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EFFECTIVE EXTERIOR WALL CLADDING

Key influences & issues
related to the selection of
cladding materials



Face to Face

Ar. Hiren Patel
Founder & Principal Architect,
Hiren Patel Architects (HPA),
Ahmedabad

Cladding - System Design

Innovative Cladding
Solutions for Ambitious
Building Skins

Project Watch

Bharatiya Centre of
Information Technology,
Bengaluru
By Edifice Consultants Pvt Ltd

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Bharatiya Centre of Information Technology, Bengaluru by Edifice Consultants Pvt Ltd
Arcot Plaza, Kodambakkam, Chennai by Architecture Plus Value

Cover Courtesy: Hiren Patel Architects (HPA), Ahmedabad



EDITOR'S

The cladding system market is projected to grow from USD 224.4 billion in 2018 to USD 292.5 billion by 2023, at a CAGR of 5.44%. This growth is due to the growing construction activities globally, especially in the Asia-Pacific region. The non-residential sector, comprising industrial, commercial, and other applications, is projected to be the fastest-growing segment. New construction and remodelling are also expected to increase the demand for cladding systems, says a report published by MarketsandMarkets. Globally, Vinyl accounted for the largest market share. Other preferred cladding materials include stone, brick, wood, stucco, EIFS, metal, and fibre cement. The report also says that in terms of volume, the ceramic segment is estimated to lead the cladding systems market in the near future.

The report reveals that the Asia-Pacific region is projected to lead the cladding system market in terms of both value and volume. Factors such as increasing availability of raw materials and manpower, along with sophisticated technologies and innovations have driven the cladding systems market growth in the region. In addition, the growing construction sector, particularly in rapidly-growing countries such as China and India and huge foreign investments drive the Asia Pacific cladding market. However, consumers in this region are price-conscious and lay a lot of importance on this criterion in every aspect of their purchase. Manufacturing cost-effective cladding systems is a challenge faced by players operating in this region.

The choice of cladding material determines the environmental performance of a building. Cladding offers several benefits such as insulation, fire resistance, pollution prevention, and provides aesthetic appeal to a building. This edition of the magazine presents a number of articles on cladding, authored by experts. Tools for designing complex cladding, various cladding materials available in the market and their pros and cons, fire rated cladding materials, regulation and norms for cladding, the standard of materials, and safety regulations.

Hope this edition will inform readers of the newest updates to some of the recent technologies and materials in the cladding market. Please feel free to pass on any suggestions of what you would like to see in our future editions. Your comments on this edition is also welcome.

To all our contributors, a heartfelt thanks.

Renu Rajaram
renu@wfm.co.in

Exterior Cladding Solutions



The Infinity House by GA Design

In simple terms, the application of one material over the other is called cladding. Exterior cladding is a term which is applied to the cladding of buildings and homes from outside. It forms a skin over the concrete and brick

and provides some degree of thermal insulation and weather resistance and also increases the aesthetic appearance of the building. Exterior cladding brings to mind many factors - weather proof, rot proof, termite proof,

heat proof and many more. And now since awareness is increasing and we realise the importance of sustainability and green, we are also concerned about the way the product has been made and its ingredients.

Choosing a cladding material for your building depends on all the above factors along with the aesthetic value a particular product might have. Exterior cladding solutions are wide and varied. A number of materials ranging from wood to aluminium composite panels, glass to metal composite panels, a varied choice is available these days for you to choose from.

Wood is the classic cladding material which has been around for a long time. But now we are seeing a lot of innovations and additions being done to the standard wood cladding. Reclaimed wood is an extremely popular choice now and so is composite wood which is made from sawdust and resins. Wood is an environmental choice

and recycled wood products are given a new life these days, but research into that has to be done as the recycling of composite wood might be done by gassing which has negative effects on the environment.

Wood can retain its beautiful and natural finish for a long time when treated well and it can also be kept protected from weather and termites with the right treatment. But every few years it has to be repeated and so constant maintenance is required to keep it looking as its natural self.

Glass fibre reinforced concrete (called as GRC) is an easy maintenance cladding material. Used for commercial, industrial and now even residential buildings, GRC is very easy to install and does not need any paint and plastering and can be fixed directly over brickwork.

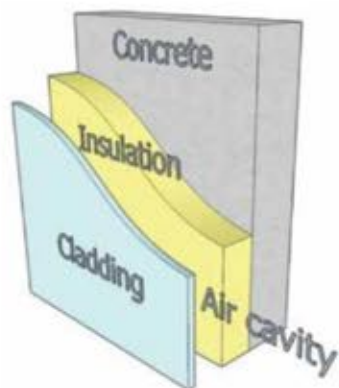
Stone is a natural and environment friendly material. Options in stone are galore,

granite, slate, marble, sandstone, limestone, Kota, Jodhpur stone etc. In the earlier days the entire construction of homes and palaces were done in stone. Even today, if you visit the palaces of Rajasthan, you will see beautiful stone cladding which have withstood the test of times. Proper installation is of extreme importance and durability of the cladding depends on the technique of installation if it's a dry cladding, and in cases of wet cladding - the thickness of the stone along with the application. The thicker the stone, the better the durability. Though there is no need of painting over the cladding surface, we do need to apply a clear coat of water proofing on the stone in high rain areas like Mumbai and Lonavala / Khandala.

