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Steel Orthotropic Deck Systems – Ideal Solution for 200 Year Bridges

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1 Abstract

Time dependent deterioration of bridge decks, directly subjected to: repeated abrasive loading from passing vehicles; the elements of weather; and winter maintenance agents, is the key challenge to achieving a 200 Year Bridge Design. In-service performance and laboratory tests over the past several decades have demonstrated that the steel orthotropic deck is the only system likely to accomplish this goal. Nevertheless, implementation of this deck system has been mostly limited to long span signature bridges, movable bridges, and temporary structures. The primary impediments to more wider application of orthotropic decks are lack of robust standards, increased efforts required for advanced analysis and design, relatively high initial cost owing to intensive fabrication, and most importantly due to concerns regarding higher possibility of in-service fatigue cracking from a large number of welded connections. This manuscript presents a standard deck design, developed based on the lessons learnt from a number of orthotropic bridge decks implemented in the greater New York region and the knowledgebase accumulated over the years from research and service performance of this deck around the world, which can be widely implemented as a prefabricated modular system towards durable, sustainable and life-cycle cost-effective design of the 200 Year Bridge.

Keywords: bridge deck; fatigue; orthotropic decks; service life; steel.

2 Introduction

Time dependent deterioration of bridge decks, directly subjected to: repeated abrasive loading from passing vehicles; the elements of weather; and winter maintenance agents, is the key challenge to achieving a 200 Year Bridge Design. Due to lower initial cost, traditional reinforced concrete is most common choice for bridge decks; however, these decks are inherently susceptible to corrosion damage, requiring repeated intervention in terms of repair and/or replacement that is an impediment to 200 Year Bridge Design. In -service performance and laboratory testing of modern orthotropic decks demonstrate that if properly designed and fabricated, this deck system can provide a durable, sustainable and life-cycle cost-effective solution for a 200 Year Bridge [1].

Use of orthotropic decks has been mostly limited to new design and rehabilitation of long span signature bridges and movable bridges. The primary impediments to more wider application of orthotropic decks for routine short and medium span bridges are lack of robust standards, increased efforts required for advanced analysis and design, relatively high initial cost owing to intensive fabrication, and most importantly due to concerns regarding higher possibility of in-service fatigue cracking from a large number of welded connections. Recent studies, however, have shown

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