JOURNAL OF DESIGN FOR RESILIENCE IN ARCHITECTURE & PLANNING

Research Article
Online: www.drarch.org
Volume 4, Issue 3, (317-338), 2023
DOI: 10.47818/DRArch.2023.v4i3100

A timeless journey of strength and beauty: The potentials of the use of stone in architecture

Serkan Yaşar Erdinç*

Abstract

Use of stone in architecture has been an enduring and timeless tradition throughout history, withstanding the test of time from ancient civilizations to today's architecture. The durability, versatility and aesthetic appeal of stone make it an exceptional material for creating striking architectural designs. Stone has been used for centuries, as an integral part of architecture since ancient times and its importance still holds true in contemporary architecture being a popular building material today. In this context, this study examines the key features of stone that make it such a vital material for architectural design by exploring the advantages and disadvantages of using stone for architecture. The paper examines the role of stone in architecture and explores how contemporary projects have utilized stone in innovative and creative ways also delves into the significance and beauty of stone architecture, highlighting its history, durability and aesthetic appeal. The research methodology includes the analysis of case studies of contemporary projects crafted from stone, examining the design process, materials and techniques used. The case studies analyzed in this paper demonstrate the versatility of stone in contemporary architecture. The projects showcase how stone can be used in innovative ways, including the creation of sculptural forms, the incorporation of technology and the utilization of sustainable materials. The paper argues that stone's timeless qualities, durability and versatility make it an ideal material for contemporary architecture, particularly in achieving sustainability and aesthetic appeal. The study concludes that the use of stone in architecture remains crucial in creating robust, sustainable and attractive structures that stand the test of time.

Keywords: architectural image, stone material, use of stone in architecture, picturesque buildings, timeless structures

1. Introduction

In the realm of architecture, the choice of materials carries profound significance, shaping not only the aesthetics but also the very essence of the built environment. From ancient civilizations to modern-day construction practices, materials have been instrumental in defining the visual, functional and experiential qualities of architectural spaces. Materials have always played a crucial role in the expressive language of architecture. Their inherent qualities, such as color, texture and transparency can evoke emotions and create sensory experiences (Biçer & Erdinç, 2023a; Öktem Erkartal, 2022). However, among the myriad options available, few materials possess the timeless allure and inherent strength of *stone*.

Throughout history, various civilizations recognized the qualities of stone and harnessed its potential in architectural design. Stone possesses exceptional strength, making it an ideal material for creating sturdy and long-lasting structures. Dal and Tokmak (2020) also states since it is an original, aesthetic, durable, healthy and sustainable material, it has been used in different forms in the past and today. 'Stone's allure extends beyond its utilitarian aspects. Its unrivaled durability and

*(Corresponding author) Assist. Prof. Dr., İstanbul Beykent University, Türkiye, yasarerdinc@beykent.edu.tr
Article history: Received 15 September 2023, Accepted 20 October 2023, Published 17 December 2023

weathering resistance ensure that stone structures persist through the ages, testifying to the indomitable spirit of their creators. Furthermore, its innate thermal properties offer natural insulation, fostering energy efficiency and sustainable design. The aesthetic appeal of stone lies in its ability to evoke a sense of timelessness and authenticity. Whether it manifests as the grandeur of ancient Egyptian pyramids and Roman temples, the delicate tracery of Gothic cathedrals or the sleek lines of contemporary edifices, stone brings a sense of permanence and gravitas to architectural compositions (Figure 1 & Figure 2).

Figure 1a Egyptian Pyramids (Stewart, 2018) & **Figure 1b** Roman Temple (Ambler, n.d.)

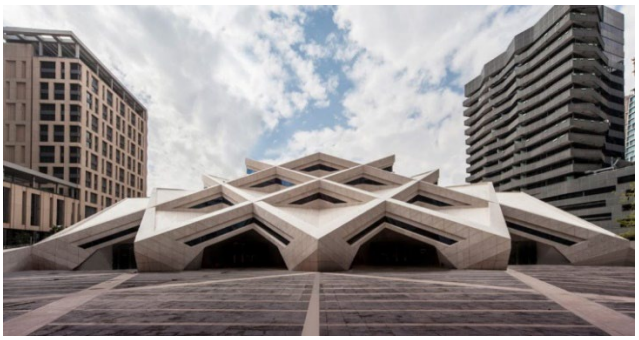

Figure 2a Gothic Cathedral (Steves, n.d.) & **Figure 2b** King Abdullah Grand Mosque (Sawantt, 2021)

Moreover, stone serves as a testament to the harmonious relationship between human creativity and the natural world. Its extraction and transformation require a delicate dance with nature, striking a balance between preservation and utilization. The marriage of human ingenuity and the earth's ancient resources gives birth to structures which survive the judgment of time, embodying the spirit of civilizations past and present. From ancient civilizations such as the Egyptians and Greeks to modern architectural marvels, stone has played a significant role in shaping the built environment. For centuries, architects and builders have harnessed the potentials of stone, utilizing its unique properties to create monumental structures that stand as testaments to human ingenuity.

In this context, this study embarks on an exploration into the world of stone in architecture, unveiling the immense possibilities and inherent beauty that lie within its rugged embrace. By delving into the rich history of stone as a building material, its origins from ancient civilizations to today marvels will be traced. The primary objective of the study is to unearth the potentials of the use of stone in architecture and demonstrate how it can surpass conventional expectations and to shed light on the enduring appeal of stone and its ability to transcend time, culture and architectural styles.

The study aims to captivate readers with the unparalleled potentials of stone in architecture and serves as a gateway to this captivating journey by unraveling the qualities origins of stone, marveling at the intricate processes that shape its composition and imbue it with remarkable resilience. By investigating various aspects such as structural performance, sustainability, aesthetics

and cultural significance, it is aimed to provide a comprehensive understanding of the benefits and opportunities stone presents in contemporary architectural practice. Moving beyond its origins and qualities, the myriad virtues that make stone an exceptional choice for architectural expression will be explored.

To achieve the objectives, this study employs a multidisciplinary approach, encompassing literature review and case studies. Historical examples of stone architecture and contemporary projects that showcase innovative use of stone will be analyzed. To unravel the multifaceted aspects of stone in architecture, the research adopts a comprehensive and interdisciplinary approach. The study delves into an examination of literature, examining historical accounts, architectural theories and case studies that showcase the diverse utilization of stone across different eras and cultures to collage valuable insights into the technical aspects, challenges and innovations related to incorporating stone in contemporary architectural designs.

By undertaking a comprehensive exploration of the potentials of stone in architecture, it is aimed to inspire architects, students and enthusiasts alike, urging them to embrace the transformative possibilities offered by this “noble material” (the description as ‘noble’ was introduced by Assoc. Prof. Dr. Murat Dal in his study titled ‘The Noblest Building Material of Architecture: Natural Stone'). In this enlightening exploration, the readers and researchers are invited to join in unraveling the secrets and embracing the timeless allure of stone in architecture.

2. The Use of Stone in Architectural Compositions

The use of stone in architectural compositions has a rich history spanning thousands of years and continues to be a prominent material in contemporary architecture. Stone offers various attributes that make it desirable for architectural applications, including durability, strength, versatility and aesthetic appeal. Agarwal and Dogne (2016) note that stones are used in different constructions purposes such as for the construction of foundations, walls, columns and arches; for flooring; as damp proof courses, lintels and even as roofing materials; for the face works of buildings; for paving of roads, footpaths and open spaces round the buildings and in the constructions of piers and abutments of bridges, dams and retaining.

Dal (2011) states that the fact that natural stone is resistant to adverse weather conditions, has high load-bearing power and is abundant in nature has enabled it to be used as the noblest building material in architecture for centuries. The fact that natural stone allows building solid structures is one of the most important features that make natural stone superior to other materials.

Stone is a natural material formed over millions of years through geological processes. It possesses inherent *strength and resilience*, allowing buildings constructed with stone to withstand the test of time and environmental challenges such as weathering, earthquakes and fire. This durability has made stone a choice for the construction of long-lasting structures, monuments and historical landmarks. Stone's *versatility* is another factor that contributes to its use in architectural compositions. It can be produced in different dimensions, forms and patterns, allowing architects to create diverse and unique designs. Stones can be produced into intricate details, enabling the creation of ornate facades, decorative elements and sculptural features. Moreover, stone can be used in combination with other materials like glass, metal or wood, offering opportunities for innovative and visually striking architectural compositions.

