*International Journal of Intelligent Information and Management Science*
*ISSN: 2307-0692, Volume 8, Issue 3, June, 2019*

# On the Integration and Application of Green Building Design Concept in Architectural Design

Wei Hu
School of Architecture, South China University of Technology, Guangzhou, 510006, China

**Abstract:** The design concept of green building has attracted more and more attention in modern architecture. Green building is a comprehensive consideration from energy saving, low carbon, environmental protection and other aspects, providing people with healthy, applicable and efficient use space, and achieving harmonious symbiosis with nature. It is a concrete embodiment of the concept of sustainable development in architecture. The development and application of this concept in architecture not only further improves the defects of modern architecture in environmental protection, but also reflects the new requirements of the continuous development of the social era for architecture.

**Keywords:** Green building; Architectural design; Integration; Application

## 1. Introduction

Green is the main symbol of nature and the symbol of human harmonious culture. Under the background of the current policy of energy conservation and environmental protection, the problem of building energy consumption has become the focus of people's attention. High energy consumption building production has brought more difficulties to people's life [1]. Doing a good job in architectural design is the first choice to control energy consumption. Energy consumption in architectural design can be greatly reduced based on the original high energy consumption through energy augmentation control. Green building is to put the concept of green environmental protection and energy conservation into architectural design, thus promoting the sustainable development of architectural design. This energy-saving and environment-friendly design method will also become the inevitable development trend of architectural design in the future [2]. In recent years, under the background of continuously strengthening environmental protection consciousness, when selecting building structures, energy conservation and environmental protection should be given priority to. At the same time, green building should be taken as an important development direction of building engineering. Through the application of innovation and design mode optimization, the concept of green building can be reasonably applied [3]. How to apply the concept of green building to architectural design has become an important topic for current architectural designers. In recent years, the rapid development of construction industry has made outstanding contributions to China's economic development and promoted the rapid growth of the national economy. However, the extensive development pattern of high pollution and high energy consumption in the construction industry has been widely questioned. Under this background, how to realize the green development of the construction industry has become an important topic. In the concept of green building design, building is the most core part [4]. On the one hand, buildings should reduce energy consumption as much as possible and reduce environmental pollution within the limited life span. On the other hand, buildings must be able to meet people's needs and create a good living environment for users. Therefore, the integration and application of green building design concepts in architectural design are proposed.

## 2. Integration and Application of Green Building Design Concept in Architectural Design

### 2.1. Optimization of layout parameters based on green buildings

In order to realize the effective application of green building design concept, the design and processing algorithm of new green building engineering based on green building layout parameters are optimized. On the top of high-rise buildings, the higher the floor, the higher the indoor temperature, especially in summer, this phenomenon is particularly prominent. In order to solve this problem, it is necessary to consider the roof air insulation technology. In winter, the use of air insulation technology can reduce indoor heat in time and reduce heat consumption, thus achieving the goal of green buildings [5]. For the design of green buildings with doors and win-

