環境技術実証事業 ETV 環境省

ヒートアイランド対策技術分野
実証番号 051 - 1326
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○ General overview

Target verification technology / verification applicant	BASEA; AP10MT01UF TOTO LTD.
Verification organization	Japan Testing Center for Construction Materials
Verification test period	September 17, 2013 to February 19, 2014

1. Overview of the target verification technology

A technology for laying water-retentive architectural materials on the balcony floors of condominiums and detached houses

*For information about the characteristics and other factors of the technology, see 4, "Reference information (overview version, on page 23)."

2. Overview of the verification test

2.1 Basic performance

We measured the basic performance (i.e., water retentiveness, water absorptivity, evaporability) of water-retentive architectural materials for verandah.

2.2 Numerical calculations

We numerically calculated the effect (e.g., lower verandah surface temperature) of the water retentive architectural materials for verandah placed on condominium verandahs. We compare the effect with that of general concrete verandah surfaces.

2.2.1 Set conditions in numerical calculations

(1) Target building

Verandah space and living & dining (L&D) space of a condominium model

[Verandah floor space covered: 5.85 m^2; L&D floor space covered: 14.04 m^2; Window opening area: 2.7 m^2; Floor height: 2.5 m; Structure: reinforced concrete]

Note: No consideration is given to the shelter of sunlight due to the effects of surrounding buildings or structures.

For details of the housing model, see 4.3.1 (1) “Target building” in the full version of main text. (See page 35 of the full version of main text.)

(2) Setting of verandah handrails

Name of setting condition	Conditions
Handrail 1 (assuming a lattice handrail)	Free airflow and transmittance of sunshine
Handrail 2 (assuming a transparent panel)	Shut-off airflow and transmittance of sunshine
Handrail 3 (assuming a concrete handrail)	Shut-off airflow and sunshine

(3) Setting of weather conditions

Weather-monitoring data issued by the Japan Meteorological Agency (from 5:00 to 24:00 on August 16, 2012), and monitored by the Tokyo District Meteorological Observatory, Tokyo.

(4) Setting of water sprinkling conditions

Name of setting condition	Conditions
Water sprinkling 1	Water sprinkling at 9:00 (sprinkling rate: 1.24 kg/m^2)
Water sprinkling 2	Water sprinkling at 16:00 (sprinkling rate: 1.24 kg/m^2)

(5) Setting of ventilation frequency

Name of setting condition	Conditions
Ventilation 1	5 ventilations / hour
Ventilation 2	20 ventilations / hour
Ventilation 3	60 ventilations / hour

3. Verification test results

3.1 Basic performance

3.1.1 Verification items

(1) Water retentiveness

Item		Measurement results			
		No.1	No.2	No.3	No.4
Absolute dry mass	(g)	18536	186.00	186.34	185.48
Wet mass	(g)	198.18	197.86	198.23	197.51
Density in oven-dry condition (average)*1	(kg/m^3)	1898			
Water capacity (average)*1	(g/cm^3)	0.12			

(2) Water absorptivity

Item		Measurement results			
		No.1	No.2	No.3	No.4
30-minute suck-up mass	(g)	195.48	196.21	196.33	195.76
Suck-up height (average)*1	(%)	84			

(3) Evaporability

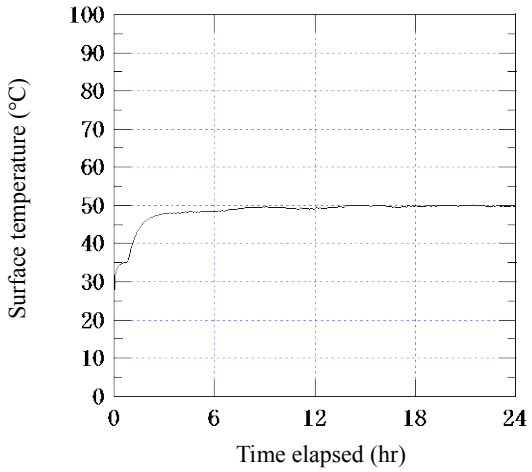
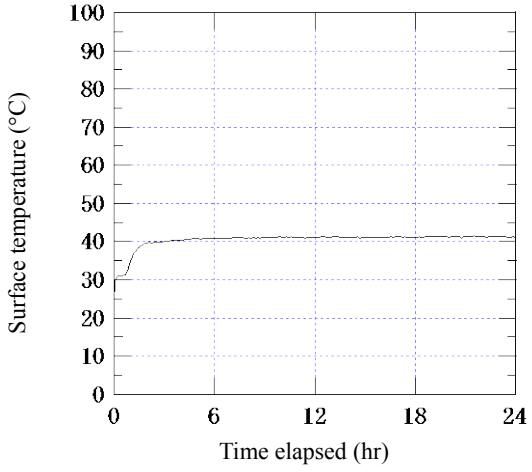
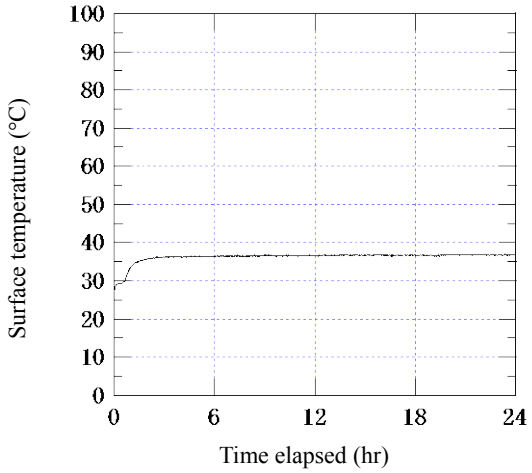
1) Measurement results

Item		Wind velocity, 1 m/s	Wind velocity, 3 m/s	Wind velocity, 5 m/s
Evaporation efficiency	(–)	0.11	0.10	0.07
Constant-rate evaporation period*2	(h)	Approx. 1	Approx. 1	Approx. 1
Integrated evaporation	(g)	47	44	42
Integrated temperature	(°C•hr)	144	232	280

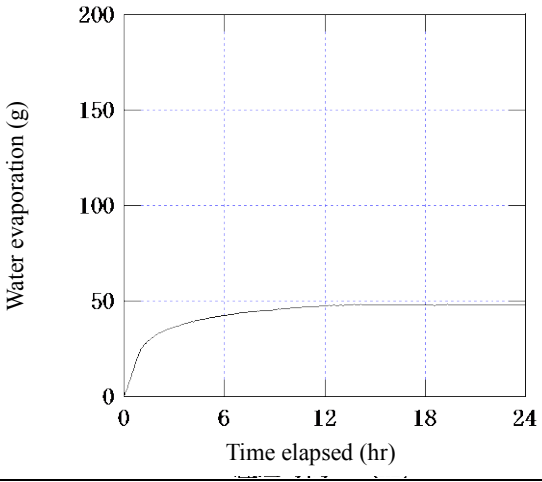
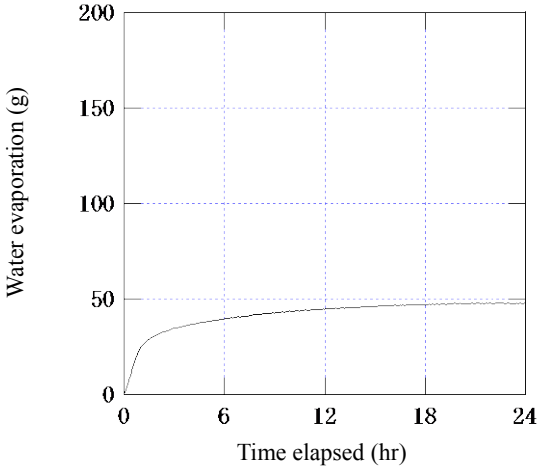
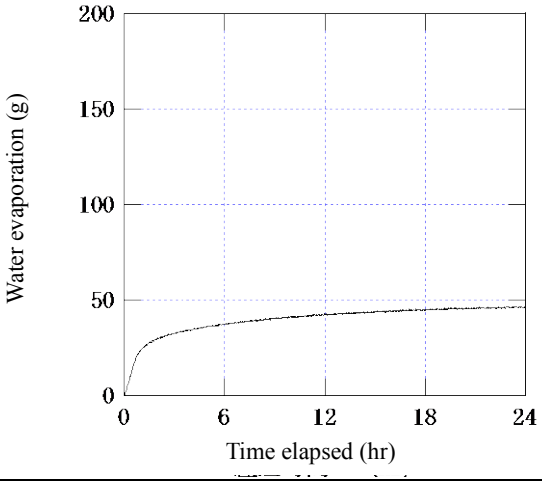
*1: Averages in four samples

*2: The constant-rate evaporation period is a series of measurements plotted on a chart whose results are used to perform calculations. In view of the effects of wind velocity in mass measurement, we indicate the results as "approximate values." [The constant-rate evaporation period is defined in 4.2, (3) 1) (on page 30 in the full version of main text).]

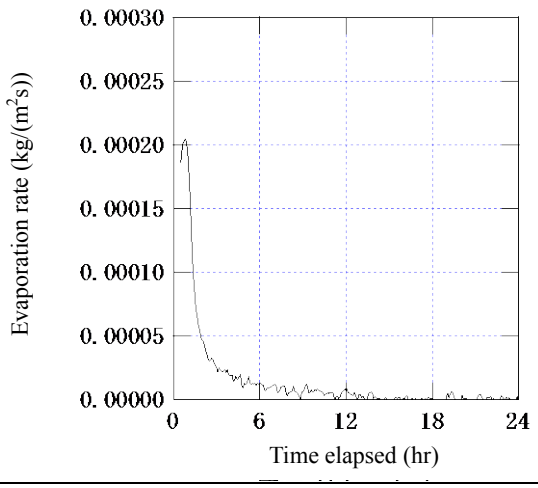
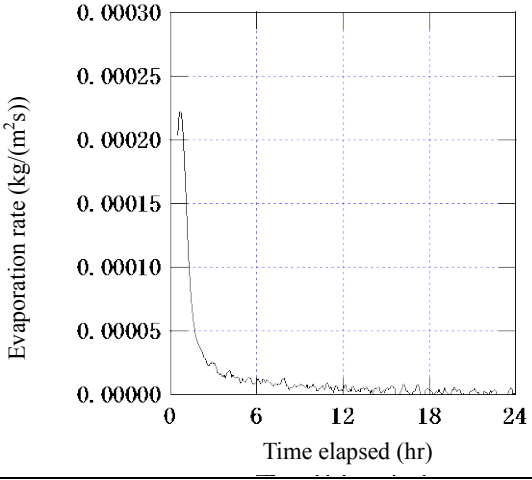
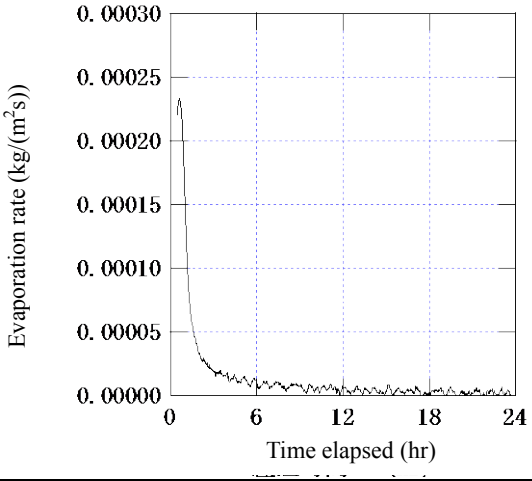
2) Relationship between surface temperature and time elapsed

