

# TRAILBLAZERS

## Cycling Organization Accurately Maps Mountain Bike Trails in Québec, Canada

Cycling is a popular sport and pastime in the Canadian province of Québec, and for good reason.

As Canada's largest province by area, Québec offers a massive trail network with world-class biking trails. Bike-friendly routes go past scenic lakes, rivers, and farms; through forests and quaint towns; up and down hills and mountains; and into the heart of vibrant communities such as Montreal and Québec City. The province's most famous bike network is Route Verte, or Green Route, which comprises more than 5,300 kilometers (about 3,300 miles) of trails.

For cyclists to take full advantage of Québec's trails, they must be mapped and maintained. As a nonprofit organization that promotes bicycling for recreation, health, tourism, and environmental reasons, Vélo Québec took charge of mapping trail networks—including Route Verte—for the province. The mapping initiative, supported in part by Esri technology, aims to

help develop mountain biking trails specifically and promote their use.

"This project is very dear to me," said Francis Tétrault, mountain biking project manager for Vélo Québec and an avid mountain biker for 20 years. "We currently have over 500 kilometers mapped this season in the first installment of our project."

Tétrault has made it his mission to help perpetuate trail networks, as he has seen too many disappear due to poor planning and maintenance and loss of landowner permissions. Ideally, Tétrault and the team at Vélo Québec will map every kilometer of mountain bike trail in the province and add each official new trail to the organization's database.

### MORE DETAILED TRAIL DATA

Recently, Tétrault and his team collected accurate data on mountain bike trails by using ArcGIS QuickCapture along with high-accuracy

Global Navigation Satellite System (GNSS) receivers from Esri partner Eos Positioning Systems. The data included points and polylines that show the trail locations from start to finish; the length, directionality, difficulty level, and surface type of each trail; signage; and any obstacles cyclists might face.

ArcGIS QuickCapture, a mobile app designed for rapid field data collection, lets users record data by tapping a large button. The app then transmits the information back to a database in real time.

To improve on the spatial accuracy of this data, Vélo Québec paired QuickCapture with Arrow 100 receivers from Eos. This gave the team submeter location accuracy when collecting data in the field.

Part of Vélo Québec's biking advocacy work includes offering trainings to cyclists and hosting cycling events and trips. To support these efforts—which involve administering risk management, maintaining trails, and amending right-of-way agreements with landowners—the organization needs precise data. The data it collects in the field will also support other goals in the future, such as updating trail maps. (See the organization's interactive online trail map, hosted in ArcGIS Online, at [ow.ly/6ZsM50y1o5o](http://ow.ly/6ZsM50y1o5o). While mountain bike trail data collected for Tétrault's project isn't on the bilingual interactive map, people can view the network of paved trails along Route Verte and use tools to look up routes, create itineraries, and find places to stay such as campgrounds and hotels.)

In many instances, trails in Québec are built on private land. Cycling clubs, which develop the trails, must acquire permission from landowners to build trails on their land. Accurate trail mapping is helpful for obtaining this permission. The maps can show, for example, what portions of a proposed trail might be on a homeowner's land.

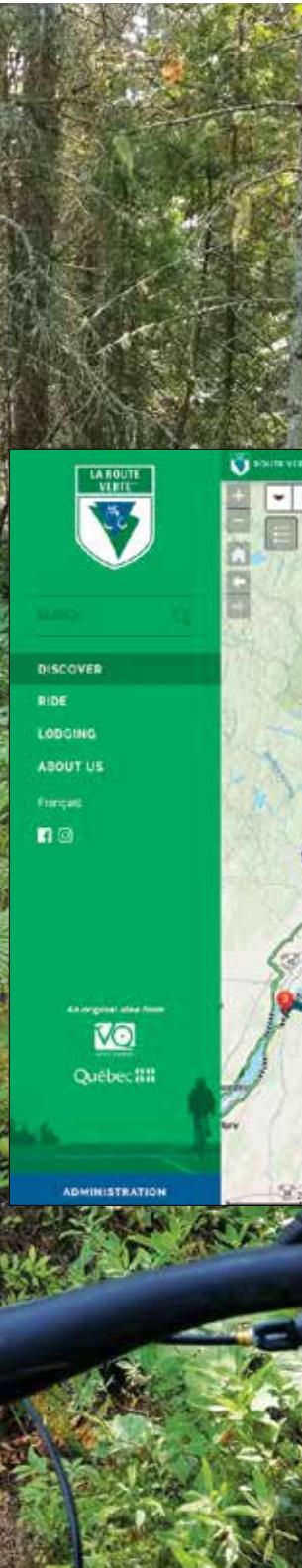
### THE RIGHT EQUIPMENT

A network of Vélo Québec staff or volunteers—some of whom are not versed in GIS—create and maintain up-to-date trail data. Because the data-capture process happens out in the field, the technology used must be easy to understand and operate, and any associated training needs to be minimal.

