THE LITTLE BOOK OF CONCRETE

A GUIDE TO THE ONE HUNDRED ADVANTAGES OF PRECAST CONCRETE
ACKNOWLEDGEMENTS

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www.precast.org  www.britishprecast.org

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NPCA is a trade association representing the manufacturers of plant produced concrete products and the suppliers to the industry.
INTRODUCTION

If concrete were to be invented today, it would be hailed as a miracle. It is the most commonly used building material in the world, and because of that we take it for granted. Too often this means that we overlook the nearly limitless possibilities offered by precast concrete components.

Now it is time to take a fresh look at the new world of concrete. This booklet highlights 100 benefits of precast concrete for architects, designers, engineers, contractors, insurers and environmentalists. But it’s just the tip of the precast pyramid. As you will see from the examples inside, the benefits and uses of precast are limited only by our imaginations.

We hope you enjoy reading about the 100 advantages of precast! If you wish to know more, we invite you to contact the National Precast Concrete Association at (800) 366-7731 or visit www.precast.org.
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WEATHERPROOF
Precast concrete is resistant to rain penetration, flood damage and wind-blown debris. It can also withstand many winters of freeze-thaw cycles unlike other materials, which can deteriorate quickly with such regular exposure to expansion and contraction.

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 dents and dings.
QUIET ...

Because of concrete’s density, precast buildings make for a peaceful lifestyle. Privacy and effective sound reduction are ensured, making precast an ideal choice for commercial and residential construction.

... YET ACOUSTICALLY VERSATILE.

Because precast can be formed in any shape, size and texture, it can be designed to deflect or absorb sound. This makes it a good acoustic material for music but also an effective sound barrier along busy roads.
THERMALLY EFFICIENT.
Costs associated with heating and cooling can be greatly reduced through concrete's thermal mass benefits. Reduced peak heating and cooling loads can be achieved because concrete reacts slowly to changes in outside temperature.

COMFORTABLE.
The versatility of precast can be seen in its application as a carrying medium for heating or cooling – by air or fluids. Hollow cores in precast floors can be used or pipes can be cast into slabs. Concrete surfaces radiate very effectively, enabling space to be used without the hindrance of radiators, and the precast protects the heating or cooling system within.
PLUG AND PLAY.
Precast concrete can carry preinstalled utility services and fixtures, whether these are communications, plumbing or even windows! Value-added components can be cast within a precast product, or panels can include connection plates ready to receive heating and lighting fittings on site. This makes both construction and maintenance easy.

WI-FI COMPATIBLE.
With homes and offices increasingly wired for information technology, it is good news that precast concrete buildings do not interfere with radio signals, local wi-fi or internet networks. This makes precast the most technology-friendly material for homes and places of work.
RESISTS BUOYANT FORCES UNDERGROUND.

With a specific gravity of 2.40, precast concrete resists buoyant forces better than any other material. Once it is installed, it stays put!
PROTECTS AGAINST FIRE.
Precast concrete is fireproof. It protects against the spread of fire between rooms or properties, and it cannot catch fire, burn or drip molten particles.

LOWER REFURBISHMENT COSTS AFTER A FIRE.
Concrete typically needs very 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.
OFFERS A SAFE HAVEN ...

The structural strength and density of precast concrete makes it an ideal choice for safe rooms in houses. Precast concrete storm shelters can easily be installed for protection in tornado-prone and hurricane-prone areas.

... AND KEEPS BUILDINGS SECURE.

Whether for homes, businesses, schools, bank vaults and increasingly in prison construction, precast is secure against break-ins and breakouts. High strength reinforced concrete is extremely difficult to penetrate and is impact resistant.
INEDIBLE TO TERMITES AND RODENTS.

Organic building materials make the best food for creatures like these, and wherever there is moisture and wood, you’ll likely find termites nearby. Precast concrete is resistant to attack from termites and other infestations such as rats and mice.

ROT PROOF, FUNGUS PROOF, AND MILDEW RESISTANT.