Wind velocity	Results
1 m/s	
3 m/s	
5 m/s	

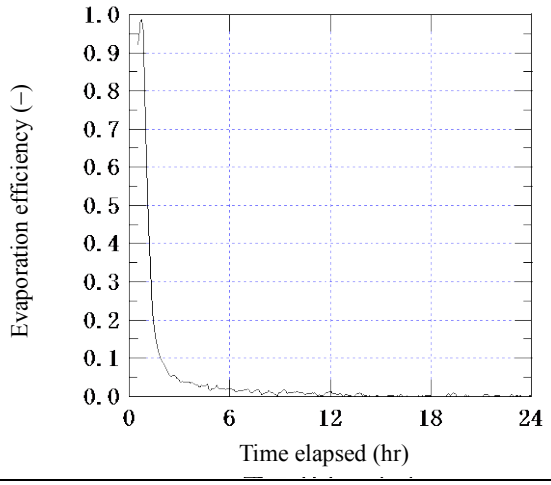
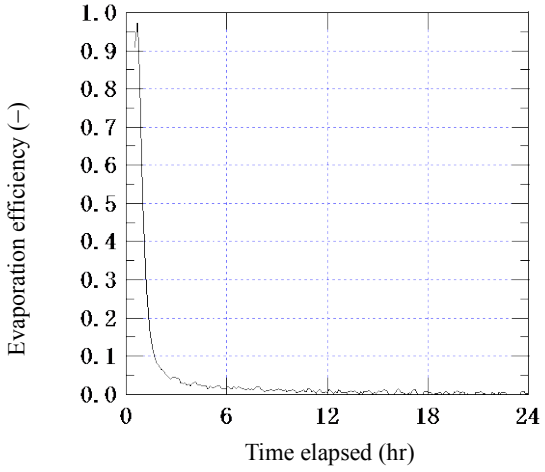
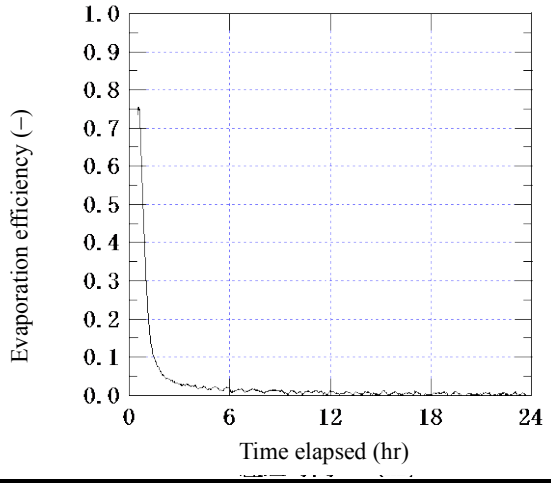
3) Relationship between water evaporation and time elapsed

Wind velocity	Results
1 m/s	
3 m/s	
5 m/s	

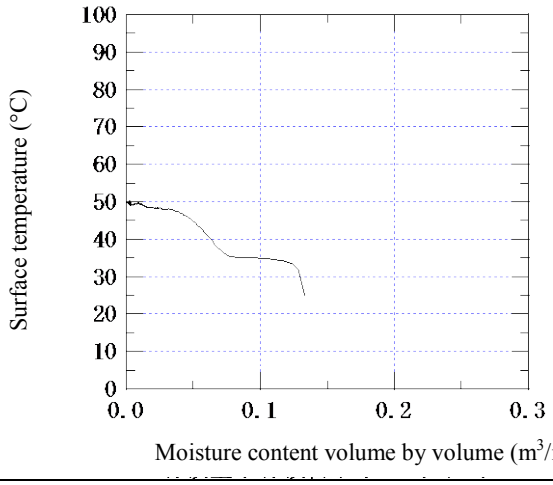
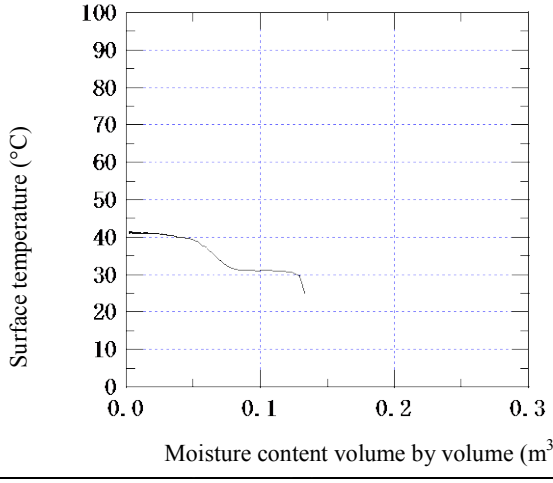
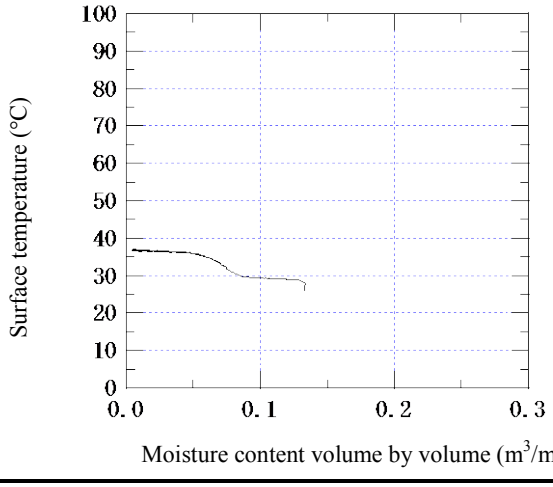
4) Relationship between evaporation rate and time elapsed

Wind velocity	Results
1 m/s	
3 m/s	
5 m/s	

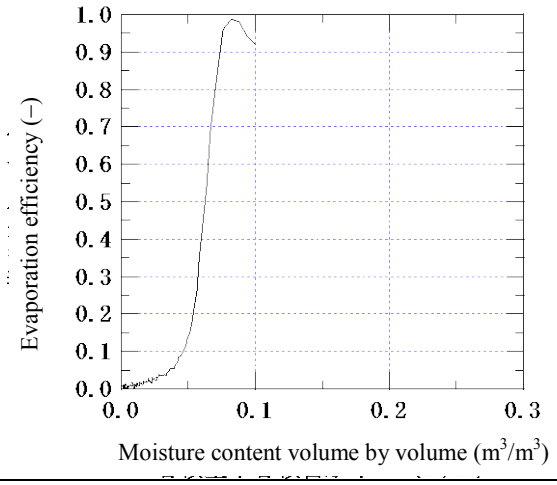
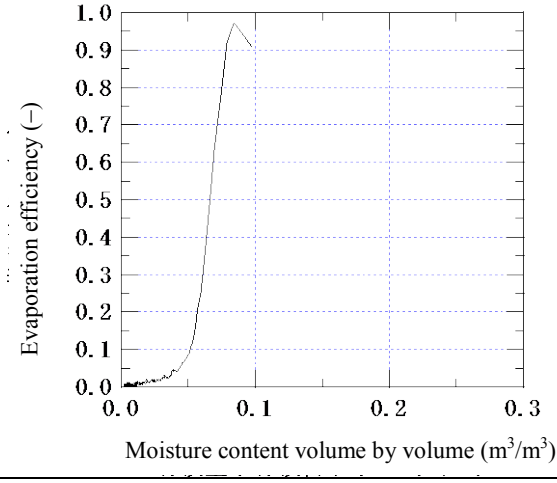
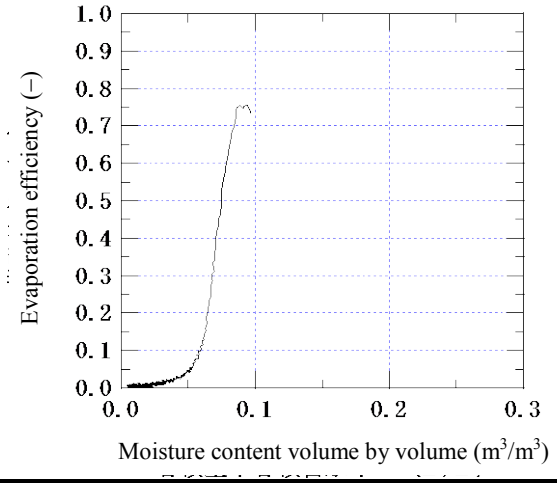
5) Relationship between evaporation efficiency and time elapsed

Wind velocity	Results
1m/s	
3 m/s	
5 m/s	

6) Relationship between surface temperature and moisture content

Wind velocity	Results
1 m/s	
3 m/s	
5 m/s	

7) Relationship between evaporation efficiency and moisture content

Wind velocity	Results
1 m/s	
3 m/s	
5 m/s	

3.1.2 Reference items

(1) Thermal conductivity

Item		Measurement results	
		Dry condition	Wet condition
Thermal conductivity	[W/(m•K)]	0.383	0.509

(2) Solar reflectance

Item		Measurement results	
		Dry condition	Wet condition
Solar reflectance	(%)	37.0	27.5