Aesthetic appeal is a significant aspect of stone's usage in architecture. The natural beauty of stone, with its range of colors, patterns and textures, adds a sense of elegance and timelessness to buildings. Different types of stone, such as marble, granite, limestone and sandstone, each possess distinct visual characteristics, allowing architects to select a stone that aligns with their design intent. Beyond its technical and visual qualities, stone also carries *cultural and symbolic significance*. Throughout history, stone has been associated with stability, permanence and craftsmanship. The use of stone in architectural compositions can evoke a sense of tradition, cultural heritage and a

connection to the past. This symbolic value makes stone a compelling material choice, particularly for projects that aim to convey a sense of timelessness, prestige or reverence (Figure 3).

Figure 3a Roman Water Channel, Pont du Gard, France (National Geographic, n.d.) & **Figure 3b** Rajkumari Ratnavati Girl's School (Crook, 2021)

In a word, the use of stone in architectural compositions offers a multitude of benefits. Its durability, strength, versatility, aesthetic appeal and symbolic value make it a favored material for creating enduring and visually captivating structures. Whether in ancient civilizations or contemporary designs, stone continues to have a significant part in composing the built environment and leaving a lasting impression on architectural compositions.

2.1. Strength, Durability and Constructional Attributes

Stone is a widely used material in architecture due to its strength, durability and various constructional attributes. In ancient times it was chosen for its abundance: As a natural material, it was readily available and dependable. But there's a lot more to the material than one might expect and there's a reason why architects continue to build with it, around it and in it. It's no wonder that it's the chosen material for important monuments and buildings such as places of worship, castles and palaces, as it will outlast almost any other material (McGrath, 2019) (Figure 4).

Figure 4a Middle Age Church, France (Pxhere, n.d.) & **Figure 4b** Steen Castle, Belgium ("Steen Kalesi", n.d.)

Stone exhibits impressive *strength, hardness and toughness* which contributes to its structural integrity. The compressive strength of stone is crucial in load-bearing applications. Different types of stone possess varying strength properties, with igneous rocks typically having higher compressive strength than sedimentary or metamorphic rocks. Balasubramanian (2017) states that factors such as hardness or softness of the components, proportions of the hard and soft minerals, size and shape of the minerals, cohesion, porosity, density and cementing material affect strength, hardness and toughness of stone material. Tensile strength, however, is generally low in stone, making it susceptible to cracking under tension. Its density and compressive strength make it capable of withstanding immense loads and resisting weathering effects. Stone structures have demonstrated remarkable resilience throughout history, enduring nature and the test of time.

Stone is renowned for its exceptional *durability*, making it suitable for long-lasting structures. It is resistant to weathering, erosion and decay, allowing stone buildings to withstand the test of time. The composition and structure of stone play a crucial role in its durability. For instance, igneous rocks like granite are known for their high resistance to wear and tear. Strength and durability are essential properties of building stone.

Stone offers several advantageous *constructional attributes*. Stone is a heterogeneous substance characterized by a wide range of mineral compositions, textures and rock structures. Consequently, the physical and chemical properties and the resulting durability are quite variable. The suitability of a stone for a given building can be easily tested in the laboratory (Winkler, 1997). Some physico-mechanical properties to determine where to use natural stones are needed to be known. For example, while density and porosity negatively affect some physical and mechanical properties, they positively affect heat and sound insulation. Those properties are more critical when it comes to the construction of outdoor spaces and large structures under different climatic conditions (Biçer, 2022).

In addition to being long-lasting and magnificent, buildings made of stone materials also have thick walls that provide many advantages in terms of maintaining *thermal comfort*. While these buildings generally do not need air conditioning in the summer, they can be heated with much less energy in the winter. Today, when considered in terms of increasing environmental pollution and energy use policies, stone buildings are considered to be very healthy and environmentally friendly structures. Stone has excellent *heat resistance* properties, making it efficient for applications involving high temperatures. Stone materials generally require minimal maintenance. They are resistant to staining, scratching and fading and can be easily cleaned with mild detergents and water. This attribute contributes to the longevity and cost-effectiveness of stone installations. Stone exhibits high *thermal mass* that provides absorbing, storing and releasing heat slowly which also helps energy efficiency. This attribute helps adjustment of indoor temperatures, contributing the energy efficiency by reducing the exorbitant heating regulation.

Each stone possesses unique characteristics due to *natural variations* in mineral composition, texture and geological formation. This variation adds an element of distinctiveness to stone applications, ensuring that no two stones are exactly alike. It also allows for customization and selection based on specific aesthetic preferences. Moreover, stone can be laid in different patterns, such as ashlar (rectangular blocks) or rubble (randomly shaped stones), providing a wide range of aesthetic possibilities. Stone possesses excellent *sound insulation* related with its density and natural composition that allows it to reduce noise transmission, making it suitable for applications in sound-sensitive environments like recording studios or concert halls. Stone materials are generally resistant to chemicals, including acids and alkalis. This attribute ensures their suitability for applications that involve exposure to potentially corrosive substances.

2.2. Natural Beauty, Aesthetical Appeal and Visual Attributes

The natural beauty, aesthetical appeal and visual attributes of stone material in architecture are derived from unique colors, patterns, textures and veining. By incorporating stone into architectural designs, architects can create visually captivating spaces that evoke a sense of timelessness and elegance while benefiting from the durability and longevity provided by these materials.

One of the key attributes of stone is its *natural beauty*. Different types of stone possess unique colors, textures and patterns, allowing architects to create visually stunning structures. The use of stone in architecture provides a sense of timelessness and permanence, as it ages gracefully and retains its elegance over centuries. This enduring quality has made stone a preferred choice for the construction of iconic landmarks like the Great Pyramids of Giza (see above Figure 1), the Parthenon and medieval cathedrals (Figure 5). Stone materials, such as marble, granite, limestone and sandstone are formed over thousands or millions of years through geological processes. Their natural beauty lies in their diverse colors, patterns, textures and veining, which are influenced by

factors like mineral composition, sedimentation and metamorphism. These characteristics make each block unique, adding a sense of authenticity and timelessness to architectural structures.


Figure 5a Parthenon, Greece (Sawe, 2018) & **Figure 5b** Duomo di Milano, Italy (Medieval Chronicles, n.d.)

Stone has long been favored in architecture for its *aesthetic appeal*. The use of stone imparts a sense of grandeur, elegance and sophistication to buildings. The rich colors and intricate patterns found in stones like marble create visually striking surfaces that can be used to enhance the overall design and atmosphere of a space. Stone's ability to reflect light can also contribute to a building's visual allure, particularly when it interacts with natural or artificial lighting.

The *visual attributes* of stone materials play a crucial role in their appeal. Stones exhibit a wide *spectrum of colors*, ranging from pure white to deep blacks and everything in between. Variations in color can be attributed to the presence of different minerals or impurities within the stone. Architects can leverage these color variations to create contrasts or harmonies within a design, enabling them to evoke specific moods or aesthetics. The color of structural and monumental stone has challenged the architect for the most effective and harmonious appearance in architectural design since ancient times. The utilization of different color shades of stone has given new life to many existing structures. Stone colors are influenced by the color of the predominant mineral, but also by the adjacent minerals, grain size and grain cement (Winkler, 1997).

The *texture of stone*, such as smooth, rough or textured surfaces, adds depth and tactile interest to architectural elements. Texture influences how light interacts with the stone, contributing to the overall visual experience. Rough textures can create a sense of ruggedness or organic connection, while polished surfaces can convey a more refined and contemporary feel. Many stones exhibit unique *veining patterns*, such as the characteristic marbling in marble. These patterns add visual interest and create a sense of movement and flow within the stone. Architects often use the natural patterns of stones to create focal points, feature walls or statement pieces, enhancing the overall aesthetic appeal of a space.

3. Exploring the Historical Context and Cultural Significance of Stone in Architecture

The historical context and cultural significance of stone in architecture unveils a rich tapestry of human ingenuity, artistic expression and cultural identity. From ancient civilizations to the present day, stone remains an enduring symbol of architectural excellence and a testament to the lasting impact of human creativity on the built environment. Exploring the historical context and cultural significance of stone in architecture provides valuable insights into the evolution of human civilization and the intrinsic relationship between culture and the built environment.