Working remotely in areas without cell coverage and using technology under varying light and temperature conditions can add another layer of challenges. What's more, staff and volunteers capture data while they're riding a bicycle, so having lightweight, compact, durable equipment is critical.

And, of course, this data collection must produce accurate data. Before this initiative, land managers had data that was largely gathered by smartphones (precise to about 14–16 meters) or handheld GPS systems (precise to around 4 meters). The low level of precision impacted data and analysis, so the Vélo Québec team needed a tool to improve accuracy.

"Because of that low level of precision, you could see lines crossing and being



↑ The Route Verte map, available via ArcGIS Online, gives people the ability to plan a cycling trip using the Route Verte network and regional bike path systems.

← Vélo Québec has already mapped all sorts of bike trails, including this advanced, single-track trail near Chicoutimi, Québec.

superimposed [when collecting trail data], especially where tight hairpin turns were concerned, which is a regular occurrence in modern bike trails," Tétrault explained. "There [are] a lot of variables that make the [tracks] less precise."

#### A BIG-BUTTON EXPERIENCE

Vélo Québec wanted an easy-to-use, highly accurate, and compact field data collection solution, which is why the team selected ArcGIS QuickCapture for this project.

The mobile app's simple, big-button user experience requires little training and runs on consumer iOS and Android devices, so anyone with either platform can load it on their phone. QuickCapture records and transmits data from the field, while the Arrow 100 receivers improve the spatial accuracy of the captured data.

Due to severe snow conditions in Québec, it wasn't possible for the team to do its first field tests on bicycles. Instead, Tétrault put the mobile solution and receivers to the test while he went ice-skating on a lake near the Vélo Québec office. Tétrault said the results were remarkable: QuickCapture was easy to use, the receivers were easy to carry, and the data was very accurate. The receivers and QuickCapture app on mobile devices, used simultaneously, were able to precisely map and attribute the tracks on ice.

The next step was to prepare each of the complementary devices for use on mountain bikes in the spring. The team attached a smartphone with the mobile app to a bicycle's handlebar and mounted the GPS receiver's antenna on a rider's helmet. The receiver itself was in a hydration pack worn by the technician. It was configured to stream locations to the app at 2 Hz (two positions sent per second) to improve the granularity of the tracks captured. The receiver was also configured so it could document different kinds of field observations: photos of

the trail, obstacles, bridges, and intersections; the difficulty and category of trails mapped; and polygons captured for trailhead parking lots and buildings.

"The development of this methodology is breaking news for our field and has been very well received," Tétrault said. "We now have a quality solution for gathering data that wasn't possible before."

#### SIMPLER DATA COLLECTION

QuickCapture has allowed Vélo Québec to simplify how it collects data and improve data processing. The whole operation is now digitized and more streamlined.

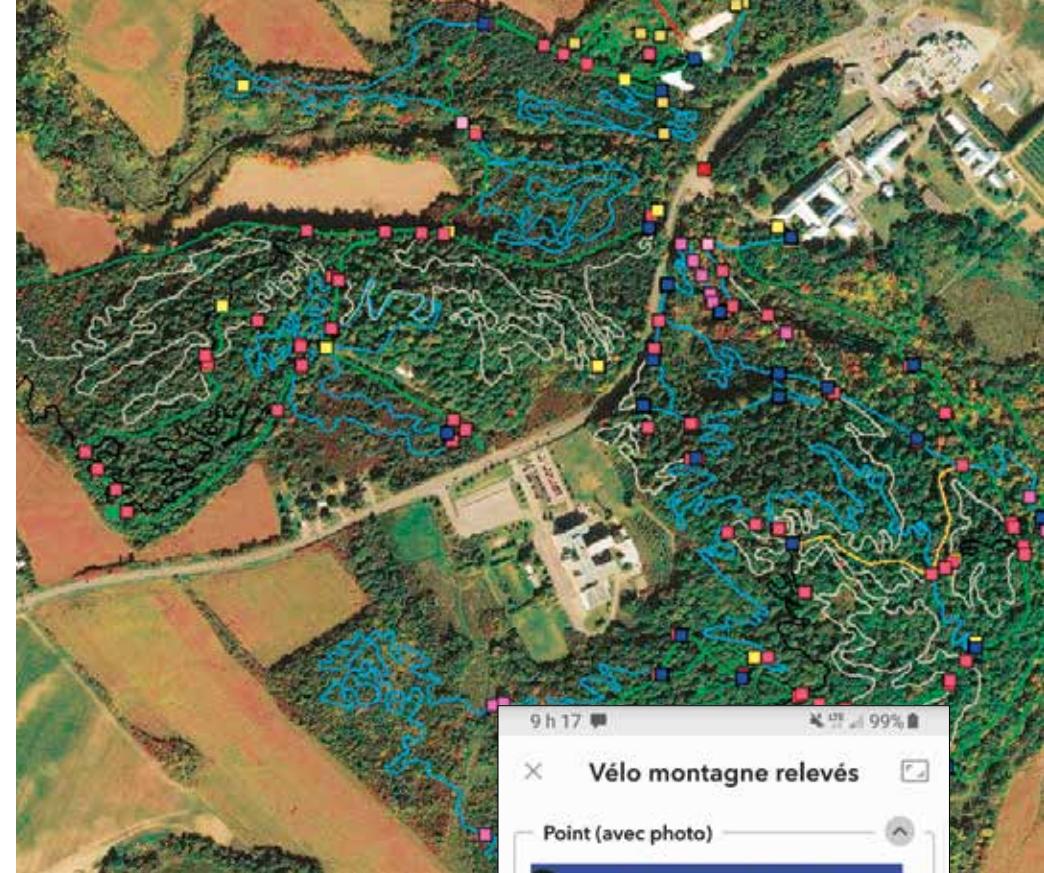
The old method of collecting data on the trails involved using a handheld GPS device to generate waypoints or polylines. Then, data was transcribed in a notebook and later entered into a spreadsheet to populate the attributes related to each point, such as the width or difficulty level of the trail. This old method was cumbersome and opened the door to data entry mistakes that would be hard to track afterward.

