



Civil Infrastructure Systems Technology Road Map 2003-2013

CSCCE 2004 National Lecture Tour

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Civil Infrastructure Systems Technology Road Map 2003-2013

**A national consensus for the
preservation of Canada's
Community lifelines**

**Guy Félio
National Research Council Canada**





Content

⇒ **Context**

⇒ **Recent initiatives**

⇒ **The Road Map**

- Objectives
- Leadership
- Process
- Results

⇒ **Invitation to action**



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Context – Canada's Infrastructures

- ⇒ **A \$25 billion/year industry**
- ⇒ **A diverse and fragmented industry**
 - Multiple owners, suppliers, operators, etc.
 - Lack of « national leadership »
- ⇒ **Assets of hundreds of billions of which many have reached 80% of their service life.**
- ⇒ **A number of gaps:**
 - Technology
 - Financing
 - Management





The cities of the 19th century ...





Provide the foundations of the cities of the 21st century





**And over the years, we have neglected
and even forgotten our infrastructure**

**... But it is reminding us about its
suffering
At first, with small warnings ...**

**But later, it started to get
worse**





**So we checked into it ... and we found
some problems ...**

Very serious problems!





So the CIS industry began developing technologies to solve these problems

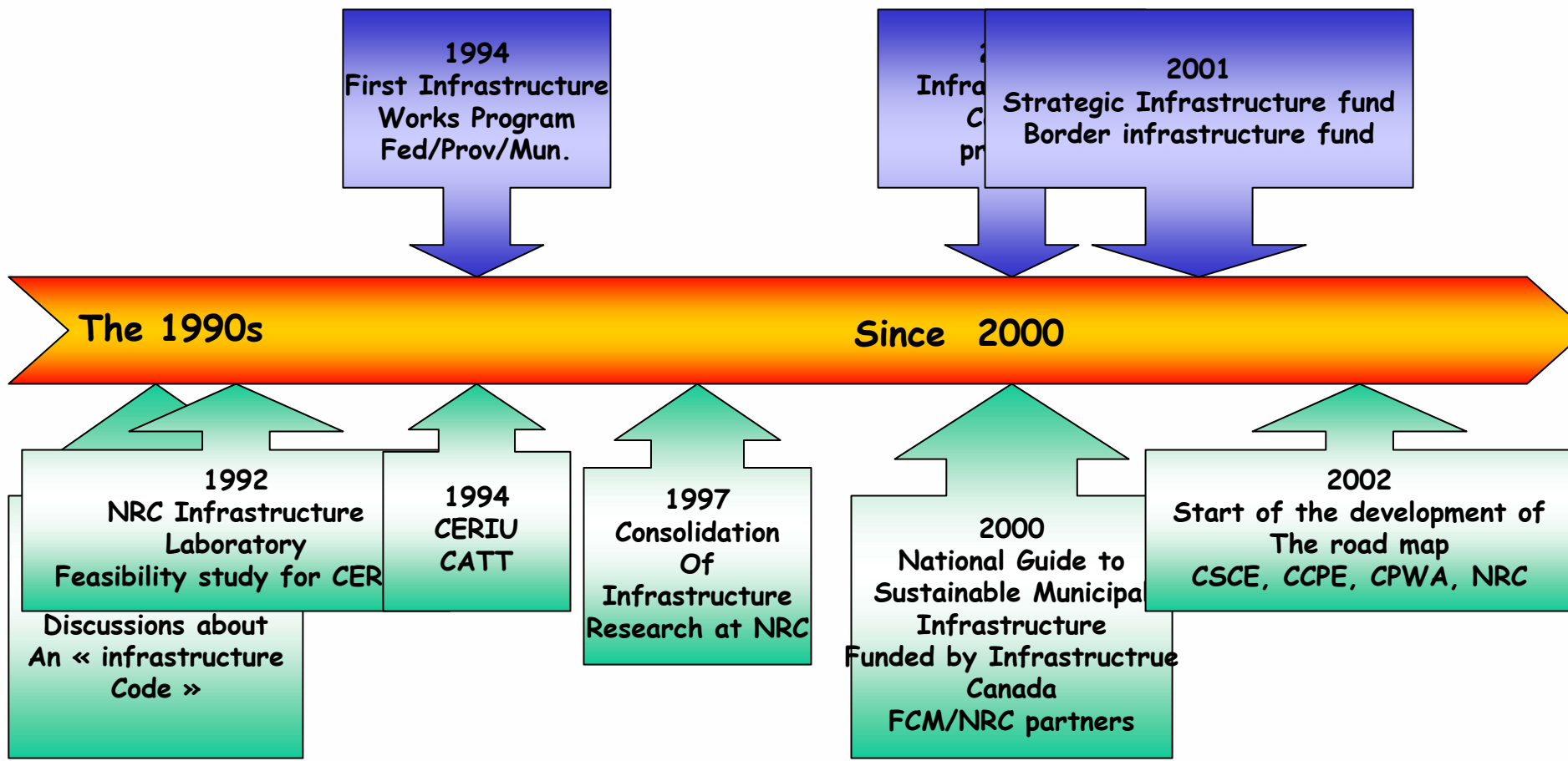




However, it is only in the past decade that the mobilisation of the CIS industry has really taken off ...

Let's look at a brief historical background







Recent national initiatives

- ⇒ **National Infrastructure programs of INFC**
- ⇒ **National Guide to Sustainable Municipal Infrastructure**
- ⇒ **FCM Green municipal funds**
- ⇒ **Communities of Tomorrow – Regina (SK)**
 - NRC Centre for Sustainable infrastructure research in Regina





National Infrastructure Programs - INFC

⇒ In 10 years, \$12B invested ⇒ \$30B from all partners

⇒ Municipal Rural Infrastructure Funds (2003)

- \$1B infrastructure fund
- Responds to the needs of communities of population less than 250,000 residents.
- Includes component targeting the needs of First Nations communities
- Targets 60% Green infrastructure
- Negotiations underway for agreements

⇒ Canada Strategic Infrastructure Fund (2001, 2003)

- \$4B infrastructure fund
- Targets large strategic infrastructure projects

⇒ Research programme

See www.infrastructure.gc.ca





National Guide to Sustainable Municipal Infrastructure - InfraGuide

- ⇒ Partnership FCM-CNRC (2000)
- ⇒ Funded by Infrastructure Canada, NRC and in-kind contributions
- ⇒ A national network of infrastructure experts AND a growing collection of best practices to support decisions and actions for sustainable municipal infrastructure.
- ⇒ Activities in 6 key areas
 - Municipal roads and sidewalks
 - Potable water
 - Storm and wastewater
 - Decision making and investment planning
 - Environmental protocols
 - Urban transit

See www.infraguide.gc.ca



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FCM Green municipal funds

⇒ **Municipal investment funds (2000)**

- Permanent \$200M fund
- Supports innovative environmental projects
- Loans at preferential rates

⇒ **Municipal Enabling fund (2000)**

- \$50M fund for co-funding of feasibility studies for innovative environmental technologies
- Contributions cover up to 50% of the studies costs

More details at www.fcm.ca





Communities of Tomorrow – Regina (SK)

⇒ Partnership (2003)

- NRC-IRC: Centre for Sustainable Infrastructure Research
- University of Regina
- City of Regina
- Provincial Government + Federal Economic Development Agency

