



Mix in Slag

BY TIMOTHY R. MURPHY

We work in an evolving industry whose members are aware of the need for continual quality improvement. Quality asphalt pavements begin with the aggregates. During the past decade, the asphalt industry has increased its successful use of reclaimed asphalt pavement (RAP), warm-mix asphalt (WMA), reclaimed asphalt shingles (RAS), and ferrous, iron and steel slag (slag). According to the National Asphalt Pavement Association (NAPA), "Cost savings have driven some of these mix-design changes, but the adoption of sustainable practices by the asphalt industry are also a source of pride." Ensuring the excellent performance

of asphalt pavements while increasing the recycled content, and maintaining safety, is the successful measure of these green initiatives.

As a virgin product the initial use of iron and steel slag meets the requirements of green initiatives; it eliminates the use of additional mineral resources in construction applications. That includes asphalt pavements.

Slag is a sustainable product that can be recycled and reused multiple times. Today, approximately 8 million tons of steel slag is used annually in the United States. The primary applications for steel slag in the United States are as a granular base or as an aggregate material in construction

applications. Federal Highway Administration (FHWA) publication (FHWA-RD-97-148) gives some origin, management options, market sources, highway uses, processing requirements and material properties. Additionally, steel furnace slag's primary use is as premium asphalt aggregate.

Once slag is in the mix, it makes a good recycled component. RAP of any nature, be it limestone, dolomite, crushed gravel or slag, comes from the crushing and screening of excavated or cold milled asphalt pavements. This processed RAP contains high quality, well-graded aggregates that have been coated with asphalt. In 2009, the Illinois Department of

Transportation and the Illinois Center for Transportation at the University of Illinois published their findings concerning the expansive characteristics of RAP used as base materials. Their conclusions led to the acceptance of the use of steel slag RAP as pavement base course aggregate and the allowable use of steel slag in all asphalt mixes—base, intermediate and surface.

GET YOUR MATERIALS

When agencies engage contractors to build asphalt projects, quite often these days they are built as Percent Within Limits (PWL) projects. With this change to payment schedules, the aggregate supplier has become even more actively engaged in the bidding and building processes. Consistency of the aggregate materials is paramount to success. Material suppliers won't be paid for an inconsistent product because, as FHWA states for a quality assurance program, "confidence that a product or facility will perform satisfactorily in service" is the basis of payment.

Material found to be non-compliant won't be allowed for use in the roadway. The agency won't pay the contractor. The contractor won't pay the aggregate producer.

Before an aggregate is considered for use on an agency project, whether it's for an aggregate base or one of the asphalt layers, the quality of the mined materials must go through rigorous agency evaluation to determine a variety of qualitative measures, including:

- safety—friction testing
 - angularity—fracture testing
 - hardness—LA abrasion test
 - durability—soundness
 - absorption—specific gravity
- Slag meets and exceeds these quality measures time after time.

FUTURE SUSTAINABILITY

As we continue to improve our design, manufacturing and construction processes for asphalt paving, new opportunities present themselves. Re-using materials multiple times is a bustling industry that has been growing since the first asphalt recycling

project in the 1970s. The FHWA policy on the reuse of materials states, "...recycled materials should get first consideration in materials selection...and...Restrictions that prohibit the use of recycled materials without technical basis should be removed from specifications."

Today there is a renewed effort to grow the asphalt recycling program in the United States because

it is economically practical, environmentally prudent and an engineered product. Agencies are committed to increasing the use of RAP, WMA, RAS and recycled slag successfully through proper engineering and production controls. As endorsed by the FHWA, volumetric, aggregate and asphalt characteristics must meet or exceed the current specification requirements.

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Typically, to be considered for use by the agency, reprocessed material must exhibit the desired engineering characteristics of consistently satisfying specification requirements, providing an acceptable level of performance, being economically competitive with available materials, and being consistent, much like aggregate from a quarry and asphalt from a refinery. Consistency comes

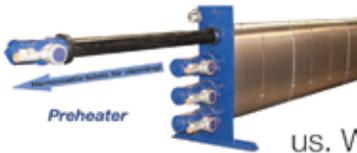
from knowledge of crushing and screening practices, building stockpiles and loadout. Most experienced contractors realize that establishing a top size of 1/2-inch assists in accomplishing these goals. These specification requirements and sizing tips will guide the future development and enhancements of the recycling specifications across the nation, leading to expanded use.

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PAVING CONTRACTORS USE SLAG

While blast furnace slag and steel slag have multiple uses in the construction industry as a whole, the asphalt industry's interests are quite focused. Here are the ways you could find yourself saving on costs, incorporating more "green" and upping quality control with slag.

According to the National Slag Association, air-cooled, blast furnace slag is used as an asphalt aggregate. The pelletized and granulated blast furnace slags are used for road base. Steel slag is also used as an asphalt aggregate and for road base.

The Federal Highway Administration (FHWA) Greenroads[™] Manual suggests blast furnace slag, coal boiler slag, nonferrous slags and steel slag for use in granular bases. If you need to place an embankment or fill, FHWA lists nonferrous slags again.

REACH YOUR DESTINATION

The process of quality control and increasing the use of sustainable material in our products is part of the journey to improving the quality of pavements for agencies and our fellow travelers. Over the past 30 years I've worked with slag aggregates from around the world. My professional experience has included working with agencies, contractors, consultants, material suppliers, associations, and academia. Slag aggregates are successfully used on roadways and airfields including interstates, heavy duty intersections, and intermodal facilities. Slag is a sustainable material that is paving the way to a future filled with quality pavement and environmental responsibility and accountability from our industry. 

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