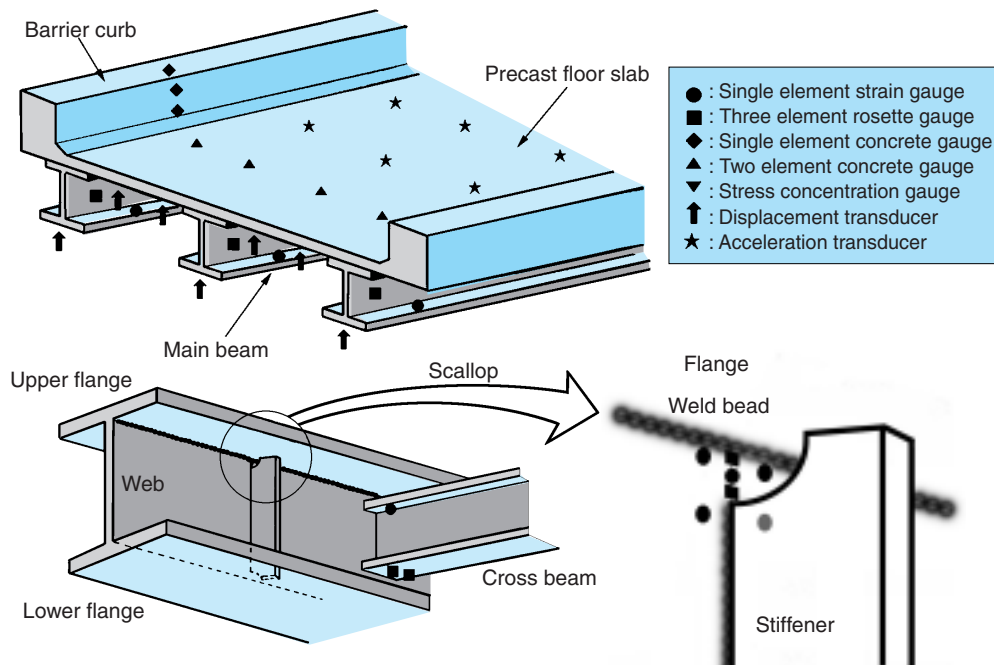


1 Bridge measurement

Measurement Management of Steel Beam Bridge

Steel beam bridge measurement is divided into four categories: static loading measurement, dynamic loading measurement, frequency measurement and vibration measurement. In the static loading measurement, the status of the generation of static stress using a test car is seized, and in the dynamic loading measurement, that of dynamic stress during a test car or ordinary car passing is observed. In the frequency measurement, the degree of fatigue affecting a steel bridge is measured. In the vibration measurement, data are collected using a constant tremor method, exciter method, vehicle stop/go method and so on, and vibration mode is identified by FFT and modal analysis of the collected data.