Precast is dense, tough and simply will not fall prey to these common enemies of organic materials. Can be specially treated for particularly corrosive environments. Specifying precast concrete means having confidence that a structure won’t rot away.
KEEPS WATER IN ...

Precast is an excellent material for containment, whether used for on-site wastewater treatment or stormwater detention/retention. The strength, resilience and watertightness of precast concrete have been proven for these and other applications such as water and wastewater treatment and conveyance systems.

... AND OUT!

When you need to keep water out, precast concrete is the best solution. It can be used for on-site wastewater systems, flood protection, rivers and coastal barriers to protect against inundation from high tides and storms. Precast foundation systems are also ideal for residential construction, where below-ground basements need robust waterproofing.
DURABLE ...

Concrete buildings from hundreds of years ago are still in use today. Some say concrete can last up to 2,000 years, and there are certainly many structures around that are well on their way to such a ripe old age.

... BECAUSE IT GETS STRONGER EVERY DAY.

Unlike most other materials, precast concrete increases in strength over time. What’s more, concrete is designed to minimize the effects of creep and shrinkage, providing a reliable structure for many years to come.
STRUCTURALLY EFFICIENT ...

Precast products can be designed with a high span-to-depth ratio, reducing the need for additional columns and supports. Precast can also be designed with lightweight concrete to reduce dead loads and decrease the size of structural members and foundations.

... WHICH MEANS IT’S EASIER TO GO HIGH.

Tall buildings up to 80 stories can be built with precast concrete panels. The structural efficiency of precast can reduce floor depths by up to 4 inches. In a 60 story building, the height would be reduced by 20 feet, which means two additional stories.
HIGH MARGINS OF DESIGN SAFETY.
The strength and resilience of precast concrete structures mean that extra safety is always built in, often well beyond what is required by design codes. In some cases, this benefit could be a life-saver.

DAMPENS VIBRATION.
Structures like sports stadiums 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. Precast concrete can be used to dampen these vibrations due to its mass, which makes it the material of choice for modern stadium and concert hall construction.
INTELLIGENT.
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 then capture the data on the chip by swiping a reading device across the surface of the element.

CAN INDICATE STRESS.
In particularly sensitive applications, these same microchips can send a signal to indicate excessive movement or impact. This is particularly useful for bridges, tall buildings and structures in earthquake zones.
CAN ACHIEVE HIGH STRENGTHS.
In civil engineering applications, high-strength concrete is often desirable, and precast components can be cast to meet such demands. If high early strengths are needed, this can be achieved through high-performance concrete, custom mix designs or accelerated curing methods at the plant.

CAN SUPPORT HEAVY LOADS.
Where point loads or high bearing stresses are likely, the dense, high-quality reinforced concrete in a precast concrete structure is absolutely critical. Industrial applications, utilities and underground structures are perfect for precast.
DOES NOT RUST

Precast concrete is corrosion resistant and can be used with confidence in very aggressive environments. For example, precast concrete piers are resistant to microbial attack experienced in some marine environments. Tight quality control in production means that cover levels for rebar in any application are ensured.

RESISTS CHEMICAL ATTACK.

For sidewalks and driveways, precast concrete interlocking pavers are an ideal choice, because they are resistant to fuel and oil spills, they can be replaced easily and they are widely available.
ABSORBS IMPACTS.
Precast concrete can resist massive impacts, so it makes an ideal material for security around public structures. Whether in day-to-day use as a median barrier or for protecting the perimeter of a building, precast structures can be designed to absorb the impact from vehicles, redirect them and/or slow them down.

PROTECTS AGAINST BLASTS
In extreme applications, blast protection from explosions may be a necessary design specification. Precast concrete components perform a critical role here.
FLIES THROUGH THE AIR WITH THE GREATEST OF EASE.