For man, stone represented a basic material that enabled him to express his thoughts in shapes and structures that would facilitate his life and activities. Stone has represented for man a basic material to manifest his ideas in shapes and structures that facilitated activity and life. From this early moment until today, stone in building has had a central role in how man has conceived his built environment, shaped his world and represented the idea of it to others (Karakuş, 2014). As Pereira and Marker (2016) states, collections of samples of natural stones are an important source

of information especially if they are accompanied by information on buildings and structures in which they have been used, technical properties and aesthetic characteristics. Stone has played a pivotal role in architecture throughout history and its usage has varied across different cultures and time periods.

The historical context of stone in architecture spans ancient civilizations like Egypt, Greece and Rome, while its cultural significance is evident through symbolism, architectural expression, cultural identity and periods of revival. Notable examples include the Great Pyramids of Giza, the Parthenon, the Taj Mahal, Gothic cathedrals and the Palace of Versailles (Figure 6) (see above Figure 1 & Figure 5). These structures stand as enduring testaments to the historical and cultural importance of stone in architecture.

Figure 6a Taj Mahal, India (Unesco World Heritage Convention, n.d.) & **Figure 6b** Palace of Versailles, France (Chateau de Versailles, n.d.)

3.1. Historical Context

The history of man reveals clearly that the origins of architecture are deeply intertwined with buildings in stone (Karakuş, 2014). The use of stone in architecture allowed the creation of permanent structures, marking a significant shift from temporary shelters to enduring monuments. The construction of megalithic structures, such as Stonehenge or the Pyramids, showcases the awe-inspiring capabilities of early civilizations in manipulating and utilizing stone. Natural stones, with their elegance, durability and potential richness, have been one of the indispensable branches of art and building elements of humankind for centuries; Hittites, ancient Egyptians, Phrygians, Mesopotamian Civilization, Persians, Lydians, Ancient Greeks, Romans, Seljuks, Ottomans and many other civilizations used it in their sculptures, monuments and magnificent structures that have survived to this day and shed light on their era (Dal, 2011) (Figure 7).

Figure 7a Yakutiye Madrasa Erzurum, Türkiye (TRT Haber, n.d.) & **Figure 7b** Great Ziggurat of Ur, Iraq ("Sumerian Period", n.d.)

Ancient Civilizations: Stone has been a fundamental material in architecture since ancient times. For instance, in ancient Egypt, the use of stone was prevalent due to the abundance of limestone along the Nile River. The Great Pyramid of Giza, exemplify the remarkable mastery of stone construction during this period (Figure 8). All three of Giza's famed pyramids and their elaborate burial complexes were built during a frenetic period of construction, from roughly 2550 to 2490 B.C. The pyramids were built by Pharaohs Khufu, Khafre and Menkaure (Handwerk, 2011) (see above Figure 1).

Classical Greece and Rome: Stone played a pivotal role in the architectural achievements of ancient Greece and Rome. Parthenon, temple that dominates the hill of the Acropolis at Athens. It was built in the mid-5th century BCE and dedicated to the Greek goddess Athena Parthenos ("Athena the Virgin"). The temple is generally considered to be the culmination of the development of the Doric order, the simplest of the three Classical Greek architectural orders ("Parthenon", n.d.). The Parthenon utilized marble to create an iconic temple. Colosseum, also called Flavian Amphitheatre, giant amphitheater built in Rome under the Flavian emperors. Construction of the Colosseum was begun sometime between 70 and 72 CE during the reign of Vespasian. It is located just east of the Palatine Hill, on the grounds of what was Nero's Golden House. The artificial lake that was the centerpiece of that palace complex was drained and the Colosseum was sited there, a decision that was as much symbolic as it was practical ("Colloseum", n.d.). The Colosseum showcased the grandeur of Roman architecture, with its massive stone structure and arches (Figure 8).

Figure 8a Great Pyramid of Giza, Egypt (Stokel-Walker, 2023) & **Figure 8b** Roman Colosseum ("Roma Kolezyumu", n.d.)

3.2. Cultural Significance

Stone, the oldest building material in human history, is found in nature as a mineral. Natural stone, which can be used in more than one area as a construction material, affects the appearance of the architectural products and the atmosphere of the created space with its characteristic features. Natural stone has different properties depending on the region where it is extracted. Thus, every building built carries the character and spirit of the region, as it is created with the materials of the region (Korkmaz & Özcan, 2021). Throughout various cultures, stone has been revered for its symbolic and cultural significance. In ancient Egypt, for example, stone, particularly limestone and granite, was believed to possess divine qualities and was used extensively in the construction of temples and tombs for pharaohs. The intricate carvings and hieroglyphics on stone surfaces conveyed religious beliefs and historical narratives.

Symbolism and Prestige: Stone carried symbolic meaning and represented prestige in architectural contexts. The Taj Mahal in India, built in the 17th century, is a prime example (Figure 9). Constructed primarily using white marble, it symbolizes love and devotion, while the use of stone emphasizes its immortality and enduring beauty.

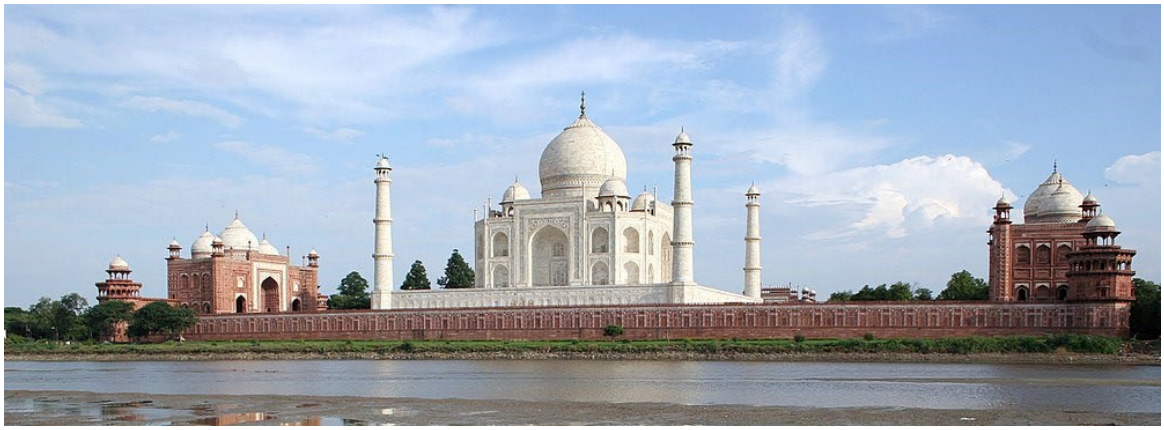

Figure 9 Taj Mahal (Handicrafts, 2019)

Architectural Expression: Stone allowed architects to express their artistic vision and showcase their skills. The intricately carved stone facades of the Gothic cathedrals in Europe, such as Notre-Dame Cathedral in Paris (Figure 10), exemplify the level of detail and craftsmanship achieved by stonemasons. Constructed between the 12th and 14th centuries, Notre Dame de Paris has borne witness to countless historical events, wars and revolutions. The cathedral's breathtaking stained-glass windows, elaborate stone carvings and soaring spires, which reach heights of over 100 meters (Friends of Notre-Dame de Paris, n.d.). This structure served as spiritual and architectural masterpieces, integrating sculpture, stained glass and flying buttresses.

Figure 10a Notre-Dame Cathedral (Afar, n.d.) & **Figure 10b (**Friends of Notre-Dame de Paris, n.d.)

Cultural Identity: The use of stone in architecture often reflected regional resources and cultural identity. For instance, the Inca civilization in South America employed massive stone blocks, precisely carved and fitted together, in structures like Machu Picchu (15th century) (Figure 11). The buildings were given walls of drastically different sizes, each made up of stones that had been stacked with impeccable accuracy. It's just one example of the Inca's specialty when it came to construction: ashlar or dry stone masonry. The masonry might sway and move, but it wouldn't topple, always settling back into place (Tour in Peru, n.d.). These constructions demonstrated the Inca's sophisticated understanding of stone craftsmanship and their deep connection to the natural environment.

Figure 11a Machu-Picchu ("Machu Picchu", n.d.) & **Figure 11b** ("Machu Picchu Gateway", n.d.)

