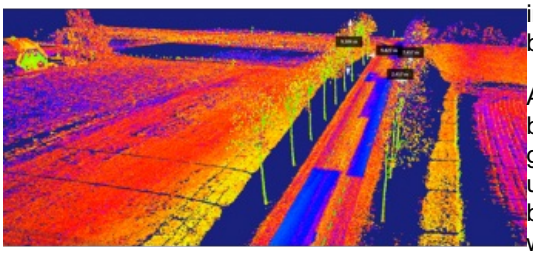
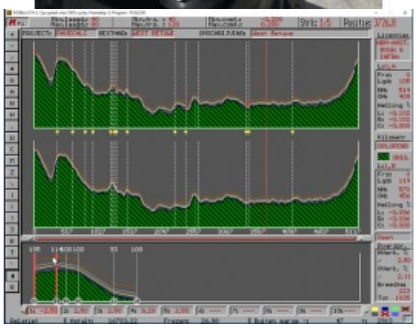
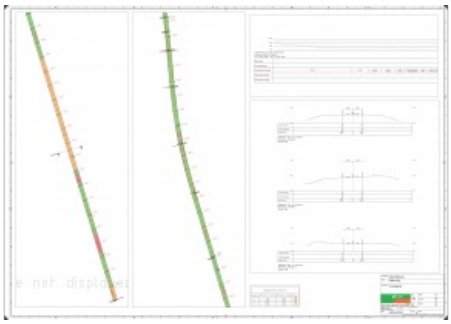
BeeMobile Case Study: Mobile Mapping with Faro Laser Scanner







BAM Infra recorded 3D road models using a Faro terrestrial laser scanner with the innovative BeeMobile mobile mapping system at various locations across the Netherlands in 2020.

BAM Infra is part of the BAM group and is active in the domestic market of the Netherlands and other European countries. As a leading and innovative company, BAM is constantly looking for improvements and innovations to optimize business processes.

An essential part of the infrastructural business process within BAM is the geodetic field in which various specialists use their specialist knowledge to serve both internal and external customers as well as possible. Traditional equipment such as tachymeters, GNSS receivers, static scanners and drones have been used on a regular basis for five years. However, this equipment lacked an important system, namely a mobile scanning system. Until recently, this service was hired externally from various market parties.

BAM Infra scanned part of the area under maintenance in this municipality in 3D using the BEEMOBILE MM system.

Since the introduction of Mobile Mapping (MM) systems, BAM Infra has been looking at the quality, possibilities and feasibility of an MM system within BAM Infra. Until the end of 2019, various MM products were considered and tested; however, high-end solutions from leading brands turned out to be impracticable in terms of investment level or left a lower quality impression. At the end of 2019, the company STORMBEE from Ghent (Belgium) launched an IPO of their innovative BEEMOBILE system. During 2020, this system was tested and evaluated on a number of BAM Infra projects.

In 2020, BAM Infra recorded 3D road models at various locations across The Netherlands:

- various locations in the municipality of Almere;
- various locations / objects in the province of North Holland;
- the municipality of Amsterdam, Stadhouderskade / Rijksmuseum;
- Rijkswaterstaat Volkerak Bridge A59-A29, combined with drone measurements, A50, A6, N33;
- various locations in the provinces of North Brabant and Gelderland.

BEEMOBILE mounted on vehicle.

Case Study: Municipality of West Betuwe

Commissioned by the municipality of West Betuwe, BAM Infra scanned part of the area under maintenance in this municipality in 3D using the BEEMOBILE MM system. This included about four kilometres of road, including some intersections and a roundabout. The purpose of the measurements was to perform a check on the existing map material and to obtain a 3D model of the existing road surface for use in the design of an asphalt overlay model.

Collection process

After a preliminary reconnaissance in which any obstacles and impediments were inventoried, the first step was to place the base station. The base station used by BAM was a Leica GS16, which was positioned roughly halfway along the route. Alternatively, RINEX files could also have been requested from a commercial or non-commercial provider.

After mounting the BEEMOBILE on the vehicle, the mobile survey was started.

Before the start of the survey, the data logging was started on the base station, which logged with an interval of one second during the entire survey. Important points when conducting the mobile survey:

- static initialization at least two minutes before the start of the survey;
- starting at least 200 metres in front of the target area, to initialize the inertial measurement unit (IMU);
- driving at a constant speed as much as possible, preferably 30km/h but up to a maximum of 80km/h;
- avoiding stopping: anticipating traffic at intersections / roundabouts to prevent this.

The BEEMOBILE is equipped with a FARO Focus laser scanner and a Trimble GNSS receiver.

Control points

After mobile data collection, a number of control points / objects were always collected to enable a check / calibration of the collected data. These were preferably high-contrast objects such as painted surfaces and signs that were clearly recognizable in the point cloud. If applicable, Ground Control Points (GCPs) were also applied to relate drone measurements. These GCPs could also be used in combination with the photogrammetry to calibrate the recorded point cloud and to test for quality. Within the post-processing software, a report was generated of the estimated accuracies in x-y and z. If the accuracies were insufficient, terrestrial measurements were carried out to equalize the trajectory file so that it met the strict quality requirements of BAM Infra. The ∂x, y, z were visualized by circles in Civil 3D, where the diameter of the circle was the achieved ∂. Below is a screenshot showing where GNSS signal loss makes manual measurement necessary.

Processing the data

The collected data was processed successively with:

- POSPac post-processing software;
- BEEFLEX point cloud processing;
- CloudCompare;
- Autodesk Recap.

In Recap there are many possibilities to provide objects with dimensions. In the example below, this included the distance of trees from the road, the distance between trees, and the crest height. The repair areas of the road model were also clearly visible in the screenshot, as dark contrasting areas.

Point cloud in Recap.

Further Processing

After post-processing and verification / smoothing, high-quality data was available for the design process. The point cloud was read into Autodesk Civil 3D via Autodesk Recap. The two main products designed with the collected data were:

- new road model / overlap model;
- design of road markings and lines.

A Rehab Corridor road model was built within Autodesk Civil 3D. This made it possible to quickly generate length profiles and cross-sections and to run camber profiles.

3D Road Model

The next step was to make an export to the road model design software PaveCalc used by BAM Infra.

The profiles were exported from Autodesk Civil 3D to PaveCalc, see screenshot below. During this design phase, an accurate new road model could be constructed using various design parameters such as comfort slope and camber and other constructive measures that fully

met the client’s requirements.


Road model software.

Autodesk Civil 3D

After road model modelling, the design process was completed in Autodesk Civil 3D. The final result was a design / outline drawing including asphalt or milling figures, cross-sections, length profiles and quantities. The lines generated from the scan data were also used to create road marking plans. The road marking plan forms the basis for the control line plan with which the asphalt spreading machines are controlled.

Conclusion

With the use of the BEEMOBILE MM system, BAM Infra had the opportunity to quickly and accurately acquire 3D road models. The system is a no-nonsense measuring system without unnecessary and expensive extra features. The combination of a highly accurate scanner of Faro with a high-quality IMU makes it possible to obtain high-quality 3D point clouds that are of considerable added value in the work process of BAM Infra.


End-product summary drawing.