

## Sustainability in Architecture: Sustainability and traditional wisdom

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**Abstract**— In the growing world, we have fewer traditional Buildings which stand with pride outshone. They emanate life style culture and wisdom of the previous generation. They are the sources of knowledge for cultures and their construction style. This paper aims to analyze the building construction styles based on the materials used. The sustainability of the material with respect to the climatic conditions and provide a traditional solution in a modern home. It provides an insight to local materials and unique building details like Wooden Entrance Porch, Ornamental Stucco Parapet, and Arched Verandah which contribute to local culture and lifestyle. The case study in this paper is Denduluru Village, Eluru, West Godavari District. The village has a huge impact of varying reigns hence it provides an insight to how cultural and lifestyle changes impact the architectural style and details. Those buildings showcase both Mughal and British influences. It is an example for how the buildings tell a story of bygone eras and how can those details be incorporated in present day in modern cities. Such traditional details incorporated in modern homes provide a sense of peace to the families that live in those homes.

**Index Terms**— Sustainability, Tradition, Materials, Interiors, Architecture, Techniques, Details, Culture.



### 1 INTRODUCTION

I West Godavari district or Paschima Godavari Jilla is one of the 13 districts in the Indian state of Andhra Pradesh. The district is situated in Coastal Andhra region of the state. The administrative headquarters of the district is situated at Eluru. As of 2011 census of India, the district has an area of 7,742 km<sup>2</sup> (2,989 sq mi) and a population of 39,36,966. It is bounded by Krishna district on the west, East Godavari district on the east, Bay of Bengal on the south and the state of Telangana on the north.

West Godavari district was formed from old Godavari District in the year 1925. The Godavari district was renamed as East Godavari district and the new district is named as West Godavari district. This building is situated in the village called Kovalli near Denduluru.



two centuries after the influential rule of Nizams ended in the region. This shows that there were few artist families of Mughal and Nizam era have survived in that region even after the British rule.

Coming to the elements of building we can find a combination of Mughal and Nizam Architecture style. The building is a witness of various beautiful elements which are in all ways best for living a happy and comfortable life. The buildings at this age are also standing young by their specific quality. The small village speaks about the Tamil Architecture as well the street is known as mini Madras because of its architectural features.



This is the entrance of the building. It is very much different and surprising to see a dog's image carved on the both sides of the porch. The entrance arch is a semicircular arch which has a beautiful carving of steel. Which depicts the British architecture. The arch style also seems to look like the combination of British and Mughal style.

### 2 HISTORIC SIGNIFICANCE

#### 2.1 Review Stage

: Denduluru Village, Eluru, West Godavari District

A house constructed in 1905 and is still intact and stronger than many of the contemporary houses. It belongs to Shri Bodempudi Balakrishna and Shri Srinivas whose grandfather constructed it and their father's marriage was celebrated in this house.

It is one of the historic evidences for the Mughal and Nizam reign in the region. It is interesting to find the element more than

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### 3 ARCHITECTURAL ELEMENTS AND DETAIL

#### 3.1 Art Deco

##### 3.1.1 Lighting

Linoleum in abstract designs or black and white tiles are typical, as are lacquered floors. Polished parquet is also perfect for flooring. Keep in mind that floors in the Art Deco period would have been overlaid with large rugs in geometric patterns, so feel free to do that if you choose.

##### 3.1.2 Lighting

- Lights were often made of glass and chrome (which was a brand new material at the time). Glass was sometimes etched or enameled. White glass and colored Tiffany- style glass were also very common.
- By incorporating these and other Art Deco elements into your décor, you can achieve the streamlined and modernist look of the Art Deco.

##### 3.1.3 Furniture

Art Deco furniture tends to be large in scale so don't be afraid to buy big pieces. Sideboards, armoires, and generously sized

##### 3.1.4 Colors

Colors in Art Deco are striking and bold with a lot of contrasts. Bright and deep yellows, reds, greens, blues, and pinks mix well with silver, black, and chrome. If you want something softer try creams and beiges which were also often used in living rooms, dining rooms, and bedrooms. These colors contrast beautifully with the polished wood and lacquered furniture common to the period.

