



Phone: +81-3-6630-3811  
www.taiheiyo-c.co.jp

2020.01

# Taiheiyo Consultant Structural surveys and diagnoses

## Technology to provide security beyond safety

Taiheiyo Consultant has been providing the best solutions by combining fundamental technologies developed through its history in the field of analysis and testing for cement, concrete and other materials with its long accumulated knowledge and experience as well as the most advanced technologies. Its efforts will continue to make contribution to the society by providing safety and security in the field of infrastructure development and maintenance in this country which has entered a stable growth period. Taiheiyo Consultant Co., Ltd. is a member of Taiheiyo Cement Group which has a history of over a century.

As shown at right,

Our service ranges from survey and testing for cement and concrete, chemical analysis, environmental measurement, to test manufacturing of various inorganic materials.

Based on the results of many years of research and development, we also work on research and development related to electric power, nuclear power and radioactive waste treatment as well as distribution of cementitious materials.

Quality of our products and services is assured by a comprehensive warranty system based on the corporate ethics and legal compliance, and our best efforts are made to provide detailed service for creating an environment that satisfies the customers.

### Main services

Concrete survey and diagnosis

Materials analysis

Instrumental analysis

Concrete and material tests

Cement Concrete Consulting

Commissioned processing of inorganic powders

Research and products related to the treatment and disposal of radioactive waste

Environmental measurement and analysis





# Field survey

**Strength**  
Core sampling for strength measurement in laboratory is performed, or concrete strength is estimated by rebound number in the field.



Normal core specimens  $\phi 100\text{mm}$   
Small-diameter core specimens  $\phi 50\text{mm} / \phi 25\text{mm}$   
Core sample  
Estimation of strength by rebound hammer

**Corrosion of reinforcing bars**  
Corrosion of reinforcing bars in concrete is estimated.




Half-cell potential

**Crack depth**  
Depth of cracks in concrete is estimated.



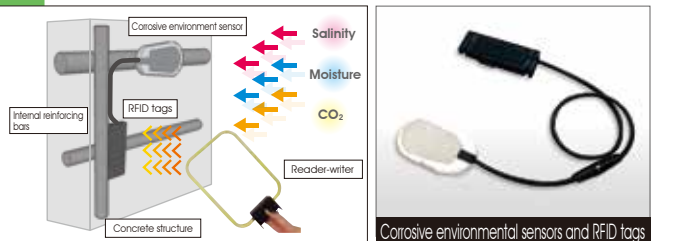
Ultrasonic

**Surface character**  
Strength and solidity of the concrete surface layer are measured.



Trent method  
SWAT method

**RFID corrosive environmental detection systems**  
Corroding environment in concrete is evaluated by monitoring the embedded sensors. The sensors are located in the vicinity of reinforcing bars, so as to enable preventive maintenance against deterioration by corrosion.



Corrosive environmental sensors and RFID tags

**RFID strain measurement systems**  
This system provides simple wireless measurement of strains occurring in a structure during construction, while in service, and with the progress of deterioration. It has wide applications ranging from construction management to maintenance activities.



Measurement status  
Strain sensors and RFID tags

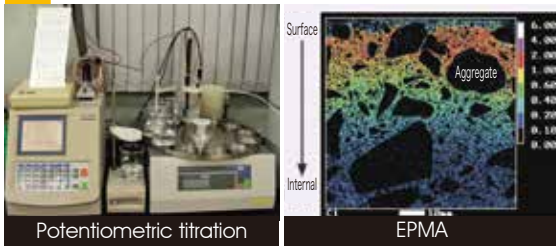
# Laboratory test

**Compressive strength · Modulus of static elasticity · Neutralization**  
Strength and carbonation depth of concrete cores are measured.



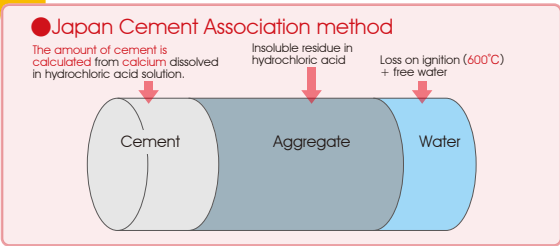
Compressive strength  
Neutralization

**Chloride content**  
Chloride ion concentration in concrete is measured.




Potentiometric titration  
EPMA

**Estimation of mix proportion**  
Unit weights of cement, water and aggregate in concrete are estimated.



Japan Cement Association method  
The amount of cement is calculated from calcium dissolved in hydrochloric acid solution.  
Insoluble residue in hydrochloric acid  
Loss on ignition ( $500^{\circ}\text{C}$ ) + free water  
Cement  
Aggregate  
Water

**Pop-out · Uneven colors · Surface deterioration**  
Causative substances for pop-out as well as causes of uneven colors or change in color of concrete surface are identified.



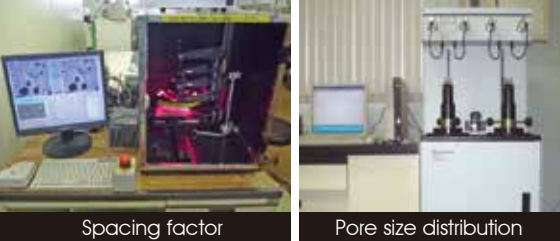
Powder X-ray diffraction  
Stereomicroscopic observation (Mold contamination)

**Chemical deterioration**  
Cause of deterioration occurring in concrete are investigated.



Cross-sectional observation  
SEM image (Formation of gypsum)

**Pore structure**  
Measurement of pore structure which is closely related to strength or durability of concrete is performed.



