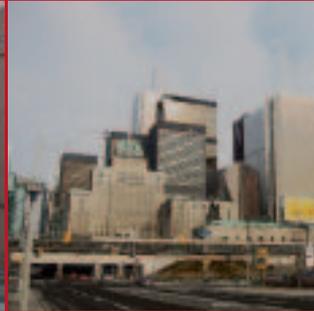
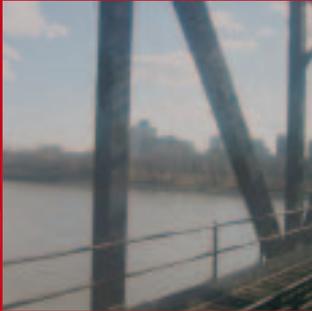
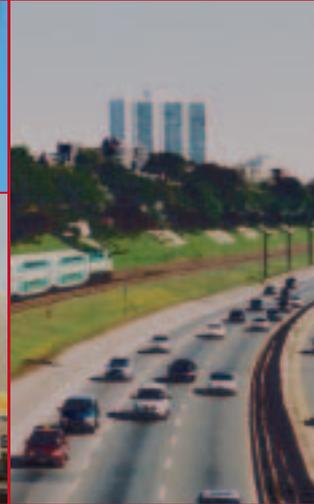


Road map



to infrastructure renewal

By Guy Y. Félio, PhD, P.Eng., and Reg Andres, P.Eng.

The National Civil Infrastructure Systems Technology Road Map (CIS-TRM), released in June 2003, presents a vision for the industry and a strategy for meeting the long-term needs of Canada's civil infrastructure system (CIS) through technology innovation.

The preparation of the technology road map (TRM) was led by four national bodies: the Canadian Society for Civil Engineering (CSCE), the Canadian Council

of Professional Engineers (CCPE), of which PEO is a constituent member, the Canadian Public Works Association (CPWA) and the National Research Council (NRC) of Canada.

Early in the TRM process, the following goals were identified:

- to promote and build support for an ongoing, long-term, holistic investment in the innovative technologies needed to renew and

enhance Canada's civil infrastructure system;

- to adopt the TRM as a blueprint for the renewal and enhancement of Canada's CIS;
- to develop a nationally shared vision among all partners;
- to develop a realistic and exhaustive analysis of the state of CIS, as driven by the needs of the construction industry; and

A number of engineering and technology-related organizations have made common cause in mapping out strategies to best meet the challenges presented by infrastructure renewal. While it is but one of several players in this effort, the engineering community might seize on infrastructure renewal as an opportunity to put forth some timely arguments on engineering governance and prudent civic investment.

- to increase research and development.

More than 140 leaders and experts were consulted in Canada-wide town hall meetings. These consultations resulted in a list of 10 Technology Road Map objectives for the next decade.

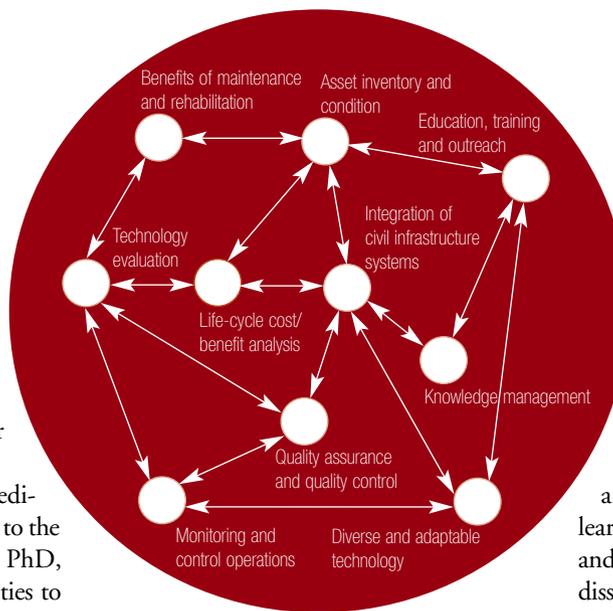
In the spring of 2004, CSCE dedicated its annual national lecture tour to the roadmap. The lecturer (Guy Félio, PhD, P.Eng.) made presentations in 17 cities to more than 600 participants. The tour confirmed the results of the roadmap and, more importantly, showed the level of commitment by the infrastructure engineering community to pursue actions that will lead to the realization of the 10 objectives.