(3) Specific heat

Item		Measurement results
Specific heat	[J/(g•K)]	0.85

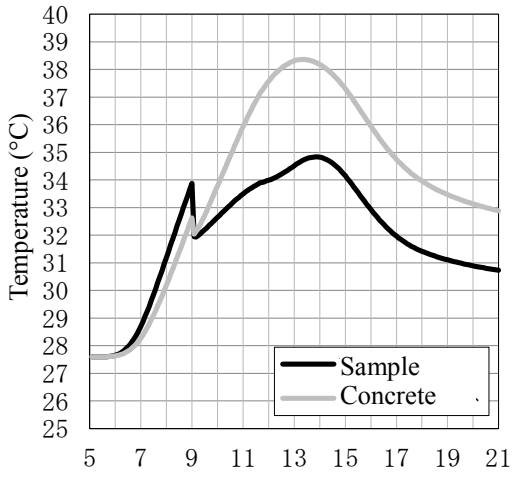
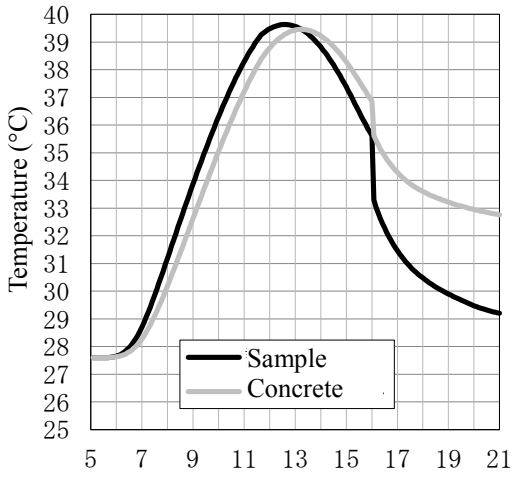
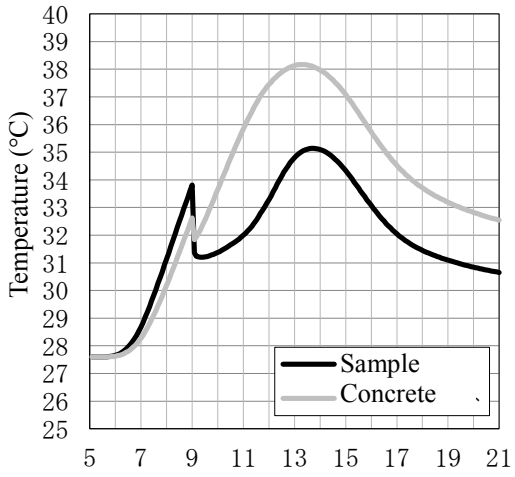
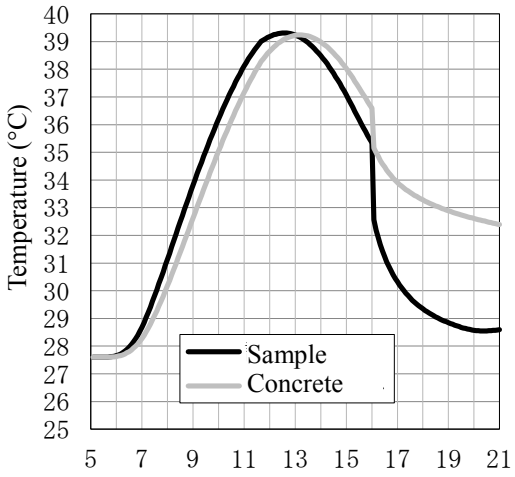
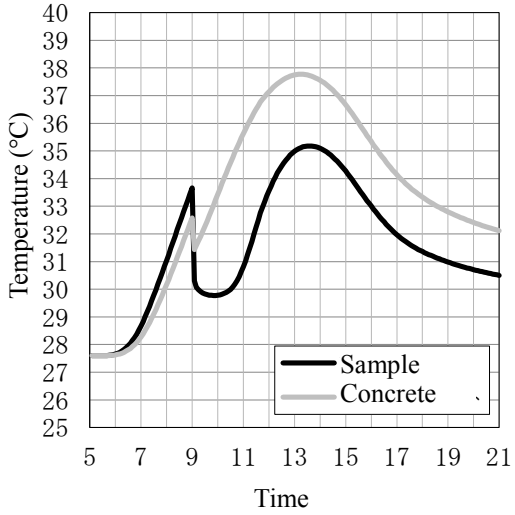
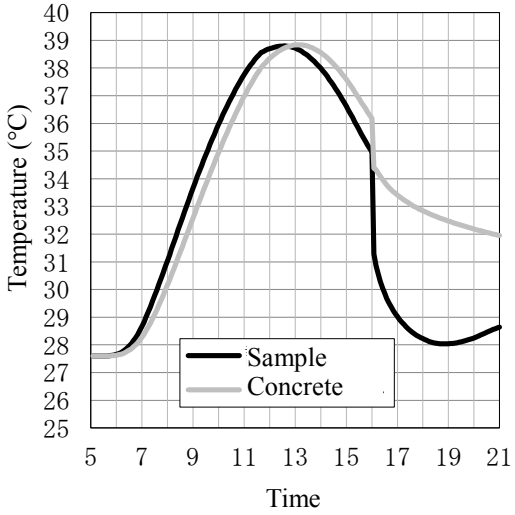
(4) Moisture content

Item		Measurement results*1
Absolute dry density	(kg/m^3)	1898
Moisture content mass by mass	(kg/kg)	0.066
Moisture content mass by volume	(kg/m^3)	124
Moisture content volume by volume	(m^3/m^3)	0.125

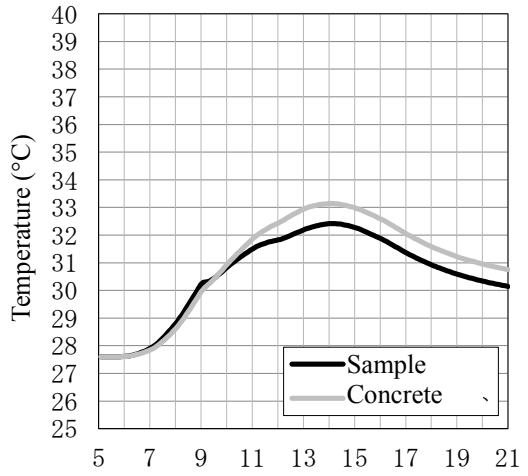
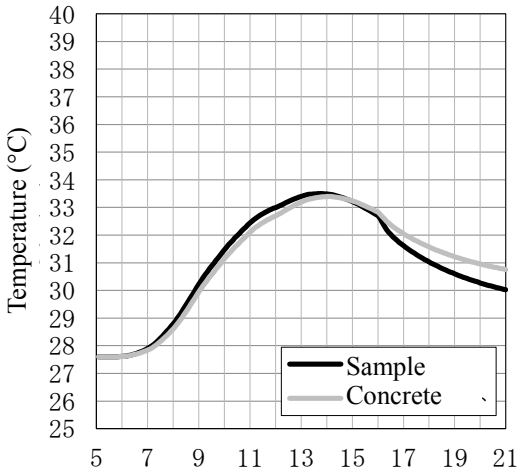
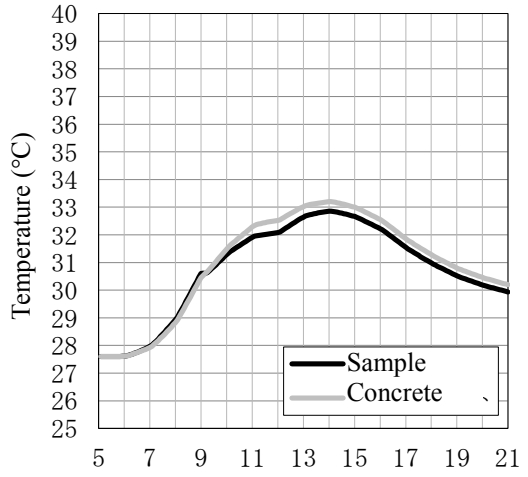
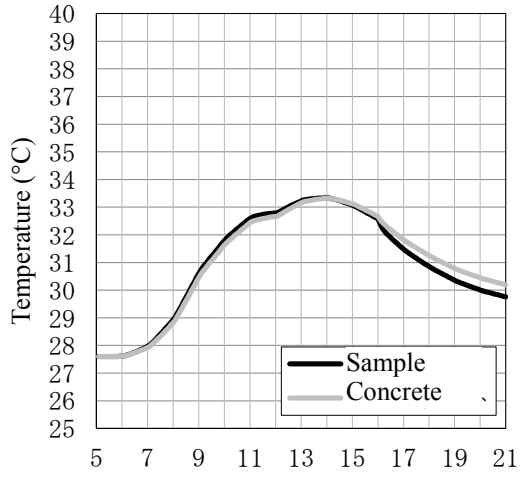
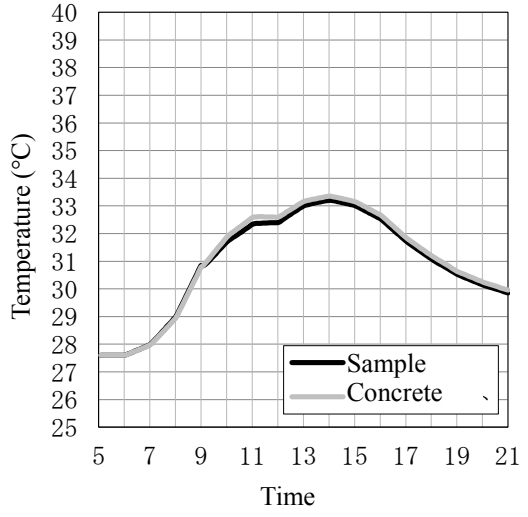
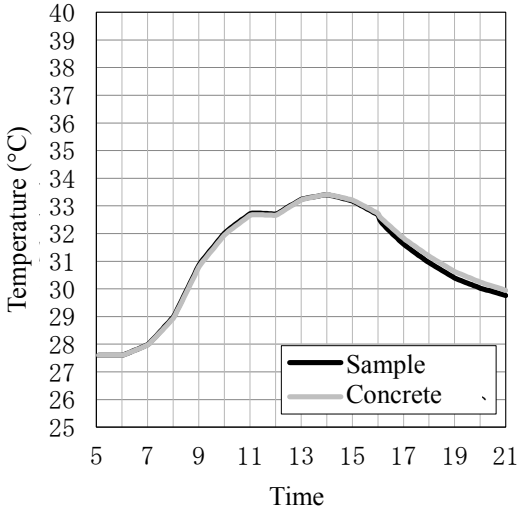
*1: Averages in four samples

