1 INTRODUCTION

The purpose of this Bridge Design Guide is to provide guidance to individuals involved in designing bridges for the Bridge Program of the Maine Department of Transportation (MaineDOT), focusing on bridge design policies specific to the state of Maine. This Guide should be used as a roadmap for developing bridge projects, providing clarity to the design thought process, and serve as a complementary resource to the relevant American Association of State Highway and Transportation Officials (AASHTO) standards.

This Guide primarily focuses on common bridge structure types using conventional construction methods and materials within the state of Maine. However, it is essential to recognize that not all structure types and complexities fit neatly into this framework. Good design practice relies on engineering judgment and experience, and the best solutions emerge when technical knowledge is combined with practical wisdom. MaineDOT encourages the use of innovative materials, technologies, and processes if these advancements can enhance service life, improve the durability of specific elements, improve user safety, save money, and/or benefit the project as a whole. Solutions that lie beyond the scope of this guide and AASHTO standards may be regarded as experimental projects or pilots requiring specific documentation and justification such as, but not limited to:

- Existing research
- Basis for design methodology
- Research work plan
- Lab and field load testing prior to service
- Draft AASHTO Guide Specifications
- QC/QA processes
- In-service monitoring plan

Collaboration among knowledgeable stakeholders, engineers with experience implementing the applicable design solution, Universities with capable research facilities, fabricators, and experienced Contractors is essential for these experimental projects. Before implementing such solutions, the MaineDOT Project Manager shall be consulted to ensure alignment with project goals and determine required documentation.

While primarily aimed at vehicular bridges, with good engineering judgement the guidance provided in this document can be adapted to rail bridges, pedestrian bridges, and ancillary structures. It's important to note that specific design guidelines should still be adhered to, particularly in the case of rail bridges.

The following definitions shall be used for interpreting the guide:

- "Shall" indicates a requirement that must be followed.
- "Should" indicates a preference.
- "May" indicates an option however there are additional approaches that would also be acceptable.

1.1 ADDITIONAL REFERENCES

This Guide shall, at a minimum, be supplemented by the following documents found on the MaineDOT website:

- *Bridge Plan Development Guide*
- Standard Specifications
- Standard Details
- Highway Program Design Guidance
- *Load Rating Guide*
- *Bridge Preservation Guide*
- Engineering Instructions

Website links provided throughout this Guide were accurate at the time of initial publication. The Department should be notified of any links that are no longer accurate or functional.

1.2 BRIDGE PROGRAM ORGANIZATION

The Bridge Program is organized in a hierarchy. Design or project decisions can occur at all levels of the organization; however, typical design decisions are approved beginning at the lowest level shown on the organizational chart in Figure 1-1. High risk decisions will be elevated up by team members as appropriate.

