

**RESEARCH PROBLEM STATEMENT**

<b>DATE:</b> 09/15/2020	<b>PROJECT AREA:</b> Materials
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**TITLE:** Investigating Coarse Aggregate Impact on Concrete Shrinkage

**PROBLEM STATEMENT:**  
 While most bridge decks in Arkansas perform adequately over their design life, early-age shrinkage cracking is a recurring issue in some bridges that can lead to compromised durability. Shrinkage cracks may lead to serious deterioration such as rebar corrosion and freezing and thawing. While construction methods and cementitious content are the main components of shrinkage, another important factor is the aggregate. National data indicates that the drying shrinkage strain for concrete cast with sandstone aggregate at one year of age is three times greater than for concrete cast with limestone aggregate. Data from TRC 1602 supports this finding that sandstone aggregate concrete does shrink more than limestone concrete. A review of approved quarries on the ARDOT QPL reveals a minimum of 7 major coarse aggregate types approved for use in ARDOT concrete. Therefore, though bridge decks may contain the same cementitious content and utilize similar construction practices, drying shrinkage may be much more of a concern with specific Arkansas aggregates. Determining the impact of aggregate type on drying shrinkage would help reduce bridge deck cracking and improve long-term durability.

**OBJECTIVES:**  
 The objective of this proposal is to quantify the impact of coarse aggregate type on the drying shrinkage of concrete and to rank Arkansas coarse aggregates in terms of their susceptibility to shrinkage. A review of the ARDOT coarse aggregate QPL will be conducted in order to select the aggregate list for research. Stockpiles of each coarse aggregate will be collected. Standard ARDOT concrete mixtures will be cast along with some mixtures incorporating recommendations from TRC 1602. A range of material tests will be performed to characterize the durability and strength properties of the mixtures with suggestions made for best performance. The results will provide ARDOT with a deep understanding of the impact of aggregate type on shrinkage.

**FORM OF RESEARCH IMPLEMENTATION AND RETURN ON INVESTMENT:**  
 Aggregates from around the state will be ranked based on shrinkage and mechanical performance in similar ARDOT concrete mixtures. Recommendations are to be provided to ARDOT for preferred aggregates for the most durable concrete. Further, mitigation techniques are to be suggested to limit the impact of poorly performing aggregates. This project will supplement TRC 1602, providing actionable items to lessen the prevalence of shrinkage cracking in bridge decks in the state.

**Estimated Project Duration:** 24 Months

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Standing Subcommittee  
Ranking

2/8

Advisory Council  
Ranking

9

Statement Combined with  
Statement Number(s)