

Leica Geosystems TruStory

Exact scan of two cooling towers to compare as-built against design



The Leica Nova MS50 scanning the inner shell of one of the cooling towers.

Following the privatisation of the Hamitabat gas power plant in Turkey by Limak Holding, the company decided to modernise it to increase performance. The new owner wanted to continue using the two existing cooling towers, which were built in the mid-1980s. A condition survey was to be carried out to determine whether the cooling towers had deformed over the years due to the static load, long period of use and the influences of weather. Heitkamp Ingenieur- und Kraftwerksbau GmbH was commissioned with determining the actual radii of the inner and outer shells of both cooling towers at an interval of every 2 metres and to compare them to the planned radii. Using

the Leica Nova MS50 Multi-Station gave Heitkamp decisive advantages.

The Hamitabat gas power plant generates 1,200 MW of power. The two cooling towers are 135 metres high and have a diameter between 67 metres at the narrowest point and 101 metres at the widest. They were surveyed entirely via 3D laser scan by Achim Hoffstiepel, Technical Director of Engineering Surveying, and his team, Marvin Diehl (M.Sc.) and Dennis Alius (B.Eng.).

“Due to the height of the structure, we had to locate the instrument positions of the Leica Nova MS50 at a relatively far distance from the cooling towers to avoid steep sighting.



■ **Company**
Heitkamp Ingenieur- und Kraftwerksbau GmbH, Germany
Engineering surveying profit center
www.heitkamp-ikb.com

■ **Customer**
Limak Holding, Turkey

■ **Project**
Exact survey of two cooling towers with as-built to design comparison of the radii at an interval of every 2 m

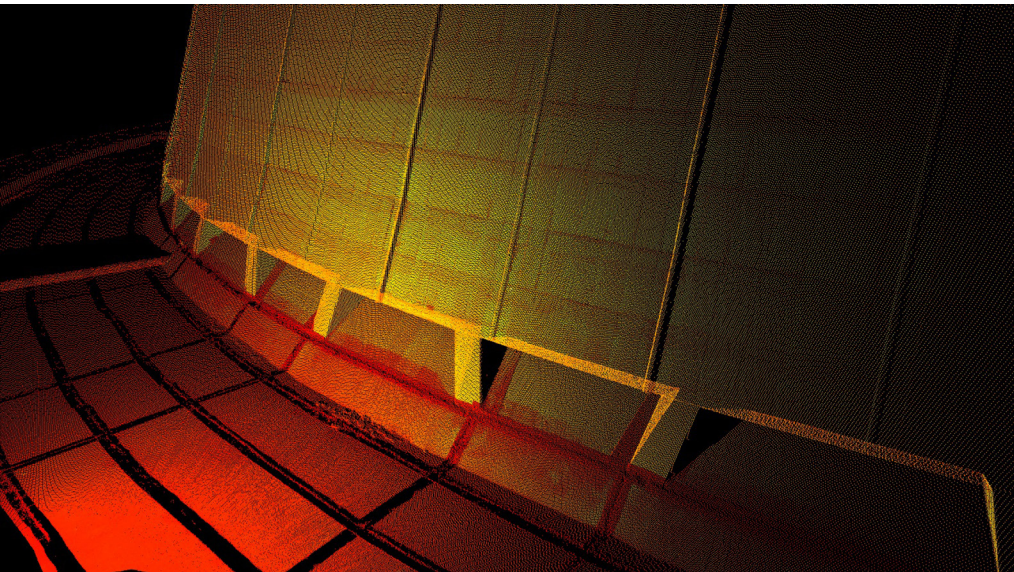
■ **Challenge**
- Both cooling towers are both 135 m high and vary in diameter from 67 to 101 m.
- More than 300m measurement distances that are impossible to reach with conventional laser scanners

■ **Location, time frame**
Hamitabat/Turkey, March/April 2014



■ **Solution**
Laser scan with the Leica Nova MS50 to achieve the required range

■ **Project summary**
Instrument
- Leica Nova MS50 MultiStation
Software
- Leica Cyclone MODEL
- Leica Cyclone PUBLISHER
- Eclipse (Java)



3D point cloud detail of the cooling tower captured with the Nova MS50 MultiStation.

As a result, the sighting distances usually increased to over 300 metres, which would have made it impossible to use conventional laser scanners. With the Leica Nova MS50, though, sighting distances like this are no problem at all," explained Achim Hoffstiepel.

To begin with, a local network was created for both cooling towers, whereby the survey and scanning positions were specified in such a way that the respective cooling tower could completely be mapped. In all, four scanning survey points were required outside the cooling tower and three inside it. The network was then created in such a way that a stable orientation from every survey point could be guaranteed with the Nova MS50 using the 'free station' method. Since the Leica Nova MS50 is a total station with an integrated scan function, the network measurements and laser scans could be comfortably carried out with the same instrument.

Scanning within the local coordinate system without registration

"The advantage of the Nova MS50 is that it supports all the workflows

of a total station. We were thus able to use the 'free station' method in the specified network and then scan right away from each defined position," said Hoffstiepel. The mapped point cloud was directly available in the local coordinate system, which made the need for the laborious scan registration from the individual survey positions into a superordinate coordinate system unnecessary.

The surveying team selected a scan point grid with a medium spacing of 5 cm. Since the MultiStation scans up to approx. 1,000 points per second, the scanning time per survey point was about two to three hours. This means that about 46 million points were measured for each of the two cooling towers. This point density was completely sufficient for the requirements of the task at hand, i.e. calculating the radii.

