# Tadao Ando's Application of Fair-Faced Concrete Building Materials

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**Abstract.** In the world of architecture, fair-faced concrete has evolved from a utilitarian building material to a symbol of design innovation and aesthetic excellence. Tadao Ando, a renowned architect, has played a pivotal role in showcasing the possibilities and beauty of fair-faced concrete in his architectural works. The use and appreciation of fair-faced concrete by Tadao Ando have permanently altered the architectural environment. As a result of his imaginative use of the material, a new generation of architects and designers are today exploring the boundless potential of fair-faced concrete to create environments that are not only functional but also visually beautiful and profoundly connected to their surroundings. Ando's imaginative work has revolutionized modern architecture and raised the status of fair-faced concrete as a medium for aesthetic expression.

**Keywords:** Tadao Ando; fair-faced concrete; application.

## 1. Introduction

Building materials have been a pillar of architectural innovation and growth throughout history. In addition to having an impact on a building's structural stability, the materials used can significantly influence its appearance and functionality. One such substance that has been popular in modern architectural discourse is clear concrete, often known as fair-faced concrete. Pushing the limitations of conventional building materials to produce structures that blend in with their surroundings in distinctive and aesthetically arresting ways, the development and use of clear concrete constitute a fascinating junction of form and function. The need for a building material that could give the structural stability of conventional concrete and a transparent or translucent appearance gave rise to the idea of clear concrete. This substance has its origins in several architectural trends, including modernism and brutalism, when architects aspired to depart from traditional design conventions. Since then, clear concrete has transformed from an experimental substance into a practical choice for building structures that meld the built and natural environments. Reviewing the work of several eminent academics who have investigated the possibilities and constraints of transparent concrete is essential in the quest to comprehend the development status of this material. In addition to shedding insight into the difficulties they encountered and the solutions they suggested, this literature review seeks to emphasize the achievements of these pioneers in expanding our understanding of fair-faced concrete. Vanden Broeck's research [1] focuses on the infancy of the development of clear concrete. The groundwork for creating a smoother, more translucent concrete surface was laid by his trials with various additives and casting methods. His work in the middle of the 20th century had a big impact on how transparent concrete developed as a building material. Fumihiko Maki, In the latter half of the 20th century [2], Maki's architectural works—such as the Hillside Terrace Complex—showcased the potential of clear concrete for producing aesthetically arresting facades. To obtain the desired level of transparency, his research stressed the significance of painstaking craftsmanship and the use of suitable aggregates. Architects and designers became more interested in the material because of Maki's efforts. The significance of this research lies in exploring the pioneering work of Tadao Ando in the realm of clear concrete. While previous researchers have contributed valuable insights, Ando's approach transcends the technical and aesthetic aspects of the material. His exploration of light, shadow, and the interplay between the material and the environment has redefined the possibilities of clear concrete in architectural design. In the following sections, it delve into the key principles and projects associated with Tadao Ando's research on clear concrete, seeking to understand how his

vision has reshaped contemporary architecture and inspired a new generation of architects and designers.

Tadao Ando, a renowned architect, often employs fair-faced concrete in his designs. This material showcases the natural texture of concrete, creating a harmonious blend of aesthetics and functionality [3]. Over time, there has been a major evolution in the creation and use of fair-faced concrete materials. Fair-faced concrete was first employed for its structural qualities, but architects like Tadao Ando soon realized and embraced the material's aesthetic potential. Intricate patterns, novel textures, and smoother surfaces are now possible for architects thanks to advancements in formwork, casting methods, and concrete mixtures. This adaptable material is used in a variety of architectural designs, from straightforward shapes to more complex ones, adding to the overall aesthetic appeal and personality of buildings.

## 2. Development and Application of Fair-Faced Concrete Building Materials

Architectural or exposed concrete, often known as fair-faced concrete, has become a popular building material in modern architecture [4]. This concrete stands out because it is purposefully left exposed and bare, exhibiting its natural texture and surface finish. The construction industry has been considerably impacted by its growth and use, which has an impact on the appearance and functionality of contemporary structures. The development, traits, and uses of fair-faced concrete building materials will all be covered in this investigation. The usage of fair-faced concrete has been improved over time by developments in construction methods and concrete technology. A wide range of textures and finishes, from smooth and polished to rough and textured, may now be achieved thanks to advancements in formwork, concrete mixtures, and surface treatments. As a nod to the material's fundamental features, fair-faced concrete has come to be associated with contemporary architectural style.