##### 3.1.5 Materials

Certain elements pop up again and again in Art and Interiors, stainless steel, mirror, glass, chrome, lacquer, inlaid wood, ebony, marbles, rare woods, etc.

#### 3.2 Jharoka

Jharoka is a stone window projecting from the wall face of a building in upper storey overlooking the street. These features are seen in royal and rich family homes and are native to Rajasthan. Generally made out of wood and sandstone but are improvised to be made in lime and stucco.

#### 3.3 Multi Foil Arch

A multi foil arch or poly foil arch is an architectural element of an arch containing multiple foils; symmetrical leaf shapes, defined by overlapping circles. The French term foil means Leaf. A specific number of foils, indicated by a prefix: trefoil (three), It is particularly prevalent in the Moorish architecture of al-Andalus.

#### 3.4 Colonnade

In classical architecture, a colonnade is a long sequence of columns joined by their entablature (the upper part of a classical building supported by columns or a colonnade, comprising the architrave, frieze, and cornice), often free-standing, or part of a building. Paired or multiple pairs of columns are normally employed in a colonnade which can be straight or curved and the space enclosed may be covered or open.

#### 3.5 Madras Terrace

- This is the Traditional roofing Found in India.
- It involves the use of wood, "aachikal" (a locally available

material which is small brick) and lime plaster.

- These are commonly used for small spans.
- Wooden beams are used to cover the span, over this wooden beams are laid at intervals less than 45cms from each other.
- The gaps between is filled with bricks on edge with lime plaster, up on this "aachikal brick" is laid on the edge across the diagonal fashion plastered with lime.
- Teak wood joists are placed on rolled steel joists.
- Sufficient slope is provided.
- Terrace bricks of size 15x75x25mm to be laid diagonally.
- Brick bat concrete of thickness 75mm to be laid.
- Rammed and allow to set for 3 days.
- Flat tiles are then laid over this concrete.
- Surface of this roof is finished with 3 coats of plaster.

#### 3.6 Lime Concrete Flooring

Existing lime concrete floors which are decayed and missing in portions need to be repaired using original specification for the base layer as well as the finish layer. A concrete made from a mixture of lime, sand, and gravel is said to be as lime concrete. It was widely used before the lime was replaced by Portland cement.

#### 3.7 Verandah

It is an Architectural feature frequently seen in royal residences and public buildings. It is an extended corridor covered with either a plain or decorative roof. The roof is supported by roman arches and modernized Doric orders. The verandah is a social space at the entrance of the residence. It is a decorative buffer as well as interaction corridor. It has the wall with opening on one side and arched colonnade on the other. It also prevents the natural elements from directly hitting the building and acts as niche for insulation. The element is an architectural trace of colonial British rule and the Dutch influences in the place. It usually is associated with the wealthy households of the times and the verandah is used as a hangout space by the users. These verandahs are usually decorated with Cast iron floral lace work. These verandahs run around the entire house in some cases.

