THE BAD TWIN

THE 2019 HESSENTAG FESTIVAL IN BAD HERSFELD SAW MORE THAN 800,000 PEOPLE VISIT THE TOWN OVER 10 DAYS. TO ENSURE THE SAFE AND ORDERLY MANAGEMENT OF SUCH A VAST NUMBER OF VISITORS, THE TOWN DECIDED TO PLAN AHEAD BY CREATING ITS OWN DIGITAL TWIN

Bad Hersfeld in Germany has plenty of experience of large-scale events. Its 'Hessentag' is Germany's largest federal state festival, with theatre-goers from across the world having been drawn to festivals in this district town by the River Fulda since the 1950s. The past few years have seen more than 100,000 visitors flood the town's theatres during the festival weeks, but the deluge of visitors to Hessentag 2019 was like nothing the town had ever seen before.

In order to avoid traffic chaos in Bad Hersfeld during the event, the town's administration, with the support of Mayor Thomas Fehling, turned to geospatial technology.

"We held meetings with Topcon in which we discussed how they could best support Bad Hersfeld in creating a Digital Twin. We soon realised that we spoke the same language and that it was possible to build a bridge between technology, industry and administration," recalls Fehling. The town's Smart City project is one that is close to his heart and it has a clear focus on the benefit to the local population: "Citizens' quality of life will improve."

To create the Digital Twin, Topcon project manager Heiko Lohre and his team of infrastructure experts moved into Bad Hersfeld, armed with a mobile mapping system.

The system they used was Topcon's IP-S3, which consists of an odometer, an inertial measurement unit (IMU) and a GNSS receiver, enabling it to provide extremely reliable and accurate data. Mounted on a car, it can capture 700,000 laser measurement points per second while the vehicle travels

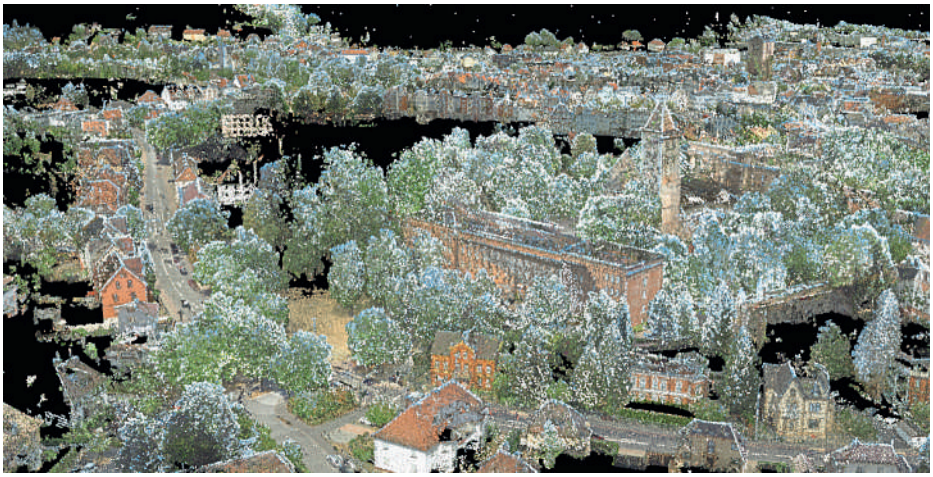
at speeds of up to 80km/h. The car 'flows along' inconspicuously with all the usual traffic, a PC on the back seat of the car with four hard drives storing the data captured during the journey.

Using the system, the team digitally captured the town centre, logistical routes, feeder roads and the available parking spaces in the space of just six hours, collecting all the necessary geodata about the 130km-long traffic route network within Bad Hersfeld and the surrounding area. Occasionally, however, the measuring team needed to drive along certain routes several times, as even a parked HGV may prevent the pavement behind it from being captured correctly. "We simply drove past that point again as soon as the obstacle was gone," says Lohre.

Big data

When the mapping trips had been completed, the team used the raw data to generate a Digital Twin of the town – the trickiest part of the process. "The model's accuracy is created in the office," explains Lohre.

The team had collected enormous quantities of data in a very short time. Although data capture stops automatically when the mobile mapping system comes to a halt, preventing any unnecessary data from being captured, the system captures 50GB of data per hour of travel, so the team ended up collecting 200GB of raw data. Data from five different sensors needed to be blended into a uniform point cloud, including GNSS data, laser measurement points and other vehicle data, such as the tilting behaviour of the car, as well as photographic data captured by the mapping system at the same time as the other data.



Bad Hersfeld's digital twin will make planning the town's future festivals easier

The key aid in processing that much data was the infrastructure and construction software, Magnet Collage. This enabled the point cloud data to be combined, visualised and analysed quickly, even though the data originated from different sources.

To provide the town with the finished Digital Twin, the team exported it to a hard drive. "We used LAS and LAZ files, which are both common exchange formats for 3D point clouds," says Lohre.

The Digital Twin in action

To successfully manage such a huge influx of visitors to the town, sophisticated traffic concepts had to be implemented. Public transport in Bad Hersfeld is covered entirely by means of bus and bicycle. But during the festival, the town centre had to be completely closed, meaning that no cars could travel in or out. Instead, the main car parks in the town's outskirts would be connected via a bus shuttle service.

This would put a lot of pressure on the town's road networks, so transport had to be run as efficiently as possible. The town used the Digital Twin to calculate the most efficient routes, pinpointing where any potential issues such as collisions and congestion might occur.

> IT WAS POSSIBLE TO BUILD A BRIDGE BETWEEN TECHNOLOGY, INDUSTRY AND ADMINISTRATION

The Digital Twin enabled seamless transport of visitors on the bus in and out of the event. It also ensured optimum safety, with scans being used to ensure that none of the planned emergency access routes were too narrow for vehicles to get through.

Hessentag 2019 was the first endurance test for the Digital Twin and it was "an immense success", according to Mayor Fehling.

The mobile mapping system was mounted on the roof of a car, capturing 700,000 laser measurement points per second

The main stage of the festival is erected in the old abbey grounds. More than 100m long, it is the world's largest Romanesque church ruins

The resounding feedback from visitors was that the event was exceptionally well presented and organised, which contributed to its uplifting atmosphere. He adds: "The staff in our town administration were able to determine from their offices how visitors will travel from A to B and how big the stage components were allowed to be, in order for them to be delivered to their respective event locations without any problems."

The future

The Digital Twin of Bad Hersfeld helped to facilitate a successful and well-organised Hessentag 2019 and will continue to do so for future festivals in the town. The exact number of parking spaces available is now known, as are the areas where festival stands can be erected in the town centre without blocking emergency access routes or leaving them too narrow. The event logistics were also easier to organise thanks to the digital model.

Over the next few years, Bad Hersfeld has committed to develop an efficient and sustainable transport system. "To this end, Topcon's digital model will provide valuable information and enormous benefits," says mayor Fehling.

But there was one other requirement of the project – Mayor Fehling requested that the process used in Bad Hersfeld be transferrable to other municipalities and cities.

"That poses no problem for us," says Lohre. "The working and capture processes can be repeated in other cities at any time."

Topcon used a mobile mapping system to capture all 130km of Bad Hersfeld's road network

The city administration registered more than 860,000 visitors during Hessentag this year. © district seat Bad Hersfeld

Mayor Thomas Fehling (third from right) and the state premier of Hesse, Volker Bouffier (centre), starting off the procession of the 59th Hessentag © district seat Bad Hersfeld

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