dows, in order to satisfy the rationality and scientificity of the design of doors and windows, it is necessary to reasonably choose the architectural orientation based on the actual architectural design situation to realize the optimization of indoor lighting. In the design, the lighting capacity of atrium and atrium is utilized to prolong lighting time, reduce power consumption time and achieve the purpose of energy conservation. The principle of combining ordinary lighting with local lighting is adopted, and lamps and electrical appliances with energy-saving effect are selected [6]. Optimize the thermal performance of surrounding structures, reduce indoor energy loss and cause temperature changes. For enclosure structure components, materials with strong sound insulation shall be selected as far as possible to reduce the impact of noise pollution, ensure the comfort of the building interior, and design the indoor environment according to relevant specifications. In addition, it is also necessary to scientifically design the building outlet, reduce the heat loss at the outlet, reasonably arrange the tuyere, and take corresponding measures to reduce the occurrence of dew and mold in the insulation layer. In the outdoor greening design, the green belt is set to prevent the pollution of the external environment and reduce the influence of noise [7]. In the design of green buildings, permeable paving technology is adopted to improve the water retention performance of the base and ensure the balance of groundwater resources. To sum up, it is of great practical significance for this paper to make an inquiry and analysis on the green building design in construction projects. Due to the imbalance between the ecological environment and economic development in recent years, all walks of life pay special attention to the concept of green environmental protection. In architectural design, green building design has been widely concerned and welcomed, and more attention has been paid to the coordination and matching between local conditions and regional geographic climate and human nature. From the beginning to the end, we are committed to using energy-saving and low-consumption new material technology and resources with strong decontamination ability, and maximize the appearance of a modern architectural fashion and simple and beautiful green building shape, thus better promoting the sustainable development and application of green building design in construction projects. Based on the investigation, analysis and on-line evaluation of the engineering situation of a number of green environmental protection construction projects with different factors, the research found that the advancing index of the construction projects with time is separated during the construction process [8]. Therefore, the growth index of the building layout is analyzed according to the time series, and the functional characteristics of the influencing factors of the non-linear buildings are obtained according to the time series, so as to achieve the effect of accurately calculating the growth index of the building layout parameters.

After obtaining the nonlinear characteristic values of the influencing factors of the green building layout, the green building layout design based on the equivalent approximate linear model is of great significance to the green building $[N_a]_{a=1}^{z}$'s engineering growth index sequence is calculated. Setting the embedding dimension of the green environmental protection building optimization index as I and the set value of the environmental protection building layout as z, the building engineering design model $P$ is decomposed and constructed: $P = K*G*T$, where $G$ and $T$ are singular values of $P$, the decomposition matrices $T$ and $G$ obtained are orthogonal matrices, then:

$$T = (t_1, t_2, t_3, t_4, ...t_n) \tag{1}$$

The complex information in the green building layout design process is screened and filtered, and the redundant information in the system is analyzed and checked by using component analysis method[9]. According to the phase space layout reconstruction trajectory matrix P and the embedding dimension I, the influencing factor P * I subspace matrix N of the green building engineering is calculated.

$$P=\begin{bmatrix} N_1^r \\ N_2^r \\ N_3^r \\ . \\ . \\ . \\ N_z^r \end{bmatrix} = \begin{bmatrix} \beta_1^n S_1 & \beta_1^n S_2 & \beta_1^n S_m \\ \beta_2^n S_1 & \beta_2^n S_2 & \beta_2^n S_m \\ \beta_3^n S_1 & \beta_3^n S_2 & \beta_3^n S_m \\ ... & ... & ... \\ ... & ... & ... \\ ... & ... & ... \\ \beta_z^n S_1 & \beta_z^n S_2 & \beta_z^n S_m \end{bmatrix} \tag{2}$$

The new model $\varepsilon_n$ for optimizing the layout of green and environment-friendly buildings mainly includes the same degree of quality opposition and efficiency of green buildings [10]. In order to estimate Ln for engineering design, architecture and structural design, and to calculate it more accurately, the following formula is obtained:

$$\varepsilon_n = L_{nz} Pn_z (L_n - L_z) \tag{3}$$

Ln and Lz are quality benefit control vectors of neighboring countries, and $L_n \in U^n, L \in 1,2,3,...,n$. If the layout data of the new green building project is $[N_a]_{a=1}^{z}$ So, if $\varepsilon_n = L_{nz} Pn_z (L_n - L_z)$ the optimization model numerical of spatial layout can be deduced from time to time $\varepsilon_n$ and $N\varepsilon_{n+1}$, Similarly, the optimal structural design $G$u and $Gv$ can be solved by the following calculation methods:

$$G_u = \sum_{L=1}^{N} M\,\mathrm{in}(U_{im}), L \in N_i \tag{4}$$

$$G_v = \sum_{L=1}^{N} Max(U_{im}), L \in N_m \tag{5}$$

In the process of layout design of green buildings, the contribution degree to the cumulative variance of the surrounding environment needs to be calculated by analyzing the components affecting the engineering experience and incorporating them into the covariance matrix J of the impact data to obtain:

$$J = \frac{1}{M}\left[N + \overline{N}_x\right]\left[N - \overline{N}_x\right]^m \quad (6)$$

$$\overline{N}_x = \frac{1}{M}\sum_{P=1}^{M} N_{im} \quad (7)$$

Among them, $N = [N_1, N_2, N_3, N_4, ..., N_m]$ in the process of studying the spatial layout of green buildings, it is necessary to take all the influencing factors into consideration, normalize the original influencing data of the engineering spatial design of green buildings, and put forward the engineering spatial design and control model of new green environmental protection buildings according to the above prediction method. The structural process is as follows:

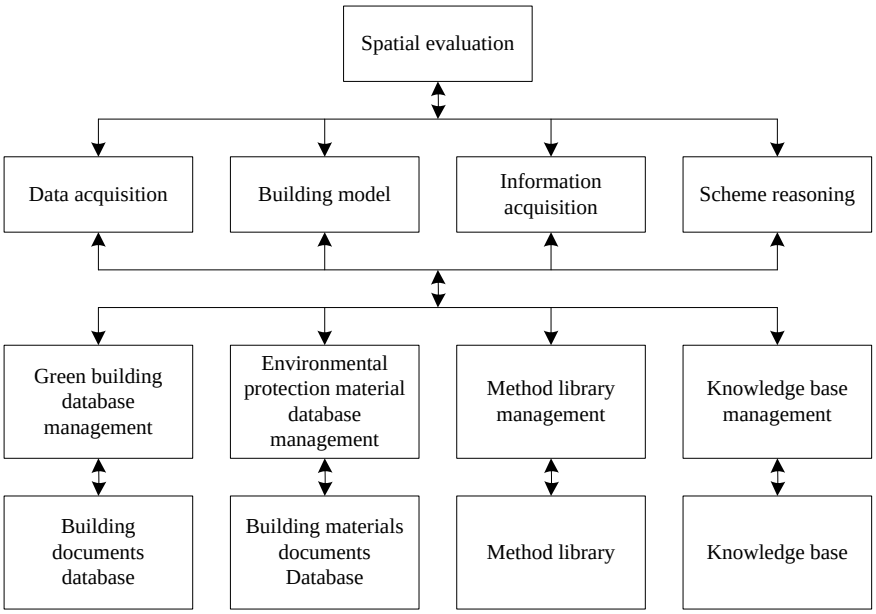


**Figure 1. Structure diagram of green building space design**

As shown in the figure, in order to achieve the goal of accurate design and reasonable decision-making of the building space structure. The database of green buildings covers all the building information resources needed in the process of green environmental protection building engineering, which is convenient for effective analysis and detection of building space structure to improve every stage of building engineering. The optimization steps of green building space design process are shown in the following Figure 2.

The above figure is a flow chart of analysis and operation of green building projects. The use of this flow chart is helpful to solve the unreasonable problems of space design and management in the construction of green building projects, effectively control the capital investment and waste of human resources in building projects, and achieve the effects of saving project investment and improving project construction quality and efficiency.

### 2.2. Material energy consumption algorithm based on green building design

After the reasonable optimization and design of the building space is completed, the research is carried out on the problems of environmental pollution damage and resource waste caused by excessive energy consumption of traditional building materials. In the two contradictory aspects of single natural lighting and sun shading (to reduce solar radiant heat), comprehensive consideration and balance should be made at the same time. More sun shading measures will affect the lighting effect, otherwise the energy saving effect will be affected. The sunshine duration and intensity are different in different latitudes. Under the condition of meeting the same production and living requirements, the lighting area and energy-saving requirements are different in different regions. Therefore, it is necessary to adjust measures to local conditions to balance the size of the external sun shading measures and glass external doors and windows. When the outer glass doors and windows need a large area but have energy-saving considerations, Lowe hollow glass and hot-cut aluminum alloy profiles can be selected when necessary. In the wall selection of the external wall, the