3.2 Verification items to be numerically calculated

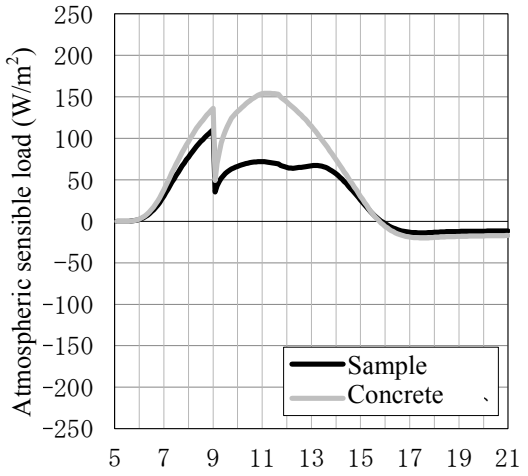
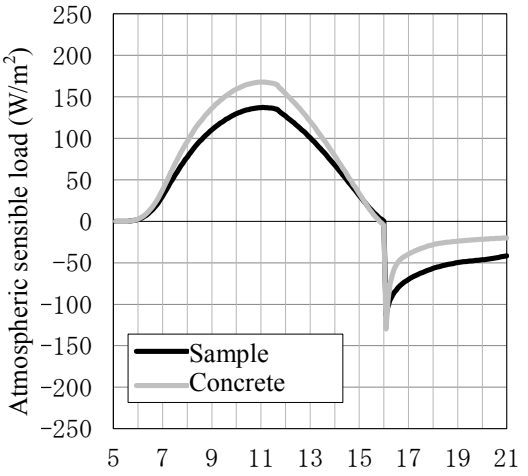
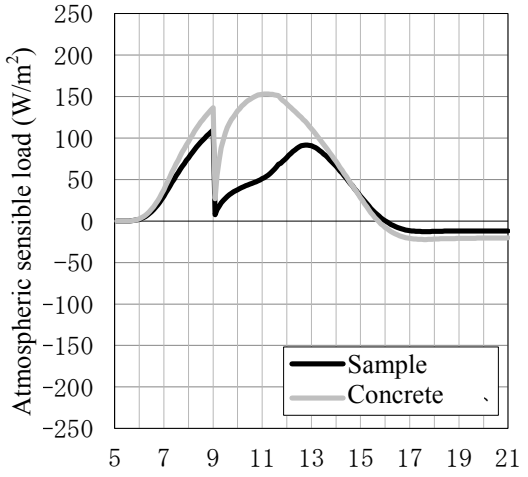
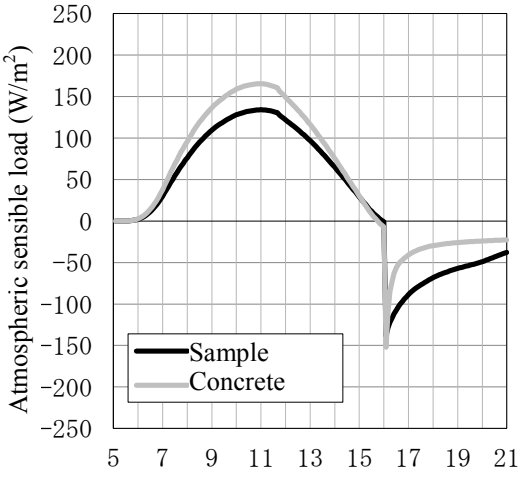
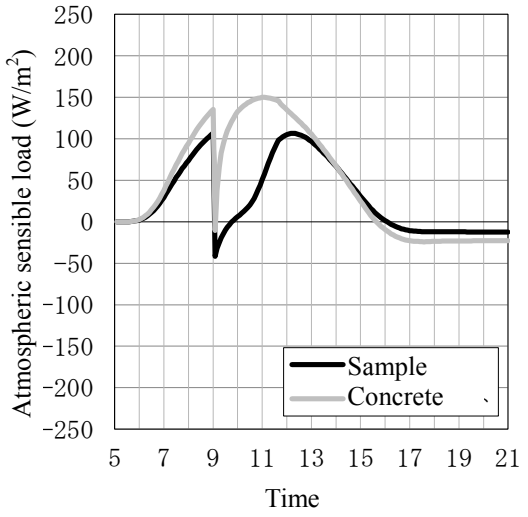
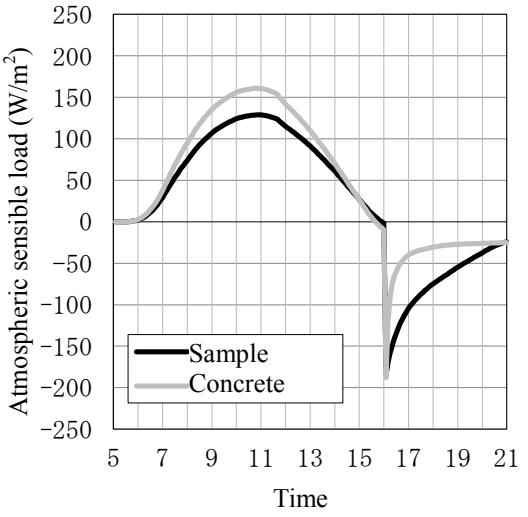
(1) Handrail 1 (assuming a lattice handrail) Change in verandah surface temperature over time

Number of ventilation	Water sprinkling 1: Water sprinkling at 9 a.m.	Water sprinkling 2: Water sprinkling at 4 p.m.
5 (times/h)		
20 (times/h)		
60 (times/h)		

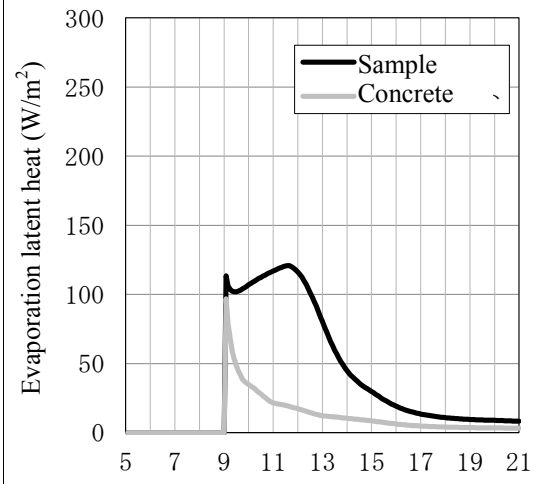
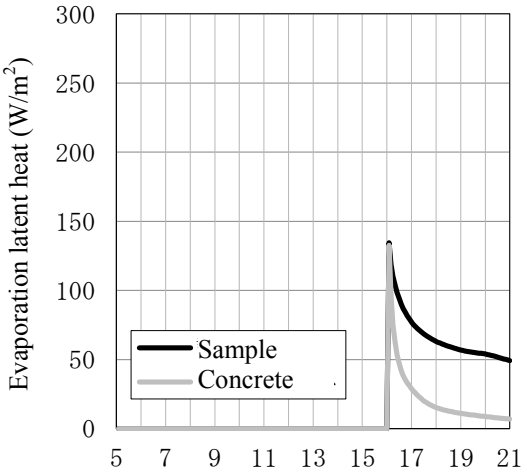
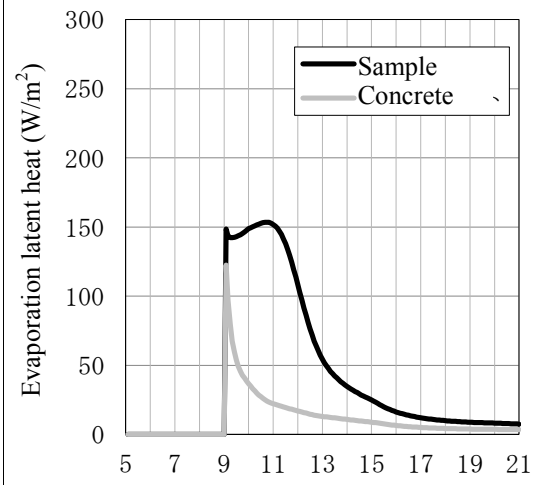
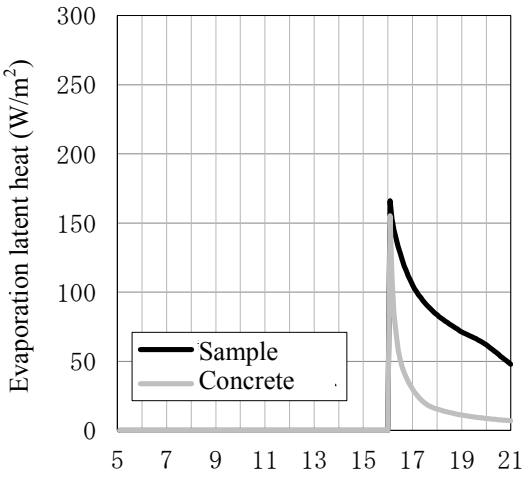
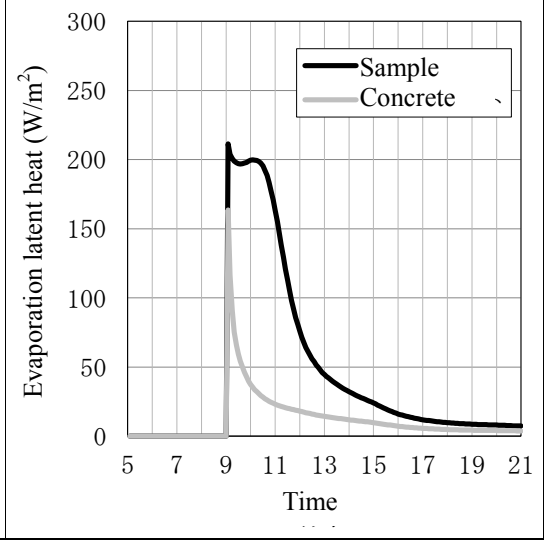
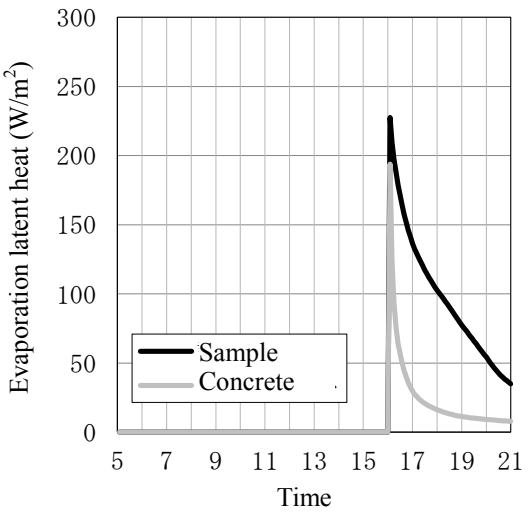
(2) Handrail 1 (assuming a lattice handrail) Change in room temperature over time

Number of ventilation	Water sprinkling 1: Water sprinkling at 9 a.m.	Water sprinkling 2: Water sprinkling at 4 p.m.
5 (times/h)		
20 (times/h)		
60 (times/h)		

