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Not *Another* Standard: Where Do We Stop or Should We?

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Abstract: ISO 15686 *Service Life Planning*, initiated in 2000, is applicable to a building asset portfolio, a single building or a facility which is part of a building. It is equally applicable to a wide range of stakeholders from owners and managers to occupants, tenants, or other users. The standard now comprises 11 parts that collectively provide functional direction and guidance to ensure that the service life of a building or other constructed asset will be equal to or exceed its design life.

In addition to ISO 15686 there are many other infrastructure asset management (IAM) related standards which are identified in the paper. Two other international standards include: ISO 15392:2008 'Sustainability in Building Construction', and ISO 55000 'Asset Management', which is currently under development. There are countless national standards.

But do we need international or even national standards when IAM is such a broad field? Can there be a 'one size fits all' approach when the role of the manager differs greatly between the public and private sector? And how do they compare in different countries, or continents? This paper examines these questions, undertakes a critical analysis of why we are or are not using the standards that have been developed, and makes recommendations on the way forward for IAM standardization.

1 Introduction

As we move towards a world of globalisation and increasing competition for trade, the more we need to be able to communicate our requirements in a way that can be understood across many countries and economic zones. The most efficient way is to develop standards to which products, processes, services, test methods, etc. should conform. When an issue of variable quality or conflict arises, the instinctive reaction is to develop a standard to resolve the issue. The result has been an exponential rise in the number of national and international standards, to the point that we need standards to harmonise the terminology used in other standards.

But do we need international or even national standards when infrastructure asset management (IAM) is such a broad field? Can there be a 'one size fits all' approach when the role of the asset manager differs greatly between the public and private sector? This objective of this paper is to shed light on the many standards that can apply to infrastructure asset management, undertake a critical analysis of why we are or are not using the standards that have been developed, and make recommendations on the way forward for IAM standardization.

The paper will consider standards that apply specifically to managing infrastructure assets throughout the plan, design, construct, operate and dispose life cycle. It will not consider standards that apply to activities such as risk management, project management and total quality management, as these processes apply to many other fields besides IAM.

2 The Rise of the Standard

2.1 The Evolution of Standards Organizations

Today, almost every developed country has one or more national organizations that develop or oversee the development of national standards and guidelines. Many of these organizations belong to international bodies such as the International Organization for Standardization (ISO) through which they strive to develop common standards for trade and eliminate barriers.

The ISO was founded in 1946 by 25 countries; work on the first standards began in 1947. There are currently almost 160 countries that comprise the network of national standards bodies. The ISO is supported by its Central Secretariat in Geneva, Switzerland. The ISO's mission is *"to be the leading value-adding platform and partner for the production of globally and market-relevant international standards, covering product specifications, services, test methods, conformity assessment, management and organizational practices"* (ISO, 2007).

In 1964, the Canadian government undertook a review of all standards activity in the country with the view to better coordinate and plan the development of national standards, and to move towards participating in international standardization (SCC 2013). The outcome was the creation of the Standards Council of Canada (SCC) in 1970. The role of the SCC is to approve national and international standards, and represent Canadian interests in international standardization fora such as the ISO. Unlike the ISO, the SCC does not develop standards. This is accomplished nationally through its member bodies and internationally through Canadian Advisory Committees (CACs) to the ISO.

The very first national standards development organizations Canada were the Underwriters Laboratory of Canada (ULC) in 1920 and the Canadian General Standards Board (CGSB) in 1934. The Bureau de normalisation du Québec (BNQ) followed in 1961 and Canadian Standards Association (CSA) in 1973. Collectively these four organizations form the major standards development organizations in Canada. The relationship between the ISO and the SCC is shown in Figure 1.

