Background and objective

South-east Asian cities and buildings are going to be developed drastically near future according to the growth of population and economic. Actually, such developments are mostly based on the western style and engineering, despite the characteristics of Asian climate and culture are largely different from that. So, it is expected that the characteristic Asian style of design and engineering for the sustainable development of city and buildings of this area.

On the other hand, Japanese modern building engineering started 50 years ago that is based on the western technology at first, and has been improved to fit its characteristic climate and culture these 50 years. So, there are efficient technologies and knowledge in this area, but these still needed to be improved and some issues. For example, standardization of building performance evaluation, integration design method of building and system, feedback method reflecting human behavior, lifestyle and climate, and so on.

In our research unit, we aim to contribute South-east Asian cities by establishing Asian style of building and city design engineering, and develop observational study and actual project in this area.

Assumed research thesis (for the south-east Asia region)

1. Observational study on the actual office building’s equipment system

Most of the existing office buildings in this area are assumed to waste energy and be uncomfortable indoor climate because of the lack of the adjustment and verification of the equipment system. For example, excessive capacity of HVAC system that includes pomp, pipe, fan, duct and coil may cause low coefficient system performance and difficulty of adequate control of indoor climate. The most important point is that actual status of these buildings should be cleared by observational study and we are going to suggest effective strategy for this issue. Some practical theses are specified as below.
1-1. Evaluation of HVAC system and indoor thermal environment based on long term time series measurement (Energy consumption and control of HVAC system, temperature, humidity, air velocity of indoor space)

1-2. Observation of the use of the buildings and human behavior (set point of HVAC system, use of OA and lighting, and so on)

2. Study on the reduction or reuse of water at the building’s equipment system

Water is going to be important focal issue because the global warming, population concentration or increasing, changing of life style affect drastically consumption and budget of water in this area. Water resource issue has been mainly studied in the civil engineering research area that include natural water budget, river conservancy and so on. In our research unit, we focus on around the buildings where water is consumed. For example, HVAC system concentrate dew from the space air and it has the possibility to substitute of supplied water. Some practical theses are specified as below.

2-1. Observation of long term time series use of water around the buildings (water, hot water, discharge water, and so on)

2-2. Study on the possibility of water reuse system substitute for supplied water

3. Development and study on the time series climate data for design of the building equipment system

In japan, there are yearly time series an hour interval numerical climate data that include air temperature, humidity, velocity, window direction and solar radiation for 1000 points. These are based on the automated measured data since 20 years ago and come to be the fundamental element for the design of building equipment system. It is also necessary for the appropriate equipment system design to prepare standardized climate data of this area. Some practical theses are specified as below.

3-1. Actual status of climate data and influence on the building equipment system design

3-2. Development of standardized time-series climate data for the sustainable building in the south-east Asia

4. Observational study on the micro climate around buildings

When thinking about sustainability of city, we have to change our view point from appropriate design for a building to aggregate collection of the buildings. Most of the strategy for the building energy conservation or internal climate is against to the external environment. For example, when the building facade is equipped with solar
shielding glass, reflected sunlight on to the street is going to increase and external environment is worsen. In this climate zone, the most important point is solar radiation budget on the whole city area. How to and how much absorb, reflect solar radiation on the building facade and what is the effective way to utilize or release it are should be studied through observational study. Some practical theses are specified as below.

4-1. Actual status of micro climate around the building in south-east Asian city (radiation, air velocity, temperature, humidity)

4-2. Study on the effect on the thermal environment of external space by utilization of water vaporization (horizontal, vertical greening, water spray, water foundation)

5. Study on the sustainable building design

Most of the high rise buildings are formed rectangular solid and have flat envelope, same material or design for each orientation. It is based on the western design and engineering for the effective construction process and economic management. Basically, solar shielding device and material is the most focal point in this area that is different from western climate. For example, double skin facade fit to the cool climate zone to collect and storage solar heat radiation and it is difficult for Asian building to release solar heat naturally from this skin. This research thesis is based on the numerical simulation study and is going to need to be integrated with the building design. Some practical theses are specified as below.

5-1. Study on the design of building facade design approached from material, design, and control system

5-2. Observational study on the building facade design of existing or historical architecture

6. Other topics

Any other topics above and cross-sectional thesis are considerable.