LL-TEQ

GREEN · FAST · DURABLE

Road Solutions — Québec

The road technology built to withstand freeze-thaw cycles

Proudly made in Québec

MUNICIPAL PRESENTATION

LL-TEQ™ Road Solutions

Green · Fast · Durable — built to withstand Québec's freeze-thaw cycles

39 **Countries**
Documented deployments worldwide

77 **Cumulative winters**
9 reference sites in real service

6,730 **Cumulative freeze-thaw cycles**
Zero freeze-thaw defects observed

2009 **Technology finalized**
Field-proven ever since

01

Who we are

LL-TEQ's mission and role in Québec

Based in Québec, **LL-TEQ** supports the introduction, deployment and oversight of its road technology. Finalized in 2009, this technology has been field-proven and today counts documented deployments in more than **39 countries** worldwide.

LL-TEQ's mission is to equip Québec with road infrastructure capable of durably withstanding **freeze-thaw cycles**, supporting public bodies in deploying a proven technology suited to the territory's climatic and operational realities.

This technology is deployed in civil, industrial and military contexts, in northern climates subject to freeze-thaw cycles as well as in environments heavily exposed to water and thermal variation. It has proven itself where conventional infrastructure reaches its limits.

Our role

PHASE	DESCRIPTION
Project structuring	Support with planning, selecting the pilot section and defining objectives
Technical support	Joint drafting of specifications and technical documents
Technical transfer & supervision	Transfer of know-how to contractors and technicians, and supervision of the first field operations
Deployment oversight	On-site follow-up to ensure compliant and durable execution

02

What the LL-TEQ technology is

A proprietary copolymer emulsion with controlled rheological* behaviour

** Rheology — the science of how materials flow and deform under an applied force.*

LL-TEQ is a proprietary copolymer emulsion with controlled rheological behaviour, designed for road construction and rehabilitation.

Its distinctive feature: the treated layer delivers both the **structural function** and the **wearing surface** at once, formed in place as a single monolith, with no interface or stratification.

The process directly integrates in-place materials — asphalt millings, granular materials or natural soils — to form a unified cohesive layer able to carry traffic loads and withstand severe environmental conditions.

Unlike traditional solutions, built on stacked layers and water-sensitive surfacings, LL-TEQ acts at the core of the material. Performance comes from the **treated volume**, not from the surface coating.

Structural approach

- Performance proven since 2011, from northern freeze-thaw to tropical conditions
- Unified layer formed in place, with no interface or stratification
- Non-floating structure, no sub-base erosion
- Unique formulation tailored to each project

03

In-service pavement behaviour

Distributed loads, controlled fatigue, neutralized defects

Once placed and compacted, the LL-TEQ structure distributes loads **evenly** and absorbs stresses through limited, reversible deformation, with no fatigue accumulation.

Pavement defects avoided

The main degradation mechanisms observed in Québec are neutralized by the very nature of the structure:

RUTTING

Shear resistance

Holds under repeated heavy loads with no permanent deformation.

THERMAL CRACKING

No hardening with age

No bituminous matrix that stiffens under thermal cycling.

POTHOLES

No initiation point

No pore or interface where the classic mechanism can take hold.

FROST HEAVE

No free water

No free water in the matrix — no ice lens can form.

04

Construction — Process 1: Full Depth Reclamation

Full Depth Reclamation (*FDR*) — structural reconstruction in a single pass

LL-TEQ offers **two complementary road processes** depending on the pavement's condition, both carried out cold with conventional road equipment.

Full Depth Reclamation (**FDR**) is the rehabilitation process: cold recycling and stabilization of the full pavement thickness in a single pass, intended for end-of-life pavements requiring structural reconstruction.

Key figures

- Up to **4 km/day** with a single contractor crew
- Reopening in as little as **12 hours** depending on site conditions
- ≈ **150 mm (6 inches)** of treated thickness in one pass
- **95%** of standard Proctor minimum at compaction
- Conventional equipment: cold recycler, vibratory roller, grader

04

Construction — Process 2: Surface-spray sealing

Preventive sealing (*Fog Seal*) — extending the life of sound pavements

Surface-spray sealing (*Fog Seal*) is the life-extension process: preventive sealing by topical spray, intended for pavements that are still sound, in the early or mid stages of ageing.

Key figures

- Cold application by spray, light crew of **2 people**
- Penetrates surface pores and restores surface cohesion
- UV protection that slows the ageing of the existing bitumen
- Standard black pigmentation, or light to reduce urban heat islands

✓ A unique formulation per project

Before each job, the LL-TEQ engineering team tailors the formulation to the site's precise conditions (geolocation, geotechnical data, climate history). Every project is treated as an individual engineering case, validated before the product is ordered. Detailed execution procedures and equipment specifications are in the "LL-TEQ Construction" document, available on request.

05

Why LL-TEQ — structural and economic value

Turning what is already under your wheels into a durable pavement

LL-TEQ offers a **complete structural** alternative to conventional road methods, by turning what is already under your wheels into a durable, economical pavement.

STRUCTURAL VALUE

One integrated structure

Load-bearing and wearing surface in one monolith. Recovery of in-place materials: the existing pavement becomes the new structure. Thermal stability: no summer softening or winter embrittlement, non-floating structure.

SAVINGS — CONSTRUCTION

One pass, one logistics chain

A single operation combines recycling, structure and wearing surface. No purchasing or massive excavation: in-place materials become the resource. Cold process: lighter logistics, wider seasonal window, no hot-mix transport.

