

VDB® INGENIERÍA CIRCULAR, SUSTAINABLE DEVELOPMENT IS TAKING THE FIELD OF CIVIL ENGINEERING



Author: Maarten N. van den Berg
Founding Partner - **VDB® Ingeniería Circular**
Email: mvdberg@vdbingenieriacircular.cl
April 2022 – Santiago, Chile



Introducing a Sustainable Innovation

Sustainable development in Civil Engineering is an approach that integrates social, economic, environmental and technical objectives that are required to reduce Greenhouse Gas (GHG) emissions and with this the criteria to face the designs of structures and their construction methods. To provide effective and realistic answers, **VDB® Ingeniería Circular** (VDB Circular Engineering) was created, cataloged as an innovation company in management of projects, science and engineering with a team that catalyzes the change to the Circular Economy based on the Structural Civil Engineering of modular concrete, implementing solutions with theoretical and practical backing.

One of the bases of the methodologies corresponds to the technical application of modular designs from the conception of remote execution, in controlled safe conditions and with quality objectives. Under these conditions, it is possible to incorporate aspects of the Circular Economy with the experience in the entire value chain of modular Precast Elements in concrete, from design to putting the structures in us, thus generating a new sustainable management of Civil Engineering projects with the method that **VDB® Ingeniería Circular** has developed.

From a global framework, this new method allows direct attention to three UN Sustainable Development Goals (SDGs) and indirect attention to five SDGs (www.UN.org). They are cross-cutting international objectives that contribute to the purpose of dealing with Climate Change and that should be considered in the field of engineering and construction. The services to manage projects in a sustainable manner have been structured under the title of **VDB® Inversiones Renovables** (VDB Renewable Investments), which allows not only technical attention to the Sustainability of Civil Works, but also enables the incorporation of new execution methods, friendlier to environment. For this, in **VDB® Ingeniería Circular** (VDB Circular Engineering) knowledge and tools are integrated with the conviction that it will be an important contribution for future generations.



Defending our green beliefs

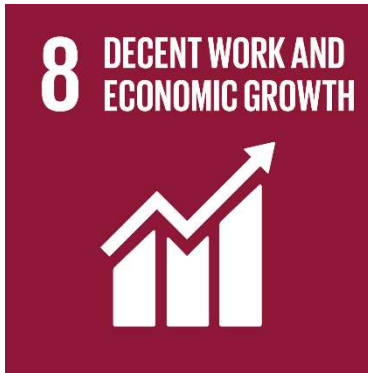
From the knowledge of industrialization and interdisciplinary collaborative work, we understand that it is possible to generate and exploit projects with less impact on the environment, compared to a linear economy system. For this reason, together with our clients, we face this historical paradigm in the construction industry, often achieving results with reduced technical uncertainties and better profitability for the projects that are carried out.

In this way, we identify ourselves with the resolution on the Sustainable Development Goals (SDG) approved by 193 countries in the United Nations General Assembly on September 25, 2015. There are 17 goals, 169 objectives and 230 indicators that will be permanently monitored until complete the objectives in 2030. This 2030 Agenda involves issues such as poverty reduction, defense of the environment, quality education, fight against hunger, among others. (www.ONU.cl).



SUSTAINABLE DEVELOPMENT GOALS

The contribution of **VDB® Ingeniería Circular** with its services for Renewable Investments and using the method **PPF® Precast Full Potential** are specific and quantifiable. To the Sustainable Development Goals numbers 8, 9 and 13, we contribute directly with our knowledge and specialization in Civil Works in the construction market in each country. Indirectly, our project and services contribute to achieving Goals 6, 7, 11, 12 and 15 for our clients.



Goal 8 (SDG): "Promote inclusive and sustainable economic growth, employment and decent work for all"

VDB® Inversiones Renovables (VDB Renewable Investments) contribute directly to the generation of more jobs in the supply chain that makes up the industry of Prefabricated Concrete Elements; privileging the national markets for projects, showing that current problems derived from the globalization of trade can be addressed locally. This translates into the need to generate greater volumes of products and services, thus favoring the potential of the national industry, thus increasing economic growth. In addition, with the new modular execution methods, the sizes of temporary works installations in inhospitable or difficult to access places are reduced, by having much less personnel in the execution stage installing the structures.

Examples of Sustainable Development Goal 8 that VDB Renewable Investments develops:

- Use of modular solutions, using prefabricated concrete, which allow projects to be produced outside the construction site.
- Generate more standardized industrial production of Precast Concrete Elements, this allows more work in these production facilities.
- Develop and implement plans for the reuse of Crushed and Grinded Rock (CGR), resulting from mining tailings, as raw material for construction to generate, for example, aggregates for concrete, geopolymer concrete and various other applications.