### 2.1. The development of Exposed Concrete Materials

Fair-faced concrete refers to concrete surfaces that are intentionally left exposed and not covered with finishes, coatings, or claddings [5]. The development and application of fair-faced concrete materials involve techniques and considerations to achieve aesthetically pleasing and high-quality concrete surfaces. This often requires careful selection of raw materials, proper mix design, meticulous placement, and finishing procedures, and attention to curing. For example, the development of fair-faced concrete materials involves refining concrete mixtures and construction techniques to achieve aesthetically pleasing and high-quality exposed concrete surfaces. Key aspects of this development include, firstly the raw material selection, careful selection of raw materials, including aggregates, cement, and admixtures, is crucial to achieve the desired color, texture, and durability of the exposed concrete surface. The mix design optimization which concrete mix proportions are tailored to ensure proper workability, strength, and appearance. The mix design might include specific aggregates and additives to enhance the surface finish. Pigments and color consistency, agents can be added to the concrete mix to achieve specific colors. Developing consistent coloring throughout the batch and the entire project is important. Admixtures for surface enhancement like plasticizers, superplasticizers, and air-entraining agents can help improve workability, reduce surface imperfections, and increase durability. Also formwork design and construction. The formwork's design and construction play a pivotal role in achieving clean lines, accurate dimensions, and smooth surfaces. Developing formwork systems that minimize surface defects is important. Placement techniques, and proper concrete placement techniques, including vibration and compaction, ensure uniform distribution of concrete and minimize voids and surface blemishes. Finishing methods as well, as various finishing methods such as troweling, brushing, sandblasting, or acid etching can be employed to achieve the desired texture and appearance. Experimenting [6] with different techniques helps achieve the desired visual effect. Surface Protection and Maintenance, on the other hand, strategies for protecting the exposed concrete surface during construction and maintaining its

appearance over time are developed to prevent damage and weathering. Also, testing and quality control which is rigorous testing of concrete mixtures and prototypes helps identify optimal combinations of materials and techniques. Quality control processes are established to ensure consistency in production. Finally, collaboration and expertise. Architects, engineers, contractors, and concrete suppliers collaborate closely to share expertise and insights, ensuring that the project's design intent is successfully translated into the finished concrete surface. Therefore, the development of fair-faced concrete materials is an ongoing process that requires innovation, testing, and continuous improvement to meet the demands of architectural design while maintaining structural integrity and long-term durability.

### 2.2. Application Principle of Exposed Concrete

On the other hand, fair-faced concrete finds a variety of applications in the construction industry, especially in architectural projects where the aesthetic appeal of exposed concrete surfaces is desired.

Some common applications include exposed Structural Elements. So fair-faced concrete is often used for columns, beams, and walls that are left exposed to showcase the inherent beauty of concrete as a structural material. Facades, architectural facades made from fair-faced concrete provide a modern and distinctive look to buildings [7]. They can incorporate intricate patterns, textures, and designs to enhance the visual appeal. Interior Walls, Fair-faced concrete can be used for interior walls, creating an industrial or contemporary aesthetic. It's often used in spaces like galleries, museums, and commercial interiors. Stairs and Steps, Staircases and steps made from fair-faced concrete can create visually stunning and functional design elements within a building. Flooring, polished fair-faced concrete flooring can provide a seamless, minimalist, and easy-to-maintain surface for various spaces, including residential, commercial, and public areas. Decorative Features, Fair-faced concrete can be shaped into decorative features, such as geometric patterns, relief sculptures, or custom-designed textures. Bridges and Infrastructure, in some cases, fair-faced concrete is used in infrastructure projects like bridges, where the exposed concrete surfaces contribute to the overall architectural aesthetic. Also, landscaping elements, fair-faced concrete can be used for outdoor landscaping elements like retaining walls, planters, and seating, integrating the material with the natural environment. And retail spaces, Fair-faced concrete can create a contemporary and industrial ambiance in retail spaces, aligning with modern design trends. Civic and public buildings, civic buildings like museums, cultural centers, and libraries often use fair-faced concrete to evoke a sense of creativity, modernity, and cultural significance. And residential projects, Fair-faced concrete is gaining popularity in residential construction, used for features like accent walls, fireplace surrounds, and exterior cladding. Therefore, the application of fair-faced concrete requires skilled craftsmanship and careful coordination among architects, engineers, contractors, and concrete suppliers. It offers architects and designers the freedom to experiment with various finishes, textures, and colors to achieve unique and striking design outcomes that reflect the desired aesthetic vision.

