

CSCE POLICY STATEMENT #2015-01: Development of Sustainable Infrastructure

Submitted for approval to PCC by the Infrastructure Renewal Committee of CSCE on May 22, 2015.

Policy

CSCE adopted the concept of “leadership in sustainable infrastructure” as one of three strategic directions of the Society going forward as part of its new Vision 2020 strategy. The availability, condition and functionality of public infrastructure systems are widely acknowledged as having a direct impact on the quality of life for all Canadians. The quality of life issues encompass the triple bottom line definition of sustainability, namely the economic, environmental and social values for current and future needs of society.

CSCE recognizes the responsibility of the civil engineering profession as stewards of core infrastructure systems. Civil Engineers are largely responsible for the management (i.e. planning, design, construction, operation and maintenance) of public infrastructure systems across the country relying on the use of natural resources in realizing the social and economic benefits provided by these infrastructure systems. Environmental, economic, social and technological development must be seen as interdependent concepts where economic competitiveness, ecological protection and restoration and social equality are complementary aspects of the common goal of sustainable infrastructure. The management of sustainable infrastructure requires a balanced consideration of these values in an integrated, multi-disciplinary and holistic approach. In order to achieve this objective CSCE supports the following implementation strategies:

- Promote a broad understanding of the interdependencies and interactions of economic, environmental, social, political, regulatory and technical issues and processes associated with the management of sustainable infrastructure in all phases of the life cycle of projects – planning, design, construction, operations, maintenance and decommissioning
- Partner with other national organizations and government agencies, including multi-disciplinary teams, with a common vision and objectives in undertaking projects, research and related processes that advance the goal of sustainable infrastructure
- Provide leadership in the implementation of a Canadian sustainability rating system for infrastructure that supports an integrated, holistic and balanced consideration of economic, environmental, social and technical issues associated with sustainable infrastructure
- Provide leadership in the on-going development and publication of the Canadian Infrastructure Report Card partnering with other like-minded national organizations
- Advance the skills, knowledge and information necessary for sustainable infrastructure management and advocacy through research, education and technological innovation in areas such as climate change impacts, vulnerability and resilience of infrastructure systems
- Advocate for a balanced approach to infrastructure development and investment considering the sustainability issues of economic, environmental and social impact for new and existing infrastructure systems

Rationale

Civil engineers have a responsibility, as stewards of the built environment specific to civil infrastructure systems on which society relies, to ensure a sustainable future. It is incumbent on engineers to provide an holistic approach to the management of infrastructure throughout its full life cycle participating in multi-disciplinary teams of professionals including ecologists, economists and sociologists that effectively address the issues and challenges of sustainable development.

CSCE requires a supporting policy on which to take appropriate actions in implementing sustainability strategies to achieve this goal.

WHITE PAPER #2015-01

BACKGROUND INFORMATION FOR PROPOSED CSCE POLICY ON THE DEVELOPMENT OF SUSTAINABLE INFRASTRUCTURE

Civil Engineers are the stewards of Canadian infrastructure. We are largely responsible for the planning, design, construction, operation, maintenance and decommissioning of public infrastructure across the country. These infrastructure systems are the backbone of our society. They have a direct impact on our quality of life and our economic, social and environmental prosperity. In a similar fashion, Civil Engineers are also stewards of our environment in that they use and impact the natural resources of the world to develop and manage these public infrastructure systems. It is therefore incumbent upon Civil Engineers to lead our society to a sustainable future. The Canadian Society of Civil Engineering (CSCE) is positioned to provide leadership in achieving this sustainable future with the adoption of a new strategic vision – Vision 2020 - that includes “leadership in sustainable infrastructure” as one of its three foundations or strategic positions for the future.

With a Problem comes Opportunity

The 2012 Canadian Infrastructure Report Card estimated that there is \$171 billion worth of infrastructure in Canadian municipalities that is in fair, poor or very poor condition. Governments at all levels in Canada recognize this problem and are taking steps to increase the financial investment in our infrastructure. Civil Engineers have the ability to turn this problem into an opportunity – to bring innovation into the next generation of infrastructure systems that will support our future society.

