

NRC-CNRC

Accelerated Pavement Testing: Advancing Pavement Performance and Construction Innovation

National Capital Heavy Construction Association
2026 Education Series


Ottawa, 2026

 National Research Council Canada Conseil national de recherches Canada



1


NRC: A Century of Innovation



A horizontal timeline on a dark blue background showing NRC innovations from 1916 to the 2020s. Each decade is represented by a circular image and text. The timeline ends with a right-pointing arrow icon.

Year	Innovation
1916	The NRC is created
1920s	Concrete for a harsh climate
1930s	Redesigned steam locomotive
1940s	WarTime innovations: radar, atomic energy
1950s	Pacemaker, electric wheelchair
1960s	Canadian flag red colour
1970s	Anti-counterfeiting technology, Canola
1980s	Canadian Astronaut Program, Canadarm
1990s	Synthetic meningitis C vaccine
2000s	Simulated brain surgery
2010s	100% biofuel test flights
2020s	Canada's pandemic response and recovery

NATIONAL RESEARCH COUNCIL CANADA

 2

2

The NRC at a glance

Three key roles:

- Business innovation*
- Federal policy mandates*
- Advancing knowledge*

- 4,000 scientists, engineers, technicians, and other specialists, including 265 SME technology advisors.
- Manages 178 buildings in 72 locations.
- \$1.1 B annual budget including \$271M in funding for SMEs.



We work with

- 8,000 SMEs (advice & funding)
- 1,000 companies (R&D)
- 150 hospitals
- 70 colleges and universities
- 35 federal departments
- 36 countries

3

Research Centres

DIGITAL TECHNOLOGIES

- Digital Technologies

EMERGING TECHNOLOGIES

- Advanced Electronics and Photonics
- Herzberg Astronomy and Astrophysics
- Metrology
- Nanotechnology
- Security and Disruptive Technologies

ENGINEERING

- Construction
- Energy, Mining and Environment
- Ocean, Coastal and River Engineering

LIFE SCIENCES

- Aquatic and Crop Resource Development
- Human Health Therapeutics
- Medical Devices

TRANSPORTATION AND MANUFACTURING

- Aerospace
- Automotive and Surface Transportation

4

NRC: A Century of Innovation



NATIONAL RESEARCH COUNCIL CANADA



5

Construction Research Centre



NATIONAL RESEARCH COUNCIL CANADA



6

Infrastructure Deficit

Statistics Canada. Table 34-10-0284-01 Estimated replacement value, required renewal budget and actual renewal expenditures of core public infrastructure assets, by physical condition rating (x 1,000,000)

Geography	Canada (nsg)		
Financial value of assets	Estimated Replacement Value ^a	Required renewal budget ^b	Actual renewal expenditures ^c
Reference period:	2022	2022	2022
Overall physical condition of assets	All physical conditions	All physical conditions	All physical conditions
Public organizations	All public organizations ^b	All public organizations ^b	All public organizations ^b
Core public infrastructure assets	Dollars		
Road assets	1,162,431.3 ^a	108,959.3 ^b	11,393.0 ^b
Bridge and tunnel assets	294,825.8 ^a	21,866.8 ^b	1,743.5 ^b
Public transit assets	132,156.1 ^b	19,895.7 ^b	3,437.0 ^b
Active Transportation	62,602.5 ^b	10,127.1 ^b	673.3 ^b
Potable water assets	357,316.4 ^a	41,948.9 ^b	4,343.9 ^b
Wastewater assets	399,045.5 ^b	33,043.3 ^b	4,826.7 ^b
Stormwater assets	246,445.8 ^a	32,531.6 ^b	1,710.5 ^b
Culture, recreation and sports facilities	154,052.0 ^b	18,337.1 ^b	2,267.9 ^b

Symbol legend:
^a data quality: excellent
^b data quality: very good
^c data quality: good

- Top assets with the highest estimated replacement values and required renewal budgets are **roads and potable/storm/wastewater**
- These renewal gaps are a central driver of the overall infrastructure deficit
- Investing in research facilities and training strengthens NRC's capacity to support high-value infrastructure sectors

NATIONAL RESEARCH COUNCIL CANADA

7

40-75 Pavement Deterioration Rule

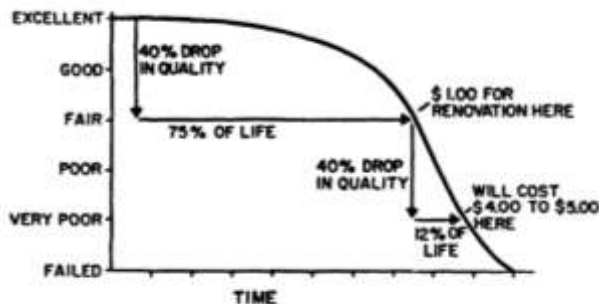


Figure 1. Typical pavement condition life cycle.