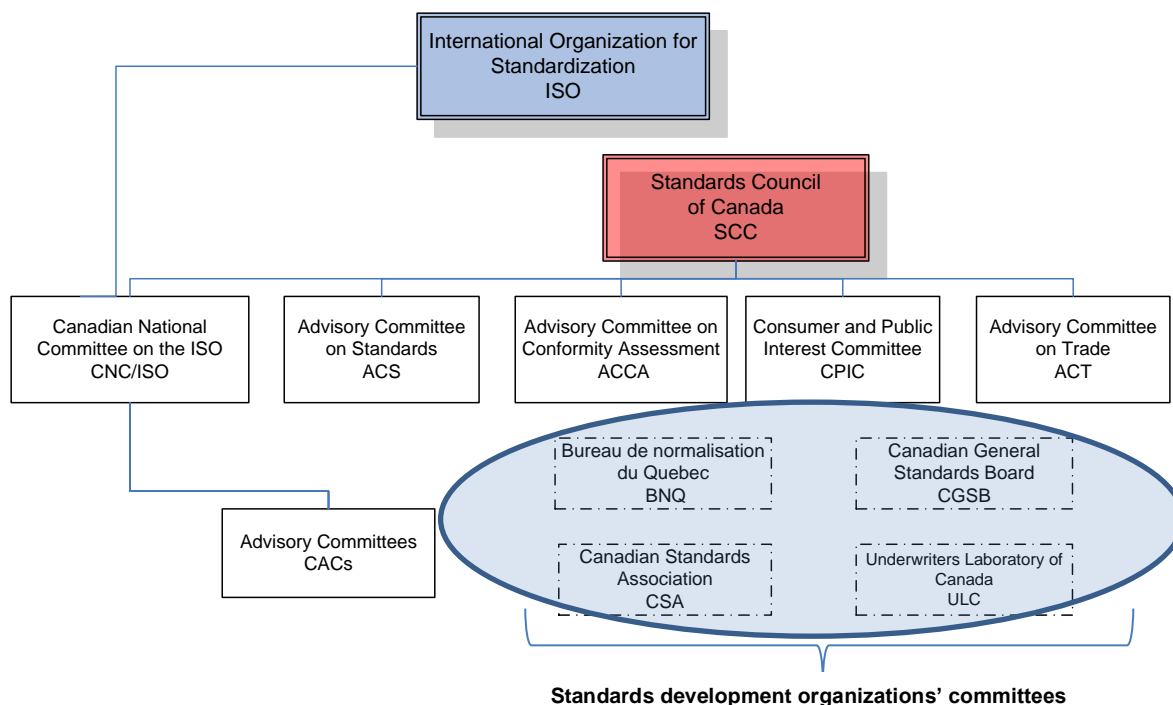


Figure 1: Relationship between the ISO and the SCC (after SCC 2004)

Similar relationships exist between the ISO and other established national bodies such as the American National Standards Institute (ANSI), the British Standards Institution (BSI), and the French Association

française de normalisation (AFNOR). These organizations, like the SCC, are certification and accreditation bodies and do not develop standards.

Regional organizations also develop standards and endeavour to work with the ISO to avoid the creation of conflicting or duplicate standards. These organizations include:

- ACCSQ - Association of South East Asian Nations Consultative Committee for Standards and Quality;
- ARSO – African Organization for Standardization;
- CEN – European Committee for Standardization;
- COPANT – Pan-American Standards Commission; and
- PASC – Pacific Area Standards Congress.

2.2 Other Standards Development Organizations

In addition to the ISO, there are other bodies that develop standards which become accepted internationally. The development process used is similar used to that of the ISO in that an advisory committee is formed from key stakeholders to create the draft standard. The document is reviewed through consultation and once consensus has been reached, the document is approved as a standard. If the document has a broad reach, it can become a de facto international standard. This is the case for many documents developed by the American Society for the Testing of Materials (ASTM), the American Society for Heating, Refrigeration and Air-conditioning Engineers (ASHRAE) and the National Fire Protection Association (NFPA).

2.3 Standards, Codes and Guidelines

The term '*standard*' can mean many things. It can often be confused with the terms 'code' or 'guideline'.

The CSA (2003) defines a standard as "*a document established by consensus and approved by a recognized body that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.*" According to the National Research Council (NRC), developer of the National Building Code of Canada (NBCC) (2012), a code is broad in scope and is often given legal standing through a process of adoption by national or local authorities whereas a standard has a narrow focus that covers specific issues. A guideline is an advisory document that describes best practices and principles to achieve results.

Building codes, such as the NBCC are normative in nature in that they provide direction through the use of words such as 'shall' and 'must'. A standard can be normative in that it provides direction and uses words such as 'shall' and 'must', or it can be informative and provide guidance, i.e. a 'guideline'. This is where confusion can arise between the terms standard/code and guideline. The key difference is in how the documents are created. Standards and codes are developed and approved through an established, consensus driven process; guidelines can be developed by established committee but most are developed by individual organizations to support internal processes. In this paper the term "standard" is used to mean both code and standard.