Revival and Reinvention: Stone experienced a revival during the Renaissance and Baroque periods. Palace of Versailles, former French royal residence and center of government, now a national landmark. It is located in the city of Versailles, Yvelines department, Ile-de-France region, northern France, 16 km west-southwest of Paris. As the center of the French court, Versailles was one of the grandest theatres of European absolutism ("Palace de Versailles", n.d.). The Palace of Versailles in France (17th century) (Figure 12) (also see above Figure 6) showcases the grandeur and opulence of this era, with its extensive use of stone in the palace's façade, interior and gardens. Stone was chosen for its association with classical aesthetics and the desire to evoke the glory of ancient Rome.

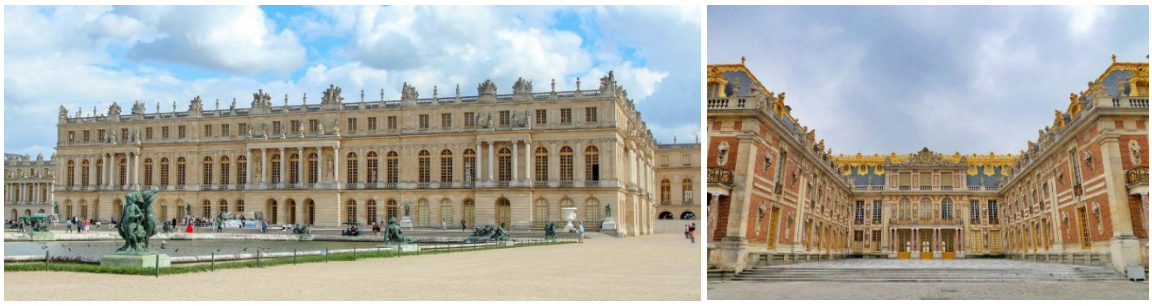

Figure 12a Palace Versaiiles (Palace of Versailles, n.d.) & **Figure 12b** (World in Paris, n.d.)

4. Seamlessly and Aesthetically Blending with the Surroundings

The use of stone has a long-standing history and remains popular due to its unique qualities, including strength, durability and aesthetic appeal. When strategically utilized, stone can create visually striking buildings that seamlessly blend with their surroundings (Figure 13).

Stone has been a preferred building material for centuries due to its inherent strength. Its capacity to bear heavy loads makes it suitable for constructing large and structurally complex buildings. Additionally, stone's durability allows structures to withstand the test of time, often lasting for centuries without significant deterioration. When it comes to visually striking architecture, stone offers a diverse range of textures, colors and patterns. This versatility enables architects to design buildings that harmonize with their natural or urban environments. By selecting stone that align with the surrounding landscape or urban context, architects can create structures that blend seamlessly with surroundings, enhancing the visual appeal.

Figure 13a & Figure 13b Sancaklar Mosque, Türkiye (Mairs, 2015)

To achieve a seamless integration with the surroundings, architects consider various factors. They analyze the local geology and select stone types that are indigenous to the region, ensuring a harmonious connection between the building and its environment. Careful attention is paid to the building's scale, shape and material composition to ensure that the stone elements complement the natural or urban landscape. The use of stone in architecture offers a unique opportunity to create structures that seamlessly blend with their surroundings, both aesthetically and functionally. Stone has been utilized in architecture for centuries due to its durability, versatility and natural beauty. When employing stone in a way that harmonizes with its environment, several key factors come into play.

Firstly, the choice of stone type is crucial. Different varieties of stone possess distinct characteristics such as color, texture and veining. Architects must carefully select a stone that complements the surrounding natural or built environment. For instance, if the surroundings feature predominantly earthy tones, a warm-hued stone like sandstone or limestone could be chosen to achieve visual integration. Next, the design and placement of stone elements should reflect a deep understanding of the site's context. Architects must consider the topography, vegetation and existing structures to ensure a seamless blend. By utilizing stone in a way that follows the natural lines and contours of the land, the architecture can appear as if it is emerging organically from the environment.

Figure 14 Oslo Opera House, Norway (Swegon Air Academy, 2022)

Furthermore, the size, shape and arrangement of stone elements play a significant role. The scale of stones should be in proportion to the overall structure and its surroundings. Carefully crafted stone walls, facades, or pathways can mimic the patterns found in the adjacent landscape, creating a sense of harmony. Additionally, irregularly shaped stones or a mix of different sizes can mimic the randomness found in nature, enhancing the aesthetic appeal. The craftsmanship involved in working with stone is also critical. Attention to detail is essential to achieve a seamless integration. Skilled stonemasons can create precise joints, intricate carvings, or textured surfaces that mimic natural formations. This craftsmanship helps establish a tactile connection between the architecture and its surroundings, enhancing the overall aesthetic experience.

Lastly, the long-term maintenance and preservation of stone elements should be considered. Regular cleaning and maintenance are necessary to prevent weathering or staining that could disrupt the intended blend with the surroundings. Architects should also pay attention to sustainability by sourcing stone locally, minimizing transportation impacts and considering the life cycle of the materials used. The use of stone in architecture allows for the creation of visually striking buildings that seamlessly blend with their surroundings. By capitalizing on the material's inherent strength, durability and aesthetic qualities, architects can design structures that both stand the test of time and enhance the beauty of their environment. The careful selection of stone types, attention to detail in construction and consideration of the building's context all contribute to achieving a harmonious integration between architecture and nature or the urban fabric.

In summary, seamlessly and aesthetically blending stone with the surroundings in architecture requires careful consideration of stone type, design, placement, scale, craftsmanship and long-term maintenance. By incorporating these elements thoughtfully, architects can create structures that not only harmonize with their natural or built environment but also evoke a sense of timelessness and connection to the surrounding landscape.

5. Picturesque Buildings Showcasing the Brilliant Use of Stone Material

The use of stone in architecture has been celebrated for its brilliant combination of design flexibility and architectural freedom. Stone is a versatile and durable material that offers a wide

range of aesthetic possibilities, allowing architects to create stunning structures while ensuring longevity and stability. Design flexibility is one of the key advantages of using stone in architecture. Additionally, stone offers a wide variety of colors, textures and finishes, providing architects with a diverse palette to work with. Architectural freedom is another benefit of using stone. Its strength and durability ensure the longevity of the building, while also providing a sense of permanence and stability. With stone, architects can create grand structures that stand the test of time, evoking a sense of awe and admiration.

The examples below demonstrate how the brilliant use of stone in architecture, considering design flexibility and architectural freedom, can result in awe-inspiring structures that stand as testaments to human creativity and ingenuity.

Taj Mahal, India: The Taj Mahal (Figure 15) (also see above Figure 6 & Figure 9) is a masterpiece of Mughal architecture and an enduring symbol of India. Constructed in the 17th century, it showcases the exquisite use of white marble. An immense mausoleum of white marble, built in Agra between 1631 and 1648 by order of the Mughal emperor Shah Jahan in memory of his favorite wife, the Taj Mahal is the jewel of Muslim art in India and one of the universally admired masterpieces of the world's heritage (Unesco World Heritage Convention, n.d.). The primary stone used in the construction of the Taj Mahal is a white marble. The choice of white marble was deliberate, as it symbolizes purity and serves as a canvas for the intricate decorative elements. The stone's durability and resilience have played a crucial role in preserving the Taj Mahal's grandeur over the centuries. The marble used in its construction has withstood the test of time, despite exposure to environmental factors. However, pollution, weathering and human activity have posed challenges, necessitating conservation efforts to maintain the monument's splendor.

