

# Application of Fair-faced Concrete Material in Architectural Design

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**Abstract** With the development of the society, the function of the building also becomes rich from single refuge, and modern architects can't satisfy the pursuit of traditional architectural form, and design goal is transformed into emphasizing the dialogue between architecture and people, architecture and emotions, and architecture and environment. As a kind of new building materials, fair-faced concrete expresses almost any emotion and meets people's emotional needs with its excellent structural performance and good plasticity. In this paper, the characteristics, expressive force and application of fair-faced concrete are studied and analyzed, and the application and development prospect of fair-faced concrete in architectural design are summarized.

**Keywords** Fair-faced concrete, Expressive force, Architectural design, Tadao Ando

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Architecture is a product of human civilization society. It is not only a pile of building materials, but also a spiritual product<sup>[1]</sup>. Fair-faced concrete itself is strong and soft, calm and warm, simple and beautiful, and can have an impact on people's spiritual senses, expressing a unique architectural charm. Therefore, fair-faced concrete buildings have become a focus of modern architecture, suitable for implicit expression and artistic expression, achieving self renewal of traditional and modern culture<sup>[2]</sup>.

## 1 Development history of fair-faced concrete

When it comes to the origin of concrete, the first thing people think of is that the ancient Romans mixed natural volcanic ash into natural sand and limestone to form mortar as a binder, which can be considered as "natural concrete". In fact, concrete first appeared in ancient Egypt or earlier Mesopotamian civilization. Broadly speaking, the pyramids built by the ancient Egyptians and the clay bricks used by the Sumerians belong to the historical category of "plastic" building materials<sup>[3]</sup>. Fair-faced concrete originated in the 1920s. Based on its artistic expression form, fair-faced concrete can be divided into three types: ordinary fair-faced concrete, facing fair-faced concrete, and decorative fair-faced concrete. It has been widely used and developed around the world, and is increasingly favored by architects<sup>[4]</sup>. For example, I.M. Pei, Tadao Ando, and others have used fair-faced concrete in their designs<sup>[5]</sup>, utilizing the unique decorative characteristics of the material itself to reflect the emotions conveyed by the building<sup>[6]</sup>.

## 2 Characteristics of fair-faced concrete

### 2.1 Advantages

Fair-faced concrete is also known as decorative concrete due to its unique decorative effect<sup>[7]</sup>. Fair-faced concrete can be formed by pouring in one go. After forming, there is no external decoration, only transparent protective agent is applied on the surface. Its surface is flat and smooth, with uniform color and clear edges, no damage or pollution<sup>[8]</sup>. As it does not require any decoration, it saves a lot of paint and decoration while reducing construction waste, making it an environmentally friendly material. Compared with reinforced concrete, its surface is coated with a special transparent protective agent, which is absolutely waterproof and avoids the disadvantages of reinforced concrete being easily corroded by rainwater and losing protection for steel bars too early. Rainwater corrosion of steel bars may endanger the building structure, causing rust marks on the concrete surface and affecting the appearance of the building. Compared with cold stones and warm wood, the simple appearance and solid texture of fair-faced concrete can better express people's emotions. Its nature may exist in the void "poetic" plasticity.

### 2.2 Shortcomings

Although fair-faced concrete has many advantages, the production process is relatively complex, and there is high requirements for selection of raw materials. The production process also requires professional personnel to operate. Moreover, specific templates need to be customized, and screw hole needs to be accurately calculated. The sand, gravel, cement, etc. required for raw materials need to be from

the same batch to avoid color differences. Self compacting concrete technology is used for fair-faced concrete. Due to the inability of self compacting concrete technology to vibrate, the pouring process requires high demands from construction workers, otherwise once the formwork is run, it will have to be redone.

## 3 Artistic expressive force of fair-faced concrete buildings

Fair-faced concrete, also known as decorative concrete, does not require any external decoration after a single pouring. Only one or two layers of transparent protective agent are applied to the surface, which has good environmental performance, does not produce material waste, and does not pollute the environment. Fair-faced concrete presents the most realistic state of materials. It is rough and delicate, hard and warm, simple and beautiful. Fair-faced concrete has multiple plasticity, and the basic process of "formwork-pouring" can not only use templates to cast various shapes, but also burn the texture inside the template on its surface, namely "performance template"<sup>[8]</sup>. This increases more possibility for fair-faced concrete material itself, and it can be combined with many materials, resonating harmoniously with materials such as wood and metal, and blending harmoniously with nature itself.

