Utilizing bridge 3D data over the course of design, construction, and maintenance

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(Key word)CALS/EC, Bridge, 3D data

1. Introduction

In the Ministry of Land, Infrastructure, Transport and Tourism, we are considering circulation and utilization of 3D data over the course of survey, design, construction, and maintenance as the effort to CALS/EC.

In this paper we introduce the method of circulating 3D data from design to construction and maintenance, to streamline our operations in the field of bridge construction.

2. Control point

In current engineering when drawing bridges, no coordinate value is entered therefore coordinate value is frequently recalculated at construction stage. This could cause mismatching of installation positions or connecting points between the upper member and lower member.

Also at the maintenance stage, estimation of deformation based on only actual structure size without the dimension entered in drawing.

Therefore, installation positions or connection points of the structure preventing miss-installation (Structure installation reference mark) and monitoring point to grasp displacement or torsion of the structure (Monitoring reference mark) are set as position coordinates (Control point) to circulate throughout design stage, construction stage, and maintenance stage. The following Figure 1 is a materialized figure of the control point.

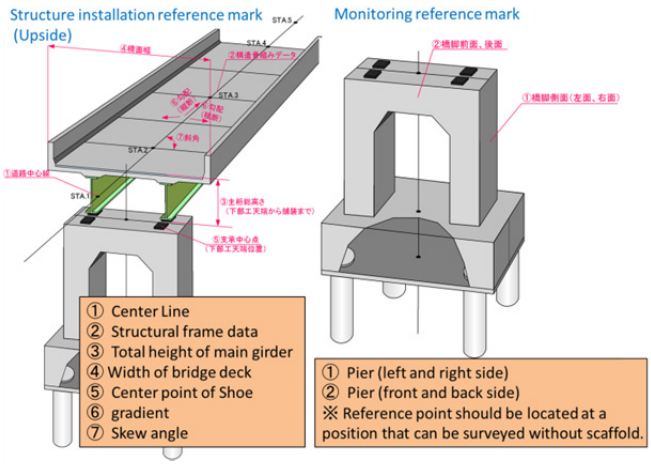

Figure 1: Example of Control Point

3. Data circulation

Three dimensional coordinate of structure installation reference marks shall be entered into coordinate graphics as 3D design data when handing over the drawing from the design section to the construction section. Also surveyed measurements of reference marks are added to coordinate graphics that is handed over from design section and the coordinate graphics shall be returned to design section as construction blueprints. By this procedure builders can easily prepare data for monitoring reference marks from the design drawing and road administrators also can have merits to keep construction blueprints for a long time.

4. Using skeleton model

Following Figure 2 is comparing skeleton models before and after an earthquake.

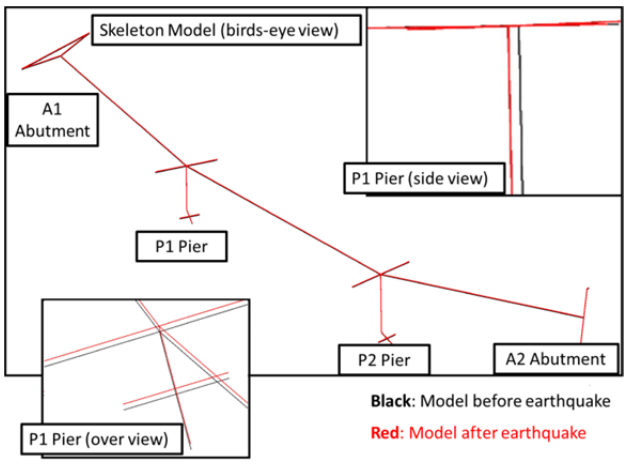

Figure 2: Comparing Skelton Models

A Skeleton model means a three dimensional model drawn by connecting control points by using straight line. Monitoring reference marks at IC Bridge installed over the Heizou River (kept by Chiba national highway office) in 2010 fiscal year were surveyed and a skeleton model was drawn up and practicality of skeleton model was verified.

By comparing two models before an earthquake and after an earthquake as shown in Figure 2 the following bridge conditions are easily grasped.

As a result, "The entire bridge has moved approximately 17cm toward southeast and sunken 5cm – 12cm" and "Almost no relative displacements are observed at each bridge abutment and bridge column, also no deformation such as lean or torsion is observed."

In the future we are going to verify the effect of this method by implementing circulation, introduction, and trial run construction work related to designing and reviewed using this standard 3D data (control point and external shape).

[Reference]

Operation guideline related to bridge 3D data circulation
http://www.nilim.go.jp/lab/qbg/cals2012/guideline//guideline bridge.pdf