# CHAPTER 1–INTRODUCTION

Culverts form an important part of the transportation infrastructure in the United States. A culvert can be considered a conduit or waterway usually placed under a fill, such as a highway or railroad embankment, to convey surface flow from the uphill side of the fill to the downhill side.[1] Drainage facilities, such as culverts, decay due to the processes of abrasion, corrosion, and erosion, shortening the anticipated service life of the facility. Many culverts in the United States have deteriorated and need repair or replacement. Until recently, most repair or replacement of culverts required open-cutting (trench digging). Due to higher traffic density, social and environmental impacts, and high construction costs associated with open-cutting techniques, State Departments of Transportation (DOTs), consultants, and Federal agencies such as the Federal Highway Administration (FHWA) have turned toward trenchless technology as a cost effective solution to culvert rehabilitation.

Trenchless technology can be used with a wide range of methods, materials, and equipment for rehabilitating existing or installing new underground infrastructure.[2] Within the category of trenchless technology, the rehabilitation of existing culverts through lining techniques has gained popularity in the United States. To date, several trenchless lining techniques have been used for the rehabilitation of existing culverts. However, choosing an optimum lining technique can be complicated considering the vast amount of organizations specializing in the manufacturing and installation of culvert liners as well as the various materials, applications, and limitations associated with each lining technique.

Due to the complexity and lack of standards/specifications associated with culvert lining techniques, past culvert lining projects were usually addressed on a project-by-project basis. To aid the FHWA and State DOTs, Colorado State University (CSU) was contracted to establish guidelines and specifications for the use of culvert liners. In order to accomplish this goal, the study was divided into three (3) tasks. Task 1 involved a thorough literature review to collect information describing the state-of-the-practice in culvert pipe lining for culverts up to 1.22 meters (4 feet) in diameter. Task 2 involved the development of a decision-making methodology for choosing appropriate culvert liners based on various factors. A user-friendly Microsoft® Excel-based Multi-criteria Decision Analysis (MCDA) tool that allows the user to customize the decision aid model was created for Task 2. Task 3 required the preparation and submittal of a final report whereby providing guidance to both the Design and Construction Branches of the FHWA and to State DOTs. Objectives associated with Task 3 are encompassed in the following report.