

FINAL REPORT
For Japan-Korea Joint Research Project

AREA	1. Mathematics & Physics 2. Chemistry & Material Science 3. Biology ④ Informatics & Mechatronics 5. Geo-Science & Space Science 6. Medical Science 7. Humanities & Social Sciences
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1. Research Title:

Optimization Study on the Evaluation and Development of the Ventilation Design Criteria
for Constructing the Future Zero-Energy Town

2. Term of Research: From 1st July 2009 To 30th June 2011

3. Total Budget

a. Financial Support by JSPS: Total amount: 2,400 thousand yen

1st Year 900 thousand yen 2nd Year 1,200 thousand yen

3rd Year 300 thousand yen

b. Other Financial Support : Total amount: 3,000 thousand yen

4. Project Organization

a. Japanese Principal Researcher	
Name	Masaaki Ohba
Institution / Department	Tokyo Polytechnic University Faculty of Engineering, Department of Architecture
Position	Professor
b. Korean Principal Researcher	
Name	Hee-Chang LIM
Institution / Department	Pusan National University School of Mechanical Engineering
Position	Assistant Professor

c. List of Japanese-side Participants (Except for Principal Researcher)

Name	Institution/Department	Position
Takashi Kurabuchi	Tokyo University of Science/ Faculty of Engineering	Professor
Akinari Iino	Niigata Institute of Technology/ Faculty of Engineering	Professor
Tomoyuki Endo	Kanto Gakuin University/ Faculty of Engineering	Associate Professor
Isaac Lun	Tokyo Polytechnic University/ Graduate School of Engineering	Researcher
Kenji Tukamoto	Tokyo Polytechnic University/ Graduate School of Engineering	Researcher

d. List of Korean-side Participants (Except for Principal Researcher)

Name	Institution/Department	Position
Chin-Suk Hong	Pusan National University/ School of Mechanical Engineering	Assistant Professor
Hyun-Goo Kim	Korea Institute of Energy Research	Research Engineer
Tae-Yoon Jeong	PuKyong National University/ School of Mechanical Engineering	Postgraduate
Young-Tae Lee	PuKyong National University/ School of Mechanical Engineering	Postgraduate

5. Number of Exchanges during the Final Fiscal Year

a. from Japan to Korea

Name	Home Institution	Duration	Host Institution
For Final Fiscal Year(FY2011) Total: 0 persons		For Final Fiscal Year(FY2011) Total: 0 man-days	
Numbers of Exchanges during the past fiscal years			
FY2009: Total <u> 4 </u> persons			
FY2010: Total <u> 1 </u> persons			

b. from Korea to Japan

Name	Home Institution	Duration	Host Institution
For Final Fiscal Year(FY2011) Total: <u> 0 </u> persons		For Final Fiscal Year(FY2011) Total: <u> 0 </u> man-days	
Numbers of Exchanges during the past fiscal years			
FY2009: Total <u> 5 </u> persons			
FY2010: Total <u> 5 </u> persons			

6. Objective of Research

Our collaboration team aims at setting up the core technology of the ventilation design criteria, which can be achieved by making the database of the thermo-fluidic properties for various parameters. The current proposal suggests it would be more applicable work for constructing a zero-energy town in the future, which is aiming to minimize energy consumption. Two leading laboratories in Korea and Japan are therefore planned to create the design criteria of the building ventilation through this cooperative work.

The objective of research is as follows.

- ◇ To obtain comprehensive mean and fluctuating thermo-fluid properties in order to delineate more clearly the relationship between the unsteady motions of wind flow and the shapes of the obstacles,
- ◇ To model the cross ventilation flow inside structures
- ◇ To make a correlation between the unsteady flow outside of the obstacles and the natural ventilation inside
- ◇ To analyze the flow and the pressure characteristics around a group of buildings with equi-spaced gaps.
- ◇ To make a ventilation effect around and inside a single building with multiple windows
- ◇ To secure the core technologies of the ventilation design criteria
- ◇ To organize joint workshops for exchanging information on the current state of the research work
- ◇ To develop a ventilation database that contains wind pressure and total pressure on external parts of buildings

7. Methodology

The proposed research is concerned with the study of ventilation effect on steady and unsteady wind flows inside and outside obstacles. Two leading laboratories in Korea and Japan planned to create the design criteria for the building structure of the following categories, as below, in order to construct a zero-energy town in the future, which is aiming to minimize energy consumption.

- ▶ Thermo-fluidic modelling between the unsteady turbulent flow and the structures
 - a. Classification of the local building structures in Korea and Japan
 - b. Generation and similarity analysis of the atmospheric boundary layer
 - c. Building the database on the thermo-fluidic properties around the structures.
 - d. Flow and surface pressure study of the structure against the aspect ratio.
- ▶ Modelling cross ventilation flow inside structures
 - a. Classification of the local building ventilation system in Korea and Japan
 - b. Building the database of the cross ventilation flow against the location and the size of the ventilation system
 - c. Analysis on the relationship between the ventilation system and the aspect ratio of the structures and its cross ventilation
- ▶ Assessment and evaluation of the design criteria to minimize energy consumption
 - a. Evaluation of energy saving in residential houses when using cross-ventilation by network model
 - b. Database on the safe factor of the energy efficiency and structural instability
 - c. Application study and analysis for the flow around the generic structure
 - d. Evaluation and optimization of the ventilation inside the structures
 - e. Assessment and evaluation of the design criteria for consuming minimum energy