Standards can be prescriptive or objective.

The difference between the two can be explained in terms of fire protection. Consider an example of building a house. Residential buildings have different fire protection requirements depending upon the nature of the building; this is known as a 'fire rating'. You need something to help you decide how to meet the fire rating requirements – in this case a one hour fire rating. You need a standard; you need directions.

A prescriptive standard will tell you the specific wall construction details i.e. '2x4' wood framing, thickness of the drywall, etc., in order to meet the one hour fire rating. But what do you do in the unlikely event that you have difficulties obtaining certain materials or components? Halt construction?

An objective standard will still tell you what the fire rating is but rather than tell you the exact method of wall construction, it will provide guiding principles on how to achieve the one hour fire rating objective. The guiding principles provide the flexibility to reach the objective using the most effective and efficient

means but they still provide limits to ensure that you do not unnecessarily complicate the construction of your building.

3 The Role of Standards in Infrastructure Asset Management

3.1 IAM Standards

IAM, by its very nature requires objective standards, ones that outlines ‘what’ needs to be done and provide a framework or ‘how’ to accomplish it. Such standards may give suggestions on the ‘how’ through examples in annexes but will not prescribe either the ‘what’ or the ‘how’. An objective standard provides general principles, which if they have been properly developed will apply to all aspects of AM, and focuses on the outcome, in the case of the example – meeting the fire rating.

With heightened public awareness of environmental considerations and the engineering community’s desire to make best use of resources throughout an asset’s life, comes new pressure to examine and alter the impacts and performance during that life. The traditional engineering, and business driven, approach to asset management is project based, while the more populace desire is to strive for cradle-to-grave management of asset life-cycle. Figure 2 depicts these two interrelated concepts.

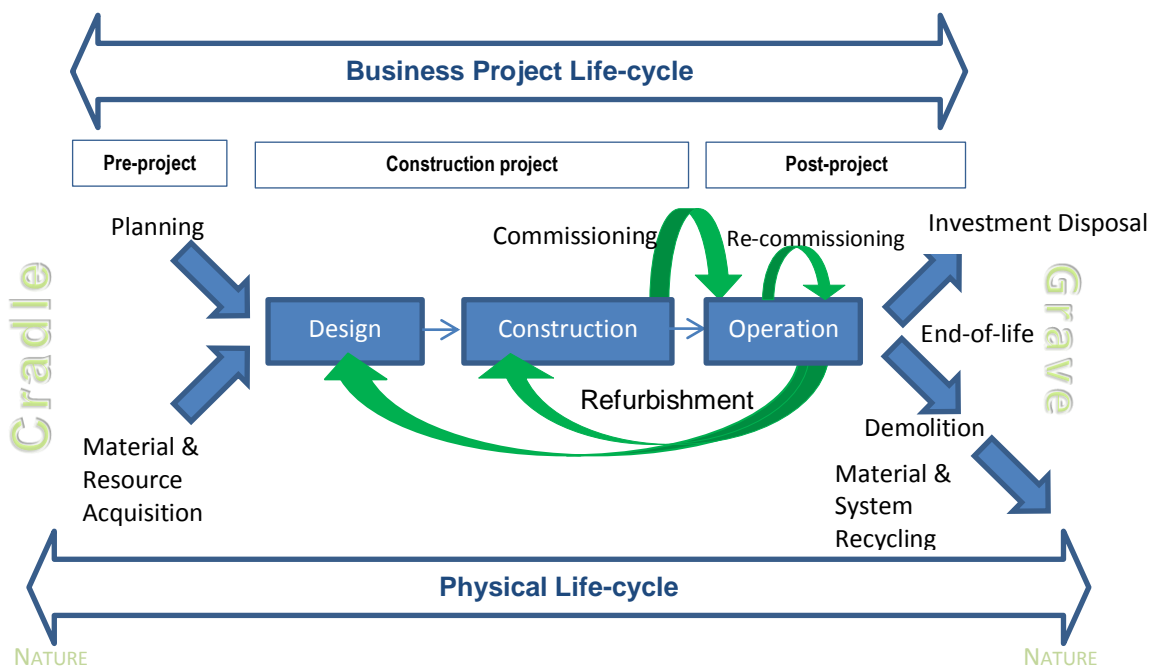


Figure 2: Project versus Physical Asset life-cycle

IAM, as a domain, is relatively new to the world of standardization. As will be illustrated in this section, most standards that have been developed focus on products and processes that are used in the ‘acquire’ phase or the ‘use’ phase as part of operations and maintenance, renovation or rehabilitation. They are typically cited in construction specifications. The first international standard to address the whole life of an asset was ISO 15686 - Service Life Planning. It was first published in 2000 and now comprises eleven parts. The most recent standard is the yet to be published ISO 55000 - Asset Management.

