

# Slag aggregates in asphalt

Building  our future 

# Carbon reducing slag aggregates for asphalt

Tarmac slag aggregates provide a high quality alternative to primary aggregates for use in a range of asphalt applications. They have inherent benefits which can play a critical part in delivering sustainable construction projects, providing the built environment today while managing resources for tomorrow.

## High performance

Quality controlled in manufacture, steel slag aggregates are consistent in quality, durability and have specific high performing engineering properties such as 'skid resistance'.

## Versatile

By way of modern, state of the art processing methods, Tarmac slag aggregates have present day applications in nearly every facet of the construction industry including: ground granulated blast furnace slag (GGBS), lightweight hydraulic fill, masonry, structural concrete, asphalt, granular base aggregate, railroad ballast, mineral wool, roofing, soil conditioning and glass production.

## Quality alternative

Slag aggregates provide a viable, cost effective alternative to traditional primary aggregates. Utilisation of the plentiful, premium supply helps to conserve the UK's mineral reserves.

## Carbon saving

As a by-product from the iron and steel industry, slag aggregates are regarded as 'carbon neutral'. Even when processed, blast furnace slag aggregates can have more than 40% less embodied carbon (t/CO<sub>2</sub>e) than equivalent primary aggregates.

## Responsibly sourced

All of our slag aggregates are certified to BES 6001, giving customers the confidence that materials are sourced and manufactured in a responsible way. This certification also helps customers achieve extra points under BREEAM, Code for Sustainable Homes and CEEQUAL schemes.

Up to  
**42%**  
carbon  
saving

Based on cradle-to-gate carbon footprint calculations (kgCO<sub>2</sub>e/tonne) for blast furnace slag aggregate from Port Talbot and limestone aggregate from Cornelly (nearest) Quarry.




# Manufacturing sustainable aggregates

With over 50 years experience of processing slag into premium construction materials, Tarmac has the knowledge and expertise to produce a diverse range of high quality materials that meet all the requirements of today's demanding construction industry.







A key strategic supplier to the iron and steel making industry we have unrivalled knowledge of the benefits these aggregates deliver and utilise slag products to help limit our impact on the environment, driving advantages and sustainable performance where other suppliers use primary aggregates.

#### **Blast furnace slag (BFS)**

Produced in liquid form, blast furnace slag is a by-product of the refining of iron process. The majority of Europe's annual production of about 23.5 million tonnes is processed into aggregates for concrete, asphalt, construction and GGBS. In the production of iron, the blast furnace is charged with iron ore, flux stone (limestone and/or dolomite) and coke for fuel. Two products are obtained from the furnace: molten iron and blast furnace slag. Leaving the furnace in a molten state with temperatures exceeding 1,500°C, there are three ways of processing the slag: air cooled, pelletised and granulated. Each of these methods produces a unique material with many different uses.

#### **Steel slag**

Steel cannot be produced in a Basic Oxygen Furnace or in an Electric Arc Furnace without making its co-product, steel slag. This is made when separation of the molten steel takes place from impurities in the furnace. The production of steel slag takes place in liquid state during the steel making process. This liquid slag is a complex solution of silicates and oxides which solidifies during cooling into steel slag.

Blast furnace and steel slag is successfully used as a surface dressing aggregate in the UK and fully meets the requirements of EN 13043 standard.



# Applications

An ideal aggregate for base, binder and surface course asphalt products, the inherent properties in steel slag are assessed in accordance with the requirements of the European standard EN 13043 and can produce asphalt materials exhibiting superior properties to those manufactured with primary aggregate.

Steel slag produces an aggregate that:

- Provides excellent resistance to deformation of ruts in surface course asphalt
- Ensures long life of road surfaces
- Is hard wearing – providing a durable material that will not wear away
- Resists polishing, providing safe riding surfaces for the whole life of the road.

Used for surfacing domestic driveways as well as heavy industrial areas and the heaviest trafficked roads including SHW 942 thin surfacings, steel slag aggregates are approved by the Highways Agency on the trunk road network (including motorways) for all traffic levels and site categories where aggregates with a minimum polished stone value (PSV) up to and including 60 are required in HA Standard HD36.

