2018 2nd International Conference on Energy and Power Engineering (EPE 2018)
ISBN: 978-1-60595-550-6

The Study on the Integration of Green Architecture and Appropriate Technology

Feng QIAO

Department of Civil Engineering, Luoyang Institute of Science and Technology, Luoyang 471023, P.R. China

Keywords: Integration, Green architecture, Appropriate technology, Strategy, Ecological community.

Abstract. The study does some discussions by putting green architecture and appropriate technology into the same framework. On the one hand, appropriate technology can be used as one of the design principle for green architecture, in order to help us assess scientifically to the architecture, and deepen the theory and practice of green architecture. On the other hand, the concept of appropriate technology which arisen from the West, will face the current situation of confrontation and challenge in China's regional social. The development of green architecture and appropriate technology will have been a interactional and mutual learning process for a very long time. The research not only put forward suggestions on theory and practice of green architecture and technology, but also rethink the applicability of current technological and social concept by the case of American Village homes green community, in order to open up the communication cooperation space and explore the feasibility for remolding the modern society.

Introduction

The concept of appropriate technology comes from "Intermediate technology" concept [1], put forward by economists E. F. Schumacher in 1973. In the book named “Small is Beautiful: Economics as if People Mattered”, Schumacher had rethought some phenomena such as putting too much emphasis on the production efficiency in order to manufacture large-scale technology, and asserted that it would led to the unfair economic activity if people ignore the protection of the natural environment and the demand of meaningful work . Therefore, the cognition to appropriate technology is firstly from the doubt to nowadays high-tech: that is the progressive rapidly and updated continuously technology had solved the problems or caused more problems for human society since the industrial revolution? High-tech brings one of the most serious consequences for natural environment is manufacturing and operating these technologies will consume more and more resource [2]. According to the book named “Appropriate Technology: Tools, Choices, and Implications” written by Barrett Hazeltine & Christopher Bull, appropriate technology approximately has several following features: small scale; Energy saving and effective utilization; environment protection; self-maintenance for user etc. Hazeltine & Bull stressed in this book that appropriate technology is not the concrete form of technology, but a way of thinking in choosing technology, that is, when we want to solve the problem by use of technology, we must make some important choices such as kind of resources, technological scale and technological complexity [3]. These choices should put away the views of the latest is the best after holistic consideration, especially because every place has different natural and social conditions, so "adjust measures to local conditions" should be the most important principles of appropriate technology. At this point, it has inner relevance between appropriate technology and green building. Green building puts attention to natural environmental protection, it recognizes that building bring damages for earth environment, and should be guided into "environmental friendly" design methods and principle in the traditional design process, in order to help people reduce the harm for earth environment as possible as they can[4]. But nowadays, the green architecture design has some problems such as commercialism and high-tech thought. For example, energy saving lamps, air conditioning and high-tech energy-saving facilities have been used

everywhere, and people don't consider whether the building need so bright or cool space, so they don’t reduce effectively the necessity of using lamps and air conditioning.

Take Village Homes Ecological Community as an Example

Village homes ecological community is located in the west of Davis city of California. Village homes covers an area of 24.3 hectares, it has 244 housing units and give service to 700 people approximately, including 222 detached houses and 22 apartment houses. There are several kinds of land type in this community, such as commercial district covering an area of 370.92 square meters which including 15 small consultant companies, commercial farm covering 1112.76 square meters, greenbelt covering 4.9 hectares, and other kinds of open space for the community. The residents and visitors who relate to the Village homes will notice the place has differences landscape with other communities firstly. For example, the road landscape has quite unique integral ambient although houses on both sides of them are mostly similar. The road is commonly narrow, and the parking card spaces are not visible because of their entrance are usually in the end of the road. Whither ride a bike or walk among the community, the residents will pass the green path and appreciate all kinds of native edible plants by the side of the road. Secondly, there is a large number of public open spaces in Village homes which including some regional little spaces owned by a few of houses, some green corridors, orchards and community gardens along the side of the sidewalk etc. Those spaces are not only the object watched by residents, but also the various life patterns integrating into community life authentically by farming, entertainment, party and walking. Finally, the Village homes also has obvious characteristics in its road design, such as closed road system reduced the chance of internal motor vehicle getting through the community, at the same time, narrow and high density path space strengthen the relationship between community consciousness and green traffic, and increase the opportunity for residents` encounter and conversation.