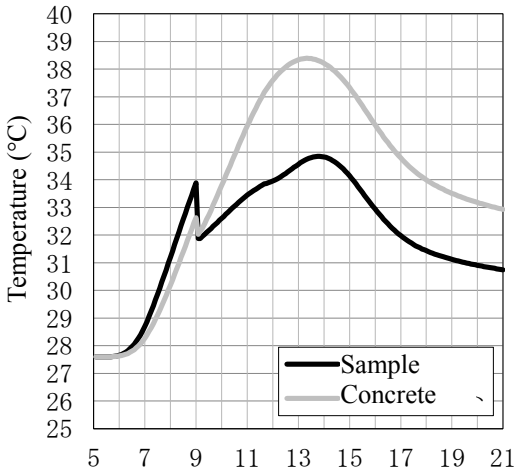
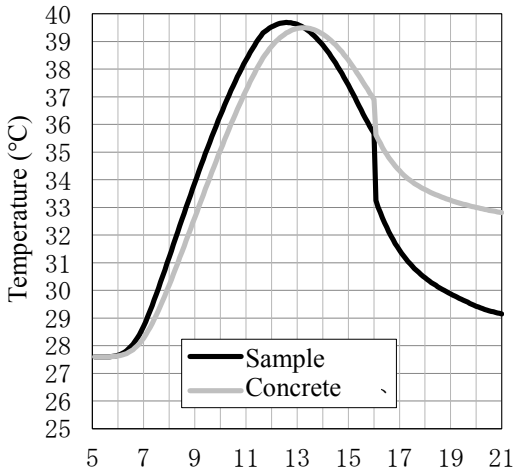
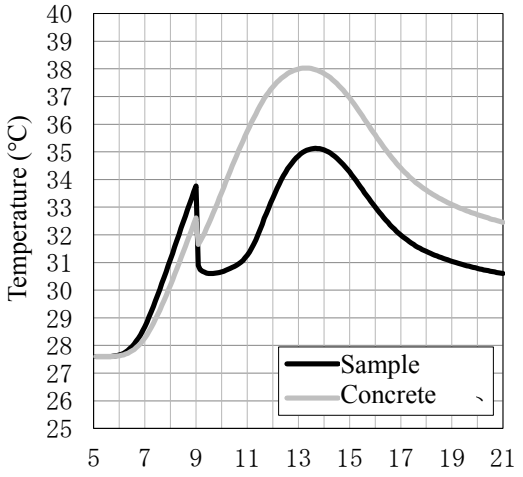
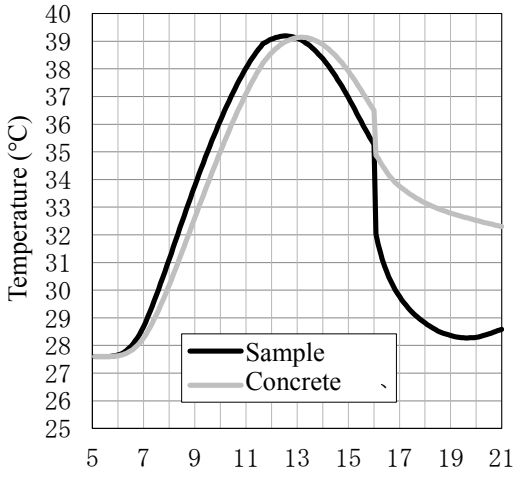
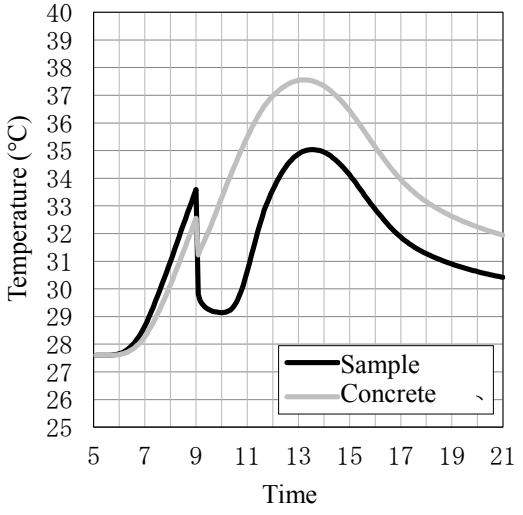
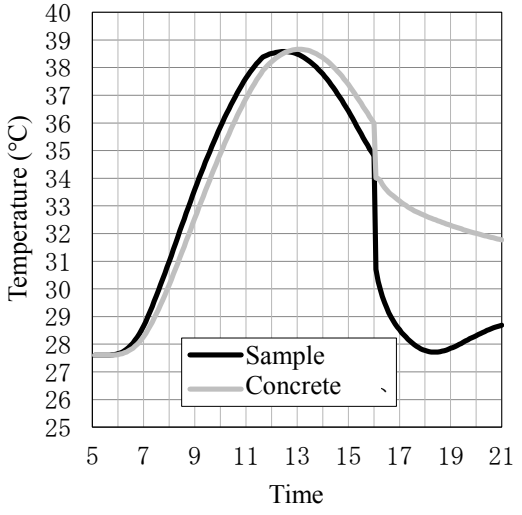
(3) Handrail 1 (assuming a lattice handrail) Change in atmospheric sensible load over time

Number of ventilation	Water sprinkling 1: Water sprinkling at 9 a.m.	Water sprinkling 2: Water sprinkling at 4 p.m.
5 (times/h)		
20 (times/h)		
60 (times/h)		

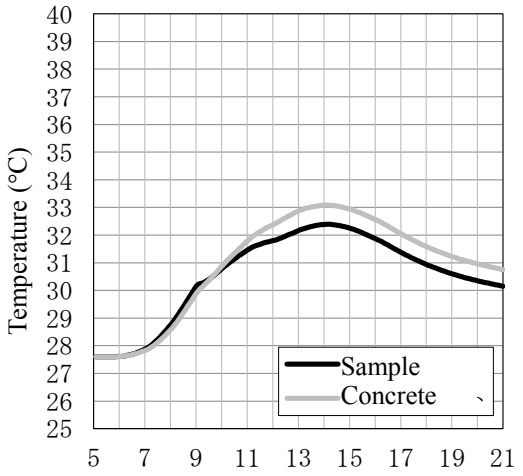
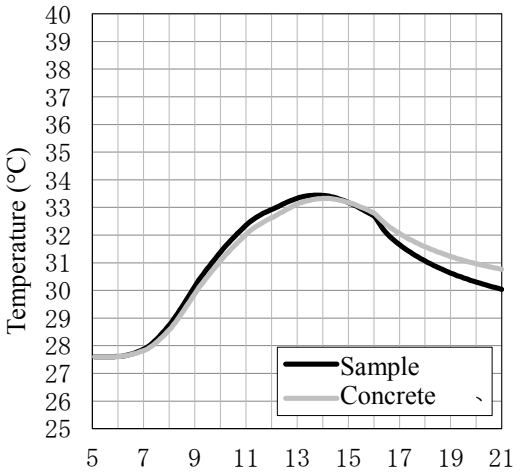
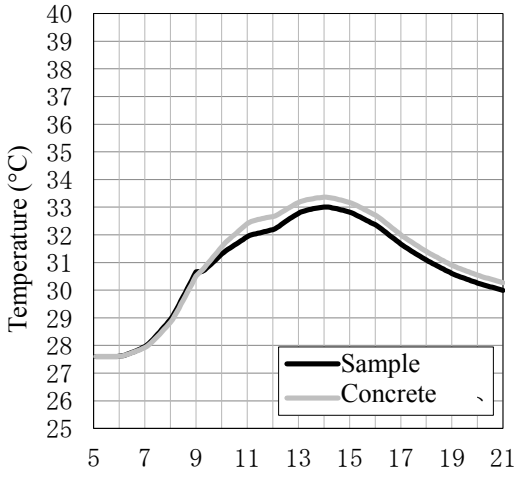
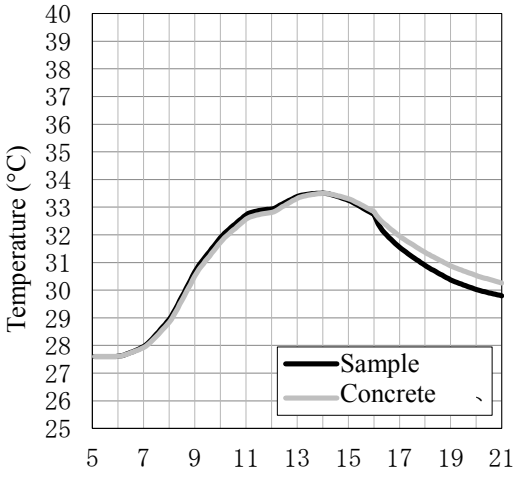
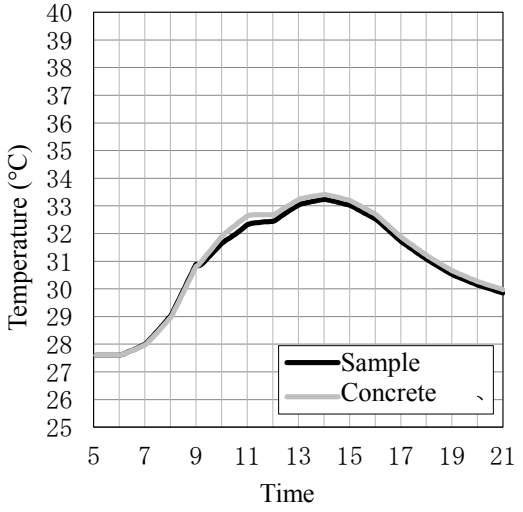
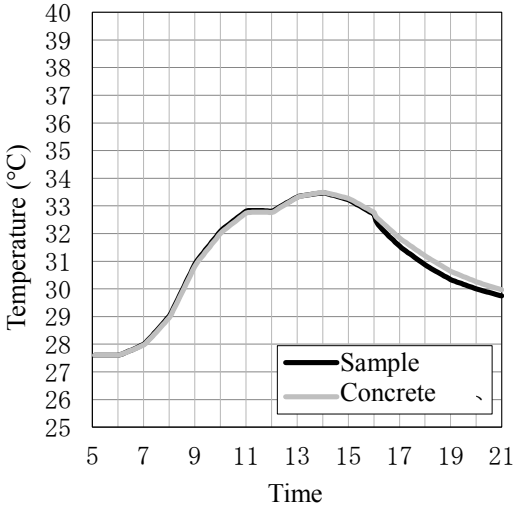
(4) Handrail 1 (assuming a lattice handrail) Change in evaporation latent heat over time

Number of ventilation	Water sprinkling 1: Water sprinkling at 9 a.m.	Water sprinkling 2: Water sprinkling at 4 p.m.
5 (times/h)		
20 (times/h)		
60 (times/h)		

