



a little book of
Concrete

Why precast concrete?

A guide to one
hundred advantages

**If concrete
were to be
invented
now it
would be
hailed as
a miracle.**

It is the most commonly used building material in the world; yet we normally take what it does for granted – too often this means that much of what concrete offers is overlooked.

This booklet re-examines what factory-made precast concrete can offer the architect, the engineer, the client, the financier, the insurer and all those with an interest in a sustainable built environment.

Precast concrete covers all factory-made concrete products from mass produced blocks, paving and roof tiles, to massive customised bespoke units.

We hope you enjoy reading about the 100 advantages of precast.

If you wish to know more contact: info@britishprecast.org

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Fit for purpose



Withstands everyday use.

All structures and buildings are subject to everyday wear and tear and this is where the use of precast concrete really makes sense. Its hard, tough surface is extremely resistant to everyday impacts and abrasion.



Weather-proof.

Precast concrete is resistant to rain penetration and wind-blown debris. It can withstand many winters of freeze-thaw cycles, endure extreme temperatures and does not degrade with exposure.

Quiet...

As a dense material, precast elements in a building make for a peaceful lifestyle. Privacy and effective sound reduction are ensured, which makes precast and masonry an ideal choice for residential buildings in particular.



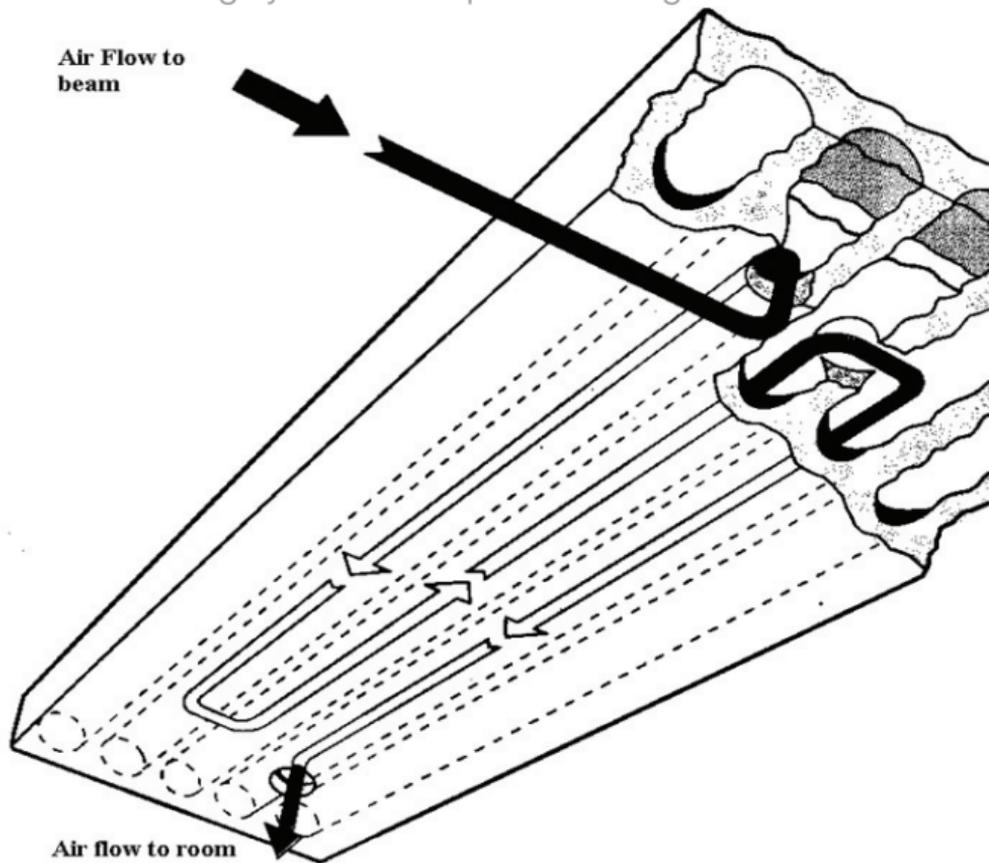


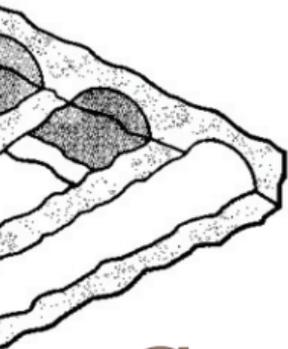
...yet acoustically versatile.

Because precast can be moulded to any shape, size and texture it can be used to deflect or absorb noise. This makes it a good acoustic host for music but also an effective sound barrier alongside busy roads.

Thermally efficient.

Concrete acts as a thermal sink. With adequate ventilation this can reduce cooling loads and avoid overheating in summer. In winter it can be used with passive solar design to reduce heating demand. In some buildings you can see precast doing both.





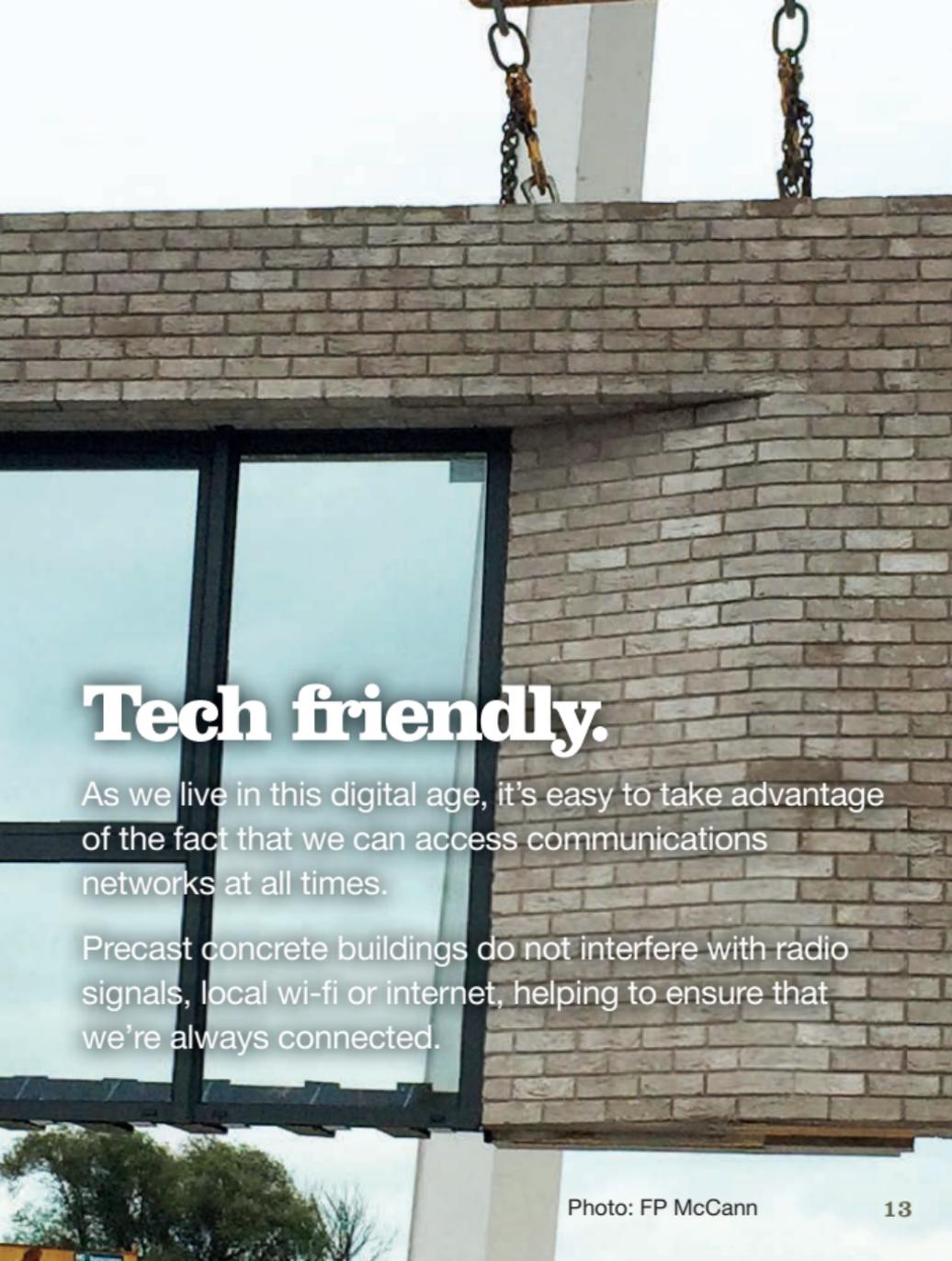
Comfortable.

The thermal performance can be enhanced by active cooling using air or fluid. The hollow cores in precast floors can be used or pipes can be cast into slabs. The concrete surface radiates warmth in winter and in summer is a cool surface providing comfort.

A large precast concrete panel with two windows is being lifted by a crane. The panel has a brick-like texture and is suspended by yellow chains. The background shows a clear sky and some construction equipment at the bottom.

Plug and play.

Precast concrete can carry pre-installed services and fixtures, whether this is electrical wiring, plumbing or even windows! Services can be cast within a precast element or panels and can include connection plates ready to receive heating and lighting fittings on site. This makes both construction and maintenance easy.



Tech friendly.

As we live in this digital age, it's easy to take advantage of the fact that we can access communications networks at all times.

Precast concrete buildings do not interfere with radio signals, local wi-fi or internet, helping to ensure that we're always connected.



Protects against fire.

Precast is fireproof. It protects against the spread of fire between rooms or properties and it cannot catch fire, burn or drip molten particles. In tests, concrete performs consistently well in fire, often requiring only minor repairs to make good.





Does not melt.

Just like other concrete and masonry materials, precast concrete does not melt in high temperatures. This means that there is no need for protective paints or special insulation. This ensures that fire resilience does not degrade over time and is not reliant on maintenance.

Offers a safe haven...

The structural strength and dense nature of precast concrete makes it an ideal choice for safe or panic rooms in houses.

...and keeps buildings secure.

Whether for homes, businesses or prisons, precast is secure against break-ins and break-outs; it can't be easily cut open and is extremely resistant to impact.



Rot proof, fungus proof and mildew resistant.

Precast is dense, tough and simply will not fall prey to these common enemies of organic materials. Specifying precast means having confidence that a structure won't rot away.



Inedible to termites and rodents.

Organic building materials make the best food for creatures like these and with climate change affecting the flora and fauna in Europe, termites are now threatening the UK. Precast concrete is resistant to attack from termites and other infestations such as rats and mice.



Keeps water in...

Precast is an excellent material for containment, whether this is for mains storage or domestic rainwater collection. The strength and resilience of precast has been proven for these and other applications such as wastewater treatment works.