Now, the app provides individual buttons for all the types of features recorded on the trails.

"We pick the right trail attributes *and* punch the appropriate button in the app, and the track gets recorded as we follow the trail. And it's the same thing for observations along the trail," Tétrault said. "It's incredibly simple. I see this procedure as less of a chore for volunteers than the traditional method of GPS and paper, and the training is much more intuitive."

The mobile app is also speeding up the capture of data in the field.

"In the short time we've been running the app on the ground, we have covered more kilometers in less time than *[we would have]* with our old method," Tétrault said. "In one 20-week season, we should be able to cover around



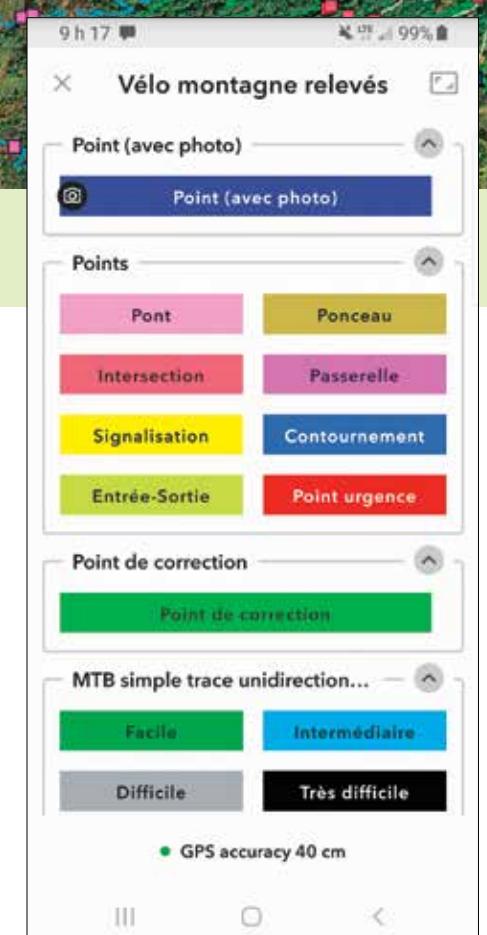
↑ This mapped mountain bike trail network is located in Oka, Québec.

600 kilometers, with an average of 20 kilometers per day. That's 375 miles for one person, which is a substantial amount."

Data is now accessible in real time as well, enabling prompt quality assurance and constant monitoring of progress. Technicians in the field can see if a trail has been entered correctly or call in to have office staff check it immediately.

There's also been considerable improvement in data quality. Tétrault describes the mobile data collection app as a user-friendly solution that is helping Vélo Québec better map and manage trails so that people will have them for generations to come.

"For us, this tool guarantees a uniform quality of the data in the project, which was a big challenge before," said Tétrault. "I had an idea of the possibilities of GIS before, but this project has opened up a can of 'wow' in terms of putting technology in service for a cause."



↑ The ArcGIS QuickCapture survey includes buttons for bridges, intersections, and signals and information such as trail difficulty.

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