

# Summary of Findings Concerning Longitudinal Cracking on 16' Wide Ramps

Office of Pavement Engineering  
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**Abstract:** This paper summarizes the current practice in ODOT regarding the construction of rigid pavement ramps and recent problems reported with cracking.

**Ramp Details:** When concrete ramps are constructed, current practice in ODOT is to construct Non-Reinforced Concrete Pavement with 15 ft. transverse joint spacing. Ramp standards dictate a pavement width of 16 ft. with 6 ft. right side and 3 ft. left side shoulders with cross slope breaks at the shoulders.

**Defining the Problem:** The following questionnaire was sent out to all Districts. Each question is followed by the District responses:

1. *How many projects did you have concrete ramps on in your District?*

1. 2 small project and a US-30 project
2. 5: 281(00), 59(01), 280(01), 311(01), 493(01)
3. None
4. 1: 323(00)
5. 5 projects total
6. No Information
7. 2 projects
8. 2 projects
9. No Information
10. No Information
11. 3 Projects (451)
12. No Information

2. *Did any of these ramps have longitudinal cracking?*

1. No
2. No
3. N/A
4. Cracking occurred on 6 of the 8 ramps constructed.
5. 3 ramps from 2 of the 5 projects constructed, had longit. cracking.
6. 6 ramps from 2 projects
7. No at 16 ft. width, one crack where ramp poured 20 ft. wide in one slab.

8. No.
9. No Information
10. No Information
11. No
12. One project, one of four ramps (451)

3. *Approximately how many slabs cracked?*

1. N/A
2. N/A
3. N/A
4. ~50 slabs of ramp pavement.
5. 6 slabs, 14 slabs, and 15 slabs
6. 33, 35, 1, 2, 25, 10
7. N/A
8. N/A
9. No Information
10. No Information
11. N/A
12. 17 of 21 slabs

4. *Where did the cracks occur in the slab, i.e., center, edge?*

1. N/A
2. N/A
3. N/A
4. Located within 2 feet of the sawed longitudinal joint.
5. Center of slab
6. Center of slab
7. N/A
8. N/A
9. No Information
10. No Information
11. N/A
12. Center of slab

5. *When did the crack appear?*

1. N/A
2. N/A
3. N/A
4. Cracks were first observed 3 to 4 months after concrete placement.
5. Before opened to traffic. On one ramp, they progressed through repairs.

6. Uncertain in one project, within a couple of weeks in other project.
7. N/A
8. N/A
9. No Information
10. No Information
11. N/A
12. ~ 6 months later

6. *Were the shoulders poured separate from the 16' ramp?*

1. Yes
2. N/A
3. N/A
4. Shoulders were placed concurrently with ramp lane.
5. Shoulders were placed separately.
6. Yes in all cases.
7. Shoulders were poured separately.
8. No information
9. No Information
10. No Information
11. No Information
12. Placed separately

7. *How did you correct the crack?*

1. N/A
2. N/A
3. N/A
4. Cross stitching, epoxy injection, and HMWM sealer.
5. Removed slabs and replaced.
6. No repairs made to 5 ramps. A saw cut/ joint seal was used on 6<sup>th</sup> ramp.
7. The crack in the 20 ft. wide slab has not been repaired.
8. N/A
9. No Information
10. No Information
11. N/A
12. Remove and Replace is pending

8. *Did the contractor repair at his expense?*

1. N/A
2. N/A
3. N/A

4. No additional cost to the project.
5. ODOT's expense
6. No to 5 ramps, Yes to 6<sup>th</sup> ramp
7. N/A
8. N/A
9. No Information
10. No Information
11. N/A
12. Contractor has been instructed it will be at his expense.

**Current Practices in Other States:** An informal phone survey was made to several states to discuss their design and construction details regarding longitudinal cracking of ramp pavement. For reference, we allow a maximum of 18 ft. between longitudinal joints. We specify Jointed Plain Concrete Pavement with 15 ft. transverse joint spacing and tied shoulders. Our ramp section inside to out is 3'-16'-6'. The following summary of other states details is provided:

**Indiana** - Kumar Dave

Indiana DOT allows a maximum of 16 ft. between longitudinal joints. They specify Jointed Plain Concrete Pavement with 18 ft. transverse joint spacing and tied shoulders. Indiana's ramp section inside to out is 7'-16'-11'. They have experienced no problems with this design detail.