3.1.1 International Standards

A review of international standards was undertaken in an attempt to quantify those applicable during one or more phases of the asset life cycle. Hundreds were counted within the ISO domain alone as there are fourteen ISO technical committees (TCs) responsible for IAM-related standards. If ASTM standards are included, the number climbs to the thousands. Not all are relevant to the Canadian asset manager or to a

Canadian company managing assets abroad however. Those that warrant further consideration are presented in Table 1.

Table 1: International Standards

Organization	Standard	Title
ISO	14040:2006	Environmental management –Life cycle assessmaent – Principles and framework
	15392:2008	Sustainability in building construction – General principles
	15686	Service life planning
	55000	Asset management
	21931-1:2010	Sustainability in building construction
	23045:2008	Building environment design – guidelines to assess energy efficiency of new buildings
ASHRAE	90.1	Energy Standard for Buildings Except Low-Rise Residential Buildings
	189.1	Standard for the Design of High-Performance, Green Buildings Except Low-Rise Residential Buildings
ASTM	E2432-11	Standard Guide for General Principles of Sustainability Relative to Buildings
BSI	PAS 55-1:208	Asset management. Specification for the optimized management of physical assets
CEN	EN 15643	Sustainability of construction works. Sustainability assessment of buildings.
	CEN/TR 15941:2010	Sustainability of construction works - Environmental product declarations - Methodology for selection and use of generic data

3.1.2 National Standards

Product standards aside, most Canadian standards of interest to the asset manager are those developed by the CSA and the NRC. These are presented in Table 2.

Table 2: Canadian Standards

Organization	Standard	Title
CSA	S478-95 (R2007)	Guideline on Durability in Buildings
	Z320-11	Building Commissioning Standard & Check Sheets
	Z762-95 (R2011)	Design for the Environment (DFE)
	Z782-06	Guideline for Design for Disassembly and Adaptability in Buildings
	Z783-12	Deconstruction of buildings and their related parts
NRC		National Building Code of Canada
		National Plumbing Code of Canada
		National Fire Code of Canada
		National Energy Code of Canada for Buildings

3.1.3 Quasi Standards

Along with standards developed through the ISO and national standards organizations, many ‘quasi’ standards and guidelines have been developed through research and other special interest organizations. Most of the documents produced by these organizations relate to the relatively new area of ‘sustainable development’ and are vying with each other to be the norms of green practice.

Four organizations bear discussing as they are relevant to IAM. They are the CIB (International Council for Research and Innovation in Building and Construction), the International Energy Agency (IEA) and the National Asset Management Support Group (NAMS). The CIB’s focus on research and innovation in the building and construction sector has led to the publication of reference documents and reports that

highlight best practices or trends in research. The IEA was established as part of the Organisation for Economic Co-operation and Development (OECD) to implement an energy co-operation program amongst the OECD member countries (Kyle, 2012). NAMS has produced the *International Infrastructure Management Manual* (IIMM) in collaboration with the Institute of Public Works Engineering Australia (IPWEA). Finally, the National Institute of Building Sciences is a U. S. organization dedicated to improving building performance.

The aforementioned organizations are described in Table 3.

Table 3: Quasi-standards Developing Organizations and Standards

Organization	Quasi-standard or guideline
British Research Establishment (BRE)	British Research Establishment’s Environmental Assessment Method (BREEAM)
CaGBC (Canadian Green Building Council)/GBC (Green Building Council)	LEED® and LEED® Canada
CIB	Towards Sustainable Roofing
Green Building Initiative	Green Globes
IEA	Holistic Assessment Tool-Kit on Energy Efficient Retrofit measures for Government Buildings
NAMS	International Infrastructure Management Manual
NIBS	Whole Building Design Guide (WBDG) - website

3.2 Connecting the Dots

Given the numerous standards and other documents identified in the previous section, is easy to understand how an asset manager can be overwhelmed trying to establish what is existing, what is relevant and thus what is worth purchasing. It is important to recognise, as said in Section 3.1, that asset management has typically concentrated on improving, or optimising operations of built works. While the connection to, and the direct influence of, the planning, design and construction phases upon the long term asset performance is long understood, the asset management focus remains on operations and maintenance, typically the longest stage of the life-cycle.

