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Deformation Monitoring Studies at Atatürk Dam

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Deformation Monitoring

Dams are critical engineering structures which are loaded with different factors. Deformations can exist both on dam and its surroundings. Structure of dam, weight of embankment and water, water pressure, temperature changes, crustal movements are the reasons of deformations.

These factors can cause geometric and physical changes. These geometric and physical changes have to be monitored and defined.

In order to provide safety, well planned and implemented geodetic and non-geodetic monitoring is very essential for such structures.


ATATÜRK DAM
Location Turkey/Şanlıurfa
River Fırat
Construction year 1983 - 1992
Dam volume 84.500 hm³
Height (from river bed) 169 m
Reservoir volume 48700 hm³
Reservoir area 817 km²
Irrigation Area 872385 ha
Capacity 2400 MW
Annual Generation 8.9 billion KWh
• A 2m high and 1m wide wall can be built around the world on the Equator with the material used to build the embankment.
• Atatürk Dam is the 10th largest dam of the World in terms of embankment volume.
• Geodetic deformation measurements have been carried out by ITU, Department of Geomatics since May 2006 in cooperation with Turkish State Hydraulic Works (DSI).


Reference and Deformation Points on Dam Embankment
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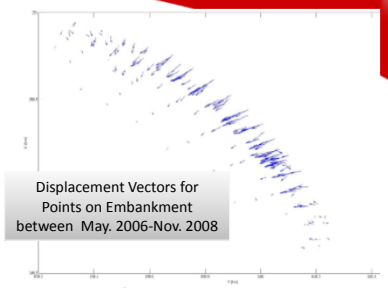
GPS and Conventional Surveying

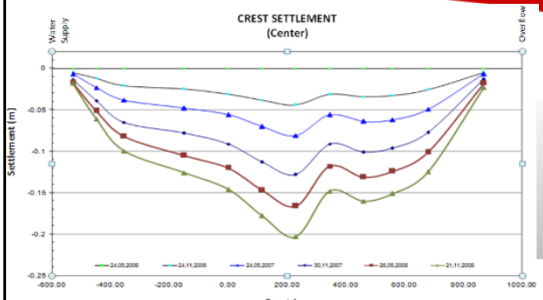
• As a result of six measurement periods, point position accuracies of just a few milimeters were obtained for the deformation points on the dam embankment.

•GPS surveying results yielded to a convenient internal accuracy of a few milimeters after post processing and adjustments.

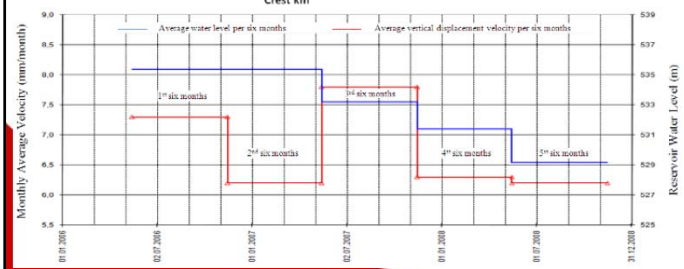


Displacement Vectors for Points on Embankment between May. 2006-Nov. 2008

FIG Sydney, 11-16 April 2010 ::::.. Deformation Monitoring Studies at Atatürk Dam ..:::: 5



The results of precise leveling measurement on dam crest performed in monthly periods are shown graphically on the figure.



Average Water Level and Monthly Average Settlement Velocity Graphics Per Six Months, Between May 2006 and Nov. 2008

FIG Sydney, 11-16 April 2010 ::::.. Deformation Monitoring Studies at Atatürk Dam ..:::: 6

Conclusions

- There are horizontal displacements on 63%, vertical displacements on 31% and radial displacement (perpendicular component to the crest axis) on 59% of the deformation points.
- The biggest displacement on horizontal direction is 9.9 cm (radial direction is 9.8 cm) and vertical direction is 11.6 cm between May 2006 and November 2008.
- On monitoring dams and their surroundings, position accuracy less than ± 1cm is sufficient for earth-rock fill dams such as Atatürk Dam. Therefore, GPS surveying can be utilized instead of conventional surveying.
- It is difficult to say the same for vertical deformations because of the lack of accuracy on the vertical component.

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