SAVINGS — LIFE CYCLE

Reduced maintenance costs

Fewer corrective repairs, more widely spaced interventions. Budget predictability for multi-year planning. Market independence: not tied to bitumen prices or asphalt plants.

06

Environmental benefits

Soils and waters preserved, reduced job-site footprint

LL-TEQ alters **neither the soils nor the surrounding waters**. Its aquatic ecotoxicity is nil, validated by environmental testing to Canadian standards.

A chemistry that does not contaminate

- **Versus Portland cement:** no increase in the pH of surrounding soils
- **Versus asphalt:** no leaching of hydrocarbons into stormwater
- **Versus hot-mix solutions:** no emission of volatile organic compounds (VOCs)

A reduced job-site footprint

Cold process, no asphalt plant: less CO_2, less noise, less dust, less hauling.

Mitigation of urban heat islands

Surface-spray sealing (*Fog Seal*) can be applied with a light pigmentation that raises albedo and reduces urban heat islands, without altering structural performance.

Compatible with sensitive areas

The absence of toxic leachate and the cold process make LL-TEQ compatible with job sites bordering watercourses, wetlands and ecologically sensitive areas.

07

Alignment with municipal priorities

An answer to the issues you manage

LL-TEQ fits the current priorities of Québec's public administrations: responsible management of public funds, measurable ecological transition and infrastructure resilience.

MUNICIPAL ISSUE	LL-TEQ RESPONSE
Ageing road network	Durable structural reconstruction, not a mere resurfacing
Multi-year budget pressure	Extended life cycle, reduced corrective interventions
Carbon-footprint reduction	Cold process, no asphalt plant, in-place recycling
Changing climate	Performance under increased freeze-thaw and thermal variation
Urban heat islands	Light pigmentation available to raise albedo

08

Technology credibility and track record

77 cumulative winters of real service, zero freeze-thaw defects observed

LL-TEQ benefits from a long, documented deployment history, validated against the highest demands for performance and durability.

Documented freeze-thaw performance

Performance dossier signed by an **Engineer of Record**, across 9 sites representative of St. Lawrence Lowlands conditions.

INDICATOR	VALUE
Reference sites in real service	9
Cumulative winters	77
Cumulative freeze-thaw cycles	6,730
Köppen climate regimes covered	4 (Dfa, Dsb, Cfa, Csb)
Freeze-thaw defects observed	0

09

Adoption and demanding conditions

A technology validated by critical organizations, across 39 countries

Adoption by demanding organizations

LL-TEQ is deployed for critical projects by:

- U.S. Army and U.S. Marine Corps (USMC)
- Bechtel — global industrial civil engineering
- ExxonMobil — oil logistics bases
- Waste Management — environmental management sites

Performance documented under demanding conditions

CONTEXT	DOCUMENTED CASE
Heavy aircraft loads	Airstrip at the USMC base in Bridgeport (California, 2,070 m elevation), hosting the C-17 Globemaster III up to 265,000 kg, under 172 freeze-thaw cycles per year since 2016
Industrial loads	ExxonMobil logistics road in Guyana, loads up to 39 tonnes
Difficult soils	Rural roads on laterite and clay soils, approved by the national road authorities of Ghana and Uganda

✓ A technology validated across 39 countries

LL-TEQ's adoption by leading organizations and its integration into demanding projects demonstrate the soundness and technical maturity of the approach.

10

Municipal reference sites

Climates representative of the St. Lawrence Lowlands

A selection of sites from the freeze-thaw performance dossier, in climates representative of the St. Lawrence Lowlands.

SITE	STATE	IN SERVICE SINCE	DISTINCTIVE FEATURE
Bessemer	Alabama	April 2016 (10 winters, the oldest in the dossier)	Humid subtropical climate, heavy rainfall
Benton Harbor	Michigan	May 2017 (9 winters)	Humid continental climate, lake effect, clay soil
Alexandria	Virginia	June 2017 (9 winters)	Potomac marine clay, comparable to the Lowlands' Champlain clays
Glenview	Illinois	August 2018 (8 winters)	Silty floodplain soil, comparable to the Lowlands' loose deposits

✓ **Full details available on request**

Site-by-site climate conditions and inspection findings in the **freeze-thaw performance dossier**.

11

Start an LL-TEQ project in your municipality

From the first conversation to reopening to traffic

Whether you are considering a pilot project on a single section or a broader deployment, LL-TEQ supports your municipality at every step, from the first conversation to reopening to traffic.

How it starts

STEP	DESCRIPTION
1. First conversation	Exploratory discussion to understand your issues, candidate sections and budget constraints
2. Site visit	Our engineering team assesses the site and collects the data needed for design
3. Custom specs and procedures	Unique formulation, dosage and execution SOPs specific to your project
4. Information session	Presentation of the procedures to contractors and municipal representatives
5. Execution and reopening	Joint inspection at startup, technical supervision, reopening in as little as 12 h

✓ Our recommendation: start with a pilot project

A pilot project on a targeted section makes it possible to assess performance under real conditions, train local contractors and manage risk before a broader deployment. As exclusive distributor in Québec and Canada, LL-TEQ supports your project until your contractor is fully autonomous.

12

Contact us

Ready to explore LL-TEQ for your project?

Whether for a technical question, a detailed presentation to the municipal council, or to assess a candidate section, our team is here to support you.

LL-TEQ

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Resources available on request

- Freeze-thaw performance dossier signed by an Engineer of Record — 9 sites, 77 cumulative winters
- Sample specifications and execution procedures for municipalities
- Technical data sheets and environmental certifications
- Presentation to your decision-making committee on request