**Pennsylvania** - Dan Dawood

Penn DOT allows a maximum of 14 ft. between longitudinal joints. They specify Jointed Plain Concrete Pavement with 15 ft. transverse joint spacing and tied shoulders. Pennsylvania's ramp section inside to out is 4'-8'-8'-8'. They have experienced no problems with this design detail.

**Illinois** - Dave Lippert

Illinois DOT allows a maximum of 16 ft. between longitudinal joints. They specify Jointed Plain Concrete Pavement with 15 ft. transverse joint spacing and tied shoulders. Illinois' ramp section inside to out is 4'-16'-8'. They have experienced problems with this design detail and have tried a ramp section of 4'-8'-8'-8' in a few locations, with no problems.

**Michigan** - Curtis Beech

Michigan DOT allows a maximum of 14 ft. between longitudinal joints. They specify Jointed Plain Concrete Pavement with 15 ft. transverse joint spacing and tied shoulders. Michigan's ramp section inside to out is asphalt-4'-12'-asphalt. They have experienced no problems with this design detail. The reason for the asphalt shoulder is for clear demarcation of the ramp lane. The longitudinal joint located in the wheel path is a concern. By placing the ramp pavement in concrete and the shoulders in asphalt, they expect a safer ramp during rain and snow events.

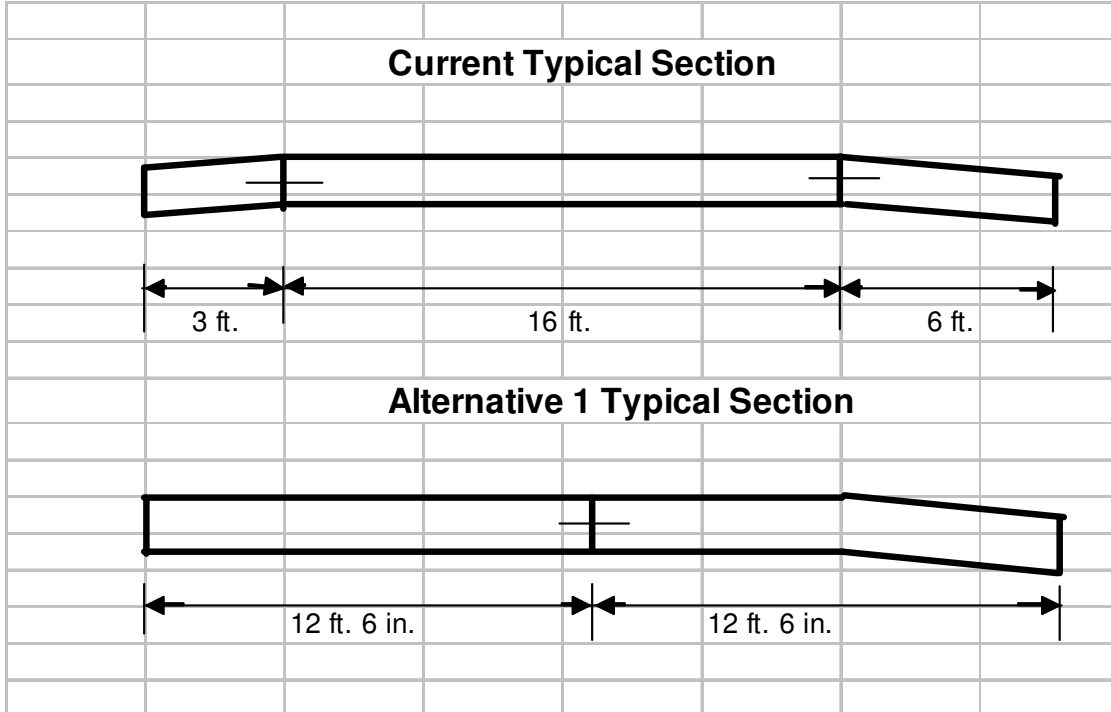
**Kansas** - Andy Gisi

Kansas DOT allows a maximum of 14 ft. between longitudinal joints. They specify Jointed Plain Concrete Pavement with 15 ft. transverse joint spacing and tied shoulders. Kansas' ramp section