filling wall should be made of new heat preservation and energy saving materials such as aerated concrete as far as possible, which not only protects the limited arable land resources in our country but also achieves good heat preservation and heat insulation performance of the external wall. When the shear wall is used to reduce the volume of garbage in the outer wall, it can also recover some heat, but it still cannot solve the problem of ash and slag, and because of the accumulation of heavy metals in ash and slag, it will eventually pose a threat to the ecological environment and even the safety of people. Based on the concept of green building design, the material selection and energy consumption practice index sequence in the greening process of engineering construction are analyzed, and an accurate prediction method for optimizing green material resources is proposed. The characteristic equation of principal component analysis is obtained as follows:

$$(\beta N-G)\ T=0 \tag{8}$$

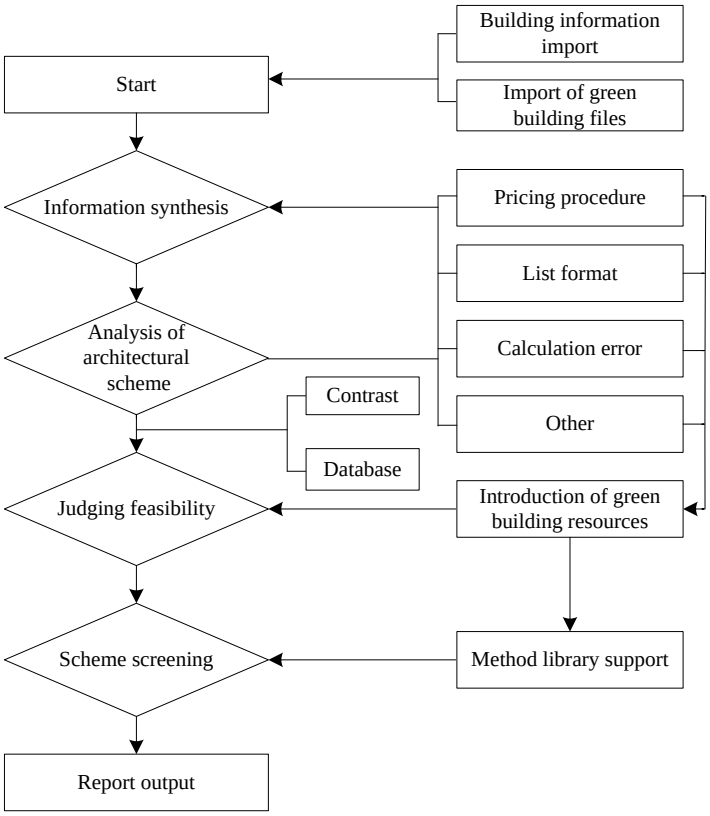


**Figure 2. Optimization of green building space design process**

Because the traditional material selection and energy consumption calculation methods do not consider the influence of cross factors, the prediction accuracy of construction projects is relatively low. Considering the influence of cross factors, the distance between control cross factors obtained by nonlinear dynamic system is calculated as follows:

$$T_m(0) = \| N_i - N_m \| \tag{9}$$

Among them, the energy consumption of building materials can be expanded to Ni+1 and Nm+1 by parameter collection Ni and nm. Therefore, the classification index formula of two vector growth changes is expressed as follows:

$$\| N_{i+1}\text{-}N_{m+1} \| = \| N_i - N_m \| \chi^{\lambda} \tag{10}$$

Since the last component N(li+1) of Nm+1 in the formula is an unknown value, a multi-factor cross control method is adopted to establish a cross equilibrium model for material selection, and corresponding data and data are input as input variables for analysis and investigation, so as to effectively achieve the effect of accurately and efficiently budgeting and analyzing building materials. In order to investigate the uncertain factors in time and improve the rationality and scientific accuracy of the selection of green building materials. In order to better realize the architectural design method based on the concept of green building, the construction engineering data are collected in combination with the influence of environmental factors. Because the algorithm is sometimes variable and chaotic, it is difficult to guarantee the accuracy of the

construction engineering prediction model by directly inputting the data into the least squares support vector machine modeling. Based on chaos theory to reconstruct the data change rule, set up $\{a(n_0 = j\Delta n)\}, j = 0,1...,x-1$

For the sequence of green building engineering data, the following trajectory can be calculated:

$$P = [x(n_0), x(n_0 + \Delta n), ..., x(n_0 + (Y-1)\Delta n)] \quad (11)$$

If x is the relative delay, n is the embedding function and $\Delta\alpha$ is the time interval, then:

$$Y = n - (\Delta\alpha - 1)x \quad (12)$$

As a reasonable value of X helps to promote the complete expansion of P, but if X is relatively small, it will lead to the problems of too much redundant data and too little sub-information. If X is too large, it will cause data to be difficult to separate and information to be lost. Assuming that the probability of construction engineering data is k and the probability of engineering data existing in the area between a and j is k, the calculation formula is:

$$L(x) = -\sum_{aj} K_{aj}(x) \ln \frac{K_{aj}(x)}{K_a K_j} \quad (13)$$

If A(m) is a limited building engineering data and the optimal value x has been determined by mutual information algorithm, the data can be reconstructed according to the above formulas.

$$A(m) = \{A(m), A(m+x), ...A(m+(n-1)x)\} \quad (14)$$

Through the above algorithm, the embedding dimension m and time n of engineering data based on environmental factors can be calculated, and architectural design units should strengthen the overall rationality of green building design and improve the coupling between environmental design and other designs. For example, the choice of building energy should be solar energy, which belongs to new clean energy. Compared with electric energy, solar energy has the characteristics of high utilization rate and less pollution. It can not only satisfy the function of architectural lighting, but also save environmental protection. Environmental requirements of green buildings in architectural design are directly related to whether designers can reasonably and reasonably choose energy supply. Therefore, in order to solve the problem of poor coordination of green building design, we need to actively adjust the design scheme according to different living conditions. According to the above results, the impact of buildings on environmental factors is calculated, and the main characteristic indexes are determined, so that the relevant parameters of green buildings in architectural design are calculated and compared according to the characteristic indexes, and the architectural design based on the design concept of green buildings is realized.

### 2.3. Architectural design based on green building design concept

In the general level design, the greening area should be designed as much as possible, the area of artificial water body should be strictly controlled, roof rainwater should be collected reasonably, and the reclaimed water treatment system should be used to treat the reclaimed sewage and wastewater as greening irrigation water. Select vegetation types suitable for local growth and favorable for ecosystem maintenance in the project site for greening design. As our country is located in a variety of climatic wind zones, relevant wind environment influencing factors in and around the local site should be considered in the general layout design. After comprehensive layout, it is necessary to achieve natural ventilation that is conducive to outdoor walking, comfortable outdoor activities and buildings. In addition, measures should be taken to reduce the heat island effect. Specifically, in the initial stage of the general layout, professional design software can be used to simulate and verify whether the heat island effect and the wind environment in the site are within the site, to comprehensively compare various situations of the general layout of various individual layout combinations, and to obtain a comprehensive evaluation of the optimal general layout. However, at present, the design process of many projects is just the opposite, and the green building design is carried out only after the scheme is determined, so that the maximum rationalization of the general layout and the complete effect of the green building cannot be achieved at the same time. Therefore, green building design cannot be regarded as a final complementary and icing on the cake. It is suggested that the related work of green building design should be involved in the whole process of building design and be considered as a whole. Only in this way can a comfortable, healthy, environment-friendly and efficient use space be created while meeting the requirements of sustainable development. The layout of pedestrian and vehicle entrances and exits in the general layout design of buildings (groups) is related to the convenience, safety and energy conservation of people's production and life. Therefore, the functional layout of this project should be set in consideration of the surrounding municipal service facilities and the functional types of the surrounding buildings. For example, pedestrian entrances and exits are designed nearby at relatively reasonable locations around the community, such as bus stations, subway stations, large shopping malls, etc., while motor vehicle entrances and exits are designed at secondary roads on the opposite back to avoid danger caused by mixed flow of people and traffic and reduce their respective traffic efficiency. According to the above data, engineering samples and judging factors are calculated. The importance of judgment factors shall be compared with the relative importance of building materials. The importance of judgment factors shall be compared with the relative importance of building materials. Through the

