ASCE FIVE-YEAR ROADMAP TO SUSTAINABLE DEVELOPMENT

Introduction

In Policy Statement 418, the American Society of Civil Engineers (ASCE) defines sustainability as

> …a set of economic, environmental, and social conditions in which all of society has the capacity and opportunity to maintain and improve its quality of life indefinitely without degrading the quantity, quality, or availability of economic, environmental, and social resources. Sustainable development is the application of these resources to enhance the safety, welfare, and quality of life for all of society.

ASCE has long considered sustainability an emerging strategic issue confronting practicing civil engineers. Its integration into professional practice is required to address changing environmental, social, and economic conditions ethically and responsibly. Although challenging issues such as climate change, urbanization, and the rapid pace of technological advancement create opportunities, they also require serious re-evaluation of current professional practice and standards. To address this state of affairs, ASCE has outlined a roadmap to transform our profession to increase the societal, environmental, and economic value of the engineering projects we deliver.

The Four Priorities for Change

Priority 1: Sustainable Project Development: Doing the Right Project

Economic considerations predominantly drive current project development methodologies. To control costs, projects are often conceived based on what was previously successful or simply on what the project owner finds expedient and is designed to existing standards and practices. This approach can result in impacts—environmental, societal, and economic—that have not been thoroughly considered or anticipated in the design process. To reach the paradigm of sustainable infrastructure, engineers must approach projects and engineering in a new way. The focus of our engineering efforts must shift from the product of our work—the stormwater management system, the bridge, the building—to the needs the project aims to address and the benefits it will provide. In other words, attend to the need and the desired benefits to define the outcome rather than simply relying on existing and perhaps outdated standards (or the lack thereof) to define the project. This shift in thinking overcomes the perpetuation of past mistakes, inaccuracies, or misapplications and seeks outcomes that truly address the need and account for unintended or unknown impacts on surrounding systems. This way of approaching development can often minimize or eliminate the need for new “hard” infrastructure by reducing or eliminating the need or by proposing nature-based systems that can accomplish the same outcome. While the Institute for Sustainable Infrastructure’s Envision Rating System is an example of how to “do the project right,” this priority indicates the importance of “doing the right project” as well.

Developing new decentralized stormwater management protocols is an example of this shift in approach. Past protocols and existing standards collected stormwater and transported it as expeditiously as possible to receiving waters. Although this approach protected crucial infrastructure, it ignored the negative environmental impacts on receiving water bodies and the possible co-benefits of conserving and beneficially re-using the stormwater. Current design methodologies integrate retention and infiltration into the outcome, providing the same protection to crucial infrastructure, but also achieving positive aesthetic, recreational, and resource preservation impacts. Such a full systems benefit can be realized if engineers ask, "What am I trying to accomplish and why?"

Priority 1 Strategic Goal

To achieve such a shift in thinking, the strategic goal is to invent or reinvent infrastructure development processes to identify and address the intrinsic needs of a program or project; minimize those needs to the extent possible; satisfy any residual needs; and consider all possible alternatives before projects and programs are conceived, executed, and operated—in other words, to "do the right project."

Priority 1 Desired Outcomes

- A new process for engineers to engage as trusted leaders before project approval and execution in identifying and defining project and program needs, as part of complex, multidisciplinary teams; and
- Project and program development methodologies that carefully consider, prior to project approval and execution, all approaches and alternatives that
    - Optimize the use and application of available resources;
    - Use economic, social, and environmental sustainability as the key criteria for selecting the right project; and
    - Meet project and/or program development needs, whether by the use of structural, nonstructural, or so-called "natural infrastructure" solutions.

Priority 2: Standards and Protocols: Do the Project Right

While "doing the right project," engineers must still "do the project right." Clearly, however, previously reliable standards and protocols no longer suffice. Current prescriptive standards may apply in conditions of stationarity. However, where non-stationarity (a condition where statistical properties, such as mean or variance, of a data set are not constant over time) is prevalent, new standards and protocols are needed that are process- and performance based rather than prescriptive. Those standards must also address resiliency to develop infrastructure that ensures society's safety and its ability to recover from disturbances, thereby allowing resources to be applied to innovation and advancement, rather than to defense and reactiveness. Adopting sustainability standards and, perhaps more importantly, protocols appropriate for this new climate paradigm can address impacts and non-stationarity in the built and natural environment.

Priority 2 Strategic Goal

To address the problem of standards and protocols that fail to address non-stationarity, the strategic goal is to establish, adopt, and implement methodologies that produce sustainable infrastructure. Methodologies meet this goal by

- Meeting the project owner's objectives, requirements, and specifications;
- Significantly improving the project's environmental, economic, and social performance;
- Accommodating a changing operating environment (non-stationarity);
- Developing standards that integrate risk, probability (forecasting) and resiliency into engineering design; and
- Accounting for operations, maintenance, and end-of-life disposition.

