

Operating costs of the simulation

Annual OPEX and 10-year projection — treatment of the 150 km network

Vélo Tunnel Québec · June 2026 · Canadian dollars (CAD) · Order-of-magnitude figures, to be refined by quote

The principle: a beautiful tunnel must stay beautiful cheaply

Building a magnificent tunnel is pointless if it becomes expensive to maintain. Operating cost (OPEX) therefore matters as much as the upfront investment. The decisive lever is simple: **how much of the treatment is passive rather than dynamic.**

In the chosen strategy, about 70% of the installation is passive (printed surfaces, porcelain enamel, the LED sky that also serves as lighting). These elements consume almost nothing and last for decades. The power-hungry equipment (screens, video projectors) is confined to stations, where there are already staff, power and easy access.

Estimated OPEX: 2 to 4% of CAPEX per year for the tiered plan, versus 8 to 10% for a “dynamic everywhere” scenario. Over ten years, the gap runs into the hundreds of millions.

Operating items

Item	Description	% of CAPEX / yr
Energy	Lighting (LED sky, which is also the main lighting) + gobo projectors	0.5 – 2%
Maintenance	LED replacement, recalibration, cleaning of surfaces and optics	1 – 4%
Vandalism / repairs	Replacement of sacrificial films, marked panels	0.5 – 1.5%
Total (tiered plan)		~ 2 – 4%

Passive surfaces (porcelain, printed panels) approach zero maintenance; it is the dynamic equipment at stations that drives most of the OPEX.

Annual estimate (CAPEX \$500M)

Scenario	Rate	Annual OPEX
Optimistic	2% / yr	\$10M
Realistic	3% / yr	\$15M
Cautious	4% / yr	\$20M

That is an OPEX on the order of **\$10 to \$20M per year**, with a realistic target around **\$15M**.

10-year projection — two strategies compared

At equivalent visual ambition, the passive-versus-dynamic choice radically changes the 10-year cost.

	Tiered plan (chosen)	Dynamic everywhere
Annual OPEX	~3%/yr (\$15M)	~9%/yr (\$45M)
Cumulative OPEX over 10 years	~\$150M	~\$450M
Equipment replacement	Stations only (low)	150 km of electronics around year 12 (a 2nd CAPEX)
Risk in a damp environment	Low (passive)	High (electronics everywhere)

Over ten years, the tiered plan saves on the order of **\$300M** in operations versus a fully dynamic treatment — for an equivalent, if not better, experience.

Why passive wins

- **Lifespan:** porcelain and printed panels last 30 to 50 years; screens and projectors, 10 to 15 years.
- **Energy:** the LED sky doubles as the main lighting (already budgeted); the gobos are low-power LED projectors. The big consumers (screens, mapping) stay at stations.
- **Humidity:** an underground tunnel is a harsh environment for electronics. Passive surfaces are immune to it.

Recommendation: validate on the pilot segment

Before any large-scale rollout, the demonstration segment (1 to 2 km with a full station) should be used to measure real OPEX over twelve months: energy consumption, maintenance costs, incident and vandalism rates, system availability. This data will replace the order-of-magnitude figures above with firm numbers.

Assumptions and limits

- Figures in Canadian dollars (CAD).
- OPEX estimated as a percentage of CAPEX, the usual planning method for a preliminary project.
- 10-year projection without discounting or inflation (to be added in a detailed financial analysis).
- The corresponding CAPEX is detailed in the document “Cost of the nature simulation”.