Efforts of the Research Center for Infrastructure Management to promote DX and GX in the infrastructure sector

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1. Introduction

The Research Center for Infrastructure Management (hereinafter called the "Center") has been conducting research and development, as an organization that carries out research on all the construction production processes, including the design, construction, supervision and inspection, as well as maintenance and management up to renewal of social capital, the Center focuses on interdisciplinary matters while cooperating with relevant institutions.

In particular, in recent years, with the onset of a digital society, we have been preparing manuals for the purpose of a smooth introduction of ICT construction and BIM/CIM into the site. The Ministry of Land, Infrastructure, Transport and Tourism as a whole have been promoting efforts based on the "DX Action Plan in the Infrastructure Field". In addition, the NILIM has established the "Infrastructure Sector DX Promotion Headquarters" as an interdisciplinary organization, to help promote research and development.

2. Efforts related to BIM/CIM

(1) Enhancement of the utilization of 3-dimensional data

We have worked to introduce BIM/CIM as a 3-dimensional model to facilitate the sharing of information among the parties concerned over the entire project and to help increase the efficiency and sophistication of the construction production processes. The Center has been involved in the preparation of the "3-dimensional Model Deliverables Preparation Procedures (Plan)". Based on the fact that the application of BIM/CIM has been started as a standard for all the detailed designs and construction work of the projects implemented by MLIT since FY 2023, we will deal with the amendments of the standard procedures.

When exchanging 3-dimensional data between the provider and the receiving party, a "DX Data Center" has been built that functions to perform browsing and storage of data as well as preparation, editing. Its operation was started in January 2022. By utilizing a virtual PC server, the DX Data Center has a mechanism that can be used from a personal computer on which no dedicated software is installed, and we anticipate that 3-dimensional data will be utilized proactively among concerned parties.

(2) Efforts at the bidding and contractual stages

Including the viewpoints, that seek the smooth introduction of BIM/CIM the technical proposal and negotiation method (ECI method) is utilized at the bidding and contractual stages. As of January 2023, the method has been applied to 32 cases of construction work implemented by MLIT. It is a method, through the involvement of the construction executor from the design stage, that enables the smooth succession of data during the period from design to construction work, by making a detailed design of a 3-dimensional model according to the needs in each construction work step. The Center analyzes the effects and problems, etc. of this method, and is involved in the preparation of guidelines.

In addition, we are proceeding with the development of the next period cost estimation system, concerning the construction cost estimation. The system is being built such that the quantities are automatically calculated from the BIM/CIM data in the design stage, and the import of such data into the cost estimation system enables the construction work cost to be calculated efficiently (see Fig. 1).

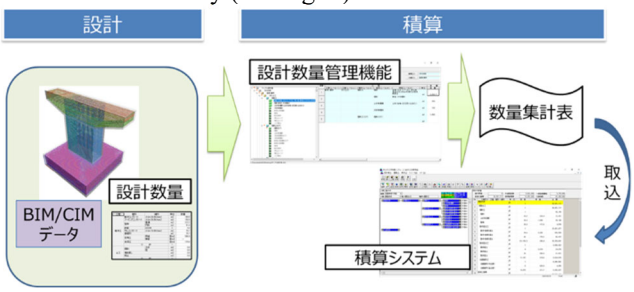

Fig. 1: Image of the next period cost estimation system

(3) MLIT Data Platform

The MLIT has made the "MLIT Data Platform" open to the public over the Internet since April 2020, aiming at increasing the efficiency of work and the advancement of MLIT measures, by integrating the data it possesses with the data of private entities. The platform enables various data to be downloaded through the same interface, such as information on social capital and basic construction work information, point group data, etc. It also enables the downloaded data to be displayed on a 3-dimensional map. The Center seeks to enhance data and to continually improve the operating functions. It believes that the platform will contribute to increased efficiency and the advancement of the construction production processes as well.

