
Eco Architecture as One of Design Research in Indonesia

M.Santosa

Chairman of the Department of Architecture
Faculty of Engineering – Gadjah Mada University
Yogyakarta
Indonesia

Abstract

Indonesia as an archipelago has thousands of islands, with five biggest islands; Sumatera, Kalimantan, Java, Sulawesi and Irian Jaya. The increase of population in the urban area influences the number of the building, which consequently effects the building coverage. By its conditions, the changing of land use is happened; the decrease of forest to agriculture area, agriculture to non-agriculture i.e. residential area grows too fast.

Indonesian forest as part of the forest of South East Asia has important function in making stable the global climate. Forest burnt, exploration with large scale, and other damages of tropicalrain forest influences the global climate.

Architecture and urban design have some problems in the tropical area especially Indonesia. The use of natural building materials i.e. timber for building construction by large scale causes the decrease of the forest. In addition, the use of asphalt for road construction causes the decrease of the water catchment area. The urban water conservation would be disturbed. Nowadays we have a big question; what kind of architecture is suitable for solving the problems? Even in Java Island, the changing of land use has to serious problems. The people need solution for solving the problems.

Eco architecture is one of the ways for solving the problems. In the urban area, the use of urban forest is necessary to be applied. Road construction needs the sustainable materials. Housing and other facilities need sustainable technology. Some research topics maybe described are: sustainable architecture and urban design, sustainable landscape architecture, eco architecture for design of the building, sustainable materials for the building construction, using the recycled materials for the building elements, and energy conservation as a building design concept.

Eco Architecture is suitable as one of Design Research in Indonesia, which is hoped to solve the problems.

1. Introduction

Population increase of the urban area influences the number of the building, which consequently effect to the building coverage in the urban area. Some public facilities have been built in the urban area as public services. Urbanization is one of the reasons in the last decade urban housing became the most important public sector. The changing of the agricultural to the residential area moves faster and faster, which means that the water conservation in the urban area is decreasing.

Indonesia has thousands of islands. Among them, the five biggest islands are Sumatera, Kalimantan, Java, Sulawesi and Irian Jaya. Java Island has the highest density of people and buildings. In the urban area, in particular in big cities i.e. Jakarta, Surabaya, and Bandung, the increase of population in the urban area influences the number of the buildings, which automatically effects the building coverage. In urban fringe, the changing of land use is happened; the decrease of forest to agriculture land, from agriculture to non-agriculture i.e. residential area grows too fast. In urban area it is difficult to get fresh water, because some water resources are not conserved, because the areas are covered buildings. By considering the problem, questions in architectural urban design are: "What kind of urban regulation can protect the water conservation in the urban area? How do we arrange urban landscape as a part of sustainable urban design?"

Building design in Indonesia has some problems, too. Housing for the people usually uses timber for building construction and materials for building elements, which causes the need for timber increases very fast. The government gave license to the Forest Concession Estate. Forest concession estate is a company having legal status engaged in

forest product collection. Forest Concession is limited right of forestry undertaking in forest area, covering activities of cutting trees, reforestation, processing and marketing of forest product, based on the rules by Forestry Minister given to government company or private company having specific condition. In the regulation, the right covering forestry activities such as cutting down trees as a raw material for local industry and for export. The period of right is maximum 20 years and may be extended. Practically, the decrease of the forest was very fast. Some environmental problems have happened.

Other questions in architecture are: "Is the decrease and some damages of tropical rain forest caused by the using timber as building material? What kind of materials can substitute timber as the building materials? What kind of timber can use as building materials without causes the damages of tropical rain forest?"

Ecologic Architecture is a holistic perspective, which requires a sensitivity awareness and discipline within ecologic design of buildings and urban areas. By a holistic ecologic perspective can be developed the equated form and economic division of space and openings be best ordered within the ecologic planning and design of architecture and its landscaping, systems, products, and natural energies of the site (Crowther, 1992: p.34).

