Journal of Civil Engineering and Environmental Technology
Print ISSN: 2349-8404; Online ISSN: 2349-879X; Volume 2, Number 1; January-March, 2015 pp. 20-24

http://www.krishisanskriti.org/jceet.html

New Type of Non-Traditional Technology and Environment

Osameh Ali Kassawneh[1] and Yahia Yosef Al Zoubi[2]

[1]PhiladelphiaUniversity Jordan–Amman 11942 P. O. Box 13285
[2]Applied Science University Jordan–Amman 11942 P. O. Box 13285
E-mail: [1]Okassawneh@yahoo.com, [2]yalzoubi@yahoo.com

Abstract—*This paper studies and discusses a new type of non-traditional technology, its transfer from developed countries to the third world, and the effect of this transfer on architectural-environmental cases. The paper also evaluates and analyses a case study of Damia village in Jordan valley, where an advanced non-traditional technology was used to build a group of housing units. It shows the inefficiency of the housing units especially with respect to the climatic-environmental aspects. It also studied the relationship between mans comfort zones and the non-traditional technology taking into consideration the Jordan valley climate, the basic physical, mechanical and architectural needs of the area, the suitability degree of the model, and the inhabitants. This paper illustrated some reasons which led to this unsatisfactory or unexpected result and submitted some recommendations to improve such housing units.*

The paper consists of six sections. The first section is an introduction. The second section is a brief about technology and its transferee. The third section studies Damia village non-traditional housing project. The fourth section is the evaluation and dissection. The fifth section is a Conclusion which shows the advantages and the disadvantages of using the new non-traditional type of building in Jordan valley. Section six of the paper Section six of the paper is the references.

1. INTRODUCTION

Technology (from Greek τέχνη, *techne*, "art, skill, cunning of hand"; and -λογία, *-logia*) is the making, modification, usage, and knowledge of tools, machines, techniques, crafts, systems, and methods of organization, in order to solve a problem [1]. Technology have several concepts, including limited production method, or it proceeds technical or scientific knowledge related to the production of goods and services, including energy and extraction of raw materials [2], and the generation of technical know it Application of work and his discoveries to industry [3], technology is former than scientific evolution, there is always different time between them may be many centuries or a few years. Recently there is a short time between them the difference between discovery and application of optical perception is 112 years old, and the discovery of radio and it is applications 35 years, and the discovery of the transistor and it is application 3 years [4]. It can be divided into three phases [4]; the first stage that previous to the Industrial Revolution the human used simple machines and tools to help him in various works. The second phase from the beginning of the Industrial Revolution until about 1940, the human used machine for the effort equivalent and equivalent to the actual effortless done by. The final phase from the post-1940 and so far, which human used to deal with the computers and machines to the mental effort on his behalf [4] This paper will study the affect of technology on non-traditional architecture, particularly with regard to the environmental aspect, and applied to the housing project was carried out in the seventies of the 20 in Damia village in Jordan

2. TECHNOLOGY AND ARCHITECTURE

Technology did not have comprehensive changes occurred as a result of the industrial revolution direct impact on the architecture. Many of the architects has avoided it but created new methods in the production of materials, methods of work, construction, and changed the aesthetic perception, with time architects convinced that they benefit from the discoveries and inventions and products, and in particular with regard to the architecture according on new materials and methods of construction [5], the architects takes three positions of it they are; First: to design buildings as machines designed [6], Second: to design buildings to mimic the form of machines or parts of them, and finally the use of machines and their products in architecture [7]. With the use of new materials such as iron types, concrete, reinforced concrete, and other materials have the same characteristics of traditional materials in addition to their high tensile strength at high, it was possible to control and shape them to suit characteristics that gave the maximum exploitation of the potential at the lowest amount of material, thus this lead to many new technological patterns [6], which concerns us in this paper is the processing Prefabricated buildings, and precast buildings [3].

3. PRECAST BUILDINGS AND TECHNOLOGY TRANSFER

The First World War (1914-1918) created housing crisis on a large scale and to overcome them and to contribute to an important role in reconstruction [5]. Architects of 20th century has proved non-traditional ways and methods. using concrete easy to implement adopted easily and manufactured by mold or more forms different used for walls and ceilings and other elements in the building or around it, there were different ways or methods of manufacturing these buildings, the kind that was carried out by the housing Damia village was the binary type dimension [8].

