Experimental and Numerical Investigation of the Bearing Capacity of Prestressed Concrete Decks

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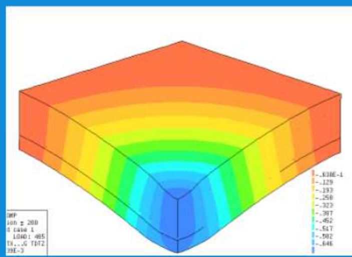


Contents

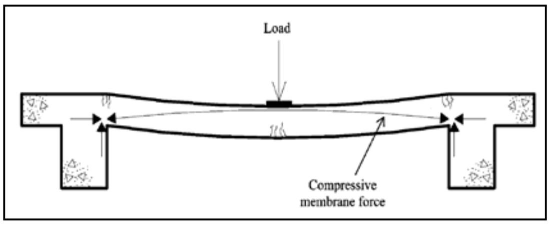
Introduction

Problem Statement

- **Bridges built more than 50 years ago**
- **Increased Traffic flow and Modern code requirements**
- **Safety is a question?**
- **Investigation of bearing capacity of prestressed deck slabs under wheel loads**
- **Exploring possibility of Compressive Membrane Action**

Introduction

Compressive Membrane Action



CMA is a phenomenon that occurs in slabs whose edges are restrained against lateral movement by stiff boundary elements. This restraint induces compressive membrane forces in the plane of the slab (Park and Gamble, 1980).

Introduction

- Bridges are traditionally designed to carry the wheel load entirely in flexure.

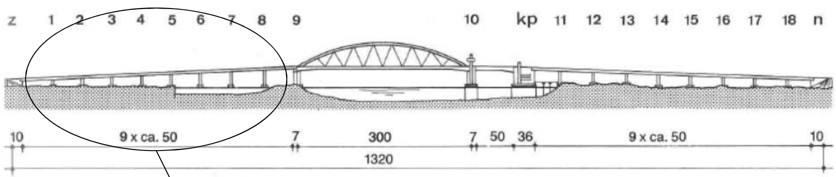
  ASSUMPTION: Adequate shear capacity.

- A reinforced bridge deck slab designed for bending tends to fail in the punching shear mode before flexural failure occurs, at loads much higher than expected. Increased capacity due to CMA.

- Prestressing provides additional in-plane forces. Combined with membrane forces, this could positively affect the bearing capacity.

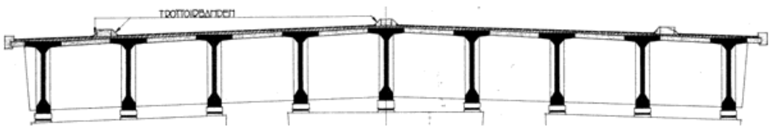
PhD Research

Project Description

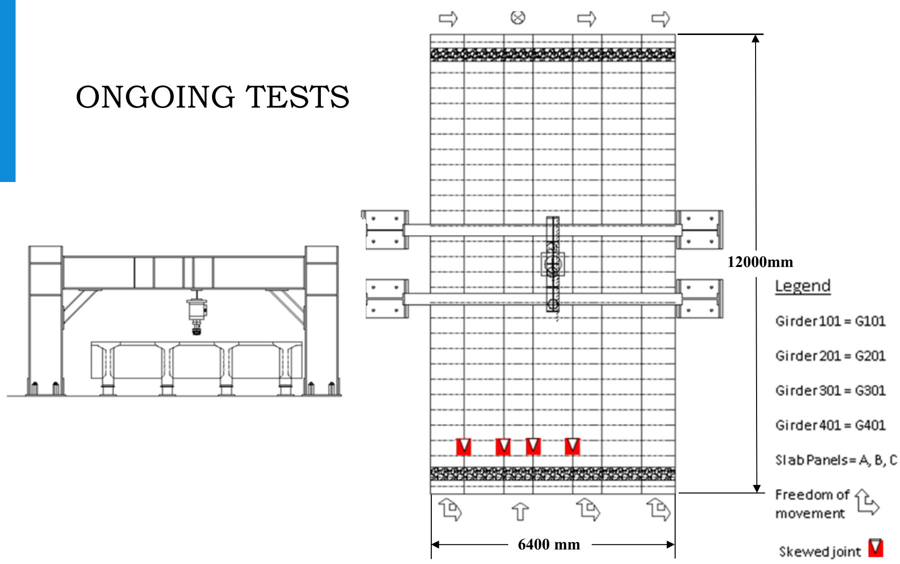


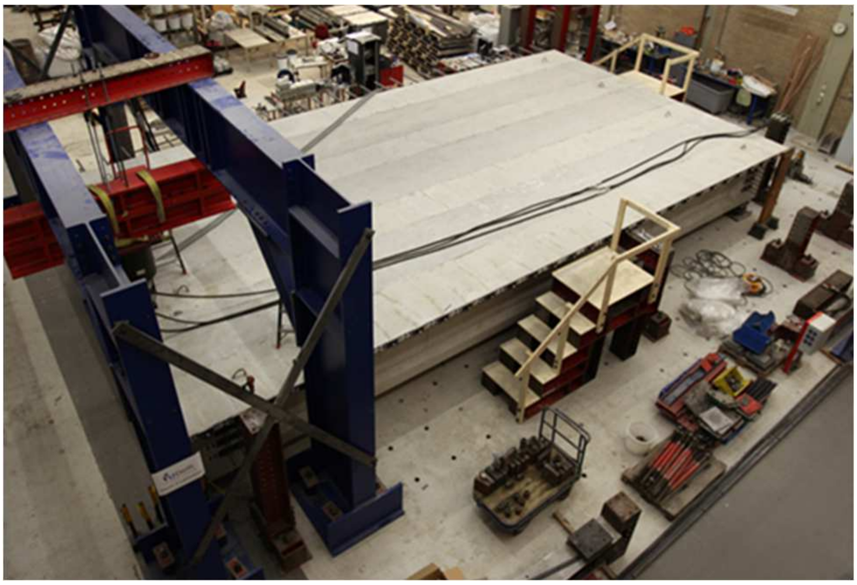
A typical "Approach Bridge"