By considering some aspects; location, archipelago, function of tropical rain forest, and natural resources, ecologic architecture may be is suitable as one of design research area in Indonesia.

Table 1. Number of Forest Concession Estates by Island and Area, 1997-1999

ISLAND (S)	Number of Estates			Area (thousands Ha)		
	1997	1998	1999	1997	1998	1999
Sumatera	125	120	118	9,902.3	7,449.6	6,289.7
Kalimantan	203	198	189	24,081.6	17,973.8	18,359.1
Sulawesi	36	34	34	3,409.6	3,044.3	2,653.7
Nusa Tenggara Barat	2	2	2	86.1	92.0	105.3
Maluku	34	34	34	3,165.7	2,727.1	2,517.0
Irian Jaya	50	52	52	12,266.7	10,746.1	10,229.0
INDONESIA	450	440	429	52,813.0	42,032.9	40,153.8

Source: Ministry of Agriculture and Forestry, R.I., 2001

2. Some Architectural Problems of Building Design in Indonesia

2.1. Building Materials

Housing and other public facilities have always been built in the city. They need materials for construction and building elements. What is the eco building material? Using wood for construction and building elements in Indonesia has contradiction. The use of wood for building materials, actually have some problems. Although timber forest in Indonesia as tropical rain forest covered Sumatera, Kalimantan, Sulawesi and Irian Jaya Islands, but it should be limited for exploration. The exploration of timber by large-scale causes the decrease of tropical rain forest. It has several impacts on global climate. In Kalimantan, some timber factories produce plywood and other side product, such as solid waste. The question is "Can they recycle the solid waste of timber to

building materials?" The people seriously need solution to use sustainable building materials.

Using recycled materials for construction and building elements need to be better considered. Recycling methods have become more extensive in reclamation of waste and more intensively promoted. Recycled, reconditioned, or remanufactured products are likely to become more economic and more broadly specified within ecologic concerns of the architect and designer (Crowther, 1992: p. 38).

Multi-storey buildings and highrise buildings usually use concrete and steel for their construction. The increase of these building especially in the big city is very rapid. At present, no other building materials for construction can substitute concrete and steel for building materials of multi-storey and highrise buildings.

Sumatera and Java have several resources of sand and gravel for concrete as quarries. Mount Merapi in Central Java is one

of the most active volcanoes in the world. Too many trucks explore sand and gravel from there. But in Kalimantan, there is no active volcano. It means that no resource of sand and gravel for concrete material are available. A question is "How do we use sand and gravel for sustainable building materials in these islands?"

Considering the natural resources of building materials in these Islands, we can choose the building materials, which are suitable to be used. Kalimantan and Irian Jaya have some potential timber forests. Sumatera, Sulawesi, and Maluku, have timber forest by moderate of area. Java and Nusa Tenggara have very limited of timber forest. Therefore wooden construction recommended to be used in Kalimantan and Irian Jaya. In other islands, for construction it is better to use alternative materials, or using selected timber for building elements. Recommendation for the use of better building materials could be described as Table 2.

Table 2. Material Resources and Using Materials for Buildings.

ISLAND (S)	Materials Resources		Using Materials for Construction	
	Timber	Sand & gravel	Wood	Concrete
Sumatera	Moderate	Good	Selected	Recommended
Kalimantan	Good	Poor	Recommended	Selected
J a v a	Poor	Good	Selected	Recommended
Sulawesi	Moderate	Good	Selected	Recommended
Nusa Tenggara	Poor	Good	Selected	Recommended
Maluku	Moderate	Good	Selected	Recommended
Irian Jaya	Good	moderate	Recommended	Recommended

Using recycled concrete for construction need to be better considered. In the USA and Europe, the use of recycled concrete with metal used, which is than use as aggregate also just beginning (Steele, 1997:p.210). This initiative could be considered in Indonesia. The use of building materials in Indonesia may consider some aspects; location, local material resources, and type of the building. Figure 1 shows that correlation its aspects decide choosing the building materials.