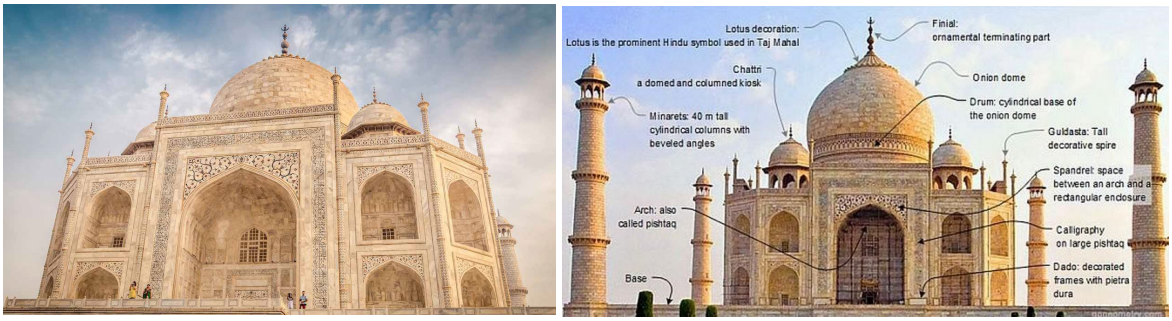

Figure 15a Taj Mahal, India (Gritora, 2022) & **Figure 15b** (Handicrafts, 2019)

Sagrada Familia, Spain: Designed by Antoni Gaudí, the Sagrada Familia in Barcelona (Figure 16) is an architectural marvel that showcases the exceptional use of stone. The Sagrada Familia in Barcelona, designed by Antoni Gaudí, is a prime illustration of this. Gaudí's dream-like vision combined Gothic and Art Nouveau elements, resulting in a transcendent and otherworldly atmosphere within the cathedral (Biçer & Erdinç, 2023b). The basilica features a combination of materials, including limestone, granite and basalt. The stone elements are intricately carved and sculpted, creating a dynamic and organic appearance. The various textures and colors of the stone enhance the building's visual complexity, while the strength and durability of the materials ensure its longevity.

Figure 16a Sagrada Familia, Spain ("Sagrada Familia", n.d.) & **Figure 16b** (Spain Official Tourism, n.d.)

Petra, Jordan: Petra is a UNESCO World Heritage Site an ancient city and a remarkable example of the use of stone in architecture. The availability of high-quality sandstone in Petra was a key factor in its architectural design. The sandstone cliffs provided a readily accessible and durable material for construction. The Nabateans skillfully carved and shaped the stone to create intricate facades, temples, tombs and water channels. The reddish hue of the sandstone adds to the unique aesthetic appeal of the city. Secondly, the use of stone in Petra served practical purposes. The solid stone structures provided stability and strength, allowing buildings to withstand the test of time. Moreover, the choice of stone in Petra also had cultural and symbolic significance. The Nabateans believed that the rock formations held spiritual and religious importance. The integration of natural rock formations into their architecture created a harmonious connection between the man-made structures and the surrounding environment. Lastly, the durability of stone has contributed to the preservation of Petra over centuries. The stone structures have withstood natural forces, including erosion and earthquakes, protecting the legacy of this ancient city.

Figure 17a Petra, Jordan (Gillan, 2020) & **Figure 17b** (Memphis Tours, n.d.)

Fallingwater, USA: Designed by Frank Lloyd Wright, Fallingwater (Figure 18) is an iconic residence that exemplifies the integration of stone and nature. In Fallingwater, Wright anchored a series of reinforced concrete "trays" to the natural rock. Cantilevered terraces of local sandstone blend harmoniously with the rock formations, appearing to float above the stream below (Frank Lloyd Wright Foundation, n.d.). The house is built over a waterfall and the use of local sandstone anchors the structure to the site. The stone walls and terraces echo the geological formations of the area, while large cantilevered balconies create a sense of dramatic suspension. The natural beauty and durability of the stone enhance the building's integration with the surrounding forest and waterfall.


Figure 18a & Figure 18b Fallingwater, Pennsylvania (Gibson, 2017)

The Colosseum, Italy: The Colosseum (Figure 19) (also see above Figure 8) is an iconic symbol of ancient Roman engineering. The massive stone blocks and arched openings demonstrate the architectural freedom provided by stone, enabling the creation of a colossal amphitheater that hosted grand spectacles. The primary building material used in the Colosseum is travertine limestone, a type of sedimentary rock abundant in the region. The extensive use of stone in the Colosseum served multiple purposes. Firstly, it provided a sturdy foundation and structural support. The massive stone blocks formed the base of the amphitheater, ensuring stability and strength. The use of stone also allowed the architects to create a tiered seating arrangement, accommodating a large number of spectators and maximizing visibility. Furthermore, stone was utilized for decorative purposes, enhancing the overall aesthetic of the Colosseum. Elaborate architectural details, such as columns, arches and friezes, were carved into the stone surfaces, showcasing the artistic prowess of Roman craftsmen.


Figure 19a Colosseum, Italy ("Colloseum", n.d.) & **Figure 19b** ("Ruins of Walkway at Colloseum", n.d.)

The Guangzhou Opera House, China: The Guangzhou Opera House (Figure 20), located in Guangzhou, China, is a remarkable architectural masterpiece designed by the internationally renowned architect Zaha Hadid. The use of stone in the opera house's construction and design is integral to its aesthetic appeal and structural integrity, reflecting both cultural and technical considerations. Stone plays a significant role in the exterior facade of the Guangzhou Opera House, contributing to its iconic and futuristic appearance. Large-scale granite panels are meticulously arranged to create a flowing and undulating form, reminiscent of the nearby Pearl River. The use of stone in this manner showcases the architect's vision and the technical expertise required to achieve such a complex design. Beyond its visual impact, stone also serves functional purposes in the opera house. It acts as a protective layer against weathering and provides insulation, contributing to the energy efficiency. The durability and longevity of stone materials ensure the opera house's sustainability and continued structural integrity. The selection of stone materials in the Guangzhou Opera House is also influenced by cultural context. The use of granite and marble,

traditional materials in Chinese architecture, pays homage to the country's rich cultural heritage while blending harmoniously with the contemporary design language of the opera house. This fusion of traditional and modern elements creates a unique architectural identity.

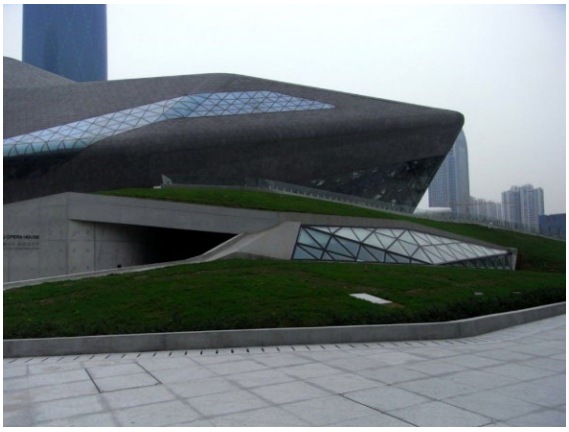
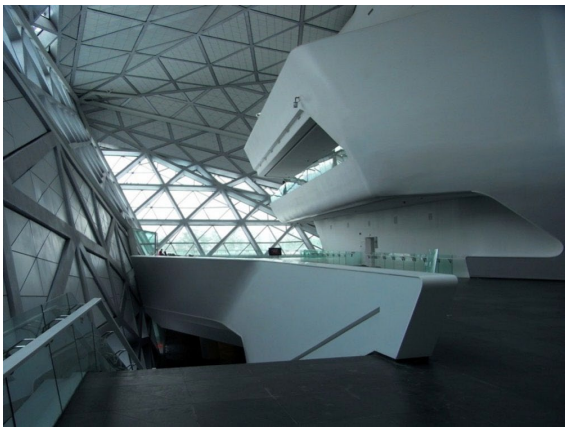

Figure 20a & Figure 20b Guangzhou Opera House, China (Sawantt, 2021)

King Abdullah Grand Mosque, Saudi Arabia: The King Abdullah Grand Mosque (Figure 21) is a prominent religious landmark in Saudi Arabia. The mosque is renowned for its grandeur and architectural magnificence, with the use of stone playing a significant role in its design and construction. Stone has been utilized extensively in various elements of the King Abdullah Grand Mosque, imbuing it with a sense of solidity, timelessness and reverence. The predominant stone material employed is marble, known for its durability, elegance and association with luxury and opulence. Marble is renowned for its ability to be carved and polished into intricate patterns, making it an ideal choice for intricate architectural details. The carefully selected stone cladding enhances the building's aesthetics while serving as a protective layer against environmental factors, ensuring the longevity of the structure. The contrast between light and dark shades of stone adds depth and visual interest to the external appearance of the mosque.

