

## **ENSE SEISMIC ARRAY OBSERVATIONS FOR DETECTING SUBSURFACE TARGETS USING TBM MECHANICAL VIBRATION SOURCE**

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Shenzhen Metro system is constructed in a very complex geological environment. Multiple types of geological targets present along the planned routes of Shenzhen subways. Tunnel boring machines (TBM) using different cutter and shields types are used as the major tunneling format. Forecasting of the geological conditions on the designed Metro subway routes ahead of the TBM is a great assistance for safety assurance and construction efficiency.

Using dense seismic array on ground surface and taking the mechanical vibration noise as the seismic source provides a couple of advantages in comparison with other approaches. First, the possibility to spread the seismometers in a surface two-dimensional (2D) array will form a significant large aperture in lateral directions and provides full-azimuth ray coverage, in contrast to the surveys conducted in the tunnel, which essentially provide only a linear coverage. Second, using the TBM mechanical vibration as the source is economical, and replaces the surface sources that might either be prohibited from urban environmental laws or regulations (such as sources using explosives), or be annoying to neighborhood citizens (such as the vibroseis sources).

We use a seismic array consistent of 100 three-component short period seismometers to form a 2D array with a 5-m spacing, to be placed 20 m in front of the tunnel face with the current TBM position, which is 15-30 meter deep in the subsurface. The survey results and the analysis will be presented at the symposium.