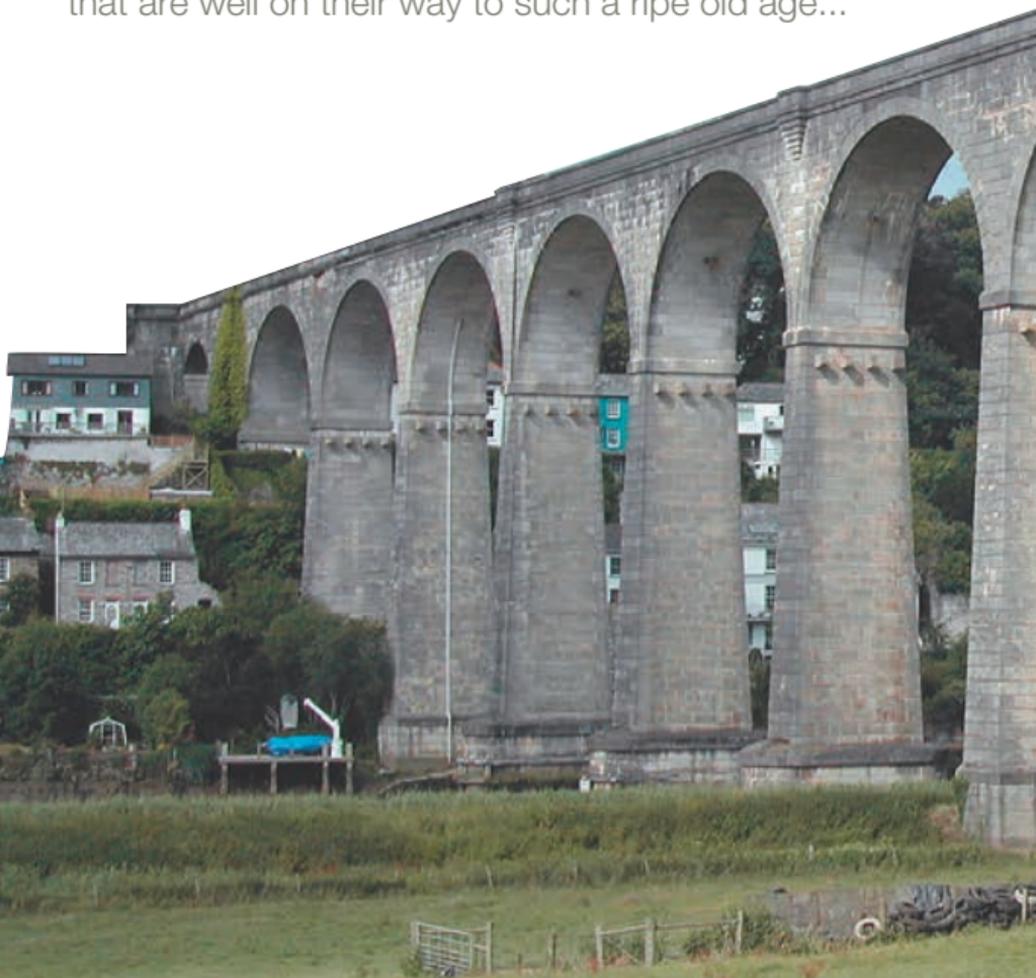
...and out!

In other situations we need to keep water out; precast can be used for flood protection, river and coastal barriers to protect against inundation from high tides and storms. On a domestic scale, precast is also used for basements where below ground living needs robust and waterproof construction.

Structures for today and tomorrow

Durable...

Concrete buildings from hundreds of years ago are still in use today. Some say concrete can last up to 2000 years and there are certainly many structures around that are well on their way to such a ripe old age...



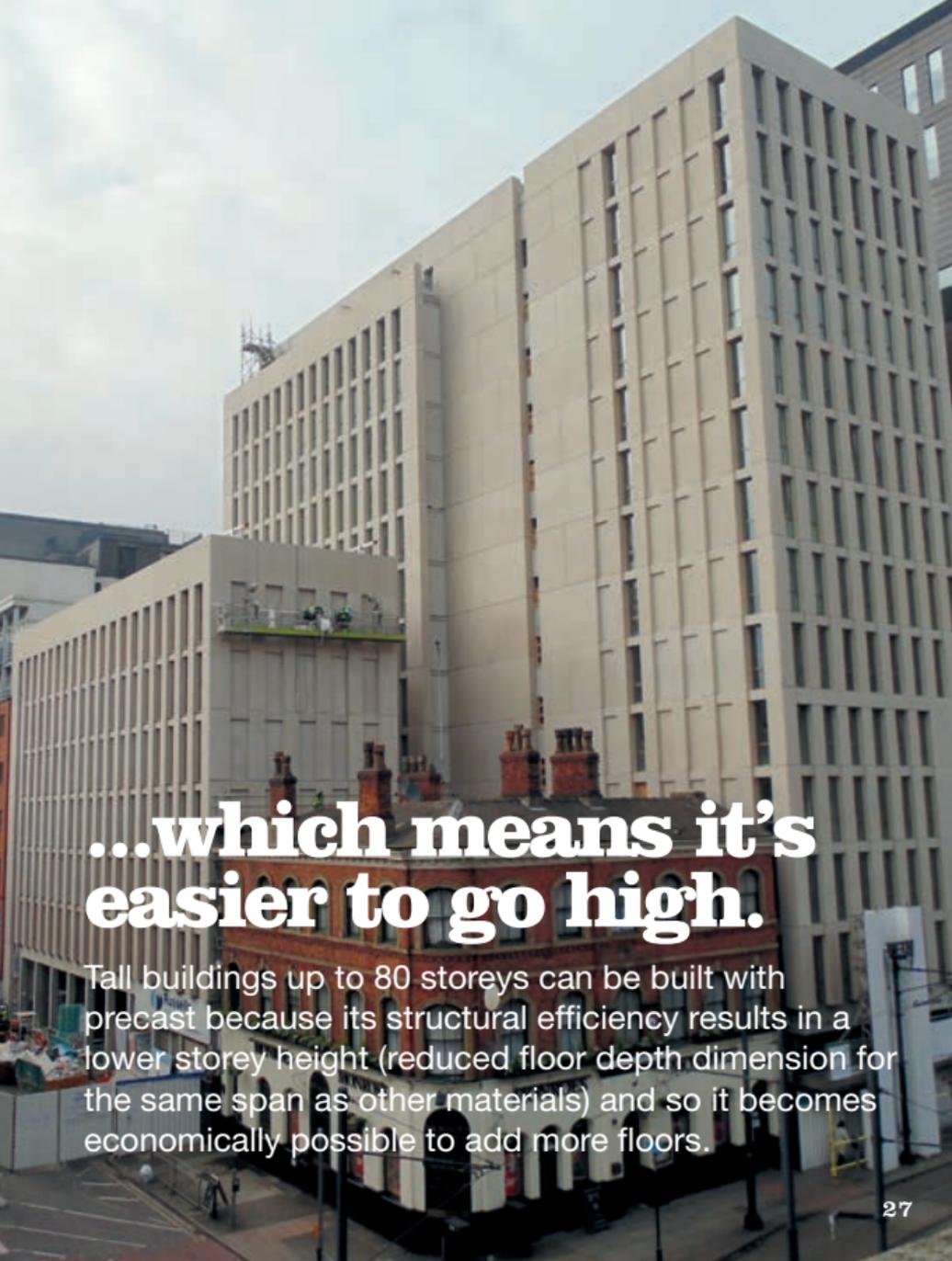


**...and it gets
stronger every day.**

Precast concrete goes on increasing in strength for hundreds of years after it is cast. What's more, it can be relied upon to perform consistently year after year.

Structurally efficient...

Quality in design and production means precast units are extremely structurally efficient; they have a high span/depth ratio and EC2 makes provision for reduced partial safety factors for precast, in acknowledgement of the controlled production environment.



**...which means it's
easier to go high.**

Tall buildings up to 80 storeys can be built with precast because its structural efficiency results in a lower storey height (reduced floor depth dimension for the same span as other materials) and so it becomes economically possible to add more floors.

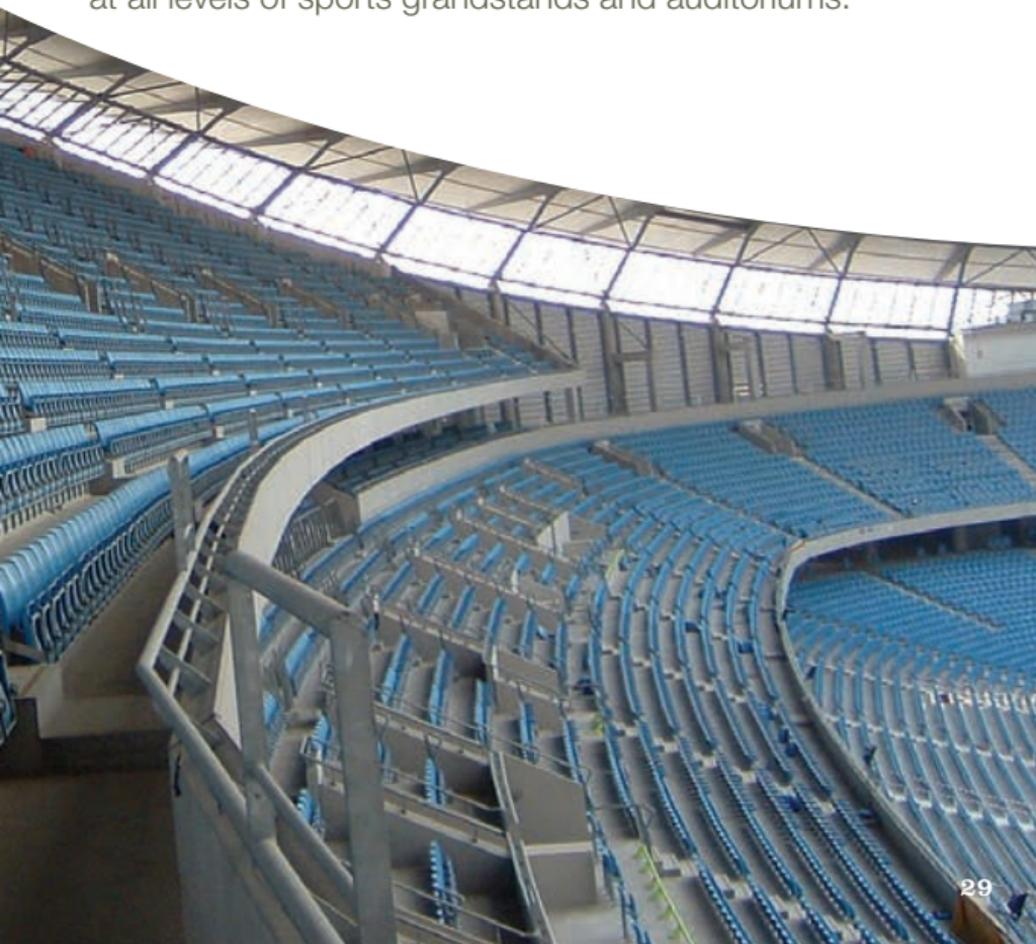


High margins of design safety.

The strength and resilience of precast structures means that extra safety is always built in, often over and above what is required by design codes. In some cases, this benefit could be a life-saver.

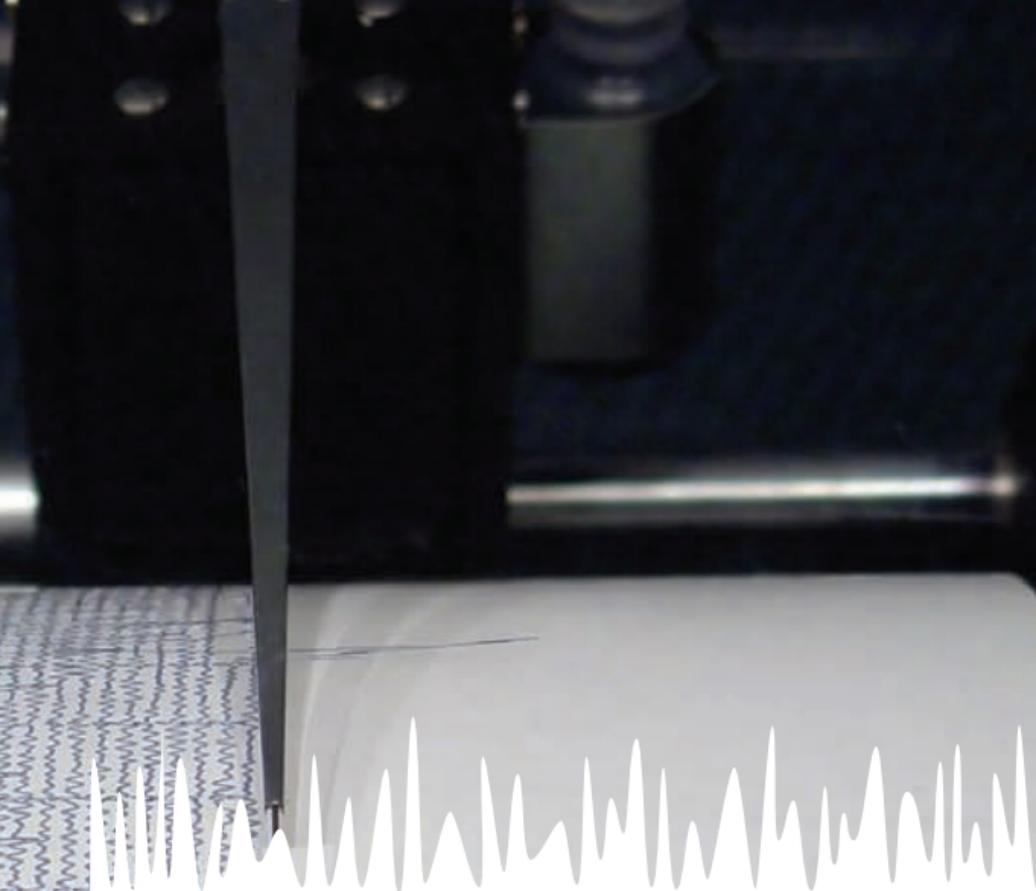
Dampens vibration.

