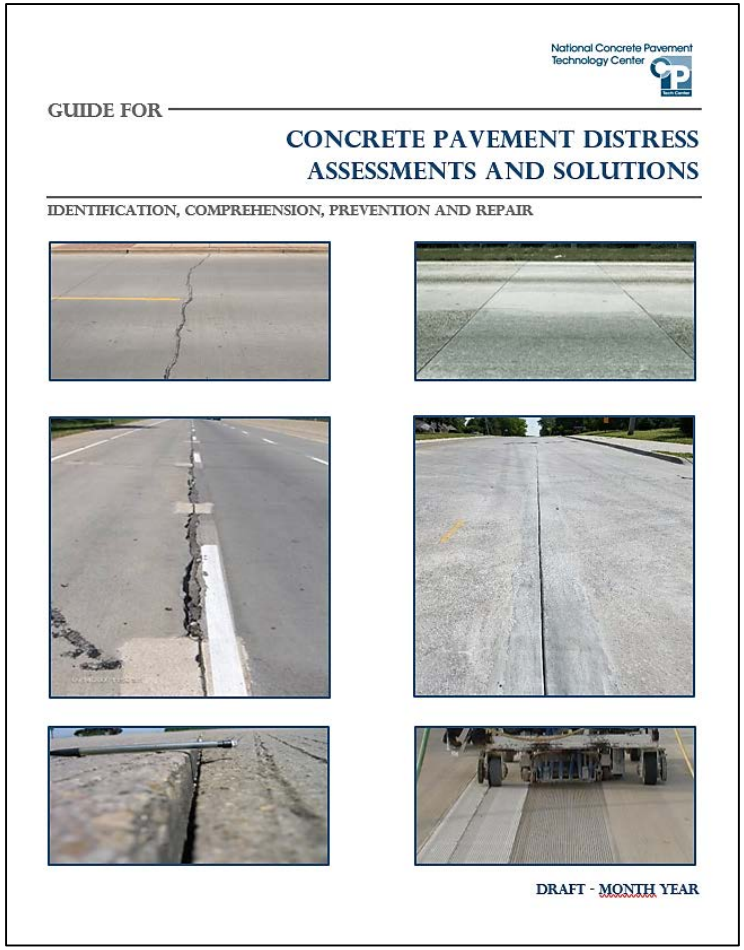
Guide for Concrete Pavement Distress Assessments and Solutions



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The Purpose of the Guide

The Guide is intended to answer the following questions:

- What distress is present?
- What caused the distress
- How can its reoccurrence be prevented?
- What are the options for repair?

Audience

- Pavement Design Engineers
- Field Engineers
- Construction or Maintenance Staff
- Asset and Pavement Management Engineers
- Consulting Engineers

Guide Details

- Work began in February 2016
- Guide includes 3 Divisions
- Guide includes 19 chapters
- Chapters average 17 pages in length

Divisions

Division I – Full Depth Concrete Pavement

Division II – Concrete Overlays

Division III – Testing and Support Conditions

Division I (Full Depth Concrete Pavement) Chapters

1. Introduction
2. Surface Defects
3. Surface Delamination
4. Material Related Cracks
5. Transverse/Diagonal Cracking
6. Longitudinal Cracking
7. Corner Cracking
8. Spalling
9. Faulting
10. Joint Warping and Curling
11. Blowups
12. Continuous Reinforced Concrete Pavement

Division II (Concrete Overlays) Chapters

13. Introduction
14. Concrete Bonded over Asphalt/Composite (BCOA)
15. Concrete Bonded Overlay Concrete (BCOC)
16. Concrete Unbonded over Asphalt/Composite (UBCOA)
17. Concrete Unbonded over Concrete (UBCOC)

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Division III (Testing and Support Conditions) Chapters

18. Subgrades and Bases
19. Laboratory and Field Testing

Typical Chapter Layout

I. Description

II. Severity

III. Identification of Causes

IV. Evaluation

- Causes
- Prevention

V. Distress Treatment and Repairs

VI. References

Spalling Subjects

Deflection Spalling From Heavy Vertical Loads

Early Saw Joint Raveling

Chloride Penetration

Dowel Bar Misalignment

Spalling Subjects

Freeze Thaw Damage

Saturated Joint Backer Rod Damage

Saturated Joint with Unsound Aggregate

Incompressible Joint Damage

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B. Joint Compression

Transverse and longitudinal joints are designed and constructed in JPCP to allow slab expansion and contraction and prevent cracking. However, there are certain factors that can lead to compression stresses at the face of the joint which can cause spalling. These are as follows:

Incompressibles: One purpose of sealing joints and cracks in concrete pavement is to reduce infiltration of moisture and incompressible materials for improved pavement performance. Incompressible material fills the joint or crack openings and create excessive stresses that may cause spalling.

Figure 11 – Image of incompressible damage to concrete joint (Photo credit CP Tech Center)

Figure 12 – Image of pavement cross-section showing incompressibles causing spalling

1. **Causes:**

   Incompressible materials, such as small aggregates can enter into unsealed joints causing excessive stresses along the joint face of the concrete when the joint contracts (Figure 11 & 12). The result can be fracturing of the joint near the top of the slab, particularly with transverse joints. Joints become wider over time (particularly the first five years) as the panels shrink. Intrusion of aggregates into the joint has also occurred in longitudinal joints near the outside edge of the slab with granular shoulders. As concrete pavement ages, the slab is subjected to continued shrinkage. This horizontal movement from contraction and expansion with temperature and moisture fluctuations, along with the vertical impact of repeated traffic loads, can cause excess compressive stress. The result can be micro cracking which eventually turns into spalling.

2. **Prevention:**

   There are basically two ways to prevent incompressibles from entering an unsealed joint.

   Joint sealing: Joints with saw cuts approximately ¼ inch wide may be sealed using bituminous material, asphalt rubber, silicone, or preformed compression joint seal materials during initial construction (depending on climate region). Sealing on a regular basis can decrease pavement damage. Joint resealing will typically be needed every 10 to 15 years depending on the material type, climate, and pavement conditions. It is often performed along with other pavement preservation work, including spall repair, individual slab replacement, and grinding.

   Narrow saw cuts: Some states specify thin (1/8±1/16 inches) saw cuts to help prevent incompressibles from entering the joint. When incompressibles are less than 1/8 inch wide they typically do not result in excessive stresses along the joint face and spalling.

Summary of Causes and Prevention of Distress Table

		Prevention or Mitigation			
Distress in Concrete Pavement	Causes	Design	Material Selection	Construction	Preventative Maintenance
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•