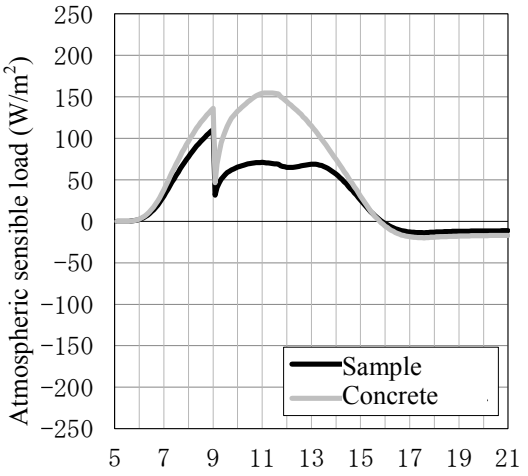
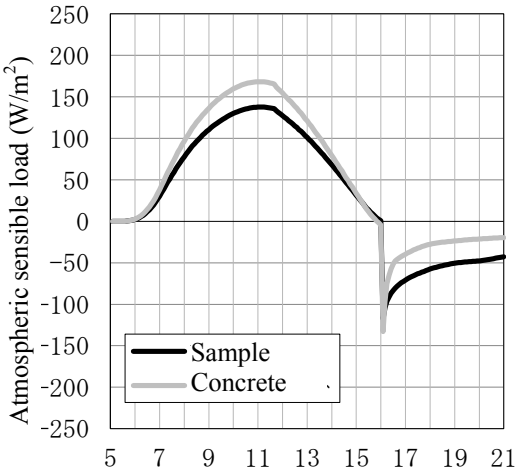
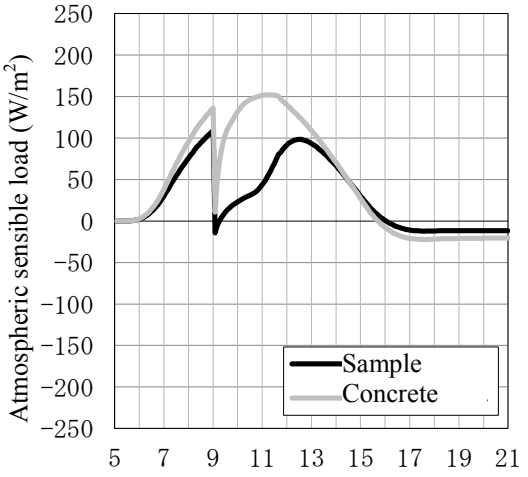
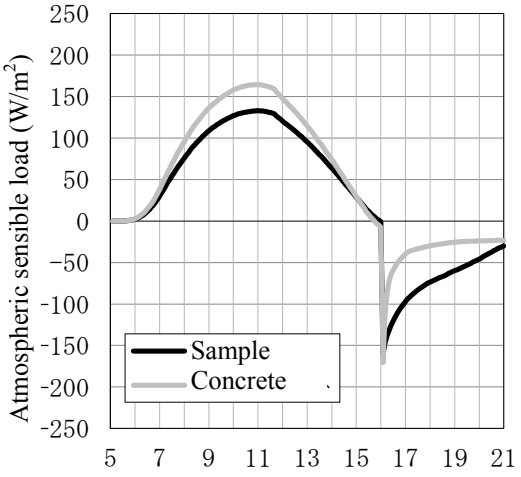
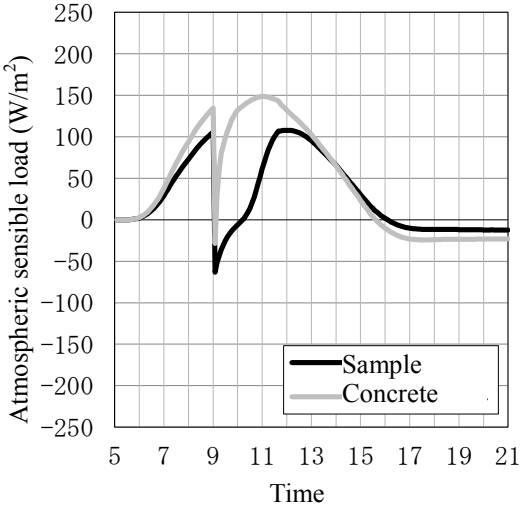
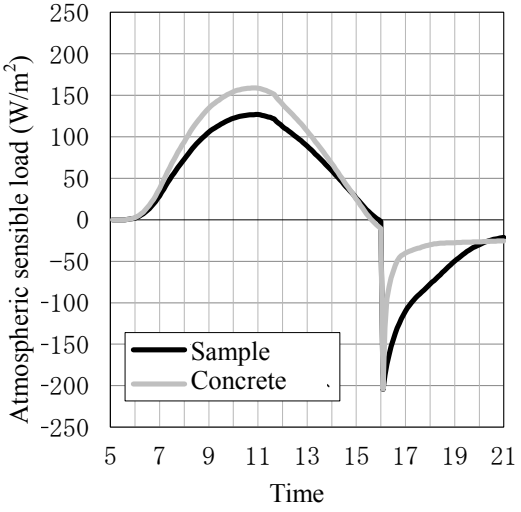
(5) Handrail 2 (assuming a transparent panel) Change in verandah surface temperature over time

Number of ventilation	Water sprinkling 1: Water sprinkling at 9 a.m.	Water sprinkling 2: Water sprinkling at 4 p.m.
5 (times/h)		
20 (times/h)		
60 (times/h)		

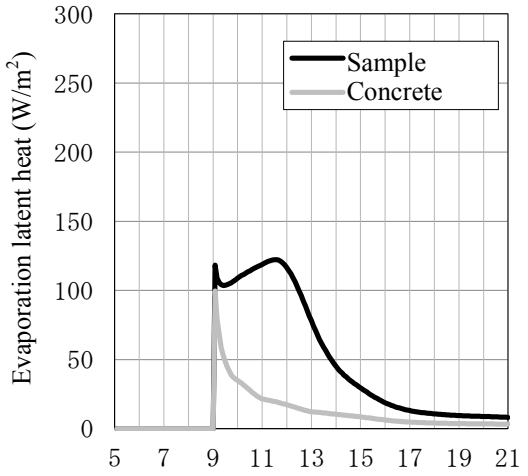
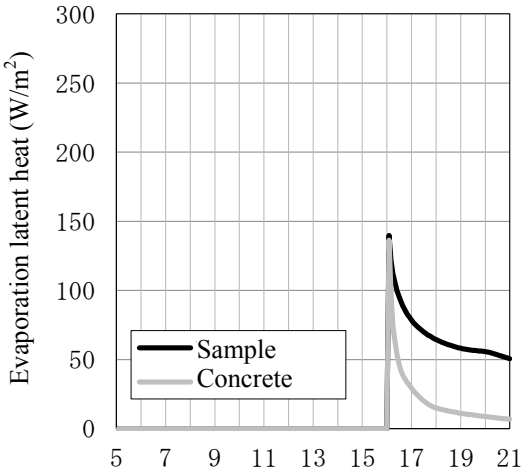
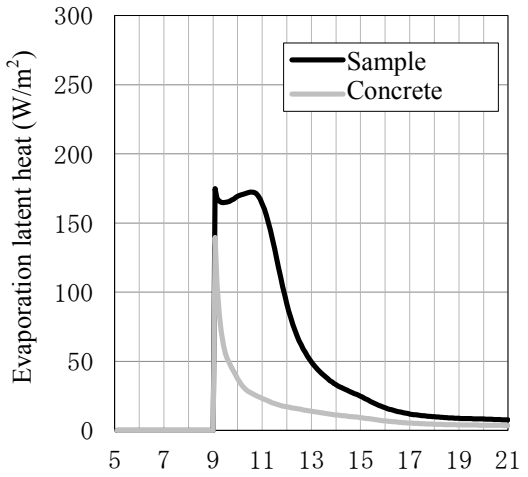
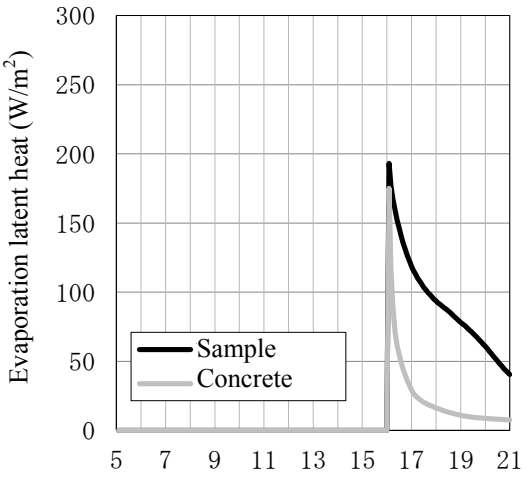
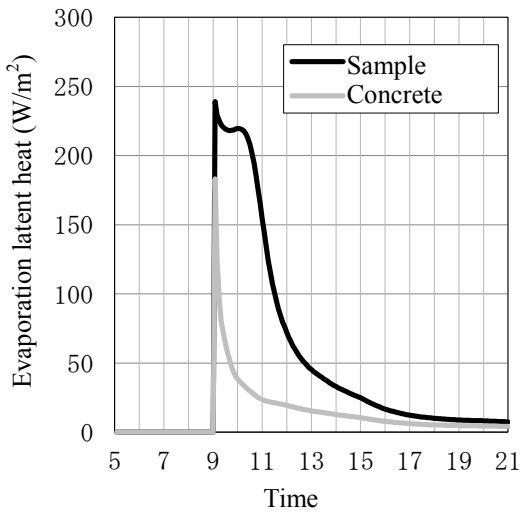
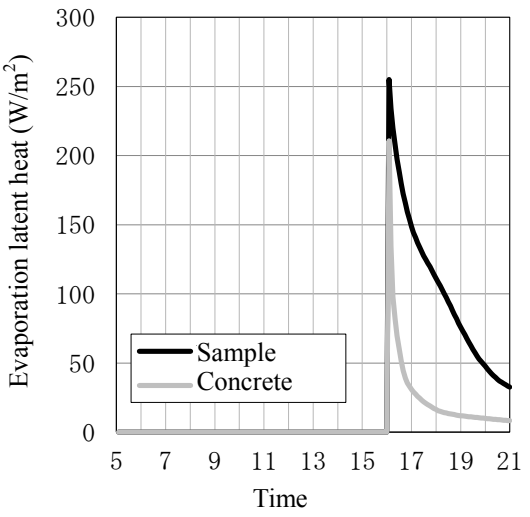
(6) Handrail 2 (assuming a transparent panel) Change in room temperature over time

Number of ventilation	Water sprinkling 1: Water sprinkling at 9 a.m.	Water sprinkling 2: Water sprinkling at 4 p.m.
5 (times/h)		
20 (times/h)		
60 (times/h)		