The principles of sustainability applied to infrastructure

Over the past few years the CSCE, through our strategic direction of *Leadership in Sustainable Infrastructure*, has facilitated a conversation amongst infrastructure stakeholders about how the principles of sustainability apply to infrastructure. It is clear from the conversation that the triple bottom line concepts that form the basis of sustainability – the balance of economic, environmental and social factors - are relevant to our infrastructure systems.

In 1993 CSCE published its first Guidelines for Sustainable Development. This document was updated in 2006¹ through by the Sustainable Development Committee of CSCE reinforcing a number of key concepts including the need for environmental restoration, the international acknowledgement of the need for climate change action plans by all industrialized nations of the world to reduce GHG emissions, the need to address climate change impacts in the management of our infrastructure systems, the need to shift transportation systems to more sustainable forms, the importance of equitable social benefits of infrastructure to the variety of social groups around the world and the importance of the operations and maintenance aspects of infrastructure on long term sustainability.

Put simply, global sustainability is an infrastructure issue.

A new generation of Civil Engineers

Over the past decade the prevalence of a new generation of Civil Engineer has emerged in our industry. This generation became interested in civil engineering because of their concerns about the social, environmental and economic state of our society and understanding the role that Civil Engineering plays in shaping this landscape. This is a generation that is not satisfied with the status quo of our industry. As these individuals advance their careers into leadership roles in organizations across Canada, they will have the ability to influence how our infrastructure systems are renewed for the future.

If CSCE is to be an agent of change it will be incumbent on the Society to engage the young civil engineers in the process. A second pillar of the CSCE's Vision 2020 is the concept of "growing with youth". With this foundational strategic objective it is important that CSCE is active in its promotion of issues that interest young professionals and active in attracting young professionals to become members of the Society. It is important that CSCE develops a strong position for taking action that satisfies the new young professional concerns about the social, environmental and economic state of our country and the role of Civil Engineers in addressing these issues. It is important that CSCE is seen as an organization that is proactively engaged in advocating and implementing sustainability solutions in our world.

Applying the concepts of sustainable infrastructure throughout a project life cycle

In order to be effective, the concepts of sustainable infrastructure need to be applied across all phases in the life cycle of a project.

➤ **Planning**

Planning is a process. The process follows a prescribed set of steps that must be followed. The predominant infrastructure planning process in Canada is the Environmental Assessment process. While this process does touch on elements of sustainable performance there is no consistency between approaches. The EA process needs to be modified to mandate a more comprehensive "Sustainability Assessment" that requires that best practices be applied to the infrastructure planning process.

➤ **Design**

The design of infrastructure is based on how we did it last time. Innovation is often trumped in favour of the "standard". Most municipalities in Canada have a set of municipal standards that dictate how infrastructure should be designed. Further, Provincial ministries have their own set of standards that must be followed to approve projects. Spending public funds on concepts that have not yet been proven or that need to be tested, by and large, is not an acceptable risk. This process needs to be dramatically overhauled so that it encourages sustainable designs. It is recognized that consistency in the look and feel of a municipality is important to the social fabric and other more technical elements related to operating (i.e. water valves must be a specific

standard in a system so that spare parts can be managed effectively) however these are very limited and form a minor element of the “municipal standards”. A good example is the use of recycled aggregate. Many municipalities lack the process in the standards to encourage this activity.

➤ **Construction**

The construction of infrastructure is evaluated on the lowest cost option. Municipalities need to consider the full triple-bottom-line costs of the projects to evaluate alternatives and to approach construction. Again, we need to go beyond following the minimum required by regulations to set a process that encourages the maximum possible within the available constraints.

➤ **Operate and Maintain**

The operation and maintenance of infrastructure is far removed from the process to plan and design new infrastructure. Concepts of life cycle costs need to be incorporated. Data to support decision making process based on historical O&M needs to be available.

It is important to break through current institutionalized processes and standards in infrastructure management to make changes that operationalize sustainability into civil engineering practice. Reference is made to a paper co-authored by the CSCE Sustainable Development Committee and the University of Windsor titled “Operationalizing Sustainability in Civil Engineering Practice”². This paper was presented to the 2014 CSCE Annual Conference in Halifax and offers some interesting perspectives and challenges to the civil engineering community in breaking through current practices.

