Project Summary

Texas Department of Transportation

0-5320: Best Design and Construction Practices for Concrete Pavement Transition Areas

Background

The performance of pavement transition areas is at times a major issue for highway maintenance due to improper design or construction that could have been avoided. Districts that regularly design and construct concrete pavements have developed their own unique standards and practices for transitions and have learned from experience what the best practices are for their district. However, these practices are not yet formalized for all districts interested in building more concrete pavements. Information is needed to address the different types of issues that arise in everyday design related to support conditions, slab geometries, aggregate type, weather, and the traffic levels expected over the service life of the pavement.

To ensure a smooth transition between two different pavement sections and to minimize future maintenance issues, transition details are necessary for joining pavement sections that incorporate different design elements including pavement type and pavement structure. The design guidelines developed in this project cover most types of transitions that consist of a variety of joint combinations and slab configurations.

What the Researchers Did

A summary of the best practices for various concrete pavement transition elements was developed based on design objective, performance factors, current practices, and suggested design improvements. Simultaneously, field visits were conducted in selected districts to survey conditions of concrete pavement transitions relative to slab cracking and associated distresses that may be related to improperly restrained segments due to inappropriate jointing practices or other design-related factors.

Guidelines were created addressing key factors for successfully designing and constructing concrete pavement transitions. These question-and-answer guidelines lead the user through a step-by-step process to obtain the best design possible for a given design condition. The guidelines address load transfer at joints and other joint details, and transitions in base materials to avoid restraint problems that would induce cracking or misalignment problems. AutoCAD is utilized to generate detail sheets from the analysis performed and the conclusions developed. The guidelines provide explanations of the situations that apply to each of the detail sheets. Conceptual drawings and necessary details are provided to allow Texas Department of Transportation (TxDOT) personnel to specify the construction of pavement transitions. The drawings address slab dimensions, joint types, and layouts of joints.

Research Performed by:

Texas Transportation Institute (TTI),
The Texas A&M University System

Research Supervisor:
Dan Zollinger, TTI

Researchers:
Steve Hughes, TTI
Youn su Jung, TTI
Anol Mukhopadhyay, TTI

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What They Found

Research for this project focused on the measures to improve current transition design in terms of three general categories: transverse construction joints, longitudinal construction joints, and thickness transitions. It addressed general features such as joint details, tie bars, and dowels for each transition type; identified limitations; and discussed optimized configurations relative to deflection criteria.

Researchers found that the transition between continuously reinforced concrete (CRC) pavements should maintain uniformity of both support and cracking across the transition area, while the transition of CRC and jointed concrete (JC) pavement should allow the action of the joint reinforcement in the joint to isolate the movements of the CRC from the JC slab. The transition of CRC to asphalt concrete (AC) pavement should reduce the free edge deflection developing at an interior slab location with a concomitant reduction in subgrade stress. A bridge terminal transition should facilitate change from a pavement type to structure while maintaining a smooth vertical profile. Performance of this bridge terminal transition can often focus on the opening and closing of transition joints and their ability to maintain proper stiffness throughout these movements. The seamless design considered as a continuum structure rather than individual elements can be an improvement to remove transition joints that are often the source of maintenance issues.

Longitudinal transitions should maintain integrity and prevent excess widening of the longitudinal joint between adjoining lanes. Joint patterns that delineate adjacent lanes should be as continuous as possible to maintain uniformity of movement between longitudinal lanes. The ramp transition should tie the movements of the ramps with the movements of the main lanes, while the transition for intersections should promote compatibility of the movements between orthogonally arranged pavement segments included in the intersection. Since transitions between new pavement and existing pavement, main highway lanes and ramps, and overlay induce thickness change transversally or longitudinally, making gradual thickness change between two slabs or employing load transfer equipment could reduce this discontinuous transition problem and improve performance.

What This Means

The guidelines developed as part of this project provide a complete picture of the requirements for design of pavement transitions for a variety of pavement types and terminal configurations. It is recommended that implementation efforts be undertaken to advance key transition details outlined in this report so that districts will fully benefit from the findings of this project. Possible candidates for transitions are located at terminal bridge connections and concrete intersections.

For More Information:
Research Engineer - German Claros, TxDOT, 512-465-7403
Project Director - Hua Chen, TxDOT, 512-506-5846
Research Supervisor - Dan Zollinger, TTI, 979-845-9918

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Texas Department of Transportation
Research and Technology Implementation Office
P.O. Box 5080
Austin, Texas 78763-5080
512-465-7403

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