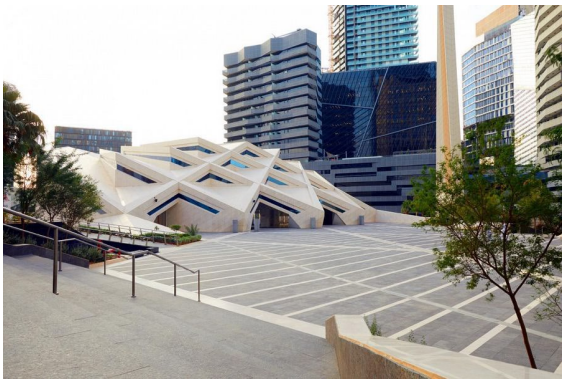
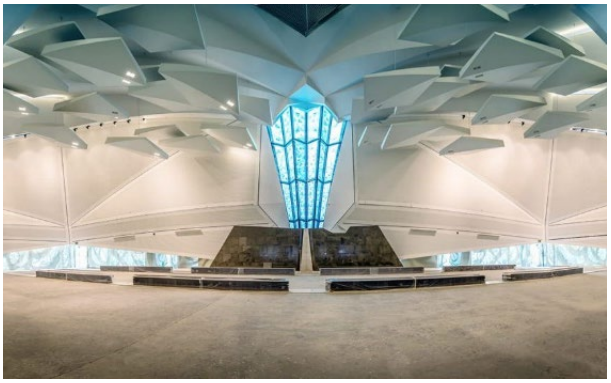

Figure 21a King Abdullah Grand Mosque, Saudi Arabia (Al-Saleh, 2022) & **Figure 21b** (Sawantt, 2021)

6. Timeless Power of Visual Expression of Stone Material

In all the iconic and visually stunning examples below, the effective and powerful use of stone in architecture is evident through the careful selection of materials, attention to craftsmanship and integration with the natural or cultural context. The stone enhances the buildings' aesthetic appeal, durability and visual expression, creating architectural masterpieces which inspire and captivate.

6.1. Casa Mila, by Antoni Gaudi

Casa Mila (Figure 22), also known as La Pedrera, is a renowned architectural masterpiece in Barcelona, Spain, designed by the renowned Catalan architect Antoni Gaudi. It exemplifies the exceptional use of stone, showcases a unique aesthetic and possesses a timeless power of visual expression.


Figure 22a Casa Mila, Spain (Arkitektuel, n.d.) & **Figure 22b** (La Pedrera, n.d.)

Designed by the world-famous Catalan architect Antoni Gaudi, Casa Mila is one of the most iconic buildings in Barcelona. Casa Mila, meaning House of Mila, was designed in 1912 for the use of Roser Segimon and Pere Mila. The building, also known as La Pedrera, is considered one of the most important representatives of the Modernista movement, the Spanish interpretation of Art Nouveau, in Barcelona. Casa Mila is an organic building. The building looks as if it has been carved from the ground and is trying to get away from the artificial appearance of architectural works. In order to achieve this structural organicity, the building is divided into two: structure and shell. The stone walls on the facade of the building have no load-bearing properties. Steel beams, which follow the same path as the inclined shape of the building, transfer the load of the facade to the columns (Arkitektuel, n.d.).

One of the most striking features of Casa Mila is its innovative and imaginative use of stone. Gaudi utilized limestone, a locally sourced material, to create a sense of harmony with the surrounding urban fabric. The stone is skillfully employed throughout the building, both in the load-bearing structure and the ornamental elements, showcasing its versatility and strength (Figure 23).


Figure 23a & Figure 23b Casa Mila, Spain (Casa Battlo, n.d.)

The building's facade is a testament to Gaudi's artistic vision and mastery of stone. The undulating organic forms of the exterior walls create a dynamic and sculptural appearance. Gaudi meticulously arranged the stone blocks, carefully shaping each one to fit the desired curves and contours. This attention to detail results in a visually captivating facade that appears almost fluid and alive. Gaudi's use of stone extends beyond the facade. The rooftop of Casa Mila is adorned with a forest of chimney stacks, known as espanta-somnis or “dreamcatchers”. These structures are constructed using stone and exhibit intricate detailing. The chimney stacks not only serve a functional purpose but also contribute to the building's aesthetic appeal, adding a whimsical and surreal touch to the design.

Figure 24a & Figure 24b & Figure 24c Casa Mila, Spain (Knowlton School, n.d.)

Moreover, the stone elements of Casa Mila exhibit a timeless power of visual expression. Gaudi's design embraces the natural qualities of the stone, allowing its texture and color variations to shine. The limestone used in Casa Mila features a warm, golden hue, which enhances the building's connection to the Mediterranean environment and creates a sense of harmony with the cityscape. The stone surfaces of Casa Mila also showcase Gaudi's attention to craftsmanship (see above Figure 24). The intricate carvings and ornamentation found on the balconies, windows and other architectural details demonstrate the meticulous care taken in the execution of the stone. This level of craftsmanship not only enhances the building's aesthetic quality but also contributes to its enduring appeal. Furthermore, Casa Mila's use of stone embodies Gaudi's philosophy of integrating architecture with nature. The fluid lines and biomorphic forms of the stone elements emulate the organic shapes found in the natural world. The building's undulating facade and the sculptural chimney stacks evoke the rugged cliffs and rock formations seen along the Catalan coastline, establishing a profound connection between architecture and its surroundings.

Casa Mila stands as a testament to the quality use of stone, aesthetics and timeless power of visual expression in architecture. Gaudi's innovative approach to stone construction and his careful use of the details have resulted in a building that seamlessly blends with its environment while showcasing the enduring beauty and strength of the material. Casa Mila's organic forms, intricate stone carvings and harmonious integration with nature make it a remarkable example of architectural excellence.

6.2. The City of Culture of Galicia, by Peter Eisenman

The City of Culture of Galicia (Figure 25), designed by Peter Eisenman, is a significant cultural complex located in Santiago de Compostela, Spain. While the complex utilizes various construction materials, the use of stone stands out for its quality, aesthetics and timeless power of visual expression.

Figure 25a & Figure 25b City of Culture of Galicia, Spain (Eisenman Architects, n.d.)

One of the notable aspects of the City of Culture is its extensive use of granite, a traditional and locally abundant stone in Galicia. Eisenman's design incorporates granite as a primary material, reflecting the region's architectural heritage and establishing a connection with the surrounding

landscape. The use of granite not only highlights the durability and strength of the material but also adds a sense of timelessness to the complex.

The hilltop site overlooks the medieval center of Santiago and required new links to the city through vehicular and pedestrian paths. The design of pedestrian caminos, or ways, on the site is derived from the city's historic street pattern. The caminos run between the buildings and lead to a multi-level plaza used for outdoor events. The forms of the buildings, related but different, seem to roll out of the landscape and echo the shape of the surrounding hills. The use of local stone, design of double roofs and an on-site power plant contribute to its environmental sustainability (Eisenman Arhitects, n.d.).

The aesthetics of the City of Culture are characterized by a unique interplay of geometric forms and abstract shapes. Eisenman's design embraces an architectural language known for its deconstructivist tendencies, with fragmented and angular elements that challenge conventional spatial perceptions. Within this framework, the use of stone contributes to the overall visual expression by providing a solid and grounded presence amidst the dynamic and abstract forms (Figure 26). The stone elements within the complex are carefully crafted with attention to detail. The granite surfaces exhibit a refined finish, showcasing the natural beauty and texture of the material. The precision in the stone construction and the meticulous placement of each granite block contribute to the aesthetic appeal and create a sense of craftsmanship.

Figure 26a & Figure 26b City of Culture of Galicia, Spain (Eisenman Architects, n.d.)

Moreover, the City of Culture of Galicia illustrates the timeless power of visual expression through the use of stone. The granite's inherent durability ensures that the complex will maintain its aesthetic integrity for generations to come. The material's natural color variations and textural qualities create a visually captivating environment, evolving with the play of light and shadow throughout the day. The presence of stone within the City of Culture also establishes a dialogue with the historic architecture of Santiago de Compostela. The integration of granite reflects the region's building traditions and pays homage to the rich cultural heritage of Galicia. This connection with the past creates a sense of continuity and contributes to the complex's significance as a cultural landmark (Figure 27).

Figure 27a & Figure 27b City of Culture of Galicia, Spain (Eisenman Architects, n.d.)

Furthermore, the use of stone in the City of Culture serves as a metaphorical representation of the region's identity and geological history. Galicia is known for its granite quarries and the incorporation of this material within the complex reinforces the relationship between architecture, culture and the natural environment. The stone acts as a link, symbolizing the deep-rooted connection between the built environment and the land it inhabits.