⇒ Integration: physical, environmental, economic and social sciences

⇒ City of Regina: living laboratory

See <http://www.communitiestomorrow.ca>

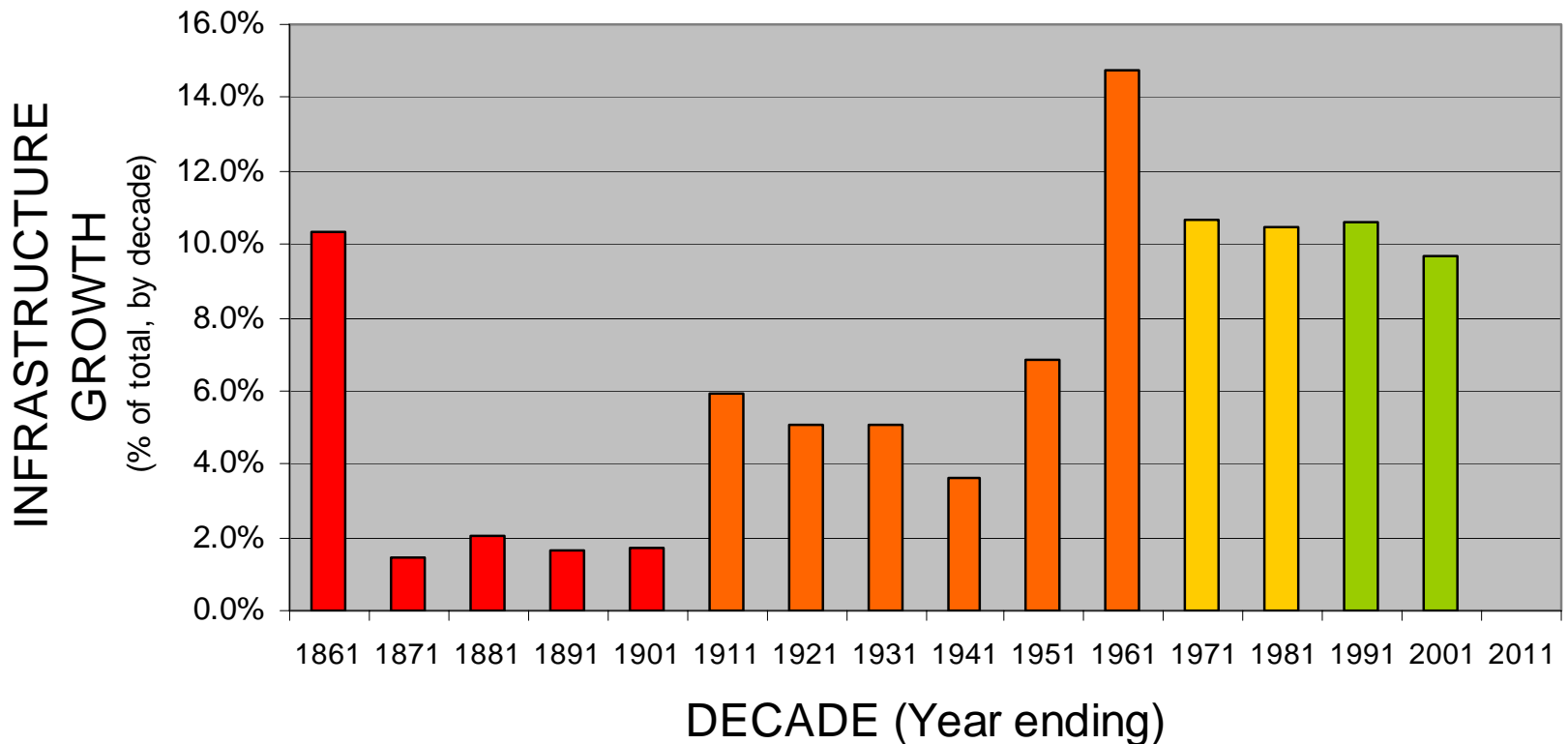


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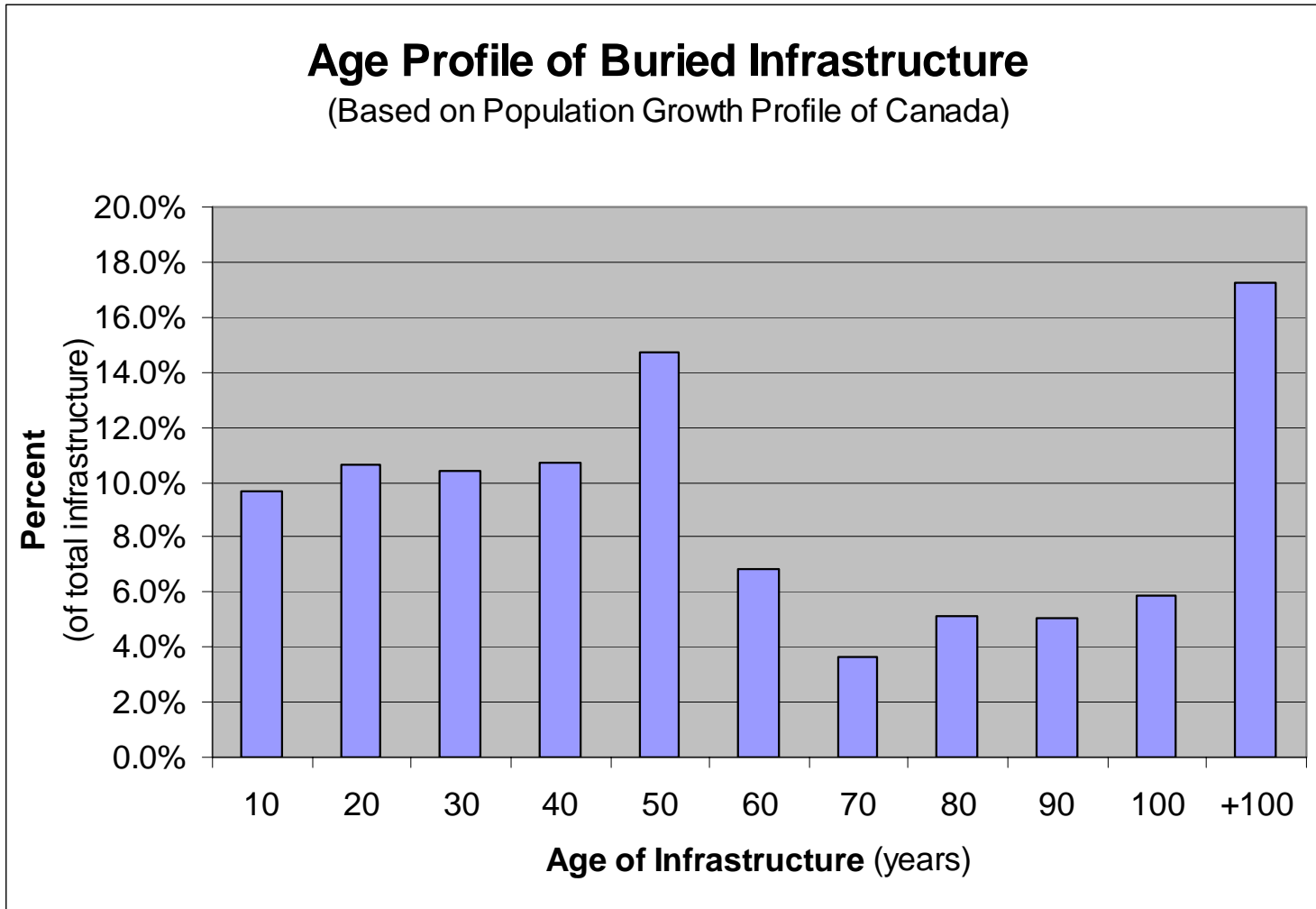
What is the forecast for the future?

INFRASTRUCTURE DEVELOPMENT PROFILE (Based on population growth profile of CANADA)



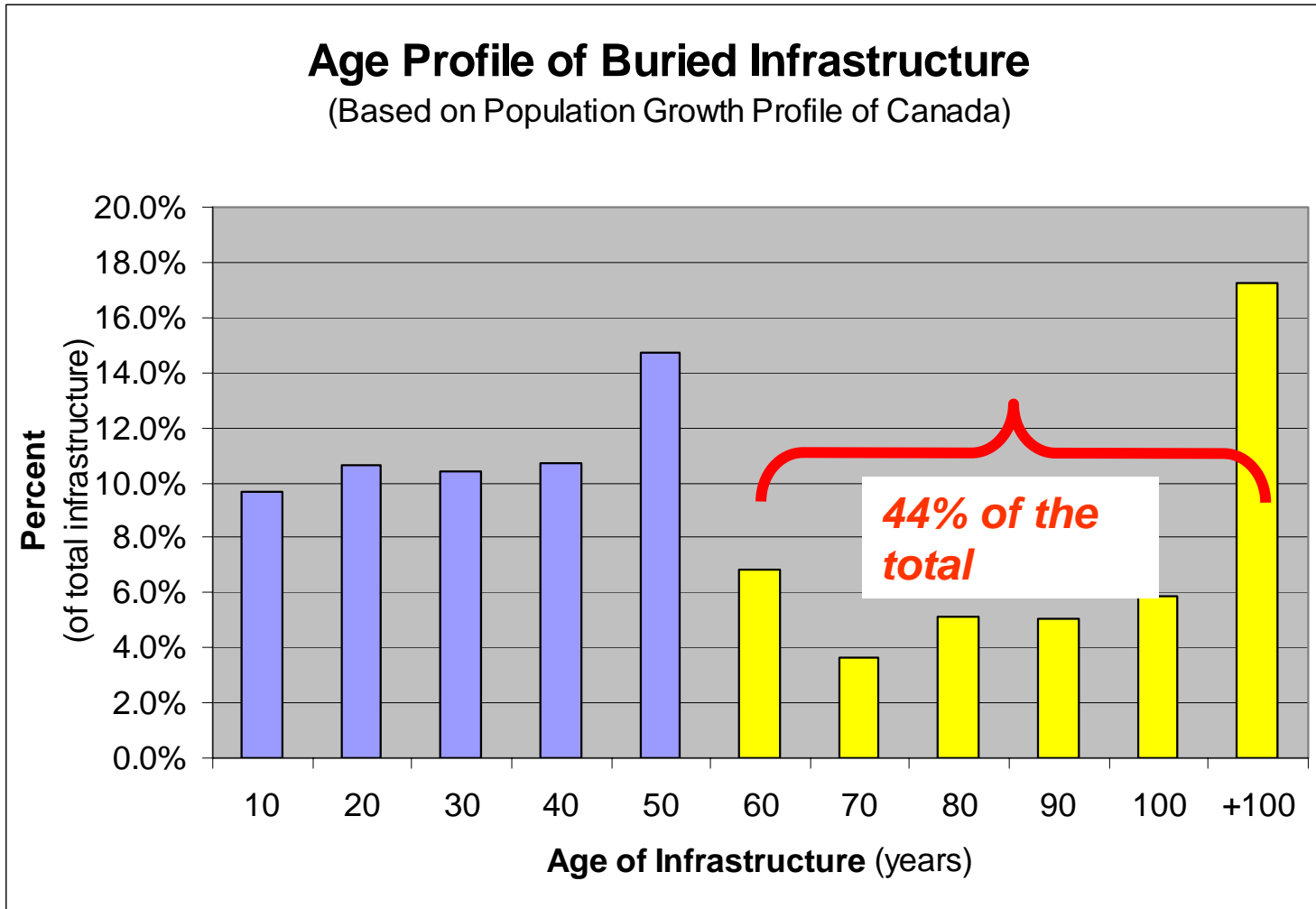


In terms of age ..



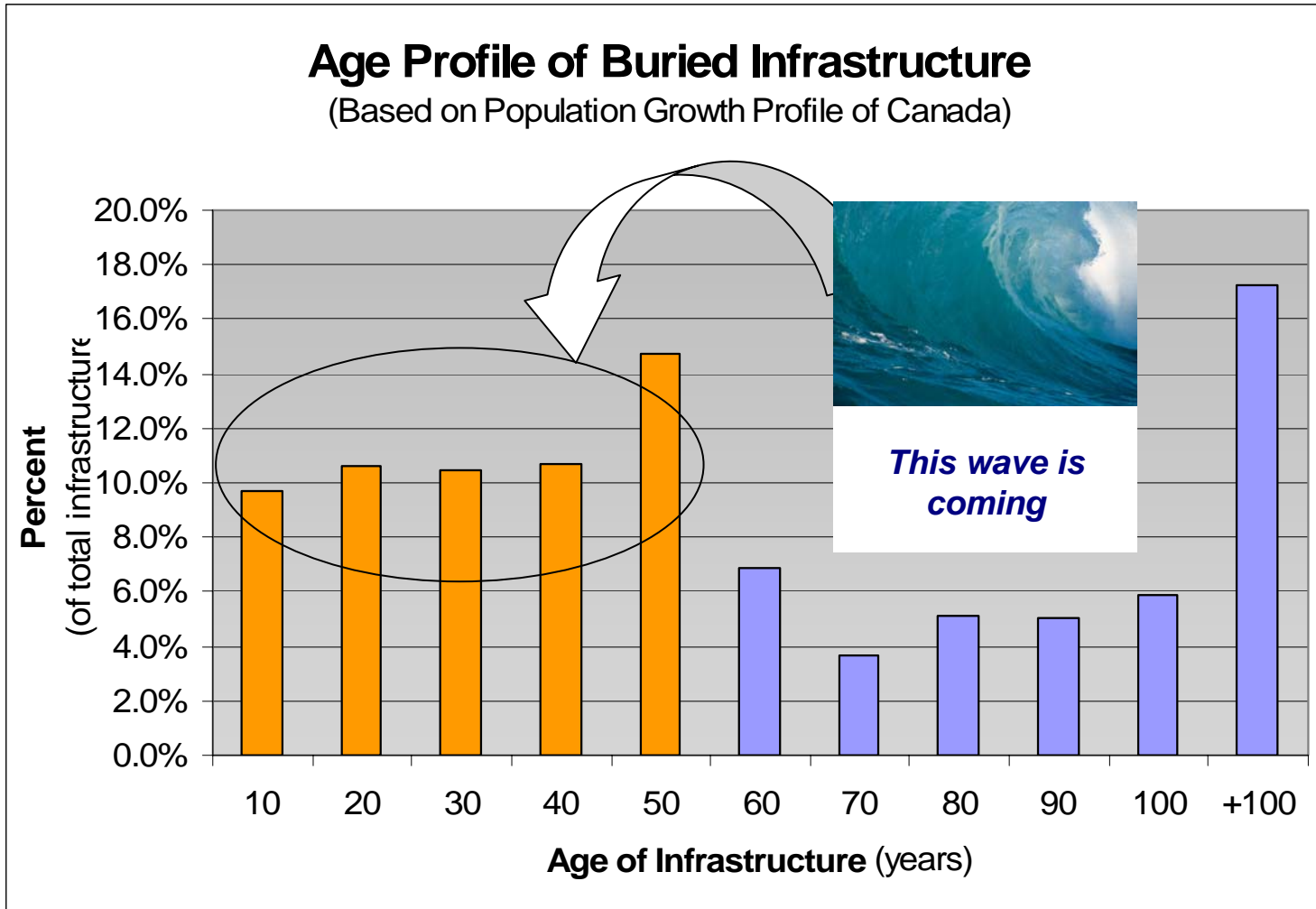


Today, we are dealing with these problems





Is the worse yet to come?





