ZVI HECKER*

REINVENTING ROMAN CONCRETE TO SURPASS GOTHIC CATHEDRALS

UDOSKONALANIE RZYMSKIEGO BETONU, BY PRZEWYŻSZYĆ GOTYCKIE KATEDRY

Abstract

The invention of reinforced concrete by Joseph Monier, a French gardener, and the subsequent development by great Swiss engineers and French architects like Anatol de Baudot, Robert Maillart, Gustave and Auguste Perret, Eugène Freyssinet – to mention only some – allowed twenty-century architects to come closer to the achievements of the builders of the Gothic Cathedrals.

Keywords: Roman concrete, Gothic cathedral, dematerialization of mass

Streszczenie

Wynalezienie żelazobetonu przez francuskiego ogrodnika, Josepha Moniera oraz kolejne etapy jego udoskonalania przez wielkich szwajcarskich inżynierów i francuskich architektów, takich jak Anatol de Baudot, Robert Maillart, Gustave i Auguste Perret, Eugène Freyssinet – by wspomnieć tylko kilku – pozwoliło dwudziestowiecznym architektom zbliżyć się do osiągnięć budowniczych gotyckich katedr.

Słowa kluczowe: beton rzymski, katedry gotyckie, dematerializacja masy

The introduction of concrete as a new building material is inseparable from the development of Modern Architecture. The wide dissemination of Modern Architecture in the 20th century crossed all geographical boundaries. It became a truly international movement, closely associated with new man-made synthetic materials, such as steel, glass and concrete. Concrete was the most recent, the most versatile and easily produced locally.

Though concrete is intimately associated with the twentieth century, its roots are much deeper. Actually, the Phoenicians on the coast of Mediterranean Sea and of course the Romans had already introduced and refined the use of a wet mixture of minerals that harden when left to dry. This technique allowed the Romans to abandon the Greek dry assembly of precisely cut stones in favor of new homogeneity of bricks, stones and their binding mortar.

Great public buildings, aqueducts and bridges were erected throughout the centuries using the principal of compression in which the mass of material played the most significant role. Roman concrete was the binding material of a structure. Weight and solidity were natural assets in a world built of bricks and stone.

* Hecker Zvi, architect, Berlin.

Ill. 1. Nôtre-Dame Cathedral, Reims, France, 1211–1275, *Interior*
Ill. 2. St. Joseph's Church, Le Havre, France, 1951–1958, *Interior, concrete* – Auguste Perret
Ill. 3. Câteau de Chambord, France, 1519–1547, *Roof chimneys* – Domenico da Cortona, Leonardo da Vinci, Pierre Nepveu
Ill. 4. City Hall, Bat-Yam, Israel, 1960–1963, *Roof concrete ventilation towers* – Zvi Hecker, Alfred Neumann, Eldar Sharon

The economy of building materials and the reduction of weight were much more evident in wooden and later in steel construction. However, the preoccupation with lightness and the dynamic of form had to wait for concrete, the new material that made dematerialization of mass an aesthetical factor.

The real breakthrough in the conversion of the traditional mortar binding substance into reinforced concrete was done by the French gardener Joseph Monier in 1867 who was one of the first to introduce steel reinforcement in the wet mass of cement pots. Monier realized the far-reaching consequences of his discovery extending its application to water reservoirs and bridges. The reinforced concrete was born to open new structural possibilities.

Made of steel rods or steel mesh embedded in cement, the new material combined strength and elasticity, which previously was unheard of. Its qualities, though not thoroughly understood, already dictated a new set of proportions considered first to be practical, but not yet aesthetically pleasing.

It took the skill and imagination of great engineers and architects like Anatole de Baudot, August Perret, Tony Garnier, Robert Maillart, Eugène Freyssinet, Pier Luigi Nervi, Eduardo Torroja, Félix Candela to refine the reinforced concrete into a new vocabulary of architectural forms. First applied to the utilitarian functions like industrial plants, stadiums, hangars and multifunctional halls, it soon became the most recognizable material of Modern Architecture.

Intended to first serve construction only, it became the originator of structural logic, an enclosure of immense architectural spaces.

My generation found reinforced concrete to be a standard building material, particularly useful because the alternative constructions with the use of wood and metal were much more expensive in Palestine. Silicate bricks of low standard were available with varieties of stones in use mostly in Jerusalem.

Concrete hollow blocks 20/40/40 cm became the commonly adopted construction element used for walls as well for spacing the concrete ribs of the ceiling.

Cement was produced locally and there was an abundance of stone aggregate and sand. Concrete became the building material of the Jewish state in Palestine.

Throughout the centuries, architecture was related to the tools of the design. The triangles and the T square dictated for centuries the form of our built environment, resulting in predominant post and beam construction.

With the introduction of computers into the design process, this new interdependence between the mind and the hand results in ever-new possibilities.

It seems that the architecture of the twenty-first century is in possession of technology that can finally surpass the achievement of the Builders of Gothic Cathedrals.