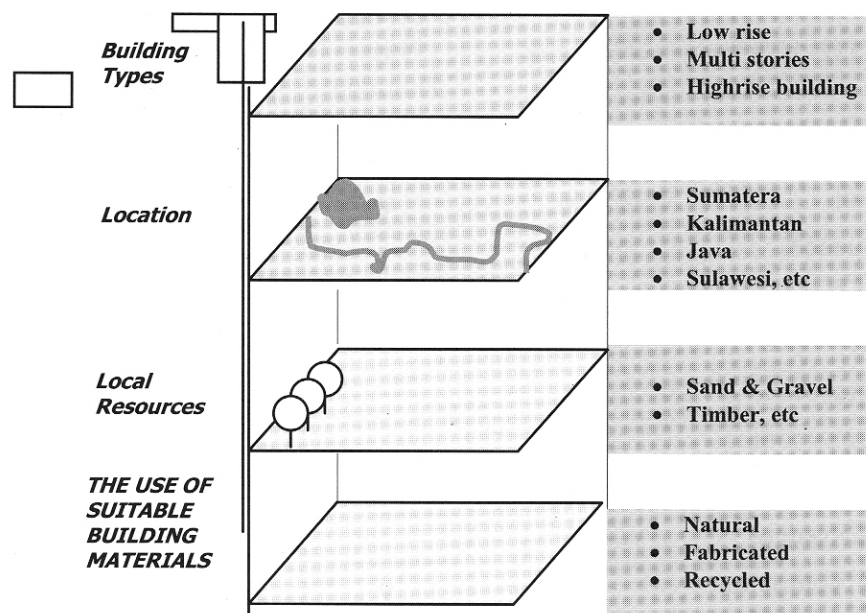


Figure 1. The aspects determine building materials in Indonesia (source: Analysis)

During the last decade, the increase of commercial housing in Indonesia was relatively high. Wood has usually been used as one of the important materials for housing. Wood as building materials in Indonesia has a contradiction. Although it can be thought as a natural way of construction and building elements, it causes the decrease of timber forest in Indonesia. Research on optimizing kinds of timber may be necessary to be done for describing plants of timber by short period of planting.

2.2. Green Buildings.

Building density in large cities causes the increase of local thermal. To obtain a comfort, people use air conditioning. It causes the increase of local thermal. Besides that condition, inefficiency of using energy occurs. Green buildings need to be designed to provide a high level of comfort and service while using less energy and having a substantially lower environmental impact (Kats, 2001).

Actually, the climate in Indonesia supports green buildings concept. Wet tropical climate gives adequate amount of wind, air moisture, and temperature. Optimizing its conditions may help us to create suitable green building concept. Some risks could be reduced as shown at Table 3.

Table 3. Risk Reducing Aspects of Energy Efficiency Measures

RISK MITIGATED	PROPERTY HEALTH			
	Fire & Wind	Water Damage	Health & Safety (poor lighting)	Health & Indoor Air Quality
Efficient Windows	v		v	
Extra Insulation	v	v		
Efficient Appliances	v			v
Light-Colored Roofs	v			v
Insulated Water Pipes		v		
Compact Fluorescents			v	
Building Commissioning	v			v
Monitoring and Diagnostics	v			v
Efficient Duct Systems	v			v
Heat-recovery Ventilation		v		

Source : Kats, 2001

It is shown in Table 3, some research on energy efficiency of the building necessary to be described. Usage of electrical energy in large cities can expected to be reduced by a better design of green buildings.

3. Some Architectural Problems of Urban Design in Indonesia

3.1. Ecologic Landscaping.

Traditional urban design has embodied land planning, new develop-

mental and existing urban context, pedestrian and traffic patterns, architectural and engineering elements, water courses, facilities and recreation, land forming, and landscaping. Every part and element of urban design has an effect upon the whole. The whole has its effect upon the smallest parts and elements of the design (Crowther, 1992: p. 184).