A recent study (1)

Feb 2004

NRC-CNRC

Client Report

B-5123.2

Municipal Infrastructure Investment Planning (MIIP)

MIIP Report: Survey on Municipal Infrastructure Assets

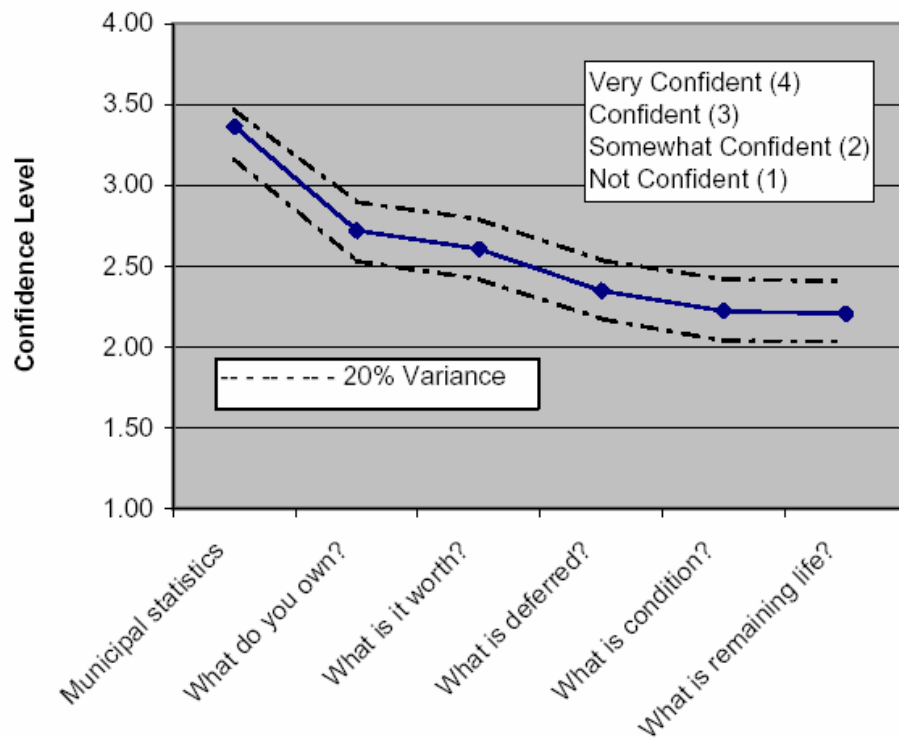


Fig. 11: Confidence Level about Asset Management Data





A recent study (2)

Feb 2004

NRC-CNRC **Client Report**

B-5123.2

Municipal Infrastructure Investment Planning (MIIP)

MIIP Report: Survey on Municipal Infrastructure Assets

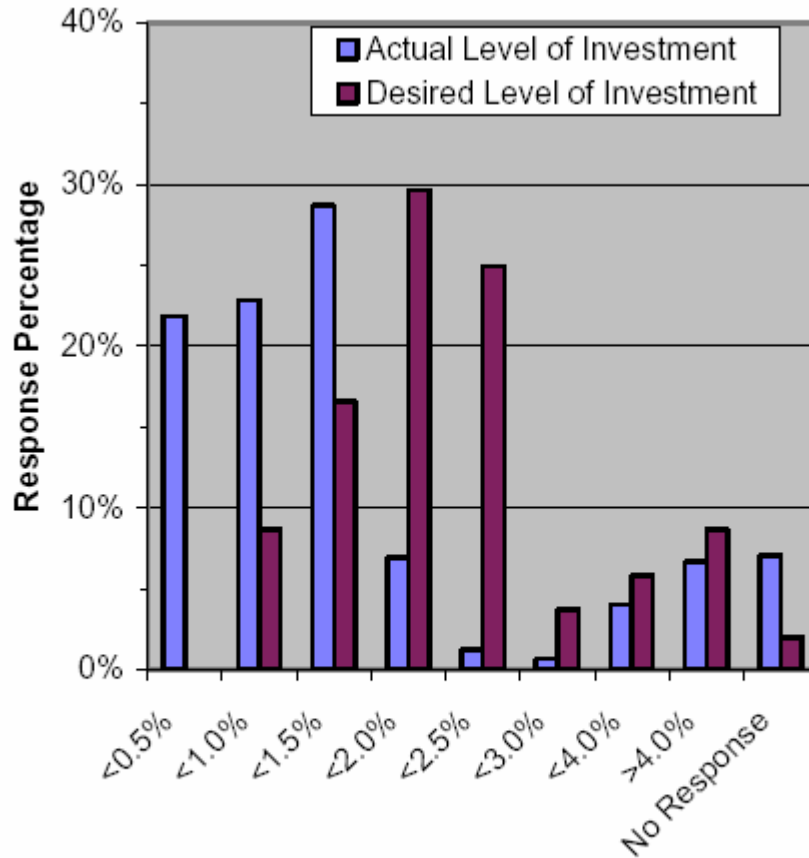


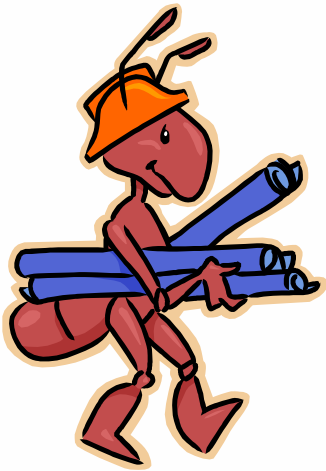
Fig. 9: Actual and Sustainable “Level of Investment” by Asset Value





Civil engineers and their partners mobilise

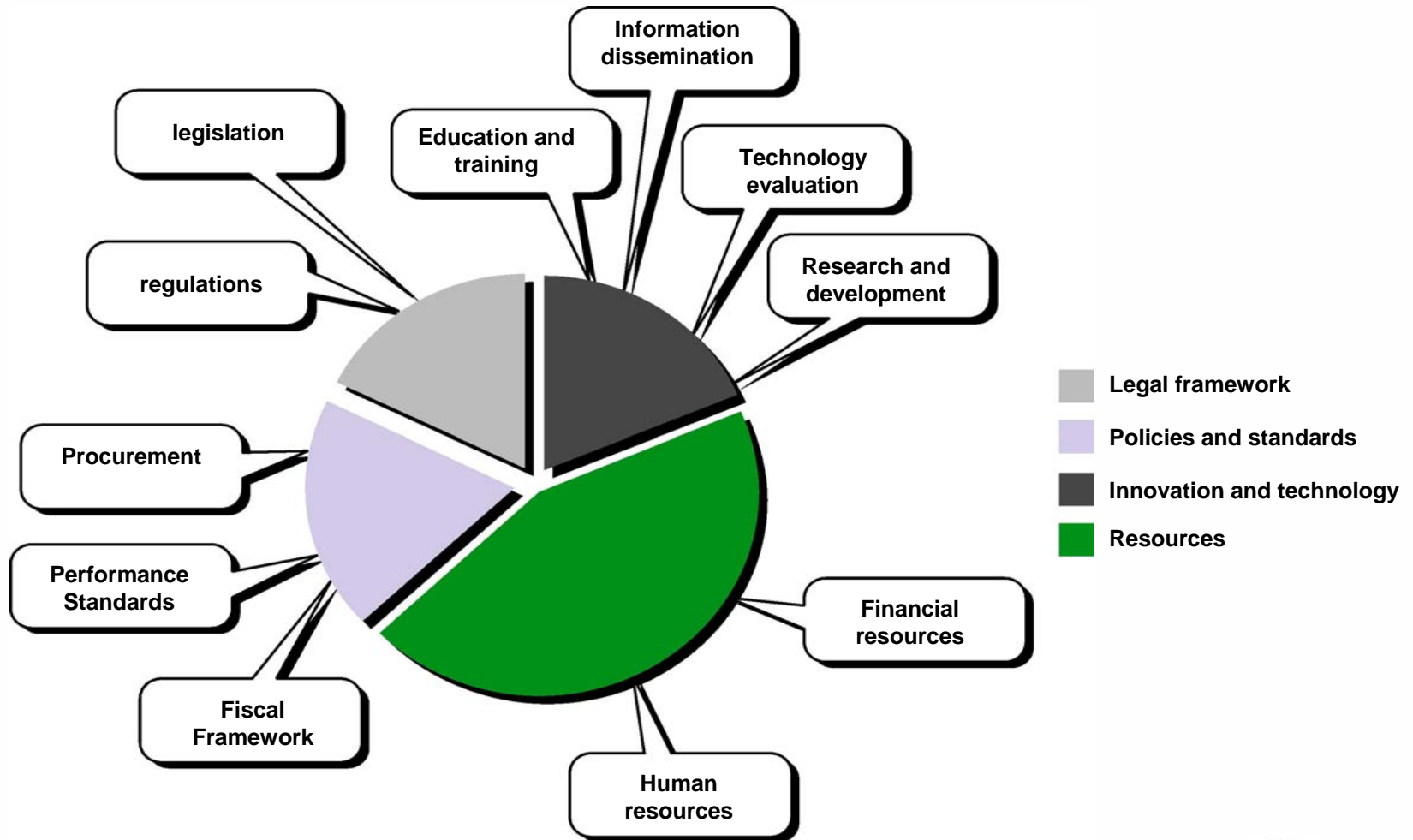
How to solve the pressing infrastructure problems?