3. Efforts in the construction stage such as ICT construction

The number of cases of ICT construction in civil engineering work implemented by MLIT is increasing year after year, and in FY 2022 ICT construction is implemented in nearly 90% of the entire civil engineering work.

Also, the work time has been reduced by more than 30% owing to the ICT construction. In the future, we will endeavor to improve the standards such as procedures for as-built management, towards the goal of the further expansion of its use for small-scale construction types and construction work ordered by local governments.

In addition, as Stage II of the ICT construction (see Fig. 2), we are promoting the development and improvement of automation and remote control technologies for construction machinery.

We are promoting research that seeks to increase the efficiency of construction work plans, by grasping the situation of work based on the utilization data of construction machinery. We are promoting our efforts toward automation and autonomous construction work, by utilizing the "Construction DX Experimental Field" located in the NILIM as well as cooperating with the Public Works Research Institute.

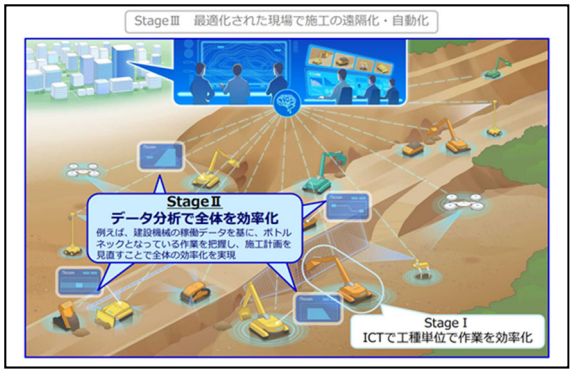

Fig. 2: Direction of ICT construction

4. Promotion of GX in the infrastructure field

The CO2 emissions in the construction work field are estimated to be about 1.4% of those in the industrial field and about 0.5% of those in Japan as a whole. Furthermore, if those in the supply chain are included, such as the emissions from construction materials and construction-related by products, the emissions from the construction field as a whole are estimated to be slightly more than 10% (see Fig. 3). Considering the declaration of carbon neutral in 2050, in an effort to reduce CO2 emissions in the construction field, and in order to promote technological development, that contributes to low carbonization, it is necessary to set evaluation criteria to ascertain the effects of such reduction. The Center is proceeding with the preparation of a CO2 emissions calculation manual in the construction work stage.

Also, as our efforts for GX Promotion, it is also necessary to evaluate the functions of green infrastructure. The Center has been conducting research on the evaluation method as well as the maintenance and management method for the greening of public roadsides, and will continue to conduct the research on road greening management, etc.

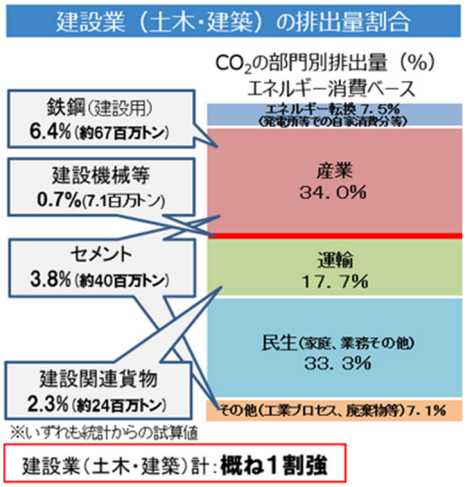

Fig. 3: Ratio of CO2 emissions from the construction industry

5. Conclusion

We consider that the construction production processes will be deployed including viewpoints, such as transformation into 3D as well as cost, process plan, and CN. To achieve this, the Center is determined to make continued efforts in the improvements of necessary standards and systems. However, the increase in efficiency and advancement of the processes and revision of the way work is carried out is indispensable. In the "DX Action Plan 2 in the Infrastructure Field" summarized by MLIT, as one of such approaches, the "accumulation and sharing of work reform" is advocated. We would like to endeavor to improve the environment as well so that the relevant personnel will be able to take such an approach with greater understanding and awareness.