Not all precast concrete 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 concrete is no exception. Some materials “relax” over time, which can be difficult to account for in design. Not precast. A precast concrete structure maintains its shape, size and properties and won’t suffer from middle-aged sag.
CAN BE THIN ...
The use of synthetic or steel fiber reinforcement, carbon composite grids and other high-tech reinforcing materials in the precast concrete mix can produce extremely slender elements. This means that precast can be used in structurally ambitious projects.

... CAN ALSO BE LIGHT OR HEAVY.
Precast concrete is made from a range of materials, which can be combined to produce different properties. This means that precast can be porous, dense or impervious; it can float or sink, be heavy or light. The possibilities are endless!
CAN BE MADE INTO ANY SHAPE.

Form and mold manufacturers can use their skills to create straightforward or unusual shapes. Manufacturers can offer helpful advice on how to achieve difficult architectural shapes for sound barriers, bridge abutments and other structures.

CUSTOMIZATION IS SIMPLE.

Molds can be designed to be customized – this means that parts of a mold can be added or removed to produce slightly different sized or shaped units (master mold concept). This is an economical way of customizing precast panels or box structures and results in well-matched and compatible units.
BLEND S W I T H E X I S T I N G S T R U C T U R E S.

In areas of historic or architectural importance, precast concrete structures can be designed to match or complement their older counterparts. Careful mix design in the precast plant and use of mock-ups can ensure that the match is satisfactory for all those involved.


The versatility of precast means that it is an excellent imitator, whether this entails copying classical details like keystones and capitals or matching the finish of materials like natural stone or brick. Perfect for restoration or preservation projects.
CAN BE STRAIGHT OR CURVED ...

For external walls or cladding panels, the shape of a precast component is called its profile. In these applications, being able to produce a variety of different profiles can be very important. 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 molds means that very highly articulated panels are possible.
AVAILABLE IN A WIDE RANGE OF COLORS ...

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

... INCLUDING WHITE AND BLACK.

Dramatic architectural projects call for dramatic colors, and precast can be used to provide long-lasting white, off-white or black shades. Integrally colored precast components tend not to fade and will resist degradation in sunlight, but manufacturers can always advise on suitable colors 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 the client wish to add a door between two rooms, for example. Thin-walled knockouts are also common in utility products that are easily adaptable to on-site conditions and changes.

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 mold makers, and through their expertise even minute details become possible.
CAN INCORPORATE LIFE-SIZE IMAGES.

By using a process called photoengraving, it is possible to turn precast concrete into a huge photo album! 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 is often used to dramatic effect.

USES SPECIAL EFFECTS.

When precast concrete is cast in the factory, it offers the option to lay down different colored layers of aggregates in the mold. When the surface is exposed in varying degrees, the colors 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 mica in the concrete mix can make the precast sparkle, adding extra detail to the quality precast finish.

EASILY PAINTED OR STAINED.

For some structural precast concrete products, it may be more desirable to opt for a painted or stained finish. Stained finishes minimize maintenance, while painted finishes can easily be changed in the future.
CAN BE DESIGNED TO CHANGE COLOR.

The inclusion of thermochromatic dyes in precast concrete will cause it to change color 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.

CAN BE SELF-CLEANING.

The inclusion of titanium dioxide in precast panels not only produces a white color, but it also helps keep the surface clean. This ingredient captures unwanted particles (in this case, dirt and dust), which are then washed away by the rain.
Textured, knobby paving slabs near pedestrian crossings can help visually impaired people to recognize changes in level and possible dangers from passing traffic or other hazards.

... AND TO OTHERS.
The same techniques of casting in textures can be used to increase the skid resistance of the surface of a precast concrete product. This can be particularly useful in high-traffic paved areas, steps and ramps where wet or icy patches could cause slips and falls.
QUALITY IN PRODUCTION AND CONSTRUCTION
PLANT-MADE ...

Precast products are manufactured in plants under strictly controlled conditions. The controlled plant environment has a steady temperature, regular shift patterns and a dedicated workforce. This means that high-quality products can be made every day, regardless of the weather.

... AND BUILT TO PRECISE SPECIFICATIONS.