Structures like sports stadia and concert halls are particularly susceptible to vibration from noise and crowd movements, which in some cases can be disturbing to people using the facility. Due to its mass, precast concrete can be used to dampen these vibrations and can be seen at all levels of sports grandstands and auditoriums.



Intelligent.

Sometimes it may be helpful to know how a structure is performing over time. Microchips can be embedded in precast concrete to log data on movement or stress. Engineers can easily 'read' the data on the chip by swiping a reading device across the surface of the element.



Can indicate distress.

In particularly sensitive applications, these same microchips can send a signal to indicate excessive movement or impact. This is useful for example for bridges and tall buildings.



Can achieve high strengths.

In tall structures and in civil engineering applications high strength concrete is often desirable, and precast units can be cast to meet such demands.



Can support heavy loads.

Where point loads or high bearing stresses are likely then the dense, high quality concrete in a precast element is absolutely critical. Industrial applications, utilities and power generation all provide good examples of this.



Does not rust.

Precast concrete is corrosion resistant and can therefore be used with confidence in very aggressive environments. For example, precast concrete piers are resistant to the inter-tidal anaerobic attack experienced in some marine environments. Furthermore, tight quality controls in production means that the cover to reinforcement bars is ensured.

Resists chemical attack.

For hardstanding, aprons and other paved areas, precast concrete paving blocks are an ideal choice because they are resistant to fuel and oil spills, they can also be replaced easily and are widely available.



Absorbs impacts.

Precast concrete can resist massive impacts, even from jet planes, so, it is more than able to cope with applications like barriers for traffic separation and protection from terrorist attack – the precast units absorb the impact from vehicles and slow them down.





Protects against blasts.

In extreme applications, blast protection from explosions may be a necessary design criteria. Sufficiently reinforced and thickened precast units can perform a critical role here.



“Flies through the air with the greatest of ease”

Not all precast is heavy and tough; its ability to span clear distances without propping means that precast balconies and bridges can cantilever elegantly.



Less stress relaxation.

Keeping in shape is important and precast is no exception. Some materials 'relax' over time, which can be difficult to account for in design; precast maintains its shape, size and properties.



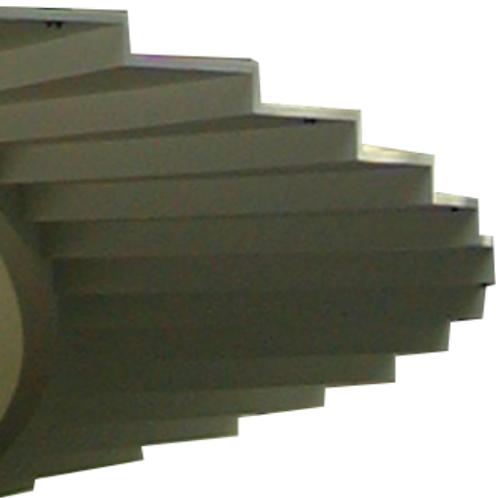


Can be thin...

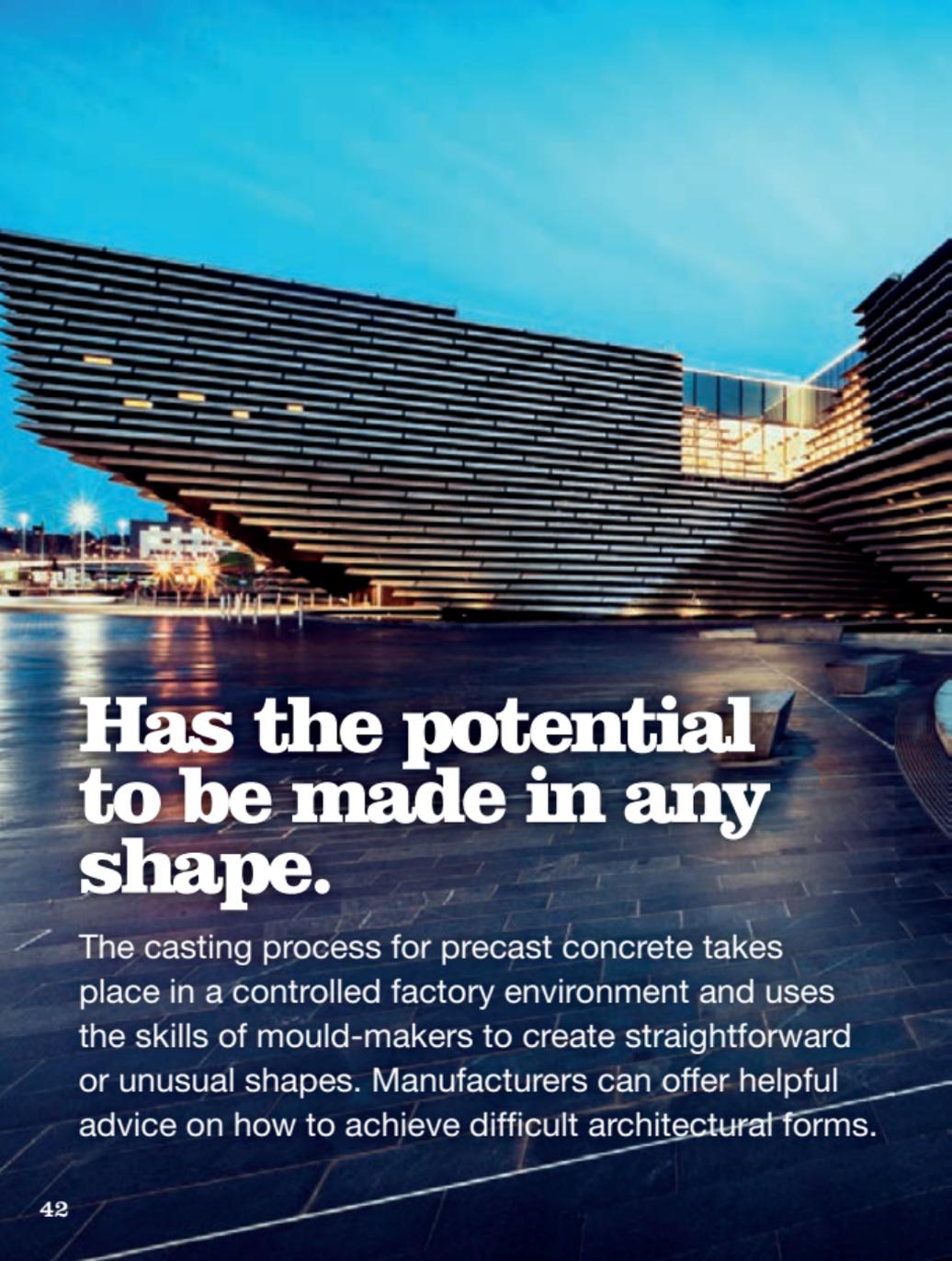
The use of steel fibre reinforcement in the precast concrete mix enables the design and manufacture of extremely slender elements. This means that precast can be used in some very structurally ambitious projects.

...can also be light or heavy or..

Precast concrete can be made from a range of constituents, which can be combined to produce different properties. This means that precast can be porous or impervious; it can float or sink, be heavy or light. The possibilities are endless!

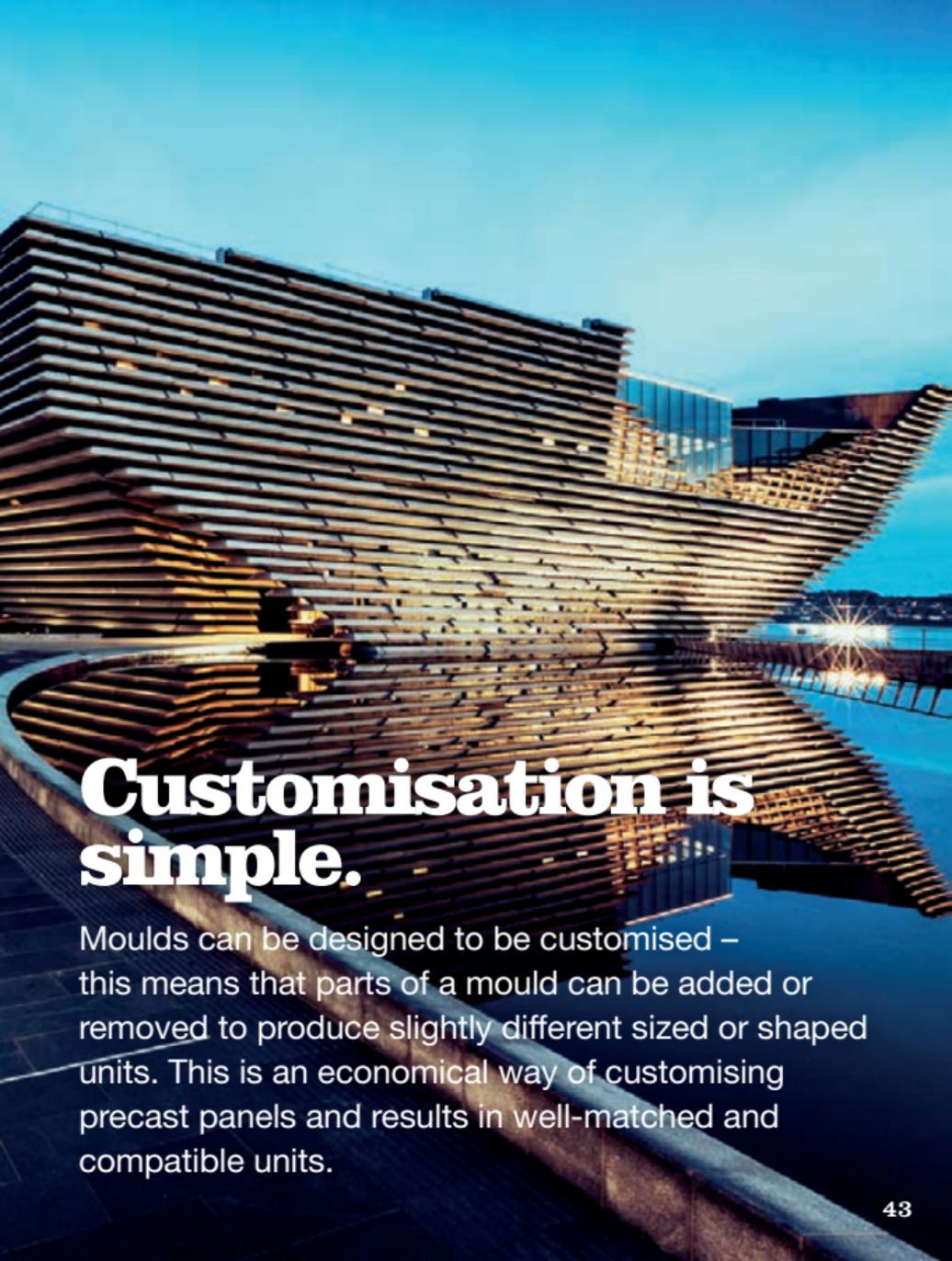


Amazing architecture and finishes



Has the potential to be made in any shape.

The casting process for precast concrete takes place in a controlled factory environment and uses the skills of mould-makers to create straightforward or unusual shapes. Manufacturers can offer helpful advice on how to achieve difficult architectural forms.