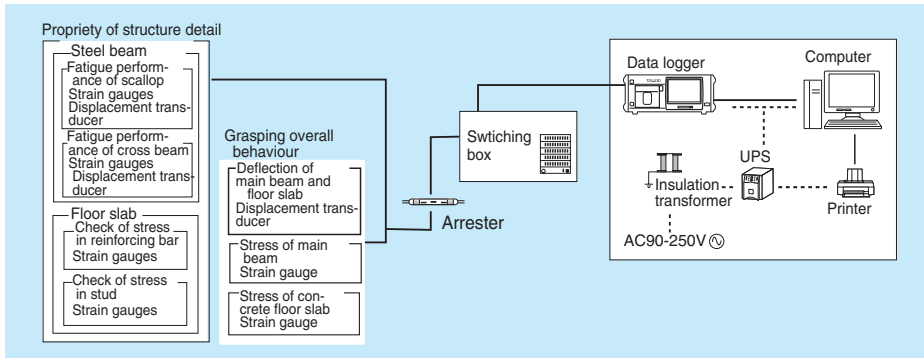


A list of Measuring Instruments

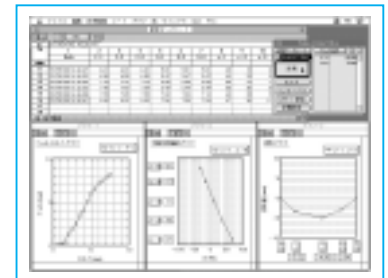
Measurement items	Instruments	Type	Description
Main beam strain	Single strain gauge	FLA	Measures strains in flange axial direction.
	3-element rosette gauge	FRA	Measures principal strains of web and its direction.
Main beam displacement	Displacement transducer	CDP, OU	Monitors deflection of main beam
Stiffener strain	Single strain gauge	FLA	Measures strains in stiffener axial direction.
	3-element rosette gauge	FRA	Measures principal strains of stiffener and its direction.
Cross beam strain	Single strain gauge	FLA	Measures strains in axial direction of stiffener
	3-element rosette gauge	FRA	Measures principal strain of cross beam and its direction.
Scallop strain	Stress concentration gauge	FXV	Measures stress concentration strains of weld part
	Single strain gauge	FLA	Measures strains in scallop axial direction.
	3-element rosette gauge	FRA	Measures principal strain of scallop and its direction.
Floor slab strain	Single strain gauge	PL	Measures strains in floor slab axial direction.
	2-element cross gauge	PLC	Measures principal strains of floor slab.
Barrier curb strain	Single strain gauge	PL	Measures strains in barrier curb axial direction.
	2-element cross gauge	PLC	Measures principal strains of barrier curve.
Floor slab deformation	Displacement transducer	CDP, OU	Monitors deflection of floor slab.
	2-directional crack gauge	KG-B	Measures X and Y of crack opening displacement of an object.
	3-directional crack gauge	Custom	Measures X, Y and Z of crack opening displacement of an object.
Vibration of floor slab	Acceleration transducer	ARF-A	Monitors waveform from a test by the methods of constant tremor, exciter, vehicle stop/go and falling weight
	Servo accelerometer	Other maker	Monitors waveform from a test by the methods of constant tremore, exciter, vehicle stop/go and falling weight.
Temperature	Thermocouple, Temperature gauge	T, KT-A	Measures temperatures of bridge members