Precast manufacturers can be teamed with engineers, specifiers, installers and owners to guarantee precise and reliable workmanship and ensure that the quality of service from precast is maintained after the products leave the factory.
Covered by International Standards.

The precast concrete industry keeps a keen eye on national and international standards. This ensures that customers receive the best quality products that are compliant to all relevant standards.

Consistently Durable.

The factory-controlled production process means that rebar coverage is consistent and correct, as are strength and concrete quality. Properly placed rebar and controlled manufacturing processes ensure durability. It is possible to obtain a 100-year service life from precast products.
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 which finishes will be used.

Many precast products are available to see every day – buildings, bridges and other structures act as showcases for prospective customers. Precast concrete appears on award-winning buildings every year, and these provide some exceptional examples of what can be achieved.
GREAT RESULTS EVERY TIME ...
Because of the quality controlled manufacturing environment, repetition of individual products can be achieved with confidence whether the job requires 10, 100 or 1,000 pieces.

... WITH LONG-LASTING FORMS AND MOLDS.
Precast concrete forms and molds can be stored to allow later replication, whether additional units are required one day, one week or one year later.
PLAYS A KEY ROLE IN HYBRID CONCRETE CONSTRUCTION.

The combination of precast with steel or cast-in-place concrete in hybrid construction can have cost and program benefits. Precast concrete brings accuracy, high-quality finishes and speed of erection to any hybrid concrete construction project.

RAPID ERECTION ON SITE.

Precast units 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.
HIGHLY CONNECTIBLE.

Because precast products are manufactured to precise specifications, watertight connections between pipes or sections are a snap, making precast perfect for most underground applications.
REDUCES NOISE FROM BUILDING SITES.

Because precast components are cast in a plant and delivered to a job site, disruption to the surrounding community is greatly reduced. Noises associated with the construction of forms and placement of concrete is contained within the plant environment. This results in substantially quieter construction sites — a genuine benefit to local residents and workers alike.

PROVIDES AN INSTANT WORK PLATFORM.

Precast structures — particularly floors and staircases — provide an early, secure and broad platform on the job site. This solid footing helps speed up construction and provides a safer working environment.
LEAVES A SMALL FOOTPRINT.
Because precast is manufactured away from the construction site, there are no messy forms to build and no concrete mixing and finishing to be done on site. That means a smaller footprint and a cleaner, safer job site.
LESS VULNERABLE TO WEATHER.

Because nearly all precast production takes place within the controlled climate of a plant, precast is significantly less vulnerable to disruption caused by wet, cold or very hot weather, enabling installation to take place year-round in most cases.

EASY TO CLEAN AND REPAIR.

Despite all the best intentions on a construction site, sometimes minor dents, damage or dirtying 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 ...

The materials that comprise precast concrete products come from natural and recycled sources, making it a very sustainable construction material, perfect for green building under LEED guidelines. Aggregates and water are all widely available and in plentiful supply.

... TO MAKE LOCALLY AVAILABLE PRODUCTS.

Precast concrete uses materials that are widely available in all locations. With an estimated 3,000 precast plants in North America, many products can be manufactured locally, saving on delivery time and cost.
USES BYPRODUCTS FROM OTHER INDUSTRIES.

Precast products can safely incorporate materials such as blast furnace slag (from the iron and steel industries) 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 the casting form. Vegetable-based release agents can be used as a substitute for 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 or asphalt.
PERFECT FOR PROTECTING GROUNDWATER.

When manufactured by quality-conscious precasters, precast products provide decades of watertight service underground, protecting precious groundwater.

DOES NOT LEACH.

Precast concrete is inert, so it does not leach out any harmful chemicals. 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.
AVOIDS EXPENSIVE ENVIRONMENTAL DISPOSAL COSTS.

Making better use of natural resources makes good business sense and holds down costs. Using ready-made precast products limits waste disposal costs on the job site.

