with considerable variation in the treatment of the elevations, generally to heights of about twenty to thirty metres but also up to forty floors high.

Fig. 1 and Fig. 2 illustrate market trends in the architectural layout of all kinds of non-orthogonally shaped floor plans, for example, ones that are elliptic, rounded and have sharp edges. This is now possible in the precast industry thanks to great flexibility in the production technique.

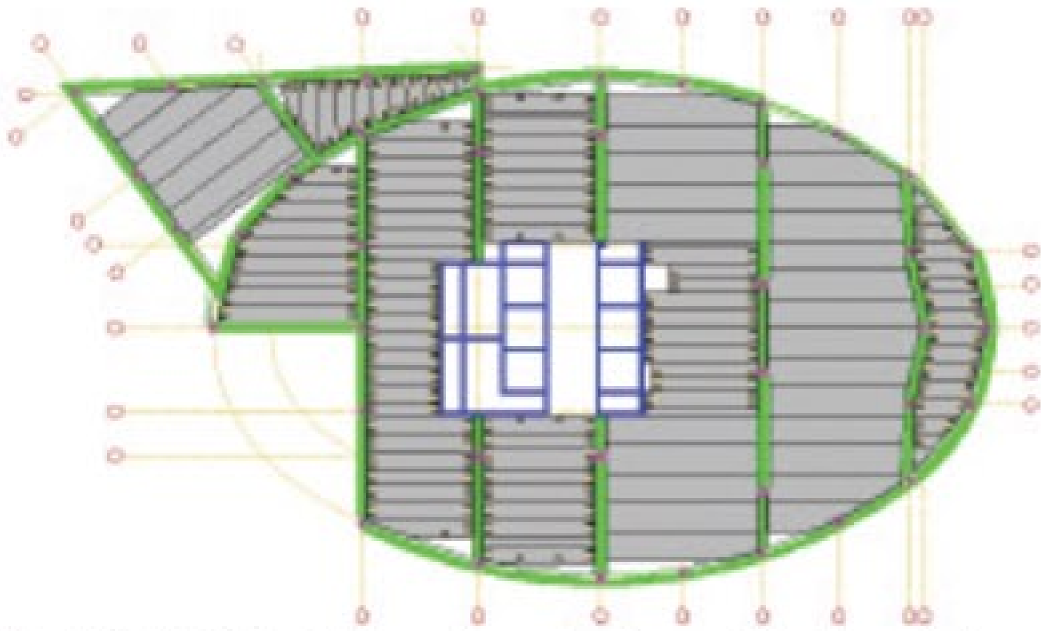

Fig. 1. Flexibility in design and construction enables this oval shape building in Brussels, Belgium, to be prefabricated with mainly rectangular concrete elements

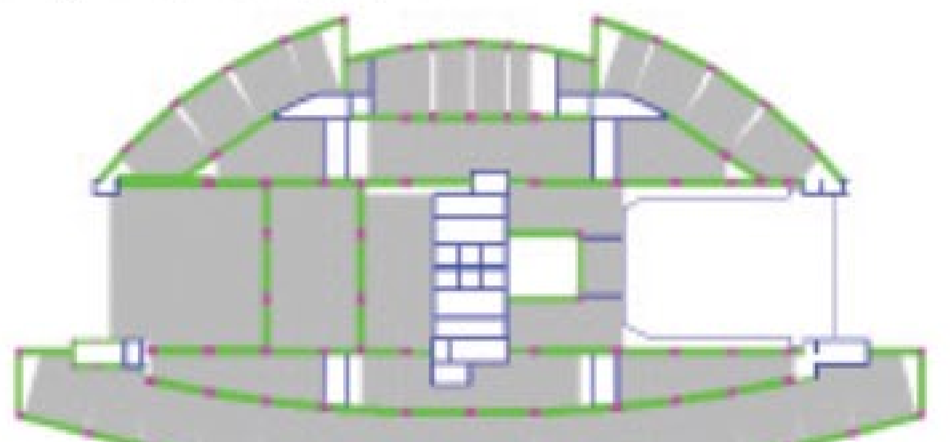

Fig. 2. Freedom in design of the floor layout of the conference building of the European Union, Brussels, with its 7 large conference rooms

Precast concrete offers considerable scope for improving structural efficiency. Longer spans and shallower construction depths can be obtained by using prestressed concrete for beams and floors. For industrial and commercial halls, roof spans can be up to forty metres in length or even longer. When precast concrete is used in parking garages, more cars can be fit into the same construction space because of the large span possibilities and slender column sections. If precast units were used to their full potential, office buildings could have even larger open spaces divided only with partitions. Using such units leads to greater flexibility as well as an extended lifetime because of a building's greater adaptability. Thus, a building can retain its commercial value over a longer period.