Static measurement

Steel beam bridge static measurement system block diagram

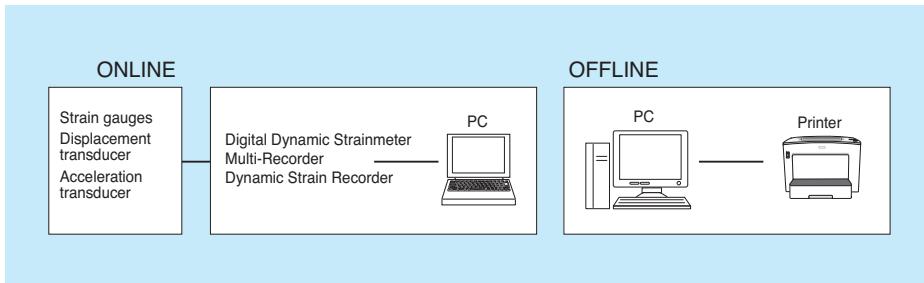


Static measurement display screen

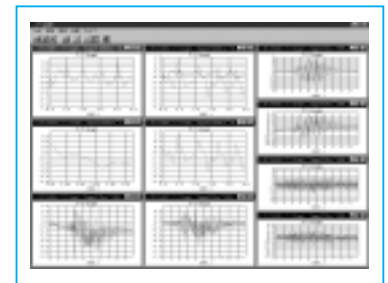


Dynamic measurement

Steel beam bridge dynamic measurement system block diagram

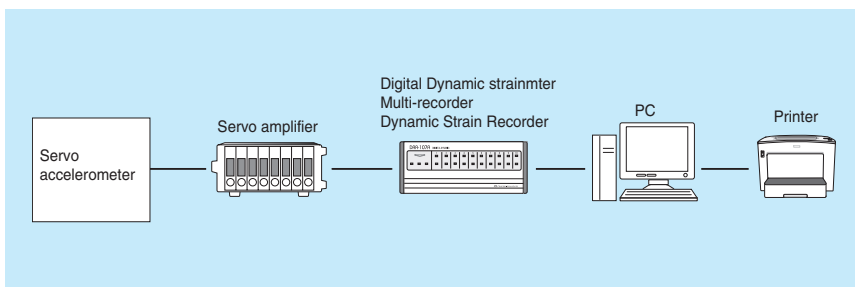


Dynamic waveform data

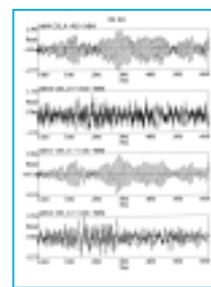


Vibration measurement

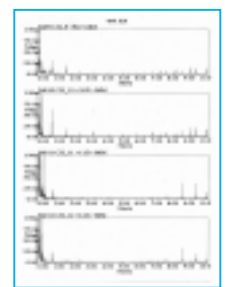
Steel beam bridge vibration measurement system block diagram



Waveform data

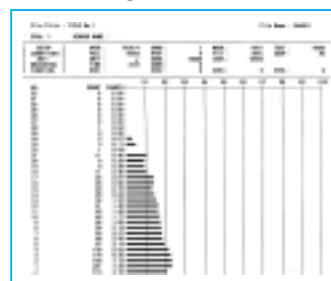
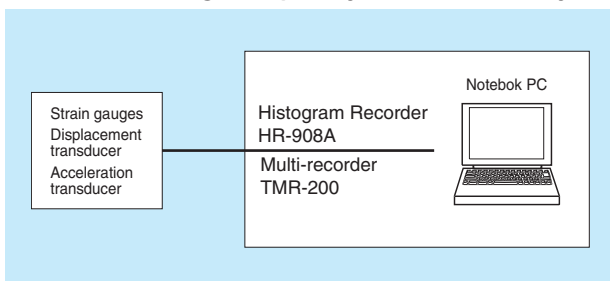