## SteelMac proprietary asphalts

A proprietary asphalt product range produced by Tarmac using steel slag. SteelMac takes advantage of the high durability of steel slag compared to standard aggregate products. The products combined with advanced asphalt design and bitumen technology, offer application solutions for all industrial locations.

- SteelMac AC 10 – car park areas, low-medium stress areas
- SteelMac AC 10 HD - high stress areas
- SteelMac 10 HT - higher speed areas requiring superior surface texture
- SteelMac Mastershield – fuel resistant.

# FAQs

## What are slag aggregates?

By-products of the steel and iron industries, slag aggregates have many valuable properties that can be used in construction and infrastructure projects.

## What advantages do slag aggregates offer over other aggregates?

Steel aggregates have a high abrasion and crushing resistance for road applications; air-cooled blast furnace products bond particularly well to cement and bituminous binders. They also offer significant environmental benefits such as the re-use of secondary materials and avoidance of the need to quarry natural aggregates.

## Are blast furnace and steel slags covered by a European Standard?

Yes, where applicable. Slag aggregates produced by Tarmac are supplied as CE marked products under the Factory Production Control Process of BS EN ISO 9001:2008 for the production of products to BS EN 12342-Aggregates for Unbound and Hydraulically Bound Mixtures, BS EN 13043 Aggregates for Unbound Bituminous Mixtures and BS EN 12620-Aggregates for Concrete.

## What is meant by ‘falling’ of air-cooled blast furnace slag?

One of the minerals (beta dicalcium silicate) present in some crystalline blast furnace slags can undergo a transformation in its crystalline structure on cooling that can cause disintegration of the product in a phenomenon known as ‘falling’, ‘dicalcium silicate unsoundness’ or ‘lime unsoundness’. Chemical equations and microscopic tests are intended to exclude slags that might contain this compound from use as aggregate. When it does occasionally occur, ‘falling’ happens only during cooling and will not affect slag aggregates in service.

## How will the products be affected by the aggregates tax?

In April 2002 taxation was introduced on primary aggregates sold for construction purposes. Both blast furnace slag and steel slag are exempt.

## What about expansion of slag aggregates?

Steel slag and old bank slags may undergo volumetric expansion in the presence of water. The risk of damaging expansion occurring when using steel slag produced in modern processes is minimised by a combination of careful production control and processing. Air-cooled blast furnace slag is non-expansive.

## Why does steel slag expand and how are problems with expansion of steel slag avoided?

Steel slag contains oxides of calcium and magnesium (lime and magnesia) that expand upon reaction with water. Expansion issues in service are avoided by process control measures which subject the steel slag to long periods of natural weathering in exposed stockpiles before use.

As part of this quality protocol the steel slag’s volumetric expansion is tested during the weathering process at monthly intervals using in-house developed test methods and measured against set limits, with a minimum of three months weathering per windrow.

The quarantined windrows of steel slag are released for sale when expansion test data complies with internal control limits to ensure fitness for purpose as part of the CE and FPC requirements of BS EN 13242, the testing for volume stability of steel slag using BS EN 1744-1 19.3 is carried out at a minimum of six monthly intervals.

## Does air-cooled blast furnace slag exhibit any volumetric expansion?

No. ‘Falling’ of blast furnace slag should not be confused with expansion.

## What effects can slag aggregates have on groundwater quality?

Unbound steel slag in contact with groundwater initially increases the pH-value of groundwater to about 11-12 but this ‘first flush finite’ effect diminishes once lime and magnesia have been washed from the surface. Similarly, blast furnace slag increases the pH-value and may also de-oxygenate stagnant groundwater. Adherence to QPA/Environment Agency guidance minimises these risks. More details are in CIRIA Report 167.

We have achieved a BES 6001 ‘Very Good’ rating across our entire product range.



Awarded to





Portland House Bickenhill Lane  
Solihull Birmingham B37 7BQ

Building **o**ur future

**TARMAC.COM**

©2020 Tarmac Trading Limited. 'Tarmac' and the 'circle logo' are registered trademarks.