In addition, fair-faced concrete is mainly composed of cement and sand, which is a first-class fireproof material and extremely resistant to pressure. Compared with ordinary concrete, fair-faced concrete does not have the problem of cracking in plastering, and structural problems are also less likely to occur because there is no need for secondary decoration, and the total cost

of the project will also be reduced.

### 3.1 Structural expressive force of fair-faced concrete buildings

In the development of architectural aesthetics, structural elements can become new artistic elements due to changes in aesthetic concepts<sup>[2]</sup>. Bucket arch, a wooden structure in China, was the first supporting member of the wooden structure at the beginning. After the Ming and Qing dynasties, its structural role has basically changed into decoration. The more noble the bucket arch, the more complex it is. The Roman pentagonal order originated from the Greek order, with a stronger decorative effect. The ancient Roman columnar order is a brilliant gem in the long history of architecture. Fair-faced concrete is a building material with the same status and characteristics as wood and stone. Initially, it played its structural function. Later, people's needs are changing with the progress of technology. People found that it has strong plasticity and structural expressive force, and is more harmonious and inclusive. More and more architects use it as an architectural art language to convey the emotions of architecture and use its artistic expressive force to convey to the public.

The Dragon Art Museum in Xuhui District, Shanghai is a fair-faced concrete building designed and constructed by the renowned Chinese architect Liu Yichun. In order to create a harmonious visual resonance with the "bucket gallery" transformed from the original dock structure "coal funnel", the building adopts an independent wall "umbrella arch" cantilever structure and a large-scale protruding arch space made of finely textured fair-faced concrete (Fig.1), creating an artistic effect that contrasts power and lightness, and a continuity of time and space between the building and the original characteristics of the site.

Valliceron Chapel is architectural work of S.M.A.O Firm (Fig.2). Compared with ordinary chapels, there are no stained glass windows and towering ceilings, and only simple materials such as concrete are used to elevate the building. The design inspiration of the building comes from origami, and the entire spatial structure of the building is formed by folding boxes, which is also known as the Corbusier style of "box". Layers of concrete are stacked together to form an elegant and serious triangular surface. The indoor space is fragmented but not disorderly. With fair-faced concrete without decoration, direct sunlight forms a mysterious spatial dimension. The reflection of light and concrete further highlights the sculptural sense of building

concrete.

Azuma House is a famous work by Tadao Ando. The entire building is a rectangular cube, with all walls made of fair-faced concrete. The thick walls can block sunlight on both sides, achieving the goal of cooling and energy conservation (Fig.3). Tadao Ando attempted to create a microcosm in this concrete structure, so there was no window on the outside of the building. From the outside, it looks like a black box without light, but it is very bright inside because he used one-third of the area of the house to set up an open-air inner courtyard, integrating the natural scenery of spring, summer, autumn, winter, rain and snow into the interior of the building. It becomes an irreplaceable natural scenery in this concrete box, and achieves the soul of the building (Fig.3). Using the hard external fair-faced concrete, the interior of the building is isolated from the hustle and bustle of the city, helping modern people return to their essence and the original relationship between humans and nature<sup>[9]</sup>.

### 3.2 Material expressive force of fair-faced concrete buildings

Modern architects prefer to directly use fair-faced concrete as the building surface. Due to the strong plasticity of fair-faced concrete materials, it can give different building effects to the surface layer. Fair-faced concrete finishes can create rich texture<sup>[10]</sup>. The rigidity and flexibility of the material itself not only affect people's senses and spirit<sup>[11]</sup>, but most importantly, it can strongly express the designer's unique emotions and design concepts, adapting to different environmental atmospheres.

The Ningbo Museum (Fig.4) designed by Chinese architect Wang Shu uses a large number of fair-faced concrete walls. In order to achieve the integration of history and reality, the template for making fair-faced concrete is made of bamboo. Bamboo strips are added to the concrete, and the texture effect of bamboo cracking is utilized for artistic qualitative change of the originally rigid concrete, making its texture and color fully integrated into nature.

