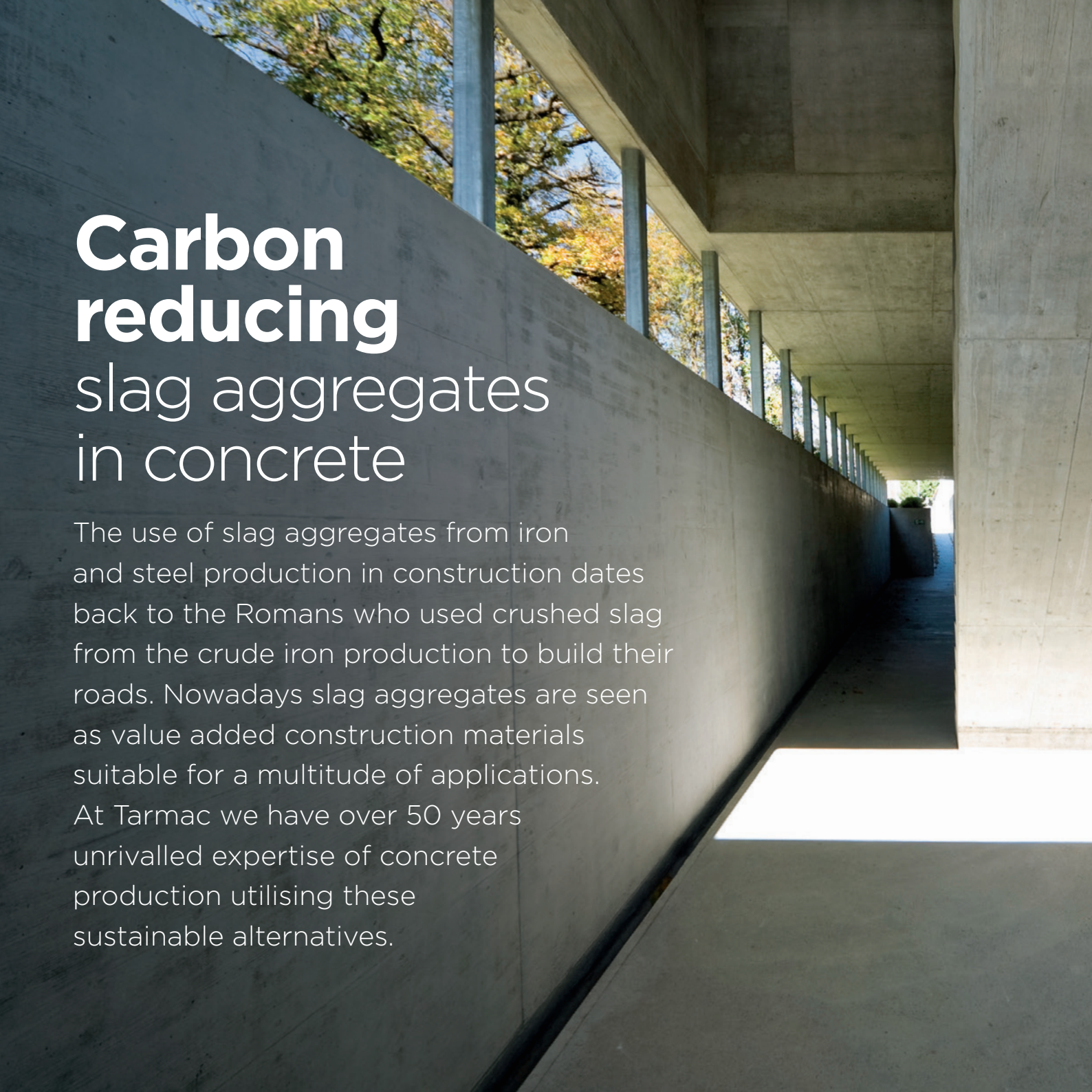
TARMAC

Slag aggregates in concrete



Carbon reducing slag aggregates in concrete

The use of slag aggregates from iron and steel production in construction dates back to the Romans who used crushed slag from the crude iron production to build their roads. Nowadays slag aggregates are seen as value added construction materials suitable for a multitude of applications. At Tarmac we have over 50 years unrivalled expertise of concrete production utilising these sustainable alternatives.

Benefits

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.

High performing

Tarmac slag aggregates are manufactured under a robust quality system for a wide range of construction applications. Unlike quarried aggregates, slag is produced in a batch process with the chemistry of the raw materials being tightly controlled which leads to an aggregate which is more predictable and consistent.

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_2e) 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.

Manufacturing sustainable aggregates

As part of the iron and steel making process there is a need for raw materials to be mined and quarried from the earth. Tarmac, the UK's largest aggregate supplier, has over four decades of experience in processing slag, the industry's by-product, into valuable construction materials.

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 advantage and sustainable performance where other suppliers use primary aggregates.

