercially-acquired experience with wet process S(fr) both in Norway and Sweden, and an early Ph.D on the subject of S(fr) was from Opsahl, 1982, who was one of our prominent co-authors in 1992.

The ability to apply accelerated steel-reinforced concrete (or polypropylene-reinforced shotcrete) even from a safe distance over the muck-pile, when stability was compromised, was of course a revolution. But from 1992 and onwards, formal dimensioning guidelines for S(fr) were updated, and gradually spread to other countries. S(fr) in contrast to S(mr) – steel-mesh reinforced – has remarkable advantages, and its gradual spread outside Scandinavia would get my vote for the most important tunnelling technique, for those who wish to put long-term value on all layers of support applied, rather than rely on that delaying and costly concrete lining. Of course rock quality comes squarely into the picture, and the ability to improve rock mass conditions by high pressure pre-injection (increasingly also ahead of TBM) has to be technique number two on the list of important developments during WT's first 25 years. I am sure others are addressing the remarkable developments in the TBM industry.

Regards,

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