The Nariwa Art Museum, designed by Japanese architect Tadao Ando<sup>[11]</sup>, is located in Nariwa Town, Takahashi City, Okayama, Japan. The site is surrounded by a stone wall, with steep cliffs on the other side, making almost any form of insertion appear light. Ando Tadao placed a complete fair-faced concrete box inside it, without any decoration. All walls and components were designed for space, and the entire building is simple and stable, echoing the rich history of the stone wall (Fig.5).

Shanghai Poly Grand Theatre is considered by Tadao Ando to be "the most completed project in China" (Fig.6). The design of the building incorporates the "three elements of Ando", namely genuine materials, light, and nature, achieving a harmonious unity between the building and the environment. The main body of the building is a cube made of fair-faced concrete, with a small volume. The exterior of the building is a transparent curtain wall, and the interior of the curtain wall is made of fair-faced concrete skin. It perfectly combines the real and simple texture of fair-faced concrete with nature to form a landscape ink painting, achieving a harmonious state between the building and the surrounding environment.

### 3.3 Expressive force of texture and color of fair-faced concrete building skin

Color is the first visual language carried by materials and an important factor for expressing emotions. It can affect people's physiology and psychology and is the soul of building materials<sup>[12]</sup>. One of the characteristics of fair-faced concrete itself is to express the texture and color of the material itself. For the first time, the Marseilles Apartment in Corbusier truly liberated the concrete surface, and the exposed concrete texture and color showed strong expressive power, bringing philosophical inspiration to future architects.

The color change of fair-faced concrete is caused by its solidification, and the changes are extremely rich, increasing the sense of hierarchy and artistic expressive force of the color of fair-faced concrete. Usually, fair-faced concrete can be divided into gray, colored, and white. Grey fair-faced concrete is the most common and sought after, reflecting the concept of traditional aesthetics. The Hiroshima Modern Art Museum designed by Kisho Kurokawa utilizes his concept of "gray space", which refers to the color of the building. The Hiroshima Modern Art Museum fully utilizes Kurokawa's "symbiosis" concept. 60% of the building is located underground, and gray fair-faced concrete is mixed in the mountains and forests, harmoniously coexisting with nature (Fig.7).

Colored fair-faced concrete is generally formed by adding colored dyes according to the needs of designers, which is a new concept and a trend for future development. The brightly colored wall is a distinctive design feature of Luis Barragan, who incorporates the vibrant colors of Mexican homes into the designs to express his emotions and demands. Cristobal Stable and Villa were created by Luis Barragan



using modern techniques to depict traditional farmhouses and estates from his childhood

memories (Fig.8).

House N is a white concrete residential

building designed by Sou Fujimoto and located in a traditional Japanese community (Fig.9). The building uses white concrete as the shell, and different voids are set on the concrete shell to allow natural light to shine in. The three layers of concrete shells are nested together, allowing for a natural transition between the interior and exterior spaces of the building. The outermost layer acts as a barrier to external sound, while the middle and innermost layers naturally form a building corridor. The innermost layer serves as a living space and has privacy. The layers of white concrete brings natural comfort and provides a sense of home security.

Bruder Klaus Field Chapel is a very unique small church (Fig.10). It is like a giant stone in the wilderness, without other buildings around it. It uses 110 pieces of wood to build a tent like design, and then injects concrete layer by layer, each layer about 0.5 m high. In this way, it gradually uses concrete to build a relatively bright rammed earth wall texture layer by layer. The interior of the church is a black void. After the framework is removed, not only are there many small voids left on the walls of the concrete interior, but the natural wood texture is also preserved, which combines the entire church with the surrounding landscape, creating a field church atmosphere.

#### 4 Conclusions

The material issue is one of the fundamental issues in transforming architectural design from abstract two-dimensional drawings to concrete construction. Fair-faced concrete has strong plasticity, low cost and environmental protection, and superior structural performance. With the continuous improvement of people's understanding of material composite technology, as a structural material, fair-faced concrete not only solves structural functional problems, but its unique expressive power and "authenticity" enable designers to integrate it with the natural environment, historical environment, cultural environment, and social environment. Its soft and hard, warm and cold material characteristics greatly enrich the design elements of designers, guide building design to develop in more diverse directions, and encourage designers to turn more design flexibility into reality.