Blast furnace slag (BFS)

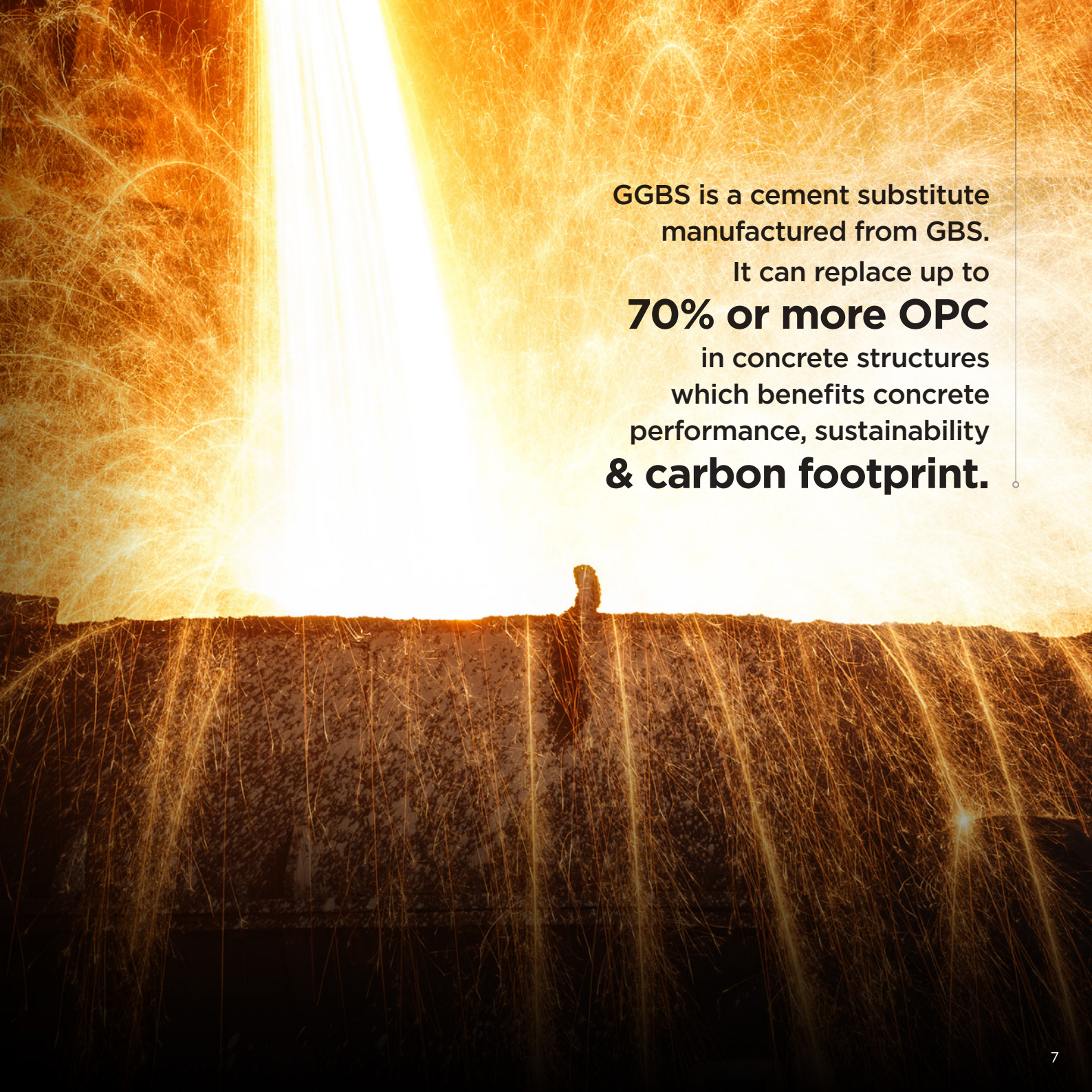
Produced in liquid form, blast furnace slag is a by-product of the refining of iron process. The majority of Europe's annual production of about 23.5 million tonnes is processed into aggregates for concrete, asphalt, construction and GGBS. In the production of iron, the blast furnace is charged with 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 two ways of processing the slag: air cooled and granulated. Each of these methods produces a unique material with many different uses.

Granulated slag

Granulated blast furnace slag (GBS) is manufactured by rapidly chilling blast furnace slag with water which forms a glassy granular material with latent-hydraulic properties. It is used for cement, concrete, mortar, grout and aggregates.

Granulated blast furnace slag has been used as a sustainable replacement for the fine aggregate in ready-mixed concrete and other concrete products.

The most common use for GBS is GGBS. To produce GGBS, the GBS is dried and ground to a fineness similar to that of Ordinary Portland Cement (OPC).



GGBS is a cement substitute manufactured from GBS.

It can replace up to

70% or more OPC

in concrete structures which benefits concrete performance, sustainability

& carbon footprint.

Applications

Slag aggregates are now often preferred in specification as they are recognised to be a valuable material supporting versatile performance qualities.

Concrete solutions

GGBS

Primarily used in the manufacture of concrete products as a cement replacement. It has been used in cement combinations and as a cementitous component in concrete for many years and the use of GGBS will continue to help meet sustainability demands.

Aggregate

Blast furnace slag, peletised slag and granulated slag can be used as an aggregate in concrete replacing primary aggregates in a number of applications.

Mortar

GGBS used as a cementitous component in mortars enhances workability and can allow further working time for the bricklayer.

Grout

Grouts containing GGBS offer control of temperature rise during hydration and in areas of aggressive conditions.

Slag can be used as a fine aggregate replacement in both grout and mortar in most applications.

Road making

As well as offering improved performance in dressing layers of asphalt, slag aggregates can also be used in base layers of roads. Unground GBS is a robust alternative as a base layer material in road construction, known as slag bound macadam (SBM).

Quality controlled and offering high performing engineering properties, slag aggregates can be used in a wide range of construction projects including bridges, roads, buildings and rail ballast.

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.

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