Engineers are ethically bound to protect the public. The National Society of Professional Engineers (NSPE) Code of Ethics states this in their first fundamental canon:

> ***Engineers, in the fulfillment of their professional duties, shall hold paramount the safety, health, and welfare of the public. – Code Section I.1.a (NSPE)***

The first ethical code for engineers was formally issued in the January 1947 issue of *The American Engineer* by the Engineers' Council for Professional Development ("History"). Ethical codes for engineers have been revised over time, but they are similar in that their scope is broad and they utilize general references. This has allowed ethical codes to withstand the test of time and to be applicable over a wide variety of situations. This advantage also comes with a distinct disadvantage: it requires that engineers assess and interpret the code as new situations arise.

Globalization has changed the way engineering is conducted, and large projects today can often require the effort of several nations to complete. Furthermore companies are not confined to political borders and engineers are often required to work abroad. Engineers, no matter the circumstances, are required to protect the safety of the public and the use of design standards is an important part of maintaining quality. The NSPE Code of ethics goes even further in noting this fact:

> ***Engineers shall approve only those engineering documents that are in conformity with applicable standards. – Code Section II.1.b (NSPE)***

While this may appear to be a simple request, it can be difficult to ascertain what constitutes an 'applicable standard.' Determining the correct design standard to employ can be difficult for engineers, particularly when working in a foreign country. Each situation is unique and with it comes its own unique challenges. Although design standards are general in nature, understanding their function and purpose gives engineers guidance on their ethical use. Case studies can also provide engineers with valuable information on design decisions that have been established historically, which can then be applied to current design situations.

The development of design standards is driven by the balance of two opposing forces, the need to create acceptable structures, and the finite availability of resources. A design standard refers to a common and repeated use of rules, conditions, guidelines or characteristics that pertain to engineering. Following a design standard ensures that structures are built to a satisfactory condition by taking into account structural loading scenarios, possible extreme weather events, and the available building materials that are common to the region. Common examples today include AASHTO design manuals, building codes, and structural load references like ASCE 7. Standards define what constitutes a satisfactory condition uniquely among different regions of the world. Factors of safety, conservative assumptions, and the potential for liability and litigation help to drive the satisfactory conditions defined by design standards. While the need to create acceptable structures causes design standards to become more demanding, limited resources serve to restrict them. Societies must allocate resources as they are available and as they are deemed necessary. If it were not for the finite resources engineered structures could be built excessively beyond the calculated design loads and concerns. The establishment of a regional design code is a statement of a society's commitment to the safety, standardization, and value that is placed on engineered systems.

Understanding the fundamental factors behind the creation of design standards creates a strong argument that when a local design code exists, that code can satisfy the ethical requirements of an engineer. Differences in economic strength, regional resources, and traditional beliefs, can be significant factors in the formation of design standards. A design standard is a society's decision on mandating certain design choices for engineers. Variations exist between the design standards of different societies for many reasons, and these differences are intentional to take regional considerations into account. Engineers should be attentive of local design standards as they may contain information or guidance that their more familiar design standards lack, even if they appear to less stringent at first glance. The local design standard should be utilized as the minimum standard when completing any design work.

There are many cases where the local design standards of a country or region are well established. In some regions of the world, there has been some effort to consolidate and combine the information of several design standards to streamline the design process. The United States previously had three different building codes governing regions of the country. With the implementation of the International Building Code these three previous building codes have become obsolete. Similarly, in the European Union, a set of 10 Technical Standards have been produced to standardize design throughout the EU, which are known as the Eurocodes (Europe). The EU has also made efforts to harmonize the terminology and metrics on which construction materials are quantified, known as the Construction Products Regulation (Europe). These new standards take into account the latest technology and information to ensure the safety of the public. Engineers working abroad can satisfy their ethical responsibilities by ensuring that they are working with the most up-to-date codes in such a circumstance. Superseded design standards cannot be utilized for new construction and it is well established that claiming unfamiliarity or ignorance to current design standards is an unacceptable reason for their absence. Outdated codes can be used as reference materials and to provide information where a current code is deficient. It is the engineer's responsibility to ensure that the current design standards have been adhered to prior to signing off on a project.