Tadao Ando<sup>[13]</sup> once said, "concrete is my material, and it also belongs to everyone. It has no limitations, and designers can use it according to their own will." What elevates the poetic expression of fair-faced concrete to the essence of materials is its creativity<sup>[14]</sup>, integrating the idea of doing nothing into its design, fully reflecting the basic connotation of Eastern culture, and



Fig.1 Structure of Shanghai Dragon Art Museum

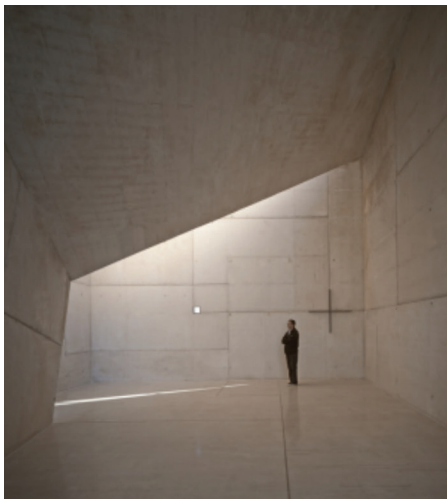


Fig.2 Valleaceron Chapel



Fig.3 Azuma House

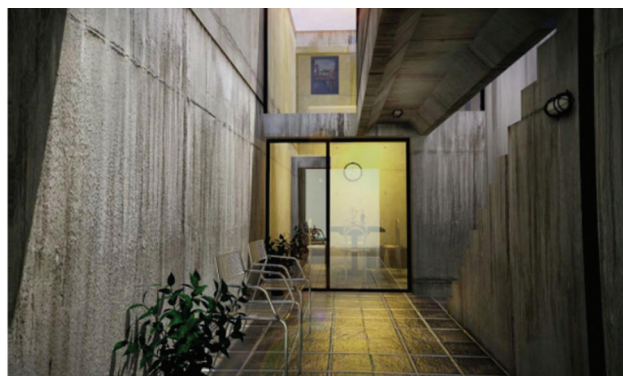


Fig.4 Ningbo Museum





Fig.5 Nariwa Art Museum

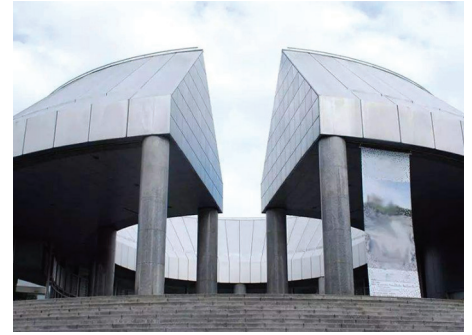


Fig.7 Hiroshima Modern Art Museum



Fig.6 Shanghai Poly Grand Theatre



Fig.8 Texture effect



Fig.9 House N



Fig.10 Bruder Klaus Field Chapel

continuously discovering its potential artistic expressive force<sup>[15]</sup>.

In summary, as a representative of building materials, fair-faced concrete is constantly

being developed and innovated, and its value far exceeds that of the materials themselves. It should receive more long-term development. In the future, the application of fair-faced concrete

in design will not come to an end, and it is still worth continuous exploration by contemporary architects in practice.

## References

- [1] Ministry of Housing and Urban Rural Development of the People's Republic of China. (2009). *Technical specification for fair-faced concrete construction* (JGJ 169-2009). Beijing: China Construction Industry Press.
- [2] Zhou, Q., Jiang, S. & Cai, H. (2020). Preliminary study on the application of expression language in concrete buildings. *Concrete*, (5), 90-93.
- [3] Li, X. M. (2019). Artistic charm of concrete architecture. *City & House*, 26(4), 102-103.
- [4] Yu, H. Y., Wang, Q. & Li, C. X. (2008). Technical characteristics and application prospects of fair-faced concrete. *Shanghai Construction Science & Technology*, (5), 69-70.
- [5] Fu, L. J., Yang, Y. & Lu, J. H. (2021). Development trend and prospect of decorative concrete at home and abroad. *China Concrete*, (7), 48-53.
- [6] Xiao, L. D. (2020). Application prospects of fair-faced concrete. *Green Building Materials*, (5), 7-8.
- [7] Zheng, L. X. (2008). Application of fair-faced concrete in engineering. *Anhui Architecture*, (1), 46-48.
- [8] Liu, J. W., Wang, X. D. & Zhang, H. Y. et al. (2021). Significance of developing fair-faced concrete buildings and its research status. *Low Carbon World*, 11(5), 182-183.
- [9] Hu, D. L. (2012). Fair-faced concrete building (To be continued in P86)