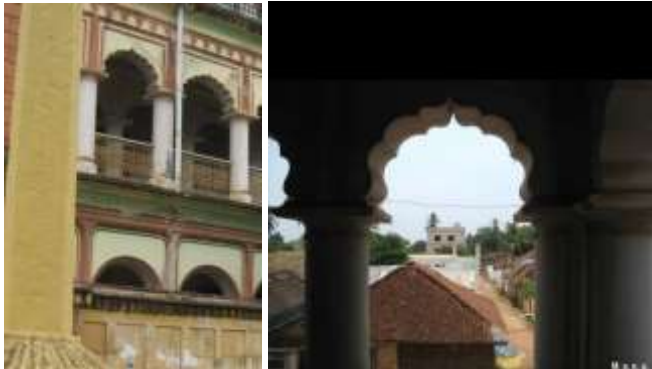


#### Shri Bodempudi Balakrishna

#### 3.8 Ornamental vector Art border.

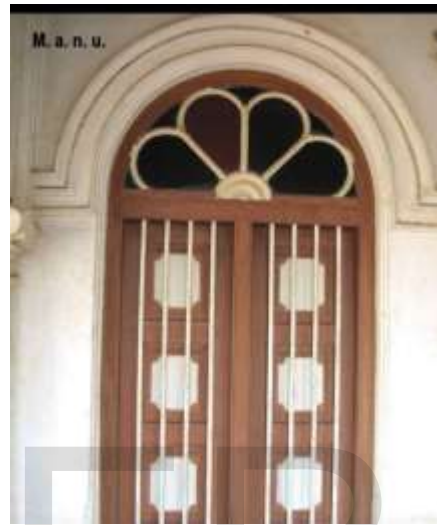
Ornamental border designs or border patterns line the surface of a specific shape where some content text, image, motif, design is found. Decorative border is technically known as a Meander or Meandros is a constructed from, a continuous line, shaped into a repeated motif. Such a design is also called the Greek fret or Greek key design, although these are modern designations. Meanders were traditionally carved on stones and also were casted using lime

mortar and then carved. Nowadays, we find ornamental border motif stencils are available, casted with cement and carved on stones which are used in exteriors, whereas laser cut designs on metal and fiber boards, printed stencils border designs are used in interiors. Meanders are common decorative elements in Greek and Roman art. In ancient Greece they appear in many architectural friezes and in bands on the pottery of ancient Greece from the Geometric Period onwards, and is also used in monumental sculpture, for example, in frieze decoration on temple pediments.



### 3.9 Semicircular Grill window

A window is an opening in a wall that allows the passage of light and may also allow the passage of sound and sometimes air. It is an Iron grill arch window. An arch window, the bottom half of the window is rectangular while the top is an arch or half-circle. It is a designed floral pattern with iron. Behind the glazed frame attached. The first metal windows were made from wrought iron by medieval blacksmiths. Throughout the early medieval period, the great majority of windows were unglazed. In timber-framed buildings, they were simple openings in the structural frame. Wider openings were often sub-divided into two or more lights with plain or molded mullions. Vertical wood or iron bars were inserted to keep out intruders. Taller windows might be sub-divided horizontally with transoms.



window

### 3.10 Staircase

It is iron based spiral stair case with lime mortar wall balustrade constructed assuming during early 15th century. The steps are called Winders. They are made of iron winders are steps that are narrower on one side than the other. They are used to change the direction of the stairs without landings. A series of winders form a circular or spiral stairway. When three steps are used to turn a 90° corner, the middle step is called a kite winder as a kite-shaped quadrilateral. The center pole or the central pillar which supports all of the treads is also made of iron. The landing looks like wooden floor with iron bars as railing.



Entrance porch arch design

DOOR

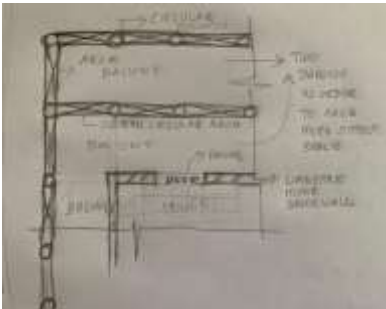


door

Without questionsome of the most beautiful antique doors in the world come from India. We're going to delve a little into the fascinating significance of some of their decoration. The Elephant's connection to door design. And we will look at the new life being given to old and damaged doors in today's home decor.

Door shapes vary from Islamic arched, simple planking, latticework and frame and panel designs. Often made and decorated with a combination of the above. Rather than heavy carving, interior doors were more often painted, plainly or decorated with murals and motives. Religious symbology, historical events and simple pure decoration may from the painted designs of these doors. There is elegance to these interior doors and their decoration, a simple beauty

6 HELPFUL HINTS



We have two veranda space

Because of the climatic conditions in the place we can see two please of verandas ...we can see two arches



ORNAMENTAL VECTOR ART BORDERS

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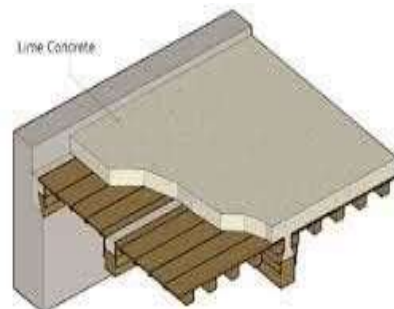
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ARCHITECTURAL MEANDERS:

Meanders are common decorative elements in Greek and Roman art. In ancient Greece they appear in many architectural friezes and in bands on the pottery of ancient Greece from the Geometric Period onwards, and is also used in monumental sculpture, for example, in frieze decoration on temple pediments.