## 3. Appreciation of Tadao Ando's Architectural Works

Tadao Ando, a renowned Japanese architect, is widely known for his exceptional use of fair-faced concrete in his architectural designs. He has mastered the art of integrating concrete into his projects to create serene, minimalist, and contemplative spaces. Here are some notable examples of Tadao Ando's application of fair-faced concrete in architecture first one is the most known one - Ibaraki, Japan [8]. It is one of his most famous works, this minimalist church features that can be seen in Figure 1, a crosscut out of the concrete wall, allowing natural light to filter through [9], symbolizing the connection between light and spirituality. Also the - Osaka, Japan, This project exemplifies Ando's ability to create harmony between nature and architecture [8]. The interior courtyard is enclosed by fair-faced concrete walls, creating a serene environment for residents. [8]- Kagawa, Japan, Ando designed this museum to merge seamlessly with the island's landscape. The fair-faced concrete surfaces complement the surrounding environment and house contemporary artworks. Therefore, -

Naoshima, Japan, also on Naoshima Island, this museum showcases Ando's mastery in creating spaces that interact with light and shadow, enhancing the visitor's experience [8]. Punta Della Dogana Contemporary Art Center as well (2009) that can be seen in Figure 2 - Venice, Italy. This conversion of a historic customs house into an art center features a combination of fair-faced concrete and large glass windows, blending modernity with the building's historical context. Hyogo Prefectural Museum of Art (2002) that can be seen in Figure 3 - Kobe, Japan, he designed this museum to house both traditional and contemporary art. The fair-faced concrete exterior provides a sense of permanence and tranquility.

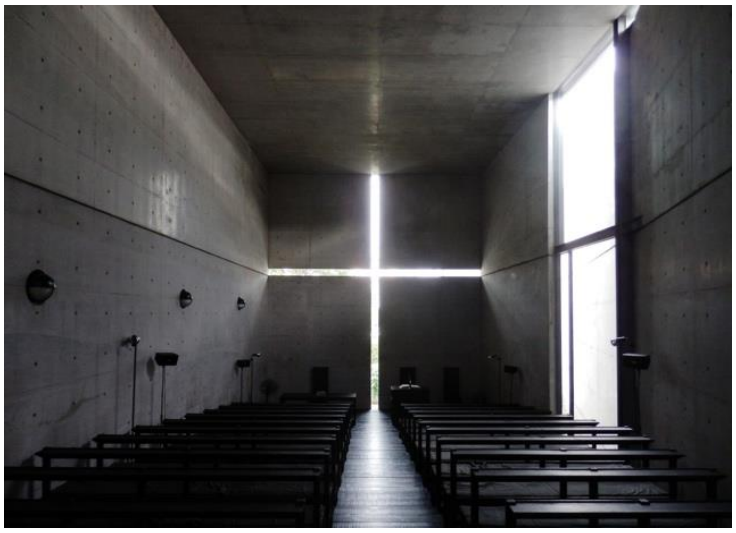


**Fig 1.** Church of Light [10].



**Fig 2.** Punta Della Dogana Contemporary Art Center [11].

Also The Clark Art Institute Visitor Center (2014) - Massachusetts, USA, can be seen in Figure 4. For this project, Ando incorporated fair-faced concrete into the landscape, creating a balance between the built environment and the surrounding nature. In conclusion, Tadao Ando's use of fair-faced concrete is characterized by its raw, unfinished appearance, which he believes enhances the texture, light, and shadow within his designs. His architectural philosophy centers on the concept of "shakkei," or borrowed scenery, where the surroundings become an integral part of the design. Through his innovative and thoughtful application of fair-faced concrete, Ando has created architectural masterpieces that have left a lasting impact on the world of architecture.