Water retention and drainage are factors that should not be over waked. In most dry and relatively dry climates the grading, type of soil, and type of planting for maximum water retention is desirable. Building coverage in the

medium size cities of Indonesia has various number, generally is very high. The conditions may cause the urban water conservation in these areas became decreased. The government of some regencies instruct to the people to build infiltration tank of storm water. This regulation is required to the people who apply the building license. The government gives the building license after people agree to build infiltration tank of storm water in their building yard. The question is “is the infiltration tank of storm water suitable to be built in every regencies?”

Infiltration of water depends on characteristics of those soil types. In sandy loam the infiltration is good, but in the limestone or clay is very difficult. The infiltration of water depends on the grain size of soil, which determines infiltration performance of the type of soil. The grain size of sand is moderate, but the grain size of clay is very small. The coarse of soil determine infiltration of storm water.

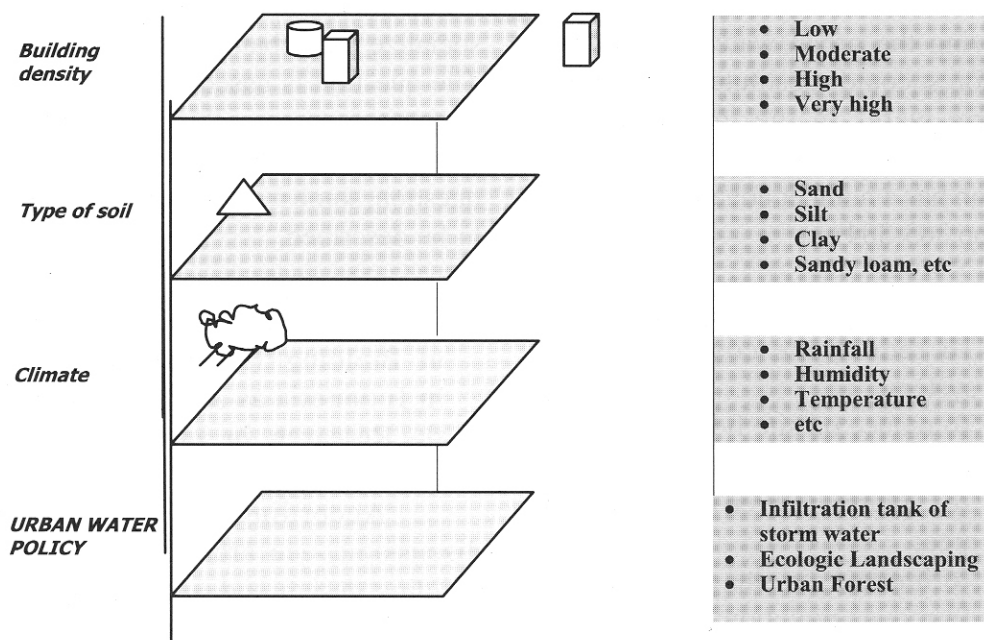


Figure 2. The aspects determine urban water policy (modified from Santosa, 2001).

The infiltration tank of storm water is not always suitable to be built in every regencies (Santosa, 2001). To solve the problem, ecologic landscaping may be suitable to be implemented in these regencies. Ecologic Landscaping is necessary as one of research topics to be described (see Figure 2).

Using asphalt as a material for the road construction causes the problem on water infiltration. In highdensity urban areas, infiltration area of storm water decreases. Research on selecting materials for road construction is necessary and expected to solve the problem.

3.3. Urban Forest.

Soil in Kalimantan and in other cities in eastern coast of Sumatera is not suitable for water infiltration. Drainage in its cities is one of urban infrastructure problems. Plants as the biological natural resources have the specific performance to conserve the storm water. Leaves of trees can keep the storm water when rainfalls, it also needs the water for photosynthesis. Root of trees can keep the groundwater, even the big tree. Therefore, water run off and the groundwater flow become decreased.