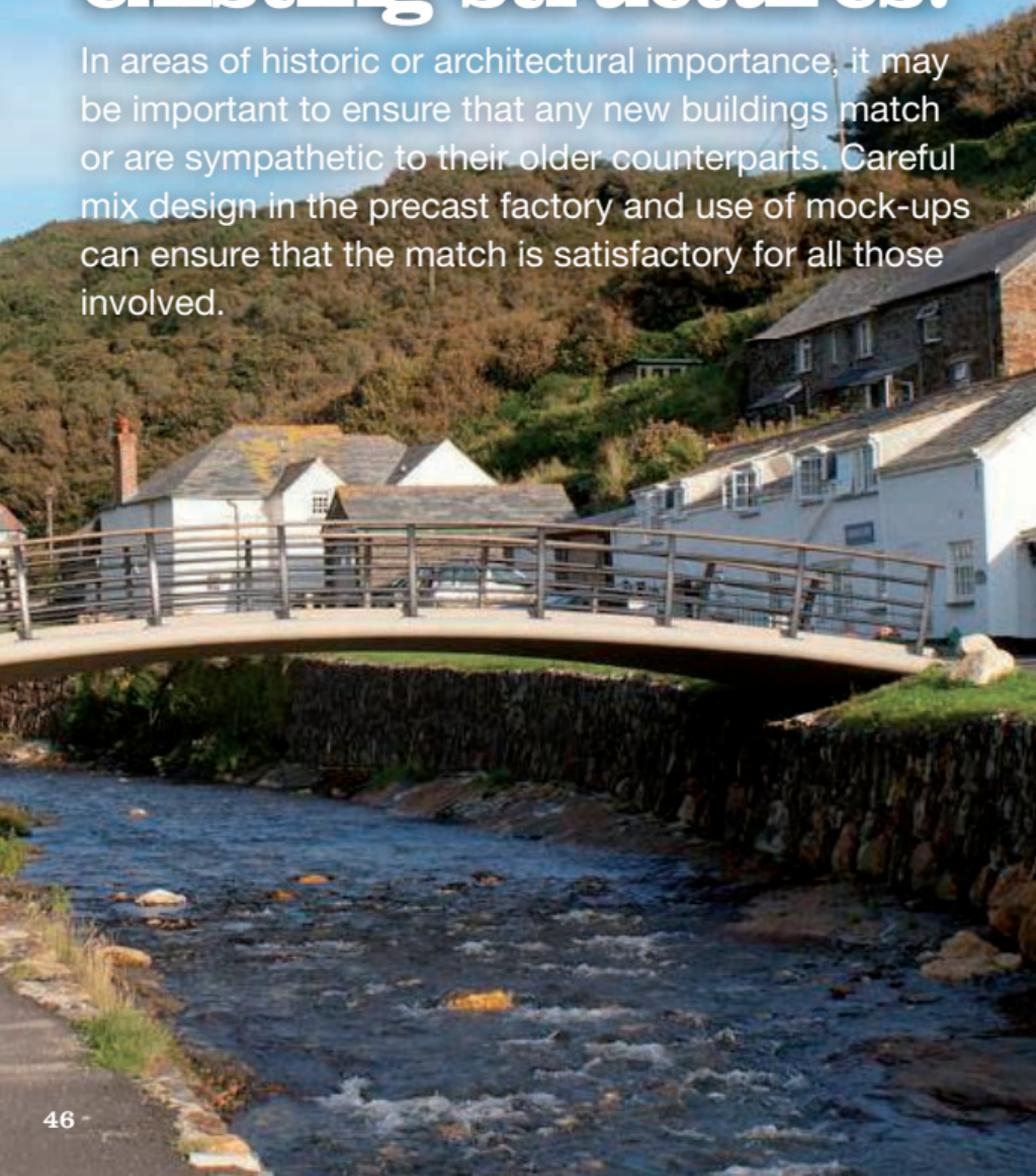
A photograph of a modern building with a facade of horizontal, illuminated slats. The building is reflected in a body of water in the foreground. The sky is a clear, deep blue, suggesting dusk or dawn. The lighting is warm, highlighting the texture of the slats and the reflection in the water.

Customisation is simple.

Moulds can be designed to be customised – this means that parts of a mould can be added or removed to produce slightly different sized or shaped units. This is an economical way of customising precast panels and results in well-matched and compatible units.

Blends in with existing structures.

In areas of historic or architectural importance, it may be important to ensure that any new buildings match or are sympathetic to their older counterparts. Careful mix design in the precast factory and use of mock-ups can ensure that the match is satisfactory for all those involved.





Can replicate patterns, shapes or other materials.

The 'mouldability' of precast means that it is an excellent mimic, whether this entails copying details like keystones and capitals or matching the finish of materials like weathered stone.

Can be straight or curved...

For external walls or cladding panels, the shape of a precast unit is called its 'profile'. In these applications, being able to produce a variety of different profiles can be very important and this is an area in which precast concrete excels because of the flexibility and accuracy in the production process.



...or highly detailed.

The level of detail on a wall or façade is often referred to as articulation - this term is used to describe the level of complexity on a surface. Casting precast concrete in carefully constructed moulds means that very highly articulated panels can be made.

Available in a wide range of colours...

There are many different aggregates and additions that can be incorporated into precast concrete elements, depending on what is required. This gives designers considerable scope to produce subtle or contrasting colours.

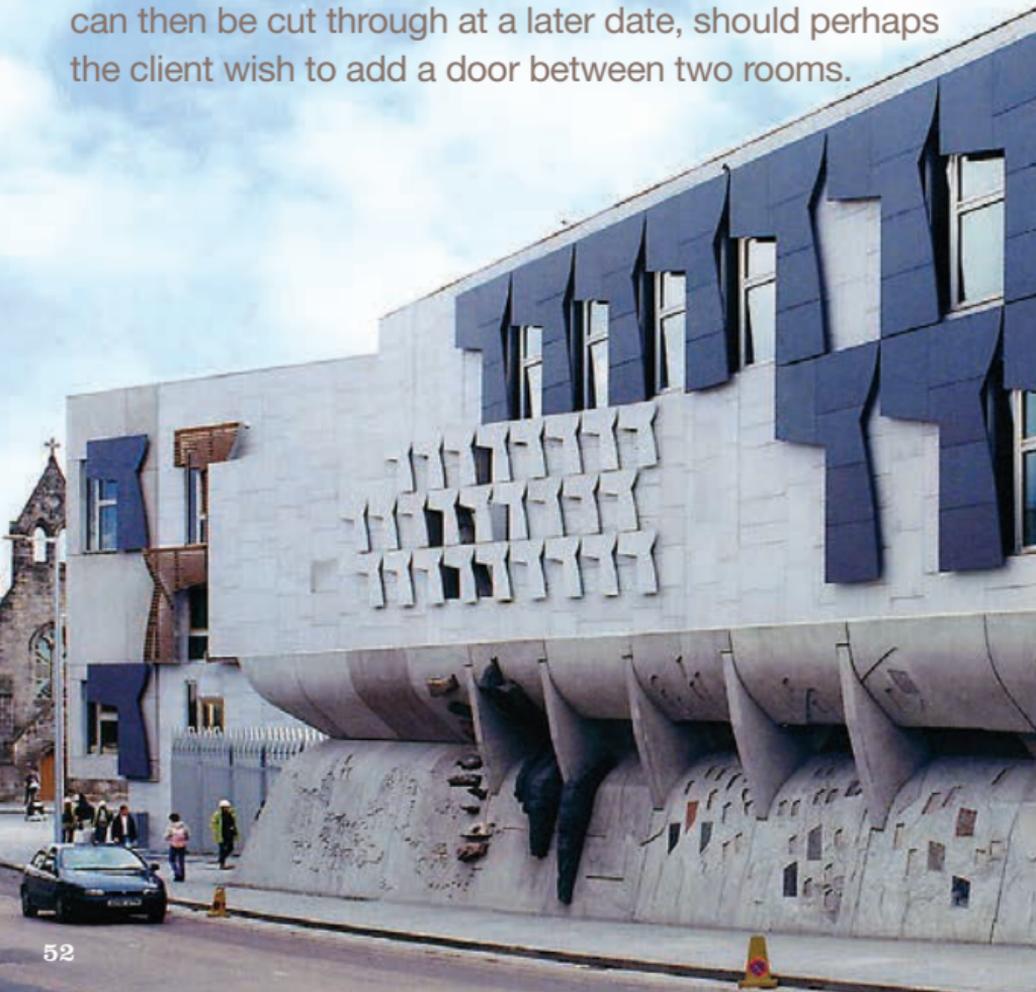


...including white and black.

Dramatic architectural projects call for dramatic colours, and precast can be used to provide white, off-white or black shades. Colours in precast are long lasting and manufacturers can always advise on suitable colours for particular applications.

Can be cut to suit.

Considerable flexibility can be built into precast concrete. Not only can window and door shapes be created, but there is scope to design elements so that they are more lightly reinforced in some areas – these can then be cut through at a later date, should perhaps the client wish to add a door between two rooms.





Perfectly precise.

The accuracy and factory controlled conditions in a precast factory are ideal for producing very precise, sharp details. This relies on the craft-based skills of mould makers and through their expertise, even minute details become feasible.

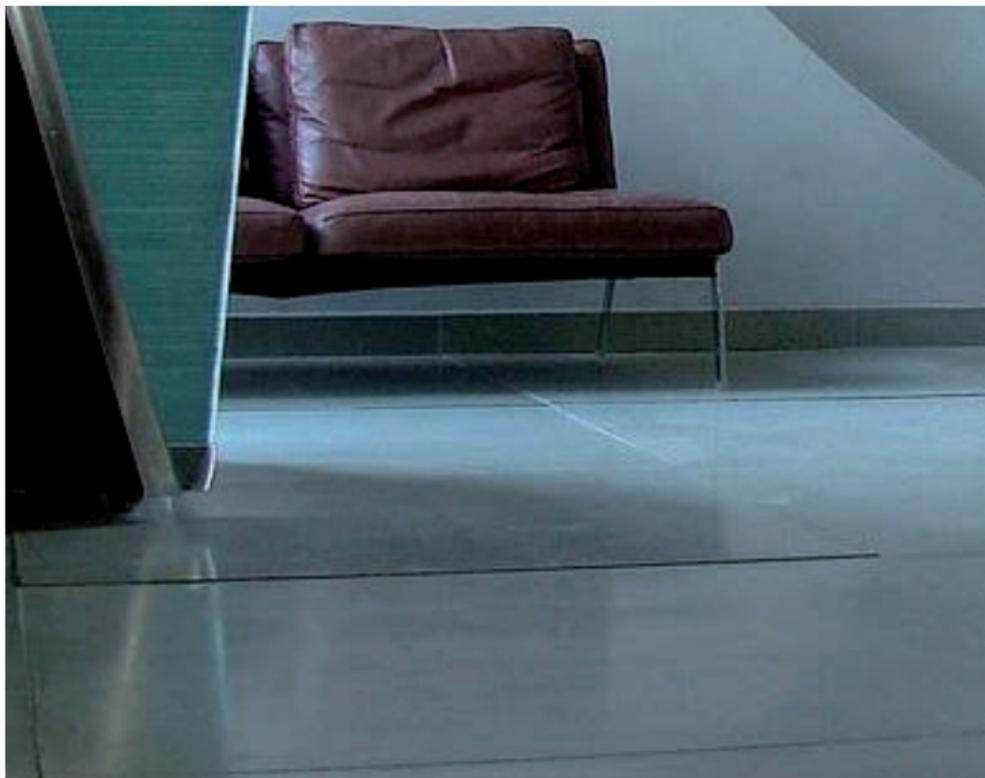


Can incorporate life-size images

By using a process called photo-engraving, it is possible to turn precast concrete elements into huge photo albums! A dot matrix of the selected photo or graphic image is effectively reproduced in the surface of the precast element, so it will not fade or wash away over time. This technique can be used to dramatic effect.

Uses special effects!

When precast concrete is cast in the factory, there is an option to lay down different coloured layers of aggregates in the mould, so that when the surface is exposed to varying degrees the colours can really come alive, producing a spectrum of effects over a relatively small area.



Smooth.

