

# Best Practices for Longitudinal Joint Construction and Compaction

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## Introduction

In an asphalt pavement, joints are considered the weakest part of the pavement as they frequently fail quicker than the surrounding pavement areas, resulting in the need for costly repairs. In particular, longitudinal joints typically tend to exhibit performance problems before the rest of the pavement structure. Improving construction practices specific to the compaction of longitudinal joints in HMA pavements could extend the life and decrease the life-cycle cost of these pavements by preventing premature failure at longitudinal joints.

The overarching goal of this study was to identify best practices for construction of longitudinal joints in asphalt pavements in South Carolina and subsequently create a best practices guide informed by the research and make recommendations for potential specification revisions.

To accomplish the objective of this study, the research involved two primary tasks:

- Survey of longitudinal joint construction practices in South Carolina and nationally.
- Field and laboratory testing to evaluate the performance of longitudinal joints.

## Longitudinal Joint Evaluation

Longitudinal joints were evaluated at nine paving projects across South Carolina as part of this study. At each project, testing was conducted in the field and cores were taken for further laboratory testing. The field testing protocol included:

### **Joint Temperature**

The temperature of the new asphalt pavement mat and the matching pavement was measured with an infrared thermometer at regular intervals to assess the temperature difference between the hot and cold lanes during construction.

### **In-Place Pavement Density**

A density gauge was used to measure the in-place density of the new pavement across the width of the pavement from the free edge to the joint.

### **In-Place Pavement Infiltration**

A field permeameter was used to measure the pavement infiltration at the joint and the center of the new pavement lane.

## **Pavement Cores**

Cores were cut at the joint and the center of the new pavement lane at the same locations where infiltration testing was conducted. These cores were then tested in lab to measure the density and air voids; permeability; and indirect tensile strength along the joint.



*Longitudinal joint performance was evaluated in the field and cores were taken to assess lab performance.*

## **Conclusions**

This study observed construction of longitudinal joints in projects in South Carolina and compared the performance of the joint and interior portion of the hot lane. Based on the density, permeability, and indirect tensile strength (ITS) results from this research, conclusions related to the performance of longitudinal joints considering individual site, surface mix type, thickness, and nominal maximum aggregate size (NMAS) were made. In addition, the effectiveness of in-place density, lab and in-place infiltration, and ITS were evaluated based on the results.

Based on the results of this study, the following conclusion were made:

- Out of the nine asphalt surfacing construction projects evaluated in this study, eight projects showed significant differences between the interior portion of the pavement and the joint based on density, permeability, and/or ITS results.
- None of the projects exhibited a statistically different in place density (gauge density) when comparing the interior of the pavement to the edge of the joint. Only one of the projects exhibited statistically different in-situ infiltration rates between the pavement interior and joint edge.
- As the density of asphalt increased, the ITS increased linearly and as the density of asphalt decreased, the lab permeability increased exponentially.
- All the field testing results had higher variability than lab testing results, indicating the field testing may not be as reliable for checking the quality of the joint.
- The density gauges were more capable of accurately measuring the density of the interior portion the lane when using the cores as a baseline, but the accuracy decreased when measuring density of the joint. This is likely due to the fact that the joint density in the field was measured next to the joint, but the cores were taken on the joint.
- The safety edge joint technique without compaction on the wedge did not significantly improve the performance of the joint compared to the butt joint technique.
- Using the Surface type A or B mix and increasing the depth of asphalt pavement, statistically improved density of the joint.
- The survey indicated that more research needs to be conducted in South Carolina to determine the effectiveness of other joint construction techniques.

## **Recommendations**

Based on the results of this research, guidelines for best practices for longitudinal joint construction were developed. These best practices include the following categories:

### ***Planning and Design***

Practices relating to location of longitudinal joints and minimum pavement lift thickness and mix design.

### ***Mix Design***

Mix design considerations to facilitate quality joint construction.

### ***Mix Delivery***

Proper timing of material delivery to the job site and transfer to the paver.

### ***Joint Preparation***

Practices that ensure a straight and clean joint.

### ***Tack Application***

Guidance for application of tack coat to the joint to ensure proper bonding between lanes at the joint.

### ***Paver Operation***

Practices that help ensure appropriate density across the entire pavement width.

### ***Roller Operation***

Compaction practices that typically result in the highest joint density including roller type and patterns.

### ***Quality Control***

Practices to measure quality of the pavement at and near the longitudinal joint during construction.

### ***Training***

Communication and training programs for paving crews and QC personnel.

### ***Other***

Alternative practices to improve joint quality (e.g., sequential mill and fill).

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