FFT



Frequency measurement

Steel beam bridge frequency measurement system block diagram



Frequency data graph

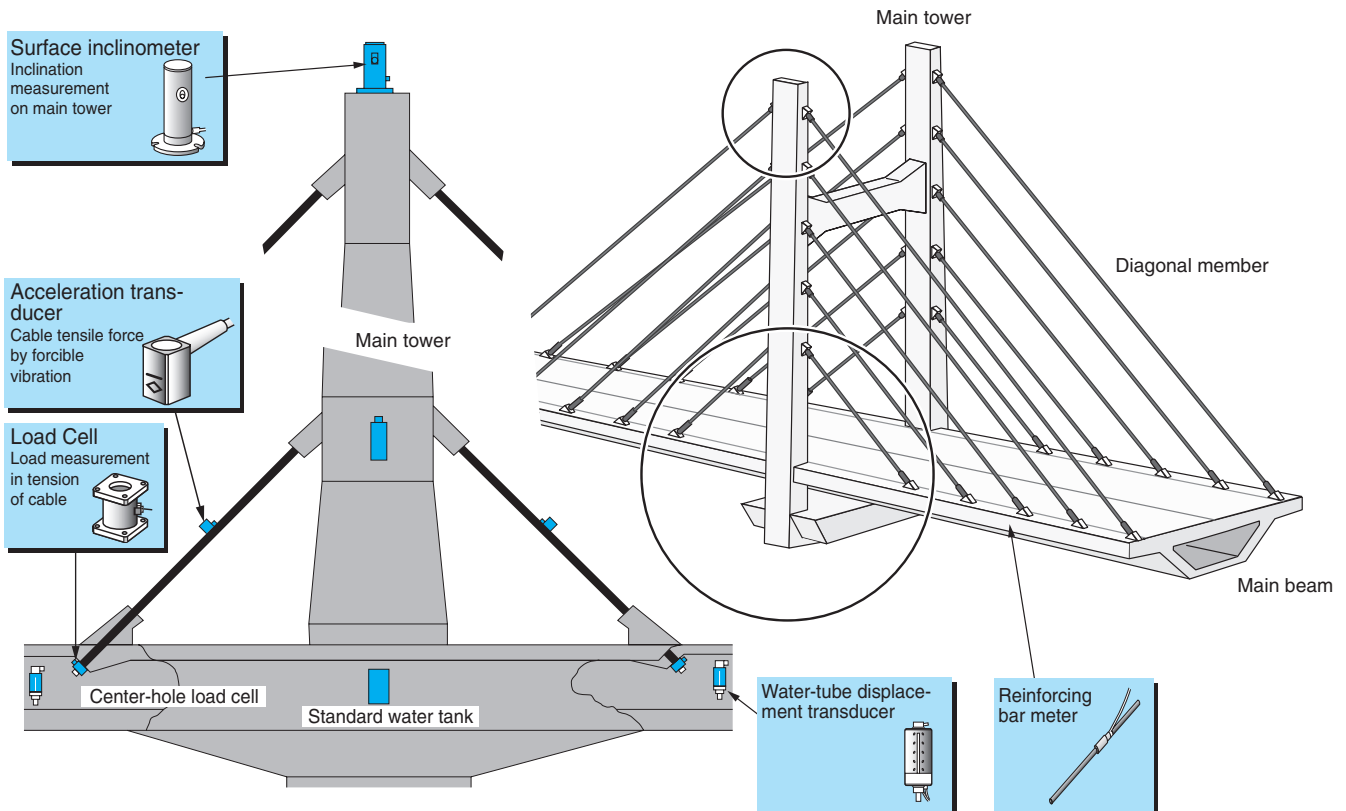


Frequency data list

1 Bridge measurement

Measurement Management of Cable-stayed Bridge

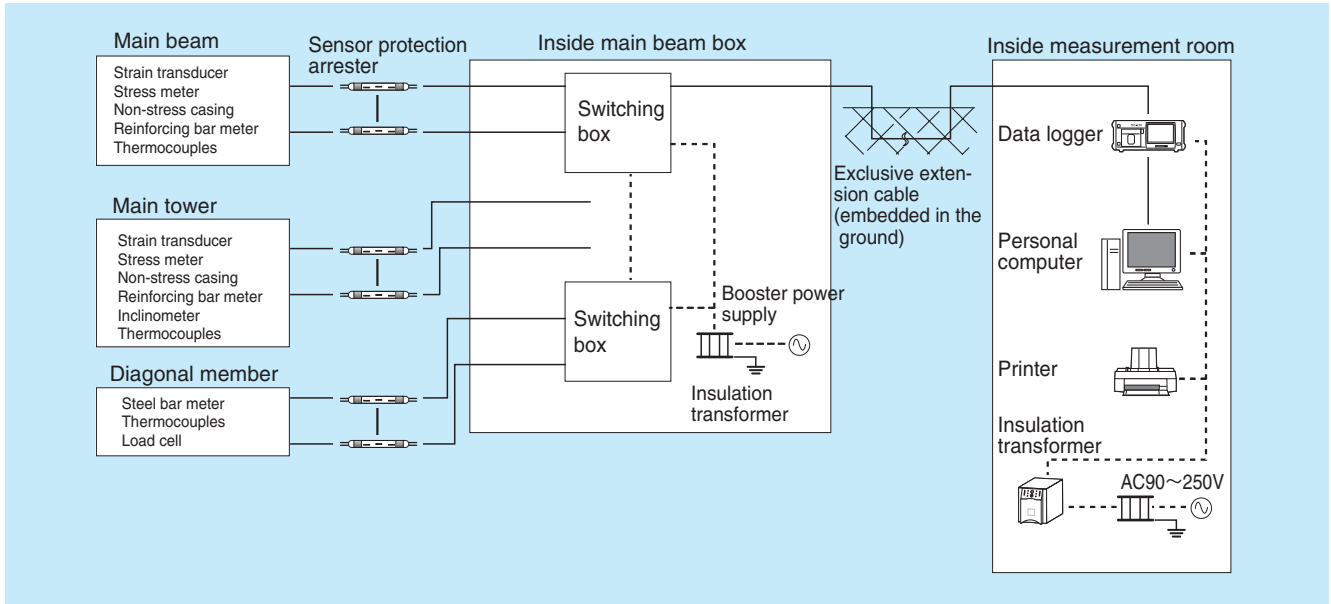
When constructing a PC (pre-stressed concrete) cable stayed bridge, the following conditions must be monitored and controlled: (1) Inclination of a main tower, (2) Materials (concrete, PC grout, etc.) quality, (3) Deflection (camber and shape), (4) Tensile force of diagonal members and (5) Tension of PC steel members. Design values (tensile force of diagonal members, temperature of members, deflection of a main beam, stress, etc.) are provided as a set of work execution management values. Work is executed and controlled by checking the work execution management values against values obtained by making actual measurement.