In the same way that natural stone is prepared, precast concrete can be polished to a smooth and in some cases reflective finish. The inclusion of attractive aggregates or other minerals such as mica in the concrete mix can help the precast element to sparkle, adding that bit extra to the quality precast finish.



Easily painted.

For some structural precast concrete elements, it may be more desirable to opt for a painted finish. This makes maintenance easy and it means that colour ways can be changed at any point. Precast units can be specified to be smooth so that paint can be applied easily and directly onto the surface of the concrete itself.

Can be self-cleaning.

The optional inclusion of titanium dioxide in white cement not only produces white precast concrete but helps to keep the finished product clean. It does this by capturing dirt particles and then washing them away during rainfall.





Can be designed to change colour.

The inclusion of thermo-chromatic dyes in precast concrete will cause it to change colour when it reaches particular temperatures. This is a fun idea, but has serious applications too – for example, the concrete can indicate when it is too cold or too hot to touch.



Acts as an aid to visually impaired people...

It is common to see textured, or profiled surfaces to paving flags. Tactile paving helps visually impaired people to recognise changes in level and possible dangers from passing traffic or other hazards.



...and to others.

Casting surface textures or secondary processing can be used to improve slip and skid resistance, improving safety in heavily used areas and on difficult surfaces such as ramps or steps, and where ice could form during cold weather.

water is curiously Careless

Quality in production and construction



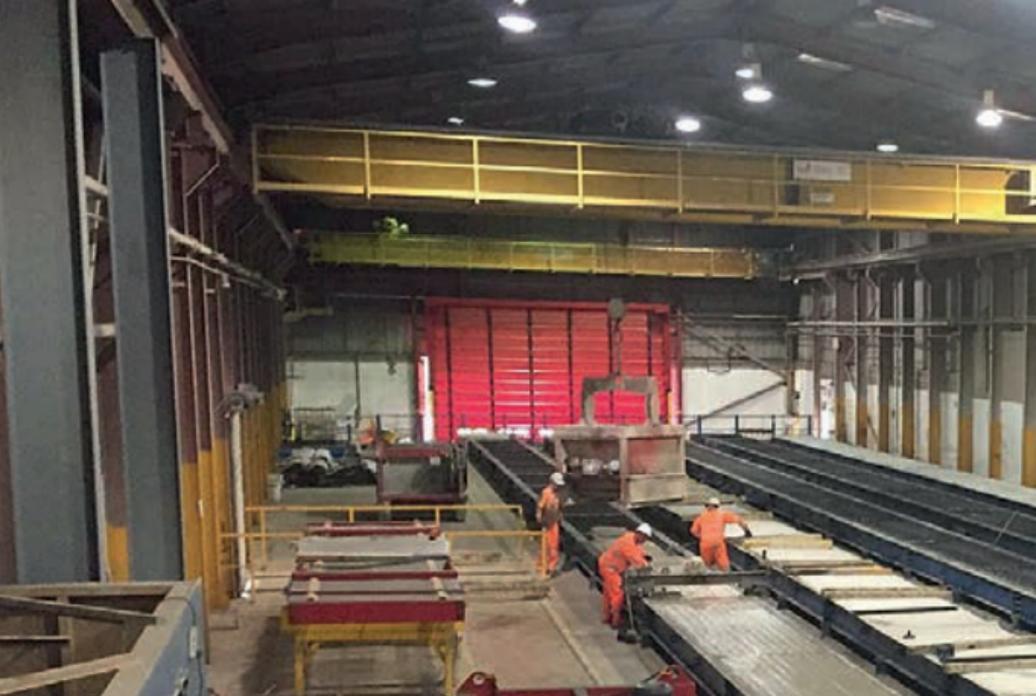
Factory-made...

Precast products are produced in factories under strictly controlled conditions. The factory environment has a steady temperature, regular shift patterns and a dedicated workforce; all this means that high quality products can be made every day, regardless of the weather.

...and built to precise specification.

Precast companies work with specialist fixing teams to install their products. This guarantees precise, reliable workmanship ensuring that the quality of service from precast is maintained after the products leave the factory



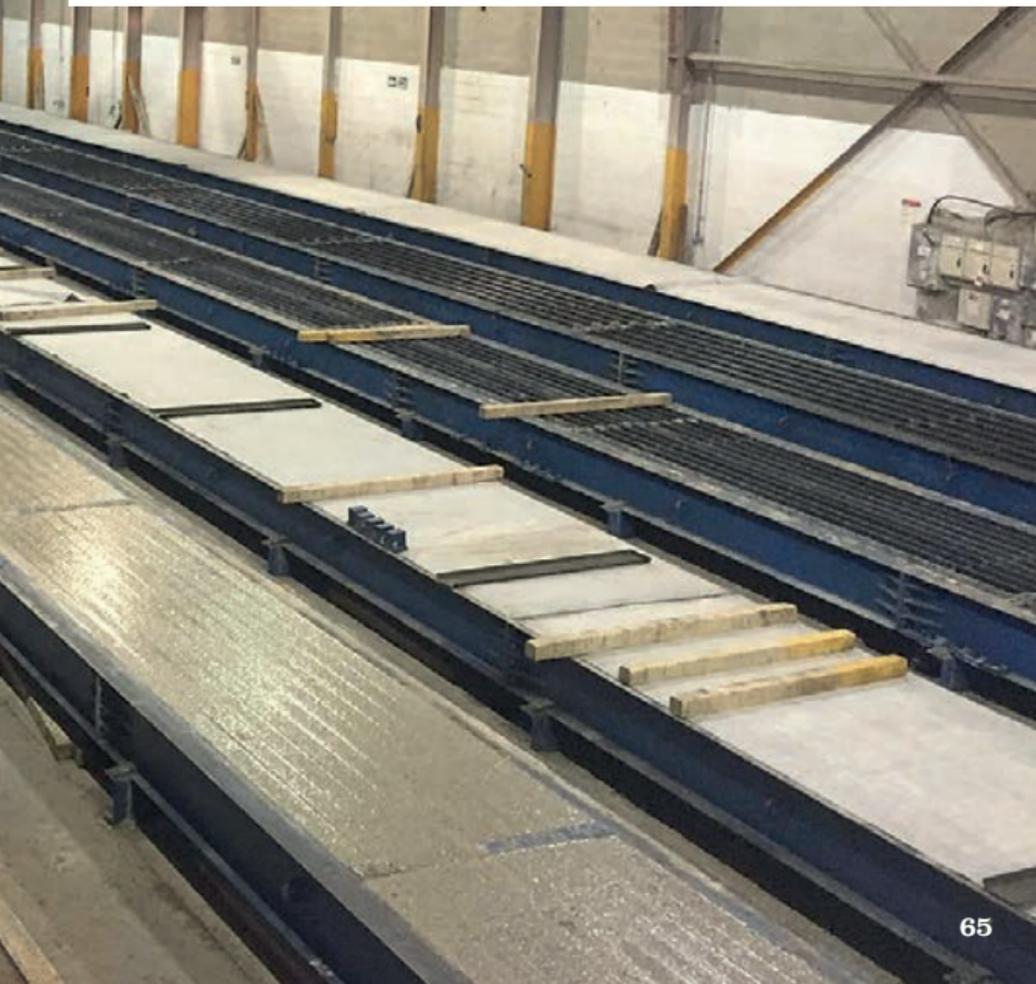


Covered by BS and EN standards.

The precast industry keeps a keen eye on national and international standards – this ensures that customers receive the best quality products which are compliant to all relevant standards. As well as specific product standards, many manufacturers also comply with ISO 9001, ISO 14001, ISO 18000 and BES6001 for responsible sourcing.

Guaranteed durability.

The factory-controlled production process means that cover to rebar is consistent and correct, as are strength and concrete quality . Hence the inherent durability of the delivered product is assured.

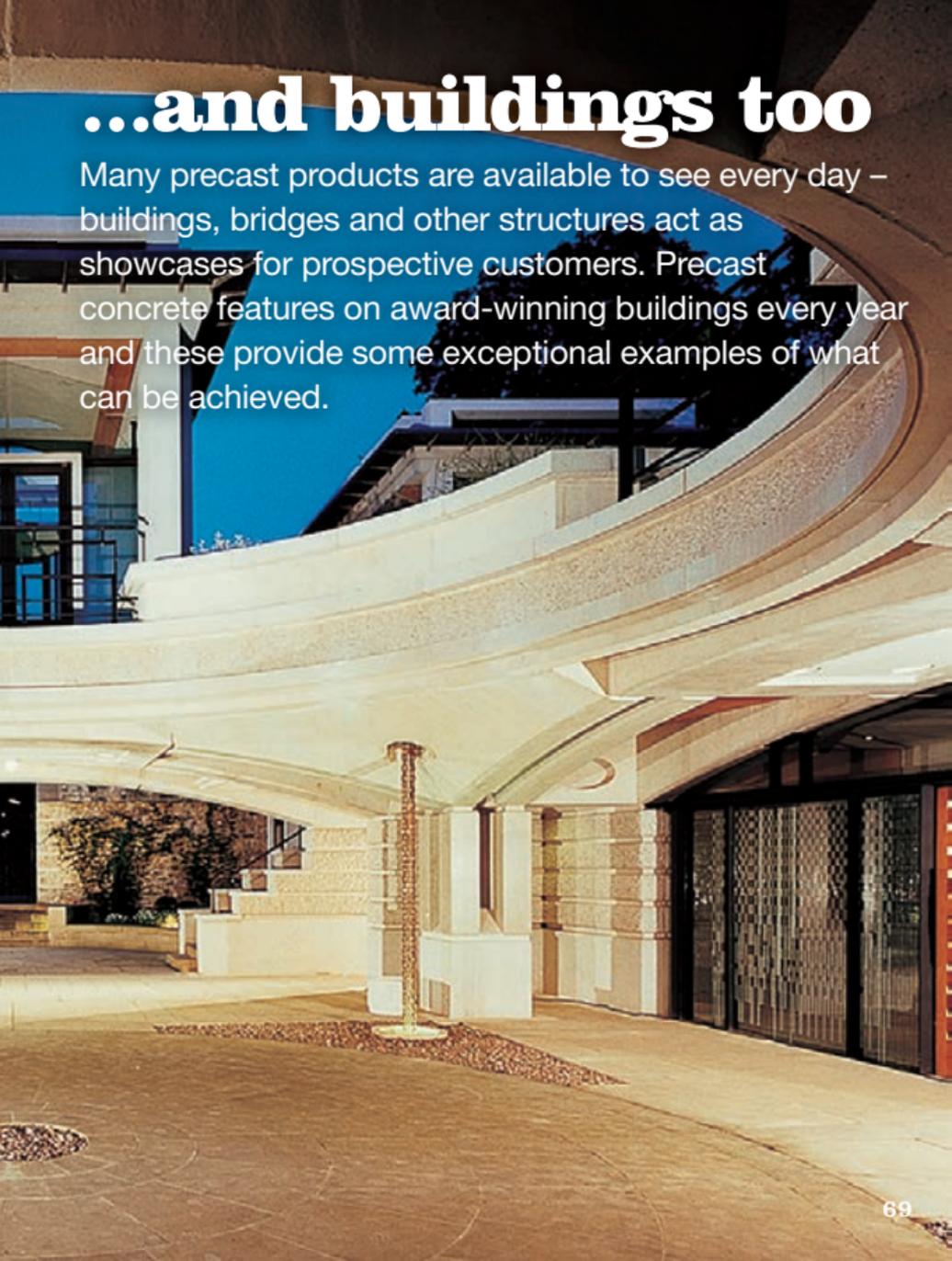


Products can be seen in advance...

Manufacturers often have vast libraries of samples and most are able to produce a full-size mock up for the client and professional team to view. This is a valuable way for all involved to agree the specific finishes to be achieved.

...and buildings too

Many precast products are available to see every day – buildings, bridges and other structures act as showcases for prospective customers. Precast concrete features on award-winning buildings every year and these provide some exceptional examples of what can be achieved.





Great results every time...

Having decided to specify precast, it's important to have confidence in the solution and this is where factory-controlled procedures really become valuable. Repetition of individual units can be achieved with confidence whether there are one, ten or 100.



