CITIZEN PROJECT · QUÉBEC CITY REGION

Market Study

A 150 km underground cycling network — why the demand is credible, and how to prove it.

150 km
of underground cycling network

≈ 10%
target — share of regional trips

365 d/yr
accessible whatever the weather

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MARKET STUDY

The demand: why it is credible, and how to prove it.

Mass cycling is not a matter of culture or climate, but of infrastructure: where the barriers are removed, people ride — even at −25 °C. This document sets out a realistic demand figure for Québec City, in the right unit of measure, then identifies the one test that can confirm it before any major commitment.

The analysis proceeds in eight steps: the principle (demand follows infrastructure), the real-world proof from Oulu, what surface infrastructure already solves and what it never will, measuring the target in the right unit, reading the route against population density, the decisive origin–destination variable, a conservative range bracketed by Oulu, and a staged validation strategy.

1. Demand follows infrastructure

The common assumption is that cycling is a lifestyle choice, reserved for athletes or mild summers. The data says otherwise: cycling's share rises, sometimes quickly, as soon as a city builds safe routes and maintains them. In Montréal, the number of bike trips on the island grew by roughly **57% between 2008 and 2013**, and the rapid rollout of the Réseau express vélo (REV) transformed ridership on certain corridors within months.

An honest clarification is needed. The figure of “15% in Montréal” is often cited: it is in fact a target the city aims to reach in its central boroughs within about fifteen years. The current mode share for trips there is closer to 3–4%. We will therefore not lean on that number: the real question is not “do people in Québec want to ride?”, but “what stops them today, and does the project solve it?”.

2. The real-world test: Oulu, Finland

There is a city that answers the question almost perfectly. Oulu, about 200,000 inhabitants, sits 160 km from the Arctic Circle: five months of snow, with cold dropping to −25 or even −30 °C — a climate at least as harsh as Québec's, and colder than our typical winters. Yet cycling there is an ordinary mode of transport, all year round.

OULU — INDICATOR	VALUE	READING
Annual mode share (all trips)	**≈ 22%**	More than one trip in five
Mid-winter mode share	≈ 12%	At −25 °C, into the wind
Summer mode share (inferred)	≈ 30%	Implied: the year averages 22%
Residents who cycle at least occasionally	≈ 77%	From toddlers to seniors
Infrastructure	≈ 950 km	Separated paths, cleared as a priority

Oulu achieves these results **on the surface**, with no tunnel, in a climate harsher than ours. The specialists' conclusion is blunt: what keeps people home in winter is not the cold or the snow, but the lack of maintained infrastructure. Asked for their secret, Oulu's planners answer simply: good routes and serious winter maintenance.

> **Two takeaways.** First, winter cycling in Québec is not a fantasy: it is a result of engineering and maintenance. Second — and this is crucial for staying realistic — even the world's best winter-cycling city tops out around 22% over the year. Weather is therefore not the only barrier: any serious target must sit below that ceiling, not above it.

3. What surface infrastructure already solves — and what it never will

Let us be honest, because that is what makes the argument credible: two of Québec's classic obstacles do not require a tunnel.

- **Snow on the ground** is solved by clearing it. Oulu proves it every morning: once cleared, compacted snow is not slippery, and two-thirds of cyclists there don't even use studded tires.
- **Hills** are solved by the electric-assist bike. The Upper Town / Lower Town break stops being an obstacle, and since an e-bike makes 18 km trips easy — versus 5 to 6 km for Oulu's typical trip — it significantly widens the pool of potential users.

The tunnel must therefore justify its cost not on what the surface already does, but on what **no surface path can offer, even perfectly built**:

- **Total separation from cars.** The number-one barrier to recruiting new cyclists — especially women, families and seniors, the "interested but concerned" majority — is neither cold nor hills: it is fear of traffic. A fully separated network removes it absolutely.
- **Complete shelter from the weather.** Clearing makes the ground rideable, but it does not remove what falls on the cyclist or pushes against them: rain, thunderstorms, headwind and biting cold. A tunnel at a steady 10–15 °C, with no wind or precipitation, eliminates all of it — and offers the all-weather reliability of a car, 365 days a year. This is what converts Oulu's winter drop (≈ 45% fewer cyclists) into sustained ridership.
- **Zero freezing rain.** Compacted snow is not slippery; freezing rain is — and it is a Québec specialty. The tunnel removes it entirely.

On top of this comes a continuous flow, with no stops or red lights, hence predictable travel times. The tunnel's value is this **margin above a maximized surface network**, in these specific dimensions.

4. Measuring the target in the right unit

This is where most comparisons go wrong. Oulu's 22% is a share of **trips**. The project's objective — 100,000 intensive users and 100,000 occasional users — is a share of **people** (200,000 of the ~600,000 residents within walking distance). The two are not comparable as they stand.