The meander is a fundamental design motif appears in bands and as infill on Shang bronzes, and many traditional buildings in and around China and India still bears geometric designs almost identical to meanders. Many ancient Greek and Indian temples incorporated the sign of the meander. The meander motif can take a number of different forms. It is commonly comprised of a series of right-angled interlocking lines, forming either a continuous spiral, or a maze-like network of broken and connected lines.



Lime concrete is composite mixture of lime as binding material, sand as fine aggregate and gravel as coarse aggregate in appropriate proportions. Lime concrete mix ratio depends on the type of construction, but in general, it can be taken up to 1:2 ratio for lime, sand respectively and up to 1:3 ratio for lime, coarse aggregate respectively

#### *Properties Of Lime Concrete*

Authenticity in sustainable architecture leads to its material condition, the use of materials that meet this feature. One material that gives full response is lime and all materials derived from it: pastes, mortars and concretes lime. Below is defined sustainable material and whys of compliance with all requirements set forth by the lime, according to its essence.

Lime concrete provides good bases to bear the sufficient loads and also provide certain degree of flexibility. It adjusts very well when it is in contact with surface.

Lime concrete also exhibits certain degree of water proofing property and thus prevents subsoil dampness in floors and walls. Lime concrete also exhibits volumetric stability. It can be made easily and can be available at much cheaper rates. It also resists weathering effects and is very durable.

#### **Reducer of climate change. Lessening pollution**

In the carbonation reaction, it is proved how the calcium hydroxide will carbonating to mix carbon dioxide from the atmosphere, it clears the atmosphere and transforms it into stone, thus demonstrates how lime mortars lower the pollution. It is estimated that environmental improvement is 150 g of CO<sub>2</sub> per kilo of lime.

#### **Efficiency. Thermal Properties**

The thermal properties of materials lime contribute to the sustainability of architecture. Lime contributes to climate control. A lime mortar is also sustainable because it is recyclable. A mortar when it has served its purpose, its waste can be reused.

Lime mortar has no toxic products, since their raw materials are minerals and inorganic: lime, aggregate, mineral pigment and water.

Efficient lime has great properties: abundance, easy to manufacture, easy pigmentation, luminosity, plasticity before and after setting, workable, bond to variety of walls, natural waterproofing, breathable, hardening to age, compatible iron and wood, insulation, surface protection, cost-effective and durable. Decreases climate change, contributes to environmental improvement and balance with nature (1 kg of applied lime removes 150 grams of CO<sub>2</sub>).

Historically lime coatings express the architectural ideas and today continue doing: contribute character, light and color to buildings. Also, lime mortars due to its plasticity, allowing for a variety of finishes. Inorganic nature supported by its mixtures with mineral pigments, incorporating in its mass; this enables infinite colors and tones are achieved as mixed in varying proportions. This workable material, the architect can shape their ideas, customize your project

giving it a uniqueness and providing outstanding durability.



Double corridor or sit out

#### **Flooring:**

- Existing lime concrete floors which are decayed and missing in portions need to be repaired using original specification for the base layer as well as the finish layer.

#### **DEFINITION:**

- A concrete made from a mixture of lime, sand, and gravel is said to be as lime concrete. It was widely used before the lime was replaced by Portland cement.

#### **Preparation of lime concrete:**

- The main ingredient of this concrete is slaked lime as binding material. The slaked lime is obtained in various forms as hydrated lime powder, lime putty, slaked lime slurry that is prepared by grinding in suitable Grinding Mills. Slaked lime is first mixed with sand to prepare lime mortar which is then further mixed with coarse aggregates, in suitable proportion. For preparation of lime concrete, first hard impervious level base is prepared by stones or brick pitching.

#### **Properties of lime concrete:**

- Lime concrete provides good bases to bear the sufficient loads and also provide certain degree of flexibility. It adjusts very well when it is in contact with surface. Lime concrete also exhibits certain degree of water proofing property and thus prevents subsoil dampness in floors and walls. Lime concrete also exhibits volumetric stability. It can be made easily and can be available at much cheaper rates. It also resists weathering effects and is very durable.