The above promotes:

- Sustainable work since the generation of specialized industries allows the development of more than one project at any given time and makes it easier for workers to carry out their duties in places with adequate facilities for decent and safe work.
- Inclusive work, related to the previous point. Indeed, it is possible to promote inclusive work because it is more feasible to implement jobs for people with different abilities in industrialized facilities, better equipped for this purpose.
- Reduction of environmental impact with fewer transfers of personnel and equipment to sites, resulting in a reduction in greenhouse gas emissions.



Goal 9 (SDG): “Build resilient infrastructure, promote sustainable industrialization and foster innovation”

VDB® Inversiones Renovables (VDB Renewable Investments) contributes directly to the generation and application of design methodologies in projects, to obtain sustainable and technically feasible structural solutions, based on the concept of Circular Economy. By using new design criteria, it is possible today, with the tools that are part of the **PFP® Precast Full Potential** methodology that has been developed for this purpose, to promote multiple uses of concrete structures.

Examples of Sustainable Development Goal 9 that VDB Renewable Investments develops:

- New variants of industrial slabs, which allow these pavements to have more than one use and are easy to install and remove, without generating environmental liabilities.
- In underground mining works, we have generated the migration of cast in-situ concrete projects to modular precast concrete solutions, incorporating innovations for the handling of the parts and in the design and creation of the joints, which allows for easy assembly and disassembly.
- In the energy and fuel industry, we have generated modular solutions with standardization of precast foundations, which allows off-site production and easy installation and removal.

The above promotes:

- The generation of local precast concrete industries, which allows the development of projects in various markets (mining, ports, energy, etc.) keeping workers close to their families and in adequate working conditions and in facilities designed for safe operations.
- Reduction of CAPEX and OPEX, since by industrializing and standardizing the projects, more durable materials and a better part manufacturing standards are used. Each element is designed for its specific use in the structure.
- Reduction of environmental impact, with a reduction in Greenhouse Gas emissions with more cycles of product use once they have been produced, with less personnel working on the sites and with less energy required for the dismantling of structures.



Goal 13 (SDG): "Adopt urgent measures to combat climate change and its effects"

VDB® Inversiones Renovables (VDB Renewable Investments) contributes directly with the implementation of solutions that have lower GHG emission rates, encourage the reuse of structural elements in concrete and the reuse of "waste", considering this just another raw material that we need to address in new processes and solutions.

Examples of Sustainable Development Goal 13 that VDB Renewable Investments develops:

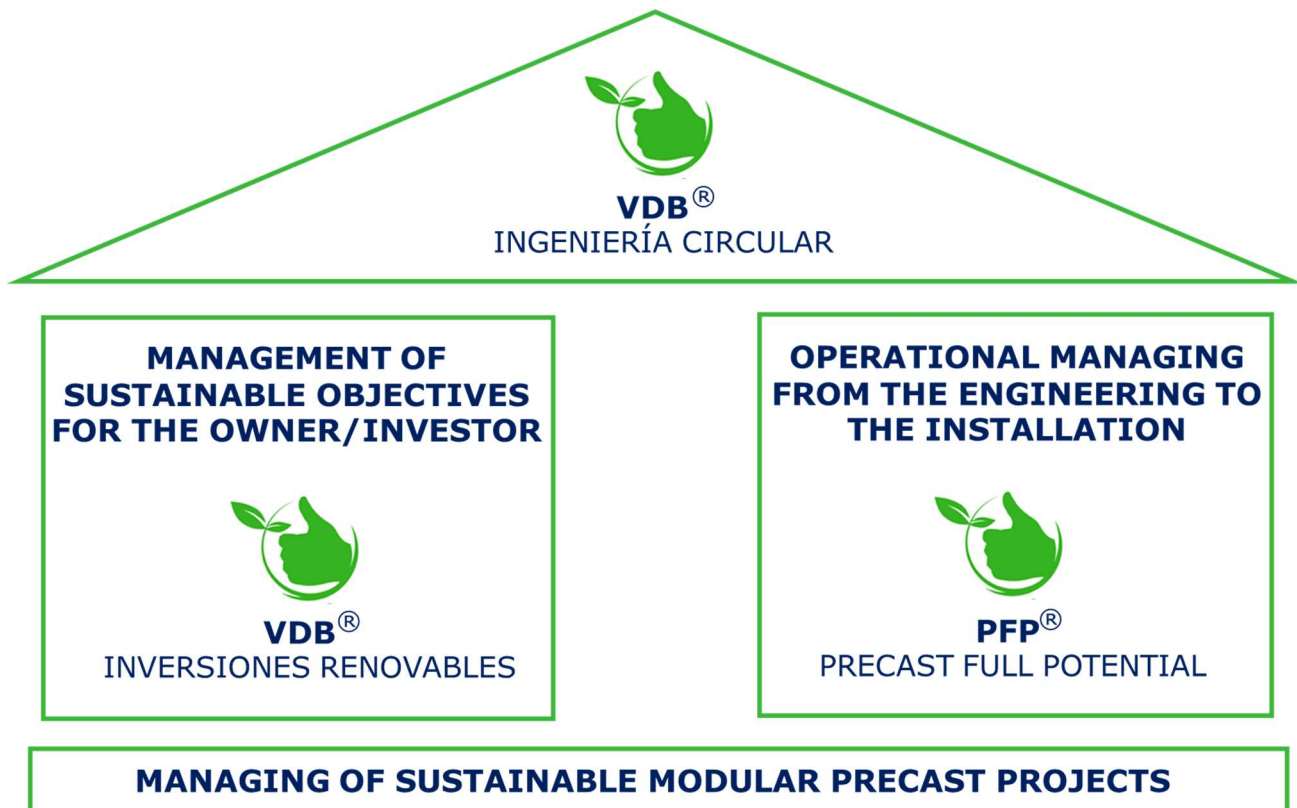
- Carry out the transformation of large-volume industrial projects, such as are required in the mining industry or for electricity generation, to modular solutions with Prefabricated Elements with more than one use, using industrial production processes, with highly qualified personnel. Innovative solutions that break paradigms.
- Management for the reuse of unused industrial materials, such as: tailings, mine rock from tunnel activities, fly-ashes, etc., as raw material for construction such as aggregates for concrete and fines in mortar, asphalt and geopolymer concrete.
- Modular solutions for pump stations and industrial complexes dealing with fuels, which not only generate cost reductions, but also contribute to the sustainable development this market at each jobsite.

The above promotes:

- Reduction of environmental impact, generating access to raw materials that comply with the laws and norms of each country and reduce illegal extraction activities.
- Reduction in the transference of personnel and equipment to sites, generating a reduction in greenhouse gas emissions.
- Reuse crushed concrete and reinforcing rebar as scrap, which means recycling the same raw materials over and over, maintaining them in use, without waste, which provides social, environmental, and economic benefits.

VDB® Ingeniería Circular (VDB Circular Engineering)

Sustainable Development Goals 8, 9 and 13 are part of the services that VDB Circular Engineering develops in a bold and ambitious way; thus achieving that the three interconnected elements of sustainable development, such as environmental protection, social inclusion and economic growth, are strengthened in each of the six parts of the value chain of modular precast concrete solutions (1 Engineering – 2 Production of facilities and equipment – 3 production of modules – 4 storage – 5 transport and logistics – 6 installation and assembly).