While it may appear that an established design standard eliminates the need for an engineer's judgment, this would be incorrect. It is an engineer's responsibility to continually educate themselves in relation to their field thereby advancing their profession, and their work. The NSPE Code of Ethics notes this matter as well:

> ***Engineers shall continue their professional development throughout their careers and should keep current in their specialty fields by engaging in professional practice, participating in continuing education courses, reading in the technical literature, and attending professional meetings and seminars. – Code Section III.9.e (NSPE)***

An engineer's continuing education ensures that their judgment can surpass any design standard. A design standard serves as a reference material, and as such, it can never be more recent than its publishing date. Engineers can improve on local design standards and incorporate recent developments in the field. Local design standards should be adhered to as a minimum and supplemented with advancements in design as they become available.

There are some instances where a local standard is not immediately apparent as multiple standards can be applicable, particularly when they cross an international border. International projects can fall under the jurisdiction of multiple nations and therefore be subject to multiple design standards or may contain conditions not addressed by any design standard. Infrastructures projects such as highways, bridges, and pipelines are prevalent examples where projects run across international borders. The Thousand Islands Bridge in upstate New York is one such example, crossing the St. Lawrence River into Ontario Canada. Built from 1933 to 1935 the design standards of the United States and Canada were not nearly as extensive as they are today (Horr). There were many instances, such as in the case of wind load design, where design had to be completed without an applicable standard. In this way the bridge wasn't built to a specific design standard, but was more on the forefront of the field. Fast-forwarding to today, the bridge is inspected to both the NYSDOT and Ontario Ministry of Transportation design standards (Horr). A more recent example of an international bridge collaboration is the Gordie Howe Bridge in Detroit. This bridge requires the collaboration of American design standards such as AASHTO and MDOT with various Canadian standards (Windsor). When conflicts between the invested parties occur collaboration necessitates that the principles of both standards are incorporated while satisfying any relevant national and international agreements or legislation (Windsor). Material selection can be a difficult task when there is a conflict between standards but agreements are ascertained by analyzing commonly accepted best practices, noting specific provisions called for in the project's contract documents, creating a hierarchy of the applicable standards, and reviewing the similarities between the materials stated in each standard. This international collaboration has in effect caused the creation of a "negotiated standard" whereby no local design standard is considered appropriate. When multiple design standards are used concurrently, designers should collaborate between the two standards and ensure that the principles and ideology of all standards is incorporated to the best of their ability.

Engineers working in foreign countries may come across areas where there is no design standard on which to base their designs. Unfortunately there are still areas of the world that do not have design standards developed for the local region. Regions of the world that do not have design standards allow for more discretion on the part of engineers. Engineering Ministries International (EMI) is a non-profit organization with engineers, architects, and design professionals who donate their technical knowledge and skills to help impoverished nations. With design projects in over 90 countries they provide an excellent case study where engineers are implementing their ethical obligations under challenging circumstances. EMI notes that there are many countries where regional design references aren't available. This has caused many of EMI's projects in African nations required engineers to borrow from European and American design standards (Larsen). While such standards help to promote the construction of safe structures, utilizing a design standard outside of its respective region does have its limitations. Some of the practices, loading scenarios, or materials specified in design standards are not applicable to foreign lands and can create issues when applied (Larsen). Issues such as these require engineers to use their discretion in the implementation of a foreign design standard and in many cases omit inapplicable sections or expand upon situations not included in the design standard. The absence of a design standard allows engineers to borrow from established design standards and modify them as necessary to ensure a viable design.

Without design standards it would be difficult for engineers to guarantee their ethical obligation to protect the well-being of the public. This can be difficult as design standards vary greatly and codes do not offer specific examples on which to base ethical decisions. Utilizing our knowledge of design standards and the precedence created by previous engineering projects help to guide professionals in their current decisions. Advancements of the future will continue to bring up new and unique ethical scenarios. Utilizing sound discussion and logical interpretation, allows engineers to address these concerns and uphold their professional commitments.

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