In order to obtain the best economic and physical performance from built assets there must be a broader application of IAM Standards through all stages of the asset life-cycle. Figure 3 illustrates the application of key IAM standards and guidelines throughout the asset life cycle.

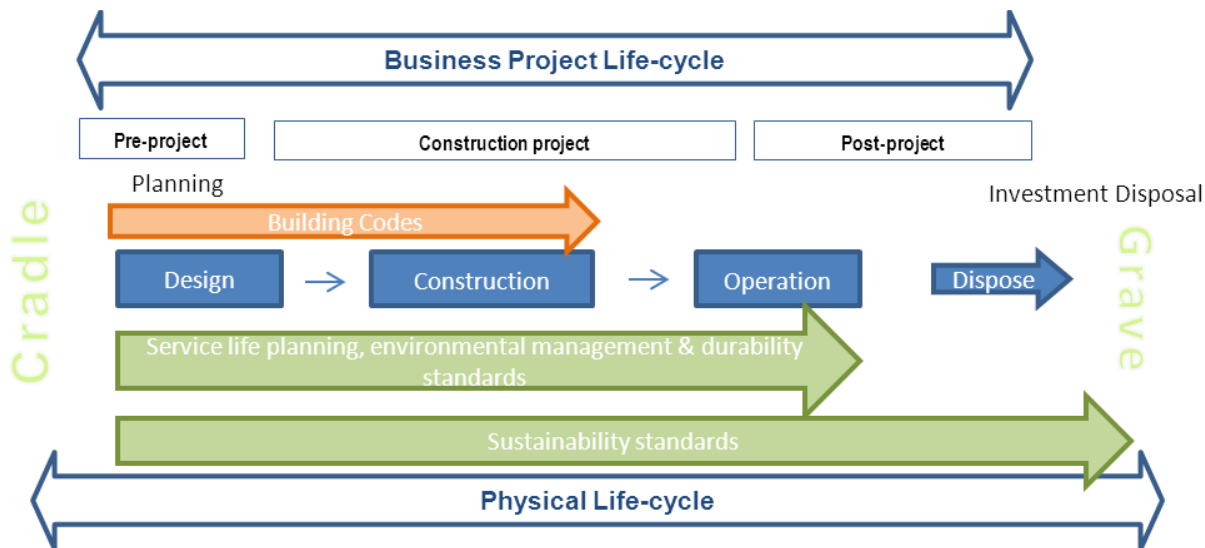


Figure 3: Application of IAM Standards through the Asset Life Cycle

3.3 Why [or] Do We Care?

Let us now return to the questions posed at the start of this paper:

- Do we need international or even national standards when infrastructure asset management (IAM) is such a broad field?
- Can there be a 'one size fits all' approach when the role of the asset manager differs greatly between the public and private sector?

Infrastructure assets are the foundation upon which our society functions, managing those assets efficiently and as cost effectively as possible, is increasingly important as governments strive to reduce deficits, cutback public spending and reduce the size of their workforces. Managing assets 'our own way' is not an option when methods already exist that can be adopted or adapted to deliver a program that will manage a portfolio of assets throughout the whole life cycle.

This is where standards come in. Standards are integral to what we do in our daily lives as consumers, individuals, and businesses, and as stakeholders in our public infrastructure. In an ever changing world, they ensure interoperability, facilitate communications and contribute to protection against hazards (ISO, 2007). For the public asset manager, standards provide a foundation upon which to develop a solid asset management program. International standards draw on the experiences of the global community and provide the benefit of those who have gone before. This is particularly relevant as climates change and as asset managers are increasingly faced with challenges not previously encountered. For private infrastructure asset management firms, standards are vital to international trade as they reduce barriers and enable the company to compete in the global market.

So perhaps the question that needs to be asked is not 'why do we need international standards' but rather 'why are we not using the standards that have been developed'? Is it because there are too many standards saying the same thing or too many saying different things?