The City of Culture of Galicia designed by Peter Eisenman showcases the quality use of stone, aesthetics and the timeless power of visual expression. The extensive use of granite, the careful craftsmanship and the integration with the region's architectural heritage contribute to the complex's enduring beauty. The stone elements establish a sense of solidity and permanence within the abstract and dynamic architectural forms, creating a visually striking environment that reflects the cultural and geological context of Galicia.

7. Conclusion

As Korkmaz (2023) states that it is important for designers to carefully follow the developments in material technology and to reveal the unlimited potential in building design with the right material selection, without consuming natural resources and without harming the nature. In this sense, throughout this study, the vast potentials of the use of stone in architecture and uncovered a myriad of exciting possibilities have been explored. By examining the attributes of stone, historical precedents and contemporary case studies it has been demonstrated that stone remains a material of immense value in the modern era. Its durability, versatility and aesthetic appeal make it a compelling preference for architects to create striking and sustainable structures.

By embracing the potentials of stone, architects can create buildings that not only captivate the eye but also embody durability, sustainability and cultural significance. The integration of stone into contemporary architectural practice can foster a renewed appreciation for traditional craftsmanship, as well as inspire innovative techniques and technologies for stone extraction, processing and installation.

Moving forward, further research is needed to explore advanced engineering methodologies for optimizing stone structures, as well as to develop sustainable quarrying and extraction practices to minimize environmental impact. Additionally, investigations into the application of new technologies, such as digital fabrication and parametric design, can unlock even greater design possibilities and enhance the efficiency of working with stone.

In conclusion, the potentials of the use of stone in architecture are vast and inspiring. This study has underscored the enduring relevance of stone as a fundamental building material, capable of creating striking, sustainable and culturally significant architectural designs. By harnessing its inherent qualities and pushing the boundaries of design innovation, architects can shape a built environment that celebrates the timeless beauty and resilience of stone. By integrating tradition and innovation, architectural marvels that not only stand as testaments to human creativity but also harmonize with our natural surroundings can be created. The potentials of the use of stone in architecture are boundless and it is up to us to unlock them and shape a more sustainable and visually captivating built environment for generations to come.

References

Afar. (n.d.). *Cathedrale Notre Dame de Paris.* Access Address (05.10.2023): https://www.afar.com/places/cathedrale-notre-dame-de-paris-paris

Agarwal, V., Suruchi, S. & Dogne, N. (2016). Stones – An Architectural Overview, *Journal of Ceramics and Concrete Sciences*, 1 (1), 1-18. e-ISSN: 2582-1938. India: MAT Journals. Access Address (05.10.2023): https://www.researchgate.net/publication/316923803_Stones-An_Architectural_Overview

Arkitektuel. (n.d.). *Casa Mila.* Access Address (05.10.2023): https://www.arkitektuel.com/casa-mila/

Al-Saleh, K. (2022, 12, 16). KAFD Grand Mosque: Architectural Masterpiece. Access Address (05.10.2023): https://www.wafyapp.com/en/article/the-kafd-grand-mosque-in-riyadh-an-architectural-masterpiece

Ambler, J. (n.d.). *Roma Mimarisi.* Access Address (05.10.2023): https://tr.khanacademy.org/humanities/anci

ent-art-civilizations/roman/x7e914f5b:beginner-guides-to-roman-architecture/a/roman-architecture
Balasubramanian, A. (2017). *Properties of Building Stones*. Technical Report. India: University of Mysore. 10.13140/RG.2.2.33338.29122
Biçer, A. (2022). The Thermal and Mechanical Properties of Building Stones from the Afyon, İzmir, Muğla and Denizli Region. NATURENGS, 3 (1), 24-32. DOI: 10.46572/naturengs.1096613. Access Address (01.10.2023): https://dergipark.org.tr/en/download/article-file/2345364
Biçer, Ü. & Erdinç, S.Y. (2023a). "Material" as a Leading Tool in Architectural Design. In Ü. T. Arpacıoğlu & S. Akten (Eds.). *Architectural Sciences, Sustainable Materials and Built Environment*, (374-408). ISBN: 978-625 367 287 4. Ankara: IKSAD Publications. Access Address (10.10.2023): https://iksadyayinevi.com/wp-content/uploads/2023/10/Architectural-Sciences-Sustainable-Materials-and-Built-Environment.pdf
Biçer, Ü. & Erdinç, S.Y. (2023b). Paper to Parametric: Dreams and Imagination in Architecture, *Yakın Mimarlık*, 7 (2), 284-304. e-ISSN: 2547-8729.
Casa Batllo. (n.d.). La Pedrera, Casa Mila. Access Address (08.10.2023): https://www.casabatllo.es/en/antoni-gaudi/casa-mila-la-pedrera/
Chateau de Versailles (n.d.). *The Palace: From the Seat of Power to a Museum of the History of France.* Access Address (08.10.2023): https://en.chateauversailles.fr/discover/estate/palace
Crook, L. (2021, 05, 27). *The Dezeen Guide to Stone in Architecture, Interiors and Design.* Access Address (08.10.2023): https://www.dezeen.com/2021/05/27/dezeen-stone-guide-architecture-interiors design/
Colosseum. (n.d.). *In Encyclopaedia Britannica*. Access Address (08.10.2023): https://www.britannica.com/topic/Colosseum
Colloseum. (n.d.). Unsplash. Access Address (08.10.2023): https://unsplash.com/s/photos/colloseum
Dal, M. (2011). Mimarinin En Soylu Yapı Malzemesi Olarak: Doğal Taş, *Mimalıkta Malzeme Dergisi*, 19 (3), 90-95. ISSN: 1306-6501.
Dal, M. & Tokmak, M. (2020). Durability Properties of Silivri Limestone and Usability in Stone Building Restorations. *International Journal of Pure and Applied Sciences*, 6 (1), 33-41. 10.29132/ijpas.724073. Access Address (08.10.2023): https://dergipark.org.tr/en/download/article-file/1179583
Dal, M. & Yardımlı, S. (2021). Taş Duvarlarda Yüzey Bozunmaları, *Kent Akademisi*, 14 (2), 428-451. ISSN: 2146-9229. https://doi.org/10.35674/kent.922313. Access Address (01.10.2023): https://dergipark.org.tr/tr/download/article-file/1719390
Eisenman Architects. (n.d.). *City of Culture of Galicia.* Access Address (08.10.2023): https://eisenmanarchitects.com/City-of-Culture-of-Galicia-2011
Frank Lloyd Wright Foundation. *Fallingwater.* Access Address (01.10.2023): https://franklloydwright.org/site/fallingwater/
Friends of Notre Dame Paris. (n.d.). *West Façade*. Access Address (01.10.2023): https://www.friendsofnotredamedeparis.org/cathedral/artifacts/west-facade/
Gibson, E. (2017, 06, 07). *Frank Lloyd Wright integrated architecture into Nature at Fallingwater.* Access Address (01.10.2023): https://www.dezeen.com/2017/06/07/fallingwater-frank-lloyd-wright pennsylvania-house-usa-150th-birthday/
Girotra, M. (2022, 05, 16). *Taj Mahal & It's Secret Room: What is the Truth?.* Access Address (01.10.2023): https://www.herzindagi.com/society-culture/taj-mahal-controversy-22-locked-rooms-secrets-article-199112
Gillan, J. (2020, 08, 27). *Petra, Jordan: Gorgeous Rose-Red City and Wonder of the World.* Access Address (01.10.2023): https://www.ancient-origins.net/ancient-places-africa/magnificent-ancient-city-petra-jordan-00214
Handicrafts, M. K. (2019, 01, 19). *Taj Mahal and Its Marble Inlay Art.* Access Address (01.10.2023): https://www.artefactindia.com/Taj-Mahal-and-its-marble-inlay-art
Handwerk, B. (2011). Pyramids at Giza. National Geographic. Access Address (01.10.2023): https://www.nationalgeographic.com/history/article/giza-pyramids
Karakuş, G. (2014). *Çağdaş Türk Mimarisinde Doğal Taş*. İstanbul: İMİB İstanbul Maden İhracatçıları Birliği. ISBN: 000-000-00-0.
Knowlton School. (n.d.). Casa Mila. Access Address (01.10.2023): https://knowltondl.osu.edu/index.php/Detail/objects/4909
Korkmaz, E. (2023). The Effect of Material Technology. M. Dal & L. Karataş (Eds.). *Architectural Sciences and Theory, Practice and New Approaches I*, (229-262). ISBN: 978-625-367-072-6. Ankara: IKSAD Publications. Access address (15.09.2023): https://iksadyayinevi.com/wp content/uploads/2023/05/Architectural-Sciences-and-Theory-Practice-and-New-Approaches-I.pdf
Korkmaz, B. & Özcan, U. (2020). Geleneksel Yerleşimler Üzerinden Mimaride Doğal Taş Kullanımı,