The Generation of Design Ideas in Village Homes Ecological Community

As designers, Judy and Michael looked forward to a rural way of life, in order that it can bring homey feeling of rural life as far as possible to the city. They think that the scale of urbanization in United States has separated itself from the human-scale; on the contrary, urbanization with modern high-tech has created neither healthy nor comfortable life style. People use land always neglect of scientific and serious consideration to natural environment, so as to make many contemporary cities often involved into some dilemmas and unrelated with surrounding environment. Judy and Michael called this way of design is a kind of "piecemeal planning", that is placed some buildings with different function on different areas separately, such as put office buildings in the city center, put residential architecture in the suburb, and put all kinds of supermarkets distributed in both sides of the road between several regions. The results of this planning led directly two consequences: on the one hand, because there are no local stores or public space could be provided to residents for their encounter, thus it cannot establish regional neighborhood relationship; On the other hand, heavy traffic has increased environmental pollution. In the view of appropriate technology, the concept and mode of thinking of piecemeal planning is similar to the high-tech's, they are all directed to solve the single problem without paying attention to the problem associated with the context, so it should produce more and more new problems ultimately. Judy and Michael had thought piecemeal planning as a design method is lack of whole picture, and acknowledged the Garden City concept proposed by Ebenezer Howard (1850 1928) is a sustainable design method[5], it accommodate the comprehensive considerations involved environment and society.

The Strategy on the Integration of Green Architecture and Appropriate Technology

Firstly, some strategies about conservation of energy and the use of solar energy had carried out in the ecological community. Davis city belongs to the Mediterranean climate zone, its temperature is usually more than 35 degrees in summer day, but is pretty cool in night. It is very cold but few of icy

in winter, maybe has weeks of heavy fog and rain. Therefore, how to reduce room temperature is the primary task of architecture design in Village homes. The first step is heat insulation, Village homes had used the local thick adobe as the wall materials, it can absorb heat and stored it effectively in material, at the same time, the buildings adopt colorful and bright outer wall painting in order to reflect sunlight. Therefore, the building can reduce the room temperature in summer, also can preserve room temperature in winter; The second step is to pay attention to the architecture orientation, all of building in Village homes have a north-south orientation, and adapt to this, most of roads in Village homes has a east-west orientation circuitously, so on the one hand this arrangement makes long axis in east-west and short axis in north-south, reducing the influence of disadvantageous orientation, at the same time shaping building the main appearance and structure proportion; on the other hand, it also help each building effectively to distribute at random, both can make each building to accept solar energy, and can keep ventilation at the east-west direction; The third step is configuration of plants, Village homes had made use of local deciduous plant as the main vegetation, because deciduous plant will be flourishing in spring and summer, and withered in autumn and winter, so this configuration very accord with the living requirement which need insulate sunlight in summer and accept sunlight in winter; The last step is to install solar energy water heater for every roof, and to reduce water supply by using water saving equipment.

Secondly, adopted a new open drainage system in the ecological community. Village homes used open channel system as the community rainwater drainage. Generally speaking, residential elevation usually higher than the road in order to let the rainwater flow to the roadside drainage system, but some open drainage of Village homes are not been installed on the side of the room, but behind the room, and the drainage not only open upwards, but also open downward at the same time, furthermore, the designer selected stone and hard soil materials to fix open channel system's shape, and planted multilayer vegetation besides the channel in order to let the rainwater seep into the ground. With the aim of not been over flown when it is heavy rain, the open channel has connected several ecological pools which were designed for water seepage.The open drainage system had worked well since the project completed, it can cooling the whole community as well as conserving moisture of the land at the same time. More valuable results are the open channel system has got the local residents, especially children's love. Long and winding river, beautiful pool and gurgling water during the rainy season are making every residents enjoy pleasure of life, reappearing the play experience near the brook of their childhood. Village homes used the appropriate technology to build its natural drainage system, so minimized the labor costs and saved $800 nearly for every resident to beautify their garden landscape [6].

Thirdly, Provided a rich community public space. Eight families as a group in Village homes share a public region, suitable measure, convenient transportation and ecological landscape coming from the open channels make the public area become the main communication place in residents' social life, continued to attract the children to play around here, and many daily neighborhood dinner will be done in here too. More crucially, this public areas are not been supervised by Village home association but by the eight families, what kind of plants to produce, or how to distribute the fruit trees' harvest and maintain landscape environment are all need to been negotiated by the eight families, those methods ensure the diversity of function and sustainability of ecological landscape for the public region. Besides this, other open public space such as garden, lawn, ecological pool etc, need to be managed by the Village home association by means of paying community tax or responsible for their own to been maintained. Public spaces of Village homes are able to achieve the goal of promoting residents' communication, because it not only provides a sociable space, but also it asks for every user to participate in public space, this makes public area become an important region for each user in their life, and have an extremely high utilization rate. Been compared with some large and formal public park of other communities, Village homes scattered its public garden and provide better social effect.

Conclusion

There are variety of green design in the Village homes, each of them is a very simple technology in fact, and the environmental protection effect and community life remodeling produced by those design, had made Village homes get much consideration from its beginning to accomplishment, and finally become the most popular residential areas in Davis, its rent is also much higher than the surrounding communities. The key of succeed in Village homes can be concluded for one point, that is designer combined reasonably variety of simple green design together from energy saving to open channel system, from road pattern to public space, each section is adopting appropriate technology, and expand the green building to community size. Therefore, Village homes more like a technological system, in the process expanding the green architecture from single building scale to community scale, it has made appropriate green technology respond effectively to the challenge of modern high-tech, and remold the modern community life.

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