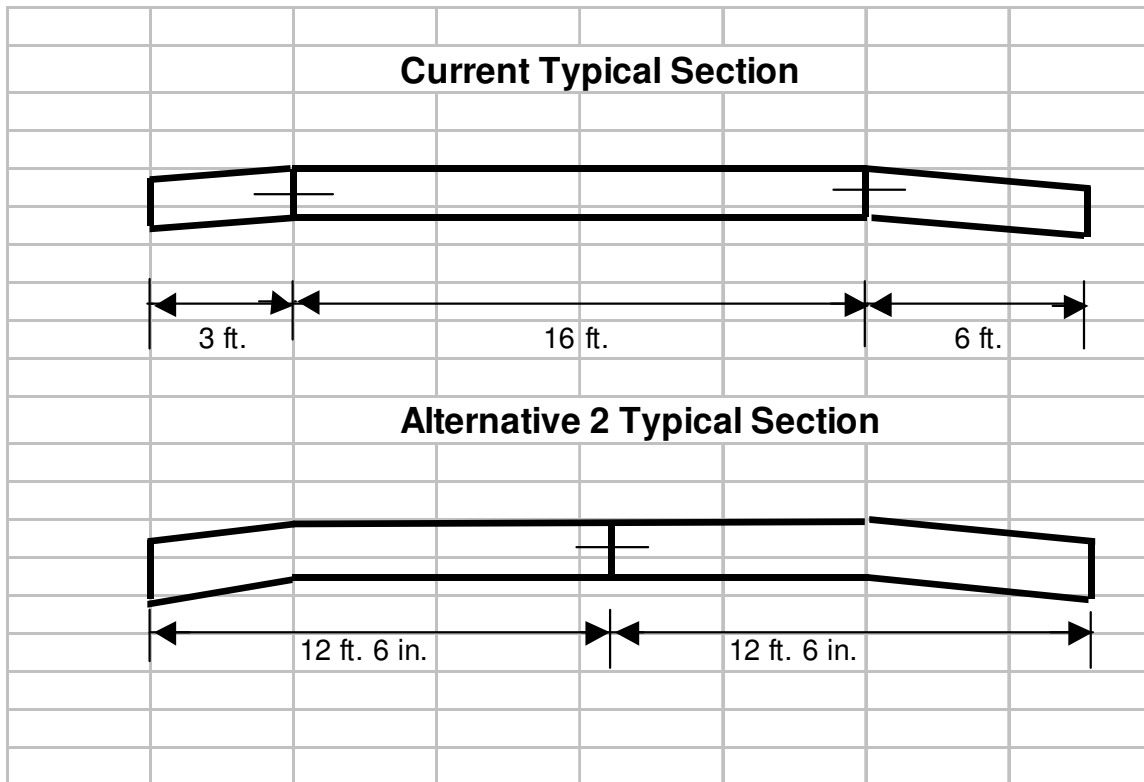
inside to out is 8'-12'-10'. They have experienced no problems with this design detail. However, previous ramp section was similar to our current detail and they did experience problematic longitudinal cracking. The Kansas DOT reported that they ignore the requirements for cross slope breaks at the shoulders, and are then able to stripe the ramp at 16 feet, with the longitudinal joint in the inside wheel path of the ramp.

**Summary:** A change is needed in Ramp construction to reduce the potential for longitudinal cracking. Although a longitudinal crack does not appear in all ramps, there are enough examples of problems in Ohio as well as surrounding states, to justify a design change. OPE recommends the following alternatives be considered:

**Alternative 1:** Construct the ramp with no break at the 3' shoulder, and a standard break at the 6' shoulder but place a single joint at the center of the ramp. This alternative requires only one longitudinal joint and one break, allowing for less paver setup, less tie bars, and less sawing. By requiring only one break in the 25 feet of pavement, the contractor would be more likely to pave the ramp in one pass, which speeds construction. The ramp can be repaired in the future using part width construction while maintaining traffic. If the degree of break changes along the length of the ramp, this alternative may not be constructable. This alternative would require approval of Roadway Engineering Services and changes to ODOT's geometric standards.



**Alternative 2:** Provide the same detail as Alternative 1 but require the breaks at both shoulders. This alternative follows current geometric standards and requires only one longitudinal joint, allowing for less tie bars and less sawing. The ramp can be repaired in the future using part width construction while maintaining traffic. If the degree of break changes along the length of the ramp, this alternative may not be constructable.



**Alternative 3:** Provide the same cross section as is currently specified, with an additional longitudinal joint in the center of the ramp. The ramp can be constructed with current methods. The ramp can be repaired in the future using part width construction while maintaining traffic.

