Construction control system for cable-stayed bridges

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Construction Control System for Cable-Stayed Bridges

Système de contrôle de la construction de ponts haubanés

Bauüberwachungssystem für Schrägseilbrücken

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1. SUMMARY

In conventional methods of construction controls of prestressed concrete cable-stayed bridges, corrections of measured and computed values of bridge behaviour is done by feeding them to a host computer in a design office, analysing data and feeding back to the site. According to the proposed method, differences in behaviour of structure due to error in assumed concrete weight, loads, etc. are obtained. These new data are fed back to a personal computer at the site which can calculate error factors and reanalyes the structure showing the new behaviour of structure. Since this is done quite rapidly as the data being measured, correction or adjustment to stay-cable and girder elevation can be done continuously as the construction proceeds.

2. SYSTEM FEATURE

The following items can be considered as the reasons for causing errors between measured and computed values.

1)Assumed design values : Concrete or Stay-cable stiffness
Coefficient of linear expansion
2)Fluctuation of load : Weight of concrete, Traveller weight
3)Structural modelling : Stay-cable length, Boundary condition
4)Measurement errors : The condition of used meters, Human error

In order to find out the influence of items 1),2),3) on computed values and also to calculate the errors, a sensitivity analysis was carried out. The errors involved in 4) was minimized by automating the measuring equipment as shown in Fig.1. The notable character of this new construction control system method is the facility to correct or adjust stay-cable tension or form height as the construction proceeds. This is done by forecasting the behaviour of the structure by sensitivity analysis with better structural parameters obtained. The flow chart of sensitivity analysis is shown in Fig.2.

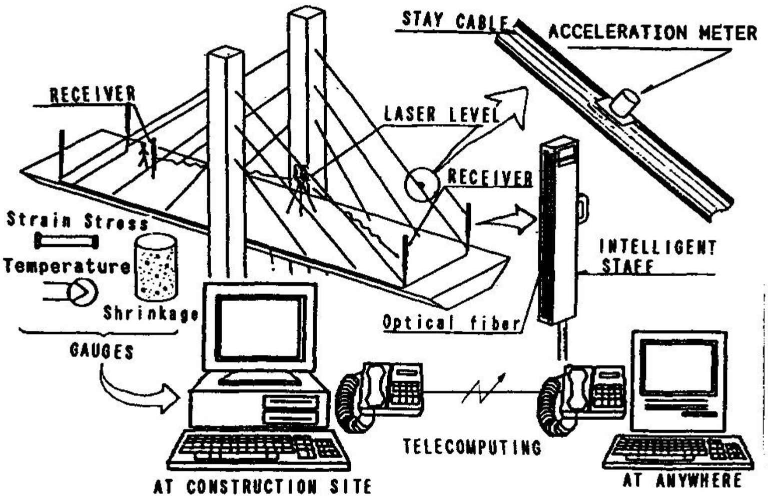

Fig.1 System Profile

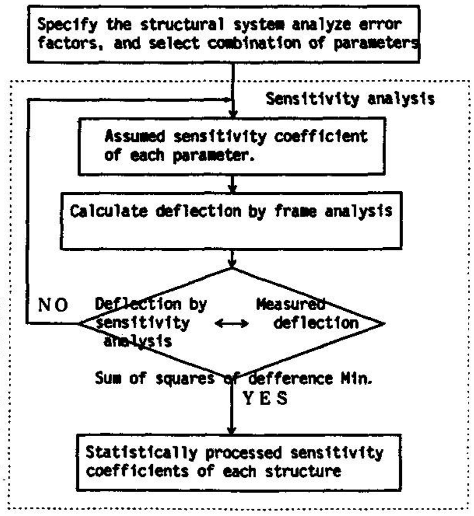

Fig.2 Flow Chart of Sensitivity Analysis

3. SYSTEM CONFIGURATION

The flow chart of this system is as shown in Fig.3.

