كلية الهندسة
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Monitoring Bridge Deformations During Static Loading Tests Using GPS

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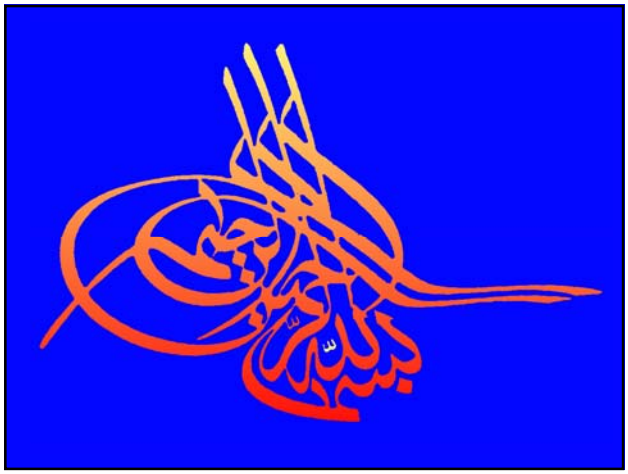


Background - continued

Background

- Mid 80's: GPS for deformation monitoring of engineering structures alongside conventional measurement techniques.
- Early 90's: GPS in deformation monitoring in Egypt regional deformation monitoring Aswan area in Southern Egypt.
- Mid 1990's: GPS deformation monitoring with IGS links along the Western shore of the Gulf of Suez.

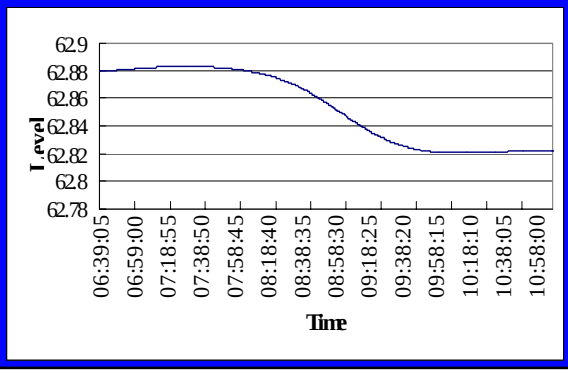
Validation Test

- Investigating GPS potentials to monitor deformations during bridge loading tests.
- Use of carrier phase observables within On The Fly (OTF) techniques.
- Validation test of potential GPS accuracy of available receivers to accurately monitor deformation.
- Premises of Faculty of Engineering Cairo University.
- Two GPS Dual frequency Trimble 4000 receivers.
- OTF Processing GPS observation interval 5 sec. for four hours over a short baseline.

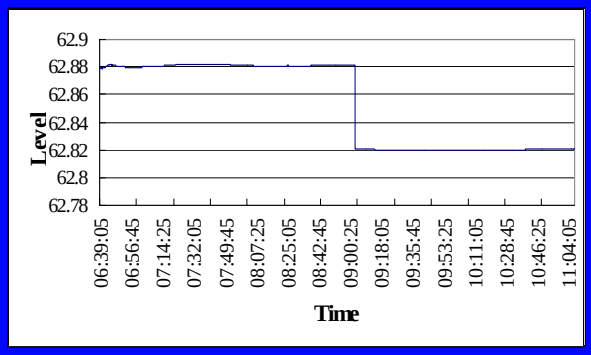
Background - continued

- Static loading tests of newly constructed bridges are routinely conducted in Egypt.
- Use of mechanical dial gauges (deflectometers) is subject to occasional limitations (bridges over water, high rise spans, environmental effects on wooden frame, observer movements on wooden frame)
- Precise leveling routinely used to complement and/or replace deflectometers.
- However, precise leveling is also subject to occasional limitations (same level position, observing pre-selected points, limited visibility distance, location of bench mark).

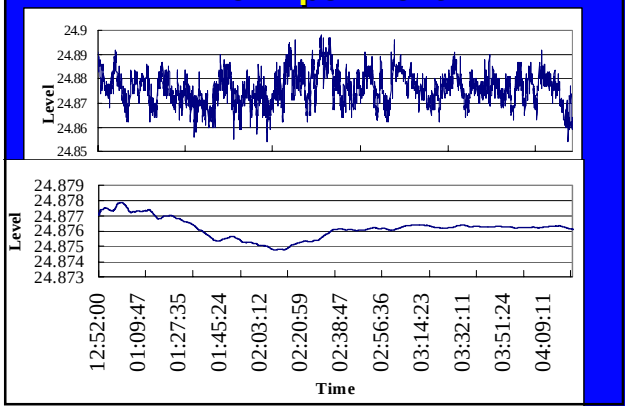
Validation Test - continued



Validation Test



The Experiment



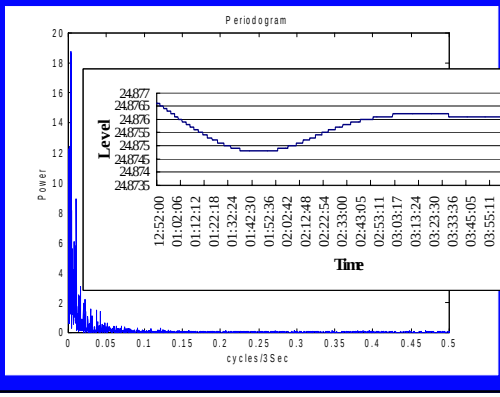
The Experiment

Upon acceptance of validation test results, an experiment was conducted using GPS to monitor deformations at El-Maadia Bridge (Alexandria) along Northern International Coastal Road, Egypt.

Conclusions

- Deflectometers and precise leveling are subject to routine limitations in bridge deformation monitoring.
- GPS can detect bridge deformation with sub-millimeter accuracy and hence provides a viable alternative.
- GPS bridge deformation monitoring gives a continuous record of the deformation phenomena.
- Smoothing of GPS results enhances the analysis of deformation results.
- FFT of GPS results gives further insight into the monitoring of bridge deformation.

The Experiment - continued

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