Natura, Kasım Aralık 2020, 98 104. ISSN: 1308 8319. Access Address (04.10.2023): https://www.naturadergi.com/anasayfa/geleneksel-yerlesimler-uzerinden-mimaride-dogal-tas-kullanimi/

La Pedrera. *Casa Mila (La Pedrera): A Total Work of Art.* Access address (15.09.2023): https://www.lapedrera.com/en/la-pedrera

Machu Picchu. In IStock by Getty Images. Access address (15.09.2023): https://www.istockphoto.com/tr/foto%C4%9Fraflar/machu-picchu-panoramic

Machu Picchu Gateway (n.d.). *Machu Picchu Travel Information*. Access address (15.09.2023): https://www.machupicchu.org/machu_picchu_travel_tourist_information.htm

Mairs, J. (2015, 04, 06). *Terraced Landscaping Surrounds Concrete and Stone of Emre Arolat's Sancaklar Mosque.* Access address (15.09.2023): https://www.newscientist.com/article/2362300-hidden-corridor-in-egypts-great-pyramid-mapped-with-cosmic-rays/

McGrath, K. (2019). 15 Magnificent Structures Built from Stone. Access Address (01.10.2023): https://www.architecturaldigest.com/story/magnificent-structures-built-from-stone

Medieval Chronicles (n.d.). *Medieval Cathedral.* Access Address (04.10.2023): https://www.medievalchronicles.com/medieval-life/medieval-religion/medieval-cathedral/

Memphis Tours. (n.d.). *Petra.* https://www.memphistours.com/Jordan/Jordan Travel Guide/Petra Attractions/wiki/Petra

National Geographic (n.d.). *Traces of Ancient Rome in the Modern World.* Access Address (04.10.2023): https://education.nationalgeographic.org/resource/traces-ancient-rome-modern-world/

Öktem Erkartal, P. (2022). Materiality as an Architectural Expression: The Case of Odunpazarı Modern Museum. G. M. Abbas, S. Acar, S. Bancı, N. Çağlar, I. Ruhi Sipahioğlu, B. Yılmaz (Eds.). *Materiart*: *Architectural Design, Research and Technology,* (625-640). ISBN: 978-989-658-668-3. Portugal: Caleidoscópio Access address (21.10.2023): https://www.researchgate.net/publication/364061579_Materiart_Architectural_Design_Research_and_Technology

Palace de Versailles. (n.d.). *In Encyclopaedia Britannica*. Access Address (08.10.2023): https://www.britannica.com/topic/Palace-of-Versailles

Palace of Versailles (n.d.). Famous Landmarks – Palace of Versailles. Access Address (08.10.2023): https://www.nationsonline.org/oneworld/map/Palace_of_Versailles.htm

Parthenon. (n.d.). *In Encyclopaedia Britannica*. Access Address (08.10.2023): https://www.britannica.com/topic/Parthenon

Pereira, D. & Marker, B. (2016). The Value of Original Natural Stone in the Context of Architectural Heritage, *Geosciences*, 6 (1), 13. https://doi.org/10.3390/geosciences6010013. Access Address (01.10.2023): https://www.mdpi.com/2076-3263/6/1/13

Pxhere (n.d.). *Church Tower of Locronan in France.* Access Address (04.10.2023): https://pxhere.com/en/photo/1636838

Roma Kolezyumu. (n.d.). 123RF. Access Address (04.10.2023): https://tr.123rf.com/photo_90451583_roma-kolezyumu-%28coliseum-colosseo%29,-roma-%C4%B0talya.html

Ruins of Walkway at Colloseum. (n.d.). Dreamstime. Access Address (04.10.2023): https://www.dreamstime.com/brick-stone-shape-walkway-path-leading-to-ampitheatre-colosseum-ruins-walkway-colosseum-image117017988

Sagrada Familia. (n.d.). *In Encyclopaedia Britannica*. Access Address (02.10.2023): https://www.britannica.com/topic/Sagrada-Familia

Sawantt, S. (2021, 08, 17). *Stone Architecture with Parametric Methods.* Access Address (02.10.2023): https://parametric-architecture.com/stone-architecture-with-parametric-methods-9-iconic-structures/

Sawe, B. E. (2018, 10, 05). *Why Was the Parthenon Built?.* Access Address (02.10.2023): https://www.worldatlas.com/articles/why-was-the-parthenon-built.html

Spain Official Tourism. (n.d.). *The Sagrada Familia, Antonio Gaudi's Most Important Work in Barcelona.* Access Address (02.10.2023): https://www.spain.info/en/discover-spain/sagrada-familia-art-antoni-gaudi-barcelona/

Steen Kalesi (n.d.). 123RF. Access Address (02.10.2023): https://tr.123rf.com/photo_77361271_antwerp-belgium-july-5-2016-steen-castle-the-stone-castle-is-a-big-building-in-antwerp.html

Steves, R. (n.d.). *France's Enduring Gothic Cathedrals*. Access Address (06.10.2023): https://www.ricksteves.com/watch-read-listen/read/articles/france-gothic-cathedrals

Stewart, J. (2018, 11, 22). *7 Suprising Facts About the Egyptian Pyramids*. Access Address (02.10.2023): https://mymodernmet.com/egyptian-pyramids/

Stokel-Walker, C. (2023, 03, 02). *Hidden Corridor in Egypt's Great Pyramid Mapped with Cosmic Ray.* Access Address (02.10.2023): https://www.newscientist.com/article/2362300-hidden-corridor-in-egypts-

great-pyramid-mapped-with-cosmic-rays/
Sumerian Period. (n.d.). *In Encyclopaedia Britannica*. Access Address (02.10.2023): https://www.britannica.com/art/Mesopotamian-art/Sumerian-revival
Swegon Air Academy. (2022, 01, 17). *Oslo Opera and Ballet House in Oslo*. Access Address (02.10.2023): https://www.swegonairacademy.com/updates-insights/case-studies/oslo-opera-and-ballet-in-norway-target-sollutions-and-challenges/
TRT Haber (n.d.). *Yakutiye Medresesi Asırlardır Tarihi Yapısını Koruyor.* Access Address (06.10.2023): https://www.trthaber.com/haber/kultur-sanat/yakutiye-medresesi-asirlardir-tarihi-yapisini-koruyor-387113.html
Tour in Peru. (n.d.). *The Wonder of Machu Picchu's Construction Technology.* Access Address (02.10.2023): https://www.tourinperu.com/blog/machu-picchu-construction-technology
Unesco World Heritage Convention (n.d.). *Taj Mahal.* Access Address (06.10.2023): https://whc.unesco.org/en/list/252/
Winkler, E.M (1997). *Stone in Architecture: Properties, Durability.* Germany: Springer Science & Business Media. ISBN: 3540576266
World in Paris, (n.d.). *Inside the Palace of Versailles*. (06.10.2023): https://worldinparis.com/inside-the-palace-of-versailles

Resume

Serkan Yaşar Erdinç was born in 1980 in Istanbul. After graduating from Yıldız Technical University, Faculty of Architecture, Department of Architecture in 2005, he completed his master's degree at Yıldız Technical University, Institute of Science and Technology Architectural Design Program in 2009. He received his doctorate degree from Beykent University, Institute of Science and Technology, Architecture Doctorate Program, upon the acceptance of his thesis titled "A Research on 'Rezidans' Culture: The Case of Istanbul" on 18.05.2017, which he completed under the supervision of Prof. Dr. Şengül Öymen Gür. He has continued his career in various architectural offices since 2005 and worked as a project manager in the concept design and construction stages of projects of different quality and scale. Currently, Serkan Yaşar Erdinç has been working as an Assistant Professor at the Department of Architecture at Istanbul Beykent University, Faculty of Engineering and Architecture and continues to serve as the Head of the Department of Architecture.