Vélo Tunnel Québec

FINANCIAL ANALYSIS — CONSTRUCTION · COMPLETE VERSION

Construction costs

A full re-estimate, now including the underground interchanges and the evacuation shafts — with two already-budgeted items broken out.

From $7.8B to $18.4B — realistic ≈ $11.2B

Five scenarios for 150 km, in constant dollars. That is $52M to $122M per kilometre — versus $940M/km for the third road link, even in the worst case.

PREPARED BY

Philippe Leblond

Vélo Tunnel Québec · June 2026 · velotunnelquebec.com

Constant dollars — excluding inflation and borrowing interest · Informational document

1. Overview

How much to build 150 km of underground bicycle network, once? Here is the complete picture, scenario by scenario, in constant 2030 dollars.

From $7.8B to $18.4B — realistic ≈ $11.2B

The realistic figure reaches $11.2B once everything is counted honestly: the nature simulation, drainage and geothermal, then the two latest additions — the underground interchanges and the evacuation shafts. That is $52M to $122M per kilometre, versus $940M/km for the third road link.

Basis: constant dollars, excluding inflation and borrowing interest (which depend on the schedule and financing structure). The contingency is technical — engineering risk and site surprises — not an inflation cushion. All figures are planning-level orders of magnitude, to be refined by tender.

2. Technical systems, line by line

The former $2,800M block, opened into thirteen lines, each backed by an analysis. The "charging docks" line is detailed to make the àVélo docks visible.

Technical-systems sub-item	$M	Source
Ventilation and air filtration	600	Ventilation analysis
Acoustics (textured concrete + panels)	450	Acoustic analysis
Nature simulation (immersive cladding over 150 km)	500	Simulation analysis
Security (1,500 cameras, 1,500 SOS posts, AI, drones, 24/7 center)	550	Security dossier
Fire suppression + emergency exits + refuge niches	350	Fire dossier
Electrical distribution (MV/LV, substations, transformers, 150 km cabling)	160	Broken out
Drainage and pumping	200	Cross-checked
Generators + backup power (UPS)	120	Energy dossier
Telecommunications (5G, WiFi, fiber, radios)	100	Telecom dossier
Bike path (150 km asphalt, base, markings)	80	Broken out
E-bike charging docks (150 stations) — incl. ≈ $22M àVélo docks, ≈ $38M power & payment	60	Itemized
Station geothermal	50	CAPEX
Phosphorescent emergency lighting	8	Phosphor. analysis
Total — technical systems (realistic)	**3,228**	**vs 2,800 before**

3. Two additions to the scope: interchanges and evacuation shafts

The base estimate stopped at ≈ $9.5B. Two technical decisions extend it: we **actually connect the tunnels to one another** (the interchanges) and we **bring the emergency exits closer together** (the shafts). Together these two items add ≈ $1.7B to the realistic figure, which rises from $9.5B to ≈ $11.2B.

3.1 The underground interchanges

A crossing where one tunnel passes beneath the other is free as long as you go straight through. But to change tunnels without stopping, you need an interchange — short ramps connecting one tube to the other, at bicycle scale (tight radii, 5–8% grades, 3.6 m diameter). The costly part is not the ramp, it is the **mined junction** where it opens into the main tunnel — to be bored during initial excavation, never afterwards. One is planned at each major node (≈ 25).

Item in a full interchange	Order of magnitude
Ramps (≈ 0.4 to 1 km of short, curved tunnel)	$5–13M
Mined junctions (4 to 8 connections — the costly part)	$15–35M
Node systems (ventilation, lighting, signage, drainage)	$5–10M
Per interchange	**≈ $25–60M**
Network — ≈ 25 nodes (realistic scenario)	**≈ $700M**

> **Some perspective.** A single highway interchange like Turcot, in Montréal, cost ≈ $3.7B. The network's ≈ 25 bicycle interchanges together come to a fraction of that: underground and cut into rock rather than perched on piers, a bicycle interchange is roughly 50 to 100 times cheaper.

