

## 9.14 Survey on the Impact on Materials and Cultural Assets

### 9.14.1 Visible observation

The equipment used for on-site surveys are limited in scope to what is portable for a single individual. As a rule, survey paper and recording paper is prepared in advance, and the format is determined experimentally. The monument survey forms introduced by Tokyo are shown in Table.9.14.1.

Items to be carried

Camera (if possible, macro, with telescopic lens), compass, small polyethylene bag, plastic bottle, desalinated gauze, bamboo spatula, ion exchanged water 100 to 200 ml, a small syringe, a loupe, recording paper.

Table 9.14.1 Effect on Metal Statues, etc. Installed Outdoors: Survey Form

Installation site	( ) Contact address
Installed object's name	( ) Data
Installation date	Date: Survey date:
Material data	Metal (Material: Processing method: )
	Other (Material: Processing method: )
	Compound
Surface processing	No Yes (Type: )
Environmental conditions	Sunlight (good / bad) Trees: Obstacle: Illumination: Air pollution source: Ventilation: Meteorological conditions: Main wind direction, location of rivers and seas, etc.
Visible observation	Extent of damage: Severe medium minor
Photographic record	Vicinity, whole, partial, partial magnified
Preservation state	Whole: Partial:
	Surface: Preservation management: Cleaning methods, surface management, management body
Sampling	Precipitation flow, dent part residue, etc.

Note: Visible observation: Bronze statue (Damage severe: patina corrosion 80%<, damage medium: Verdigris corrosion 30 to 80%, damage minor: 30%>) Stone, concrete statue (Damage severe: Profile damage 80%<, damage medium: Profile damage 30 to 80%, damage minor: Profile damage 30%>)

### 9.14.2 Methods of measuring and analyzing deterioration <sup>1)</sup>

#### (1) Observation of outside

When collection of samples for analysis cannot be done and direct observation of the target alone is possible, it is necessary to divide them into ranks, as the first stage of outdoor monitoring, by standardizing the extent of deterioration of the sample by each material. Reference is also made to the method shown by the percentage area, as when evaluating photochemical plant damage, and methods whereby soot is measured according to the Ringelman's smoke chart.

#### (2) Measurement and analysis using equipment

X-ray diffraction, X-ray fluorescent analysis, color differentiation, and microscopic observation can all be applied with regard to samples obtained from the survey targets. If appropriate, chemical processing can also expand the methods of analysis. Atomic absorption analysis, emission spectroscopic analysis, radiation analysis, and ion chromatography can also all be applied.

#### (3) Measuring air pollution and meteorological factors

As much data as possible is collected on typical air pollutant concentrations and meteorological items that are considered to be responsible for the deterioration of the target materials. When it is impossible to use data collected by other organizations, the surveyor must take measurements directly themselves. Measurements of NO<sub>2</sub>, atmospheric temperature, and so forth, through the simple measurement method can be taken easily.

#### (4) Field exposure tests using standard samples

When it is possible to conduct comparative long term surveys, standard samples are prepared for each substance, and exposure tests are conducted on-site to examine the relationship between environmental factors and the extent of damage. From these results, a damage function can be compiled, which can also be used for assessments.

#### (5) Artificial exposure tests using standard samples

Controlled concentration exposure tests in an artificial meteorological chamber are used as experiments with the aim of quantitatively elucidating the effects of environmental factors on materials individually. Through this method, for example, the correlation between the extent of the damage, and sulfur dioxide concentrations can be quantitatively evaluated when artificially exposing just the sulfur dioxide in a given substance, for a certain time period, by concentration. By comparing these results with the field data, the accuracy of the mutual function can be improved.

#### (6) Reports

The format of the report is also extremely important to secure the standards of the survey, and it is necessary to prepare this in advance depending on the survey objectives.