Easy processing of laser scans

The point clouds were easily exported from the Nova MS50 to Leica Cyclone 8.1 using an XML file and both cooling towers were fully available as complete point clouds.

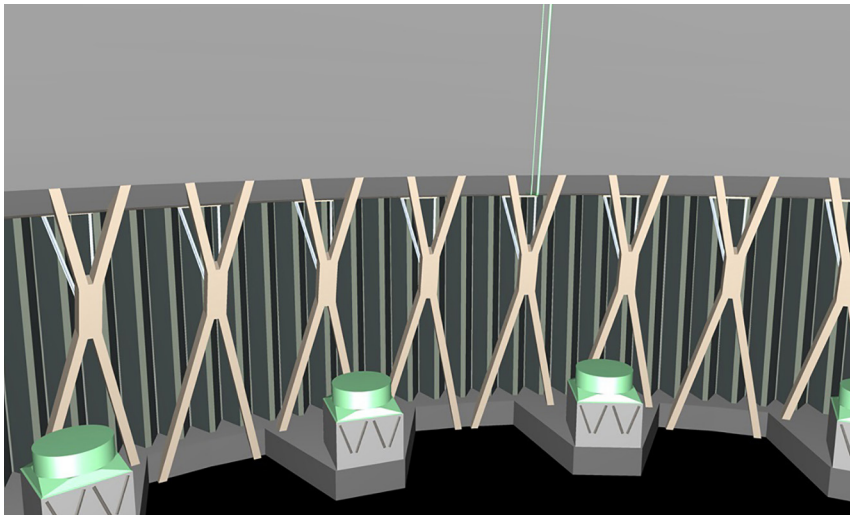
Advantages and benefits

- Greater range than other laser scanners
- Geo-referenced 3D point cloud available directly after the measurement
- Automatic approximation enables optimum estimation of the cooling tower radii and saves lots of time
- Network measurement and workflow identical to the total station



Scanning at distances of up to 300 m.

In Leica Cyclone, the point clouds were first cleaned up and then the inner shell of the cooling tower was "separated" from the outer shell. This enabled the actual radii of the inner and outer shells to be calculated separately. The cleaned and separated data of the cooling tower shells were then exported so that the 232 radii could be estimated using additional software. As a result of the chosen scanning density, about 3,000 points could be used

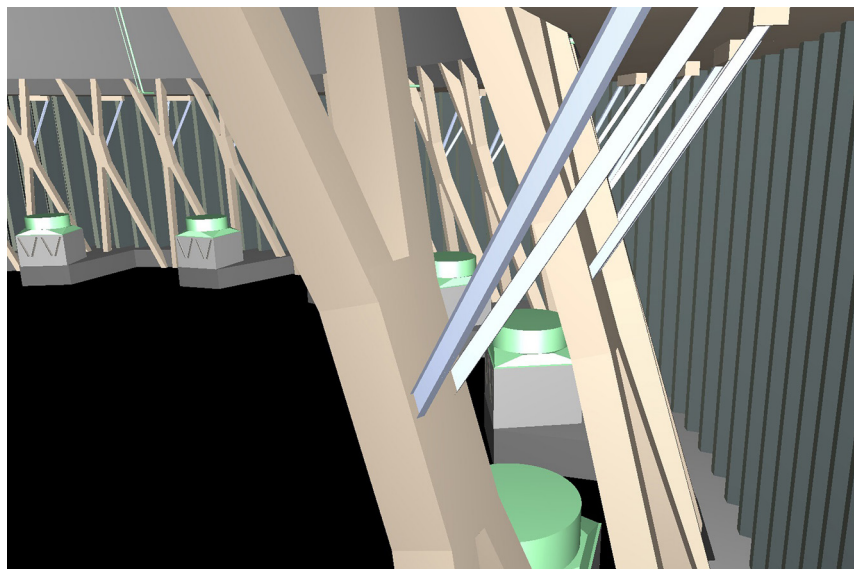


Detail of the 3D model of one of the cooling towers created with Leica Cyclone.

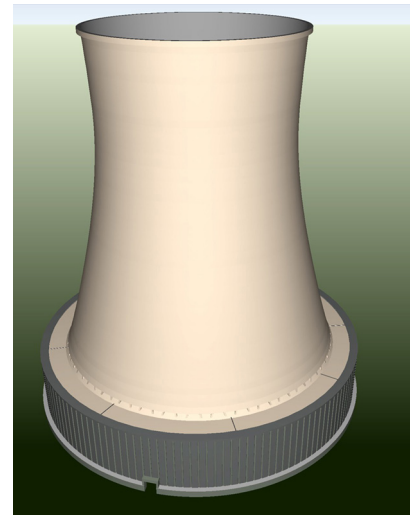
for each estimate of a radius, enabling the radii to be calculated with very high accuracy. Comparison of the calculated actual radii to the planned radii showed the deviations between the plan and the current condition to be approx. 2 cm on average, which is completely acceptable.

Nova MS50: The first choice for large-area scans from great distances

Achim Hoffstiepel was delighted with the use of the Leica Nova MS50: "This project clearly showed that the Nova MS50 was the optimum solution for this job because its range exceeded that of conventional laser scanners. The direct linking of the individual scan positions saved valuable time when post-processing the scan



Another 3D view from the inner shell.



Complete model of a cooling tower.

data, as the scanned point cloud was already directly available in the defined coordinate system using the 'free station' approach."

As Heitkamp Ingenieur- und Kraftwerksbau GmbH (Engineering Surveying Profit Center) showed with this project, the Leica Nova MS50 offers new possibilities for extensive mapping and analysis of large engineering jobs.