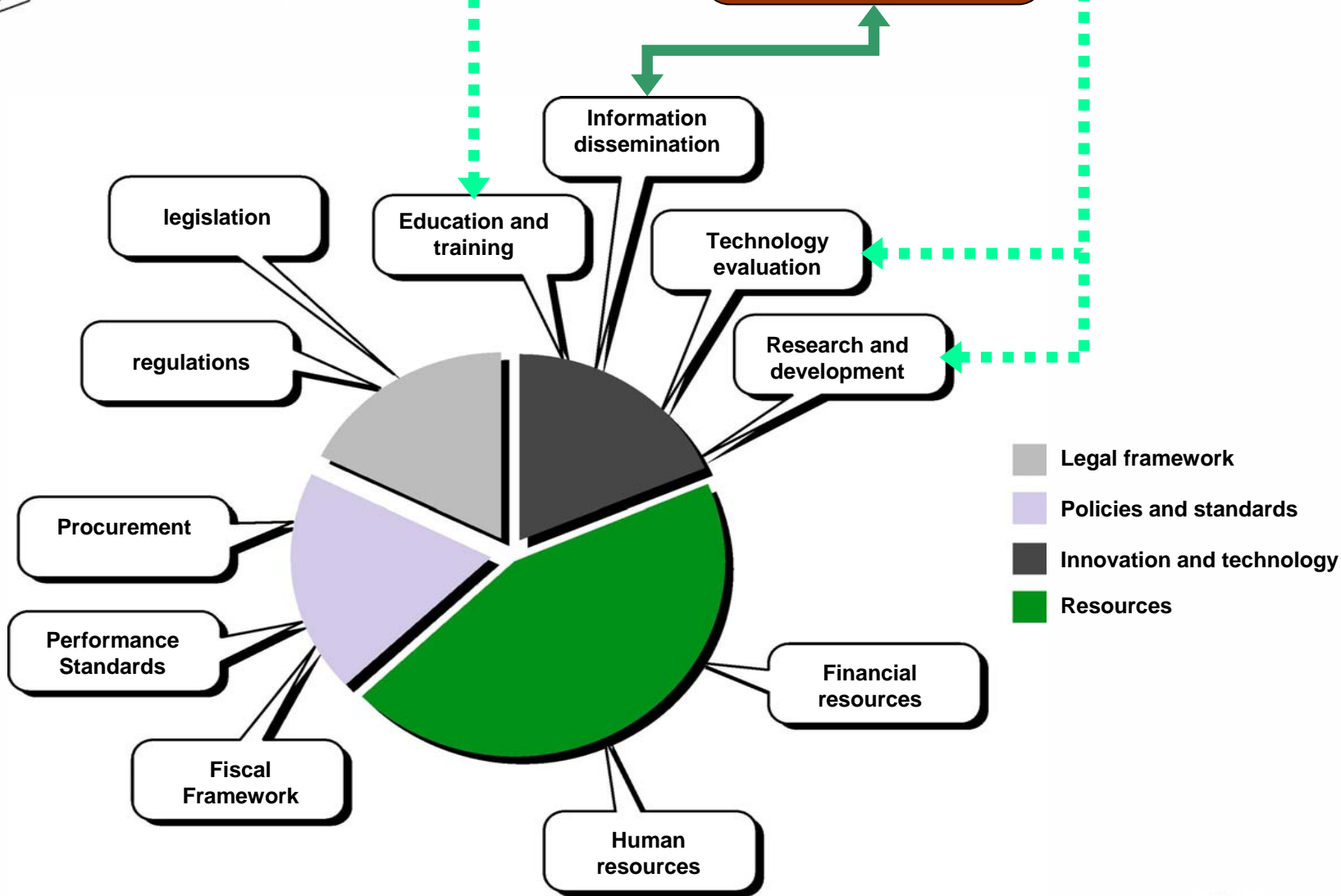
The technology road map provides direction.



Responding to Canada's infrastructure needs ...

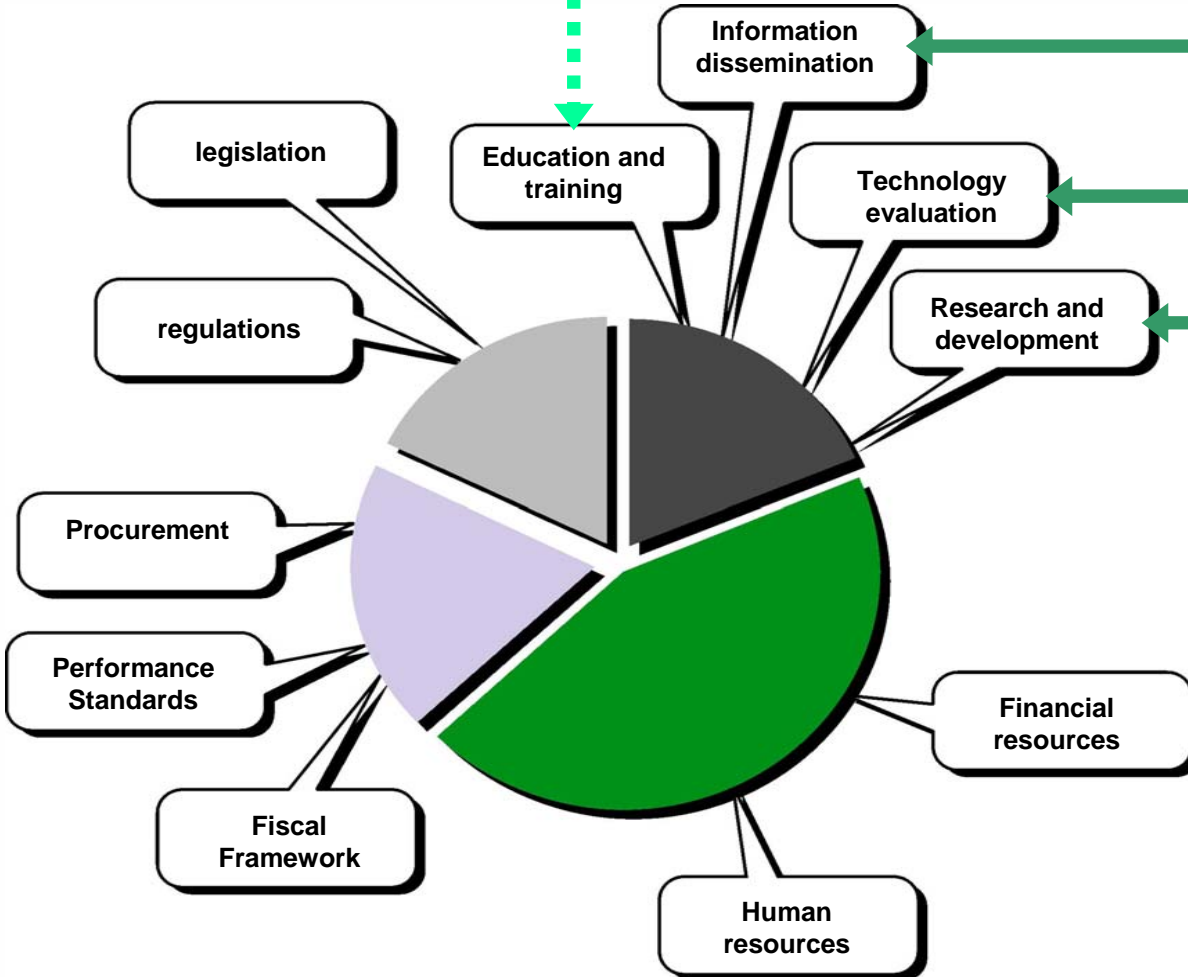


National Guide to Sustainable Municipal Infrastructure « InfraGuide »





NRC
Institut for research
in construction



- Legal framework
- Policies and standards
- Innovation and technology
- Resources



CANADIAN COUNCIL OF PROFESSIONAL ENGINEERS
CONSEIL CANADIEN DES INGÉNIEURS



NRC-CMRC



Trade and Professional Associations

Information dissemination

legislation

Education and training

Technology evaluation

regulations

Research and development

Procurement

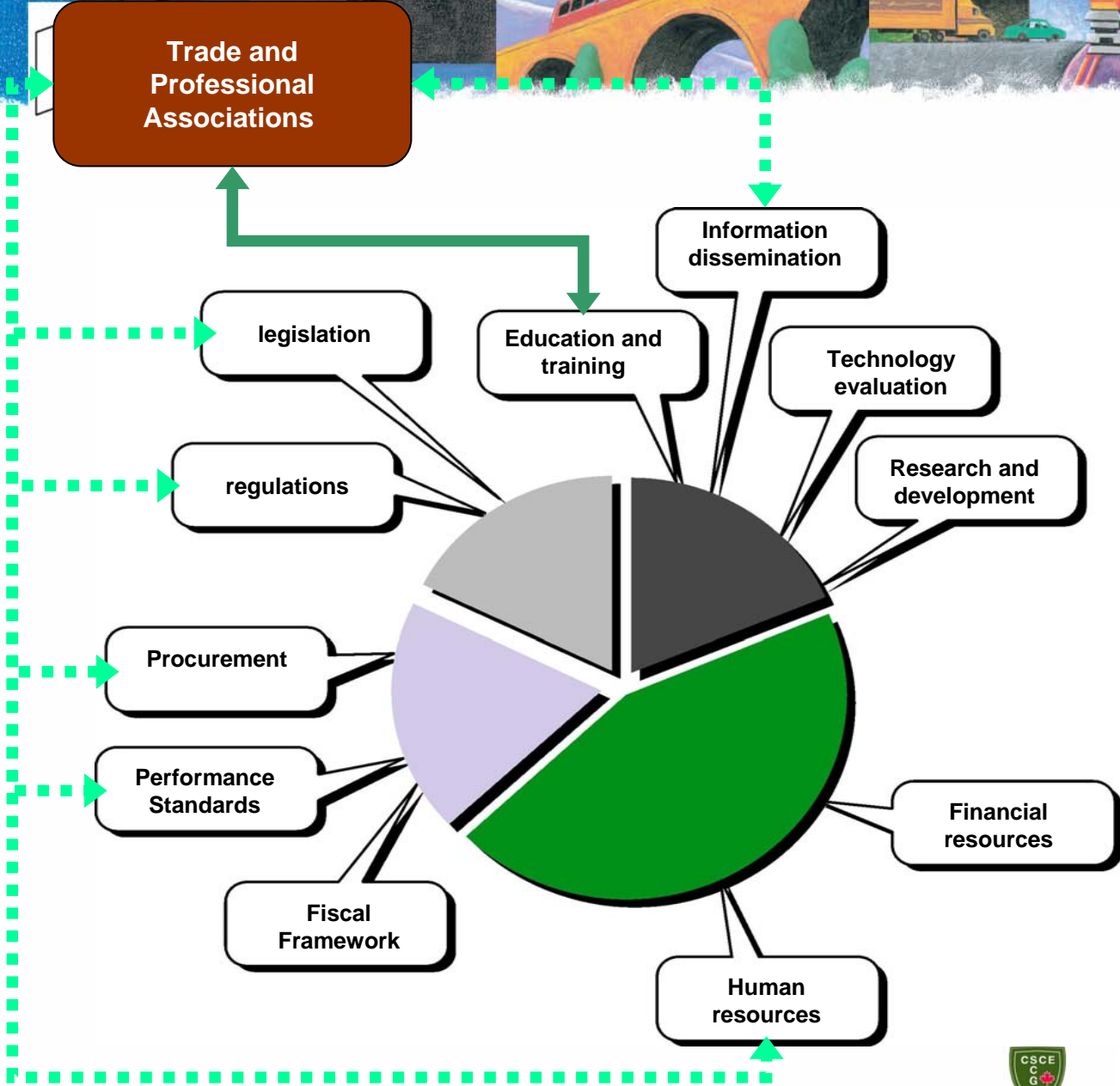
- Legal framework
- Policies and standards
- Innovation and technology
- Resources