Technical aspect is a result of certain requirements in advanced countries, the success of it depends in those communities to give solutions to fit the conditions and requirements of these countries, or industrialized countries. It dependent on the availability of raw materials, labor, manufacturing methods, means of transport, machinery, and other things no need to mention in this paper.

The technical communities, or industries, or other countries such as developed States needs it. They moved its entirety, or transported it with minor adjustments, or moved and then make major revisions.

In order to have a movable technique to be successful we have to check the conditions on the social aspects, psychological, building materials, labor, and the tools used, finance, and most of all to achieve thermal comfort in the very cool climate, or very hot climate, as in Jordan Valley climate.

4. HOUSING OF DAMIA VILLAGE

Damia village located at the intersection of latitude in 32°13 north of the equator with Longitude 35°37 East Greenwich in the Jordan Valley area, it located below sea level by 224 meters approximately.

Pre cast Panels project was implemented in Damia village from 1973-1984 in cooperation between the Jordan Valley Authority and the World Bank, who spoke on conditions of implementation of the Structural system of consultant designed by Zenon A. Zielinsk [9] the project was implemented by American company (Padco), which stipulated that the implementation of the same system.

The project consists of 67 residential units, and a school, the unit consist of a total cut displayed 100 cm, depth of 20 cm, various lengths starting from 265 cm, and 4 cm thickness (Figure 2). Mostly of the pieces are solid and a few of them contain doors and windows.

The pieces were collected with each other during implementation using winches and Cranes. Cement Mortar closed between these pieces using cement mortar. (Figure 2) shows architectural drawings of some of these units, and architectural details. All the wiring electrical, plumbing connections were external; no any kind of plaster was used in the internal or external surfaces.

A public housing project similar to this project was carried in the city of Kalecota now called Kolkata (India), and another similar project was established in north Bengal.

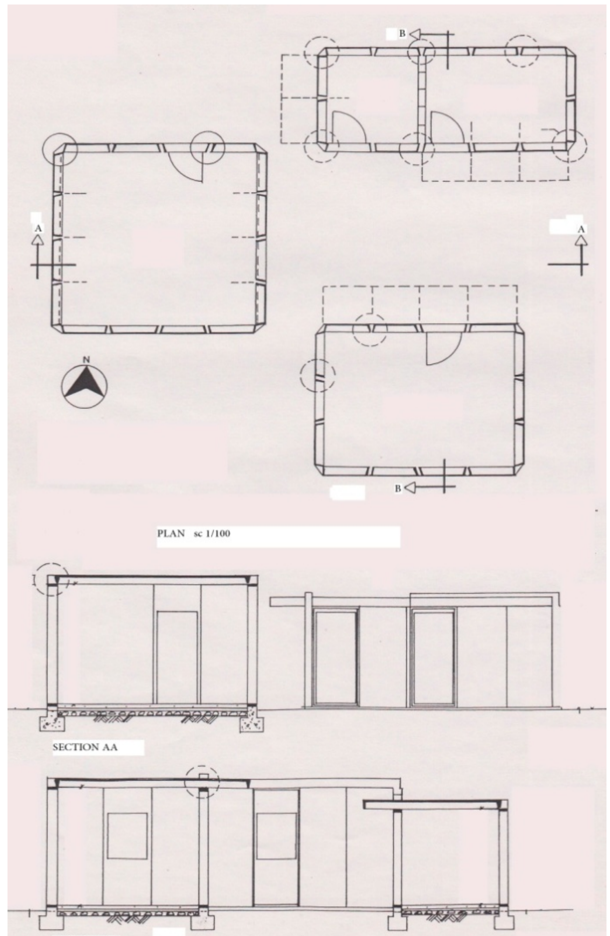

Fig. 1: Unit Details.

3.12. The Non-traditional Technology and thermal comfort.

The traditional buildings provided thermal comfort of buildings to the occupant, which means to achieve thermal equilibrium of the human body within the architectural spaces where the energy produced from the human body (Metabolism) equal to the energy lost inside the architectural spaces [10] and thus the human body is making less stress physiology possible.

