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# CONCRETE PAVEMENT GUIDE

## PART 3: PRESERVATION STRATEGIES

### CHAPTER 340 – GRINDING AND GROOVING

*This chapter provides an overview for restoring functional surface characteristics using diamond grinding and grooving.*

#### **340.1 PURPOSE AND DESCRIPTION**

Grinding is used as a preventive maintenance strategy to remove roughness from faulting or other sources, enhance concrete pavement surface friction characteristics, and improve safety. In snowy environments, grinding can remove rutting from surface attrition due to studded tires, tire chains, or other factors. Gang-mounted diamond saw blades (see Figure 340-1) are used to shave off 1/8" or more from the existing concrete surface, creating a level, quiet finished surface with longitudinal texture (see Figure 340-2).

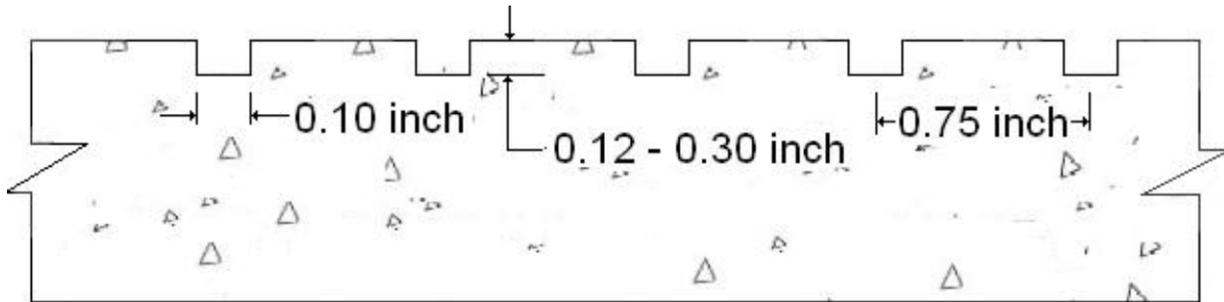


**Figure 340–1: Diamond saw blade**



**Figure 340–2: Diamond ground surface**

The same technique and equipment is used for grooving, which is a separate preservation strategy from grinding used to reduce hydroplaning and traffic collisions. Grooving provides escape channels for surface water by cutting deep channels using power-driven, self-propelled machines with 0.10" wide diamond blades spaced at  $\frac{3}{4}$ " on centers to cut grooves from 0.12 to 0.30" deep in the longitudinal direction (see Figures 340-3 and 340-4).



**Figure 340-3: Grooved pavement detail**



**Figure 340-4: Grooved pavement surface**

## **340.2 CRITERIA FOR USE**

### *340.2.1 Grinding*

#### Applications

Grinding improves pavement smoothness and ride quality. Roughness can develop from structural distresses such as cracking or spalling, or from faulting, which is a preliminary indicator of structural deficiencies (see Section 110.2.1). Pavement is considered to have poor ride quality when the international roughness index (IRI) is  $> 170$  inches/mile. Grinding is more cost effective for treating faulting  $> \frac{1}{4}$ " over 50% of the pavement management segment.

For new JPCP or CRCP construction in lane replacement or widening projects, the entire adjacent lane width should be ground before widening if  $IRI \geq 90$  inches/mile to establish a smooth profile for concrete paving equipment.

In some situations, grinding should be used in combination with other preventive maintenance strategies such as spall repairs, dowel bar retrofit (Ch. 330) to treat poor load transfer < 70%, or individual slab replacement (Ch. 320) when cracking extent is < 10%. For rutting > ¼” due to concrete durability issues, grinding can be used in combination with specialized surface hardener treatments (see Ch. 350) or HMA overlays (Ch. 370).

#### Limitations

Grinding may not be the most effective strategy if cracking extends > 15% throughout the segment. Rehabilitation alternatives such as lane replacement (Ch. 400), crack, seat, and HMA overlay (Ch. 410), and unbonded concrete overlay (Ch. 420) should be considered. See Chapter 100 for more information about strategy selection.

Grinding can remove faulting and rutting to restore smoothness, but if the failure mechanism is not repaired the effects can be short-lived. If the pavement has structural or material deficiencies, such as slab cracking or rocking; inefficient load transfer; or reactive, soft, or polishing aggregates; grinding will not repair or improve these defects and repair strategy combinations should be considered and analyzed.