Let us first establish the base, once and for all — everything else depends on it. A "trip" is a journey from point A to point B: going to work is one, coming back is a second. The roughly 600,000 residents near the network each make on the order of 2.5 trips per day (work, study, school, errands, leisure). Over a year:

> 600,000 people × 2.5 trips/day × 365 days ≈ **550 million trips per year** in the network's region, across all modes.

It is this total — not the number of inhabitants — that serves as the denominator whenever we speak of "share of trips". Aiming for 10% therefore means that on the order of **55 million of these trips** would be made through the tunnel rather than by car, bus or on foot. The table below starts from the other end — the users — and lands on the same 10%.

SEGMENT	USERS	TRIPS/YR (ASSUMED)	TRIPS/YR
Intensive users (daily round trip)	100,000	≈ 500	≈ 50 M
Occasional users (leisure, weekend, tourism)	100,000	≈ 75	≈ 7.5 M
Trips on the network			**≈ 57.5 M**
Total regional trips (all modes, ≈ 2.5/person/day)	600,000	≈ 915	≈ 550 M
Equivalent share (of trips)			**≈ 10%**

≈ 10% of trips

Brought to the same unit as Oulu, the project's target corresponds roughly to its **winter level** (≈ 12%) — and stays well **below its annual average** (≈ 22%). This is not asking for a feat: it asks for less than what the coldest city in the world already achieves, on the surface — while the tunnel adds shelter from the weather, the absence of freezing rain, and total separation from cars. The target is conservative, not heroic.

5. A route drawn over population density

A mode share is only realized if the trips “fit” the network. That is why the route was not drawn along the major highways, but directly **over population density**, to maximize the number of trips with both ends near an entrance.

WITHIN WALKING DISTANCE

≈ 600,000

Residents a few minutes' walk from an entry station.

