

# The Evolution of FLEPOS 3.0

A continuously operating reference station (CORS) provides GNSS data to support very accurate 3D positioning and additional geophysical applications. Flemish Positioning Services (FLEPOS) is the real-time global navigation satellite system (GNSS) CORS network for the Flanders region in northern Belgium. This article outlines the evolution of the next generation of the real-time network, FLEPOS 3.0.

FLEPOS is part of Informatie Vlaanderen, a Flanders public administration organization. The first version of FLEPOS was established in 2002. Between 2002 and 2018, FLEPOS evolved through version 2.0 into the current FLEPOS 3.0 RTK real-time network (RTN) thanks to support from the Trimble Network Operations team.

## FLEPOS 1.0 AND 2.0

From the initial FLEPOS 1.0 system in 2002 to the end of FLEPOS 2.0 in 2018, there was a large increase in users and their demand for high-quality data. There were also extensive technology improvements. FLEPOS 1.0, operational in 2002, was equipped with dial-up access and designed for 50-500 users. User support was available from 9 a.m. to 5 p.m. The hardware was multi-party manufactured.

The next generation, FLEPOS 2.0, built on FLEPOS 1.0 and was operational from 2010 to 2017. It was designed for 500-3,500 users and, while still using dial-up access, it supported GLONASS using multi-party receivers. From a maintenance perspective, it was designed to minimize on-site interventions and was equipped with seven servers, a web interface and a remote power switch. User support was still only available from 9 a.m. to 5 p.m., even though customers were increasingly active outside of those 'office hours'.

## FLEPOS 3.0 SERVICES

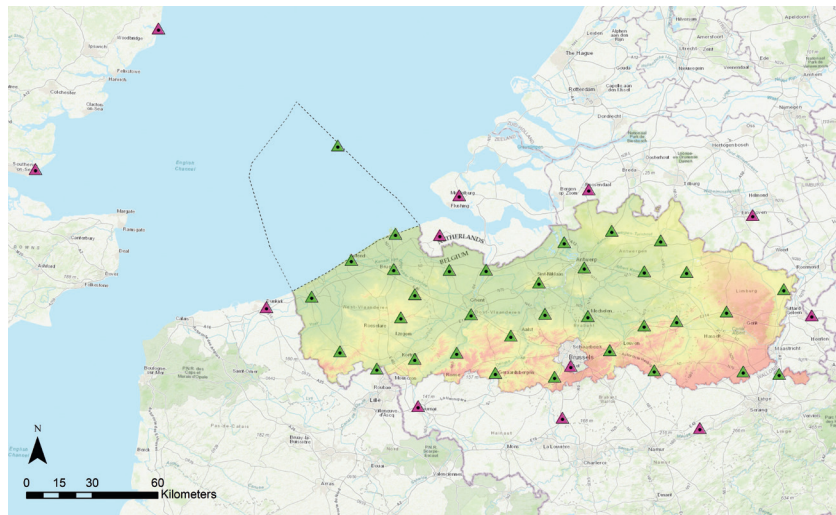
FLEPOS 3.0 was required to provide 100% coverage of Flanders, which included two user zones (land and water). Reliable, uninterrupted coverage is paramount for key industries in

Flanders, which include survey, agriculture and construction on land, as well as hydrographic survey, river pilotages, dredging and offshore windfarm users in water. FLEPOS 3.0 also had to be capable of supporting 3,500 registered users, including peaks of more than 800 users simultaneously. Additionally, FLEPOS needed a dependable and consistent service for the outsourcing of information technology operations tasks. This led to a shift to Trimble cloud-based services. The shift to superior cloud-based services was a priority for FLEPOS to avoid a repeat of past service disruption issues that resulted in forced shutdowns of all servers, several days of non-service and a multitude of employee overtime hours.

Not only are there more users nowadays (including a more than 5,000% increase in



▲ CORS installation in Ruiselede, Belgium.



▲ Map of the FLEPOS CORS network for the Flanders region in northern Belgium.

simultaneous users over the past ten years), but those users are also more diverse and applying data in innovative ways. As the scale of the data's impact has broadened, the user tolerance for outages has drastically decreased because data use affects public safety more than ever before. For example, Flanders' river pilots use RTK for guiding massive container ships into the Port of Antwerp's locks.

### FLEPOS 3.0 TECHNOLOGY

The current version, FLEPOS 3.0, was made available in 2018 after a 15-month design and build process by the project partners: FLEPOS, Trimble and local Trimble dealer AllTerra BeLux. Stakeholders were involved during the design process, which required strategic planning, in-depth research, experience-based recommendations and strong collaboration between all project partners. The project team took local geography, land ownership, climate, data communications and power supply resources into consideration. The system is streamlined with six servers, including two RTN servers, two Networked Transport of RTCM via Internet Protocol (NTRIP) servers, one SQL server and one test server. The network has the capability to permanently archive data collected by the receivers.

