



Use of Ground Penetrating Radar in tunnel maintenance: detection of loose rocks on top of the concrete inner lining

A. Lalagüe (1,2) and I. Hoff (2)

(1) SINTEF Building and Infrastructure, Norway , (2) Department of Civil and Transport Engineering, University of Trondheim, Norway

The purpose of this study is to find a fast method for increasing the safety against collapse and rockfall in tunnels using Ground Penetrating Radar (GPR).

Rockfall or collapse of the roof in tunnels may occur both during construction and operation of the completed tunnel, as evidenced by major accidents in recent years. The Norwegian expertise is not spared and experienced a serious setback a couple of years ago when a part of a tunnel roof collapsed due to insufficient rock support. It is therefore important to carry out regular inspections and risk management activities to ensure an adequate level of safety.

The access to the rock surface is often difficult due to the precast concrete lining placed to preserve the road lanes from frost and water leakages. Traditional inspection methods usually consist in drilling randomly in the concrete elements, which is both time consuming and hazardous for the personnel involved. To remedy this, the Ground Penetrating Radar (GPR) technique has been introduced to best locate drilling sites.

GPR is a nondestructive method generally used to image the subsurface. It has now proved its usefulness in tunnel investigations. Used as a distance measuring tool, it determines the thickness of the precast concrete lining; it detects with success the cavities behind the concrete lining and measures the distance to the rock surface. Such scanning technology provides very satisfactory data; it is time-saving and safer to use than random manual inspections.

New GPR surveys also revealed the applicability of GPR in detecting loose rocks of different sizes on top of the concrete lining. Presence of loose rock indicates instabilities that should be further investigated; the results presented in this paper are of a great interest for tunnel engineers and it is likely that GPR measurements could become a routine activity in tunnel maintenance.