

# **Use of latex modified concrete as a bridge deck overlay.**

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Civil Engineering

1989

## **Abstract**

The main theme of this thesis has focused on the development and evaluation of a latex modified concrete, using local materials from the Eastern Province of Saudi Arabia. The materials used were locally manufactured nito bond styrene-butadiene rubber latex, Portland cement Type I, sand from Halfmoon Beach and marginal aggregates from Jabel Dhahran.

The work was divided into four parts, with the first part dealing with the optimization of the mix to evaluate the latex effectiveness in upgrading concrete quality. Polymer-cement ratio, water cement ratio fine coarse aggregate ratio and cement content were varied in evaluating the properties of latex modified concrete. The basic properties were measured in terms of slump, air content, compressive strength, flexural strength, splitting tensile strength and permeability. The choice of the approximate mix design was based on the criteria that the protective system have low permeability, reasonable workability and good strength.

The second part of the thesis addressed the study of bond between latex modified concrete and normal concrete in a two stage construction. Several surface treatments were tested and the final choice was based on shear strength of the joint and economy.

In the third part, assessment of latex modified concrete overlay to improve the durability of concrete against corrosion of rebars was investigated. Several superplasticized concrete panels were cast with different overlay thicknesses and corrosion of rebars was monitored by taking half-cell potential readings for a period of ten months. Chloride/depth profiles of the slabs were also plotted to see the effectiveness of overlay in preventing the permeation of chlorides, moisture and oxygen. The effect of large temperature variations in the Arabian Gulf on the permeability of latex modified concrete was investigated separately, by subjecting cube specimens to different number of heat cycles and measuring the corresponding permeability according to DIN standards.

The fourth part of the study investigated the structural behavior under static and cyclic loadings of the composite beams consisting of superplasticized concrete and latex modified concrete overlay. The beams with overlay at top and bottom were tested so as to simulate the positive and negative regions. Under static loadings, the experimental results were compared with the theoretical results to examine the composite action upto failure. Under cyclic loadings, the beams were tested at different stress levels to investigate if delamination of the overlay occurred before failure.