Glass is a cladding material which has taken the world by storm. Glass cladding of the building has been prevalent for a number of years now and has evolved now to a fine science. The

trend began with BPOs and the IT sector when multinationals came to India and architecture saw a shift in design and use of material for cladding. Today there are several companies offering a varied range of choices from supplying different types and colours of glass to customisation, cleaning and maintenance. Architects consider glass as a preferred option not only for the unobstructed view of the surrounding but also because it reduces the weight on the foundation and hence makes the building lighter as compared to constructing walls.

Glass claddings are available in several opacities and various textures and finishes. Some modified varieties of glass are reflective glass, insulated glass, laminated or toughened safety glass, glass bricks, tinted glass, patterned glass, wired glass and many more. Sustainability has played a major role in the development of glass façade



Cladding - the cross-section diagram



The Hill Crest by GA Design



Regency Anantam by GA Design

Cladding - Materials

cladding. Latest glass technology involves performance glass and several other modified glass with enhanced properties making the glass cladding fire retardant, reduced heat gain, reduced construction time and facilitate faster and efficient façade.

Metal Profile cladding are metal sheets manufactured in a range of corrugated and other profiles. The most commonly used metals for cladding purposes are: steel which is the most affordable; aluminium, which is very light weight and anticorrosive; zinc, which is highly durable and can acquire a hue if left untreated (very widely used now in exterior cladding); copper, which is another long lasting metal that requires minimum maintenance and can also be used in its different shades and finishes.

Composite metal is another very widely used cladding material where two metal skins are bonded to an insulating core, forming a composite 'sandwich' panel. The metal component, can be aluminium, zinc, stainless steel, titanium and so on, available in a wide variety of colours, finishes and profiles. The USP of metal composite panels is that they can be bent, curved and joined together to form shapes and designs and hence widely preferred by architects world over. And now available in the market are also fire retardant composite panels which are safer and stronger and can be used for cladding for commercial, industrial, residential projects alike.

Composite panels in comparison to single layer metal sheeting have more advantages as they provide resistance to weather - heat or cold, acoustic and thermal insulation. With technology improving in leaps and bounds, they are cost

effective compared to other cladding materials and installed faster than any of their heavier counterparts like granite, stone or concrete panels.

As external cladding systems have enhanced building façades aesthetically, making them sustainable and durable at the same time, a side effect or rather one of the cons is that they offer a potential route for the spread of fire. Especially in high rises, as fire spreads quick and fast as recent examples like the Grenfell Tower fire in London. Combustible cored sandwich panels are contributors to serious injuries and death. A façade fire has serious consequences. The basis of all modern fire regulations is that a fire in a tall building must be confined to a single storey. Use of combustible structural elements, insulation and finishes should be carefully restricted and controlled. So research into the cladding system being used is a must, especially by the contractors and engineers involved in the construction process.



Indu Villa - Podium by GA Design



RAJAN GOREGAOKER
Principal Architect and Director (Partner),
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ABOUT THE AUTHOR:

Rajan Goregaoker, a graduate of Sir J J College of Architecture, co-founded the firm GA design in 1999. With an extensive experience in residential & commercial buildings, township projects, interiors of luxury homes and offices in and around Mumbai, Rajan is recognised as one of the leading architects in Mumbai. Associated with some of the region's most prominent builders and industrialists in the field of architecture and design, Rajan brings together the design expertise of both architecture and interior design in projects successfully. Responsible for steering the firm's overall strategic objectives, he has collaborated with multi-disciplinary design teams on projects across varied scales for over 20 years. With a profound attention to detail and a focus on simplistic, yet elegant and artistic solutions to complex project briefs, his technical expertise and pragmatic design approach is the reason behind the success of his firm.

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Effective Exterior Wall Cladding

Cladding is an exterior finishing system akin to a skin or an additional non-load bearing layer which serves a dual purpose. It not only helps in protecting the interiors of the building from the harsh weather elements but also makes the outside decorative and attractive. The right cladding helps to maintain the buildings weathertight and cost-effective, at the same time provides thermal insulation, reducing the temperature variation inside the building. It also helps to improve interior acoustic and day lighting. The cladding can influence the value, saleability and safety of the building. So cladding your property effectively is a wise investment that pays both short and longer-term dividends.

There are now more cladding systems in the market than ever before. Finding the most appropriate choice may take a little time, but cladding – used creatively and intelligently – is a great way to stamp your own personal style on a property. Ready to invest in new cladding, but not sure where to begin? Here's our round up of everything you need to know.



Infinity House by CA Design

Cover Story



KRISHNA MURTHY
Principal Architect,
Folds design Studio



Mundhra Chemicals, Sonapat. Image courtesy - ADCPL



B.D. SINGLA
Head of Technical Services,
Arvind SmartSpaces



JASMINE HANDA
General Manager
Construction, Tattva Mittal



ANUP NAIK
Partner and Director,
Space Matrix

What is cladding? Is it a surface treatment that we are designing for the aesthetics of the building or we are detailing for encasing the build volume? In today's context buildings are designed in two ways: 1. Building volume of spaces and then surfacing the building; 2. Design a surface and then detail the internal spaces. In both ways, cladding material or surface treatment has become the prime necessity for an architect to design. Surfaces should be designed with a context and a purpose. If so than these surfaces should be intelligent surfaces, says Krishna Murthy, Principal Architect, Folds design Studio.

According to B.D. Singla, Head of Technical Services, Arvind SmartSpaces, the skin of a building (i.e. cladding) has witnessed a huge evolution in its variety and

popularity in all building typologies. The introduction of pre-engineered structures, market demands of speedy project execution, the zest for quality and innovative options, foreign investment, the stress on getting the global outlook for the Indian companies are the drivers for the demand in the cladding industry.