**...with long-lasting
moulds.**

Precast concrete moulds can be stored to allow later replication, whether additional units are required one day, one week or one year later.

Rapid erection on site.

Precast products arrive ready for installation and can be scheduled to arrive 'just-in-time' so they can be lifted directly into place. This avoids the need for storage space and unnecessary handling.





Bar-codes or e-tags speed up construction.

The addition of bar coding strips or embedded micro chips on precast products helps distribution managers identify individual elements, making sure each reaches its correct destination at the correct time.

This technology also helps managers on site speed up the construction process while at the same time ensuring accuracy.



Highly compatible.

Designers and those involved with construction can ensure that connection details and joints are developed and fully checked. Precast connections can be simple and easy to use to help speed up construction and reduce the risk of errors.

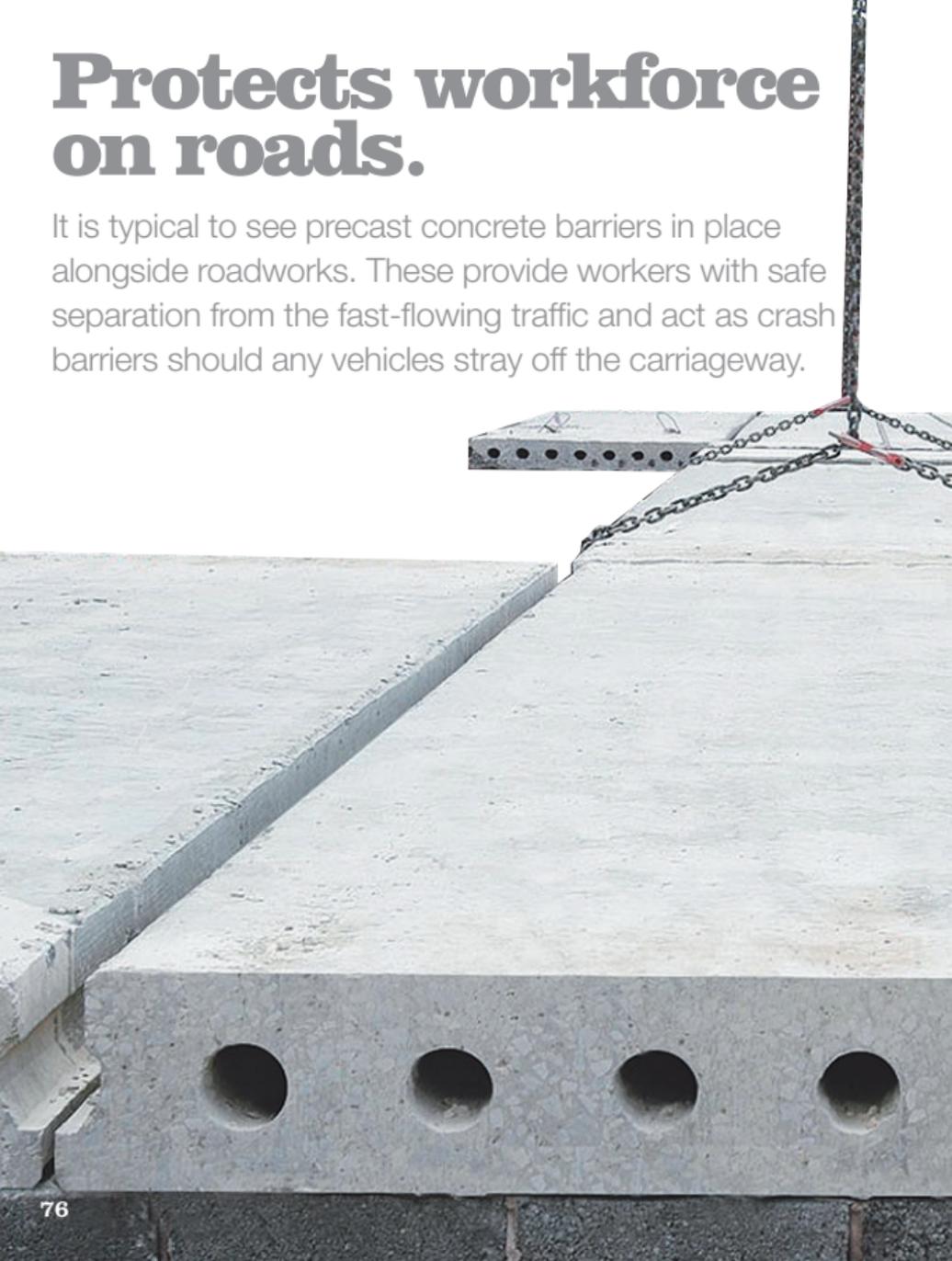


Has a key role to play in hybrid concrete construction.

The combination of precast and other materials like in-situ concrete and steel in hybrid concrete construction can yield cost and programme benefits. Precast concrete brings accuracy, high quality finishes and speed of erection to any hybrid concrete construction project.

Protects workforce on roads.

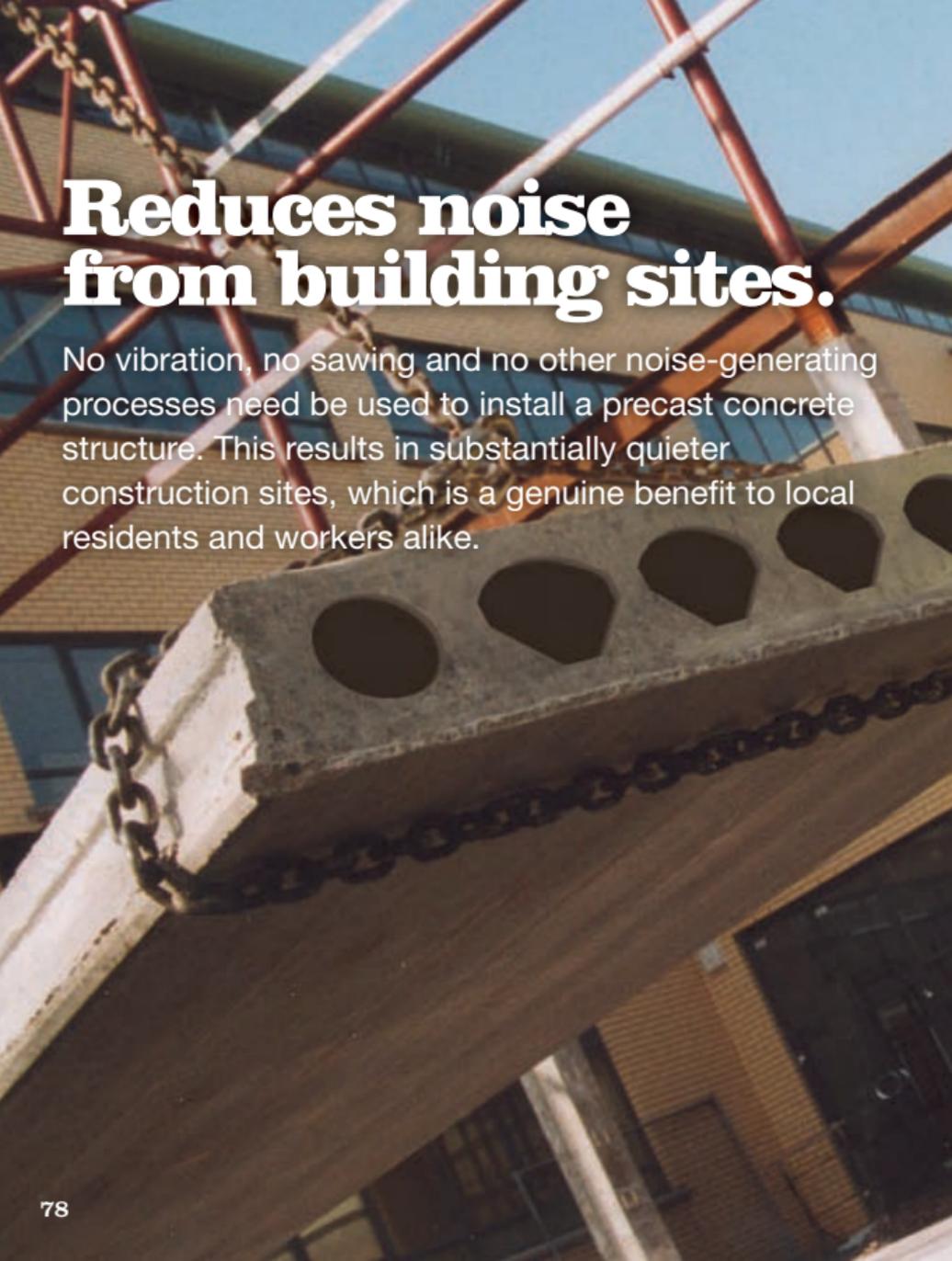
It is typical to see precast concrete barriers in place alongside roadworks. These provide workers with safe separation from the fast-flowing traffic and act as crash barriers should any vehicles stray off the carriageway.





Provides an instant work platform.

Precast structures and in particular floors and staircases provide an early, secure and broad platform from which subsequent site activities can be undertaken. This solid footing helps speed up construction and gives managers confidence that operatives can go about their work safely.



Reduces noise from building sites.

No vibration, no sawing and no other noise-generating processes need be used to install a precast concrete structure. This results in substantially quieter construction sites, which is a genuine benefit to local residents and workers alike.



Improves safety on site.

Innovations to make the use of precast concrete even safer include air-inflated crash bags, nets and mats. These are used in an area under construction until such time as the precast units are securely installed. In the event of an accident, these break the fall of a worker.

Less prone to disruptions caused by inclement weather.

Precast production activities take place within the factory. It is only fixing that needs to be done on the construction site. This means that precast is significantly less vulnerable to disruption caused by wet, cold or very hot weather; whatever happens, precast manufacture can continue.



Easy to clean and repair.

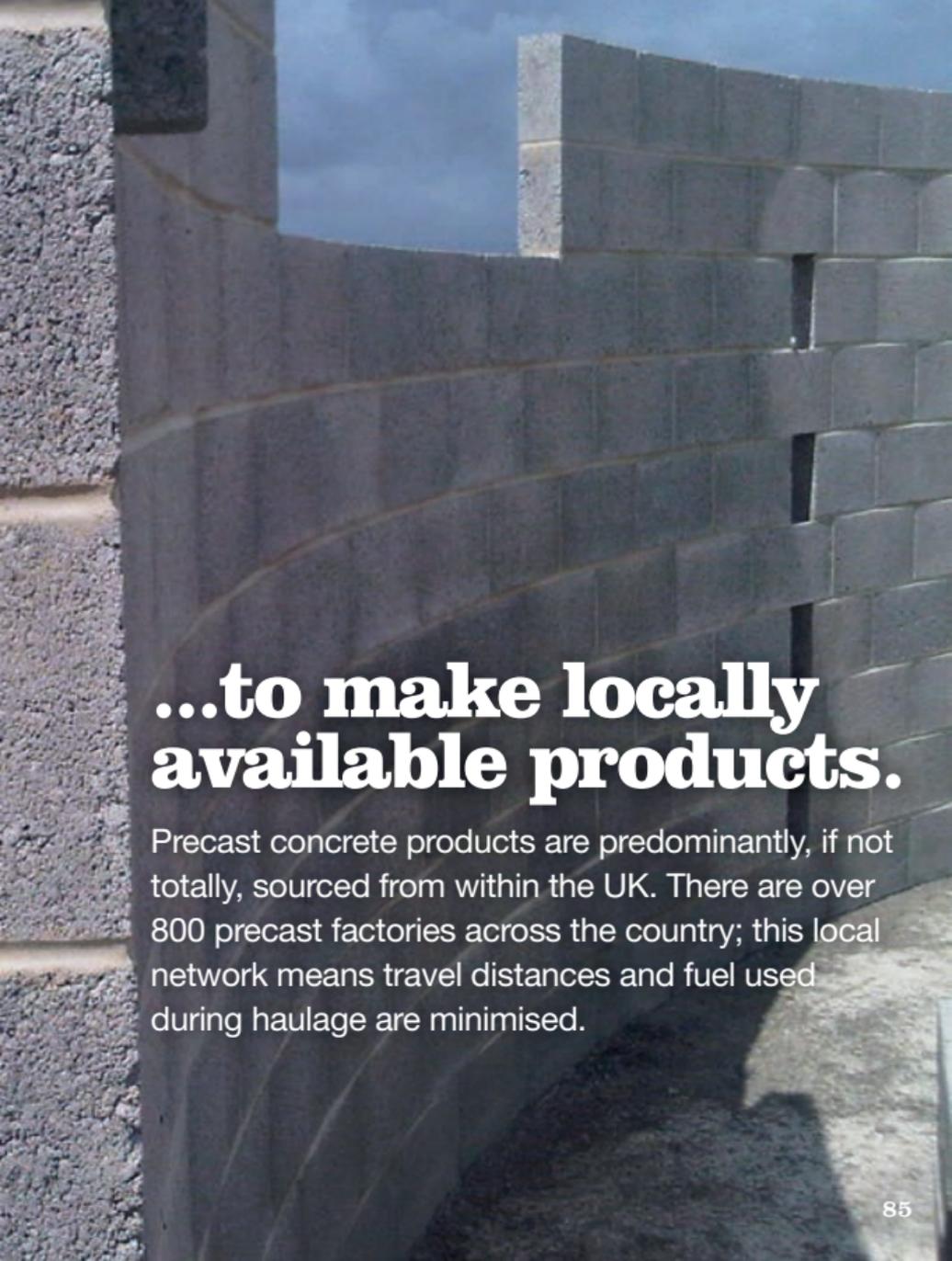
Despite all the best intentions on a construction site, sometimes minor dents, damage or dirtying can occur which can compromise the appearance of neatly installed concrete units. The excellent surface finish of precast makes cleaning and repairs easy – most manufacturers offer extensive guidance on how best to undertake these tasks.