The provision of appropriate environmental conditions of the human being inside buildings and architectural spaces is very important factor for the success of the climatic architecture in many areas. But it is the main and important factor in the very hot or the very cold climate areas, as in the Jordan Valley, and this requires careful and specialized study for different elements of the air. And its impact on non-traditional construction and their success in overcoming resistance to these weather conditions and to achieve thermal comfort of the human person and these elements are; Temperature, Relative Humidity, Solar Radiation, and Air Movement [11].

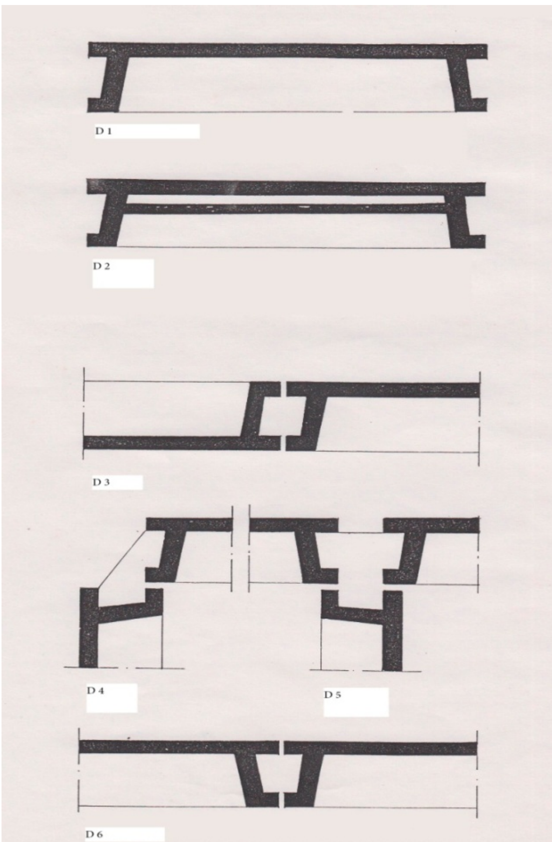

Fig. 2: Details

3.2. Damia Climate and requirements

Accurate data were obtained from the Meteorological Department in Amman represents temperatures, relative humidity for the years 1976 - 1990 i.e. at 0, 16 , 12, 18 GMT, local time was 2, 8, 14, 20 for all the previous months of the years, then the previous climate data were signed the environmental (Bioclimatic Chart) (Figure 3), where the climate areas of the design were divided on this chart in to 6 zones [12]; First: (Very Cold Zone - A). Second: (Cool Zone - B). Third: (Comfort Zone – C). Fourth: (Hot Humid Zone - D). Fifth: (Hot Dry Zone - E). Sixth: (Very Hot Zone - F [10].

The rate of frequency of every climatic zone of design compared to the frequency of all climatic zones of design in zone (A) equal to 0%, zone (B) equal to 40%, zone (C) equal to 22%, and zone (D) equal to 14%, zone (E) equal to 8%, and in zone (F) equal to 16%. Thus frequency of warm zones ratio is compared to the total frequency of all climatic zones of design in the region equal 37.78%, and this requires mechanical and architectural intention of being able to control the interior climate of the building to control the internal environment.

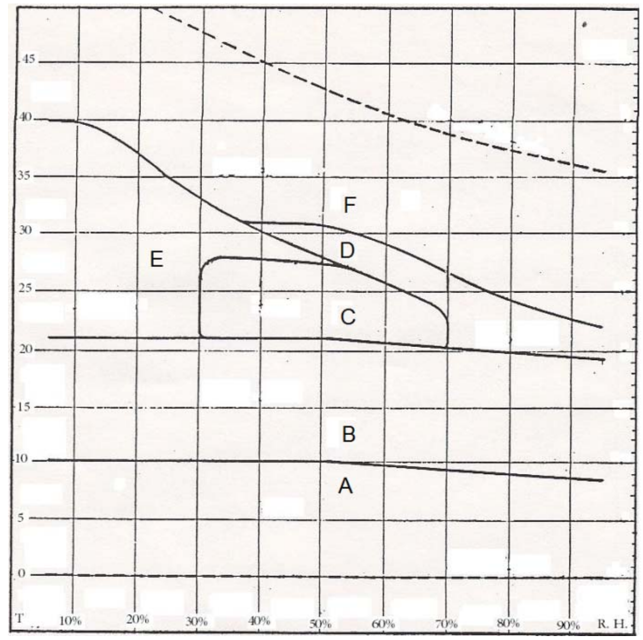

Fig. 3: Bioclimatic Chart

4.2 Natural and mechanical requirements of Damia

Thermal comfort can achieve through natural needs, or mechanical requirements, or both [10], the natural needs of Damia can achieve some of its elements and prevent the other items depending on the situation or the need. Knowing the number of hours that must be an element is achieved or prevent the total number of hours during the year, it must:

1. Prevent heat gain from climate warming by 60% and allow 40%.
2. Prevent heat loss from inside the building by 62%, allowing for their loss of 37%.
3. Prevents air moving inside or around the building within 16%, and allowed it within 15%, and no importance of its move within 69%.
4. Prevents cross ventilation through the building within 56%, allowing Permeability by 36% and the importance of force by 7%.
5. Prevents shading the outer surfaces of the building within 64% of the hours located between sunrise and sunset during the year and allow shaded 36% of the same hours during the year.

And prevent air cooling by adding moisture within 76%, allowing cooling it within 24%.

In consideration that natural needs are more important for the residents than the mechanical needs. Which are difficult to apply because the vast majority of the population of limited-income. And no need for them in this paper.

4. 3 Architectural requirements for Damia village

The realization of all-natural and mechanical requirements above lead to the desired thermal comfort which can be achieved architecturally by:

1. Use of a thick walls single walls or double walls with internal spaces, colored Bright or white, and does not allow heat transfer to from inside to outside and conversely.
2. Make openings through the walls with small dimensions relatively so as not to increase the width of 90-100 cm and a height of 100-150 cm, and use sun breaks to prevent direct sunlight to entry into the interior spaces during certain hours it can be calculated according to the building orientation, and the form of the land, and buildings or adjacent construction.
3. Implementation of compact buildings with square plan or rectangular plan with ratio of 1: 1.2, and two long elevations facing north and south.
4. Make covered balconies in the building facing south and west, and its ceilings of Hollow Blocks.
5. Using carpets in winter period only, and don't furnished floors with carpets or synthetic rubber in summer.

Evaluation and discussion:

Heat is transferred as a result of the difference temperature in one or more of the methods of heat transfer, namely: Conduction, Convection, and radiation.

During the operations of the heat transfer transmission methods of transfer may be changed. In most buildings, solar energy reaches the outer surfaces of the building in the form of radiation then transmitted through solid walls by conductivity, in the case of double walls or walls which contain internal spaces, the heat is transferred through the void by convection and radiation at the same time to reach the inner part of the wall. It transfers after that to the internal space by convection and radiation.

The building material properties affect the rates of heat transfer inside or outside, and consequently affect the internal climate partial thermal comfort to the occupants of these spaces. These properties are affected by several factors of which the most important is Thermal Conductivity-k or thermal resistance, and Thermal Transmittance [11].

5.1 Thermal conductivity of housing units of Damia

Thermal Conductivity is the amount of thermal current flowing vertically through the homogeneous material with area of a square unit (square meter or square feet), thickness of unit of length (meter or feet), and the thermal difference between the two heat is one degree (Celsius or Fahrenheit), the unit measured in the metric system is (Kcl / hm2degc / m), and in English system (Bt4 / hft degf / ft2) [12], [13]. The buildings consist of several materials of a different thickness. The amount of thermal current flowing does not depend on the thermal conductivity of the material only, but also it depends on the thickness also known it is called in this case (Thermal Conductance-c) [14] it is equal to C=* / d (1). Where C is thermal conductivity, * Thermal Conductivity, d material thickness.

The structural component can reduce the heat transfer through or between the inner surface and outer surface what is known as thermal resistance-R, and it is calculated as the inverse of thermal conductance-C [14] and is equal to

$$R=1 / c$$

Structural elements in buildings made up mostly of several different layers of different thicknesses. Then the total resistance of it is equal to the sum of thermal resistance for all wall elements in addition to the indoor air resistance and the outdoor air resistance close to structural element [12], it is calculated as the following equation:

$$R=1/hi + d1/\lambda 1 + d2/\lambda 2 + ... + dn/\lambda n + 1/he.$$

Where R total thermal resistance of the construction elements, (1 / hi) thermal resistance of the internal air, (1 / he) thermal resistance of the surface outside, (d1/*1) is the thermal resistance for different applications constituent the element.