Why do we need cladding? The exterior cladding of any building may participate in many ways to support the building to withstand external/atmospheric impacts, says Singla - for example:

- To protect against weather - heat (direct sun or indirect), cold, wind, rains, pollution, etc.
- To provide thermal insulation to the exterior façade and maintaining internal heat load conditions



Le Méridien Thimphu - A project by Reza Kabul Architects

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SUSHANT JAI-AMITA VERMA
Cofounder, rat[LAB]



Curved metal cladding.
Image courtesy - BES Consultants



ASHWANI KHANNA
Head - Marketing,
Fundermax



AR. REZA KABUL
Principal Architect, Reza
Kabul Architects Pvt Ltd



RAJAN COREGAOKER
Principal Architect and
Director (Partner), GA design

• To provide an acoustic barrier against busy urban conditions outside the building. Earlier, wall cladding was considered as a part of visual art, but today it has gone beyond the looks to become a necessity, says **Jasmine Handa, General Manager Construction, Tattva Mittal**. Over the years, choices, as well as the functions of cladding, have enhanced, now for wall cladding, there are many options like laminate, plastic, metal, vinyl, wood, and there are cladding manufacturers available across India. Even the end users are looking for something that has good quality, is sustainable over a time period in all weather conditions, and cost-effective as well as aesthetically pleasing to the eye.

TRENDS IN THE USE OF CLADDING MATERIALS

The building industry is in its major cusp of change, says **Anup Naik, Partner and Director, Space Matrix**.



Zinc cladding, Image courtesy - BES Consultants

Application of technology has played a big role in this momentum shift. The most visible change is in the cladding materials. Traditionally, various types of stone were very popular, though today, the range is enormous: ceramics, aluminium composite panels (ACP), terracotta, Corian, zinc, corton steel, copper, concrete fibre boards, glass reinforced concrete panels, fibre reinforced plastic, wood, wood composites, exterior grade laminates, glass, LED façades to name a few. Rapid transformation is seen in the fixing technology of these materials moving away from the traditional wet fixing to dry systems, saving tremendous time in the building cycle.

Agreeing with Naik on availability of diverse cladding materials, **Sushant Jai-Amita Verma, Cofounder, rat[LAB]** observes that the market has seen changes in terms of functionality and performance too. With the introduction of pre-engineered structures, the market demands speedy project execution and innovative designs. Wall cladding comes with a variety of uses and functionalities. In the past three years, the market has seen double-digit growth in the use of cladding materials, points out Verma. Modern cladding material scores in a number of ways like increased protection against weather and pollution, less water absorption, increased mechanical strength, more thermal insulation, improved acoustical properties, etc. The Indian façade market is majorly ruled by glass and stone, followed by



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AR. L A MURTHY
Founder Partner,
ADCPL



Metal cladding with lights, Image courtesy - BES Consultants

aluminium composite panels (ACPs), HPL, fibre cement boards and wood, adds Verma.

Ashwani Khanna, Head - Marketing, Fundermax adds that few new and innovative materials such as exterior grade laminates (as per EN438-6) give a high degree of design freedom for people who create. Glass fibre reinforced concrete and metal claddings (zinc, copper, and steel) are gaining popularity and shaping the market due to their versatile properties. Some of the key advantages of these cladding materials over traditional ones are eco-friendliness, thermal efficiency, energy renewability and sustainability.

According to **Ar. Reza Kabul, Principal Architect, Reza Kabul Architects Pvt Ltd**, the old trends of stone, marble, terracotta / clay tiles have come back in fashion. The only difference is that artificial material with these finishes is available in the market now, which look like the natural materials, but all don't have the same feel. Ceramic tiles are one of the materials which are widely



GRC cladding,
Image courtesy - BES Consultants

used in many projects, he adds. There are a variety of sizes available from small to large slabs, which facilitate in creating unique patterns in the façade without wastage of material," says Reza. Also, fibre cement boards are one of the new trends in the market, which come in a variety of finishes, mostly printed replicas of the natural marbles/stones/wood. These boards can be used by laser cutting desired pattern or intricate designs to create the required aesthetic look.

With the evolution of organic forms



AR. AMIT MURAO
Partner,
ADCPL



ASHOK KUMAR BHAIYA
CMD,
Aludecor

Intelligent & Responsive Cladding



Mutlipurpose Hall at Satara by Folds Design Studio



Mutlipurpose Hall at Satara by Folds Design Studio

An intelligent and responsive surface is the necessity in today's context for any building to sustain.

Cladding materials can never be earthquake resistant, can be fire resistant, but structurally designed surface materials with a purpose could be. Intelligent façades can be responsive and aesthetical. If the commonly available cladding materials are used intelligently, then they can be responsive and interactive with the environment as they have their inbuilt properties. Their properties can be defined and detailed for sustainable living.

Today's needs are to build spaces with time management, cost, availability and maintenance, and to design with various responsibilities and liabilities. Therefore, a lot of details are scrutinised before execution. Intelligent façade detailing with interactive and responsive surfaces gives the opportunity to design and execute various possibilities.

Mechanically/electronically designed **Kinetics surfaces** are the new trends to build sustainable buildings. Surfaces designed with calculative analysis on digital software give opportunities to mould many materials with respect to the local climatic conditions. Hence cladding and surface textures can be executed easily. They may not be cost effective. The purpose to design and execute such surface helps in creating interactive and intelligent surfaces with various possibilities. Such materials executed to respond to the environment in precise formats. These surfaces have more flexibility to control the environment as they can be calibrated. Such surface claddings can also be designed to form structural members for seismic calculations. Landscape can also be integrated. Such surfaces or textures gives the opportunity to design futuristic buildings.