Planned for realization over the next 10 years, the objectives are:

- establishing an inventory of infrastructure and making note of its condition;
- outlining the benefits of maintenance and rehabilitation;
- explaining life-cycle cost benefits;
- working toward the integration of civil infrastructure systems;
- developing the tools and methodologies for technology evaluations;
- implementing processes to ensure knowledge management;
- increasing the diversity of and access to technologies for design, construction, maintenance and rehabilitation;
- implementing measures designed to maximize the operation of infrastructure systems through real-time monitoring and control;
- increased use of tools and processes for improved quality of design, construction, rehabilitation, management and operation of infrastructure systems; and
- ensuring that education and training programs are in line with decision-makers, labour and industry.

Working groups

During the summer of 2004, discussions between the original TRM partners and other stakeholder organizations, including Infrastructure Canada, led to the decision that several working groups needed to be established to address ways to achieve the objectives. Recently, four working groups were created.



1. *The National Round Table on Infrastructure (NRTI) will be led by the CCPE.*

The NRTI will bring together a complex and fragmented industry and will provide independent, expert, non-partisan advice, as well as facilitate dialogue among federal, provincial and municipal policy makers, to enhance the decision-making process for civil infrastructure renewal.

The NRTI will encourage the use of best practices and innovative technology and will work toward creating a National Action Plan on Infrastructure to rehabilitate Canada's CIS that will make the most effective use of limited financial resources. The working group will evaluate the options for the "governance" model and will lead the creation of the NRTI.

Marie Lemay, P.Eng., CEO of CCPE, said a key to infrastructure renewal considerations is developing new attitudes toward investment. "When you are talking about life cycles, a holistic approach and overall sustainability, sometimes you are talking about intangibles," Lemay said. "And what we at the CCPE have been saying is that you have got to change the focus from funding to investing. It's a totally different approach."

2. *Education and Training will be led by the CSCE.*

The working group will produce a position paper on a strategy to enhance infrastructure education and training. Elements to explore will include: incorporating infrastructure rehabilitation, operations and maintenance into university curricula, continuing professional education (including InfraGuide best practices), partnerships for

delivery, and cost-effective and accessible delivery mechanisms.

3. *Knowledge Management: Creation, Dissemination and Transfer will be led by CSCE.*

The working group will explore Canada's infrastructure needs in terms of knowledge creation through research and development, case studies, lessons learned, best practices, etc. Cost-effective and accessible mechanisms for knowledge dissemination and technology transfer will also be investigated by considering existing processes through such organizations as the Centre d'expertise et de recherche en infrastructures (CERIU), Canadian Academy of Travel and Tourism (CATT), Ontario Good Roads Association (OGRA), InfraGuide, CSCE, NRC, etc. The discussions will also include the capacity of owners and operators of infrastructure, particularly those in small and remote municipalities, to adopt innovation. Commercialization of technology will be part of the discussions.

4. *Asset Management: Management, Inventory and Valuation will be led by the CPWA.*

The objectives of this working group are to:

- identify the type of data needed for a reliable national infrastructure inventory and which mechanisms would be used for the data collection;
- identify how best municipal infrastructure should be valued and how it should be reported in municipal balance sheets; and
- develop a strategy for basic asset management principles to be adopted by Canada's municipalities.

The timeline for each working group varies, but results are expected in the winter of 2005. Stay tuned!

Guy Félio, PhD, P.Eng., is co-chair of the Canadian Society of Civil Engineering's Infrastructure Renewal Committee. Reg Andres, P.Eng., is chair of the Civil Infrastructure Renewal-Technology Road Map Expert Panel. For more information on the TRM report, visit www.csce.ca/trm/index.htm.

Profession awaits impact of infrastructure renewal plans

By Michael Mastromatteo

Anyone sitting in on the lectures accompanying the release of the Technology Road Map (TRM) would almost certainly appreciate that discussion around sustainable infrastructure constitutes a watershed moment for the engineering community.

Although practitioners, regulators and advocacy groups recognize that engineers are but one player in the multi-faceted response to infrastructure renewal strategies, there is little doubt that infrastructure holds no small role for engineers and the contributions they can bring to issues relating to public welfare, safer communities, and prudent investment of financial and environmental resources.

As the Canadian Council of Professional Engineers (CCPE) noted in its 2003 pre-budget recommendations to the federal government, "Cohesive networks need to be created that link infrastructure stakehold-

ers, including engineers and government, to ensure that money and resources are allocated effectively."

the basic infrastructure of 19th-century communities—roads, waterways, transportation systems, water treatment systems, power generation facilities—provided the foundations of the cities in the 21st-century. But with neglect, rapid expansion and financial constraints, much of this infrastructure has deteriorated, and only recently have technologies been advanced to abet rehabilitation.