Even on site, even if all does not go to plan, there are still options available with precast. Scrap created at the building site can be collected and broken up to create material for road beds.
At the end of a structure’s life, precast products can be reclaimed as whole elements such as floor slabs. These could be reinstalled 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. Demand for “previously enjoyed” materials like this is growing every year. Even the reinforcing steel can be recycled.
SUSTAINABLE ...
Precast is perfect for today’s focus on preserving resources and protecting the environment through sustainable building practices.

... AND GREEN
Precast concrete building products correlate with at least four categories of LEED certification and can also help a building qualify for additional “Innovation” points.
MINIMUM WASTE EXPORTED OFF SITE.

Even small amounts of scrap or waste in the process can be recycled. Cement, slurry and process water can be recycled, and scrap products can be crushed and reused in other sectors of the construction industry.
PROTECTS HIGHWAY WORKERS ... 

Precast concrete highway barriers improve safety in construction work zones on roads and highways and can be readily moved based on traffic volume, reducing delays and speeding construction projects.

... AND MOTORISTS TOO.

When installed parallel to roadways, precast concrete barriers help realign stray vehicles and reduce their speed, which reduces accidents.
REDUCES DAMAGE FROM STORM SURGES.

Precast concrete highway structures can withstand severe storm surges in hurricane-prone regions, keeping vital arteries open after a disaster.

This is a picture of the Ernest Applewhite Causeway in Ocean Springs, Miss., after Hurricane Katrina in 2005. It withstood a storm surge that cleared the top of the precast structure by 8 feet.

STANDS TALL IN A FLOOD.

The high-quality surface of precast and the fact that it does not corrode or rot helps in flood cleanup and other weather disasters.
REDUCES URBAN ENERGY USE.
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, keeping buildings cooler and limiting the “urban heat island” effect.

CAN REDUCE TRAFFIC FUMES.
Using an ingenious new innovation, precast concrete coated with a special layer can absorb the harmful emissions from traffic fumes. A process called photocatalysis occurs, which entraps noxious particles and disperses them harmlessly when rain falls.
HELPS CREATE HEALTHY INDOOR ENVIRONMENTS.
The simple lines and smart edges of precast concrete are easy to clean, and its hard, smooth finish does not accumulate dust, creating a healthier indoor environment.

PRECAST IS EMISSION-FREE.
In its daily use, precast concrete is a totally inert substance, so it will not emit any gases, toxic compounds or VOCs (volatile organic compounds). This means allergy sufferers can breathe easy because precast does not contribute to “sick building syndrome.”
APPEALS TO INVESTORS.

The longevity of precast structures and their resistance to both everyday and extreme events mean that institutional investors and other funding bodies tend to look favorably upon the precast option.

EASY TO SELL, LEASE OR RENT.

The aesthetic appeal and longevity of a well-made precast structure can attract occupants as well as investors and produce a reliable return on investment. The architecture and performance qualities of precast mean that units can be sold or leased easily.
EASY TO EXTEND.
The fact that precast components can be dismantled 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 reinstalled upon completion.

LOWER INSURANCE COSTS.
With amazing structural properties, fire and mold resistance, and modularity and functional benefits, precast concrete buildings may in some cases attract lower insurance premiums than those built with other construction materials. This can become particularly apparent in high-risk areas such as those at risk from tornados, hurricanes, floods, fire and burglary.
LOWER MAINTENANCE COSTS.

In exposed locations, some structures will need regular painting to protect against corrosion and enhance their aesthetic appearance. Not precast. This advantage is particularly relevant for roads, bridges and structures that cannot be easily accessed.
IMPRESSION VALUE FOR A LONG SERVICE LIFE.

There’s no doubt that the many advantages of precast comprise a significant package. It’s super strong, long-lasting and resists buoyancy underground. And it offers beauty and value through attractive finishes, modularity and quick all-weather installation above ground.

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, precast concrete pipe easily withstands power flushing, and precast road slabs provide a quick fix and a durable surface when used to repair sections of busy roadways and bridge surfaces.
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 production facilities demonstrate this forward-thinking attitude.
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 with a long history and a high-tech future.
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