Biomimicing nature and reinventing new materials with

scientific calculations opens up diverse possibilities to achieve different forms and textures with various energies. These complex structures can be built along with surface texturing with the aid of 3D printing technologies. The built forms can carry energies, information and technical data of different subjects within and reduce lots of service activities and amalgamate with the context. In such buildings, the surface can also become the structural members and carry different loads, which can be seismically calculated and approved along with fire resistant applications. These print forms can also be designed to conserve and reuse energy. They can also change their forms as per the environmental conditions. With such advanced technologies, the built forms can be controlled by artificial intelligence.

(Krishna Murthy, Principal Architect, Folds design Studio)



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Organic forms in façade architecture - Bungalow, Vengurla, Folds Design Studio

in architecture, cladding materials have also evolved to complement this design style. Apart from aluminium, which is bendable to a certain extent, glass fibre reinforced (GFRP) is used as it can be moulded into various organic shapes, says **Rajan Goregaoker, Principal Architect and Director (Partner), GA design.**

According to **Rajan Govind, Director, BES Consultants,** use of textured materials, metallic finishes and natural materials like terracotta, stones are some latest trends.

Shabbir Kanchwala, Senior Vice President, K Raheja Corp lists some of the popular cladding materials and their advantages:

- **Terracotta:** This material has an earthy look and is 100% natural. It is fire resistant and is often seen in heritage buildings.
- **High Pressure Laminates (HPL):** This material is mass produced, easy to install and is available in a wooden look with a lot of varieties.
- **Stone and ceramic tiles:** This material is easily available, is eco-friendly and gives an earthy look.
- **Façade cladding systems** like Aluminium Composite

Panels (ACP), glass, metal cladding panels, GRC (Glass Reinforced Concrete), FRP (Fibre-reinforced Plastic), GRC (Glass Reinforced Gypsum), UHPC (Ultra High Performance Concrete), Stone CNC (Computerised Numerical Control) are some of the latest cladding technologies that are emerging in India.

According to **Tavishi Rana, Façade designer, HBC Corp,** the most common trends being ventilated façade cladding, parametric façades, energy generating solar panels, GFRP, perforated aluminium panels and kinetic façade claddings.

The material for wall cladding can be selected on the basis of application, construction type,

material type and end-use. The selection is done very smartly depending on the location, weather, surrounding area, type of property - residential, commercial, industrial, etc., which can help to plan for the material accordingly. Nowadays, there are materials that are sustainable yet easy to maintain, buildings that are using such materials have a low maintenance cost, points out Handa.

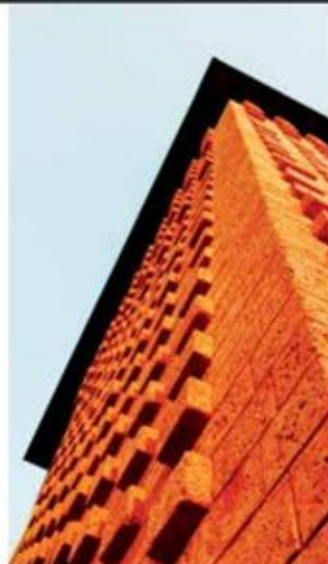
SMART CLADDING TECHNOLOGIES & SUSTAINABLE BUILDINGS

For many years, architects have been using precast concrete panels, metal screens and timber panels as the main cladding materials, but the focus has shifted more towards sustainability, so those materials that provide cost savings to the client and

Key parameters to decide cladding material:

- Aesthetic appearance
- Applications - location, exposure to the sun, ease of execution
- Cost
- Strength
- Durability
- Eco-friendliness

(B.D. Singla, Head of Technical Services, Arvind SmartSpaces)



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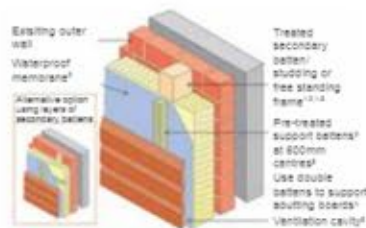
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help reduce the carbon footprint of a building are one of the primary considerations for designers.

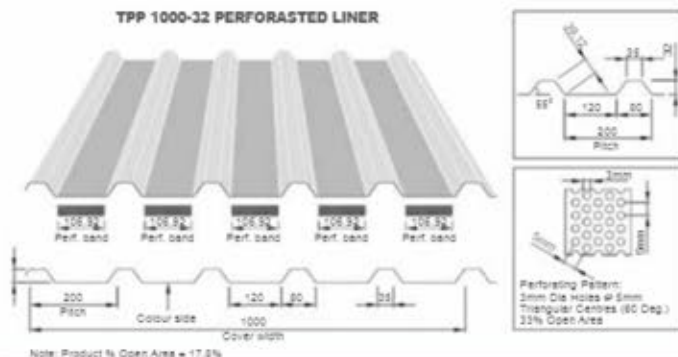
Ar. Reza Kabul looks forward to smart solutions for the façade with analysis and reports that can be extracted from modelling the project in the environmental conditions of that location. Maybe in future, there might be cladding solutions with inbuilt sensors which could monitor the health of the building.

"Recently, architects in this domain have been experimenting with different materials and we have seen a few new types of cladding materials such as perforated screens, WPC panels and timber panels being used in low rise built forms and we are also starting to see an increase in the use of mineral fibre panels replacing the old traditional metal panels. Fritted glass double glazing is also seeing a resurgence, thanks to its versatility and the fact that not only does it provides transparency to the building, it also helps reduce the solar gain of the built form thus reducing operational costs," says Verma of rat(LAB).