Differences in precast and cast in-situ structures

Apart from a production in weather-controlled conditions, precast concrete offers several other differentiating features. Cast in-situ concrete structures behave as three-dimensional frameworks (Fig. 3a). However, for precast concrete structures in non-seismic areas, the creation of a three-dimensional framework is seldom. The stability of precast structures should be assured by appropriate systems that are easy to achieve on site: by the

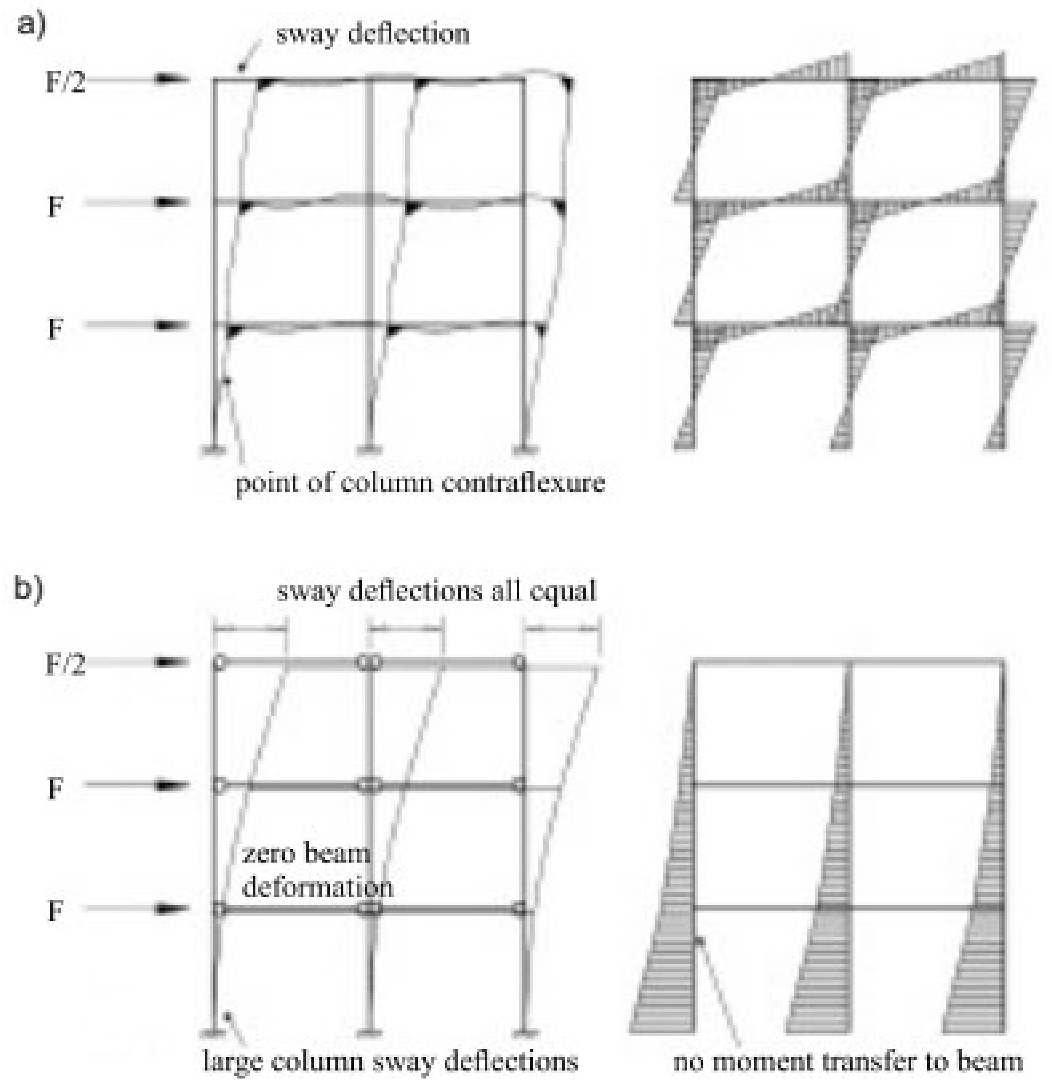

Fig. 3. 2-D and 3-D continuous frame action in cast in-situ frames is replaced (a) and by moment-resisting columns in a precast skeletal frame (b)

restrainment of columns in foundations (Fig. 3b), the in-plane stiffness of shear walls or cores, diagonal bracing, floor and roof diaphragms, or combinations of these systems.

Precast plants use computer-controlled batching and mixing equipment. Additives and admixtures are used in the mix design to obtain the specific mechanical performances needed for each product. The casting and compaction of the concrete is performed in indoor working conditions, with optimum equipment. The water content can be reduced to a minimum and compaction and curing are performed in a controlled environment. The result is that the grade of concrete used can be exactly suited to the requirements of each type of structural element to eliminate the use of more expensive and exhaustible materials. Usually, the concrete cube strength of precast concrete elements is 50 to 60 N/mm^2. In addition, the optimisation of the mix is beneficial for durability.

High performance concrete, with cylinder strength exceeding 100 N/mm^2, is common in prefabrication and widely used. The major benefit for building structures is an improved structural efficiency that contributes to more slender products and the optimum use of materials. Another advantage of high-strength concrete is its smaller ecological footprint. Whereas high-strength concrete essentially focuses on improved product performances (strength and durability), self-compacting concrete (SCC) also provides significant benefits to the production process. It needs no vibration and thus offers many advantages, such as a low noise level during casting, less mould pressure and formwork wear, rapid casting, easy casting when using dense reinforcement or for thin or complicated cross-sections, fewer air pores at the surface and easy pumping.

Fig. 4 shows a new application achieved using SCC for circular columns. In the past, circular columns were cast in a vertical position using cardboard moulds with an inner aluminium lining. The column height was usually limited to one storey. The inconvenience of this limited height, compared to multi-storey columns, lies not only in the additional cost for the production, handling and erection of a larger number of columns, but it also

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