comparison results, the environmental information scale method shall be used to judge the environmental information under the weight index of each element:

**Table 1. Environmental quality data sheet**

| Engineering | Qualitative index | Quantitative indicators | P |
|---|---|---|---|
| Qualitative index | 2.50000 | 2.00000 | 0.67676 |
| Quantitative indicators | 1.20000 | 1.50000 | 0.43433 |

**Table 2. Data quantification of environmental impact of buildings**

| Quantitative indicators | Height | Single layer area | Foundation depth | Year | layer numbers | Ground bearing capacity | P |
|---|---|---|---|---|---|---|---|
| Height | 1.500 | 2.100 | 1.300 | 2.000 | 1.600 | 2.000 | 0.1879 |
| Single layer area | 1.200 | 1.100 | 1.800 | 2.200 | 2.600 | 2.100 | 0.2341 |
| Foundation depth | 1.800 | 2.000 | 2.300 | 1.600 | 1.300 | 2.500 | 0.1657 |
| Year | 2.500 | 1.500 | 2.100 | 1.900 | 2.200 | 1.7000 | 0.0835 |
| Layer numbers , | 1.800 | 2.300 | 1.600 | 2.400 | 1.800 | 2.000 | 0.1413 |
| Ground bearing capacity | 1.000 | 1.500 | 2.200 | 1.200 | 2.400 | 1.500 | 0.2145 |

**Table 3. Impact Indicators of buildings on environmental factors**

| Qualitative index | Basic type | Structure category | flat shape | Interior decoration | Exterior decoration | Doors and Windows Project | P |
|---|---|---|---|---|---|---|---|
| Basic type | 1.100 | 1.100 | 3.100 | 3.100 | 3.100 | 2.200 | 0.2458 |
| Structure category | 1.100 | 1.300 | 2.400 | 3.100 | 2.900 | 4.400 | 0.3012 |
| Flat shape | 0.3356 | 0.2624 | 0.3333 | 0.2876 | 0.1584 | 0.1968 | 0.1456 |
| Interior decoration | 0.3345 | 0.2471 | 0.3636 | 0.3333 | 0.2154 | 0.2779 | 0.1035 |
| Exterior decoration | 0.2987 | 0.3333 | 0.3636 | 0.2798 | 0.3565 | 0.3232 | 0.0769 |
| Doors and windows project | 0.3356 | 0.2498 | 0.1000 | 0.3536 | 0.2984 | 0.1000 | 0.0923 |