Protecting people and the environment



Uses plentiful, local, natural materials...

All the materials that go into precast concrete products come from natural and recycled sources. Aggregates from rocks or river gravels, and water are all widely available and in plentiful supply. With precast there's simply no need to import materials from thousands of miles away. Manufacturers demonstrate credentials of their products through use of the responsible sourcing BES6001 standard.



...to make locally available products.

Precast concrete products are predominantly, if not totally, sourced from within the UK. There are over 800 precast factories across the country; this local network means travel distances and fuel used during haulage are minimised.



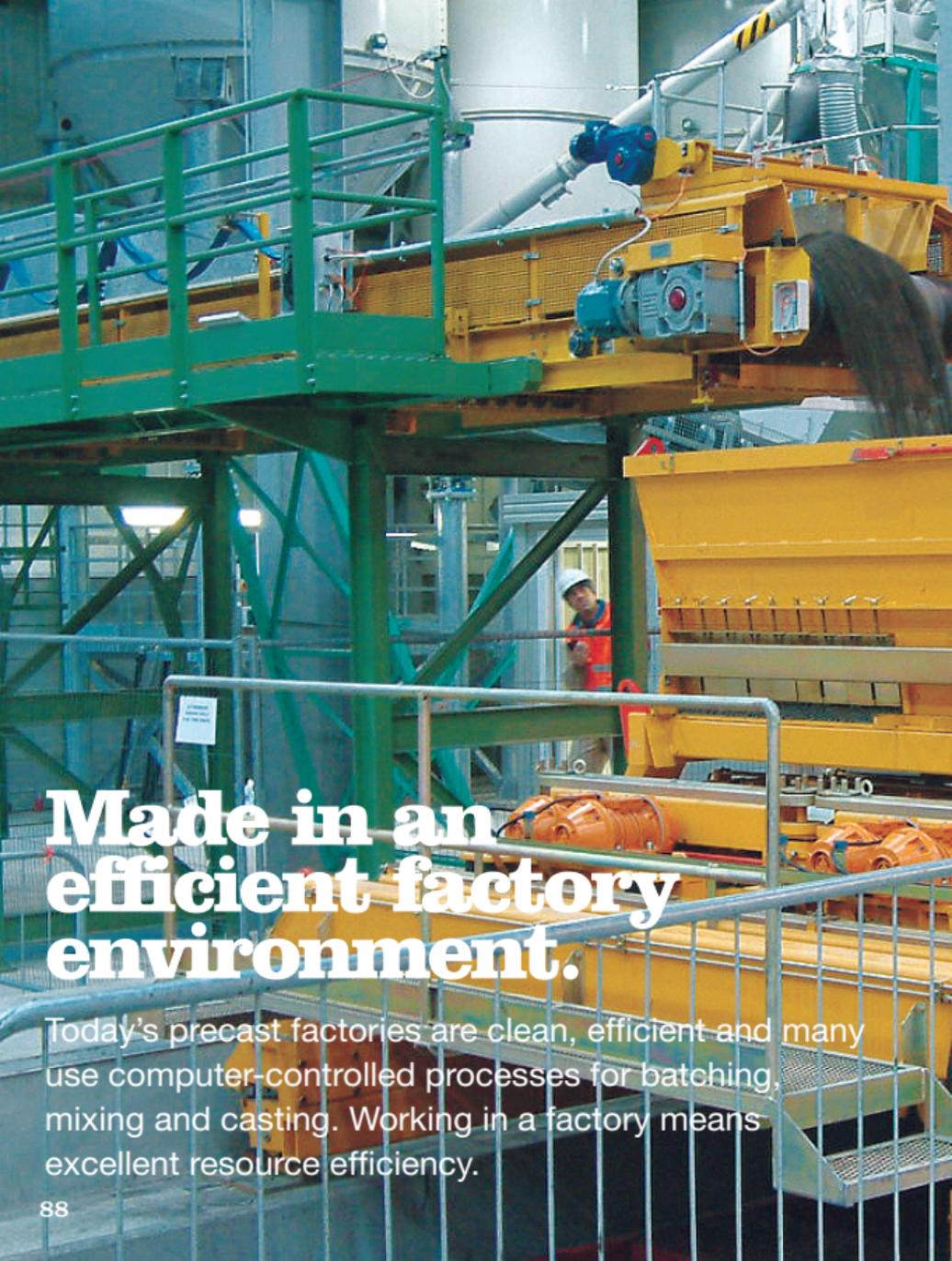
Uses by-products from other industries.

Precast products can safely incorporate materials such as blast furnace slag (from the iron and steel industry) and fuel ash (from coal-fired power stations) that might otherwise go to waste. These materials can improve the performance of precast concrete and can be used as partial replacements for Portland cement.



Not reliant on oil-based products.

A good quality finish relies on achieving a clean break between precast concrete and its casting mould or bed; vegetable-based release agents are used rather than oil-based chemicals, thereby reducing the overall environmental impact. In addition concrete is not as vulnerable to increases in oil and gas prices as plastics and asphalt.



Made in an efficient factory environment.

Today's precast factories are clean, efficient and many use computer-controlled processes for batching, mixing and casting. Working in a factory means excellent resource efficiency.

Minimum off-factory site waste exported.

Even small amounts of scrap or waste in the process can be recycled; cement, slurry and process water are recycled and unwanted hardened concrete is crushed and re-used.





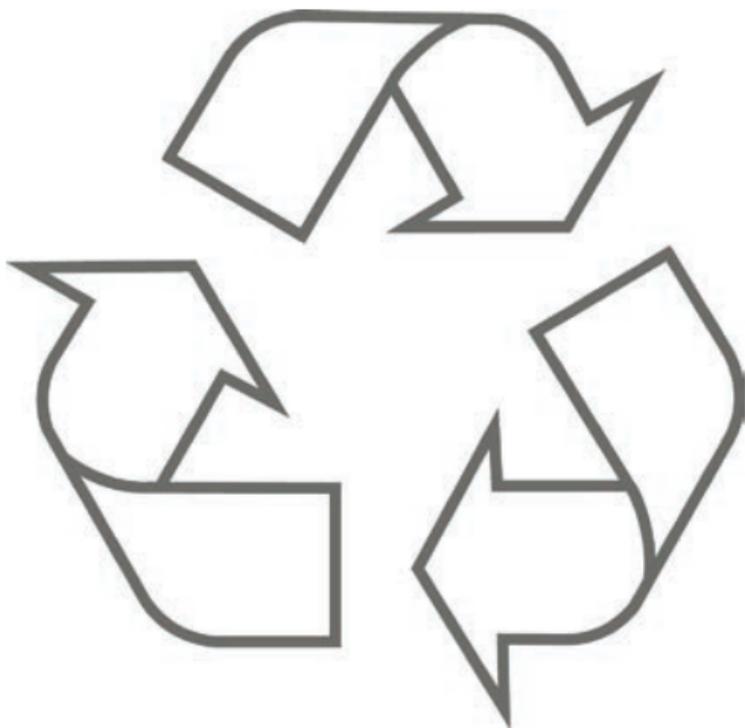
Avoids expensive environmental disposal costs.

Making better use of natural resources makes good business sense; the Landfill Tax penalises poor use of materials. Using ready-made precast products prevents the incurring of waste disposal costs.

Waste on site is not lost.

Even if all does not go to plan on site, there are still options available with precast. Unused elements can be used elsewhere. Scrap created at the building site can be collected and broken up to create aggregate.





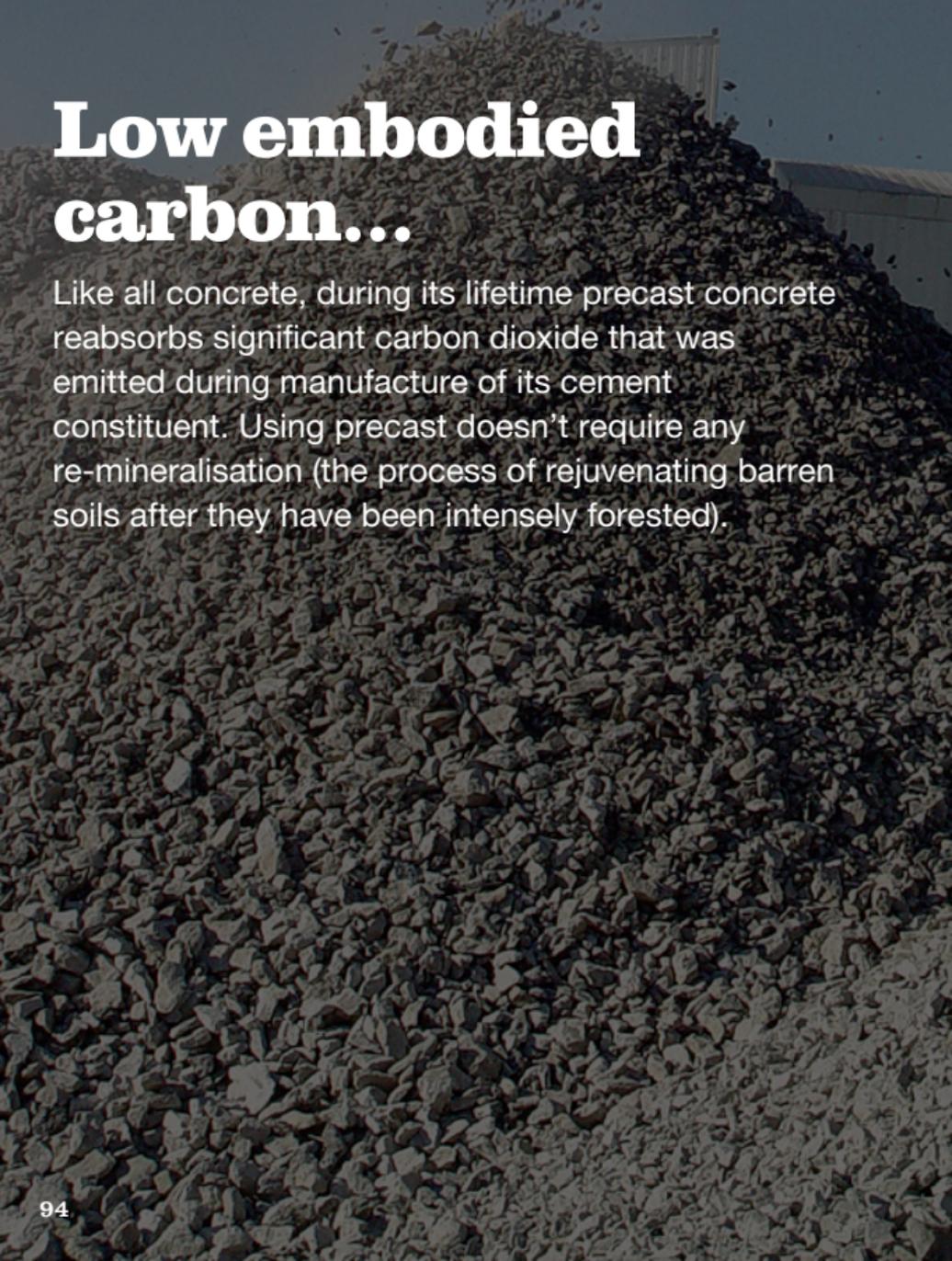
Can be re-used...

