

INDUSTRIAL TECHNOLOGY

Machines. Technology. Automation

Number 6, November 2025



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SUSTAINABLE CONCRETE IN ITALY: COMPLIANCE WITH UNI 11104 AND UNI/PDR 176

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The construction sector is responsible for approximately 40% of global carbon dioxide (CO₂) emissions, a significant portion of which comes from building operations (heating, cooling, lighting) and the remainder from construction materials and processes. Most of these emissions are related to the operational energy consumption of buildings (69% of total emissions along the supply chain), but emissions “embodied” in materials (from extraction to construction) are also a key component. Among

these, concrete plays a key role, with cement having the greatest environmental impact in terms of its carbon footprint.

Concrete contributes approximately 8% of global CO₂ emissions.

Europe has long identified the construction sector as a critical sector for its impact on climate change, which is why the CBAM regulation included cement from the outset.

In Italy, “sustainable concrete” has recently been defined with the UNI 11104 and UNI/PdR 176 standards





(July 2025) and its implications for the entire industrial supply chain have been assessed.

Sustainable Concrete: Definition and Benefits

Sustainable concrete is an innovation that aims to reduce the material's environmental impact through the use of alternative materials, production optimization, and recycling. The adoption of sustainable techniques and materials achieves:

1. **Reduced CO2 Emissions**: By using secondary materials and reducing the amount of Portland cement, emissions related to concrete production can be reduced.
2. **Lower Energy Consumption**: Improved production processes and the use of renewable energy sources can reduce energy consumption in concrete production.
3. **Waste Recycling**: Recycled concrete (RCD) reduces the amount of materials to be disposed of, promoting a more circular life cycle.

UNI 11104 Standard -The UNI 11104 standard provides guidelines for the use of concrete containing recycled materials. It establishes the criteria for the design and quality control of recycled concrete, specifying technical and performance requirements.

Recycled concrete (RCD) reduces the amount of materials to be disposed of, promoting a more circular life cycle.

Key elements of UNI 11104:

- **Types of Materials**: Definition of the materials to be used (recycled aggregates from demolition, etc.) and the conditions for their acceptance.
- **Mechanical Characteristics**: Standardization of the mechanical performance of concrete composed of recycled materials.
- **Safety and Stability**: Evaluation of the durability and long-term resistance that recycled concrete must guarantee.

UNI/PdR 176 - Design Principles UNI/PdR 176 provides a framework for the design and construction of sustainable concrete structures, with a particular focus on resource planning and waste minimization.

Key aspects of UNI/PdR 176:

- **Life Cycle Assessment**: Importance of considering the entire life cycle of concrete, from production to use, through disposal or recycling.
- **Alternative Materials**: Promotion of the use of alternative cements and recycled aggregates.
- **Environmental Impact**: Tools for

assessing the environmental impact of design solutions and promoting more responsible practices.

Implementation and Practical Examples- Implementing the guidelines contained in the UNI 11104 and UNI/PdR 176 standards requires a shift in thinking in the construction industry. Several companies are already adopting sustainable practices, reporting positive results in terms of performance and environmental impact.

Examples of sustainable concrete

•Low-Carbon Concrete:

Use of admixtures that reduce the amount of cement required while maintaining high standards of strength.

•Recycled Concrete:

Urban reinforcement projects that use recycled aggregates from demolition sites, thus reducing the need for new raw materials.

Conclusions

Sustainable concrete represents an effective response to the environmental and social challenges of our time. The adoption of the UNI 11104 and UNI/PdR 176 standards is essential to promoting more responsible construction practices and ensuring the quality of the concrete used in our infrastructure. Investing in sustainability is not only an environmental necessity, but also an opportunity to innovate and improve the resilience of the construction sector in the contemporary era.

Esalex's commitment to sustainable concrete

To support this project to decarbonize construction, which represents a new and exciting challenge for the construction industry, the ESALEX team promptly launched the development of an app capable of assessing concrete's GWP in real time, based on its life cycle assessment (LCA), and correlating this value with the specific efficiency characteristics of the concrete. The tool thus allows the designer to select the



best possible raw material mix on the production site and to promptly assess the sustainability level of the concrete produced, in line with the contracting authority's requirements. The validation of this IT tool, the "GEMMI 2030 - Sustainable Concrete" app, led to a collaboration with the Polytechnic University of Marche, to evaluate, together with graduate students, the deviations from the sustainability values of other concretes around the world.

There is no doubt that training and raising awareness among all stakeholders, from public administrations and their contracting authorities to manufacturing companies and their workforces, represents a delicate yet essential step that must be addressed decisively, while also providing easy and readily applicable tools.



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