Reasonable choice of architectural orientation can realize indoor lighting optimization. In the design, the lighting capacity of atrium and atrium is utilized to prolong lighting time, reduce power consumption time and achieve the purpose of energy conservation. The principle of combining ordinary lighting with local lighting is adopted, and lamps and electrical appliances with energy-saving effect are selected. Optimize the thermal performance of surrounding structures, reduce indoor energy loss and cause temperature changes. For enclosure structure components, materials with strong sound insulation shall be selected as far as possible to reduce the impact of noise pollution, ensure the comfort of the building interior, and design the indoor environment according to relevant specifications. In addition, it is also necessary to scientifically design the building outlet, reduce the heat loss at the outlet, reasonably arrange the tuyere, and take corresponding measures to reduce the occurrence of dew and mold in the insulation layer. In the outdoor greening design, the green belt is set to prevent the pollution of the external environment and reduce the influence of noise. In the design of green buildings, permeable paving technology is adopted to improve the water retention performance of the base and ensure the balance of groundwater resources. To sum up, it is of great practical significance for this paper to make an inquiry and analysis on the green building design in construction projects. Due to the imbalance between the ecological environment and economic development in recent years, all walks of life pay special attention to the concept of green environmental protection. In architectural design, green building design has been widely concerned and welcomed, and more attention has been paid to the coordination and matching between local conditions and regional geographic climate and human nature. From the beginning to the end, we are committed to using energy-saving and low-consumption new material technology and resources with strong decontamination capability, and maximize the appearance of a modern architectural fashion and simple and beautiful green building shape, thus better promoting the sustainable development and application of green building design in construction projects.

## 3. Analysis of Experimental Results

In order to verify the rationality of the integration and application of green building design concept in architectural design, a building construction case in a certain place was selected for follow-up investigation. The following figure is obtained through data investigation and analysis of the rationalization degree of construction project management and the degree of environmental pollution based on the environmental management impact assessment index proposed earlier.

From the figure, it can be seen that reasonable design management and planning department of green buildings can effectively reduce environmental pollution. Environmental assessment research is carried out through

building evaluation of energy, resource consumption and pollution consumption. The following data are obtained in Table 4:

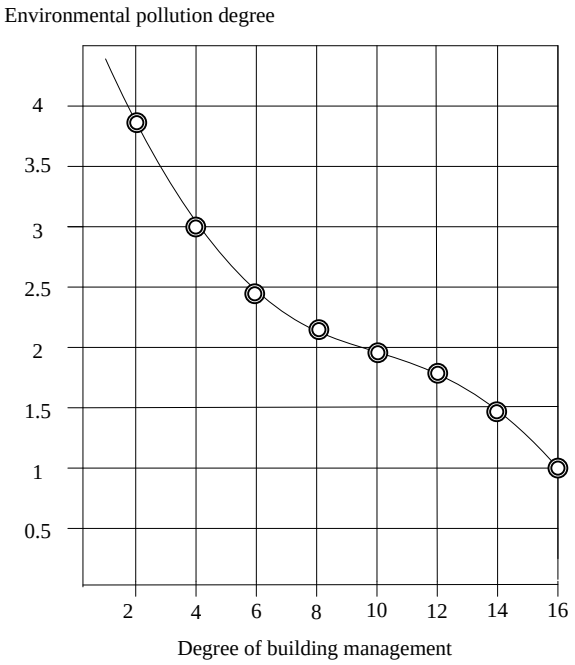


**Figure 3. Measurement results of rationality information of green application in buildings**

**Table 4. Weight of pollution degree in construction stage**

| Stage | W1 | W2 | W3 | W4 | W5 | Weight |
|---|---|---|---|---|---|---|
| 1 | 1 | 7 | 3 | 1 | 4 | 0.03535 |
| 2 | 5 | 1 | 5 | 7 | 7 | 0.21543 |
| 3 | 3 | 5 | 1 | 3 | 3 | 0.32542 |
| 4 | 4 | 3 | 4 | 2 | 1 | 0.24657 |
| 5 | 7 | 2 | 7 | 4 | 2 | 0.07851 |