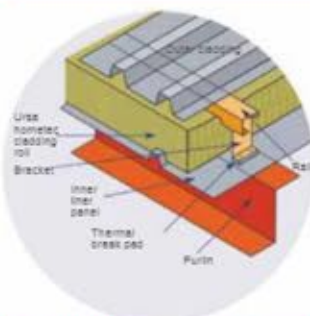
Façade design alternatives have shifted to utilising dynamic fenestration and shading systems for optimal control of daylight and solar gains, observes **LA Murthy, Founder Partner, ADCPL**. Integration of dynamic façades with other building systems is one of the many choices which could potentially save energy in buildings.



Exterior cladding layers, Image courtesy - Tattva Mittal



Perforated liner cladding - Tattva Mittal



Perforated Liner Cladding system - Tattva Mittal

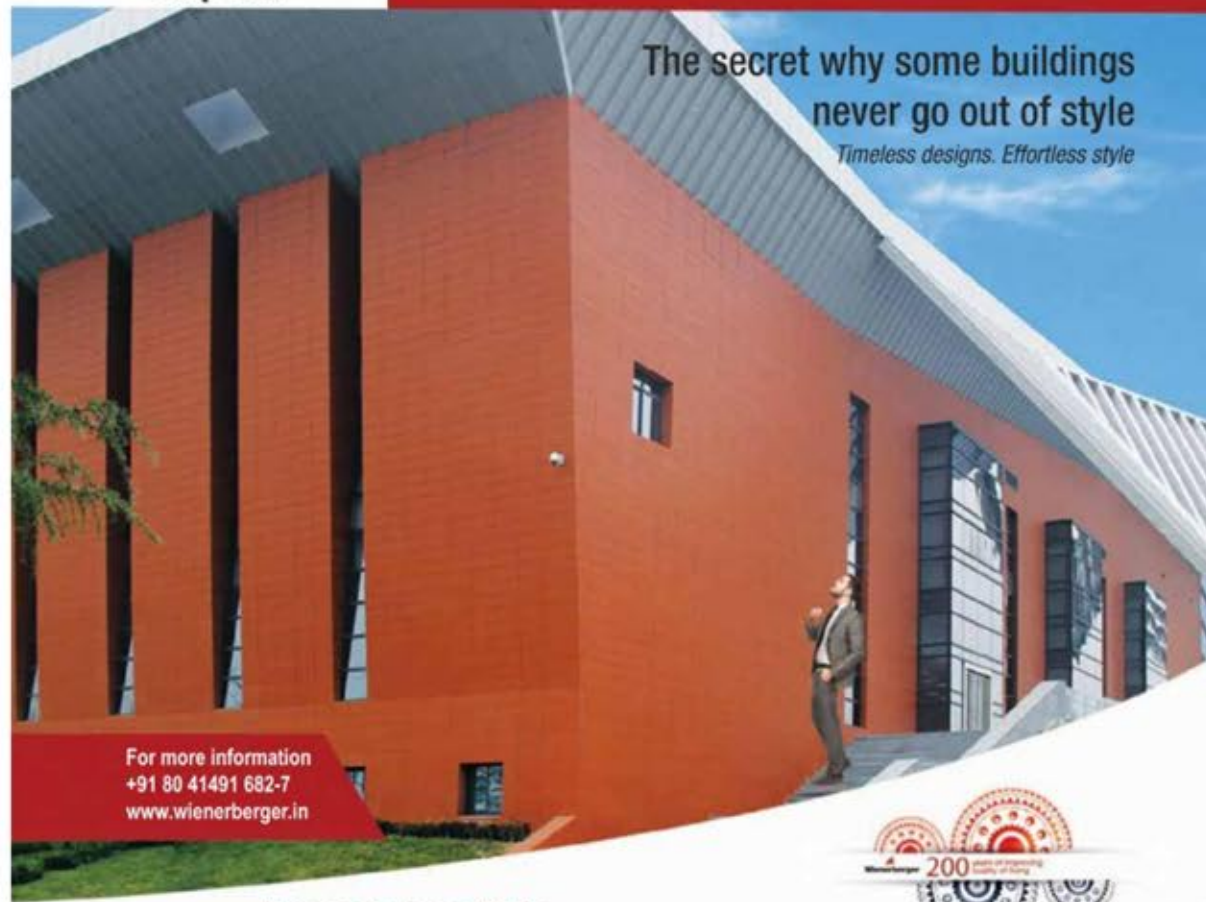
Dynamic façade or responsive façade is a building exterior that can change in response to its surrounding environment to maximise its performance. In this way, the 'skin' of the building

is not static, but dynamic and can transform according to requirements. The dynamic façades act as filters between the indoors and the outdoors, facilitating the users providing appropriate shade, sunlight, ventilation and a visual union with the world in motion outside. With the help of new techniques (**sensors & motors**), façades calculate the elevation angle of the sun and respond accordingly by constantly changing the orientation of shading elements throughout the day. The façade also has a layered design which includes opaque and transparent elements, which can be moved around on top of each other according to the time of day and weather conditions. Overall, the system is made up of a thermo-active wall and three sheets, which