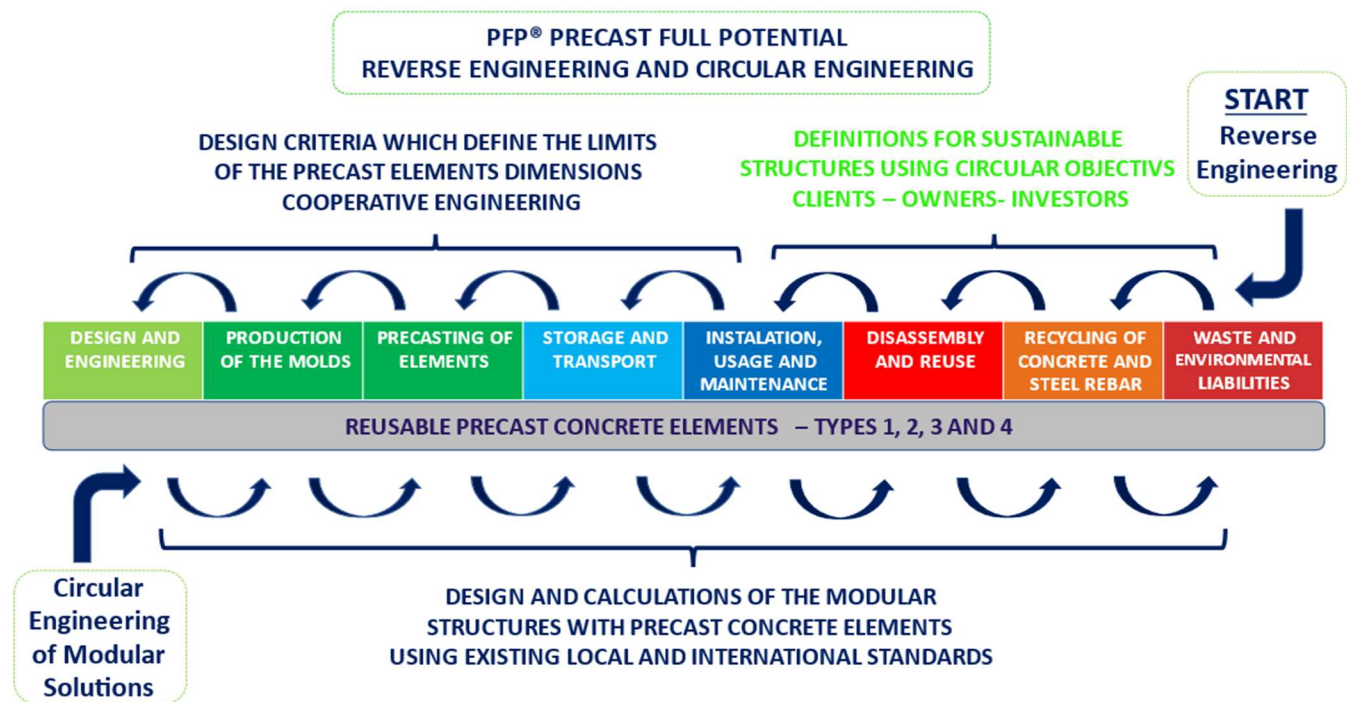


Pillar 1 "**MANAGEMENT OF SUSTAINABLE OBJECTIVES FOR THE OWNER/INVESTOR**": through the contribution to each company of a transformation strategy with new tender documents and design criteria, we improve the complete value chain for each project. Incorporating the sustainable objectives from the UN in the heart of each new investment. Having an objective and global vision of construction issues, which incorporates the values and specific objectives of each company, facilitates the design and the way of acting, thinking, and working of all those involved in the project teams, from the pre-feasibility stage to its completion to be put in use.

It is in the VDB Renewable Investments methodology that sustainable concepts are brought together for the management of the green concrete strategy. The focus of the strategy is on cooperation, planning, measurement, and financial results of the project. Since it is at this stage of the project financing evaluation, that the sustainable objectives provide the clarity to generate social, environmental, and economic results during each stage of the investment.

Pillar 2 "**OPERATIONAL MANAGING FROM THE ENGINEERING TO THE INSTALLATION**": incorporates the knowledge of experts who contribute to Civil Engineering by generating modular solutions with Prefabricated Elements. It is the way to implement the migration of monolithic cast in situ concrete structures to precast modular ones, which allow them to be disassembled for reuse or subsequent recycling, thus eliminating environmental liabilities. The new design solutions incorporate knowledge about the constructability on site, the productivity during fabrication and installation, coordination, planning, digitization, and automation. By incorporating the Sustainable Development Goals at an early stage of engineering and the designs, it is possible to have access to the greatest economic, technical, social, and environmental benefits.

In the methodology of **PFPP® Precast Full Potential**, the way of gathering the required information has been implemented, in a sequence of data gathering steps called **REVERSE ENGINEERING**, which allows for design criteria, from the beginning of each project, that incorporate such relevant aspects, as the objective percentages of reuse and recycling of each concrete structures. Saying green concrete is possible, since raw materials, such as steel and concrete, can be kept in reuse cycles indefinitely, without generating environmental liabilities. The Sustainable Management of concrete projects allows transforming the Linear Engineering of structures to Circular Engineering.



VDB® Ingeniería Circular is increasing the degree of circularity in the different processes, from its financing and the design of its elements and products, to the putting into use of these. The innovative methodologies **VDB® Inversiones Renovables** and **PFPP® Precast Full Potential** allow conserving the value of the Resources, of the Prefabricated Elements and of the raw materials to extend all their uses to at least two, allowing afterwards for their easy disassembly, reconditioning, repair, or recycling.

Use of concrete structures during the second cycle

The **PFP® Precast Full Potential** methodology allows generating renewable investments from civil concrete structures with design criteria that consider the first and second use cycles. After a first use of, for example, 30 years, many parts of structures made of concrete maintain their excellent quality, characteristics and shapes which allows technically for them to be part of a second cycle of use.