A number of federal government-supported programs, such as the Canada Strategic Infrastructure Fund and Infrastructure Canada, were established in the 1990s to examine the state of the country's infrastructure and to initiate debate on priority areas and the kinds of planning, investment and resource-allocation models that would best address the situation.

The TRM and lecture tour identified concerns about the country's civil infrastructure system, none of which was more acute than

engineering education programs, while regulators and professional associations might be asked which regulatory and licensing modifications might be considered to mobilize their respective professions in meeting the infrastructure renewal challenges.

Many of the recommendations stemming from the TRM focus on encouraging input from, and sharing information and advice among, all stakeholders. One recommendation that could impact on engineering education is that "rehabilitation and maintenance of infrastructure be integrated into education and training." As well, all stakeholders including, presumably, engineering regulators, are being encouraged to develop individual action plans that will achieve or advance the objectives of the TRM. To date, issues surrounding infrastructure renewal have not come up for discussion within PEO's Professional Standards Committee, but it's expected the commit-

"Cohesive networks need to be created that link infrastructure stakeholders."

CCPE

tee, and the association, will be watching with interest.

If nothing else, the emphasis on sustainable infrastructure and building safer, more viable cities and communities may help elevate the public perception of the engineering profession. Says Marie Lemay, P.Eng., CEO of the Canadian Council of Professional Engineers: "This could help raise our profile, but it can't be seen as the reason why we [engineers] are taking part in this. If we do this right, the decision makers and politicians will see that we do play an important role in the pre-design stage. They will see the advantages of having us involved, so it's a question of finding a way that we can get involved and make it happen. On the other hand, engineers have to be open to all the other aspects that we're not used to, and that means including all the other players when we talk about design infrastructure and thinking of the social impact of all these things."

Adding urgency to the process are some hard numbers prepared by the authors of the TRM. Canada's overall civil infrastructure system (CIS) is said to represent a \$1.6-trillion asset. Yet, despite its importance to the country's long-term health, safety and economic viability, the infrastructure system is looking at a debt of \$60 billion, and fully one-half of the CIS will be in need of replacement by the year 2027.

A typical presentation accompanying the roll-out of the TRM highlighted how

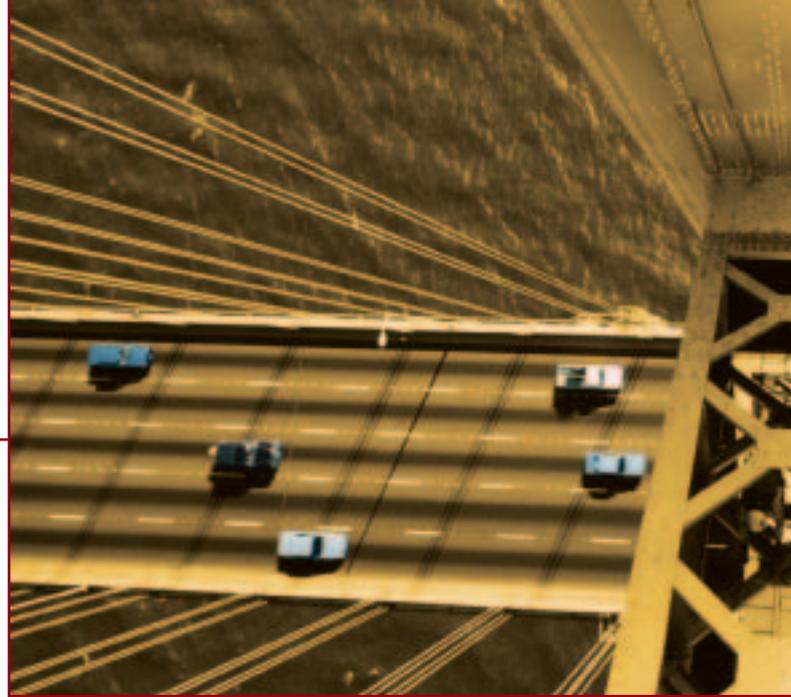
what still lies underground. "Buried infrastructure," some 44 per cent of the entire system, ranges in age from 60 to 100-plus years, and its upgrading or replacement hangs like an albatross around the necks of government leaders and policy makers, ever more sensitive to the need to expend public resources more effectively.