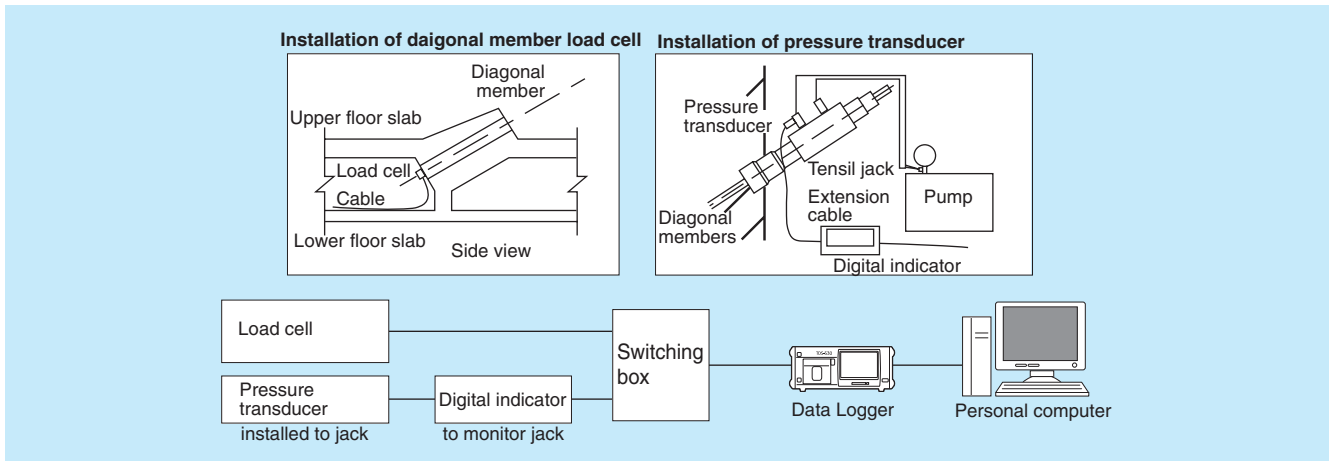
A list of Measuring Instruments

Measurement items	Instruments	Type
Concrete strain	Strain Transducer	KM-A, KM-AT, KM-B, KM-BT
Concrete dry shrinkage	Non-stress casing	KM-B, KM-BT, KM-KMF
Reinforcing bar stress	Reinforcing bar meter	KSA-A, KSAT-A
Pre-stressed introduction force of main tower	Center-hole load cell	KCM-NA, KCE-NA, KCG-NA
Main tower inclination	Surface inclinometer	KB-AB, KB-AC, KB-DB, KB-EB
Tensile force of diagonal members	Center-hole load cell	KCM-NA, KCE-NA, KCG-NA
Tensile force of jacks	High capacity pressure transducer	PWH-PA
	Center-hole load cell	KCM-NA, KCE-NA
Temperature	Thermocouple, Temperature gauge	T, KT-A
	Temperature-integrated strain transducer	KM-B, KM-BT
Tensile force of diagonal members by forcible vibration	Acceleration transducer	ARF-A
Concrete stress	Stress meter	Other products
Deflection of main tower	Water-tube displacement transducer	KWL-B, KWL-E
	Electronic level staff	Other products

Measurement System Block Diagram



Measurement in stretching diagonal members



Measurement of tensile force of diagonal members