3.2 The evacuation shafts

The safety dossier sets an emergency exit every ~300 m, made possible by the shallow depth (10 m): a short staircase topped by a small kiosk. Over 150 km, ≈ 500 exit points are required; the network already has ≈ 190 (stations + ventilation shafts). ≈ 310 dedicated shafts remain to be bored.

Step	Calculation	Result
Exit points required (1 / 300 m)	150 km ÷ 300 m	~500
Already available	~150 stations + ~40 ventilation shafts	~190
Dedicated shafts to add	500 − 190	~310
Unit cost (10 m staircase + kiosk + land)	$1–4M, center ~$2M	~$2M
Gross cost	310 × $2M	~$620M
Already in the "fire + exits" line ($350M)	—	~$100–150M
Net new cost	**—**	**≈ $500M**

No double counting: the "fire + exits" line ($350M) already contained about a hundred million in exits. The "evacuation shafts" line therefore counts only the **net** to be added.

Combined effect: ≈ +$1.7B → realistic ≈ $11.2B

≈ $700M of interchanges and ≈ $500M of shafts (hard costs), propagated through engineering, management and contingency for ≈ $1.7B. The realistic figure rises from $63M to $74M/km — still three to thirteen times cheaper per km than the other megaprojects.

4. Two items already budgeted, now itemized (the total does not change)

Unlike the previous two, these do not add to the total: they were already in the budget, buried in a broader line. We break them out so that no item remains implicit — but the total stays ≈ $11.2B.

Item now itemized	Already included in…	Estimated share
àVélo docks (locking + charging), ≈ 30 per station	“Charging docks” ($60M)	≈ $22M
Spiral parking (personal bikes), ≈ 150 spaces/station	“Stations” ($1,240M)	≈ $22M
Total — already included, does not add to the rest	**—**	**≈ $44M**

Dock detail: of the $60M of “charging docks” (≈ $400k/station), about $22M are the àVélo docks themselves (≈ 30 × ~$5k × 150 stations), ≈ $38M the power supply and payment. Spiral parking: ≈ 150 spaces × ~$1,000 × 150 stations ≈ $22M, folded into the ≈ $8M per station.

5. Five scenarios, from minimum to maximum

The spread comes from decisions and one technological unknown. The dominant lever remains the **tunnel-boring rate in rock**; then the station mix, the extent of the cladding, and whether land is bought or leased.

Item ($M)	A · Optimistic	B · Realistic	C · Cautious	D · Stagnation	E · Full freeze
Effective tunnel rate (rock, US$M/mi)	8	15	21.5	32	40
Tunnels (150 km)	1,030	1,930	2,770	4,120	5,150
Stations	800	1,240	1,240	1,700	1,700
Underground interchanges (≈ 25 nodes)	400	700	850	1,100	1,250
Technical systems	2,913	3,228	3,258	3,378	3,418
of which immersive cladding	250	500	500	550	550
of which drainage	150	200	220	260	280
of which geothermal	35	50	60	90	110
Dedicated evacuation shafts (~310, net)	350	500	520	600	640
Bicycle fleet (76,000)	177	177	177	177	177
Québec–Lévis link (shuttles)	90	90	90	90	90
Land acquisition	0	125	125	250	250
Hard subtotal	**5,760**	**7,990**	**9,030**	**11,415**	**12,675**
Engineering and design (10%)	576	799	903	1,142	1,268
Project management (5%)	288	400	452	571	634
BAPE, geotechnics, permits	120	120	120	120	120
Subtotal	**6,744**	**9,309**	**10,505**	**13,248**	**14,697**
Technical contingency	15%	20%	20%	25%	25%
TOTAL	**≈ $7.8B**	**≈ $11.2B**	**≈ $12.6B**	**≈ $16.6B**	**≈ $18.4B**
Cost per kilometre	**$52M**	**$74M**	**$84M**	**$110M**	**$122M**

A — Optimistic: TBMs reach their long-term target, easier rock, economical stations, leased land, 15% contingency. **B — Realistic:** 2030 target, balanced mix, full cladding. **C — Cautious:** anchored on Nashville. **D — Stagnation:** boring plateaus (~32 M$/mi), premium stations, purchased land, 25% contingency. **E — Full freeze:** today's rate frozen + hard rock = 40 M$/mi. The worst credible case.