regulations should be clearly listed for tourists, and it accepts supervision and suggestions to increase transparency.

**References**

[1] Fakeye, P. C., Crompton, J. L. (1991). Image differences between prospective, first-time, and repeat visitors to the lower Rio Grande Valley. *Journal of Travel Research*, 30(2), 10-16.

[2] Echtner, C. M., Ritchie, J. R. B. (1991). The meaning and measurement of destination image. *Journal of Tourism Studies*, 2(2), 2-12.

[3] Tasci, A. D. A., Gartner, W. C. (2007). Destination image and its functional relationships. *Journal of Travel Research*, 45(4), 413-425.

[4] Hunt, J. D. (1975). Image as a factor in tourism development. *Journal of Travel Research*, 13(3), 1-7.

[5] Goodrich, J. N. (1977). A new approach to image analysis through multidimensional scaling. *Journal of Travel Research*, 16(3), 3-11.

[6] Pearce, P. L. (1982). Perceived changes in holiday destinations. *Annals of Tourism Research*, 9(2), 145-164.

[7] Phelps, A. (1986). Holiday destination image-The problems of assessment: An example developed in Menorca. *Tourism Management*, 7(3), 168-180.

[8] Fakeye, P., Crompton, J. (1991). Image differences between prospective, first-time, and repeat visitors to the lower Rio Grande Valley. *Journal of Travel Research*, 29(2), 10-16.

[9] Gartner, W. C. (1993). Image formation process. *Journal of Travel and Tourism Marketing*, 2(3), 191-215.

[10] Echtner, C., Ritchie, J. R. B. (1993). The measurement of destination image: An empirical assessment. *Journal of Travel Research*, 31(4), 3-13.

[11] Kotler, P., Barich, H. (1991). A framework for marketing image management. *Sloan Management Review*, 32(2), 94-104.

[12] Sheth, J. N., Newman, B. I. & Gross, B. L. (1991). *Consumption values and market choices*. Cincinnati, OH: South-Western.

[13] Andes, N. (1992). Social class and gender: An empirical evaluation of occupational stratification. *Gender & Society*, 6(2), 231-251.

[14] Tideswell, C., Faulkner, B. (1999). Multidestination travel patterns of international visitors to Queensland. *Journal of Travel Research*, 37(4), 364-374.

[15] Lue, C. C., Crompton, J. L. & Fesenmaier, D. R. (1993). Conceptualization of multi-destination pleasure trips. *Annals of Tourism Research*, 20(2), 289-301.

[16] Guo, Y. Z. (2003). Summarize on the study results of tourism appreciating image. *Economic Geography*, (2), 280-284.

[17] Bao, J. G. (1996). *Research on tourism development: Principle, method and practice*. Beijing: Science Press.

[18] Wu, B. H., Tang, J. Y. & Huang, A. M. (1997). A study on destination choice behavior of Chinese urban residents. *Acta Geographica Sinica*, (2), 97-103.

[19] Chen, C. K., Wang, X. J. (1996). Image planning of fairy world and Taishan cultural tourism city. *Tourism Tribune*, (1), 48-52.

[20] Gu, M. (2000). On the Positioning of Dalian's Urban Tourism Image and Overall Planning. *Tourism Tribune*, (5), 63-67.

[21] Li, L. L. (1999). *Planning of Tourism Destination Image: Theory and Practice*. Guangzhou: Guangdong Tourism Press.

[22] Wang, L., Liu, H. T. & Zhao, X. P. (1999). Research on connotation of tourist destination image. *Journal of Xi'an Jiaotong University: Social Sciences*, (1), 27-29.