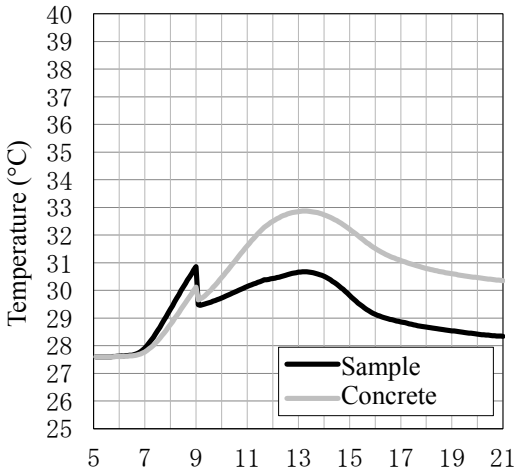
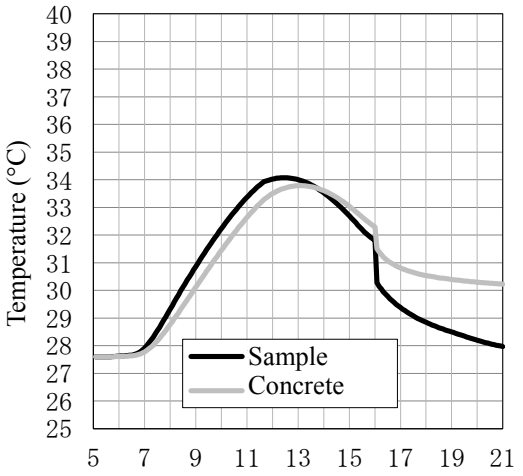
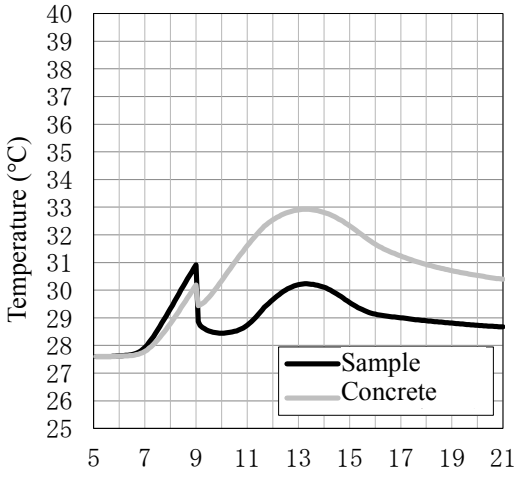
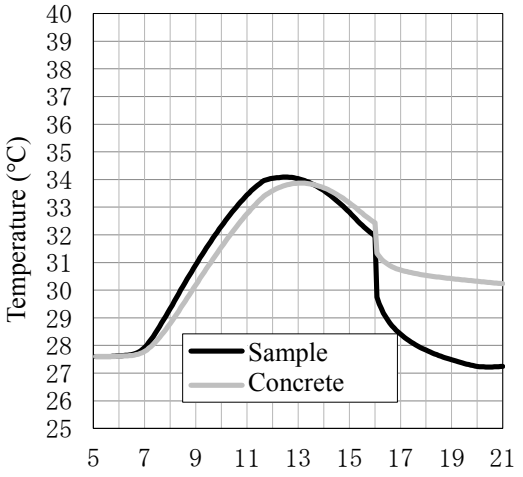
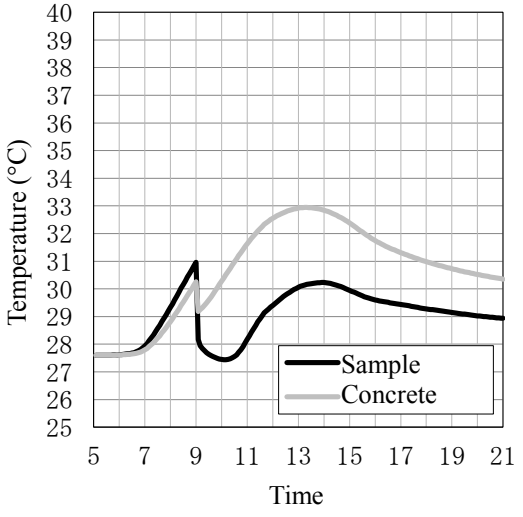
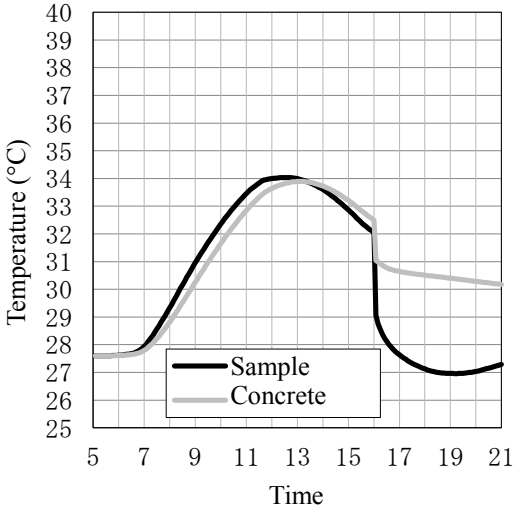
(7) Handrail 2 (assuming a transparent panel) Change in atmospheric sensible load over time

Number of ventilation	Water sprinkling 1: Water sprinkling at 9 a.m.	Water sprinkling 2: Water sprinkling at 4 p.m.
5 (times/h)		
20 (times/h)		
60 (times/h)		

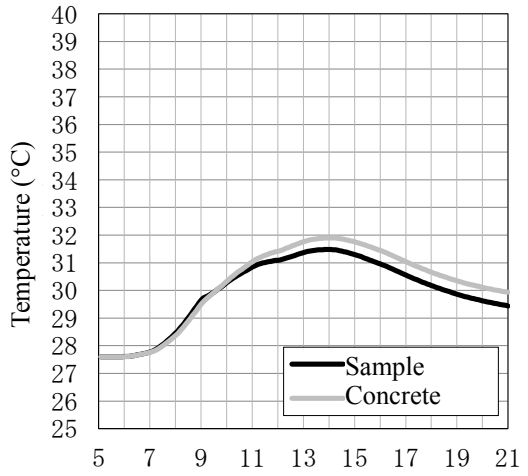
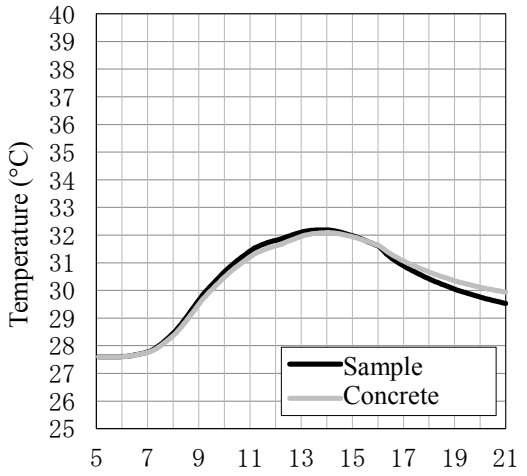
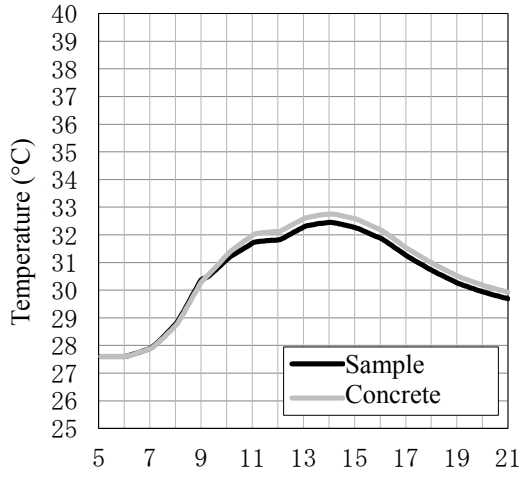
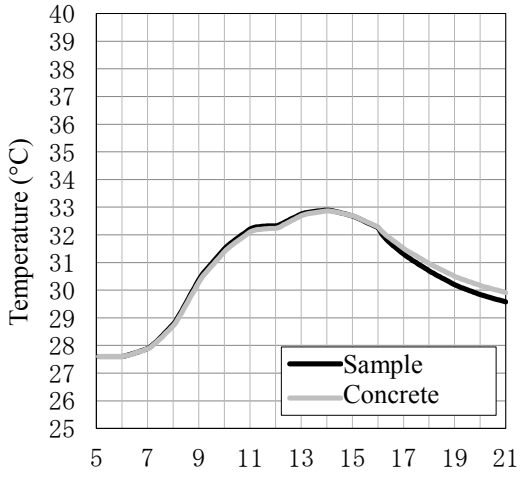
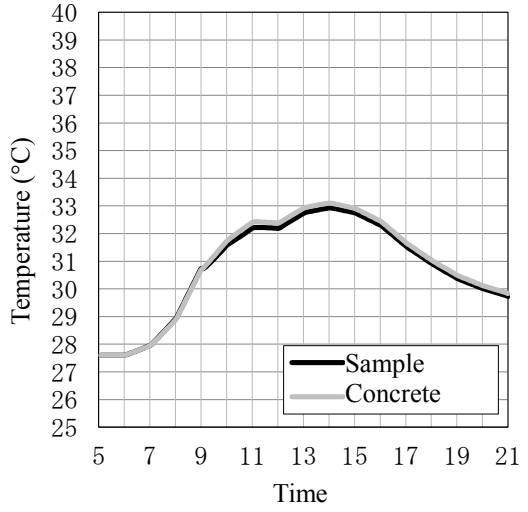
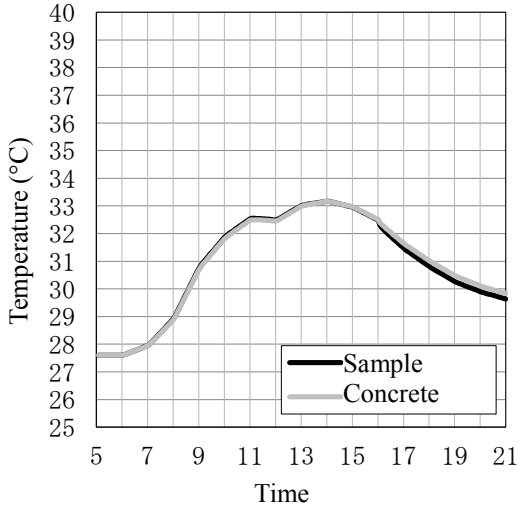
(8) Handrail 2 (assuming a transparent panel) Change in evaporation latent heat over time

Number of ventilation	Water sprinkling 1: Water sprinkling at 9 a.m.	Water sprinkling 2: Water sprinkling at 4 p.m.
5 (times/h)		
20 (times/h)		
60 (times/h)		

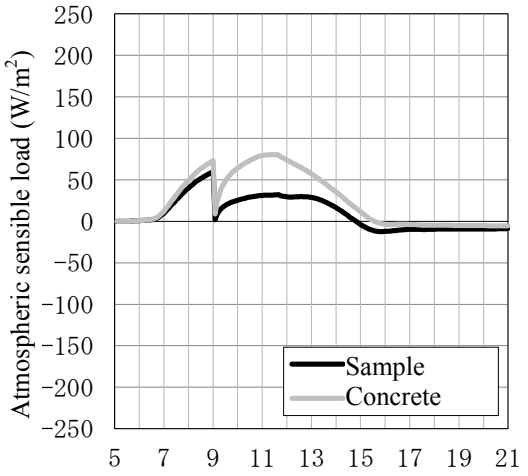
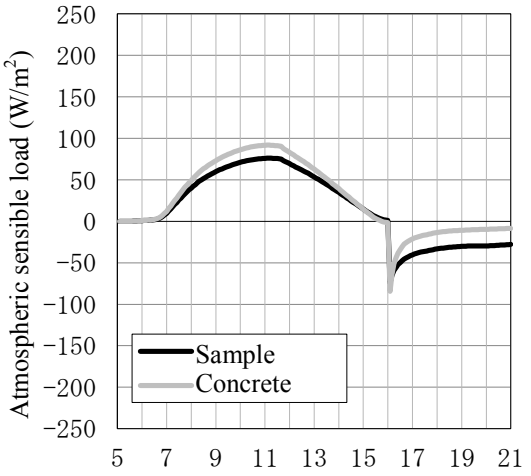
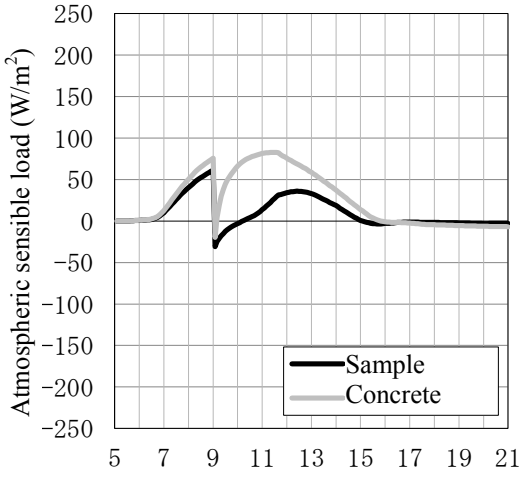
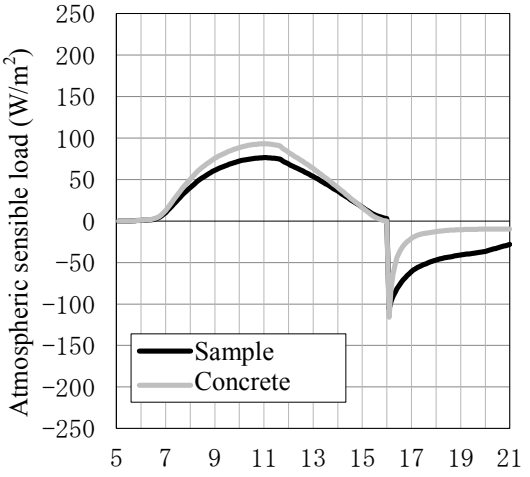
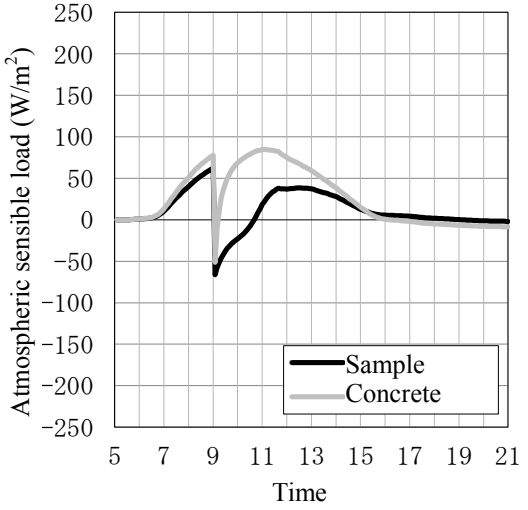
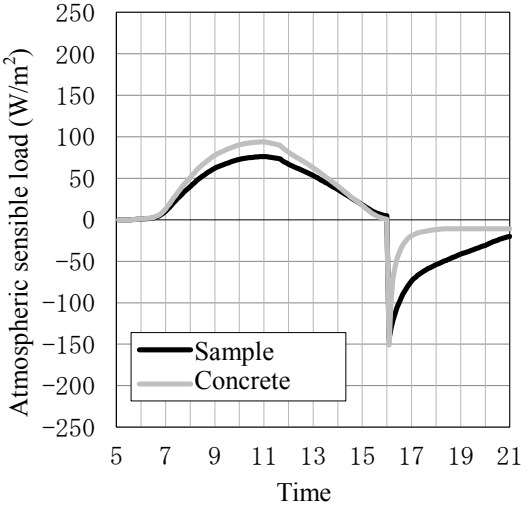
(9) Handrail 3 (assuming a concrete handrail) Change in verandah surface temperature over time