The Hyogo Prefectural Museum of Art, also known as the Hyogo Prefectural Museum of Modern Art, is one of his major projects where he used fair-faced concrete building materials. The museum, which is in Kobe, Japan, was finished in 2002 and features a superb illustration of Tadao Ando's architectural design and mastery of concrete. The term "fair-faced concrete," often referred to as "exposed concrete" or "raw concrete," is used to describe concrete surfaces that are purposefully left unfinished without any further finishing treatments like paint or plaster. Tadao Ando used fair-faced concrete for the Hyogo Prefectural Museum of Art because of its structural and aesthetic benefits. Clean lines, geometric shapes, and a strong feeling of minimalism are prominent design elements of the museum. One of the most important factors in implementing these architectural concepts is the use of fair-faced concrete.



**Fig 3.** Hyogo Prefectural Museum of Art [12].



**Fig 4.** The Clark Art Institute Visitor Center [13].

In this museum, he used the Formwork and Pouring Technique: Fair-faced concrete requires careful attention during the pouring and curing process. The quality of the final surface depends on the formwork used and the precision of the concrete pouring. Tadao Ando's team would have ensured that the formwork was meticulously designed to achieve the desired surface texture and appearance. Surface Finish: Tadao Ando is known for achieving a high level of precision in his concrete work. The museum's fair-faced concrete surfaces are characterized by their smooth and uniform appearance. Achieving this level of consistency requires skilled craftsmanship and attention to detail. Exposed Aggregate: Tadao Ando often incorporates exposed aggregate in his fair-faced concrete designs. This involves deliberately exposing the coarse aggregate within the concrete mix, creating a textured surface. This technique adds visual interest to the concrete while maintaining its natural character. Light and Shadow Play: The fair-faced concrete surfaces of the museum interact with light and shadow, creating a dynamic visual experience. Ando's manipulation of light enhances the texture of the concrete, adding depth and dimension to the building's appearance. Integration with Nature: Tadao Ando's architectural philosophy often emphasizes the harmony between the built environment and nature. In the Hyogo Prefectural Museum of Art, fair-faced concrete serves as a connection between the museum's interior and the surrounding landscape. The natural materiality of concrete complements the natural beauty of the site. Longevity and Durability: Fair-faced concrete, when executed properly, is known for its durability and longevity. Tadao Ando's choice of this material

aligns with his approach to architecture which prioritizes enduring designs. Overall, Tadao Ando skillfully manipulated the material's aesthetics and structural attributes in his usage of fair-faced concrete at the Hyogo Prefectural Museum of Art. The museum is evidence of his skill to turn a functional material into an artwork that blends with its surroundings and attracts visitors on various levels.

## 4. Conclusion

Fair-faced concrete has transformed the world of architecture from a basic building material to a mark of creative design and superior aesthetics. In his architectural creations, well-known architect Tadao Ando has been instrumental in showing the benefits and beauty of fair-faced concrete. Fair-faced concrete has been converted by Ando into a medium that goes beyond its functional beginnings by carefully considering formwork, pouring procedures, surface finishes, exposed aggregates, and the interaction of light and shadow. Iconic buildings like the Hyogo Prefectural Museum of Art, where Ando achieved a seamless fusion of minimalist architecture and natural settings, serve as examples of his masterful use of fair-faced concrete. His use of fair-faced concrete as a link between these two components, known as "shakkei," or "borrowed scenery," emphasizes the significance of integrating architecture with the environment. Fair-faced concrete is another material that Ando chose because it demonstrates his dedication to longevity and resilience in architectural design. Fair-faced concrete, when applied with accuracy and knowledge, improves a structure's aesthetic appeal while also ensuring its long-term durability. In conclusion, Tadao Ando's appreciation for and use of fair-faced concrete has irrevocably changed the landscape of architecture. A new generation of architects and designers are now exploring the limitless potential of fair-faced concrete to develop environments that are not only practical but also aesthetically pleasing and profoundly connected to their surroundings because of their inventive use of the material. Ando has transformed modern architecture and improved the prestige of fair-faced concrete as a means of aesthetic expression via his visionary work.

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