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Precast concrete, the way forward.

A modern solution for today's residential buildings!

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The use of precast concrete in construction is widely regarded as an economic, durable, environmentally friendly, structurally sound and architecturally versatile form of construction. The precast concrete industry is continuously making efforts to keep on line with the demands of modern society: economy, efficiency, technical performance, safety, labour circumstances and environmental friendliness. The evolution of building construction and civil engineering works during the next decades will undoubtedly be influenced by the developments in information processing, global communication, industrialization and automation. These are already certain to be implemented in prefabrication. However, when considering the efficiency of present building processes, there must be a smoother transition from the design of the construction to its completion. The only way to move forward from the traditional labour intensive methods to the modern approach of prefabrication is to apply an industrial philosophy throughout the entire building process.

Sustainability is a major issue in any industrial activity today. In the building industry, prefabrication provides the best approach to this end. In fact, the whole life-cycle is better controlled. Industrialized production of elements allows for saving materials and energy when constructing. In all phases, time, waste, noise and dust, in a whole environmental impact, are reduced. Prefabrication of concrete structures is an industrialized process with a large potential for the future. It is often considered by uninitiated designers as a variant execution technique of cast in-situ construction, where the notion of prefabrication means that parts of the construction are precast in specialized plants, to be assembled afterwards on site in such a way that the initial concept of cast in-situ structures is obtained again. This viewpoint is false. Every construction system has its own characteristics which to a greater or lesser extent influence the structural lay-out, span and width, stability system, etc. For the best results a design should, from the very outset, respect the specific and particular demands of the intended structure.

In 2014, the *fib* Commission on Prefabrication published bulletin 74, a handbook that dispels these misguided impressions by providing a detailed review of the subject and thereby promoting a greater awareness and understanding of precast concrete buildings. The bulletin gives a synthesis of the work carried out by a focus of industrialists, consultants, contractors and academic members of the *fib* Commission on Prefabrication over the past decades. It has been written particularly for those less familiar with this way of construction, but will also be of interest to all engineers, architects and others concerned with the design and construction of buildings. Best Practice examples for buildings and structures made of precast concrete encourage the readers to consider this way of construction for future projects.

This paper is taken from Chapter 1 of this handbook. The full bulletin is available on **www.fib-international.org.** All credits go to the authors of the handbook, especially Arnold van Acker, main author and convenor of the Task Group in charge of this handbook.

Suitability of precast concrete construction

At the initial design stage the first requirement is to identify whether the building project or certain parts of it are suitable for construction in precast concrete, and what the specific advantages and inconveniences are compared to other building systems. The main advantages of precast concrete are the speed of erection, the quality of the concrete, long-span prestressed concrete floors, a controlled working environment and the economy of the project. However, many misunderstandings occur around, for example, the lack of flexibility, the multiplicity of precast building systems and the long lead-in times needed for a complete study.

Precast concrete has many more advantages than are mentioned above, and the excessive repetition of products or long design and manufacture periods no longer exist in contemporary practice. On the contrary, thanks to modern production techniques and computer aided manufacture, in combination with Building Information Modelling (BIM), its flexibility combined with its short delivery times have become a major commercial asset for prefabrication. Over the past thirty years the latest generation of precast concrete buildings have become high-specification buildings. Architectural structural precast concrete elements are being used on an increasing number of prestigious buildings, and steelwork, timber, plastics and masonry are being combined for the holistic benefit of the entire building process. Designers are becoming more aware of the high-quality finishes available for prefabricated units, and changes are now being made to the way that the traditional precast structures are conceived and designed. The construction industry is calling for multi-functional design, where the optimum use of all the elements forming the building must be maximized. In the initial phase of study, precasting cannot be ignored any longer, either as a solution for the whole structure or for parts of it.

Advantages and limitations

Most buildings are suitable for precast concrete construction. Buildings with an orthogonal plan are, of course, ideal for precasting because they exhibit a degree of regularity and repetition in their structural grid, spans, member size, and so forth. When designing a building, one should always strive for standardisation and repetition to ensure economical construction while still attempting to respect the individuality of the architectural design. This rule applies to every design and not to precast concrete construction only. On many occasions, irregular ground layouts are, if not totally then certainly partially, suitable for precasting. It is a misunderstanding that precast concrete offers no flexibility. Modern precast concrete buildings can be designed safely and economically, with a variety of plans and

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