Performance Standards

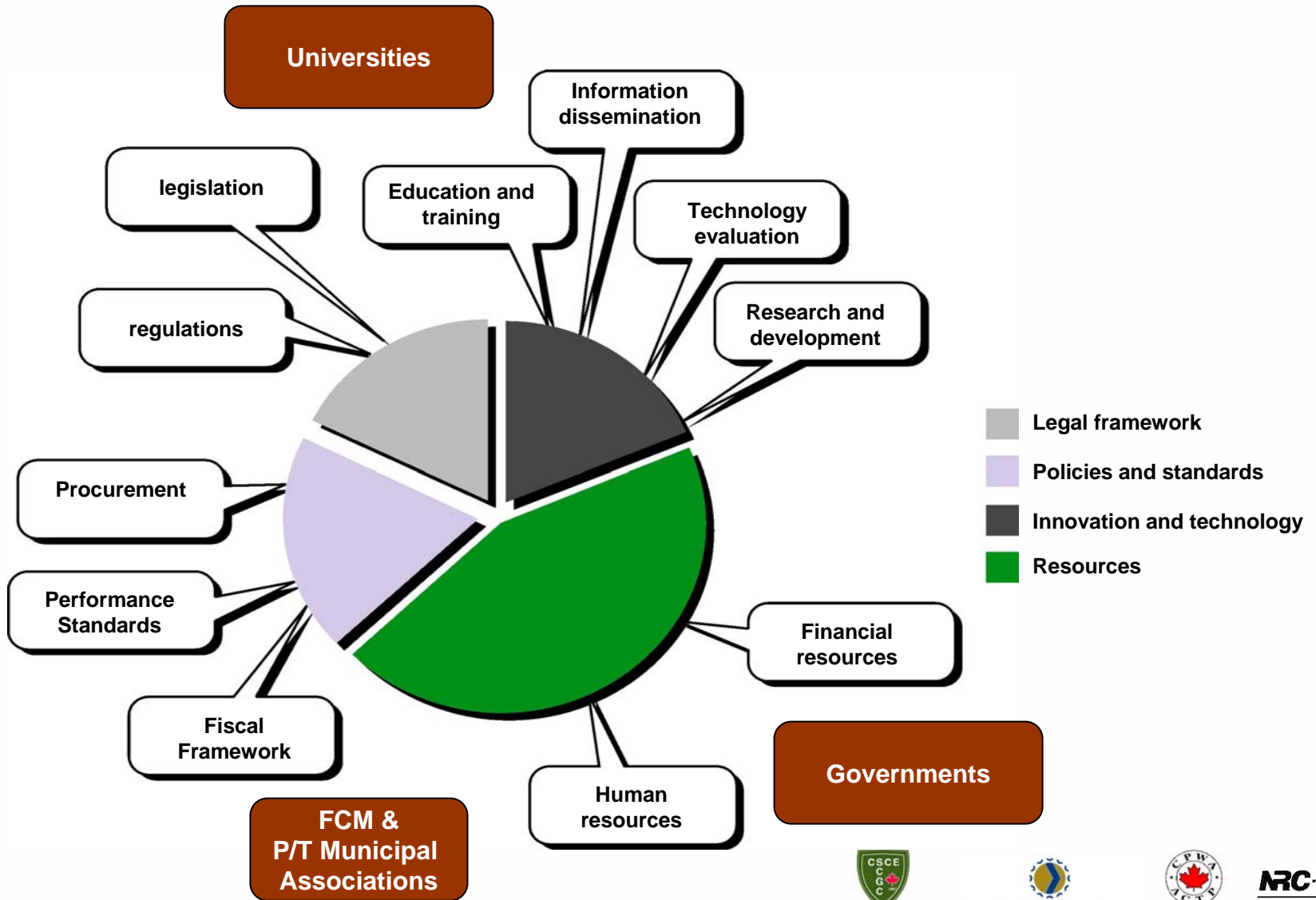
Financial resources

Fiscal Framework

Human resources

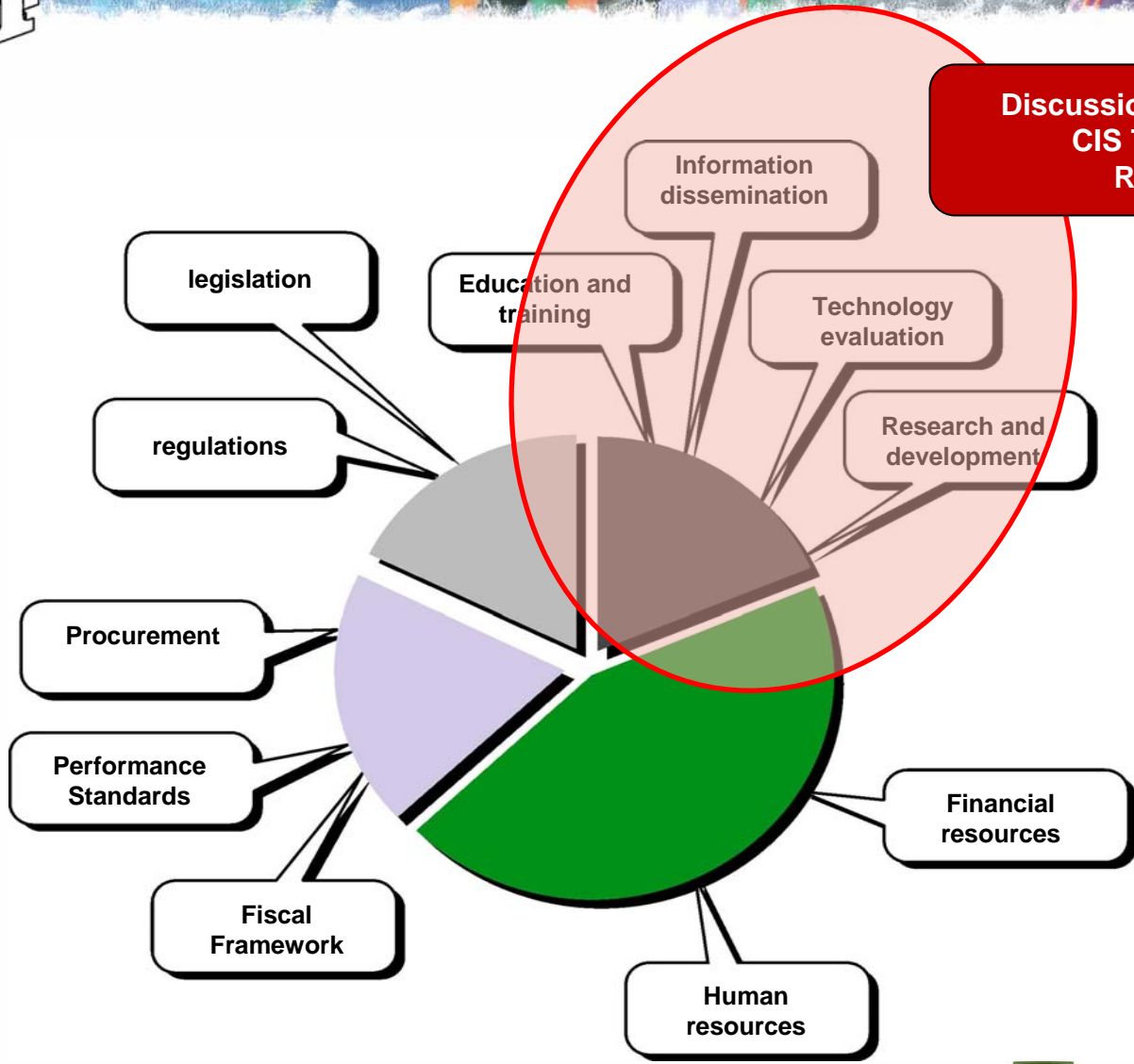


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**Discussion Domain of the
CIS Technology
Road Map**

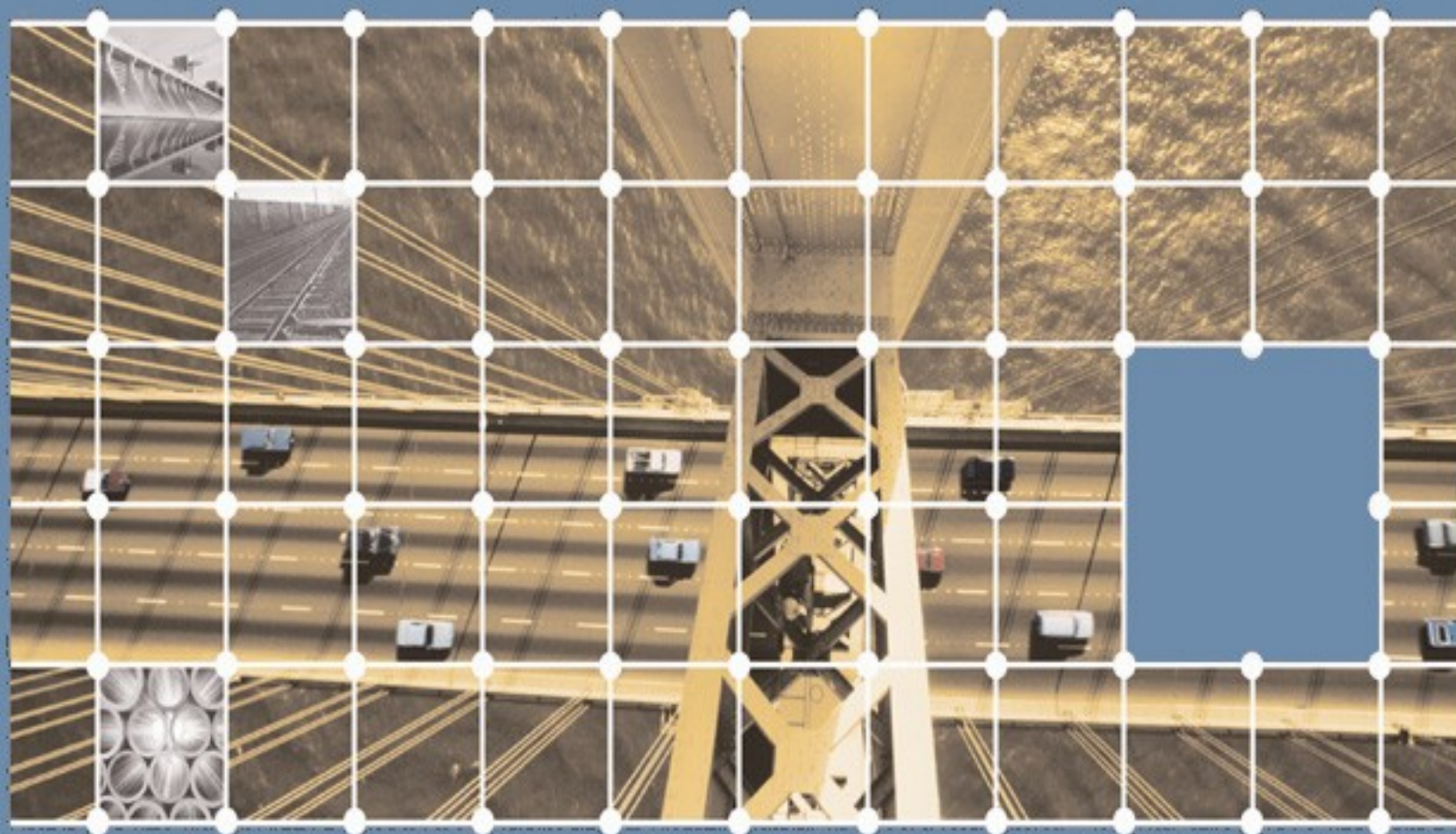


- Legal framework
- Policies and standards
- Innovation and technology
- Resources



Civil Infrastructure System **TECHNOLOGY ROAD MAP**

LA CARTE ROUTIÈRE TECHNOLOGIQUE pour les infrastructures civiles



National Research Council Canada
Conseil national de recherches Canada

INDUSTRY
INDUSTRIE

INFORMATION
INFORMATION

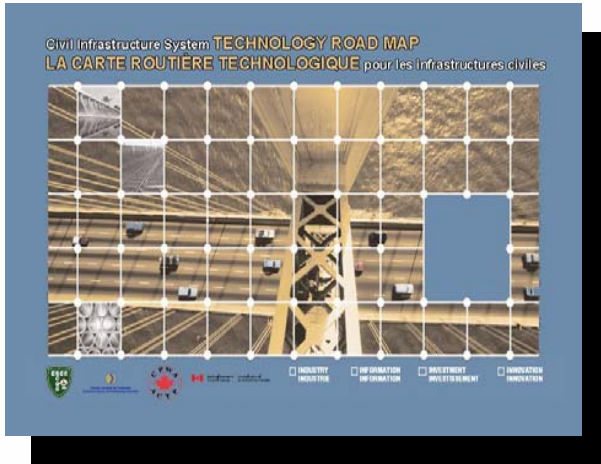
INVESTMENT
INVESTISSEMENT

INNOVATION
INNOVATION



The technology road map is ...

