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Original research paper

# Field cracking performance of airfield rigid pavements

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## HIGHLIGHTS

- Reinforced isolation joints were not as effective in reducing the edge stresses as compared to thickened joints.
- Longitudinal cracking was more prevalent over asphalt base than over econocrete base for all three test sections.
- Slabs over the econocrete had greater percentage of corner cracks than the slab over the bituminous base.

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ABSTRACT

This paper discusses cracking in airport pavements as studied in Construction Cycle 6 of testing carried out at the National Airport Pavement Testing Facility by the Federal Aviation Administration. Pavements of three different flexural strengths as well as two different subgrades, a soft bituminous layer and a more rigid layer known as econocrete, were tested. In addition to this, cracking near two types of isolated transition joints, a reinforced edge joint and a thickened edge joint, was considered. The pavement sections were tested using a moving load simulating that of an aircraft. It has been determined that the degree of cracking was reduced as the flexural strength of the pavement was increased and that fewer cracks formed over the econocrete base than over the bituminous base. In addition, the thickened edge transition joint was more effective in preventing cracking at the edges compared to the reinforced edge joint.



## 1. Introduction

Cracking in concrete airport pavements is primarily caused by slow-moving heavy aircraft loading. Several factors are associated with the cracking or deterioration of the concrete pavements such as environmental conditions, joint performance, and subgrade material. To better understand the failure mechanism, full scale testing is conducted at the National Airport Pavement Testing Facility (NAPTF) in Atlantic

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City, New Jersey in which all three factors were evaluated. One of the objectives of the testing of Construction Cycle 6 at this facility was to evaluate the influence of concrete flexural strength and two different support conditions on pavement performance. The long term performance of pavement is directly related to the stability of the subgrade material supporting the various layers in the pavement structure. Without suitable subgrade, the pavement will ultimately experience excessive bending thus causing premature cracking and deterioration throughout its lifespan. In addition to evaluating the subgrade material, two types of isolation joints were compared to assess which type of joint performed better overall in preventing deterioration of the concrete slabs in each MRS section. The authors have already presented the load transfer efficiency of these doweled and isolation joints under full scale testing (Cunliffe, 2013). This paper was formulated to present the results of the full scale testing performed on the pavement. It should be noted, however, that a detailed evaluation of the performance of slabs and isolation joints is not presented.

## 2. Objectives

The objectives of this study were as follows.

1) To quantify the deterioration and formation of cracking in three different flexural strength concrete pavements under dynamic loading.
2) To determine the influence of the stiffness of the stabilized base layer on the cracking patterns.
3) To evaluate the performance of two different types of isolation joints.

## 3. Significance of study

The results of this study provided useful insight into the influence of rigid pavement flexural strength and the influence of base layer stiffness on cracking behavior under full scale testing. The type of cracking that forms and quantification of cracks provides insight into how the stiffness of the base layer, the flexural strength of the pavement, and the type of joint used in connect slabs affects cracking behavior. This cracking pattern would provide an understanding into how isolation transition joints and support conditions respond to long term repeated loading.

## 4. Test sections characteristics

Full scale testing at the National Airport Pavement Testing Facility has been conducted to evaluate pavement performance as well as dowel joint performance and isolation transition joint performance over different stabilized base layer types and with different flexural strength concretes. The test pavement, shown in Fig. 1, consists of 10-inch concrete pavements of three different target flexural strengths. MRS-1 corresponds to a low flexural strength pavement (28-day strength of 500 psi), and MRS-3 corresponds to a high flexural strength (28-day strength of 1000 psi) pavement. Each of these flexural strength pavements is divided into north and south test sections, where the north test section has a 6-inch bituminous stabilized base layer beneath the concrete pavement and the south test section has a 6-inch econocrete stabilized base layer beneath the concrete pavement. As depicted, there are two additional layers

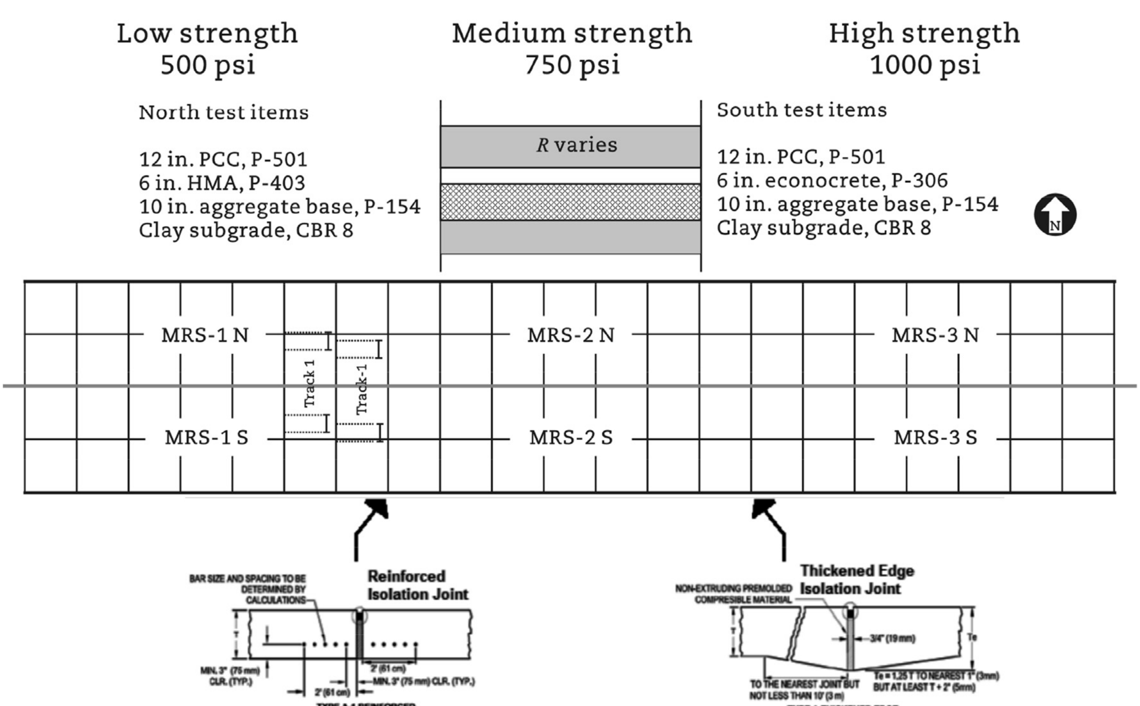


**Fig. 1 – Test pavement composed of different flexural strength pavements on different stabilized base layers and the positions of different joint types (Cunliffe, 2013).**