After knowing the total thermal resistance (R) of the structural element, thermal transition (U) can be calculated. This value is an important value in thermal calculations it is equal to the inverse of the thermal conductance-C [12] and it is equal to:

$$U=1 / R.$$

The overall thermal resistance values of Damia the units calculated by equations 3, 4. The units were consisting of precast reinforced concrete with a thickness equal to 4 cm without internal or external plaster R equal to:

$$=1/7 + 0.04 / 1.40 + 1/18=0.226984.$$

The value of thermal transmittance-u is equal to:

$$U=1 / 0.227=4.405597$$

In order to increase the thermal resistance of the transition and reduce the thermal transmittance two layers has been added to the original model, the outside layer was of reinforcement concert of 4 cm thick, and a layer of polystyrene 3 cm thick between the two reinforcement layers (see Figure 1). Then R1 equal to:

$$R1=1/+0.04/1.4+0.030/0.025+0.03/1.4+1/18$$

$$= 1.448413.$$

$$U1=1/1.448413=0.690411$$

Comparing the thermal resistance and thermal transition of Damia model, after amended, and before the amended shows theoretically that there is a significant improvement in the performance of the model but the reality was just the opposite is expected. As a result of unit's height and small area, the internal temperature was big increase, as has not been achieved in a timely in model acoustic insulation [12], [15].

5. RESULTS AND RECOMMENDATIONS:

The paper shows that the new technology has not achieved the desired from it as in Damia, and it is not achieve the majority of architectural requirements that must be met in Damia, with regard to environmental aspects such as lighting and ventilation, and suitable sound insulation.

In addition to what already has been shown the models is very costly in economic terms and the executive many disadvantages and are difficult to avoid them in a relatively poor area.

The model was not suitable socially, and population refuse this new type of technology.

For future vision technology must be clear and constructive, particularly from an environmental perspective, it must take several things into account, including: Built experimental models of new non-traditional projects to see their suitability in its new home, it can be designed and studded after its success thorough the scientific research institutions studied and comprehensive studies.

Study the basic Environmental requirements in very cold climate and in the very hot climate before using new technology.

Modification and development of new technology is possible to suit new areas. Don't transfer new technology as it is.

6. ACKNOWLEDGEMENT

The authors are grateful to Philadelphia University, Amman, Jordan, for the partial financial support granted to cover the publication this paper.

REFERENCES

[1] http://en.wikipedia.org/wiki/Technology

[2] Nadeem and Osama Maraashly, Asahah in Language and Science (median Lexicon) - Dar Al Arab civilization (first edition), Beirut, 1975, p. 111.

[3] Al-Zoubi, Yahia., Impact of environmental conditions on the architectural configuration (Dialectic of Architecture Form)., Doctoral Thesis Cairo University, Egypt, 1978.

[4] El-Erian Ahmed., Entrance to the world of engineering, World of books, Cairo, 1972. P. 191-192.

[5] Sami, Erfan: Theory of architecture (2), special edition, Cairo.

[6] Sami, Erfan: Theory of architecture (Organic), Almaaref house, Cairo.

[7] Sami, Erfan: Theory of architecture (Function), Almaaref house, Cairo.

[8] Al Sharif, Rohi: The construction of buildings (Part I), press alquasmeh, Amman, 1984, pp. 111-113.

[9] Zenon A. Zielinski- Consultant Ford Foundation adivory group, Calcutta metropolitan planning organization, Calcutta, India.

[10] Al-Zoubi, Yahia., Buildings with inner courtyard as a regulator of environmental conditions (Master of Architecture) - Cairo University, Egypt, 1972.

[11] The Ministry of Transport (Jordan Meteorological Department), Climate Atlas, 1971 Amman several pages.

[12] Givoni, B. Man, Climate and Architecture- Applied Science publishers Hd (2nd. Ed.) London, 1976, P. 103.

[13] Royal Scientific Society (Building Research Center), the Ministry of Energy and Mineral Resources (Renewable Energy Department), thermal insulation in buildings guide, Scientific Society Press, Amman 1988, pages 9, 48.

[14] Royal Scientific Society, the thermal insulation in buildings guide, p 9, 75.

[15] Hall, F., Design calculations for Plumbing & Heating Engineers, Longman scientific & Teachnnical. U. K. P 114, 115.