Spacing factor  
Pore size distribution

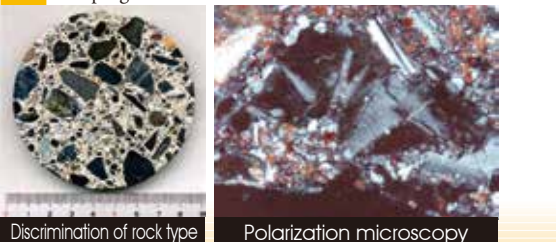
## Alkali-silica reaction (ASR)

**Gel observation**  
Presence or absence of alkali silica gel is determined.



Stereomicroscopic observation  
SEM image

**Rock type determination · Degree of deterioration**  
Highly reactive rock types and minerals are determined, and progress of reaction is evaluated.



Discrimination of rock type  
Polarization microscopy

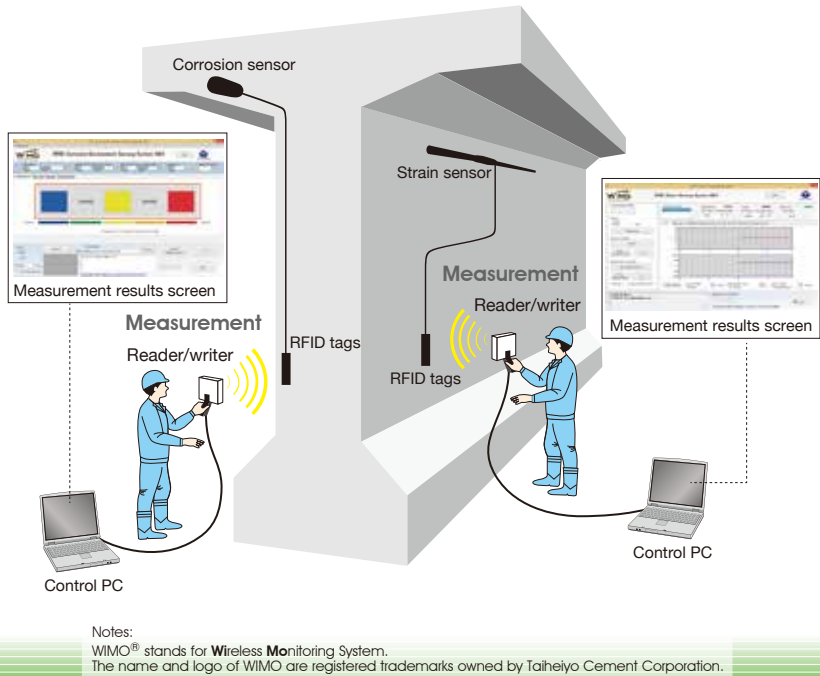
**Accelerated expansibility**  
Expansion rate of cores taken from a concrete structure is measured.



JCI-DD2 method  
Alkaline solution immersion method

**Wireless Monitoring System WIMO**  
**Monitoring**

This system utilizes the radio frequency identification (RFID) technology developed for chip cards and determines internal condition of a concrete structure by means of radio waves which are supplied to the surface of the structure. No cables are exposed, and no battery change is required. This makes the system best suited for long-term maintenance.



Corrosion sensor  
Strain sensor  
Measurement results screen  
Measurement Reader/writer  
RFID tags  
Control PC

Notes:  
WIMO® stands for Wireless Monitoring System.  
The name and logo of WIMO are registered trademarks owned by Taiheiyo Cement Corporation.

# Providing exact solutions to structural survey and diagnosis — that is the mission of Taiheiyo Consultant.

From structural survey and diagnosis to repair proposals

From survey and diagnosis, repair proposals, further to monitoring and inspection...total support!  
Based on various survey and test results, we propose the best solution to each client.

Deterioration of structure over time

Grasp of deterioration status

Field survey

Determination of cause of deterioration

Laboratory test

Proposal of repair and renovation

Method selection of repair and renovation

Repair and renovation design

Repair, renovation and reinforcement work  
Count on Taiheiyo Cement Group for repair, renovation and strengthening projects!

**Field survey**

Visual-appearance inspection	Cracking, Peeling, Desquamation, Reinforcing bars exposure, Discoloring
Strength	Core sampling, Small core sampling (Soft coring method), Rebound number, Bond strength, Ultrasonic, Impact elastic wave
Investigation of location of reinforcing bars	Electromagnetic wave radar, Electromagnetic induction
Corrosion of reinforcing bars	Chipping, Half-cell potential, Polarization resistance
Crack depth	Ultrasonic, Core collection
Surface character	Surface permeability test (Trent method), Surface water absorption test (SWAT method), Permeability, Surface tensile strength

**Laboratory test**

Compressive strength · Neutralization	JIS method, Soft coring method
Chloride content	JIS method, JCI method, EPMA, Fluorescent X-ray method
Estimation of mix proportion	Japan Cement Association method, Sodium gluconate method, ICP method
Chemical deterioration	EPMA, Powder X-ray diffraction, SEM-EDS
Pop-out · uneven colors · Surface deterioration	Powder X-ray diffraction, Stereomicroscopic observation, SEM-EDS, Thermal analysis
Pore structure	Spacing factor, Pore size distribution
ASR : Gel observation	Macroscopic and stereomicroscopic observation, Polarization microscopy, SEM-EDS
ASR : Rock type determination	Macroscopic observation, Polarization microscopy, Powder X-ray diffraction
ASR : Accelerated expansion tests	JCI-DD2 method (JCI-S-011), Alkaline solution immersion method, Saturated NaCl immersion method

**Monitoring and inspection**

**Monitoring**

- RFID corrosive environmental detection systems
- RFID strain measurement systems