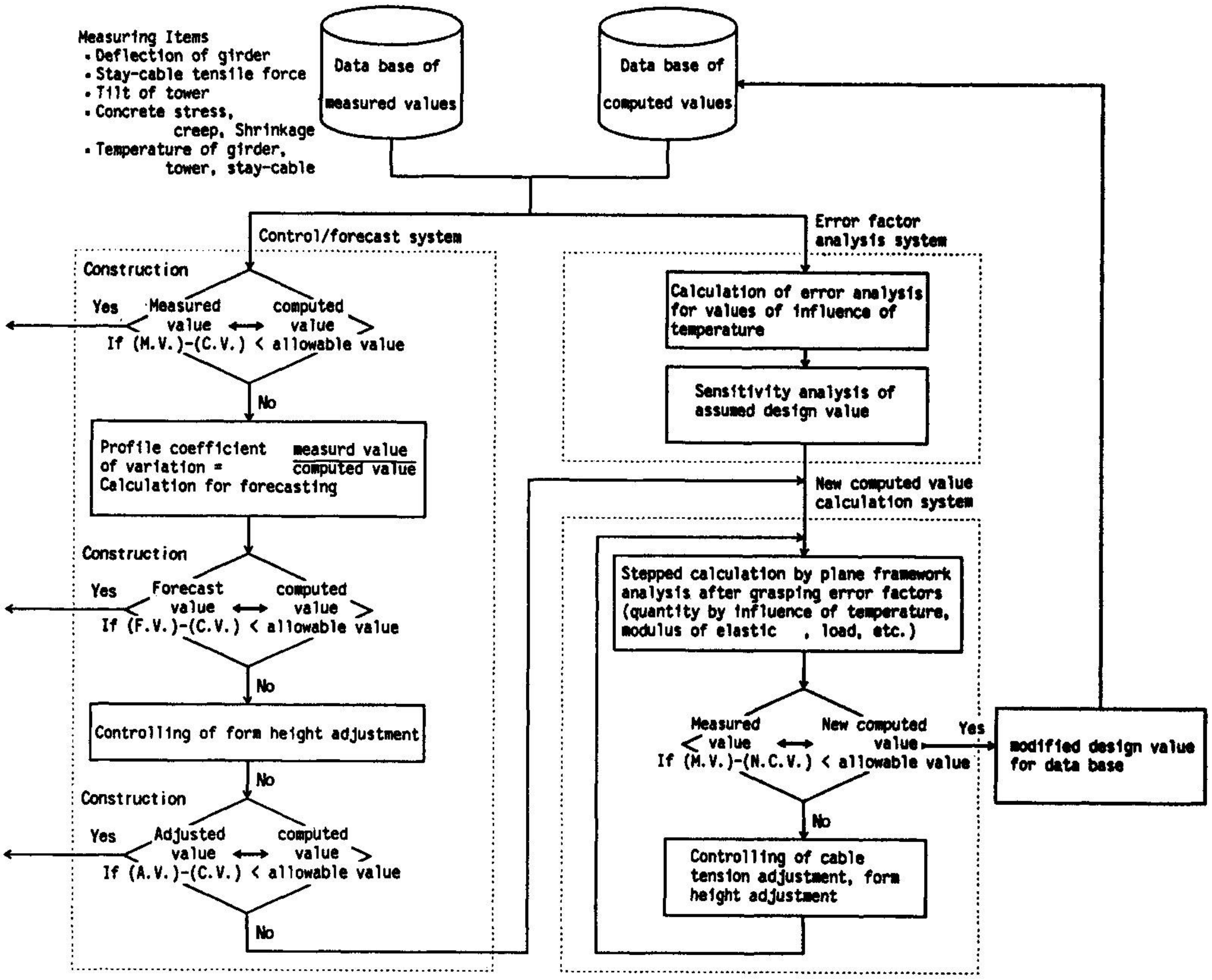

Fig.3 Flow Chart of Construction Control System

4.RESULT

This system has been in operation in actual bridges. These bridges are described below,

Nitchu Bridge (completed in March,1989,Fukushima Pref.,JAPAN)
Tomei-Ashigara Bridge (completed in March,1991,Shizuoka Pref.,JAPAN)

The practicability of this system was verified during the construction of these bridges. Maximum error of final girder elevation of Nichu Bridge was only 6mm. This is because adjustments of form height and stay-cable tension were executed quantitatively by error factor analysis system. The results of sensitivity analysis are shown in Table 1.

Parameter	Initial assumed design value	Sensitivity coefficient	modified design value
Modulus of Elastic for concrete	3.1×10^5 kg/cm^2	1.081	3.35×10^5 kg/cm^2
Traveller weight Telpher Falsework	 31.1 t 70.3 t	 1.113 1.089	 34.6 t 76.6 t
Weight of concrete	2.50 t/m^3	1.011	2.53 t/m^3

Table 1 Calculated Results of Sensitivity analysis(Nitchu Bridge)