And as priorities have been identified, and the best ways of allocating resources become clear, engineers and others with a stake in sustainable infrastructure have turned their attention to some best practice models. The TRM lectures devoted some debate to how to respond from a policy-making perspective to the infrastructure renewal challenge. Certainly, the expertise of (primarily) civil engineers will come into play with some of the technical solutions, but the overall response invites input from players well beyond the federal, provincial and municipal governments. Universities will be called on to consider changes in

“A society that neglects its infrastructure loses its ability to transport people and food, provide clean air and water, control disease and conduct commerce.”

CCPE CEO Marie Lemay, P.Eng.

Engineers raising profile of infrastructure debate



Engineering-related organizations across Canada are among the leading voices asking federal and provincial governments to clarify their positions on infrastructure-renewal programs. Engineers are also using the infrastructure debate to focus attention on the contributions the profession can bring to a more sustainable form of social and economic investment.

Infrastructure issues have gained prominence among policy makers over the last decades, particularly in light of the challenges related to near-capacity energy generating facilities, over-taxed transportation and water treatment systems, and aging bridges, hospitals, schools and public buildings in many Canadian urban centres. The Canadian Council of Professional Engineers (CCPE) estimates that Canada's total infrastructure system is worth some \$1.6 trillion, but that half of that system will reach the end of its lifespan within the next 20 to 25 years.

Complicating matters, with respect to infrastructure, is a lack of political will to commit the massive resources necessary to undertake effective, long-term renewal. Efforts to include sustainability in long-term infrastructure renewal have led to calls for a more collaborative approach among governments, the private sector, engineers, other design and building professionals, and the public to develop a best-practices approach.

PEO and the Ontario Society of Professional Engineers (OSPE) have been

active in different areas of the infrastructure-renewal debate. In the spring, PEO used the release of the Ontario government's Ministry of Public Infrastructure Renewal's paper on financing proposals to highlight the contributions of engineers in making valuable, cost-effective investments in the economy. In a letter to Infrastructure Renewal Minister David Caplan, PEO Registrar Kim Allen, P.Eng., linked infrastructure renewal with the public's trust in the self-regulating engineering profession. "For over 80 years, the people of this province have entrusted the design and construction of Ontario's infrastructure to professional engineers," Allen said. "During this time, public accountability has been afforded through the *Professional Engineers Act*. PEO would continue to offer this reassurance by urging that your ministry look for ways to make use of this legal instrument to ensure that the public interest is preserved and that those taking the responsibility for any infrastructure projects are held accountable via licensure."

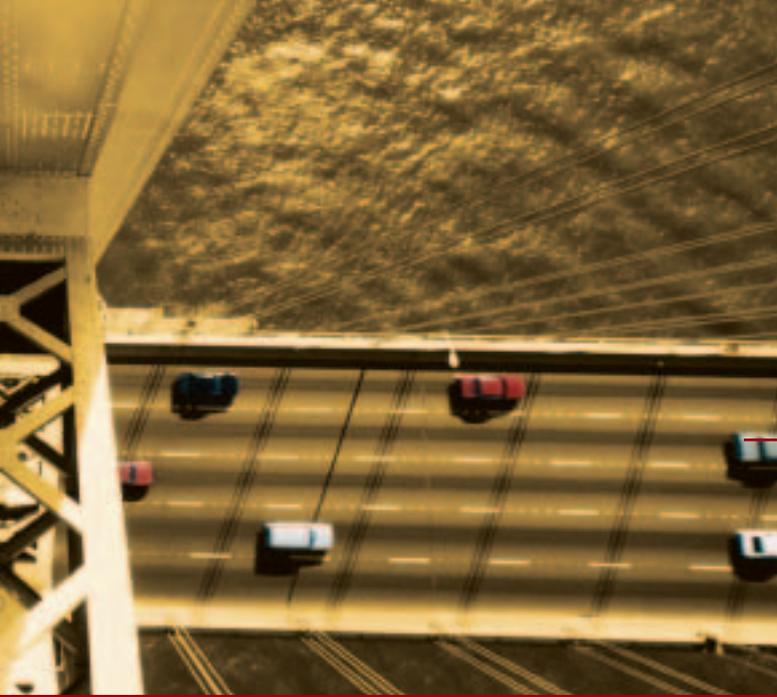
In June, OSPE voiced its support for the province's restructuring of Ontario's electricity sector, and for its efforts to create new generation capacity and promote price stability. "We have long held that conservation and sustainable new generation are of equal importance to the economy and quality of life in Ontario," said OSPE Vice-Chair Chris Cragg, P.Eng., the head of the society's energy working group. "We look forward to reviewing the new legislation in

detail and sharing the expertise of Ontario's engineers with the government during the consultation process."