Number of ventilation	Water sprinkling 1: Water sprinkling at 9 a.m.	Water sprinkling 2: Water sprinkling at 4 p.m.
5 (times/h)		
20 (times/h)		
60 (times/h)		

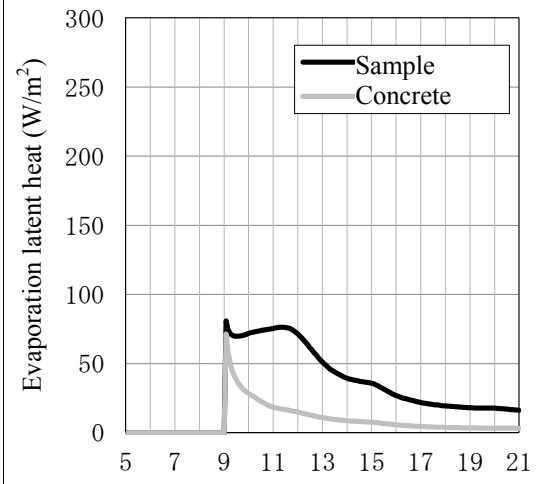
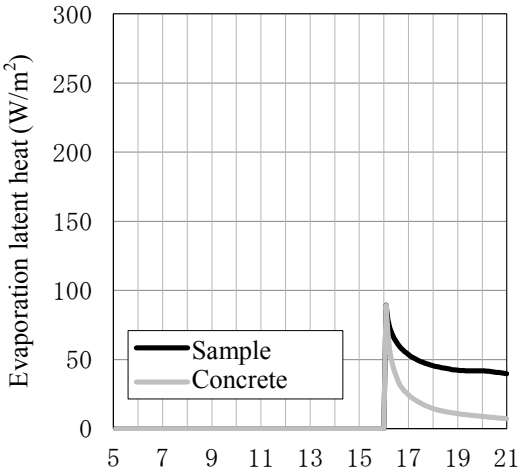
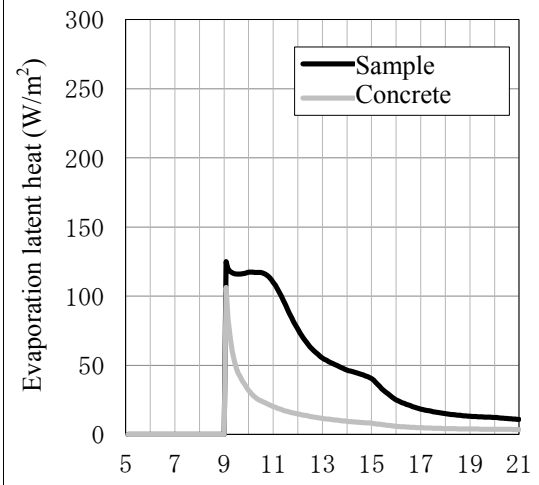
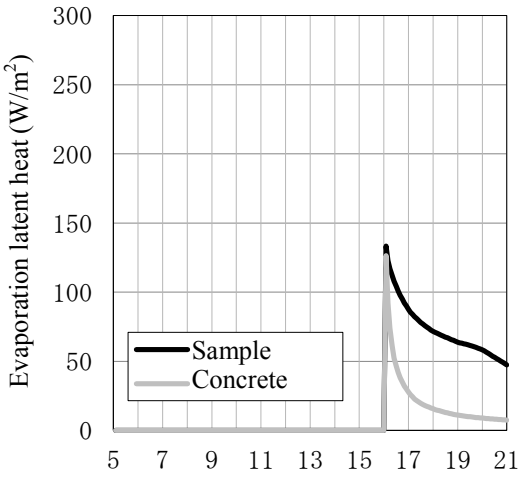
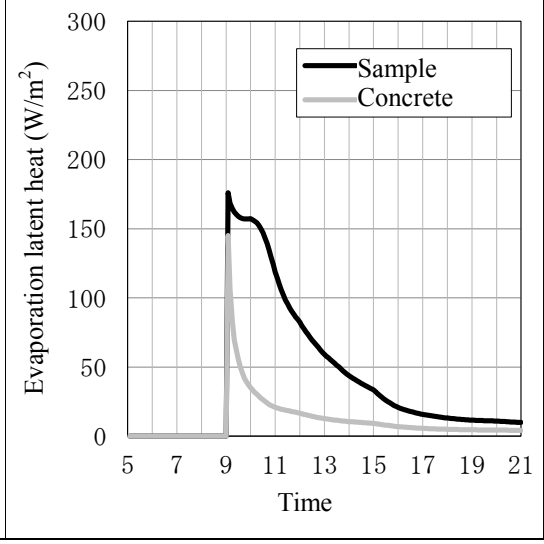
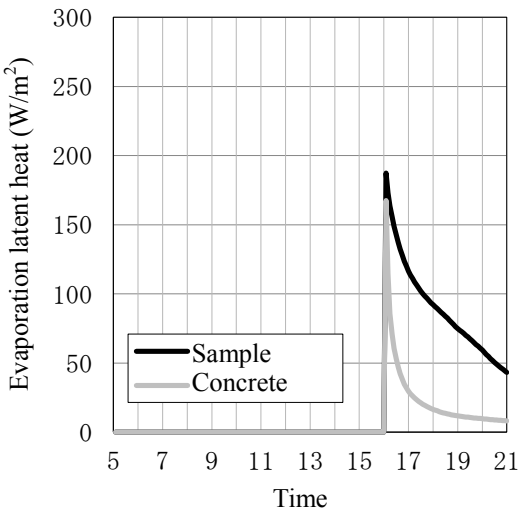
(10) Handrail 3 (assuming a concrete handrail) Change in room temperature over time

Number of ventilation	Water sprinkling 1: Water sprinkling at 9 a.m.	Water sprinkling 2: Water sprinkling at 4 p.m.
5 (times/h)		
20 (times/h)		
60 (times/h)		

(11) Handrail 3 (assuming a concrete handrail) Change in atmospheric sensible load over time

Number of ventilation	Water sprinkling 1: Water sprinkling at 9 a.m.	Water sprinkling 2: Water sprinkling at 4 p.m.
5 (times/h)		
20 (times/h)		
60 (times/h)		

(12) Handrail 3 (assuming a concrete handrail) Change in evaporation latent heat over time

Number of ventilation	Water sprinkling 1: Water sprinkling at 9 a.m.	Water sprinkling 2: Water sprinkling at 4 p.m.
5 (times/h)		
20 (times/h)		
60 (times/h)		

3.3 Cautions on the numeric calculation results

(1) Numeric calculation is conducted using a typical condominium as a model under various requirements that differ from those of the actual installation environment.
(2) Numeric calculation was conducted from 05:00 to 24:00 on August 16, 2012. (The other period was not calculated.)
(3) The drop in surface temperature generated on verandah, and the amount of sensible heat from evaporation after installing water-retentive architectural materials for verandah were calculated on the assumption that said factors would not affect the air-conditioning load of the indoor space. Therefore, we do not calculate or otherwise handle the electric energy due to the decline in air-conditioning load.

4. Reference information

The verification applicant has submitted the information specified in (1) "overview of the target technology (reference information)" and (2) "other information from the manufacturer (reference information)" on his or her own responsibility. Therefore, MoE and the verification organization assume no responsibility whatsoever for the contents thereof.

(1) Overview of the target technology (reference information)

Item		To be filled out by the verification applicant		
Verification applicant		TOTO LTD.		
Name of the technology-developing company		TOTO MATERIA LTD.		
Name of the target product		BASEA		
Model of the target product		AP10MT01UF		
Contact information	Phone	0572-57-4812		
	Fax	0572-57-4835		
	Web address	http://www.toto.co.jp		
	E-mail	kimio.sasaki@jp.toto.com		
Characteristics of the technology		Technical user using actively supply water to the water retention building materials, by utilizing the latent heat of vaporization of water contained in the building material, to improve the vicinity of the indoor environment.		
Conditions for installation	Corresponding building and its region	Balcony floor of condominiums and single-family		
	Considerations on installation	If you are installing to vulnerable place the effects of wind, use the shatterproof member.		
	Other constraints on the installation location, etc.	Is waterproof treatment I as a base having a sufficient strength of only walk in the flat. Installation to the 16th floor more balcony I improper.		
Need for maintenance, weather resistance, product service life, etc.		If the surface is dirty, the water wipe, and the wash of a sponge or a brush.		
Rough estimate of the cost		Design and installation price (with materials and installation)	1,650 yen	per 1 sheet

(2) Other information from the manufacturer (reference information)

・For cost estimate of the construction specifications for the user to install, the description of the material costs only.
・3rd Eco-Products Awards Eco-Products department Jury Special Award. (Awarded by TOTO Materia, Inc.