Priority 2 Desired Outcomes

- A new standard for transformational infrastructure planning, design, construction, operations and maintenance, decommissioning, and overall management that (1) meets the project owner's needs, requirements, and specifications; (2) meaningfully reduces the net ecological footprint; and (3) accounts for changing environmental and societal conditions;
- A new higher-level standard for sustainable infrastructure and engineering, including, for example, the use of tools like Envision; and
- An inventory of all ASCE standards that affect sustainability, with plans to update current standards and incorporate sustainability into all future standards.

Priority 3: Expand Technical Capacity: Transform the Profession

Now that the familiar lighthouses of the past may no longer be relevant, civil engineers must have the protocols, processes, and standards needed to navigate the unfamiliar waters of the future safely and effectively. We must develop tools to perform life-cycle assessment and life-cycle cost analysis to account for lifetime impacts of infrastructure—and even for impacts beyond its useful life. Unfortunately, the data and conditions that underpin previous standards and bodies of knowledge no longer accurately and reliably describe future conditions and requirements. Designing infrastructure based on such standards and methods without knowing whether those standards really apply is inherently risky and leads to the commoditization of civil engineering. Although applying old standards and processes may *feel* less risky than stepping beyond the comfortable bounds of traditional engineering practice and integrating the roles of "master builders, stewards of the environment, innovators, managers of risk, and leaders in public policy," as ASCE's Vision 2025 advocates, doing so is necessary.

To apply the principles of sustainable development, expanding engineers' abilities and capacities beyond the currently accepted technical acumen and professional standards of engineering practice is necessary. Engineers must gain confidence and expand their capacities to identify, understand, navigate, and manage the new risk and uncertainty adequately and appropriately. The new engineer must develop relationships of trust and respect to become the trusted advisor. This role requires expanded

approaches, courses, study methods—even new bodies of knowledge—for pre-college, college, and post-graduation training and new advanced certifications, accreditations, and standards.

Priority 3 Strategic Goal

Achieving the necessary professional transformation requires civil engineers to build or expand their capacity to achieve the visions and principles of sustainable development through new training and professional development opportunities, including formal and continuing education opportunities.

Priority 3 Desired Outcomes

- An operational Certificate Program for engineers to demonstrate understanding of sustainable development principles and their implementation;
- A significant number of professionals pursuing the certificate, with a goal of 1,000 in five years.

Priority 4: Communicate and Advocate: Making the Case

Transforming the civil engineering profession and methods for sustainable infrastructure development requires communication with all stakeholders and advocacy to promote acceptance and adoption. Orchestrated messaging must be presented with a common, recognizable, and cohesive voice to best serve and guide ASCE's members and the public. Communication and advocacy must be composed carefully to include varied and diversified disciplines outside of ASCE and engineering. Examples of organizations to collaborate and build common purpose with include American Planning Association, American Institute of Architects, and American Public Health Association, among many others. In addition, the profession and its practitioners in the institutes, committees, regions, sections, branches, and other ASCE entities must be informed and their expertise and technical acumen expanded to recognize, accept, and champion the changes required to meet this challenge. Finally, ASCE must align with the United Nations Sustainable Development Goals to support global implementation and collaboration with other international supporters of sustainability.

Priority 4 Strategic Goal

This significant transformation of the civil engineering profession requires communicating the reasons for change with members, the public, and all stakeholders. The end goal is a membership and public that demand environmentally, economically and socially sustainable infrastructure that meets the needs of human welfare equitably and enables healthy communities.

Priority 4 Desired Outcomes

- Comprehensive and consistent engagement with sustainability committees in ASCE's sections, branches, institutes, and divisions;
- Development and distribution of advocacy and communication materials for use by ASCE's sections, branches, institutes, and divisions to enable adoption of ASCE-endorsed or -sanctioned principles of sustainable development in engineering services procurement by federal, state and local agencies;

- Recommendations for revisions, with commentaries, to ASCE's Code of Ethics, standards, and policy statements to strengthen consistency with triple-bottom-line sustainability concepts as expressed in ASCE Policy 418;
- Delivery of compelling messages in meetings and conferences that align with ASCE's strategic goals and in meetings and conferences where ASCE should have a proactive presence; and
- Development of strategic alliances with aligned and complementary organizations, both within and external to ASCE. Such organizations may include American Institute of Mining, Metallurgical, and Petroleum Engineers; American Public Health Association; American Institute of Architects; American Planning Association; American Society of Landscape Architects; National Recreation and Park Association; American Public Works Association; American Council of Engineering Companies; Institute for Sustainable Infrastructure; and National Emergency Management Association.

Conclusion

Civil engineering is at the crossroads of a critical time in history. Charged with transforming our profession in light of emerging sustainability issues, with this Roadmap ASCE presents details of how to do this. ASCE can accelerate this professional transformation by providing direction on why and to what extent this roadmap should be implemented in all ASCE organizations and programs and by the civil engineering profession in general, consistent with existing Society policies and efforts. Only a visionary approach such as this can maintain the continuing relevance and importance of our profession in these changing times. Join us!