The size of the network was increased due to the need to support Galileo and BeiDou satellite systems, as well as to accommodate the increase in users and data applications. The network now has a total of 45 CORS consisting of 33 FLEPOS-installed GNSS reference receivers and 12 receivers from surrounding networks. Because of the Sparse GNSS app in the Trimble Pivot Platform, only a subset of the reference stations need to be equipped with Galileo and BeiDou for FLEPOS customers to obtain corrections that include all the constellations. This made it possible to reduce the amount of new hardware without compromising on data quality and allowed customers to upgrade their rovers over time. Approximately 50% of the CORS are now equipped with GPS/GLONASS receivers and 50% are GPS/GLONASS/Galileo/BeiDou receivers.

### STANDARDIZATION

In FLEPOS 1.0 and 2.0, the network was a combination of different hardware and software brands, and this worked fine early on, before user demands and system complexities increased. However, as more GNSS constellations and signals were added,

it became apparent that some features of hardware and software products only worked in a single-manufacturer product environment, meaning they could no longer be used by FLEPOS.

Furthermore, by the time FLEPOS 3.0 was designed, the existing GNSS hardware was eight years old, which for GNSS receivers can be considered outdated. FLEPOS therefore faced a very real risk of hardware failure, which meant decreased user productivity, an unhappy customer base and increased operational costs. As a result, in FLEPOS 3.0 all system software and nearly all hardware is now standardized using Trimble RTN solutions with Ethernet ports and a web interface. This standardization has helped to ensure high compatibility, enabling easy integration between the field and office for operator control of the network.

### FLEPOS 3.0 OPERATIONAL CHANGES

Due to higher usage activity outside of office hours (9 a.m. to 5 p.m.), FLEPOS engaged a 24/7 Trimble Network Management support team to keep a constant eye on the performance of the FLEPOS service. That team provided expertise and support ranging from early planning and consultation to complete operational and maintenance responsibility for FLEPOS 3.0. In instances of service interruption, Trimble and AllTerra BeLux respond on behalf of FLEPOS to provide reliable and trusted support to users. Thanks to the backup support of Trimble Network Management, FLEPOS network operations staff can take time off without needing to be on call. The team members now work far fewer overtime hours and FLEPOS has improved its culture and its employees' health by allowing them to achieve a better work/life balance.

In FLEPOS 3.0, downtime has been eliminated thanks to full migration to the cloud and the addition of backup servers. The risk of failure has been reduced by performing network configuration tests on a dedicated server and correcting issues before bringing changes into production, leading to higher overall service satisfaction. FLEPOS has also achieved maintenance update operational efficiencies, since these updates can be completed during standard business hours versus after-hours (i.e. overtime hours) once field users have left for the day. Overall, operating efficiencies have increased, operating costs have decreased, employees and customers are happier and FLEPOS is enjoying a steady return on investment.



▲ The evolution of the FLEPOS network.

### CONCLUSION

The region-wide FLEPOS network is the result of careful planning, team collaboration, cultivating strong business relationships and simply knowing what was necessary to keep customers working well into the future. The network meets current and future needs for the organization and its users, yields a satisfied customer base and offers a better work/life balance for employees. FLEPOS 3.0 provides 100% coverage of Flanders 24/7 and all year round, while outsourcing the service to Trimble Network Operations and operational support to AllTerra BeLux. The system also eliminates the risk of downtime by providing dedicated servers for testing and system upgrades. Now, after a year of FLEPOS 3.0 operations, the team can reflect upon several advantages to the system upgrade, including increased operating efficiencies and decreased operating costs. The Trimble Network Management team and local dealer provide extremely valuable support in terms of their knowledge and expertise. ◀

### FURTHER READING

- Trimble real-time networks: <https://www.trimble.com/Real-Time-Networks/Index.aspx>
- FLEPOS's region-wide network system: <https://overheid.vlaanderen.be/informatie-vlaanderen/producten-diensten/centimeternauwkeurige-positiebepaling-flepos>

### ABOUT THE AUTHOR



**Bart Dierickx** has been the network operator of the FLEPOS service since 2005. Prior to this role, he was active as a surveyor in the dredging world and for the public administration of Flanders, Belgium. He recently led efforts to evolve the FLEPOS regional real-time network (RTN), with support from a Trimble Network Operations team, to accommodate additional users, decrease operating costs and increase return on investment.