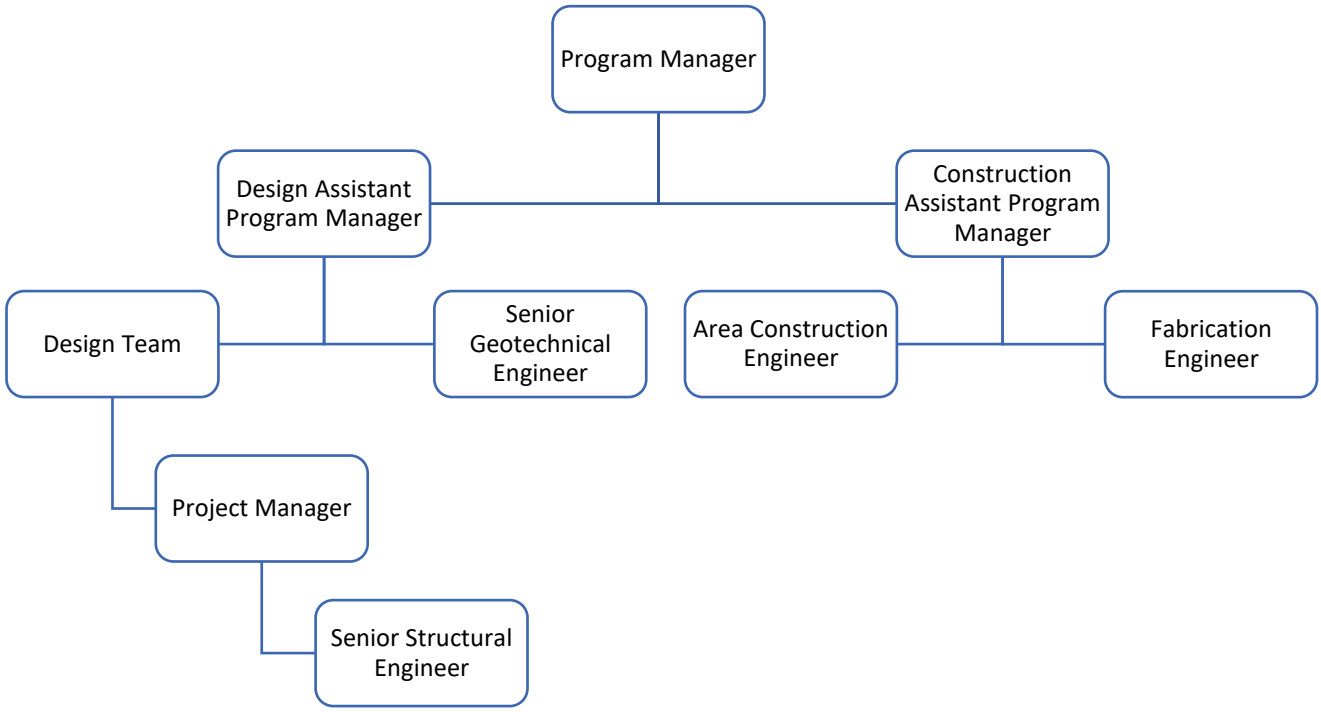

Figure 1-1: MaineDOT Bridge Program Partial Organization Chart.

In addition to the positions noted above, each design team has Designers and Design Technicians (detailers). For the purposes of this guide, the Project Team includes the design team in addition to a Utility

Coordinator, the Property Office, the Environmental Office, and a geotechnical engineer, if required. Each design team is responsible for coordinating with the Property Office for right-of-way impacts and the Environmental Office for project constraints and impacts. The construction side of the Program has two regional teams consisting of project Residents and Inspectors assigned to active construction projects. Each of these regional construction teams is led by an Area Construction Engineer who also serves as the construction team member for the design teams during project development.

1.3 QUALITY CONTROL POLICIES

Quality control (QC) checks are required for all project deliverables including but not limited to checking of plans, calculations, estimated quantities, construction cost estimates, specifications, bridge concept forms (BCF), preliminary design reports (PDR), studies and construction submittals for all phases of a project. QC checks shall occur at each intermediate milestone as described in Chapter 2. QC checks shall verify that deliverables represent a safe, constructible, cost-effective design as well as meeting the expected quality level.

All deliverables, and their associated QC checks, shall include an Originator and a Checker. The Originator is an individual responsible for the production of a deliverable, typically an engineer. The Checker is a qualified individual with sufficient relevant experience in the area to be checked. The Checker shall be familiar with the project scope, design criteria, and MaineDOT practices. QC design checks shall be completed using one of the two following approaches: Independent Design Check or Design Review Check.

- Independent Design Check: Independent design checks shall be completed by a qualified individual, independent of the original design and without reference to the originator's design calculations. If a design is based on a computer model, such as a finite element model as part of a refined method of analysis, the independent design check shall not utilize the same model as the original. The Checker shall perform an independent analysis of the major structural components, including any intermediate conditions. This checking approach is expected for structural and geotechnical components of new and rehabilitated structures including bridge geometrics. The Senior Structural Engineer will confirm the need for independent design check of a component if the design team is uncertain which check approach is required. A review of completed design calculations is not considered an independent design check.

- Design Review Check: The design check review is a detailed review of the originator's deliverables including calculations, when applicable. This checking approach is typically used for horizontal and vertical alignments and approach work. When this approach is used for design calculations, the design review check shall include a conformance and accuracy check to determine that the deliverable meets the design criteria and is free from mathematical inaccuracies and consistent with design plans, specifications, or reports.

When an independent design check is completed, differences between the original design and independent designs are anticipated. Discussion between the originator and checker should occur to verify design assumptions and design intent to ensure a safe and efficient design meeting all applicable standards.

Consultant designs, including plan sets, Special Provisions, reports, BCF's, and PDRs, should be peer reviewed by an experienced engineer, preferably one familiar with MaineDOT policies and practices, prior to being submitted to the Department.

Documentation for QC reviews shall be completed for all milestone deliverables (see Chapter 2) and maintained with project files through the length of the project. At a minimum, the documentation shall identify the originator and checker. Each milestone deliverable shall also include a comment resolution log identifying previous comments from the Department or Stakeholders and the resulting action from each comment.

1.4 PRACTICAL DESIGN

Design teams should familiarize themselves with the Department's Practical Design Philosophy and Corridor Priority approach to utilizing public funds for transportation projects. Recall that the MaineDOT Mission Statement is:

> *To support economic opportunity and quality of life by responsibly providing our customers the safest and most reliable transportation system possible, given available resources.*

In order to meet this Mission Statement, it is understood that Practical Design and Corridor Prioritization will help guide bridge design decision making. Specific design guidance or Engineering Instructions may reference the Corridor Priority for decision making, but not all scenarios can be captured in general policies and consideration also needs to be given to the historical performance of a site. Safety for all modes of transportation impacted by a project shall be addressed.

In addition to policies and guides helping to identify project needs, engineering judgement and awareness of project budget and market trends are critical in providing efficient designs. Labor and material supply are constantly changing, which can dramatically affect construction costs. It is important for design teams to stay current with construction trends and market forces. Project decisions should carefully consider the balance of many different factors such as Contractor risk, labor, material supply, and impacts to the environment.

Practical Design: https://www.maine.gov/dot/doing-business/engineering-policies

Corridor Priority Definitions: https://www.maine.gov/dot/programs-services/highway/asset-management-glossary