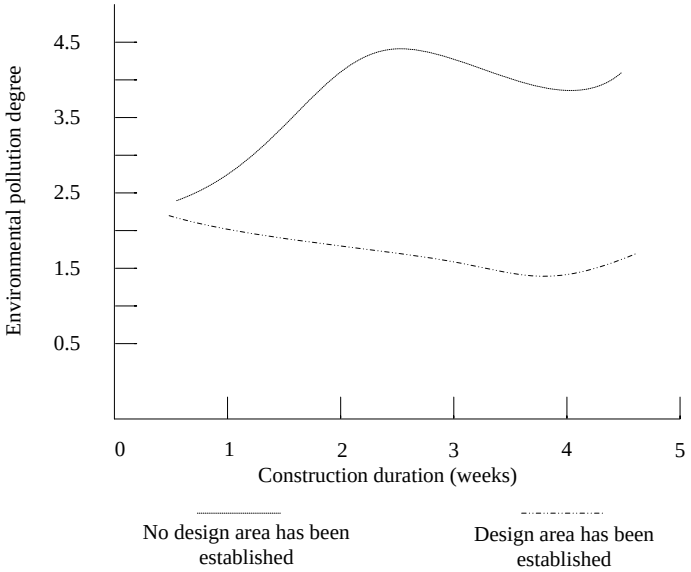


**Figure 4. Comparison of environmental impact results of building construction management**

From the above data, it can be seen that the construction area is divided into two parts. Under the condition of ensuring the consistency of other environmental impact factors in the two areas, one area is strictly managed and controlled during the construction phase through the environmental management system in the construction proposed above, and the other area is continuously constructed according to the normal scheme. The data of environmental pollution degree during the construction of the two areas are recorded and compared and analyzed, and the Figure 4 is obtained.

As can be seen from the above figure, the building effect based on the green building principle proposed in this paper is evaluated under the same environment compared with the traditional method. The results show that the green building design method based on the principle of this paper has higher energy saving and pollution performance, and fully meets the research requirements.

## 4. Concluding Remarks

The mainstream idea of today's era is sustainable development, while the construction field is an industry with relatively high energy consumption and serious pollution. Therefore, it is imperative for the construction industry to develop towards greenery. Employees in architectural design have also got a full understanding of this. They realize that only by applying the design concept of green building can the influence of the local environment of the construction team be effectively reduced. The architectural design work should also keep pace with the times and conform to the requirements of today's social development, that is, to form a society of sustainable development. The essence of green building is to save resources and protect the environment to the greatest extent in the whole life cycle of the building so as to realize the sustainable development of mankind. However, the times are developing and the society is progressing, and people's production and life are constantly changing and developing with the times. However, as long as we stick to the people-oriented and sustainable development path and adjust measures to local conditions in different regions, we can certainly create a green building that meets the needs of the contemporary people, and can also leave a sustainable and virtuous circle of green mountains and green waters for future generations.

## References

[1] Li Xiangyang. Research on the integration and application of green building design concept in architectural design. Engineering Construction and Design. 2017, (24), 17-18.

[2] Wang Suohong. Integration and application of green architectural design concept in shangluo architectural design. Building Materials and Decoration. 2018, (18).

[3] Fu Rao, Yuan Sujie. On the application of green architectural design concept in architectural design. China Real Estate Industry. 2017, (27), 99.

[4] Zhang Liming. Research on the integration and application of green building design concept in architectural design. Engineering Construction and Design. 2018, 384(10), 35-36+87.

[5] You Rui. Integration and application of green building design concept in architectural design. New Technologies and New Products in China. 2016, (9), 114-115.

[6] Jin Liang. Integration and application of green building design concept in architectural design. Building Materials and Decoration. 2017, (43), 119-120.

[7] Liu Lili. Integration and application analysis of green building design concept in architectural design. Housing and Real Estate. 2018, 509(24), 80.

[8] Wang Yong. Integration and application path of green building design concept in housing design. Architectural knowledge. 2017, (9), 36-37.

[9] Wang Lijun. Research on the integration and application of green building design concept in architectural design. Housing and Real Estate. 2018, 510(25), 63.

[10] Zhai Qing. Integration and application of green architectural design concepts in architectural design. Building Materials And Decoration. 2018, 547 (38), 104-105.