

# **VIBRATION CONTROL IN A TUNNEL PROJECT UNDER AN EXISTING HOSPITAL**

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## **ABSTRACT**

This paper describes a very exacting tunneling project. Planning and technical realization of this service and transportation tunnel was especially difficult as a matter of vibration control, because the tunnel is situated only a few meters under Maria Hospital, which is one of the most busiest hospitals in Helsinki. In this hospital there are many departments for bedpatients, research and treatment with high-tech equipment, operational surgery and a big laboratory. Besides access tunnels are situated near several apartment buildings. The functionality of the tunnel required the placement of the access tunnels to be straight towards these apartment buildings for which special care for blast induced air pressure had to be taken.

The vibration risks of the blasting work were clarified at the early stage of project planning by mapping out the vibration sensitive installations, structures and buildings in the neighborhood. The guidance levels for blast-induced vibration were also given in the contract papers. The need for damping of sensitive equipment, special safety precautions and the area of pre-blast surveys for the buildings were determined.

Test blast program was done during the planning in order to find out the distribution and attenuation of vibration. As a result it was possible to give site specific information for contractors for economic evaluation of the project.

During the blasting special attention was paid to vibration control. Monitoring was done in several sites. The latest technology was utilized in analysis of vibration. The main purpose of analysis was to find out the functionality of tunnel blasts, especially the scattering and the balance between cap delays. The main frequencies and the time-history of blast-induced vibration had to be examined for controlling the vibration sensitive equipment. Each tunnel round was analyzed and both drilling patterns and charging layout were modified when needed. With the utilization of vibration analysis significant results were achieved in reducing the vibrational effects.

As a result this tunnel project could be done cost effectively and safely. There was no harm with sensitive installations and damage caused to structures was minimal.