# Prospect for Utilization of Three-dimensional Topographic Data in the River Field (Study period: from FY2017)

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## 1. Progress of survey technology

During the last decade, Airborne Laser Bathymetry (ALB), enabling measurement of river topography including underwater topography, and Mobile Mapping System (MMB), vehicle-mounted type laser survey technology enabling levee shape measurement with high density, were developed. In addition, drone-mountable laser survey devices have been developed during the last two years, enabling the acquisition of survey results of river topography as high-density point group data for not only levees but flood plain or land area of low water channel. Further, since laser survey devices mountable on large weeders or hay collectors were developed, it is possible to obtain data on the shape of levee slopes as high-density point group data with little effect of vegetation.

Utilization of three-dimensional topographic data thus obtained for desktop analysis of deformation in channels and levees is expected to improve efficiency in inspection work. In addition, channel design has been conventionally conducted using the results of cross-sectional survey with a 200 m interval, and use of river morphology data areally obtained as fundamental information is expected to change river development. This paper introduces effects expected from use of three-dimensional topographic data with an example of Nature-oriented River Management and prospects future utilization.

## 2. CIM and Nature-oriented River Management

Introduction of CIM (Construction Information Modeling/Management) is going on in order to facilitate information sharing between stakeholders across the project and improve efficiency of / upgrade a series of construction production system through utilization of the models of topography and structures prepared in the planning, research and design phases using three-dimensional topographic data etc. ("topography and other models") for construction and maintenance (Fig. 1). Application of such CIM has also begun to be considered in the river field.

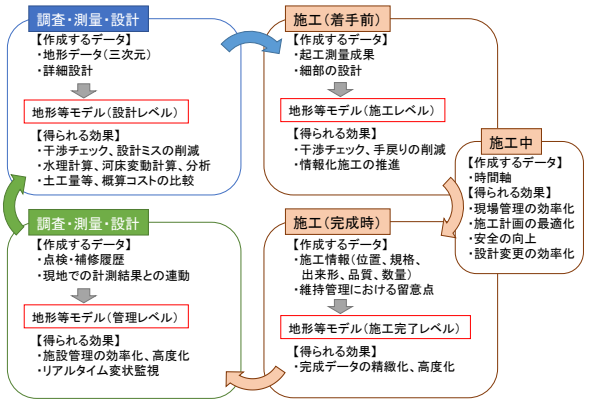



**Fig. 1 Concept of the introduction of topography / structure models in research, design, construction, and maintenance** [1)]

On the other hand, the concept of planning / design may not be fully reflected in construction work for river improvement or disaster restoration. In particular, in practice of Nature-oriented River Management, discussion is made from the viewpoints of a landscape, use, and organism habitat about river shape, arrangement of ramp, etc., installation area / color tone of revetment, channel excavation method, etc. Sharing an image of the river after renovation only with a sectional view and a plan view interpolated from it is difficult, and transfer of the shared image to the persons in charge in each phase is further difficult. River Division is therefore developing "river version" CIM using three-dimensional topographic data and aerial photographs taken at the same time as basic data of CIM so that an image of completion is shared among stakeholders and the concept in planning and design stages is accurately reflected in construction (Fig. 2). Further, River Department is proceeding the study on utilization method of three-dimensional topographic data and structure of models of topography, etc. particularly for channel models in cooperation with Advanced Construction Technology Division and Information Platform Division.

## 3. Prospect for future utilization

To make contents of movies and games more enjoyable, some technologies have been developed to create virtual