1:2 Scale Model

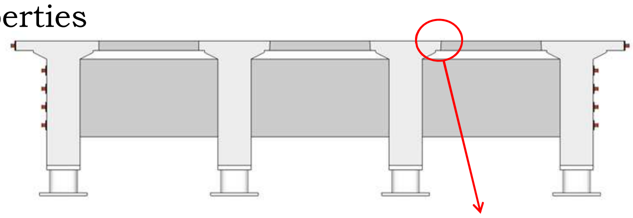


ONGOING TESTS





Material Properties

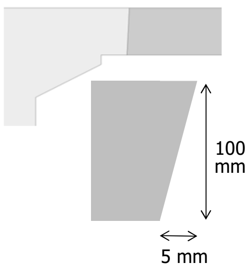


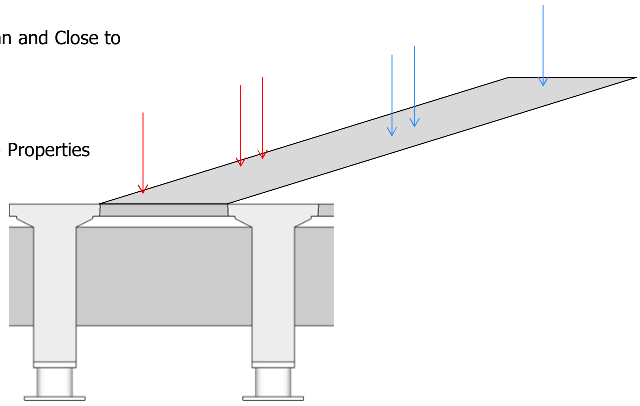
Material	Units	Property	Value
Concrete	[MPa]	28 days Mean Compressive Cube Strength, $f_{cm,cube}$	75
		28 days Mean value of Tensile Strength, f_{ctm}	5.41
		Modulus of Elasticity, E_{cm}	38375
Reinforcing Steel	[MPa]	Characteristic Yield Strength, f_y	500
		Modulus of Elasticity, E_s (MPa)	200000
Prestressing Steel	[MPa]	Characteristic Tensile Strength, f_{pk}	1100
		Modulus of Elasticity, E_p	205000

1-2 mm deep
30 x 10 mm tear drop

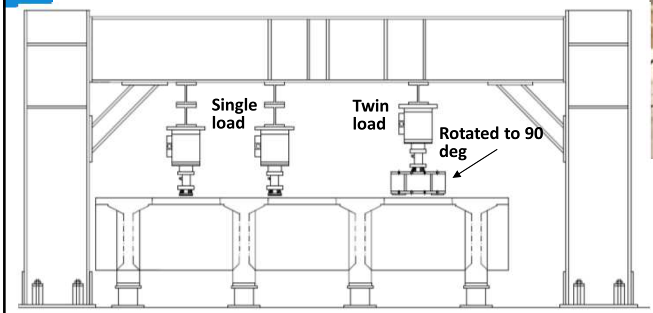
Parameters to be investigated

- Transverse Prestress Level : 1.25 MPa and 2.5 Mpa
- Position of the load: Midspan and Close to the support
- Single and Double
- Skewness of Joint/Interface Properties

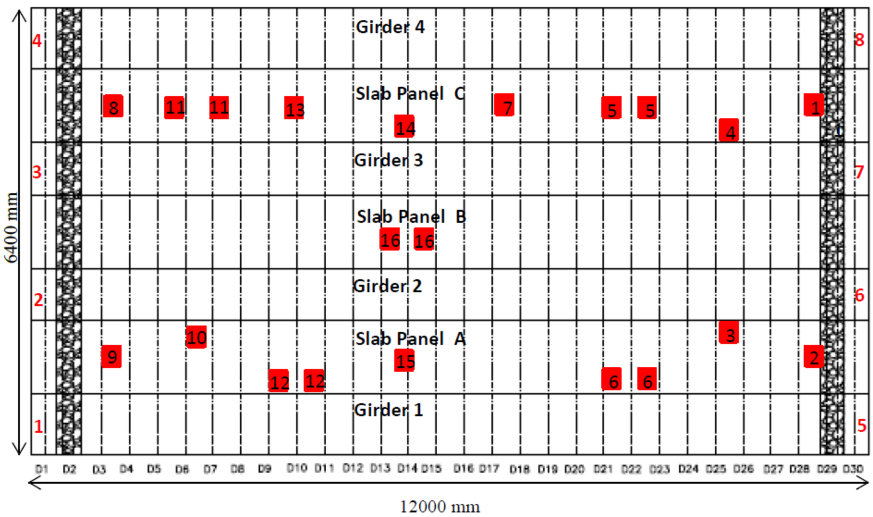




Typical load assembly



200 x 200 x 20 mm Loading plate



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Test Position

Tests

Single				Double			
Interface		Midspan		Interface		Midspan	
Straight	Skew	Straight	Skew	-	Skew	Straight	Skew
Between ducts							
Above duct		Above duct	Above duct				

TEST RESULTS

The following sheets are at the moment confidential

After 4th June 2014 they are becoming available