# Study of the Finished Shape Management Fully Using ICT for i-Construction

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## 1. Introduction

In full utilization of ICT, which is an effort of top-running i-Construction measures, three-dimensional data is used for design, construction, and management. Therefore, we studied a method for using three-dimensional point group data obtained by terrestrial laser scanning (TLS) or aerial photographic surveys from Unmanned Aerial Vehicles (UAV) in the measurement of finished construction shapes. In addition, for the expansion of facial management, we also studied the expansion of applicable work types and the application to new measuring devices.

## 2. Standards for the Management of Finished Shape using ICT in Civil Engineering

For efficient management of the finished shapes of civil engineering projects (such as excavation and embankment) using three-dimensional point group data obtained by terrestrial laser scanner or photographic surveys from UAVs, we redefined the meaning of managed items (reference height, width, and slope length) of conventional finished shape management standards from the perspective of quality management to study a facial management method that manages the finished shapes by replacement with the altitude difference between designed and finished shapes.

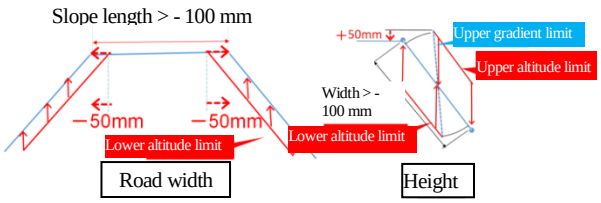


Figure-1 Replacement of management standards

Facial management requires larger numbers of measurement points than conventional management based on representative cross sections, resulting in greater variation in the measured values. Since applying conventional standard values to all measurement points leads to a demand for excessive finished shape management, we established standard values for facial management so that the values would be equivalent to conventional ones. In the study of standard values for facial management, we investigated the actual situation of the finished shape of areas other than managed cross sections at a civil engineering construction site where construction was managed based on conventional finished shape management standards (investigation on the actual situation of construction accuracy). Based on the investigation result, assuming the variation in finished shape follows the normal distribution, we specified a value that was three times the standard deviation as the width of 100% management standard values and set the standard values for the averages of the measurement points, as well as for each measured value, as the finished shape standards for facial management of civil engineering.

## 3. Study on the Review of Standards and Utilization of New Measuring Devices

In 2016, we conducted a study of the revision of procedures based on the follow-up investigation of the actual situation of ICT civil engineering worksites, as well as a study for responding to new measuring devices. In addition, in the study conducted for the relaxation of the method of UAV-based photographic surveying, we verified the possibility of relaxing measurement rules by determining the relationship with measurement accuracy in the lap ratio and orientation point setting frequency.

In addition, as a response to new measuring devices, we investigated the adaptability of new three-dimensional measurement technologies that would possibly be introduced into construction sites, such as vehicle-installed laser scanners (MMS), UAV-installed laser scanners, and ground mobile body-installed stereo cameras for finished shape management.

## 4. Standards for the Management of Finished Shapes Using ICT in Pavement Words

As the expansion of work types where ICT is utilized, we studied pavement projects. In the facial management of pavement projects, we decided to utilize three-dimensional point group data obtained by LS and summarized the preliminary draft of the finished shape management procedures based on the investigation result of the actual situation of the precision of construction work at pavement worksites. With this, the standards for ICT pavement work were released in March 2017.

## 5. Future Development

In the future, we will conduct follow-up investigations of the actual situation of worksites, such as the effect of enhancing productivity through an improvement in the efficiency of fieldwork and the grasp of tasks, as well as continue the research on the expansion of the utilization of ICT into other work types. In addition, we also would like to work on research toward the utilization of data on the maintenance stage.