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DESIGN OF BUILDINGS ERECTED FROM PRECAST PANELS

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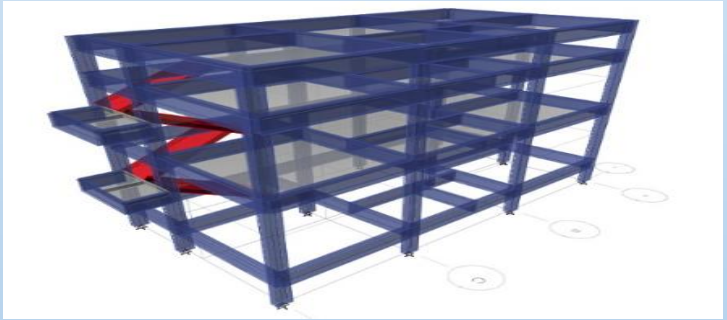
Abstract

The report presents the structural analysis and the reinforced concrete design of a precast building. Precast concrete is concrete that is mixed, poured, and cured offsite, usually in a factory with reusable molds.
In this project, the structural system consists of two-way solid slabs with a thickness of 14 cm and a reinforcement of 5Ø10/m. The building also consists of main beams with a section (30 * 60) and secondary beams with a section (20 * 60). It also consists of 12 columns (30*30). The foundations were also designed according to the descent of the vertical loads and we chose isolated footings. All structural elements were designed using the Saudi building code SBC.
A comparison was made between manual design and design using ETABS software. The difference between the results comes down to the fact that the ETABS software works using the Wilson FNA (Fast Nonlinear Analysis) method which is a very precise method.

Objective and scope

People in Saudi Arabia are in dire need of housing. According to the Ministry of Housing, Riyadh needs 3.3 million units to meet demand in 2025, which requires the construction of 550,000 units each year. We find precast to be one of the best choices for building lots of residential units.
Precast is a method that allows the house to be built in a short time and with high quality. It uses less labor compared to the traditional cast-in-site method. Its economy not only saves costs, but also continues to save operating expenses throughout the life of the building through extended durability and lower maintenance costs.

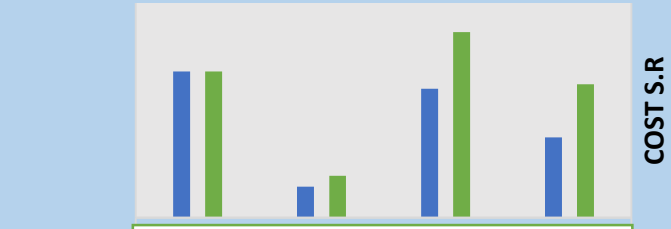
Models



Model using ETABS

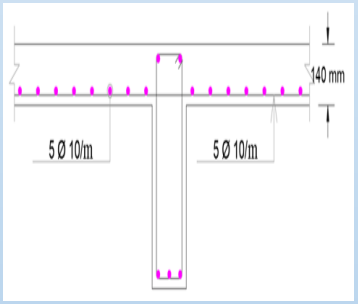
Results

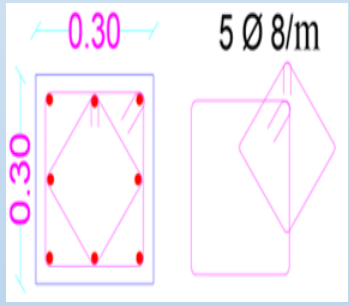
Comparison between precast and cast-in-site cost



	Footing	Column	Beam	Slab
Cast-in-sit	6125	1749.6	7776	5600
precast	6125	1296	5400	3360

Design of solid slab and columns Sections





Conclusions

Precast concrete is highly recommended to solve the problem of high demand for housing in KSA (mass housing) because of its numerous advantages:
- save time making building faster,
- reduce the cost compared to traditional cast-in-site techniques,
- has good quality of products manufactured in the factory under close control
- has higher ease of handling
- gives good durability and thermal properties.

In conclusion, we were assigned a problem that we design a reinforced concrete building. Throughout this report, we demonstrated the problem solutions in detail.
- First, we introduced the project and talked about the objective that should be achieved. Moreover, we did a brain storming process to come up with best solution for the problem. In other words, we choose the solid slab system with main beams. Furthermore, we explained the design inputs such as dead loads and live loads etc. by using ETABS program.
- Second, we solve the structural system and compare between the manual solution and ETABS program the different between results because in manual solution we used approximated method (Moment coefficient method), and ETABS uses numerical integration technique known as the Wilson FNA (Fast Nonlinear Analysis) method and this is very accurate method.
- Finally, a comparative study was carried out between the costs of prefabrication and casting on site, which further confirmed the reduction in costs when the prefabrication solution was chosen.