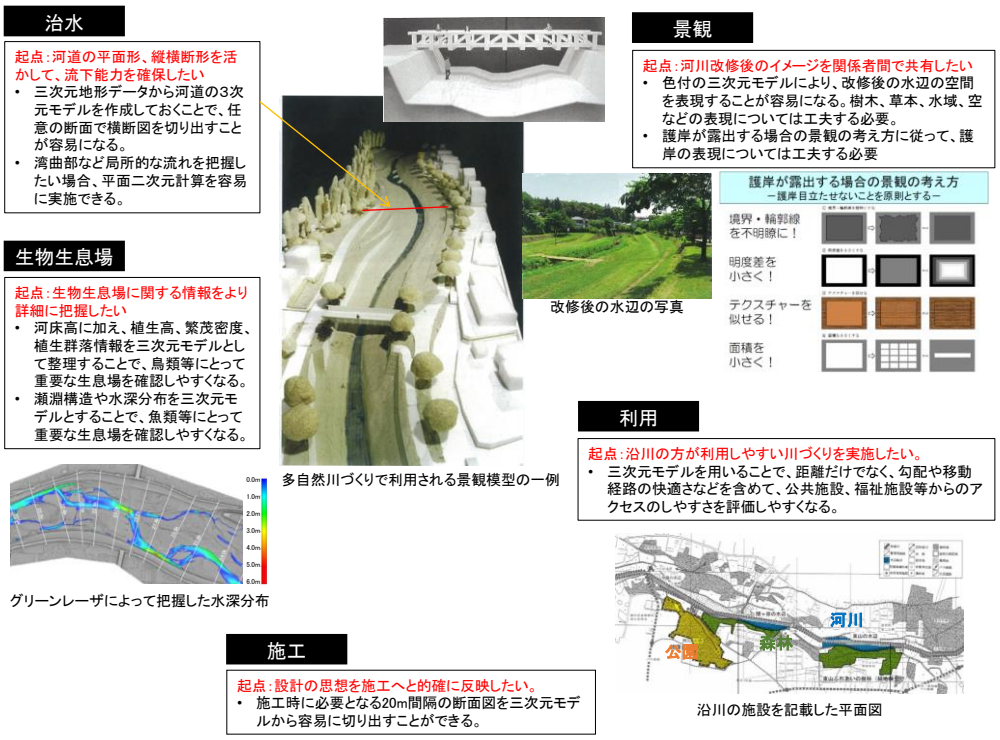
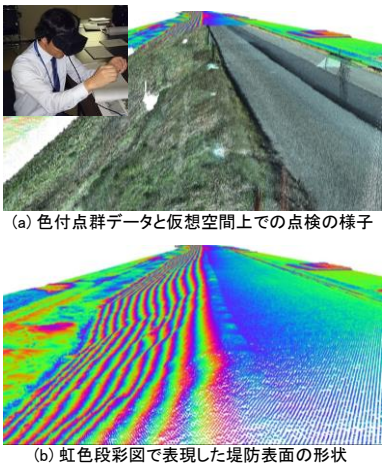



**Fig. 2 Image of utilization of topography / structure models in Nature-oriented River Management (river version CIM)**

space or add additional information to real space, such as VR (Virtual Reality), AR (Augmented Reality), and MR (Mixed Reality). Three-dimensional topographic data has high affinity with such technologies.

Figure 3 expresses models of topography etc. as colored point group and gradient tints diagram using the photos of levee surface taken by large weeder and results of laser survey. Rainbow color gradient tints diagram is a mode of expression that makes easier to check concavo-convex on the levee surface by repeating the colors of contour lines. If deformation is checked on virtual space using a VR head set in advance of levee inspection, on-site inspection will be efficient and failure to detect deformation is expected to decrease.

Models of topography etc. are expected to be used in many scenes, such as consensus building, evaluation of organism habitat, and study of waste soil disposal. When outline of a river project is explained to community people, it will be possible for each resident to see topography (landscape) after renovation, spatial relationship with their homes, etc. In evaluation of organism habitats, it will be possible to easily recognize the positions and shapes of riffle pools, wands, former flow channels, etc. from topographical information with high space resolution, which is expected to lead to meticulous development of rivers, such as consideration for important organism habitats. In addition, for treatment a large amount of sediment generated in channel excavation, which is sometimes difficult, it will be possible to estimate the amount of surplus soil provisionally in the design phase to consider treatment thereof in early stage, which is expected to lead to planning of construction projects with high effectiveness. We intend to extend the possibility of utilization of three-dimensional topographic data to contribute to better river development in cooperation with Regional Development Bureaus, etc.


(a) 色付点群データと仮想空間上での点検の様子

(b) 虹色段彩図で表現した堤防表面の形状

**Fig. 3 Levee inspection on virtual space**

**☞See the following for details.**

1) MLIT CIM Introduction Promotion Committee: CIM Introduction Guidelines (draft), Part I, Common Part, p.4, March 2017