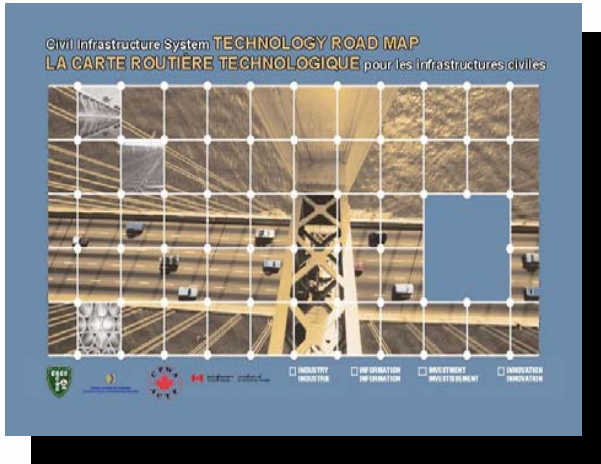
An initiative of 4 national organisations with different mandates but a common goal: public safety and well-being through infrastructure





The technology road map is ...

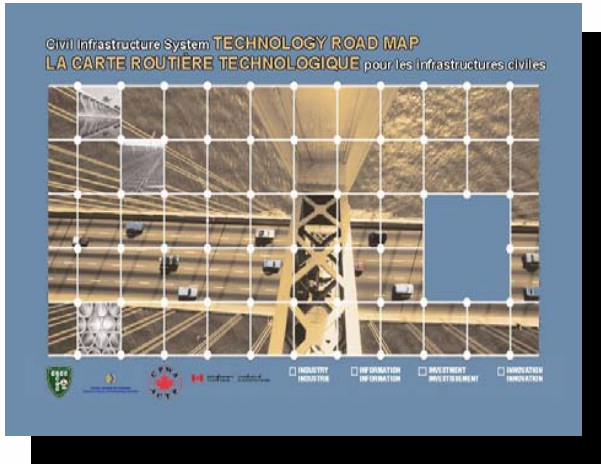
A National consultation report by which infrastructure stakeholders defined their vision of the future of the industry and how to achieve it.





The technology road map is ...

A consensus in terms of technology needs for core infrastructure systems:



Water



Transportation



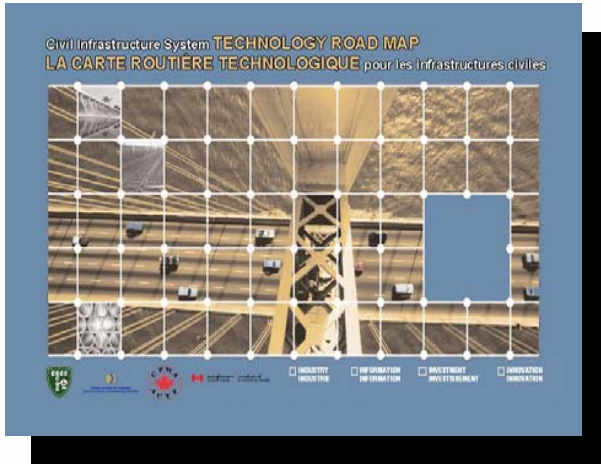
Wastewater





The technology road map is ...

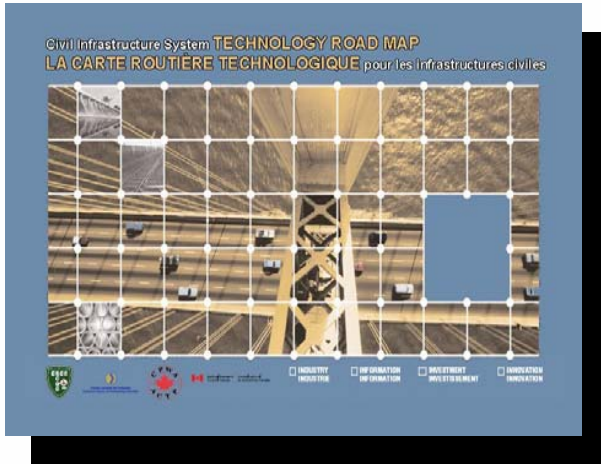
Promoting long term and permanent investments in innovative technologies required to renew and improve Canada's infrastructure systems.





The technology road map is ...

A message to decision-makers that the civil engineering and public works community is ready to work with them in order to ensure the longevity and quality of Canada's civil infrastructure systems.



The TRM Project Team

CIS-TRM Project Steering Committee:

Co-Chair	Sherif Barakat	National Research Council of Canada
Co-Chair	Gordon Jin	Canadian Society for Civil Engineering
	Marie Lemay	Canadian Council of Professional Engineers
	Wally Wells	Canadian Public Works Association
EX-OFFICIO:		
	Guy Félis	National Research Council of Canada
	Michel Langelier	Canadian Society for Civil Engineering

CIS-TRM Project Coordination Team:

Project Manager	Director	Michel Langelier
NRC Support		Guy Félis

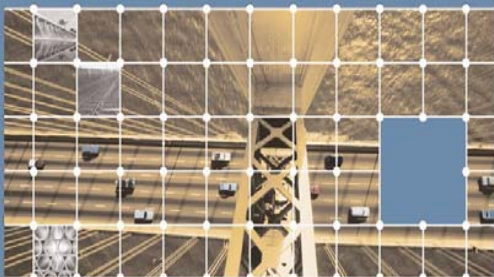
CIS-TRM Expert Panel:

Chair	Reg Andres	R.V. Anderson Associates Limited
	George Aldcroft	Finning Canada
	David Calam	City of Regina
	J. Richard E. Corbett	Associated Engineering Group Ltd.
	J.G. (Geoff) Greenough	City of Moncton
	Ralph Haas	University of Waterloo
	Joseph Loiacono	CERTU
	J. Marsalek	Environment Canada
	Mike McNally	McNally Engineering Corp.
	Osama Moselhi	Concordia University
	Don Osmond	Government of Newfoundland and Labrador
	Dave Rudberg	City of Vancouver
	Andrew L. Steeves	ADI Group
	Don A. Taylor	National Research Council of Canada

Stakeholders

Industry, Academia, Government,
Trade and Professional Associations

Civil Infrastructure System TECHNOLOGY ROAD MAP LA CARTE ROUTIERE TECHNOLOGIQUE pour les infrastructures civiles



Development of the TRM Process

Formation of Project Steering Committee

June 2002

Formation of Expert Panel

Literature Review

Town Hall Meetings
(Fall 2002)
Waterloo, Ont.
Regina, Sask.

Priority needs identified
Brief to Minister

Town Hall Meetings
(Winter 2003)
Vancouver, B.C.
Longueuil, Que.
Halifax, N.S.

Technology needs and challenges

Expert Panel Meetings

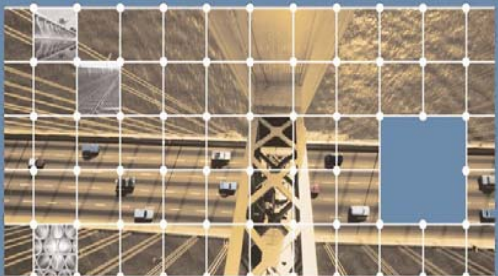
Development of objectives and recommendations

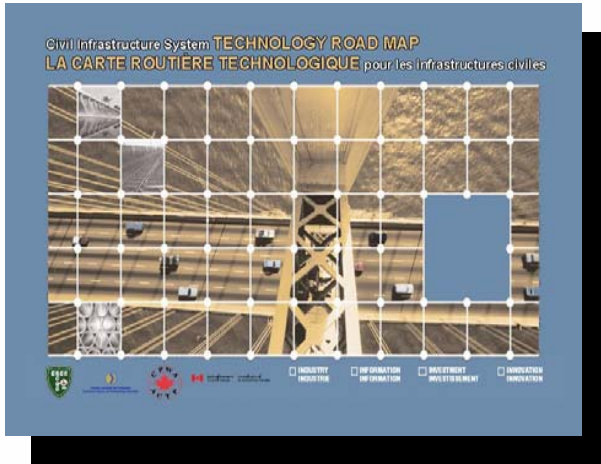
TRM Report

June 2003



Civil Infrastructure System TECHNOLOGY ROAD MAP
LA CARTE ROUTIERE TECHNOLOGIQUE pour les infrastructures civiles



