

In a country where 20 deaths a day are contributed to vehicular accidents, a public transportation system could translate into saved lives. In the capital city of Riyadh in Saudi Arabia, one of the world's largest construction projects in history is underway now to provide just such a resource.

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# MOVING A CAPITAL CITY FORWARD



With 90 per cent of the nearly 6 million population in the city using cars, a sustainable public transportation system was desperately needed. The current public transportation system, though, was close to non-existent with no metro and no bus lines travelling inside the city. In 2014, ground was broken to begin the Riyadh Metro Project with an ambitious due date of late 2018.

The city's first rail metro will have six lines with 85 stations covering 176 kilometres with about 40 per cent of the lines underground. The metro will be able to move up to 3 million passengers a day. All together, the project comes in at an approximate 20.1 billion Euros.

### FINDING COMMON GLOBAL SOLUTIONS

To build one of the largest infrastructure construction projects in the world, it took a multicultural team. Three multinational consortiums are working together on the project, combining companies from around the world.

FAST Consortium, led by FCC Construcción from Spain with Freyssinet of Saudi Arabia, Atkins of England, Alstom and Setec from France, Samsung C&T from South Korea, Tyspa also of Spain, and Strukton of The Netherlands, was contracted to construct and design Lines 4 (Yellow), 5 (Green) and 6 (Purple) of the metro. The project oversees 64.6km of the rail track, 29.8km of viaducts and 24 stations at an overall cost of 7.1 billion Euros.

Construction of these three lines is overseen by three partners in the Consortium: FCC Construcción, Samsung C&T and Strukton. Each line has a dedicated survey team with all using solutions from Leica Geosystems.



Strukton, in charge of Line 6 (Purple), has been tasked with capturing data for topographic surveys, as-built checks, volume calculation, and inventory of existing utilities. The technology company specialising in rail systems and civil infrastructure is also in charge of stakeouts for construction and deviation monitoring.

“Though these are typical tasks for us, the sheer size of the project is new for us,” said Clemens Tierie, survey manager for Strukton. “Only on Line 6, I have 28 teams with more than 10 nationalities represented.”

With such a diverse mix, Tierie needed to find common solutions familiar to all the team members. He found that in Leica Geosystems. Using a combination of total stations, GNSS receivers, and construction lasers and levels combined with measurement software, the Strukton team is well on its way to completing the project on time and on budget.

“Surveying is teamwork, and surveyors from all across the world know and appreciate Leica Geosystems solutions,” said Tierie.

### RACING AGAINST THE ELEMENTS

With an ambitious deadline of just more than four years for such a large project, Tierie knew the team couldn't allow for any disruption.

First, working in temperatures upward of 50 degrees Celsius in desert conditions, they needed to be able to trust the instruments to withstand.

“Due to our time schedule, there have been many days we've had to work straight through. We couldn't wait for evenings or cooler temperatures,” said Tierie. “With the durability of our Leica Viva TS15 total station, we were able to perform high-accuracy stakeouts at any part of the working day. This enabled us to ensure everything was ready for construction to start on time.”

Using Leica Geo Office and Infinity software, the team was able to instantly transfer reality capture data back to the office from the field for quicker processing. This way, if there were extra measurements needed, the team could do so while on site without having to return later.

The team also used the Leica Rugby rotating laser and construction levels to perform accurate as-built checks. With almost all of Leica Geosystems instruments able to operate from -20 to 50 degrees Celsius, the Strukton team is on schedule to finish the project.



Next, as the largest city in the country and with a unprecedented growth in the past decade, the city's utilities have created a complex infrastructure challenge. While constructing the Riyadh Metro Line, the team had to remain vigilant not to interfere with any of the buried utilities or lines running above, many times not knowing exactly where these utilities were located. Combining the Leica GS14 GNSS smart antenna with the Leica GR10 GNSS reference station receiver, Tierie and his team were able to precisely locate and account for rogue utilities. Saving precious time and avoiding dangerous utility strikes, the team was able to work quicker, safer and more efficiently.

“Due to precise locating abilities of these instruments, we were able to inform our designers in the early stages of the project exactly where the utilities were located so they could incorporate this new information in the metro design,” said Tierie.

Finally, the constant ongoing construction put roads and buildings in unstable environments. With the vibration from heavy machinery, such as when excavating trenches for cut and cover tunnels, these city assets were in danger of uneven and unsafe settlement. In conjunction with their measuring task, the surveyors were also in charge of monitoring the ongoing construction and its impact on the surrounding areas.

“With the accuracy of the Leica TM50 total station, we were able to quickly determine if construction operations were negatively impacting surrounding structures,” said Tierie. “Improving the safety for the crew and community, our work has been well received here in Riyadh.”

The team has future plans to supplement the monitoring process with Leica GeoMoS monitoring software for instant alerts to deviations in the structures.

### WORLDWIDE SUPPORT

Perhaps even more critical in an international environment such as the construction site of the Riyadh Metro Project is the assurance of support at anytime, anywhere.

Tierie says he arranged the project in Saudi Arabia through a combined effort of Leica Geosystems locations. His former Leica Geosystems network in The Netherlands with support from the Dubai and Switzerland locations and the local dealer in Riyadh all pitched in to make the project possible. Since moving to the desert nation at the beginning of the project in 2014, he has relied on the excellent support he receives from the many locations of Leica Geosystems.

“The quality of Leica Geosystems solutions is great, but the support for me is the biggest benefit. I've received very good support from Leica Geosystems Netherlands, Dubai and the local dealer SITML,” said Tierie. “Due to the Active Customer Care support, we can quickly and efficiently handle any problems we encounter on site.”

