Preface

The California Department of Transportation Trenching & Shoring Manual was originally developed by Structure Construction in 1977. Its purpose then, which continues now, was to provide technical guidance for Structure Construction field engineers analyzing designs of trenching & shoring systems used in the California Highway Construction program. Beginning with the initial edition, this manual was well received by both the Department and the construction industry, and was distributed nationwide as well as to foreign countries.

This 2025 manual revision remains to be devoted to the analysis of trench and excavation earth support (shoring) systems needed for the construction of the Department's infrastructure. An additional very important objective is to inform the Engineer of California's legal requirements regarding worker protection. The Engineer should bear in mind that this manual is a book of reference and instruction to be used with respect to the administration and engineering of excavation shoring. In cases of conflict, the contract documents will prevail.

This revision retains the enhancements made in 2011 through significant contribution from Anoosh Shamsabadi PhD, PE, and those of Kenneth J Burkle, PE, both of whom have continued to support this manual and the current Caltrans Trenching and Shoring Check Program. While the 2011 edition emphasized the AASHTO, this 2024 revision of the manual reintroduces the more rigorous and classical analysis of cantilevered shoring systems.

The first two chapters remain devoted to the legal requirements and the responsibilities of the various parties involved. Excavation safety begins with a clear understanding of the responsibilities of one's role in the planned work. Not only must construction personnel be aware of the various legal requirements, but they must also thoroughly understand the risks excavations pose to worker safety.

The engineering objective of a shoring system is to be both safe and practical. The design of a shoring system requires two distinct efforts. First is the classification of the soil to be supported, determination of inherent soil strength, calculation of lateral loads, and distribution of lateral pressures. This is the soil mechanics or geotechnical engineering effort. The second is the structural design or analysis of members comprising the shoring system. The first part, the practical application of soil mechanics, is the more difficult. The behavior and interaction of soils with earth support systems is a complex and often controversial subject. Books, papers, and "experts" do not always concur even on basic theory or assumptions. Consequently, there are no absolute answers or exact numerical

solutions. A flexible, yet conservative approach is justified. This manual presents methodologies that will be adequate for most situations. The Engineer, on their part, must recognize situations that affect the use of the procedures discussed in the manual and utilize sound engineering judgment as to which methods are appropriate.

There are many texts and publications of value, however, be cautious with dated and historical material that may not be current with soil engineering theories. There are other satisfactory methods of approaching an engineering problem. The subject of Geotechnical Engineering, which is used in shoring design, is recognized as an engineering art. The need for good judgment cannot be over emphasized. Do not lose sight of the primary objective: a safe and practical means of doing the work.

There are two major reasons why the Department considers shoring and earth retaining systems a subject apart from other temporary works such as falsework. First, an accident in a trench or excavation is more likely to have a greater potential for the maximum penalty, that is, the death of a workman. Cave-ins or shoring failures can happen suddenly, with little or no warning and with little opportunity for workers to take evasive action. Second, earth support systems design involves the complex interaction of soil types plus engineering factors that are often debatable and highly empirical.

Trenching or shoring is generally considered temporary work. However, a shoring system's "temporary" status may extend 90 days or longer for complicated structures; this time can be extended even longer due to delays caused by weather, material shortages, labor disputes, or other disruptions. Thus consideration of a shoring system's "temporary" status, should be evaluated and monitored against the initial assumptions made during the design and installation.

The Department's goal in maintaining this manual is to provide practical guidance for commonly used temporary systems. This manual is the result of merging the Structure Construction (SC) experience with continued research and study by engineering staff from the Division of Engineering Services (DES) and industry. This manual represents hundreds of years of combined experience.

It is impossible to acknowledge each and every individual who contributed to the development of the manual. However, recognition is due to the major contributors as follows:

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Signed,

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