Vimhans Hospital, Nehru Nagar, Image courtesy - ADCPL

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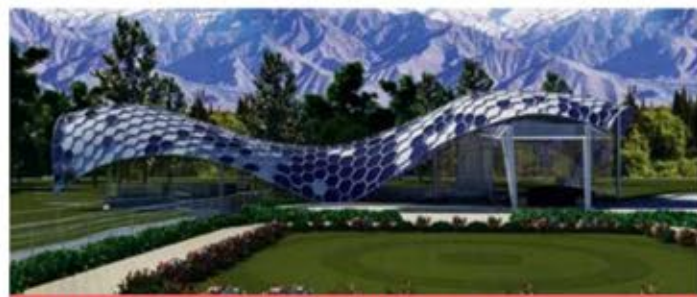
- Aspect is made of clay, 100% natural, weather resistant, long lasting
- Ventilated design provides excellent thermal and sound insulation
- A wide range of colors & finishes to support design flexibility
- Blends seamlessly with other contemporary façade systems, glass and steel
- Robust installation, technical support from Wienerberger

Aspect Clay Ventilated Façade is fast becoming the Architects' first choice for façade, across India. The brand is marketed by Wienerberger, one of the world's largest & most trusted manufacturer of building materials. Aspect Façade imbibe the lasting qualities unique to clay, while at the same time, providing aesthetic appeal as well.



Clay tile thickness available in 20 mm & 30 mm

Wienerberger



The Zen Ladakh Resort, Leh, Image courtesy - ADCPL

can be coated with a maximum of three different functional layers: insulation, thin film, photovoltaic and sun-protection.

"Since technology has moved in rapidly into the design fold, we are able to simulate various conditions in the buildings and its users may encounter in its life cycle. This knowledge has forced the façade technology, to make itself agile and climate responsive", says Naik. With the advancement in technology, we can see dynamic façades that are connected to **sun trackers**, which respond to the sun's movement - **movable louvers** open and close automatically to control light and heat ingress into the built environment, shading devices expand and contract to reduce the glare and heat gain, **ventilated façades** control the air draft inside the double layer, based on the heat gain to reduce the surface temperature. **Building integrated photovoltaic façade**, generate electric energy, which

could work as a sizable offset on the power demand, observes Naik. These aspects have definitely ushered a new era of the passive right approach in the sustainable design domain of buildings.

Khanna too agrees that smart cladding systems are used for optimising temperature levels inside a building nowadays. The materials used in the cladding system are with low U values. To make a project sustainable, energy conservation is of primary importance. Glass façades incorporate Lo-E technology in colder climates where the glass allows heat transmission, but does not let the heat escape; in warmer climates, performance glass is used which reduces the solar factor improving on air conditioning cost, observes Goregaoker. Sun breakers on the façade are aesthetical elements, at the same time reduces the heat gain in buildings.

The implementation of smart cladding technologies not

only curb the building's energy consumption but also helps improve safety, comfort and security for the residents, adds Kanchwala. Intelligent façades have the ability to adapt to the local weather. These allow users to take control of its performance as per the needs such as shielding during extreme heat and opening up during cool weather. Furthermore, the use of louvers in cladding provides diffused light into certain public areas which allows air movement, thereby reducing the need for air conditioning in certain areas of the building. Cladding with insulation cavities can also help reduce energy consumption and heat ingress into the building. Kanchwala adds that locally available cladding materials are beneficial as they do not require long distance transportation and helps save the cost on fuel. The colour of these materials also affects the total heat gain. Furthermore, the sun path plays an important role in deciding the glazed and the non-glazed component of the façades.

According to Rana, recent smart technologies for cladding, including solar energy generating panels and dynamic wind façades, can reduce the carbon footprint and energy loads of the building. These cladding technologies in the future will have a huge role to play in making buildings "zero energy". A more "frugal approach" would be, the use of waste plastics, recycled steel, broken tiles as cladding materials for new buildings, she adds.

VENTILATED ENERGY CONSERVING FAÇADES

According to Ar. Goregaoker, ventilated façades incorporate a technology where the cladding system is installed at a certain gap from the building face and the system itself has vertical gaps between the cladding materials so as to let the natural air to flow in the space between. Ventilated

façades are a complex, multi-layer structural solution that enables "dry" installation of ventilated walls. This reduces the amount of heat that buildings absorb in hot weather conditions due to partial reflection of solar radiation, says **Amit Murao, Partner, ADCPL**. The heat is absorbed by the covering, the ventilated air gap and the application of insulating material. This, in turn, helps in achieving a considerable reduction in the costs of air conditioning. Vice versa, in winter, ventilated walls manage to retain heat, resulting in savings in terms of heating. Handa too agrees that the process achieves a well ventilated façade cladding involves combining a substructure and an insulation layer to the support wall that covers the building by means of a port structure (mainly made of aluminium).

By employing a ventilated energy conserving façade, an energy concept can be developed for each building that ideally combines heating requirements for winters, cooling requirements for summers and the perfect day light quality, note Murao and Rana.

Ar. Reza Kabul adds that ventilated cladding is easier to maintain in which the panels can be replaced without effort as they are generally fixed on aluminium framework with clips. Due to partial reflection of the sunlight and air movement behind the panels, the amount of heat which the building absorbs is reduced, thus reducing the consumption of air conditioners, which is a step

towards sustainable development. Kanchwala agrees with this, adding that ventilated claddings have relatively low maintenance, ability to reduce water absorption into the building, resist pollution and they increase the mechanical strength of the building. Energy generation through the seamless integration of photo voltaic and fire resistance are plus points.