During last summer's federal election campaign, CCPE, for its part, distributed a questionnaire to party leaders on the infrastructure issue. "A society that neglects its infrastructure loses its ability to transport people and food, provide clean air and water, control disease and conduct commerce," said CCPE CEO Marie Lemay, P.Eng. "As engineers, we are mandated as a profession, in the same way that the medical community is empowered to comment on the state of public health, to be the social conscience for infrastructure rehabilitation. We are ready to work with government to share a clear view of what needs to be done in the service of the public's interest."

Lemay told *Engineering Dimensions* that while only the Liberals and the Bloc Quebecois responded to the CCPE questionnaire, it was important to get infrastructure issues on the election campaign agenda. "If you look back five to 10 years ago, what we had to do was to raise the issue that there was an infrastructure deficit," Lemay said. "But that is now something that even the public knows. The challenge now is to be able to do things differently, to do more with the tax dollars we've got and to do it in a more planned way. We've got to make sure that we set the right processes and the right mechanism to make things happen in a long-term way."

Michael Mastromatteo



“Action must be taken to manage demand rather than simply accommodate it.”

ICE State of the Nation 2004

British engineers outline infrastructure renewal plans

Canada isn't the only country wrestling with issues related to infrastructure renewal and its impact on professional engineering. In June, Britain's Institution of Civil Engineers (ICE) released its *State of the Nation 2004* report, which calls for increased public awareness of the importance of infrastructure renewal, and lobbies for a greater commitment from government to allocate resources toward rebuilding efforts.

The ICE paper offers a report card grading of the different elements of Britain's infrastructure situation. The ICE gives the country a D+ on infrastructure overall, with similar poor grades in energy, waste management and urban/housing issues.

Only in the drinking water quality and wastewater disposal areas did the country earn an impressive B+ grading, while the other sectors—sustainability/environment, flood risk management and transport—came in with mediocre C grades.

One objective of the ICE is to convince policy makers and other stakeholders that investment in infrastructure requires significant and sustained investment, rather than short-term, quick-fix expenditures. The British engineers also call for increased involvement of the private sector, regional governments and the public at large, to forge a coordinated effort toward infrastructure renewal. “Short-term populist decisions cannot deliver a viable future,” the ICE says in its report. “As the pressures

on our infrastructure increase, action must be taken to manage demand rather than simply accommodate it.”

Conditions in the U.K. appear to be similar to those in North America in that many transportation systems, water-treatment facilities and energy-generation plants are aging or nearing the end of their lives.

In the energy sector, for example, Britain faces additional pressure stemming from a move away from environmentally harmful coal, and continuing public disfavour with nuclear energy. The ICE recommends that policymakers continue to consider all energy options, while promoting conservation and working to create new confidence in the energy sector marketplace to encourage investment in generation, distribution and transmission assets.

The British engineers suggest that the all-important transportation sector be managed in a more cohesive, balanced manner. “Addressing one mode of transport, while ignoring its impact on another, leads to short-term gain at the cost of long-term sustainability,” the ICE says. “A more strategic view of transport will also enable trade-offs between modes. For example, a high-speed rail network can mean less reliance on domestic flights, with reduced pressure on U.K. airports, and less congestion on the roads.”

One of the key recommendations in the British engineers' report is the creation of an independent “chief engineer” position to ensure that a coordinated, long-term

sustainable approach is adopted, and that actions relating to infrastructure renewal are not driven entirely by political considerations. This recommendation accords with proposals in some Canadian engineering jurisdictions that “engineering governance” might be more appropriate than the traditional accounting/bottom-line model for coordinating the massive infrastructure renewal projects expected over the next decade.

In a message sent out in June, Neal Weston, manager of external affairs for the ICE, encouraged civil engineers to contact Members of Parliament to show their support of the *State of the Nation* report. He said increased public and political support for the infrastructure renewal report will have the added benefit of raising the profile of civil engineers in the U.K.

The ICE report is similar to a 2003 study by the American Society of Civil Engineers (ASCE), which indicated that the general condition of infrastructure in the United States continues to deteriorate. The U.S. study cited population growth, lack of voter support for infrastructure projects and inadequate maintenance as the main reasons for the worsening condition of U.S. bridges, schools, roadways, dams, airports, wastewater systems and airports. Concerns about terrorism have also served to direct funding from infrastructure to security measures, the U.S. engineers said.

Michael Mastromatteo