6. What if the boring machines never get cheaper?

This is the heart of scenarios D and E. The Boring Company's soft-ground rate has fallen — ~50 M$/mi in 2018, ~30 in 2021, ~27 today (Prufrock-4) — and the 2030 target is 8 to 10 M$/mi. Nothing guarantees that drop in hard rock. Here is the full scale and the resulting tunnel cost.

Boring assumption	Soft ground (US$M/mi)	Rock premium	Effective (US$M/mi)	Tunnels 150 km
A — Long-term target reached	~5–6	×1.4	8	1,030
B — 2030 target (realistic)	10	×1.5	15	1,930
C — Nashville anchor	~14	×1.5	21.5	2,770
D — Stagnation (plateaus early)	~21	×1.5	32	4,120
E — Full freeze (today's rate frozen)	~27	×1.5	40	5,150

The nuance that protects the project. The debate over the rock premium (+40% vs +60%) moves the tunnels by only about $0.25B. It is the base rate — the Prufrock trajectory — that drives the whole spread. And Québec's geology belongs to the same Ordovician family as Nashville's limestone, the best real-world anchor available.

7. The realistic scenario, in detail

The full Scenario B budget, line by line — the recommended reference.

Item	Amount ($M)
Tunnels (150 km in Québec rock, US$15M/mi effective)	1,930
Stations (150, balanced mix — incl. ≈ $22M spiral parking)	1,240
Underground interchanges (≈ 25 nodes)	700
Technical systems (13 sub-items)	3,228
Dedicated evacuation shafts (~310, net)	500
Bicycle fleet (76,000 vehicles)	177
Québec–Lévis link (trucks, boats, terminals)	90
Land acquisition (partial)	125
Hard subtotal	**7,990**
Detailed engineering and design (10%)	799
Project management (5%)	400
BAPE, geotechnics, permits, consultations	120
Subtotal	**9,309**
Technical contingency (20%, excl. inflation)	1,862
TOTAL — realistic 2030 (interchanges and shafts included)	**≈ 11,171**

8. Comparison with other megaprojects

The figure that does not move, even after re-estimate: the per-km cost stays in a class of its own. The realistic figure ($74M/km) and even the full freeze ($122M/km) remain well below the region's other large projects.

Project	Length	Cost/km	Status
Vélo Tunnel Québec (realistic)	150 km	**≈ $74M/km**	Proposed
Vélo Tunnel Québec (full freeze, worst case)	150 km	≈ $122M/km	Scenario E
REM de Montréal	67 km	$254M/km	Partially in service
Québec tramway	19 km	$305M/km	In planning
Québec–Lévis third road link	8.3 km	$940M/km	Est. $5.3B–$9.3B

The gap stems from three factors: a much smaller diameter (3.6 m versus 12 to 15 m), stations with no platforms or rail cars, and the absence of heavy rolling stock. The network stays three to thirteen times cheaper per km, even in its most pessimistic scenario.

> **Methodological honesty.** This re-estimate brings the realistic figure to ≈ $11.2B — not because the project “grew,” but because every item is now counted at its true value: nature simulation, drainage and geothermal first, then interchanges and evacuation shafts. Presenting the most complete figure makes the case stronger: there is no longer a hidden item to dig up. The amounts remain planning-level estimates; a specialized engineering study, and the completion of Nashville, will refine the tunnel range — the only item that truly moves the total.