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Sustainable Design of Pipelines

Guidelines for Achieving Advanced Functionality

Task Committee on the Sustainable Design of Pipelines

EDITED BY
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UTILITY ENGINEERING & SURVEYING INSTITUTE

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A manual or report in this series consists of an orderly presentation of facts on a particular subject, supplemented by an analysis of limitations and applications of these facts. It contains information useful to the average engineer in his or her everyday work, rather than findings that may be useful only occasionally or rarely. It is not in any sense a "standard," however, nor is it so elementary or so conclusive as to provide a "rule of thumb" for nonengineers.

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PREFACE

This Manual of Practice (MOP) was developed for sustainable design and construction of pipelines and presents methods, practices, and decisions that influence and guide sustainable planning, design, construction, and operation. The contents of the MOP are based on the principles of sound engineering practice but use the framework of an infrastructure sustainability rating system, Envision, to provide a more quantitative decision-making process and to include focus on potential project considerations that may not be typically considered. Envision® is a product of the Institute for Sustainable Infrastructure (ISI), an independent entity formed as a result of joint cooperation among ASCE, the American Public Works Association (APWA) and the American Council of Engineering Companies (ACEC).

Envision was discussed and its applicability and features appropriate to pipeline design and construction evaluated. The Task Committee on the Sustainable Design of Pipelines (SDP) recognized the value of the already developed Envision rating system and used it as a framework for developing the process and methodology of sustainable pipeline design. The MOP goes beyond what Envision currently includes related to pipelines and develops chapters as listed in the Table of Contents.

VISION

This manual is intended to be a resource guideline for those interested promoting sustainability in the development, construction, and operation of pipeline projects and was developed as an MOP for project proponents, consultants, government agencies, and others who are not familiar with sustainability practices as they may be applied to pipeline technologies and for those who engage in the practice of pipeline development on a daily basis.

It is not the purpose of this MOP to promote the development of pipeline projects that will "save the world" or debate the causes or the potential effects of climate change. Rather the goal is to provide guidance for those in the pipeline industry, such as engineers, contractors, and particularly pipeline owners, to promote the inclusion of project considerations that go beyond the typical domain of what can be a relatively mundane, single-purpose project to include components that reduce life-cycle costs, as well as adverse impacts to society and the environment. In some cases, a pipeline project may be able to be planned and developed to include benefits beyond the basic purpose of the pipeline.

It is important to not only develop a pipeline project with sustainable components that serve to maintain or enhance economic, social, and environmental considerations but also develop a pipeline project that has increased resilience to the potentially damaging impacts of climate change. Without considering the cause or duration of climate change, there is little doubt that the planet is currently in a cycle of increasing sea-level rise and the associated potential for flooding as well as an increase in storm intensity that can affect the long-term performance of the constructed project if they are not considered as part of the system design. As discussed later in this MOP, such considerations are a crucial factor for the overall life-cycle cost of a project.

This MOP will provide the pipeline professional with guidance and processes that allow for the considerations and trade-offs necessary to produce the most-sustainable overall project design. For the most part, the processes are not prescriptive, but rather serve to provide the resources needed to balance the project requirements that result in the least overall impact for the functional life cycle of the project. The purpose of the MOP is not to describe how to successfully rate a project under Envision but rather to take the concepts of the Envision system and incorporate them into the design process. The MOP uses the concept of Life-Cycle Analysis (LCA) to develop project life-cycle costs in a more rigorous evaluation of a project's total carbon footprint and impact of the triple bottom line. The ability to successfully rate a project under Envision is a value added that project proponents can use to promote their efforts.

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Appendix A: Pipe Standards, Design Manuals, and Guidelines

Appendix B: Pipe Materials Resource Information

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CHAPTER 1
INTRODUCTION AND BACKGROUND

1.1 BACKGROUND

In recent years, the idea that development and building construction could continue without regard to available resources and impacts on the environment and society has rapidly given way to an increased understanding that we cannot continue to consume resources both locally and globally without regard to their replacement. These considerations apply to the primary raw materials required to complete a construction or development project, as well as secondary and tertiary considerations such as impacts on the environment, displacement of other functionalities, or changes in the quality of life for those in close proximity to the project. For better or worse, the concepts of "green" living and sustainable growth have become popular buzzwords around the world and have assumed a political tone that often detracts from the ability to do the right thing.

The groundwork for these concepts dates back several decades. In the United States, the 1970 National Environmental Policy Act formally established as a national goal the creation and maintenance of conditions under which humans and nature "can exist in productive harmony, and fulfill the social, economic and other requirements of present and future generations of Americans."

Globally, the concept of sustainable design and construction is attributed to a report prepared for the United Nations by the Brundtland Commission in 1987, which states, "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Over the last 30 to 40 years, the concept of sustainability has evolved to reflect the differing and not always compatible perspectives of the public