



# Bridge management systems: overview and framework for smart management

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## Abstract

Throughout the world, many medieval and historic bridges remain in operation. Deterioration and failures have increased in the already aging bridges due to consistent growth in traffic volume and axle loads. Therefore, the importance of Bridge Management Systems (BMS) to ensure safety of operation and maximize maintenance investments has also increased. Recent improvements in technology also contribute to the demand for optimized and more resource-efficient BMS. In this study, a literature review was performed to map current bridge management practices and systems in operation in the world. The outcomes identified Bridge Information Modelling (BrIM) and Digital Twins as novel approaches that enable efficient management of the whole lifecycle of a bridge. From these outcomes, a framework of an ideal BMS is proposed to achieve automated and smart management of bridges.

**Keywords:** bridges; bridge management systems; BMS; BrIM; review.

## 1 Introduction

Bridges on public roads faced lighter loads before the proliferation of road traffic. The reaction to the then increased accounts of failure was to establish national standards requiring regular bridge inspections and evaluations. The activity of managing and scheduling bridge inspections and evaluations, recording and handling bridge data, and making maintenance recommendations became known as bridge management [1].

Bridge management is an essential part of long-term asset management, applicable to all existing bridges, old and new [2]. The main purpose of management is maintaining the bridges by

identifying deficiencies and ensuring the continued safety of traffic through rehabilitation [2]. In the past few decades, the scope of bridge management has grown, and the goal of maximizing the effect of maintenance funds to protect the investment in bridges has been added to the primary goal of protecting the safety of the traveling public [1].

Expansion in physical infrastructure and improvements in technology have lead government authorities to find ways to enhance efficiency in managing maintenance activities and maximize the value of maintenance spending [3]. Recent developments in Information Technology (IT) promote changes in bridge management, better quality of inventory and inspection