Rear Ventilated Façade Systems are installed on substructures that leave ample space between the wall and the panel. During monsoons, this façade system drains the rain water away from the walls. It is a sustainable system and can help reduce the power consumption of AC in buildings. It

creates a gap between the building wall and façade, which reduces the overall U factor of the system by allowing active air movement, explains Khanna. This improves heat and noise reduction while also imparting better weather protection.

Ventilated cladding allows taking in diffused light, reduce glare and exposure to dust in the window system behind it. Good thermal and vapour barrier performance increases the building's life and in some cases increase the quality of the air surrounding the façade. The main purpose of a ventilated façade is to create an interface between the interior and the exterior environments.

New Cladding System to Save Energy

Recently, two researchers have developed a ventilated façade with a double chamber and flow control device that significantly saves energy in buildings. This sustainable, efficient solution can be applied in both renovations and new buildings due to its simplicity. Conventional ventilated façades are composed of an inner sheet, thermal insulation, ventilation chamber and exterior finish. The new façade adds a second air chamber between the existing one and the façade insulation. Both chambers are interconnected by the bottom of the façade. Another feature is a new element at the top to regulate the airflow in the chambers, depending on the gradient of the existing temperature between inside and outside the building. This presents two improvements over conventional

systems. Energy gains/losses are reduced through the façades, and consequently, reducing the energy consumption due to air flow. Secondly, the design of the system helps to reduce the vertical temperature gradient along with the envelope, homogenising the air temperature in the chambers throughout the year.

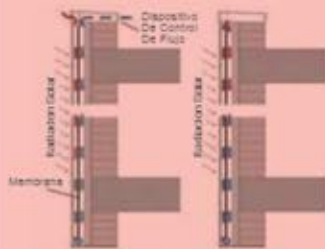


Diagram of the façade functioning in summer (left) and winter (right). Credit: Jaime Santa Cruz and César Porras

Credits: <https://phys.org/news/2017-11-facades-energy-efficiency.html> (Sushant Jai-Amita Verma, Co-founder, rat[LAB])



Sunset Streaks - A project by Fundermax



Optical and mesmerising - A project by Fundermax



GA Design, Indu Villa



Shangri La, Bengaluru - A project by Aludecor

RAIN-SCREEN CLADDING - DETAILS & ADVANTAGES

According to Murthy and Khanna, rain-screen cladding system is a form of double-wall construction that uses an outer layer to keep out the rain and an inner layer to provide thermal insulation. It prevents excessive air leakage and carries wind load. The outer layer breathes like a skin while the inner layer reduces energy losses. The main benefit of rain-screen cladding systems is that it protects the structure of the building, whether it's a steel frame or masonry based system, from the weather elements, especially rainwater. It does this because the cladding panels form a barrier to rainwater, preventing it from penetrating across the rear ventilated cavity and reaching the exterior wall of the building. This process is helped by air continually circulated up through the ventilated cavity, driving away any moisture that penetrates between the panels, upwards and out at soffit level before it reaches the building structure.

The rain screen assembly allows for water getting past the outer (face) barrier to weep down and outward (gravity assisted and pressure equalised) once the wind abates through a series of

engineered flashings and weep-assemblies, explains Sushant Verma. The key to this system is to allow for pressure equalisation behind the face materials which will allow the water to drain away instead of continuing its way through the wall assembly.

According to Ashok Kumar Bhaiya, CMD, Aludecor, with rain screen cladding, which acts as a ventilated façade as well, there is no need for any weather sealant to be used. The air gap between the building and rain screen creates pressure equalisation which will not allow any air or water infiltration. Appropriate pressure equalisation also helps in minimum undulation in metal composite panels.

According to Govind, rain screen is a terminology used to refer a building envelope, not necessarily a watertight system, the main function is to protect direct rain and used for common or service areas of the building. Otherwise used for architectural or choice of external finishes.

Reza Kabul notes that its advantages are similar to ventilated surfaces and also their design parameters, only the terminology defers as per climatic conditions. Care has to be taken such that the system is designed to provide proper drainage for water which can get collected in the cavity of the structural support system for the cladding.

Rana says that there are two basic types of rain-screen cladding - drained and ventilated rain-screen and pressure equalised rain-screens. The drained and ventilated rain-screens require a sufficient level of detailing so that the water in between the cavity can vent outside, whereas the pressure equalised rain-screen allows movement of air inside the cavity so that water is evaporated itself.

A rain-screen façade consists of a ventilation cavity of around 25mm right behind the cladding panel, explains Kanchwala, preventing



Shreepati Arcade at Mumbai - A project by Reza Kabul Architects

energy loss and structural decay. The insulation can be positioned within the cavity and the openings at the top and bottom of the clad, which can allow the evaporation of moisture vapour and drainage. External wall insulation is superior in performance as it eliminates the condensation risks associated with internal or cavity wall insulation. This is important for renovation schemes and in new construction, the use of back ventilated rain-screen cladding provides the designer with the opportunity to use economical single skin load bearing block work for infill walls.

Most wall systems (brick and stone veneer, siding, EIFS, cement board, etc.), says Verma, are designed to work as part of a rain screen wall system - there are few barrier walls left, other than precast concrete panels, which have a rain screen caulking system that helps drain these assemblies.

According to Coregaoker, a wide range of metal and metal composite materials (MCM) can be used to manufacture rain screen cladding systems. They can be of aluminium or other metals such as copper, zinc and stainless steel continuously bonded under tension to either side of a thermoplastic or mineral core. Adding to this, Handa says that rain-screen cladding keeps the underlying structure dry, which means less maintenance as



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Le Méridien Thimphu - A project by Reza Kabul Architects

there are fewer incidents of rust or corrosion on metalwork.