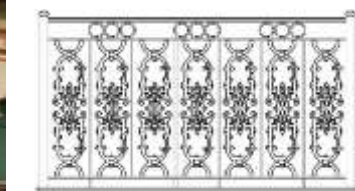
#### **GRILLS**

Iron railing and use of Islamic jail patters can be seen in the image. The floral pattern is used. Jali is usually with an ornamental pattern constructed through the use of calligraphy and geometry. This form of architectural decoration is common in Indo-Islamic architecture and more generally in Islamic architecture

## ARCHES

Evident in both entrances and interiors, Islamic arches are categorized into four main styles: pointed, ogee, horse shoe and multifoil.

Arches are important in Islamic architecture, because of their symbolic significance and how they allow builders to create mosques that reflect the importance of precepts such as unity, beauty and light in the Muslim faith



Iron grills

## HISTORY OF GEOMETIC PATTERNS

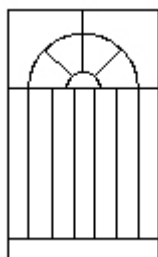
For centuries, Islamic geometrical patterns have been used as decorative elements on walls, ceilings, doors, domes, and minarets. However, the absence of guidelines and codes on the application of these ornaments often leads to inappropriate use in terms of time scale accuracy and architectural style matching

Thus, history of Islamic geometrical ornaments is characterized by a gap of nearly three centuries—from the rise of Islam in the early 7th century to the late 9th century, when the earliest example of geometrical decorations can be traced from the surviving buildings of the Muslim world

## IRON GRILL TRADITIONAL WINDOW



Key shape



Iron grills

**window** is an opening in a wall that allows the passage of light and may also allow the passage of sound and sometimes air. It is an **Iron grill arch window**. An 'arch' window, the bottom half of the window is rectangular while the top is an arch or half-circle. It is a designed floral pattern with iron. Behind the glazed frame attached.

The first metal windows were made from wrought iron by

medieval blacksmiths.

## HISTORIC VALUE

Most traditional windows will illustrate, in varying degrees, the materials and technology, the craftsmanship, and the architectural taste of the period from which they date.

Throughout the early **medieval period**, the great majority of **windows** were unglazed. In timber or wooden framed buildings they were simple openings in the structural frame. Wider openings were often sub-divided into two or more 'lights' with plain or molded mullions. Vertical wood or iron bars were inserted to keep out intruders.

Windows are the eyes of a building – they let in light and give views out – and profoundly affect its appearance. Also, traditional windows bear witness to the artistic, social, economic, and technological developments of past ages.

## 4 CONCLUSION

Lastly we conclude that the building is a great form of traditional wisdom which was well designed as per the requirement of the client. The materials used the designs are as per the availability of materials which is a good example of sustainability .as seen the building is one of the great example which needs to be more understood and the form

## ACKNOWLEDGMENT

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## REFERENCES

1. [https://en.wikipedia.org/wiki/Kovvali,\\_West\\_Godavari\\_district](https://en.wikipedia.org/wiki/Kovvali,_West_Godavari_district)
2. <http://www.westgodavari.org/police/maps.html>
3. <https://westgodavari.ap.gov.in/>
4. <https://villagemap.in/andhra-pradesh/west-godavari/denduluru/1946700.html>
5. <https://villageinfo.in/andhra-pradesh/west-godavari/denduluru/kovvali.html>
6. FACEBOOK
7. Van der Rohe, M. (1995). *La palabra sin artificio. Reflexiones sobre arquitectura 1922/1968*. 479-481. El Croquis. Madrid.
8. Robador, M. D.; Arroyo, F.; Perez-Rodriguez, J.L. (2014), Study and restoration of the Seville City Hall façade. *Construction and Building Materials*. 53, 370–380.
9. Robador, M. D. (2012). La noble cal en la restauración del patrimonio histórico. *Materiales y aplicaciones, Aparejadores*, 80, 47-63.
10. UNE-EN 459-1. 2011. Cales para la Construcción. Parte 1: Definiciones, especificaciones y criterios de conformidad.
11. Robador, M. D. (1997). Cal de Morón de la Frontera,

*Aparejadores, 49, 34-39.*

12.

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