

Leica Geosystems **TruStory** Monitoring System for Hong Kong Airport Express Line



The Kowloon Southern Link project connects the East Rail with the West Rail of the Kowloon-Canton Railway.

The Kowloon Southern Link (KSL) will be a 3.8 km connection between the East and West Rail in Hong Kong. The construction of the \$8.3 billion KSL is scheduled for completion in 2009. The Kowloon-Canton Railway Corporation (KCRC) in Hong Kong acquired an Automation Deformation Monitoring System from Leica Geosystems in December 2005 for continuously monitoring settlement and overall deformation of a section of existing Airport Express Railway.

The Kowloon Southern Link project is a 3.8 km extension of KCRC's West Rail Link from Nam Cheong Station connecting to East Tsim Sha Tsui Station of KCRC's East Rail Link. There is about 1.2km of the new extension area located very closely to the existing Airport Express Rail and MTRC Tung Chung Line. In order to ensure

the construction works do not have serious structural effect and distributing daily operation and safety of the Airport Express Rail, an Automatic Deformation Monitoring System is deployed mainly to continuously monitor settlement along the affected rail track.

The 1.2km track is divided into three different sections (600m, 210m and 400m) for continuously monitoring where cover ballasted section, trough section and tunnel section. A pair of mini prisms with tailor-made protection is installed in every 13 m interval along the rail track. TCA2003 Total Station that are driven remotely via a data communication network by Leica GeoMoS software at the Control Center measure the positional change of each target prism automatically in every 2 hours

■ Challenge

There are 3 sections of railways settlement measurement, included tunnel, trough and ballasted sections of total 1.2km, total 18 Total Stations and 600 prisms needed for measurement, Leica GeoMoS measurement cycle with 2 hours each. Running for 24 hours for 36 months non-stop. There are only 2 hours at night and 2-3 days per week to get the installation work and the tasks needed to be finished in two months time. After the system running, everyday, it is necessary to get a line safety report on 5:00am morning to all the related engineers and station manager for status of the railway in order to commerce the construction work.

■ Customer

The Kowloon-Canton Railway Corporation/
Hong Kong

■ Date

December 2005

■ Project Summary

Instruments

Leica TCA2003 and prisms

Field

Metro sensor, stand, pillar,
cable running for 2 km.

Office

Workstations, Web Server with Web Interface,
Leica GeoMoS Professional

■ Benefits:

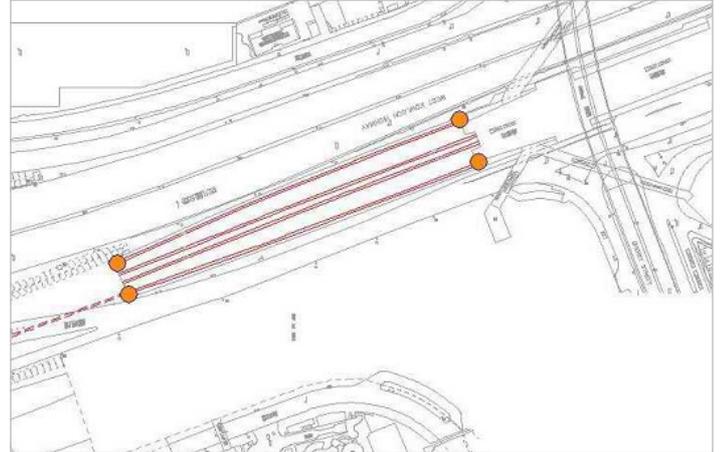
- Real time continue monitoring system with SMS, email alert, web interface for client to get the data in real time.
- Continue monitor the progress of the contractor work if the work disturb the railway systems
- Eliminate the 24 hours manual measurement on MTRC railway and tunnel which are dangerous and labour intensive.
- Complement the existing geotechnical sensors work

- when it has to be **right**

Leica
Geosystems



Through section (210 m)



Total station configuration in the Through section.

interval. To get the best line of sight for measurement, those Total Stations are installed at various locations including tunnel wall, roof of rail station and structure along the track. There is continuous power supply at each Total Station location and they are well protected by special design mounting device and security lock.

To ensure achieving the highest accuracy and reliability of the rail deformation measurement result, the highest accuracy automatic Total Station available in the current market - Leica TCA2003 is used, which can achieve +/-0.5" angular accuracy and 1mm +/- 1ppm distance accuracy. Thanks to the automatic target reorganization technology built in the Leica TCA2003, it can automatically pin-point the center of each target prism and detect slight positional changes. Furthermore, before taking every cycle of monitoring points measurement, each Total Station also first measures assigned control reference points located at stable structures (reference prisms) and then re-adjust its own position and monitoring reading

afterward. Thus, even any structural movement happening at the Total Station location does not have any affect to the overall measurement accuracy and the system can achieve less than 1mm measurement error over a distance of 100m.

The measurement reading is transmitted to Leica GeoMoS software for computing the updated coordinates of all monitoring points. Then, coordinates comparison can be made against the initial reading and the deviation and trend of movement can be easily presented as numeric and graphical presentation report to engineers and surveyors every 2 hours. All the information can be found from an Intranet webpage and engineers can also remote control the system configuration and monitor its performance via the Ethernet. They can also preset various levels of settlement tolerance in the software, so when the measurement result reach the critical level, then various alarm messages will be automatically sent to all mobile phones of assigned persons via

SMS. At the same time, the alarm and a report will also be automatically sent to those persons by email. Thus, engineers and surveyors can verify the settlement immediately and take necessary actions to prevent damages and maintain rail safety to passengers. As said by Mr. Andrew Wong, Engineering Solution Manager of Leica Geosystems: "It is a well-proof solution for engineer making quick and right decisions and also take necessary actions regarding the influence of new construction works to existing structure".

The system installation works since February 2006 for a period of 36 months continuously.