Advantages of rain screen cladding:

- Accounts for improved thermal performance of the building
- Enhances water management
- The use of lightweight façade materials like aluminium panels mean that the loadings on the underlying building structure are much less than masonry-based materials
- Modern rain-screen cladding systems are lightweight and strong, making it relatively easy to create engaging, striking designs that appear to defy gravity
- All rain-screen cladding material is lightweight in nature and also accounts for easy installation
- Modern rain-screen cladding systems allow individual panels to be removed, giving your maintenance team easy access to services

Disadvantages of rain screen cladding:

- An additional load being applied to the existing structure
- The internal structural elements have to be designed and executed, ensuring the

provisions for external façade or screen element fixing requirements

- Additional cost part
- Improper joinery and fixing may cause water seepages and corrosion to metal elements
- Should be used for vertical surfaces only rather for horizontal or skyward sloping surfaces
- Specifications and contracting methods need to be closely coordinated and controlled to assure satisfactory performance of the entire system

Materials & methodologies for fire safe & earthquake-resistant cladding:

Façade materials play a key role in fire safety, as it would be extremely difficult to control the building fire on the exterior. Hence, more focus is needed in selecting appropriate materials, and this requires designer knowledge on material behaviour and performance, points out Murao. Such materials used for external cladding should have been tested for its combustibility, ignitability, flame spread and burning droplets.

Before making buildings more earthquake resistant, we also need to consider earthquake resistant cladding as it is the future of construction design. Lightweight wall claddings reduce the forces exerted on the structure and foundations when the building is subjected to lateral seismic loads. Lightweight sheet claddings on buildings tend to rely on the flexibility of the fixings to the frame to accommodate lateral distortions of the structure, says Murao.

Rana observes that the most common way of the spread of fire is - spreading by the material of the cladding and via the air gap. The easiest way to ensure fire safety in buildings is by using fire tested and rated materials for claddings, compartmentation of

cladding areas so that the fire does not spread, cavity barriers, and use of high fire rated insulation for cladding.

As NBC stipulated the flame spread index (FSI) on the surface of the cladding material has to be considered, notes Ashwani Khanna. Windows and glazing junction areas are vulnerable areas from which fire can spread into the building. Exterior grade laminates are flame retardant material that doesn't propagate fire. Further, covering the windows and cladding junction by fire seal reduces the scope of fire spread on the façade or into the building.

In case of a fire, the exterior walls get susceptible to radiant and convective heat which quickly transfers a ground fire to the structure's roof, elucidates Kanchwala. To combat this, the exterior walls can be protected by fire-resistant materials such as stucco, plaster, cement, concrete masonries like brick, stone or blocks. The key points regarding fire safety are to prevent spreading of smoke and fire in the building. Suitable fire stops and smoke seals play a crucial role in preventing the spreading of fire. Provision should be made for required openings for safe evacuation and passage of smoke. The framing which grasps the cladding makes it strong and prevents the structure from collapsing during a fire spread.

According to Handa, well-constructed buildings can help



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A studied choice of the material is made adhering to the following points:

- A tested fire resistance level of the material and the system - Fire resistance levels are calibrated to minutes for structural stability, integrity and insulation
- Combustibility parameters and fire hazard properties need to be prescribed as a mandatory checkpoint for cladding materials
- Compliance of the fire laws and the specifications in the national building code should be a prerequisite
- Spandrels, insulation and horizontal fire barriers should be fire rated to prevent vertical transmission of fire
- Test reports and certificates from a registered testing authority for cladding materials should be made mandatory
- A key aspect which does not get addressed is the maintenance, as the building ages the systems suffer fatigue, and most often fire barriers, joints and insulation give way and lead to fire leaks. A maintenance policy should be a prerequisite for any building sanction
- Guidelines for product properties focussing on hazards, encompassing linings assemblies and materials

(Anup Naik, Partner and Director, Space Matrix)

prevent tragedies due to the fire by using materials that are relatively fire-resistant. Materials nowadays are rated in the order of their ability to restrict the fire from affecting the structures. Hence the smart way is to construct a building in which a fire would take effect slowly, allowing the occupants plenty of time to escape in emergency situations.

Covind says that cladding material shall not use combustible or character of fire propagations. For

these risks materials such as timber based are not recommended for cladding. Commonly used ACP must be selected carefully such that material is free from combustible poly ethylene (PE) core. Due to recent fire instances in a few international buildings, there is greater awareness of Fire Retardant ACP (FR) panels, which is recommended instead of PE core ACP materials.

With regards to fire safe cladding material, a minimum of two-hour

fire rating on materials is required, points out Reza Kabul. Since the fire in the Address Hotel in Dubai the industry is moving away from ACP as a cladding material and heading towards tiles and high pressure laminates, he adds.

For earthquake resistant cladding, notes Kanchwala, the material selected need to have movement and should resist lateral forces. It is mandatory to select the appropriate façades during the stage, with the use of unitised lazing façade that is often used in tall towers to resist movement.

Earthquake generally have no direct impact on cladding materials and its choices, however brittle or stiffer materials are not advised for high risk seismic zones, says Covind. Furthermore, seismic resistant design of cladding systems will have to be taken care of supporting systems and fixings to the building. For earthquake resistance, explains Reza, the cladding needs to be dry cladded onto the building and the joint should not be rigid but account for movement due to earthquakes. The material should not crack and falls during an earthquake. The thickness of the material plays an important part. For tiles, they should be 10mm plus. High pressure laminates, even though they are thin, they are very flexible and do not break easily.



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