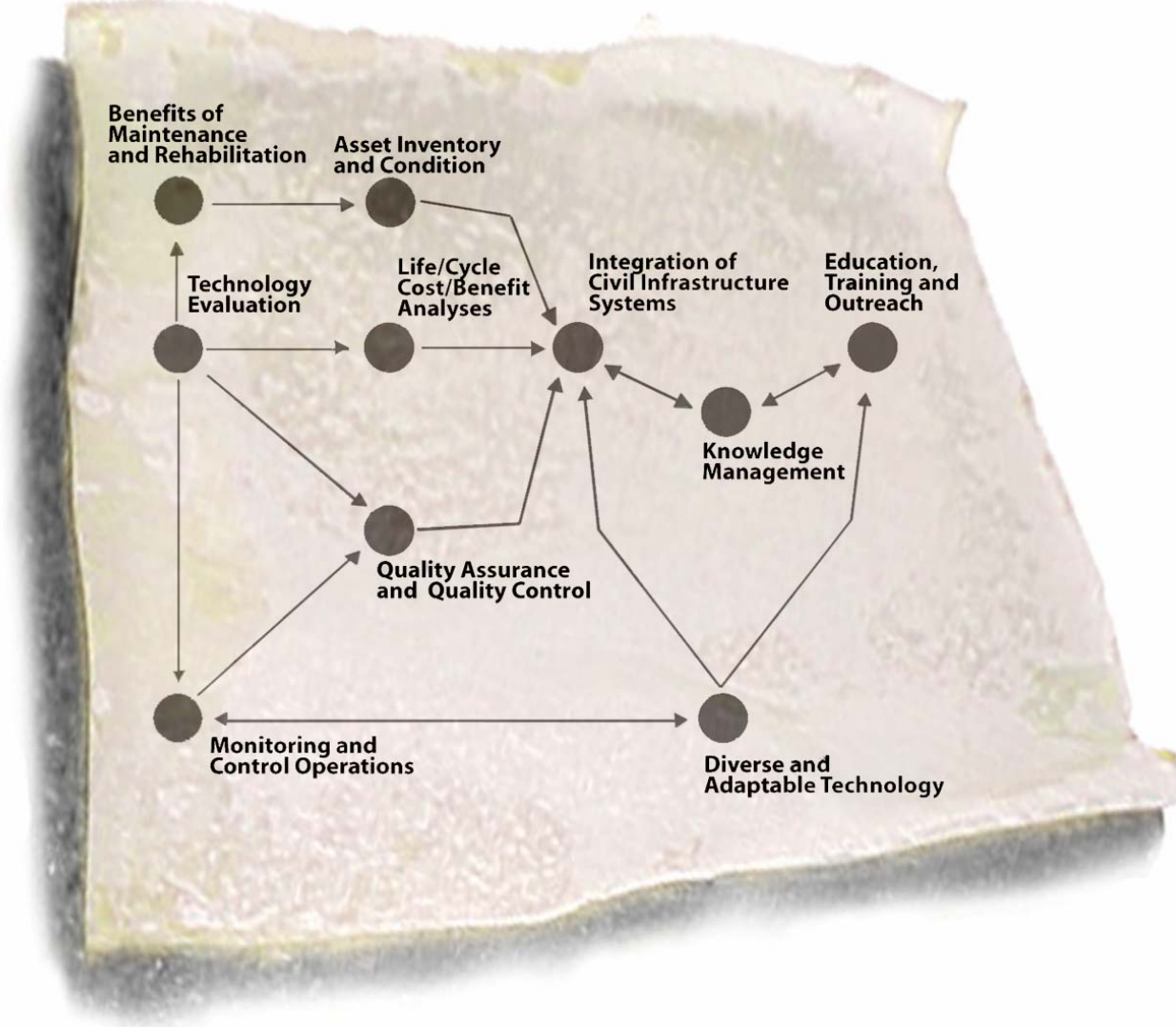


The TRM results

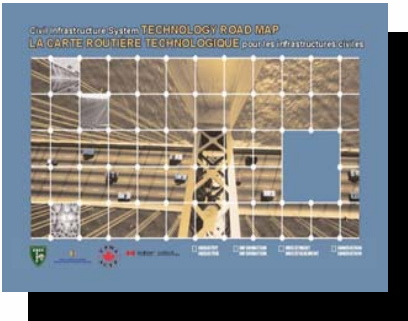
10 objectives

- ⇒ To accomplish in the next decade
- ⇒ To facilitate the adoption of innovative and efficient technologies and of improved management methods
- ⇒ To position the infrastructure industry in a leadership position nationally and internationally

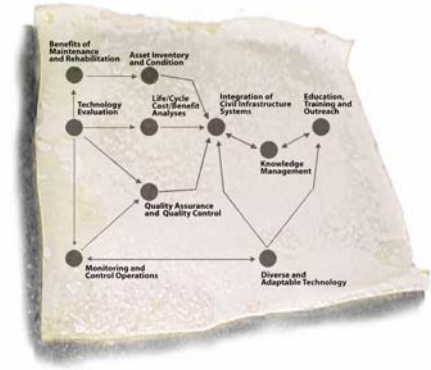




NRC-CNRC



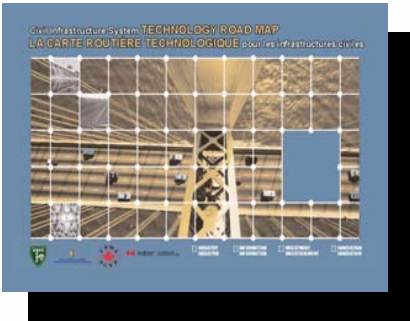
The Objectives in 10 years



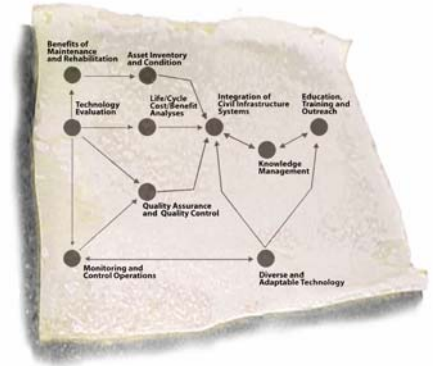
Inventory and condition of infrastructure

- ⇒ ***Reliable and accessible inventory***
- ⇒ ***Including condition and location***
- ⇒ ***To support integrated asset management***





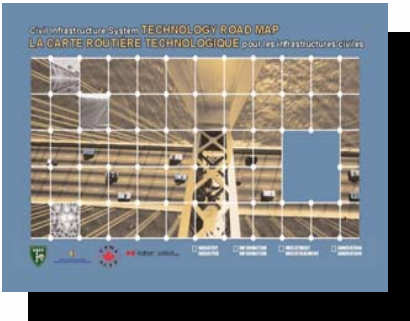
The Objectives in 10 years



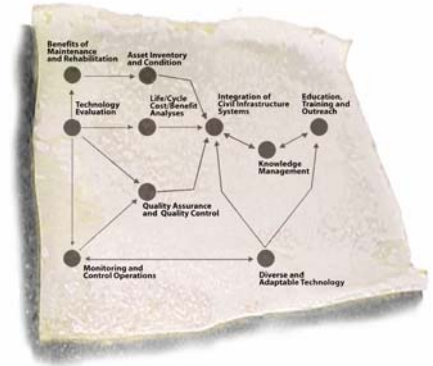
Benefits of maintenance and rehabilitation

⇒ *Properly understand the relation between acceptable maintenance and rehabilitation practices and the longevity of infrastructure*





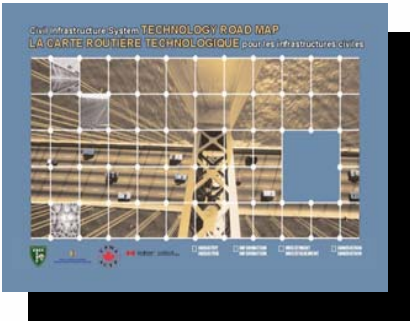
The Objectives in 10 years



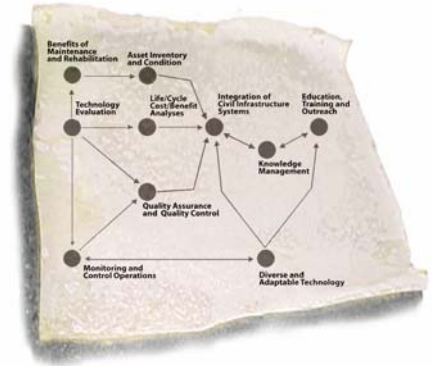
Life cycle cost-benefits

- ⇒ ***Integrate technical, economic, environmental and social factors in sustainable decision making processes for investments in CIS***
- ⇒ ***Base on life-cycle cost-benefits***





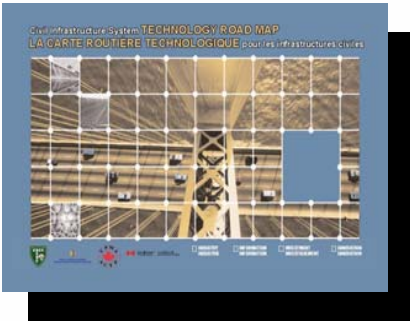
The Objectives in 10 years



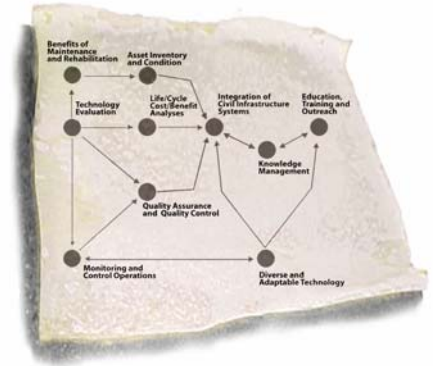
Integration of civil infrastructure systems

⇒ ***Manage infrastructure as a system of inter-dependent assets.***





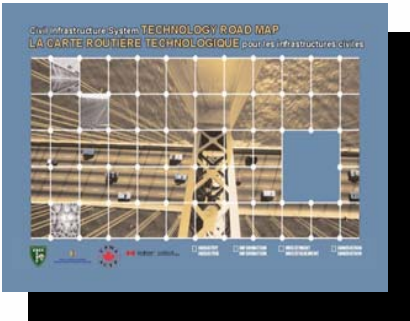
The Objectives in 10 years



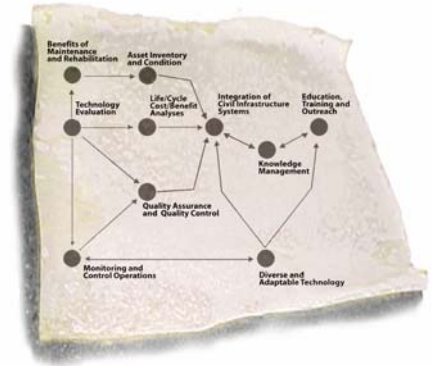
Technology Evaluations

⇒ ***Develop tools and methodologies for the assessment of the field performance of existing infrastructure and for the prediction of the performance of new materials and technologies***





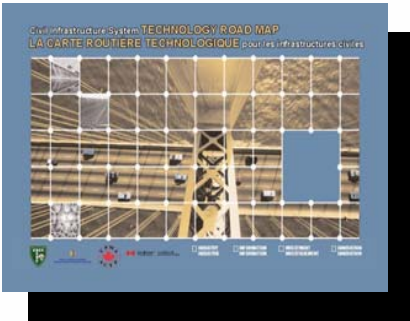
The Objectives in 10 years



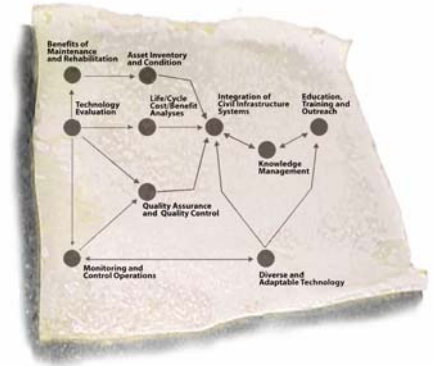
Knowledge management

⇒ *Implement processes to ensure knowledge sharing and dissemination*





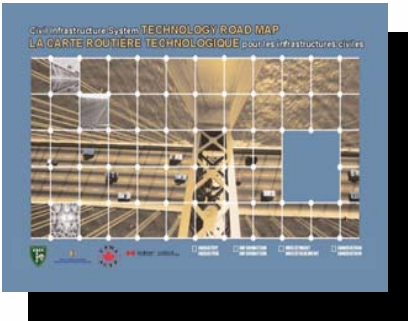
The Objectives in 10 years



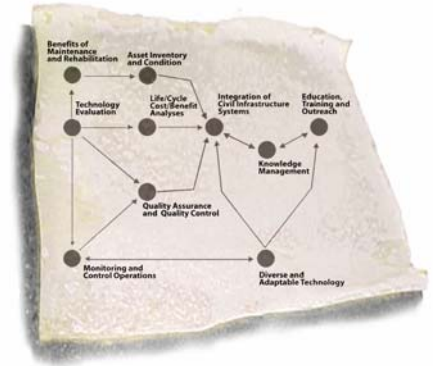
Diverse and adaptable technologies

⇒ ***Increase the diversity of and access to technologies for design, construction, maintenance and rehabilitation that consider local conditions.***





