
Initiatives of the Research Center for Infrastructure Management Based on Changes in Natural and Social Conditions

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(Keywords) *global warming, declining birthrate and aging population, productivity improvement, infrastructure DX*

1. Introduction

With global warming and climate change (changes in natural conditions) and the increase in severity and frequency of flooding and sediment disasters said to accompany them, and with the aging and deterioration of infrastructure itself (changes in social conditions), the importance and necessity of infrastructure improvement, maintenance, and management may or may not increase in the future, but it is difficult to imagine it decreasing. Conversely, Japan's construction industry, which is involved in infrastructure improvement, maintenance, and management, is seeing more significant aging and decreases in the working population than in other industries (changes in social conditions), and it has been pointed out and feared in various sectors that the industry will shrink further. As shown in figure 1, the decrease in construction machinery operators has been particularly significant, and even looking at the number of people holding heavy vehicle licenses according to driving license statistics, further decreases are expected.

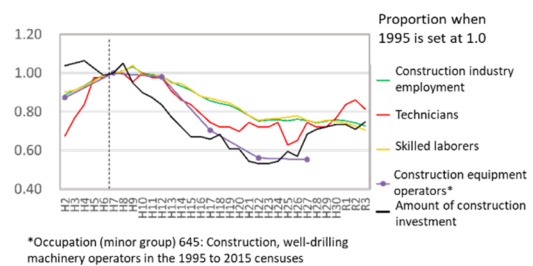


Fig. 1. Trends in worker numbers

In response to these changes in natural and social conditions, the Research Center for Infrastructure Management is working on research relating to improving productivity—especially labor productivity—in construction production systems from planning, investigation, and design, through construction, to maintenance and management, and function evaluations of parks, green spaces, and other so-called green infrastructure, which is supposed to be effective as a strategy for alleviating climate change.

One way to improve productivity in construction production systems is to maximize use of digital technologies. The National Institute for Land and Infrastructure Management (NILIM) is constructing the DX Data Center and the MLIT Data Platform, major parts of the efforts of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) in infrastructure DX. However, improving

productivity requires more than this—we also need analog methods to review and improve the regulations, standards, customs, and other rules that have been taken as given until now.

Here, we introduce the Research Center for Infrastructure Management’s initiatives that leverage digital technologies and its examinations to improve concreter’s productivity as one analog method.

2. Initiatives leveraging digital technologies

2.1 DX Data Center

NILIM is building the DX Data Center as a demonstrative research system to centrally store three-dimensional data, such as BIM/CIM 3D models and point group data, and smoothly share them between the orderer and the contractor in the processes of surveying, investigation, design, construction, management, and maintenance. Software that enables the 3D models for BIM/CIM, etc. to be displayed and edited has been installed by making use of schemes from joint research with software vendors and others, and as it is possible to browse 3D maps of rivers under administration, road MMS point group data, and other information besides 3D models for BIM/CIM, the center is expected to be an important tool for applying BIM/CIM principles. The center began operating in January 2023 and was made available to all contractors in directly administered projects from April 2023.

2.2 MLIT Data Platform

In addition to the various data held by MLIT, the MLIT Data Platform links technology and data held by other bodies, including the private sector, and makes it possible to display, search, and download them at once on a single platform. It was mostly completed and

opened to the public in April 2020, and we are making ongoing improvements to create a system that is easier to use, such as continually expanding the linked data, upgrading the user interface, and strengthening search functions.

2.3 Standard development using experimental fields for construction DX

By making use of the earthworks field for developing and demonstrating unmanned construction and automated or autonomous construction and the construction DX experimental field with models for completed form measurement for demonstrative experiments on 3D measuring technologies for buildings, which NILIM and the Public Works Research Institute (PWRI) improved in a joint effort, we can test new technologies and create proposals for guidelines and standards concerning work progress management and testing, among other areas. These facilities are also lent to private companies, universities, and others, including startups, to support research and development.

3. Examinations to improve concreter’s productivity

The amount of labor invested in concrete structures and related works in public works directly managed by the Japanese government accounts for 13.8% of the total (fig. 2), and improving labor productivity in this field is a matter of urgency. Progress is being made in maximizing the use of precast products, but it is also necessary to improve productivity for concrete poured on-site.

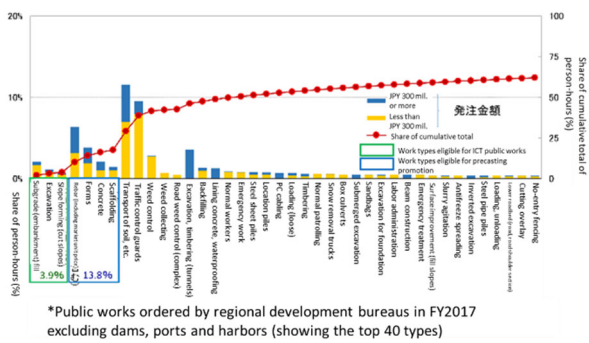


Fig. 2. Amount of labor by work type (public works ordered by regional development bureaus in FY2017)

Because of this, the Research Center for Infrastructure Management is conducting research jointly with regional construction companies that are having difficulty securing labor on (1) improving productivity and the working environment by making use of materials and equipment like fixed horizontal jib cranes (fig. 3), which are used as standard in Western construction works, and system forms, and (2) improving productivity in technical work that has been finely divided into form work, rebar work, and concrete work by making use of multiskilled workers who can handle multiple work types. In particular, fixed horizontal jib cranes do not require the qualifications needed for mobile cranes and they allow workers to operate the cranes themselves to transport work that is mainly transported by hand, such as minor transportation of rebar and the like on site, thus leading to expectations of increased productivity and an improved working environment on site. To date, we have confirmed the cranes' utility through monitoring in nine test works.

Furthermore, with regard to using precast products as well, it is important from the perspective of securing labor to take into account the entire process including product

standards, manufacturing, and transportation, as well as the work on site, when considering promoting its use.



Fig. 3. Fixed horizontal jib crane

4. Conclusion

As mentioned at the beginning, the negative impacts that changes to the natural and social conditions surrounding Japan exert on infrastructure improvement, maintenance, and management cannot wait any longer. Among these, the worker shortage, especially the decrease in skilled laborers and operators on-site, is considered likely to be the greatest problem in infrastructure improvement, maintenance, and management in a few years, and accelerating research and social implementation relating to increases in labor productivity in both digital and analog aspects, which the center is currently implementing. As they will also contribute to promoting strategies to ameliorate and adapt to global warming, we will also move forward with our initiatives on new issues, such as deepening our current research on function evaluations of green infrastructure and computing its greenhouse gas reduction effects.