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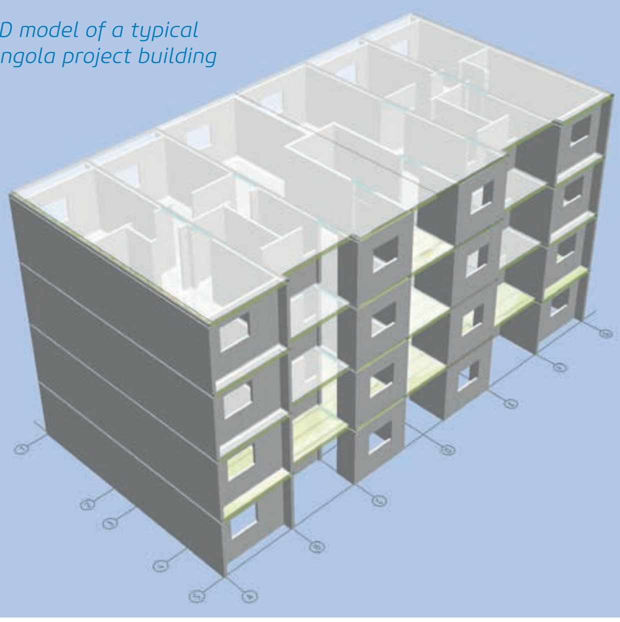
The challenge of large-scale housing projects

Joost Terlage, CEO Peree Bouwadvies B.V., The Netherlands

Peree Bouwadvies B.V. has been providing structural design services and solutions since the early fifties, acting as structural designers for several projects in the fields of industrial buildings, utility facilities, office buildings, and housing; all made from building materials such as steel, reinforced concrete, composites, and especially autoclaved aerated concrete (AAC). During the early eighties, Peree was particularly recognized as a structural designer for AAC Housings and hence focused on this material and the specific properties and construction systems that come along with it. In this manner, structural solutions for large-scale developments mainly in East and West Germany during the nineties came into being.

Owing to the so-called "Ringanker" approach and other stability aspects, but also the German building code (DIN) and further regulations pertaining to the execution of construction projects, certain provisions conflicted with glued wall panel systems and prevented rapid execution. Therefore, the dry-disk frame solution was designed as an alternative and approved by relevant authorities for each individual case.



3D model of a typical Angola project building

Since then, Peree has been involved as structural engineers in many large-scale housing projects and developments, starting in 2010 with the Kora-Angola project.

This Angolan project included a total of 40,000 apartments built in several locations all over the country and was designed to be entirely executed as an AAC wall and floor panel system.

Due to the size and volume of this project, the AAC needed for its execution was produced on a worldwide basis by three companies, Xella (Ytong), H+H and Nanjing Ashai, and subsequently shipped to Angola.

The challenges posed on this development did not only come about on account of expectations in terms of end products and certain limitations on project execution such as the needed manpower, but also resulted from aspects like shipping, transport and logistics in general, all of which were handled by Mr A. Rabinovich/Mitrelli, who managed all contacts and cooperation with suppliers and developers.

The project mainly consisted of four types of housing featuring up to four levels with minor acoustical and thermal requirements. Owing to these requirements, optimized panel sizes could be used which could be handled by crane or, if needed, by manpower bearing in mind the production of over thousand apartments per month.

Together with architect Jame Lerner/Giora Gur and developer Kora-Angola, Peree was able to design the layout of the housing types in such a manner that unnecessary building structures could be avoided and an optimal building concept with minimal material requirements was implemented.

Preparation, execution, and special situations and circumstances

Most of the projects were located deep inside the Angolan territory far away from the country's coastline and therefore relatively inaccessible for fast delivery. Road traffic and transport turned out to be difficult and often impaired logistics and material... Any inappropriate shipment has a direct influence on execution and leads to delays in project execution with building materials missing on construction sites on account of long distances for delivery.

Due to the enormous size of the project, there often occurred circumstances that were unforeseeable and not in line with European experience gathered in the course of time. One example was the seawater incident at Luanda Harbour and subsequently decisions regarding the load.

Josephus Willem Jacobus (Joost) Terlage., Civil. Eng. has more than 25 years of experience in structural design, detail engineering and project management, related to conventional and non-conventional building-systems. Furthermore, he is leading the company Peree BV for more than 16 years as CEO. Joost has managed the construction of industrial structures, public buildings and was responsible in project development and large-scale housing projects. He is involved in preliminary design, cost estimation design, detail and execution design and project management.
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Angola

The country comprises a territory of about 1.2 million km², is thus approximately twice the size of France, and boasts a coastline of roughly 1,600 km. Given this enormous size and corresponding distances, it was a challenge to arrive at a common climatic denominator for appropriate project execution.

Angola underwent a civil war from 1972 until 2002. Consequences of this war are still visible. Before commencing any infrastructural projects, locations had to be checked for explosives and, if discovered, needed to be cleared.

Average construction time for a building unit was 3 weeks

Example of a building unit made of Ytong-AAC

Environmental situation

Angola's climate is influenced by both a cool maritime current along its coastline and a plateau in the interior of the country with corresponding elevation. As a result, subtropical climatic conditions are prevalent almost everywhere.

From May to August, that is, winter time in the case of the Southern Hemisphere, a cool and dry season called Cacimbo will be encountered, while in summer, there is usually a hot and rainy season lasting from mid-September to April in the northeast, from mid-October to April in the country's central area, and from November to March in the south. Along the coastline and therefore also in Luanda, the nation's capital, this season only lasts from February to April and is almost nonexistent along the southern coastline and has consequently developed into a desert.

Locations

The building sites are located all across the country, for instance, in Kuito, Caala, Lossambo, or Uige. Some of these locations

Several different types of buildings erected within one district comprise as many as 4,500 housing units. After excavation and, if needed, soil improvement, rafts and flat slab foundations designed by Peree with anti-erosion edges were installed. The increased density of superstructures led to cost-optimized foundations.

Structure

Executed superstructures are based on glued AAC wall and floor panels connected by rebar in the floor joints whenever needed. Intermediate stairs have been executed as steel stairs to constitute, at a later project stage, a structurally autonomous steel stair core reaching every level.

The stability of superstructures has been accomplished by an optimized panel configuration and a disk-framing structure to end up as a minimized reinforced concrete topping per each level.

A double kicker system was used to adapt the topping formwork and subsequently the required levelling blocks. Although this seems a rather unusual approach, feedback from construction sites was very positive.

The finishing of superstructures was carried out with reinforced plaster adapted to the structure in such as fashion that resistance not only to rain but also to the high Angolan UV index could be accomplished.

Looking back, it can be said that, when carrying out structural designs in different countries and cultures, difficulties and obstacles one will face will also turn out to be different. It is then structural engineering that plays a major role in optimizing the appropriate and needed structures to reduce costs for execution and transport that go hand in hand with customer needs and, of course, individually and culturally related aesthetical aspects.

Interior design example

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