Urban forest is one of solutions for conserving the urban water. In that case, urban forest could substitute the infiltration of storm water in the urban area and automatically as storm detention. Storm detention has a number advantages (Turner, 1998: pp.303-304):

- To reduce downstream flooding;
- To reduce the cost of drainage system;
- To reduce on site flooding;
- To reduce soil erosion;
- To capture silt, even in the limestone area;
- To improve on-site drainage;
- To reduce pollution;
- To improve aesthetic quality of the area;
- To enhance recreational opportunities;
- To replenish groundwater supplies;
- To supplement domestic water supplies; and
- To catch water for irrigation.

Some possible research topics of urban forest on urban design context may be described as follows:

- Urban Forest in the Large City in Urban Design Context;
- Urban Forest to Conserve the Urban Water;
- Urban Forest and Landscaping of the City;
- Layout of Urban Forest in the Metropolitan City;
- Combination of Urban Forest and Urban Park in the City.

The next problem of implementation urban forest in the big city is “How to socialize the urban forest to the people?”. The question is based on land value in the large cities, even in the center of the cities, commonly are very high. For answering the question, some research topics are necessary to be described.

4. Solving the Problems: Eco Architecture of Building Design and Urban Design in Indonesia as Archiectural Cases of the Research in Indonesia.

According to the previous discussion, eco architecture concept of building design and urban design may be useful to be implemented. In every architectural case should be described design problems and design requirements. Tentatively, the design problems and design requirements are shown in Table 4.

Table 4.Architectural Cases, Design Problems and Design Requirements of the Research

ARCHITECTURAL CASES	DESIGN PROBLEMS	DESIGN REQUIREMENTS
Building Design	Sustainable building materials	• Sustainable materials • Local materials • Recycled materials • Good performance • Good duration
	Energy conservation	• Natural ventilation • Natural lighting
	Green Buildings/ Bioclimatic building design	• Materials • Ventilation & Lighting • Planting around the building
Urban Design	Urban forest in the big city	• Layout of Urban Forest • Type of plants • Relation between Urban Forest and Other Areas
	Ecologic landscaping for the urban water conservation	• Relation between type of soil and suitable plants • Layout of the landscape elements in the city • Storm detention

Source : Analysis (2001)

5. Conclusions

Based on the justification of eco architecture of building design and urban design are necessary to be defined as design problem of the research in Indonesia, the conclusions may be described are follows:

1. Ecologic Architecture in Indonesia as a holistic perspective requires a sensitivity awareness and discipline within ecologic design specification and construction could be expected to solve building design and urban design problems.
2. The use of building material in Indonesia have to consider some aspect; location, local material resources, and type of the building. The use of building materials may have a contradiction; using wood as construction and building element is nature, but it cause decreasing of timber forest in Indonesia. In that case, research on optimizing kinds of timber may be necessary to be done for describing plants of timber by short period of planting.
3. The use of recycled materials for

- construction and building elements needs to be better considered Recycling methods have become more extensive in reclamation of waste and more intensively promoted.
4. Some research on energy efficiency of the building necessary to described. The use of electrical energy in the big cities can expected to be reduced by the good design of green buildings.
 5. To solve the problem of urban water, ecologic landscaping is suitable to be implemented in some regency. Urban forest is one of the solutions for conserving the urban water. In that case, urban forest could be substitute the infiltration of storm water in the urban area and automatically as storm detention.
 6. Some research topics maybe developed are: sustainable architecture urban design, sustainable landscape architecture, eco architecture for design of the building, sustainable materials for the building construction, using the recycling materials for the building elements, and energy conservation as a building design concept.
 7. By considering some aspects; location, archipelago, function of tropical rain forest, and natural resources, ecologic architecture is suitable as one of design research area in Indonesia. Eco Architecture is suitable as one of Design Research in Indonesia.

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