[23] Zhang, Z. Z., Li, J. Y. (2014). A comparative study on the data of a questionnaire and web texts in tourism image researches: A case study of Xi'an's tourism image perception. *Tourism Science*, (6), 73-81.

[24] Xu, X. B., Zhao, L. & Liu, B. Y. et al. (2015). Study on perceived image of Chinese tourist cities. *Geographical Research*, (7), 1367-1379.

[25] Yi, T. T. (2013). Image perception of tourism destination in Tibet through Internet communication: Based on the content analysis of tourist travel notes. *Consumer Economics*, (4), 84-88, 92.

[26] Huo, H., Liang, Y. K. (2017). Research on image perception of tourism destination in Guangzhou based on online travel notes. *Social Sciences in Guangdong*, (6), 202-209.

[27] Li, P., Chen, T. & Wang, F. Y. et al. (2017). Urban tourism community image perception and differentiation based on online comments: A case study of Beijing. *Geographical Research*, (6), 1106-1122.

[28] Gao, J., Zhang, Y. G. & Zhuang, D. Q. (2009). A study on domestic tourists' perceived image of coastal tourism cities: Based on text analysis of online comments on Ctrip and Tongcheng. *Consumer Economics*, (3), 62-65.

[29] Choi, S., Lehto, X. Y. & Morrison, A. M. (2007). Destination image representation on the web: Content analysis of Macau travel related website. *Tourism Management*, 28(1), 118-129.

[30] Pi, R. Zheng, P. (2017). A research on Shaolin Temple's tourism cognitive image, affective image and overall image-Based on web text. *Journal of Arid Land Resources and Environment*, (4), 201-207.

[31] Wang, Y. Xu, X. & Feng, X. G. et al. (2013). Research on tourists' perceived image of ancient town using web text mining methods: A Case Study of Zhujiajiao. *Tourism Science*, (5), 86-95.

[32] Zhang, G. J., Li, J. Y. & Zhang, L. (2011). A research on tourism destination image perception of Huashan Scenic Spot: Based on text analysis of weblogs. *Tourism Science*, (4), 87-94.

[33] Zhang, W. T., Luo, P. C. (2017). A comparative research on tourism destination image of tourists' perception and official dissemination based on network text: Taking Yongding Tulou in Fujian as the case. *Journal of Fujian Normal University: Natural Science Edition*, (1), 90-98.

[34] Fu, Y. Q., Wang, X. J. & Zheng, X. M. (2012). Study on tourism image based on web text analysis: Case of Gulangyu. *Tourism Forum*, (4), 59-66.

[35] Zhao, L., Wu, W. Z. & Li, J. et al. (2018). The formation mechanism of tourist loyalty in ecotourism scenic spots from the perspective of tourist perceived value: Evidence from Xixi National Wetland Park. *Acta Ecologica Sinica*, (19), 7135-7147.

[36] Baloglu, S., McCleary, K. W. (1999). A model of destination image formation. *Annals of Tourism Research*, 26(4), 868-897.

[37] Ba, Z. C., Yang, Z. J. & Zhu, S. W. et al. (2016). Research on the domain theme evolution analysis based on keywords semantic network. *Information Studies: Theory & Application*, (3), 67-72.

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of Tadao Ando under humanistic perspective. *Anhui Architecture*, 19(5), 14-15.

[10] Dai, Y. Q. (2015). *Emotional expression method of fair-faced concrete in architectural design* (Master's thesis). Retrieved from China National Knowledge Infrastructure.

[11] Zhao, Y. H. (2018). Performance of fair-faced

concrete in architectural design: A case study of design works of Tadao Ando. *China Housing Facilities*, (3), 80-82, 70.

[12] Fang, Y. (2020). Detail structure and artistic expression of fair-faced concrete. *Concrete*, (12), 132-137.

[13] Master Series Book Editing Department. (2005). *Tadao Ando's works and thoughts*. Beijing:

China Electric Power Press.

[14] Zhang, Q., Chen, H. (2018). Constructed of concrete poetics constructivism vision. *Chinese & Overseas Architecture*, (6), 174-177.

[15] Christian, H. (2007). Development opportunities for fair-faced concrete in the precast industry. *Betonwerk und Fertigteil-Technik/Concrete Plant and Precast Technology*, (10), 4-11.