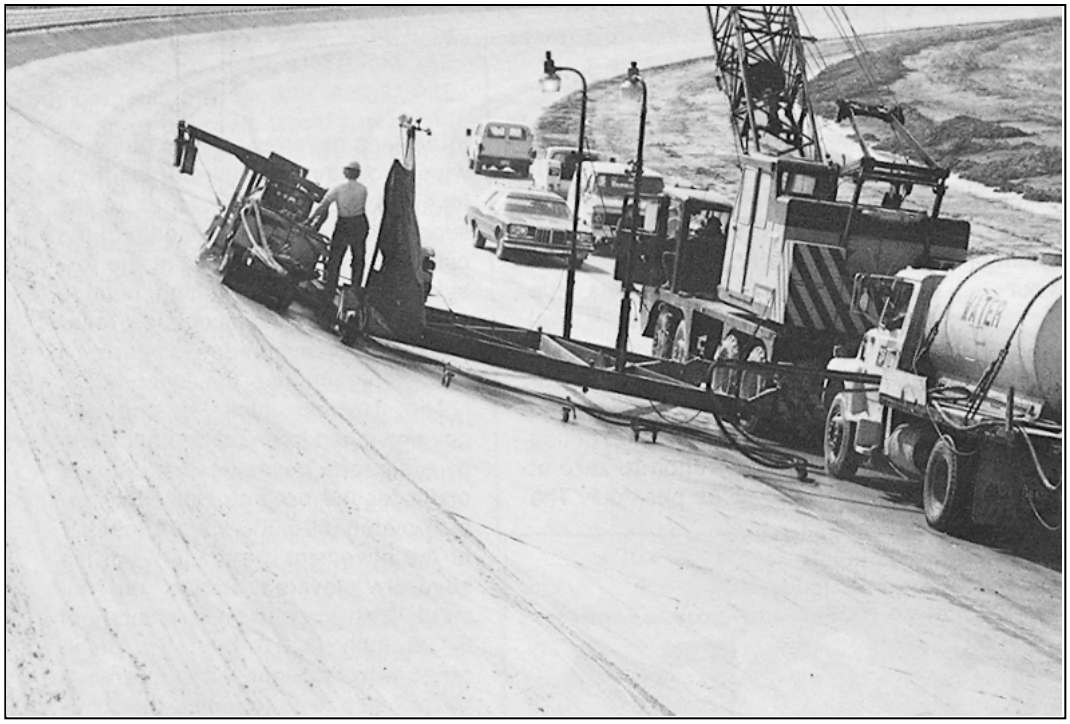
Diamond blades smooth new concrete surfaces and renovate old ones

The necessity for grinding is no longer bad news

If you can't correct it in any other way, you may have to grind it." It was not long ago that this advice about how to make a rough surface on new concrete smooth enough to meet tolerances was generally received as bad news. Now things have changed. Members of the International Grinding and Grooving Association (IG&GA) are routinely smoothing out new pavements. But they have gone further. They use grinding as an alternative to resurfacing when restoring and updating old pavements.



The work train used on the Ohio test track consisted of a concrete planer, a crane to which it was attached by steel beams, a water tank and a trailer carrying a generator to power the electric motor on the planer

An example of restoration

To correct roughness produced by faulting of the joints, members of Concrete Grinding and Grooving Inc. of Walnut Creek, California, used a bump cutting machine in 1970 to give new life to 8.3 miles of old two-lane concrete pavement. Twenty feet long and weighing 30,000 pounds, the machine smoothed a 6-foot swath of pavement in one pass with 360 diamond-tipped blades. The rehabilitated pavement was incorporated into the new I-460 route between San Jose and Warm Springs.

The bump cutter, powered with twin 276-horsepower diesels and running on crawler tracks, trimmed ⅛ to ¾ inch off the surface of the concrete slab and completed the project within a time limit of 50 days. Interference with traffic was minimized by grinding at night and simultaneously using a vacuum system that cleaned the pavement by sucking up the slurry produced by grinding.

In this and many other projects nationwide IG&GA members are restoring old rough-riding pavements to current smoothness tolerances by grinding with circular diamond-tipped blades. The cost is less than that for resurfacing with new paving materials. The diamond-bladed bump cutters make corrections automatically by sensing the profile of the existing pavement and electronically adjusting depth of cut to bring the surface into conformity. The blades plane high spots but do not come into contact with pavement areas which meet the specified surface tolerance.

