

CONCEPTUAL DESIGN OF AUTOMATIC FOOTING DEVICE FOR MODULAR HOUSING CONSTRUCTION

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ABSTRACT: Efforts to improve building construction speed have led to a new construction type, called the modular housing. Designs and construction technologies for the modular house have been actively studied in several countries including Japan, and the technologies have also spread. A relative newcomer to this field, Korea intends to develop related technologies, which are currently lagging behind the level of the technologies in developed countries, through the One-day Housing Project. The information technologies to be developed over the next 5 years will be utilized to automate modular house design, to reduce the construction period, and to develop new materials suitable for larger structures.

As part of the development of one-day housing technologies, this research aims to present a conceptual design for an automatic footing device for one-day housing, and develop a prefabricated method for building a multi-family house. Through the One-day Housing Project, the feasibility of the prefabricated method presented in this research and the automatic footing device will be verified through research and fabrication in the future. It is expected that the automatic footing device and prefabricated technologies shown in the study will induce the expansion of the prefabricated method for small- and medium-sized structures, and contribute to improved productivity on construction sites and a more consistent level of quality.

Keywords: *Construction Automation, Module Housing, Automatic Footing Device, Constructability*

1. INTRODUCTION

Modular housing refers to a method of building a house that is carried out by bringing to a site and assembling standardized units that have been manufactured in a factory. With modular housing, we can expect a reduction in the construction period, resources recycling, and improved quality [1]. For these reasons, a variety of types of modular housing techniques have been studied and applied to construction sites in Korea, as well as in foreign countries. While the construction methods used in Korea have the benefits of minimizing the work on-site and enabling a dry construction method, the conventional construction method is used for the foundation. As a result, the construction period cannot be shortened to the maximum extent. This research aims to suggest a new dry footing method and present the concept of an automation device to increase the efficiency of the suggested technique. The suggested

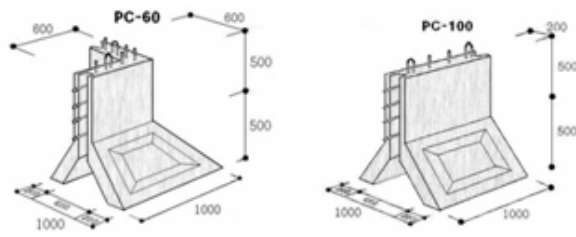
technique and device are expected to contribute to improving both productivity and quality control in building a modular house.

2. CURRENT STATUS IN KOREA

A PC block technique was developed to introduce a dry method to the foundation practice. The PC block foundation technique refers to a technique of making a wall foundation by connecting prefabricated PC blocks for straight line and corner. This technique enables accurate construction and also has the advantage of radically reducing the construction period, from 7-8 days to 2-3 days. Moreover, as there is no need to make a mold, a reduction in construction waste is also enabled [2].

3. CONCEPT OF THE PC FOUNDATION METHOD

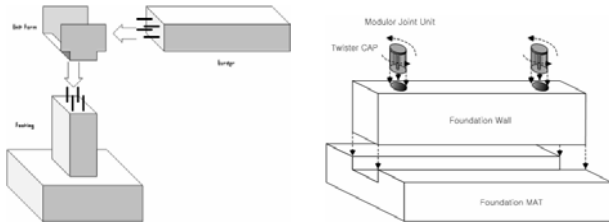
Recently, a development project of Korean type modular



(a) Corner Type (b) Straight Line Type

Fig. 1 PC Block Foundation [2]

housing method named one-day housing is started and independent foundations as well as wall foundations are applied to the low-rise structures of the one-day housing. For this reason, the respective basic modules for the independent foundation and the wall foundation were set as shown in Fig. 2. Fig. 2(a) depicts the concept of combining the independent foundation with a footing beam. The PC independent foundation and the footing beam are combined using Unit Form. Fig. 2(b) shows the concept of putting it in one piece by first disassembling the mat and wall of the foundation in order to lessen the weight of a unit, and then putting it in one piece on the site using filling material.



(a) Independent Foundation (b) Wall Foundation

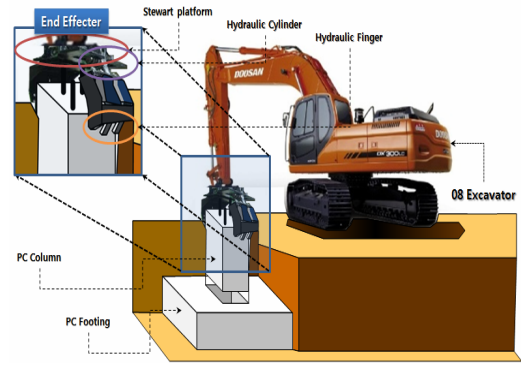
Fig. 2 Concept of PC Foundation Modules

4. CONCEPT OF AUTOMATION DEVICE

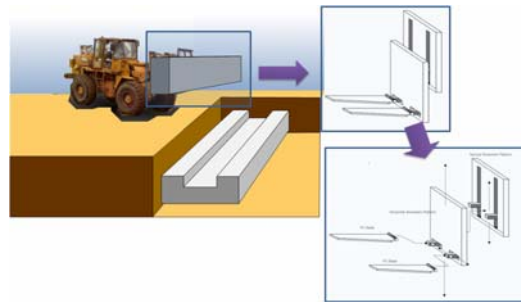
The concept of the equipment for automated installation of the aforementioned PC independent foundation and wall foundation is shown in Fig. 3. PC modules are carried by a backhoe or a forklift. However, since the backhoe or forklift is not ideal for carrying and installing the PC modules, we are going to develop an attachment method as shown in Fig. 3(a) and (b).

5. CONCLUSION

Recently, various studies have been actively conducted on



(a) Device for Independent Foundation Module



(b) Device for Wall Foundation Module

Fig. 3 Concepts of Automatic Footing Device

one-day housing. However, conventional construction method is still used for the foundation, which prevents the construction period from being reduced to the fullest extent possible. This research presented an improved PC foundation technique, and developed concepts of equipment to efficiently apply the technique. The presented technique and equipment are expected to contribute to improvements in construction productivity and in the quality of low-rise structures.

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REFERENCES

[1] K.T. Kim, a Feasibility analysis on a Modular House Construction for Urban Type Living Housing, Proceedings of the Architectural Institute of Korea, 2011
 [2] <http://greenhomekorea.org>