Grinding can maintain smoothness for up to 15 years of service life, but should be used with discretion when IRI  $\leq$  170 inches/mile because it reduces pavement thickness, which can affect long-term pavement performance. Depending on existing thickness, pavements may be ground up to 2 or 3 times without significantly affecting the structural capacity of the pavement structure. However, grinding is not advisable on concrete pavement thinner than 8” with heavy vehicle loading because reduced pavement thickness will lead to pavement rupture and cracking.

#### *340.2.2 Grooving*

A grooved surface is expected to remain effective for at least 10 years. The life of grooving is reduced where there is exposure to tire chains and studs. Grooving longevity varies inversely with the traffic volume and gross weight of vehicles with tire chains. Concrete with better durability or abrasion resistance properties improves grooving effectiveness.

Similar to grinding, grooving should only be applied to pavements with sound structural and functional characteristics and where requested by district maintenance or traffic safety engineers.

### **340.3 OTHER CONSIDERATIONS**

#### *340.3.1 Order of Work*

Diamond grinding is usually performed in conjunction with other repairs, and the order of work is important for pavement quality. Slab subsealing and jacking (Ch. 300), spall repairs (Ch. 310), individual slab replacement (Ch. 320), and dowel bar retrofit (Ch. 330) should be performed before diamond grinding to ensure uniform final smoothness and surface friction properties. Crack and joint sealing (Ch. 360) should be performed after grinding is completed to avoid residue accumulation.

Prior to widening or lane replacement, complete all repair work in the adjacent lane. If the adjacent lane has an IRI  $\geq$  90 inches per mile, grind the entire lane width before widening to establish a smooth profile for concrete paving equipment.

#### *340.3.2 Concrete Pavement Grooving and Grinding Residues*

Grinding and grooving generate concrete slurry residue from cooling water and ground concrete particles that must be removed and disposed of according to the guidance in [Design Information](#)

[Bulletin 84](#). The large, motorized grinding and grooving machines have internal vacuums that collect the slurry, which must be removed and disposed of by the contractor according to the requirements in Section 13 of the Standard Specifications (see Figure 340-5).



**Figure 340-5: Grinding residue collection**

### 340.4 PLANS, SPECIFICATIONS, AND ESTIMATING

#### 340.4.1 Plans

The location and limits of grooving or grinding that is paid separately should be shown on the project plans, including lanes adjacent to widening where IRI > 90 inches/mile. The typical cross sections should also indicate the grinding depth.

#### 340.4.2 Specifications

Grooving specifications are in Section 42-2 of the Standard Specifications. Grinding specifications are in Section 42-3. Table 340-1 lists grinding and grooving related standard special provisions (SSPs) for the 2010 and 2015 Standard Specifications and some usage instructions.

**Table 340-1: Grooving and Grinding 2010 and 2015 SSPs**

SSP	Notes
<a href="#">42-1.03B</a>	Use for concrete residue from grooving and grinding when onsite drying or disposal within the highway is allowed.
<a href="#">42-3.03A</a>	Use if grinding locations are not specified in Section 42-3.03A or shown, such as at bridge decks or weigh-in-motion scales.

For new JPCP or CRCP construction under Standard Specification Section 40, including reconstruction, lane replacement, widening, and unbonded overlays, corrective grinding for localized IRI > 60 inches/ mile is included in the pavement work, so no additional grinding item is required for those surfaces.

Grinding is an optional combination strategy for spall repairs and individual slab replacement, but grinding is required for dowel bar retrofit work and paid separately.

### 340.4.3 Cost Estimating

Initial costs can be estimated using historical prices bid by Contractors and other information available on the Division of Design cost estimating website at <http://www.dot.ca.gov/hq/oppd/costest/costest.htm>. Available unit cost data should be adjusted based on project-specific factors such as location, quantity, contractor availability, and construction constraints such as lane availability and environmental issues.

The cost of grinding or grooving is paid by area at the contract unit price per square yard (see Table 340-2). Grinding and grooving is continuous along a traffic lane for the entire lane with, including lane lines. Due to the high mobilization costs associated with the large, specialized grinding equipment the unit cost will increase for projects with staged construction or if multiple setups are required to accommodate project conditions. Grinding cost does not include the water pollution control program, pavement marker or traffic striping removal, or joint seal replacement.

Grinding is not included in the pay item for spall repairs, individual slab replacement, or dowel bar retrofit and must be paid separately.

**Table 340–2: Grinding and Grooving Item Codes**

<b>Item Code</b>	<b>Description</b>	<b>Unit</b>
420102	Groove Existing Concrete Pavement	SY
420201	Grind Existing Concrete Pavement	SY