Shahin, M.Y., and Walther, J.A. (1990)

- Pavement quality drops **40% during the first 75% of its life**, and then drops another **40% in only the next 12% of its life** (Death Spiral)
- Because of this rapid drop, repairs made after the 75% life mark **typically cost 4 to 5 times more** than those made just a few years earlier (Cost Multiplier)
- Traditional field monitoring is **too slow** to observe the most critical part of pavement life ; Accelerated Pavement Testing (APT) compresses time so we can observe!

8

Heavy Vehicle Simulator (Under Consideration)

Full-Scale Accelerated Pavement Testing (APT) Platform
 Mobile system applying millions of axle loads

Real-World Loading & Climate
 Applies real traffic loads under real climate conditions

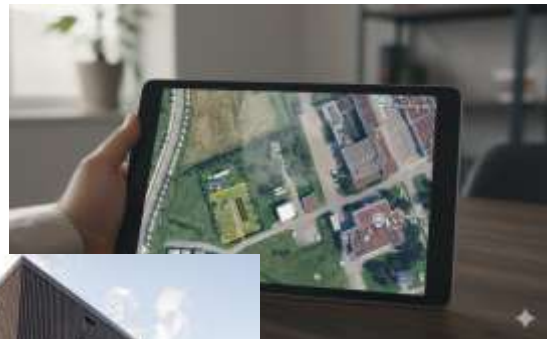
Rapid Material Validation
 Enables fast evaluation of pavement materials & designs



9

Potential Site for Accelerated Pavement Testing

- Designated area within NRC's Montreal Road campus for in-house pavement experiments as well as existing large climate chamber
- Mobile unit powered by an on-board generator, capable of deployment off-campus for external projects
- Real-time monitoring and sensor integration to provide actionable structural analysis to industry partners and NRC clients



10

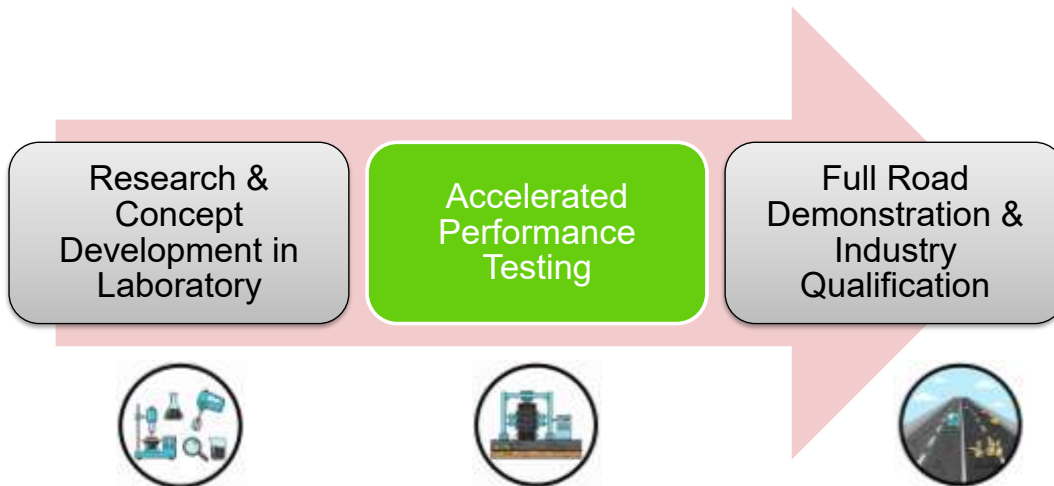
Performance-Based Engineering (PBE)

- **Supports Performance-Based Specifications:** Ensures materials and designs meet real-world heavy traffic performance targets.
- **Reflects Canadian Pavement Design and Cold-Region Practices:** Tailored for local climates, freeze-thaw cycles, and construction methods.
- **Replicates Real-World Traffic Loading:** Accurately simulates heavy trucks and fleet traffic to test pavement response.
- **De-Risks Innovation for Suppliers and Infrastructure Owners:** Encourages adoption of new materials and technologies with reduced financial and operational risk.
- **Improves Lifecycle Cost and Durability Decisions:** Provides data-driven insights to optimize long-term performance and maintenance costs.
- **Accelerates Product Qualification and Market Adoption:** Speeds up the process for new products and designs to reach the market safely and efficiently.



11

Fast-Tracking Pavement Innovation: From Lab to Lane



12

From Lab to Lane: Asphalt Binders and Hot Mix Asphalt in a Newly Established R&D Lab



13

Harnessing AI Through Smart Pavements



14

Online FEM-Based Analysis Tool

Why This Is Different:

Supports specific research, validation, and calibration of cold region models

Ability to introduce new distress equations, material models, and climate scenarios

- Project Information
- Cross Section
- Material Properties
- Climatic Data
- FE Analysis
- Performance
- Sensitivity Analysis
- Export Results



15

Redesigned with Improved Features

Project Name	Report Date	Pavement Type	City	Construction Year	Service Life	Actions
test	Feb. 12, 2026	Flexible	Calgary	2026	20	[Edit] [Delete]

16



17

Stakeholder Support

Organizations that have provided letters of support (more anticipated!)

















18

Thank you



Ehsan.Roshani@nrc-cnrc.gc.ca
Mohammad.Shafiee@nrc-cnrc.gc.ca