The Need to Measure Sustainable Performance – what gets measured gets managed

To move the concepts of sustainable from ideas to action, the engineering practice needs to be engaged across all phases of infrastructure development. We must break out of our current introverted networks and share the innovative ideas with the rest of society. The only way we will be able to get this to happen in an efficient manner is to have a two sided approach to measure the sustainable performance of a project:

- Mandate a triple bottom line analysis for all infrastructure projects that is in accordance with CSCE Sustainable Infrastructure Best Practices to evaluate the degree to which improved sustainable performance of the project is being achieved over its full life cycle.
- Use tools or other quantitative mechanisms to evaluate the sustainable performance of the infrastructure activity.

Through the Infrastructure Renewal Committee, CSCE has led a discussion group of several national organizations with a similar interest in the concept of a sustainability rating system for infrastructure in Canada. The Canadian Public Works Association (CPWA), the Association of Consulting Engineering

Companies (ACEC) and the Canadian Construction Association (CCA) have joined with CSCE in reviewing different rating systems in use around the world and are ready to action the implementation of the concept. As part of this cooperative discussion the ACEC tabled a report titled “SUSTAINABLE DEVELOPMENT FOR CANADIAN CONSULTING ENGINEERS”³ commenting on sustainability rating systems currently in use around the world. This review was intended to provide an overview of the degree to which each of these systems addressed a pre-set list of criteria in sustainable engineering.

The American Society of Civil Engineers (ASCE) has adopted the Envision™ system developed by the Institute for Sustainable Infrastructure (ISI), a non-profit entity created as a joint partnership of ASCE, the American Public Works Association (APWA) and the American Council of Engineering Companies (ACEC). This is one of the systems reviewed by ACEC Canada and is being considered as the basis of a proposed system for Canada by CSCE, CPWA, ACEC Canada and CCA. It is gaining traction throughout the US and in Canada in the past year and is viewed as meeting the key criteria for sustainability by considering the entire life cycle of a project.

In an ASCE Leadership Brief titled Transitioning to a Sustainable World (Tools for Sustainable Solutions)⁴, ASCE provides a detailed review of the characteristics of the Envision rating system noting the point system it uses is organized into five categories including:

- quality of life (purpose, community, well-being),
- leadership (collaboration, management, planning)
- resource allocation (materials, energy, water)
- natural world (siting, land and water, biodiversity) and
- climate and risk (emissions, resilience)

The referenced Leadership Brief provides an overview of many other sustainability tools available to civil engineers for different purposes such as educating, assessing sustainability, enhancing the sustainability of a project (e.g. LEED rating system), etc. The primary author of the Envision™ rating system has quoted that “...achieving sustainability for the long haul is not simply adding a little efficiency here and there into our infrastructure projects. It is about fundamentally changing the way we build our projects to operate in a constrained setting and a changing environment. That requires both good leadership – helping decide what the right project to do is – and good management – helping to do the project right.”

The civil engineering community around the world has recognized that more and more a decreasing availability of natural resources to create infrastructure is resulting in fewer lower-cost solutions. This has resulted in more complex and costly alternatives with more undesired societal and environmental consequences. In response to this trend, in 2006 the CSCE in conjunction with the ASCE and the Institution of Civil Engineers (ICE) signed a sustainability charter that recognized the current approach to development is unsustainable and that way civil infrastructure systems are developed needs to shift from less-sustainable practices toward higher degrees of sustainability in serving needs of people and

society. The implementation of a sustainability rating system for infrastructure is just one of the tools that begin to address this need.

REFERENCES

1. Guidelines for Sustainable Development “Entrusted to our Care” (CSCE guideline prepared by Sustainable Development Committee 2006, Authors: Alan Perks, Brian Burrell, Bob Korol, Ata Khan, Jean Heroux, and Laurie Ford - Members of the CSCE Task Force on the updating of the CSCE Guidelines on Sustainable Development)
2. Operationalizing Sustainability in Civil Engineering Practice (Paper presented to CSCE Annual Conference 2014, Halifax, Authors: Alan Perks, Gordon Lovegrove, Ata Khan, Edwin Tam, CSCE Sustainable Development Committee and David Brown, University of Windsor)
3. Sustainable Development for Canadian Consulting Engineers (Published by the Association of Consulting Engineering Companies | Canada ACEC 2014)
4. Tools for Sustainable Solutions (ASCE Leadership Brief: Transitioning to a Sustainable World)