Unusual repair— Ohio test track

Bump cutters are being used with increasing frequency to smooth out parts of pavements that do not meet

* Numbers in parentheses are references to the metric equivalents listed with this article.

specified smoothness tolerances. The cutters are often used on bridge approach slabs, which are traditionally of complicated design and difficult to construct, and to correct deviations in bridge decks.

A not-so-typical job was the smoothing of the 7.5-mile oval test track at the Ohio Transportation Research Center northwest of Columbus last year. The two ends of the track are steeply sloped to reduce gravitational acceleration to zero at a speed of 140 miles per hour. The three-lane pavement on the tangents widens out through spiral transitions to 47 feet and the slopes of the super elevations in the middle of the curves range from 0.127 at the low side to 0.800 at the high outside safety lane. At these outside locations the pavement edge is nearly 18 feet higher than the inner edge.

The 10-inch thick concrete pavement had been placed full width by a slipform paver designed especially for the project. However, approximately 500,000 square feet of the pavement, particularly on the severely elevated slopes, did not meet the specified tolerance of 0.125 inch in 10 feet. These areas were brought within tolerance by grinding with circular diamond-studded blades.

A major problem in this operation was the steepness of the slopes, which prevented the lubricating oil from circulating properly within the engine of the grinding machine. For this reason the machine used on the slopes was modified to operate from an electric motor. A standard machine was employed on the straightaways.

On the straightaways a swath 36 inches wide was planed in a single pass. For the slopes, the electrically powered machine planed smooth an area 20 inches wide. Work there was done with a small head because the slope changed one degree every 20 inches.

The work train for grinding the elevated slopes consisted of the grinding machine, a crane, a water tank and a trailing truck which carried the generator for powering the electric motor. The grinding machine was held on the steeply banked pavement by a rail system attached to beams. The rails in turn were connected to the outriggers of a truck-mounted hydraulic crane. As the machine moved higher on the curve, more beams were added to the holding system. Weights on the outside of the grinding machine provided a counterbalance for holding the machine on the cut.

The project was successfully completed by Transportation Safety Systems Inc. of Columbus, Ohio, a member of the IG&GA.

Surface restoration

The first surface rehabilitation of old roads by pavement grinding was done 10 years ago on the San Bernardino Freeway east of Los Angeles. Since then millions of square yards of old roads in all regions of the country have been smoothed by this method.

Only critical areas are treated. By contrast, when pavements are resurfaced by the overlay method the total surface area of lanes and shoulders must be treated. Grinding saves 50 percent or more of this cost. Another significant advantage of rehabilitation by grinding is that traffic control costs are lower because the work is confined to one lane at a time and done during off-peak traffic hours. All water and residue are removed by vacuuming.

In some cases rehabilitation requires removal and replacement of unsound concrete. The grinding process is economically sound if no more than 25 percent of the existing pavement requires such replacement. Permanence of the smoothness depends upon the stability of the pavement foundation. On the earliest projects (where the pavement was supported by stabilized subbase) grinding appears to have afforded permanent restoration, judged on the basis that some work is now 10 years old. Surface roughness on pavements with unstable foundations has recurred within a few years after grinding.

Smoothing new pavement surfaces

Grinding a surface smooth serves as an alternative to removal and replacement of out-of-spec pavement or penalty payments by the contractor.

Current state highway department specifications for pavement smoothness are generally in agreement with those of the American Association of State Highway and Transportation Officials (AASHTO), which call for deviations of no more than 0.125 inch in 10 feet. However, many highway engineers consider this specification inadequate for detecting long dips and humps in a highway. Increasingly, individual states are specifying surface smoothness in terms of inches of roughness per mile as determined by a profilometer. This roiling machine traverses the pavement and records the accumulation of surface deviations outside of tolerance as inches per mile. In the original application of this concept, 7 inches per mile was established as the maximum surface deviation for an acceptable pavement.

Grooving

Another major undertaking by members of the IG&GA is the improvement of skid resistance by grooving of highway and airfield pavements for greater safety. The same machines are used with different spacings of saw blades.

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