IGGA
International Grooving & Grinding Association
Your Pavement Preservation Resource® since 1972

dowel bar retrofit

Rebuilt to Last

DBR Restores Concrete Roadways to Structurally Sound, Smooth Conditions

DOWEL BAR RETROFIT (DBR) is a Concrete Pavement Preservation (CPP) tool that restores load transfer across joints and cracks by installing dowel bars linking the adjoining slabs. By linking slabs, the traffic load is shared, preventing differential vertical movement of the slabs at the joints and cracks, thereby eliminating the formation of faults or stepoffs. It is these faults that cause the rough ride and wheel slap that is sensed when traveling on a concrete roadway that has lost its ability to transfer load from one panel to the next.

DBR, in conjunction with other CPP practices such as diamond grinding, can return a concrete roadway to a structurally sound, smooth condition that can exceed the smoothness and noise values attained at the time of construction.

» BACKGROUND

In 1992, the Washington State Department of Transportation (WSDOT) constructed a DBR test section to determine the appropriateness of DBR and diamond grinding to restore the functionality of concrete pavements by providing a smooth, structurally sound, rut-free surface. Due to the success of the test section, the first large scale DBR project was constructed on I-90 in 1993. Since that time, WSDOT has rehabilitated well over 300 miles of existing concrete pavement by employing DBR followed by diamond grinding. According to WSDOT research, the average construction costs for DBR was approximately 16 percent less (2006 dollars) than the typical cost of a four-inch asphalt overlay, which is the minimum recommended overlay depth for rehabilitating a faulted concrete pavement. The success realized by WSDOT has promoted widespread acceptance of the process and as a result, 20 states and one Canadian province have completed numerous successful projects.

» BENEFITS OF DBR PROJECTS:

LONG LASTING	When properly constructed, DBR lasts 15 to 20 years.
ENVIRON-MENTALLY FRIENDLY	DBR maintains the existing surface with very little new material required. Also, keeping the pavement light reduces the heat island effect as these pavements reflect more light, which in turn reduces roadside lighting requirements.
TRAFFIC FRIENDLY	Projects can be completed during off-peak hours with short single lane closures.
FLEXIBLE	DBR only has to be applied to the lanes that show distress, whereas other treatments require the entire roadway to be treated.
EASY TO BID	Its simple design process allows projects to be designed and advertised in a fraction of the time required for competitive processes.
SAFETY	Diamond grinding enhances surface friction and safety. In Wisconsin, researchers found that the overall wet weather accident rate for diamond ground surfaces was only 57 percent of the rate for non-ground surfaces.
SMOOTH	Diamond ground roadways typically have a smoothness level equal to or better than original construction.
COST EFFECTIVE	DBR is considered cost effective since it is only applied to the faulted lane, while an asphalt overlay would be required on all lanes and shoulders, significantly increasing costs unnecessarily. When utilizing the asphalt overlay option, guide rails, overhead signs and bridges may need to be raised, increasing overall project cost.

» THE PROCESS: INVESTIGATION

Before completing any work, the owner must determine that the existing pavement has the structural integrity to warrant DBR. A good DBR candidate is a roadway in which a majority of the pavement slabs exhibit a sound surface and provide significant remaining load carrying capacity. Roadways that have extensive spalling of the surface, with special attention paid to joint and crack locations, require further evaluation. Extensive deterioration may be an indication of larger problems within the slab not visible from the surface. Cores should be taken at these locations to determine the level of deterioration. Excessive bottom-up deterioration and spalling will inhibit bonding and may lead to premature DBR failure.

The DBR must be placed on sound concrete, which is a requirement for a successful and long-lasting installation. Working joints or cracks that have opened up 1 inch or more at the surface require further investigation. Areas demonstrating this bottom-up deterioration below the pavement surface should be considered as full-depth repair candidates. Areas that demonstrate heavy spalling at joints and cracks but minimal bottom-up deterioration should be repaired utilizing partial depth repairs prior to DBR installation.

Corner cracking may be an indication of voids under the slabs. Further testing with ground penetrating radar or other devices may be required to determine if undersealing should be included as a part of the project.

» INSTALLATION

To begin, diamond saw blades mounted on a gang saw capable of forming a minimum of three slots at a time are used to saw-cut the perimeter of the slots. The slot dimensions should be based on the length and diameter of the bar being used, allowing enough room for the aggregate within the mix to move freely around the bar and chairs. The most common slot width is 2 ½ inches when using a 1 ½ inch diameter dowel bar. The slots should be placed on 1-foot centers, centered over the transverse joint or crack and parallel to the centerline with three or four slots per wheel path.

Next, the team must remove the existing concrete within dowel bar slots utilizing light-weight jackhammers. To clean the slot, the team will utilize sandblasting to remove saw slurry and other debris from the slot. They then seal the existing joint or crack with a caulking compound and place the DBR assembly (bar, cap, coreboard and chair) into the slot centered over the joint or crack. Prior to backfilling, all surfaces of the slot are moistened. Non-shrink patching material is placed and consolidated into the slot and cured according to manufacturer recommendations.

Diamond grinding is then used to provide a safe, smooth and quiet pavement surface followed by a joint resealing operation to prevent moisture and incompressibles from entering the repair area.

For more information on DBR and diamond grinding, as well as a complete set of industry recommended specifications, please visit **www.igga.net**.

WHERE TO CONSIDER DBR
Pavements that exhibit load transfer below 60 percent.
Joint and crack faulting between 1/8 to 3/4 inch.
Transverse cracks that are reasonably tight with minimal spalling. If applied early, diamond grinding costs may be greatly reduced.
Pavements that were constructed as non-doweled jointed pavements can have DBR applied to prevent future faulting as an effective **pavement preservation** treatment.

WHERE NOT TO CONSIDER DBR
Pavements that demonstrate extreme deterioration at the joints or cracks require coring and joint sounding to determine if the pavement has the structural integrity to support the DBR process.
Pavements that exhibit severe signs of chemical deterioration such an ASR or D cracking should be examined closely before considering DBR.
Under-designed pavements that are cracking due to loading may require structural enhancement through the use of an overlay.
Pavements with significant base deterioration and/or erosion should be addressed with undersealing prior to applying the DBR process.

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ABOUT IGGA

The International Grooving & Grinding Association (IGGA) is a non-profit trade association founded in 1972 by a group of dedicated industry professionals committed to the development of the diamond grinding and grooving process for surfaces constructed with Portland cement concrete and asphalt. In 1995, the IGGA joined in affiliation with the American Concrete Pavement Association (ACPA) to form what is now referred to as the Concrete Pavement Preservation Partnership (IGGA/ACPA CP3). The IGGA/ACPA CP3 now serves as the lead industry representative and technical resource in the development and marketing of optimized pavement surfaces, concrete pavement restoration and pavement preservation around the world.