At the end of a structure's life, precast units can be re-used in their entirety, for example reclaimed as whole elements such as floor slabs. These could be re-installed in the same building or even transported a short distance and used in a comparable structure elsewhere.

...or recycled.

As with many concrete products, precast is easy to crush and recycle as aggregate. The UK uses all recycled aggregates because of the aggregates levy and landfill tax, but also because of the variability of crushed concrete aggregate.





Low embodied carbon...

Like all concrete, during its lifetime precast concrete reabsorbs significant carbon dioxide that was emitted during manufacture of its cement constituent. Using precast doesn't require any re-mineralisation (the process of rejuvenating barren soils after they have been intensely forested).

...and reduced in-use energy consumption.

The thermal mass of concrete helps even out daily and seasonal temperature swings, making indoor spaces more comfortable without having to resort to air conditioning. This saves both energy and money, not to mention maintenance bills.



Reduces the risk of flooding.

Permeable precast paving, pipes and soakaways are used in sustainable drainage systems (SuDs). These help prevent rapid run-off of rainwater from roads and pavements by allowing water to permeate more naturally. Precast concrete flood mats and barriers protect river banks and livelihoods.

Does not leach.

Precast concrete is an inert family of products, so it does not leach out any harmful chemicals in use. This means it is safe to use in applications like distribution of drinking water. It also means that when precast concrete is used to store or transport potentially harmful fluids, these will be contained securely.

A blurred city street scene. In the foreground, the rear of a dark car is visible, featuring a prominent red taillight. The background shows several pedestrians walking, their figures blurred to convey a sense of motion. The overall color palette is muted, with greys, blues, and reds.

Reduces urban energy use.

The pale colours that can be achieved with precast concrete finishes help to reflect light, so at night the streets are brighter and safer. On a hot day, these same finishes reflect sunlight, so keeping buildings cooler and preventing the 'urban heat island' effect.



Can reduce traffic fumes.

Using an ingenious innovation, precast concrete coated with a special layer can absorb the harmful emissions from traffic fumes. A process called photocatalysis occurs which entraps SO_x and NO_x particles, which are then dispersed harmlessly when rain falls.

A close-up photograph of a young child with short brown hair, looking slightly to the left. The child is holding a clear plastic nebulizer mask in their mouth. The mask has a small ring at the top and a clear tube leading to a reservoir containing a light blue liquid. The background is a plain, light-colored wall.

Helps create healthy indoor environments.

The simple lines and smart edges of precast concrete are easy to clean and its hard, smooth finish therefore does not accumulate dust which may exacerbate asthma.

Precast is emission free.

In its daily use, precast concrete is inert, so it doesn't emit or give off any gases, toxic compounds or VOCs (volatile organic compounds). This means allergy sufferers can breathe easy because precast does not contribute to the symptoms of 'sick building syndrome'.

**The best
value
solution**



Appeals to investors.

The longevity of precast structures and their resistance to both everyday and extreme events means that institutional investors and other funding bodies tend to look favourably upon the precast option. This is particularly well-matched in city locations where the solidity and sympathetic appearance of precast structures reflects the commercial businesses inside.



Lewis

Easy to let.

The issues mentioned before attract occupiers as well as investors, so the attractive appearance and robustness of precast concrete produce a reliable return. The architecture and performance qualities of precast mean that units can be leased easily.

Lower insurance costs.

With amazing structural properties and functional benefits, precast concrete buildings tend to attract lower insurance premiums than those built from other construction materials. This can become particularly apparent in high risk areas such as those at risk from floods, fire and burglary.





Easy to extend.

The fact that precast elements can be dismantled (or deconstructed) means that it is easy to add extensions or new wings to precast structures. Simply remove end panels and continue building – the end panels can be re-installed on completion.

Lower maintenance costs.

In exposed locations, other materials will need regular painting to protect against corrosion and enhance their aesthetic appearance. This is not the case with precast concrete, which does not require such treatment. This advantage is particularly relevant for bridges and motorway gantries that cannot be accessed easily.





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& DIVERTED TRAFFIC

Everyday resilience.

Precast concrete is tough and durable and can withstand everyday maintenance, but it is also resilient in the face of intense pressure. For example, used for underground pipes, precast is resistant to jetting (to clean out the system) and on roads or other paved areas it provides a durable surface against the rutting caused by traffic.



Lower refurbishment costs after a fire...

Concrete typically needs little remedial treatment following exposure to the high temperatures of a fire. In many cases, some minor patching and a coat of paint may be all that is required to make good.

...or a flood.

The high quality of precast and the fact that it does not erode or rot make the task of clearing up after a flood very straightforward. This can be a difficult time for people struggling to come to terms with the devastation that floods can bring, so precast brings a welcome respite.



Impressive whole life value.

There's no doubt that all of the previous 96 advantages add up to a significant package – and it is exactly this idea that convinces people to use precast. The argument is compelling. Precast offers value through attractive finishes, robust structures and major performance advantages such as fire-proofing and thermal mass throughout its life.

Peace of mind.

The technology behind precast production, design and construction stretches back hundreds of years, so customers can be assured of peace of mind when specifying precast products. Precast is a proven technology.

Product developments...

Manufacturers of precast concrete products invest heavily in research and development to make their products and services even better. New products, new information technology and new factories demonstrate this forward-thinking attitude.

...and innovation.

This little book shows that innovation is an everyday part of the precast world, but we think there's still more to come. We're keen to hear of new benefits of using precast – please send in your suggestions for the next 100 reasons to info@britishprecast.org

Why choose British Precast members

All of our precast members manufacture and supply in the UK. British Precast manufacturer members are all required to sign up to the British Precast Charter Membership Scheme, which includes signing both our Health and Safety and Sustainability Charters. These charter schemes are part of the 'Raising the Bar' initiative, which demonstrates our members' commitment to zero harm and improving environmental performance in the industry.

Health and Safety Charter

All full members pledge to reduce accidents, and work towards the long-term aim of causing zero harm. Commitments include:

- Continuous reduction on Lost Time Incidents
- Continuous improvement in accident severity ratio
- Implementation of training initiatives to improve health and safety

Sustainability Charter

All full members commit to work towards principles which include:

- Develop products that improve the quality and sustainability of the built environment
- Measure, report and improve performance on sustainability issues
- Operate to the highest ethical standards necessary to develop a skilled and competent workforce

YOUR ASSURED STEEL PRODUCTS SUPPLY CHAIN



YOUR SUPPLY IS ASSURED

You require steel assured to the highest standards of quality, safety and integrity. Our Sustainable Constructional Steel (SCS) Scheme includes Product Quality certification AND Sustainable Reinforcing Steel certification.

FULL PRODUCT TRACEABILITY

Fully traceable from mill to site delivery. If your reinforcing steel carries the CARES mark, no further testing is required.

ABOUT CARES

We are an independent, not for profit certification body providing assurance and certification services to the users, purchasers and specifier of reinforcing steel through regulation, testing and inspection. CARES is governed by its Board and advised by its Policy Advisory Committee; it includes specifiers, contractors, users and manufacturers.

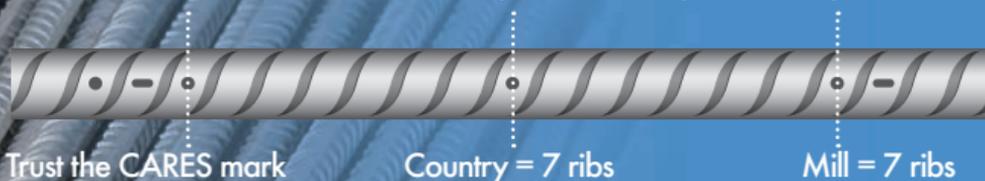
Independent, Impartial and Trusted
ukcares.com





Independent Identification of Steel Products

The CARES mark identifies a specific mill in a specific country



Trust the CARES mark

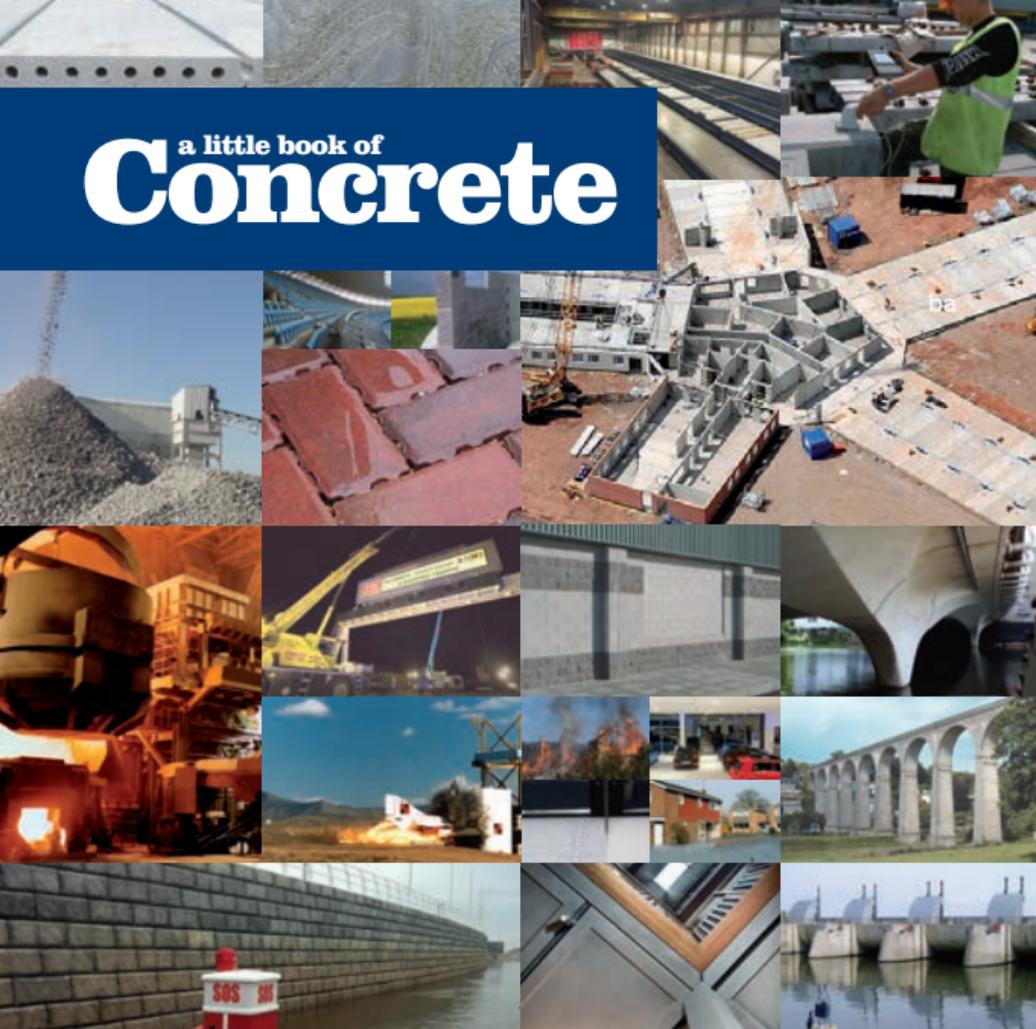
Country = 7 ribs

Mill = 7 ribs



Independent,
impartial
and trusted

ukcares.com



a little book of Concrete



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