Reuse of the existing industrial plant was a logical starting point to design the new educational building.

(Images Architectural Studio MVRDV)

Photographer Ossip van Duivenbode - Instagram @ossipvanduivenbode

As a very good example we share here 2 images that were published in the magazine "Cement" 5-12-2021 in an article written by Mrs. Kirsten Hannema about the transformation of a Cement Plant built in the 60s of the last century into a school in Roskilde, Denmark. In the article the following is mentioned and translated from Dutch to English.

“In the Danish town of Roskilde, architecture studios MVRDV and COBE have transformed a 1960s cement factory into an educational building for the Roskilde Folk Festival Højskole. By reusing the concrete support structure of the hall, the industrial heritage and 'rough' atmosphere were preserved, and the CO₂ footprint of the project was limited. The new façade, made with prefabricated concrete sandwich panels, is a contemporary copy of the previous one. ”

Projects like in Roskilde motivate us to think and go further. Generating civil works in concrete must, from its first concept and design, incorporate multiple uses. More uses of structures, more uses of Prefabricated Elements and more uses of raw materials with recycling processes.

Glossary

Sustainability - In ecology, sustainability describes how biological systems remain productive over time. It refers to the balance of a species with the resources of its environment. In construction, the noble material of reinforced concrete does not need to generate waste because it can be kept in the environment and be reused or recycled repeatedly. Crushed concrete generates new aggregates and steel bars become scrap to enter a new cycle to produce steel.

Environmental Liability - The concept of Environmental Liability can be defined as that environmental situation that were generated by man in the past or in the present and future, that can generate a progressive deterioration of this situation over time, representing a risk to the environment and the quality of life of people at present and/or in the future. For example, a reinforced concrete structure left abandoned on a site that can remain there for centuries and/or collapse over time.

Residual Waste - The word residue (from the Latin residuum) describes a material that loses its usefulness after having fulfilled its mission or having served to perform a certain job. Residual wastes are products and materials that cannot be reused or recycled at this time.

Renewable Investments - Generate investments in reinforced concrete civil works that over time continue to generate value for investors and owners. This is possible when the investment conditions stipulate the need for the presence of reuse, recycling, and generation of new raw materials in a **new way to manage Civil Engineering designs and engineering**. From early stages in the projects, it is necessary to generate the visualization of the economic values that concrete structures maintain after their first use.

PLANIFICATION AND COORDINATION OF THE PRECAST VALUE CHAIN



1. ENGINEERING



2. MOLDS PRODUCTION



3. PRECASTING



4. STORAGE AREAS



5. TRANSPORTING



6. ASSEMBLY

UN Sustainable Development Goals (SDGs) – Below is a table with the titles of the SDGs, which 193 countries are implementing in their economies and societies. In green, the SDGs that are related to the value proposition of **VDB® Ingeniería Circular**.

N° SDG	Descriptive title Sustainable Development Goals (SDGs) https://www.UN.org
Goal 1	End poverty in all its forms everywhere in the world
Goal 2	End hunger
Goal 3	Ensure a healthy life and promote well-being for all at all ages
Goal 4	Ensure inclusive, equitable and quality education and promote lifelong learning opportunities for all
Goal 5	Achieve gender equality and empower all women and girls
Goal 6	Guarantee the availability of water and its sustainable management and sanitation for all
Goal 7	Ensuring access to affordable, secure, sustainable and modern energy
Goal 8	Promote inclusive and sustainable economic growth, employment and decent work for all
Goal 9	Build resilient infrastructure, promote sustainable industrialization and foster innovation
Goal 10	Reduce inequality within and between countries
Goal 11	Make cities more inclusive, safe, resilient and sustainable
Goal 12	Ensuring sustainable consumption and production patterns
Goal 13	Take urgent actions to combat climate change and its effects
Goal 14	Conserve and sustainably use the oceans, seas and marine resources

N° SDG	Descriptive title Sustainable Development Goals (SDGs) https://www.UN.org
Goal 15	Sustainably manage forests, combat desertification, halt and reverse land degradation and biodiversity loss
Goal 16	Promote just, peaceful and inclusive societies
Goal 17	Revitalize the Global Partnership for Sustainable Development
Definition of the color	VDB® is contributing directly to the Sustainable Development Goals 8, 9 and 13 with its services and deliverables.
Definition of the color	VDB® is contributing indirectly to the Sustainable Development Goals 6, 7, 11, 12 y 17 with its services and deliverables.