4 Challenges

4.1 Cost versus Benefit

Ironically, standard development is similar to asset management. First the standard is planned; it is then developed and promulgated (acquire); it will require maintenance to ensure it remains current as it is used; and eventually it may be withdrawn as it becomes obsolete. Developing standards also involves time and money. In the same manner that new assets attract attention, so too does the creation of new standards. At the onset, there is enthusiasm in the stakeholder community to participate in the creation of the standard. Organizations will provide committee members and fund their individual costs along with contributing to the cost of development. The standard gets published and then the real work begins. The standard must be promoted so that it will be adopted by the broader community who will then buy it. Unless it becomes mandatory, it must gain recognition beyond the initial cohort. It will require ongoing review (typically a three to five year cycle) involving meetings, travel, time and money.

Financial support for the maintenance of standards is increasingly being eroded. As noted by Bourke (2013) in a recent article in *ISO Focus* on the development of ISO 15686, whereas most representatives to the committee were funded from national or research bodies at the start, ten years on few are funded except for travel expenses and some work *gratis*. If governments and industry are benefitting from the standard, why is there a reluctance to support this activity? Are there simply too many standards for us to benefit from them? If so do we need specific asset management standards?

4.2 Protectionism versus Globalization

To the uninitiated, the realm of standardization is overwhelming. The ISO alone has a collection over 17,000 international standards (ISO 2008) and there is no movement at present to reduce this number. It really is a case of 'not being able to see the forest for the trees'.

Virtually all standard writing bodies, whether they be international, national or developers of "quasi-standards", are first and foremost standards publishers and have a primary goal of selling what they

produce. Ideally, coupled with strong inter-agency communication and cooperation, markets would prevent the development of standards that have overlapping domains, mandates and objectives. To promote international cooperation, agreements are in-place between ISO and their numerous national member bodies. The Vienna Accord, between ISO and CEN, is another agreement aimed at avoiding duplication of effort and to streamline regulation. Unfortunately, for various reasons some nations/organisations have selectively decided to go-it-alone in certain domains. Such independent moves are quite often linked to economic uncertainty and seen as a method of minimising short-term change to accepted practices on a national level.

If we truly are moving towards a globalization, it should not be difficult to move towards harmonization of the numerous national and international standards. Protectionism is never far from the surface however. When it comes to standards, the move towards harmonization is supported by organizations in principle as long as their standard is the one used as the benchmark or has added caveats. There are many reasons for this, not the least of which are legal obligations of certain jurisdictions to promote national or regional products and services i.e. protect 'producers' rather than 'consumers'. The challenge then is to identify an appropriate level of national and international standardization.

The rise in regional importance of many quasi-standards bodies and their documents has further eroded the global standardisation effort. This trend is most notable in the field of green building and sustainable infrastructure assessments, where numerous regional and national players emerged and then began to compete on a global scale by offering regionally modified versions of their processes. This is evident in North America with the emergence LEED® and LEED Canada® and the creation of Green Globes from the BREEAM methodology.

As new issues or requirements arise associated with the design and service life performance of built works, it is important that Canadian industry be aware of the international standardization solutions being proposed, and that best efforts be made to recommend and represent the typical and best Canadian practices as appropriate.

The European Union construction building products directive/regulation, took effect in June 2012, and obliges material and system suppliers to evaluate and declare the capabilities of their products in accordance with the service life prediction methods described within the ISO 15686 series. Materials or systems not having such documentation will not be permitted. Such a regulatory change is clearly not a protectionist measure and is aimed at enhancing the longer-term performance of built works. It does however, point out how important it is for industry to be kept informed of any proposed changes that will impact their potential export markets, to take the opportunity to modify their service or product offering to meet changes proposed in the standard and potentially to develop new export markets.

5 Conclusions

As the globalization trend gathers speed, there is no doubt that standards are necessary. We increasingly need to be able to communicate our requirements in a way that can be understood across many countries and economic zones. However, if we truly are moving towards globalization, we should also strive to harmonize the numerous national and international standards. The challenge is to identify an appropriate level of national and international standardization. The rise in regional importance of many quasi-standards bodies and their documents does not help in this effort. As new issues or requirements arise associated with the design and service life performance of built works, it is important that Canadian industry be aware of the international standardization solutions being proposed, and that best efforts be made to recommend and represent the typical and best Canadian practices as appropriate. Rather than create yet another standard, we should stop and see what's already in the forest.

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