WITHIN 1 KM

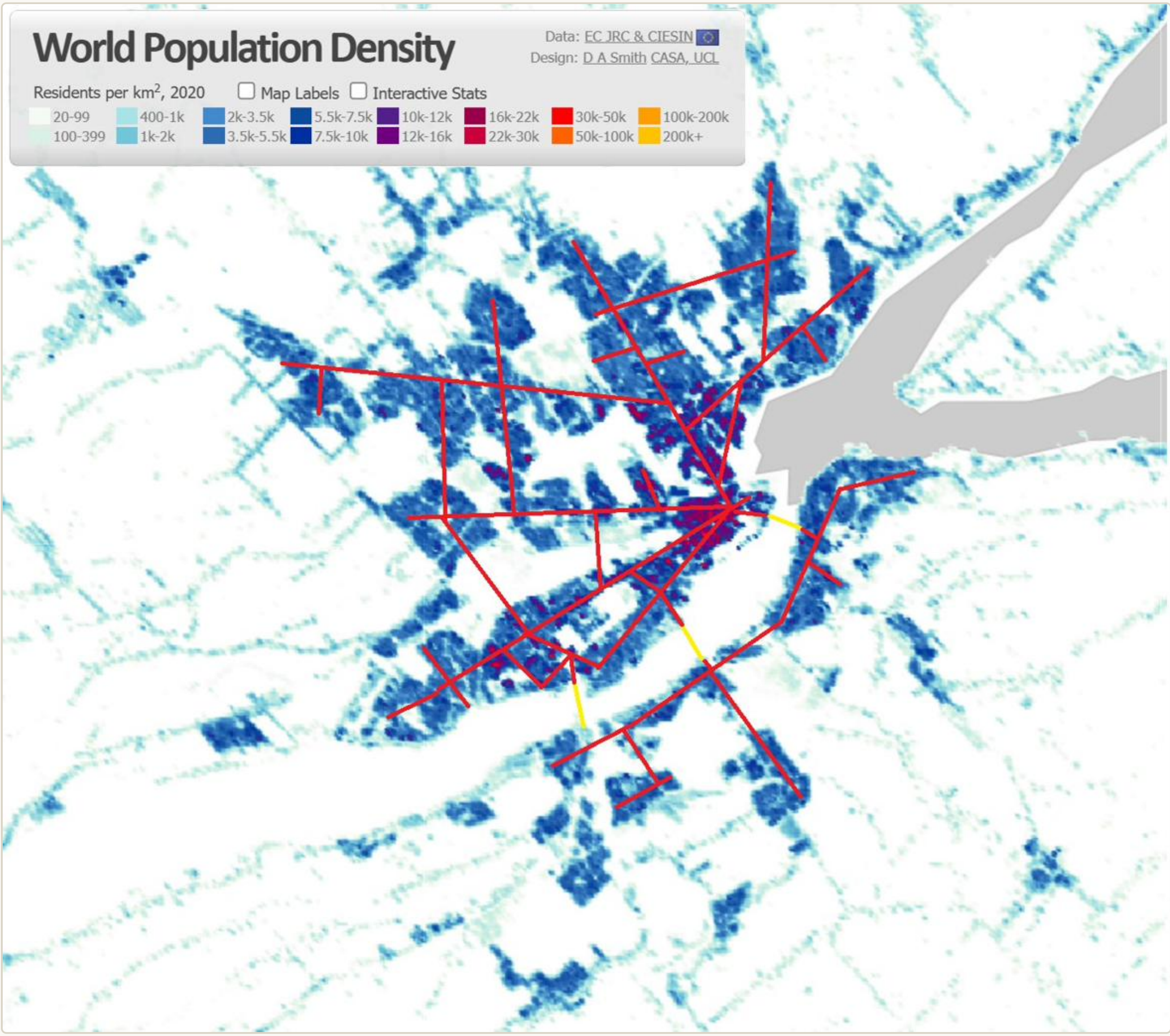
480,000

People living less than a kilometre from a network route.

WITHIN 2 KM

700,000

Wider catchment, relevant in the e-bike era.



Proposed route (red) overlaid on the population density of the Québec City region: the lines follow the densest zones (blue to purple) to capture the most trips. In yellow, the Québec–Lévis links served by shuttles. Base map: world population density (EC JRC & CIESIN).

The logic is simple: the denser a corridor, the more people have both their home and their destination near the line. Density is therefore the mechanism that turns “people who would like to ride” into “trips the tunnel actually serves”.

6. The variable that decides everything: origin–destination

Oulu settles the question of willingness: yes, people ride when conditions allow. That leaves a single real unknown, and it is neither cultural nor climatic — it is **geometric**: how many daily trips in the catchment have both ends near 150 km of network? This does not depend on preferences, but on where people live and go.

It is also why the **100,000 intensive users** matter most: it is their daily trips that carry the capital amortization. Occasional users bring revenue and goodwill, but few trips. The entire economics of the project therefore rests on this origin–destination question — which no argument can settle on paper.

7. A conservative target, validated in stages

Rather than a single figure, here is a range bracketed by the Oulu benchmark, placed honestly between its winter low and its annual average.

All the figures rest on the same base established above: ~600,000 residents make ~550 million trips per year together. The **share of trips** is the fraction of this total that uses the tunnel; the **number of users** is the number of people needed to produce it — two ways of stating the same target, linked by the middle column, and not two quantities to multiply by each other.

SCENARIO	SHARE OF TRIPS	TRIPS/YR NETWORK	USERS (INT. + OCC.)	READING VS OULU
Conservative	≈ 5%	≈ 29 M	≈ 100,000 50,000 + 50,000	Below Oulu's winter low
Median (target)	**≈ 10%**	**≈ 57 M**	**≈ 200,000** 100,000 + 100,000	≈ Oulu's winter level
Optimistic	≈ 18%	≈ 101 M	≈ 350,000 175,000 + 175,000	≈ Oulu's annual average

Why you cannot extrapolate to "100% = 2 million users": the percentage is a share of trips, not of people, and there are only ~600,000 people near the network. Even if every one of them became a cyclist, the ceiling would be around 30% of trips — Oulu's summer level — because a large share of trips (long distances, carrying loads, off-network destinations) simply cannot be made by bike. The table only makes sense within its realistic 5–18% range. The 50/50 split is illustrative, and "200,000 users" does not mean 200,000 daily commuters: half of them ride little.

Above all, the project does not ask anyone to bet $8.7 billion on a forecast. It proposes to **measure first**. Phase 1 — a central 15 km segment linking Sainte-Foy, Université Laval and Old Québec, for about $1.2 billion — serves as the test: it measures the corridor's actual mode share once the network is in service.

> **The only reliable judge.** If Phase 1 approaches the 10–12% of trips the model assumes, demand is no longer a hypothesis to defend: it is measured data, enough to justify the rest of the network. If it stays below that mark, we will have learned it for $1.2 billion rather than $8.7. That is how a megaproject de-risks itself.

8. Conclusion

The demand for an underground cycling network in Québec is credible, and that can be said without exaggeration. Cycling's share responds to infrastructure (Montréal, and above all Oulu, which rides at −25 °C on the surface). Winter and hills are already solvable — through snow clearing and the electric bike — which refocuses the tunnel's value on its genuinely exclusive advantages: total separation from cars, which addresses the real barrier of fear of traffic; complete shelter from rain, wind, storms and cold, 365 days a year; and the elimination of freezing rain. Measured in the right unit, the target equals Oulu's winter level, below its annual average: conservative, not heroic. The single variable that decides everything — the geometry of trips — is settled not by argument, but by Phase 1. Build 15 km, measure, then decide.

Vélo Tunnel Québec — A citizen project for a 150 km underground cycling network in the greater Québec City region, using The Boring Company's Prufrock tunnel boring technology. Document prepared by **Philippe Leblond**, June 2026.

Reference data sources: City of Oulu and Traficom (Finland); City of Montréal (cycling master plan); winter-cycling literature. The trip assumptions (≈ 2.5/person/day) are orders of magnitude to be refined by a local origin–destination survey.