

**RESEARCH PROBLEM STATEMENT**

<b>DATE:</b> 09/06/2019	<b>PROJECT AREA:</b> Maintenance
<b>TITLE:</b> Latex modified concrete: structural properties	
<b>PROBLEM STATEMENT:</b>	
<p>Latex modified concrete (LMC) overlays are becoming a popular bridge deck repair method in Arkansas. LMC is designed to have high flexural strength and adequate compressive strength with a reduced elastic modulus. Some past studies have focused on the durability or the physical properties of LMC, but few have investigated the properties of composite sections of concrete and LMC. Discussions with Bridge Design and Heavy Bridge Maintenance staff have revealed that bridge deck damage often extends to the full depth of the bridge deck in isolated locations. If LMC is then used, it must be able to perform compositely, as a structural addition to the existing deck concrete, not simply as a wearing surface. It is not understood if a full depth repair with LMC will affect the structural performance of the bridge deck. The properties of concrete bridge decks repaired in this way should be understood if full depth repairs with LMC are being used. A study is proposed, that will characterize the repair abilities of LMC, from LMC-concrete bond, LMC-steel bond, to the performance of a concrete-LMC composite beam including full-depth LMC repair.</p>	
<b>OBJECTIVES:</b>	
<ol style="list-style-type: none"> <li>1. Determine current state-of-practice in bridge deck overlay techniques around the state.</li> <li>2. Perform steel-LMC pull-out bond tests. Perform concrete-LMC bond tests (45 degree compression cylinder, flexural repair specimen)</li> <li>3. Cast full-scale beam or slab mock ups with no damage and with simulated damage. Repair simulated damage specimens with LMC extending full depth and as an overlay.</li> <li>4. Perform flexural and shear testing on damaged beam specimens.</li> <li>5. Compare performance of repaired concrete and undamaged concrete. Provide recommendations on the proper use of LMC for bridge deck repairs.</li> </ol>	
<b>FORM OF RESEARCH IMPLEMENTATION AND RETURN ON INVESTMENT:</b>	
<p>Knowledge gained from this study can be used to determine if full depth repairs of bridge deck concrete using LMC are safe and if they impact performance. If structural performance is affected by LMC overlays, a calculation methodology to determine the impacts of the repairs will be proposed. Based on this work, recommendations for bridge deck preparation and proper application of LMC repair method will be delivered.</p>	
<b>Estimated Project Duration:</b> 24 Months	
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Standing Subcommittee  
Ranking

Advisory Council  
Ranking

Statement Combined with  
Statement Number(s)

# Latex modified concrete: structural properties

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# Bridge Deck Repairs

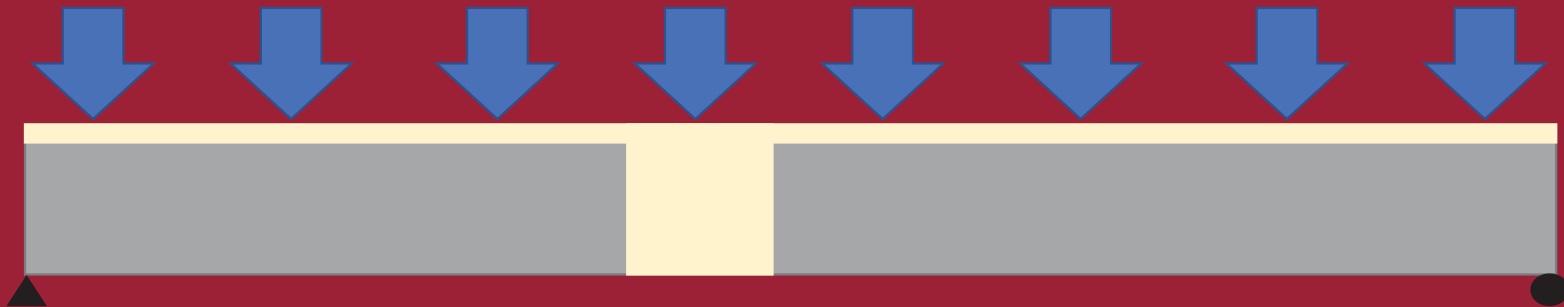
- Latex modified concrete overlays are popular
- Hydrodemolition of surface concrete required
  - Sometimes exposes full-depth damage
- Resulting repair must be a structural strength, fully-composite fix



# Latex Modified Concrete

- Concrete modified with styrene butadiene latex
  - Makes concrete more impermeable
  - Similar strength, reduced stiffness
- Often also made with high-early strength concrete
- If used to repair full-depth, need to ensure that resulting structure has the same or better performance than original concrete

# Latex Modified Concrete



- How does this section compare to original concrete?
  - Stiffness
  - Cracking behavior
  - Ultimate load
- If full-depth repairs are needed, repair **MUST** be safe and serviceable

# Study Goals

- Determine current state-of-practice
- Steel-LMC pull-out bond tests, concrete-LMC bond tests (45 degree compression cylinder, flexural repair specimen)
- Full-scale beam mock ups with no damage and with simulated damage – effects of full depth and top/bottom repairs
- Compare performance of repaired concrete and undamaged concrete. Provide recommendations on the proper use of LMC for bridge deck repairs.