

Robotics in Construction and the New Era of Efficient Concrete Bridges

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1 Abstract

Autonomous robots will most likely replace human labour as the primary means of production in bridge construction. This article examines the effect of this transformation of construction on the design of structural systems used for bridges. It begins with a review of changes made to structural systems in response to increases in construction wages in the 1950s and 1960s. High labour costs led to structural systems that were optimized to minimize the quantity of labour but which used materials inefficiently. The expected use of robots as the primary means of production in bridge construction is likely to have the opposite effect. Robots will lower the cost of production relative to human labour, thus making it worthwhile to design structural systems that use materials efficiently. Cast-in-place concrete holds good potential for use as the primary material in this new generation of efficient structural systems. Structural systems that proved themselves in the era of low construction wages prior to mechanization offer a solid basis for the development structural systems that take maximum advantage of the opportunities offered by robotic construction.

Keywords: Bridge design, bridge construction, robotics, construction cost.

2 Introduction

It is almost certain that human labour will eventually be replaced by autonomous robots as the primary means of production on bridge construction sites. Robots will be used in construction for the same reason they have been used with great success in manufacturing, namely, they will enable a significant reduction in the cost of production.

The challenges associated with an intensive use of robots in heavy construction will be greater than those faced in manufacturing. Robots in construction will need to function in harsh and

unpredictable outdoor environments. They will most likely need to have greater mobility and be able to perform a greater variety of tasks than their counterparts in manufacturing. There is good reason to be confident, however, that these problems will be overcome relatively soon. The technologies that underly autonomous robots, i.e., information technology, artificial intelligence, and mechanical systems, are currently developing at a rapid pace that shows no signs of slowing down. These are the same technologies that underly driverless vehicles, which in spite of significant challenges are already poised to enter the market. If the challenges associated with driverless vehicles can be solved, then it should not take long before