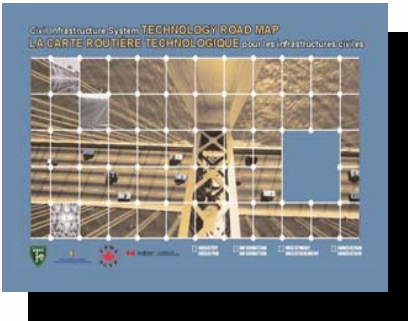
The Objectives in 10 years



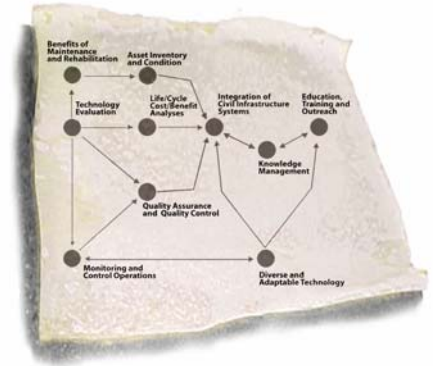
Monitoring and control operations

⇒ ***Implement measures aimed at optimising the operations and maintenance of infrastructure systems through real time monitoring and control.***





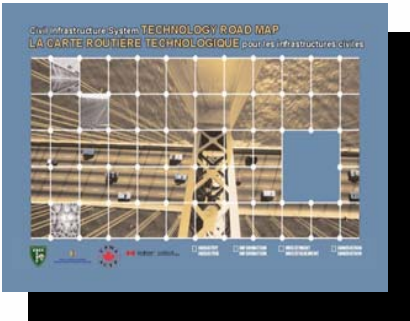
The Objectives in 10 years



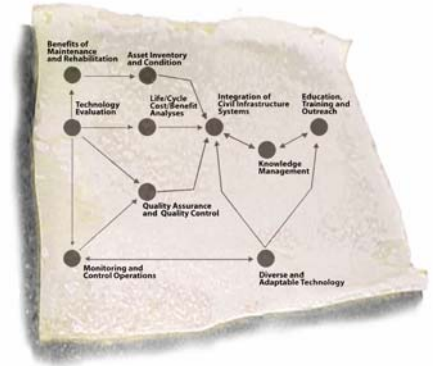
Quality assurance, quality control

⇒ ***Increase the use of tools and processes for improved quality of design, construction, rehabilitation, management and operations of infrastructure systems.***





The Objectives in 10 years

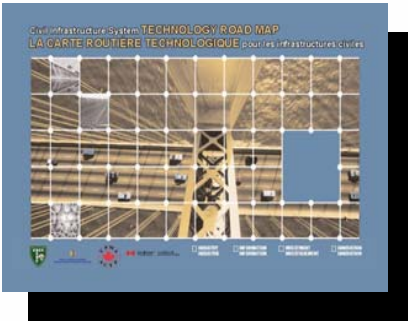


Education, training and outreach

⇒ ***Ensure education and training programs are in line with decision-makers, labour and the industry***

⇒ ***Public information***



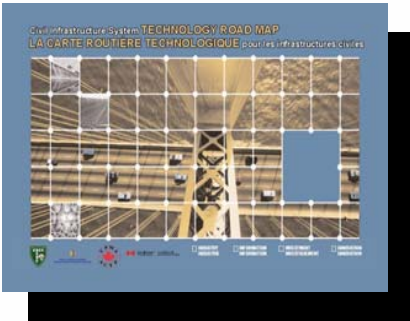


Recommendations (1) immediate actions ...

⇒ Creation of a National Round Table for Infrastructure

- Multi-stakeholder
- To develop a national action plan
- Include a technical expert committee



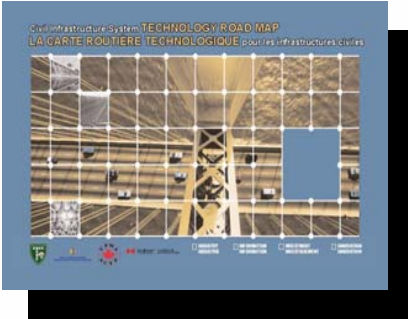


Recommendations (2) immediate actions ...

⇒ **Develop economical inventory data collection system**

- Usable by programs such as Infrastructure Canada and others
- First step towards a national inventory



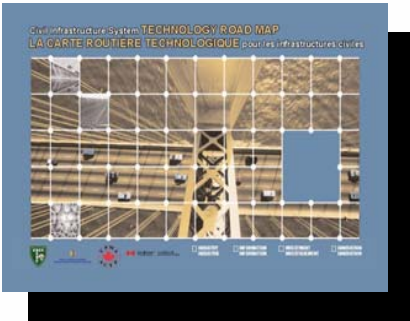


Recommendations (3) immediate actions ...

⇒ **Include life-cycle cost-benefit analysis in all mechanisms of project selections**

- *For projects submitted by municipalities or to municipalities*
- *Will result in increased return on investment, increased longevity, and promote the use of innovative technologies*

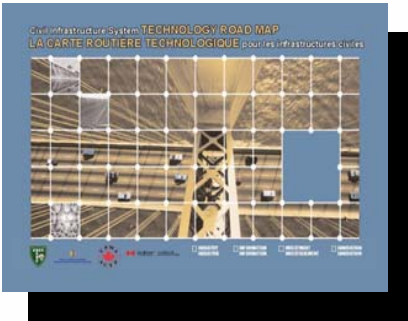




Recommendations (4) immediate actions ...

⇒ Request INFC create a technology demonstration program

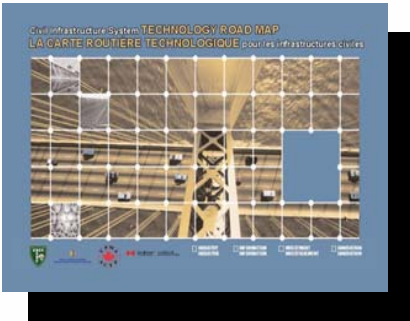




Recommendations (5+6) immediate actions ...

- ⇒ **Create a NCE or equivalent for infrastructure**
- ⇒ **Request the Federal, Provincial, and Municipal governments and Industry increase R&D funding for infrastructure.**

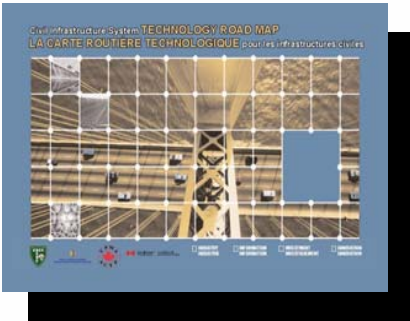




Recommendations (7) immediate actions ...

⇒ That rehabilitation and maintenance of infrastructure be integrated into education and training

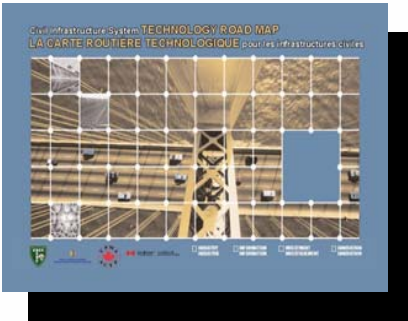




Recommendations (8) immediate actions ...

⇒ **Create a program for infrastructure technology transfer that encourages commercialisation of innovative technologies**





Recommendations (9+10) immediate actions ...

- ⇒ **Within 5 years, evaluate progress on the objectives of the TRM;**
- ⇒ **That individuals and organisations involved in the TRM support others to achieve the objectives and recommendations**





An invitation to action

All stakeholders are challenged to ...

- 1. Adopt the TRM objectives as the national vision for the long-term management of the CIS*
- 2. Within the mandate of individual organizations, develop an action plan that will achieve or advance TRM objectives*
- 3. Expand the mandate of individual organizations to create the opportunities to meet TRM objectives*



NRC-CNRC



Since June 2003 ...

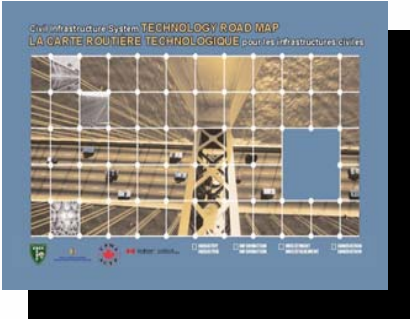
- ⇒ More than 25 presentations to associations (conferences, boards, etc.) across Canada
- ⇒ Several working meetings with Infrastructure Canada
- ⇒ Discussions between CSCE, CPWA and CCPE and the Minister responsible for INFC
- ⇒ Partnership between CCPE, ACEC and EIC (CSCE) creating « Engineers for Safer Infrastructure »
- ⇒ Various action plans under development
- ⇒ NCE-Infrastructure proposal (Sep. 2003 – not funded)

⇒ NSERC-PSEPC « infrastructure

interdisciplinary research program (March



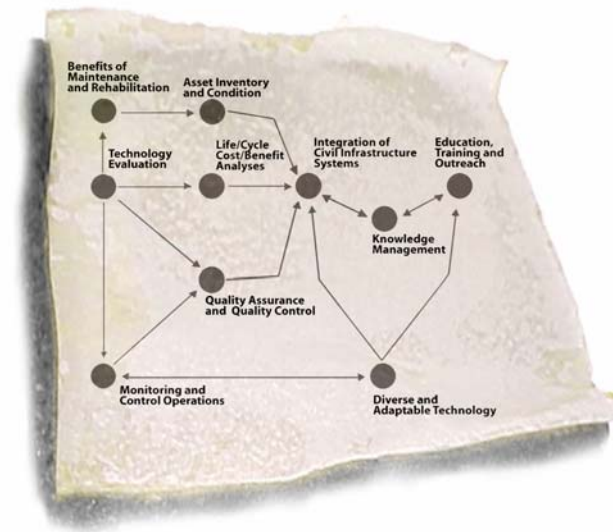
NRC-CNRC



The National CIS Technology Road Map

You have the road map and the destinations ...

You are the vehicles to reach these destinations.



Thank you

