

DEPARTMENT OF ENVIRONMENTAL
ARCHITECTURE

RESEARCH . ANALYSIS . SYNTHESIS . PROPOSALS.

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ABOUT US

Endowed with an excellent infrastructure, motivating faculty and a great tradition of empowering women through education for the last 126 years, we at BNCA are committed to establish and enhance the importance and role of women in the challenging field of Architecture, Interior Design, Digital Architecture, Environmental Architecture and Landscape Architecture, as well as Doctorate in Architecture. We have always been on the fore front and in pace with the latest technological developments. It is our dream, that keeps us motivated, to make our campus a hub of Architectural education and experimentation. We are therefore forever keen to introduce as many courses possible to our students. BNCA aims to give the student's profile a competitive edge by making them specialist in various advanced fields, one of which is computer applications. Our college ensures that the students will not only excel in academics but also simultaneously tread a path to a total holistic growth.

Environmental Architecture encompasses the entire gamut of environment that we are a part of both built and unbuilt. The course aims at sensitizing the professionals to the environmental issues, global as well as site specific, focusing on the design approach, technology and economics to address them. The architects can play a major role in influencing the clients and authorities to practice energy conservation and contribute to environmental sustainability. The department offers a two year full time master's programme in Environmental Architecture. The course is designed & detailed as per the norms of Council of Architecture, India, AICTE (All India Council of Technical Education) & Savitribai Phule Pune University.

RESEARCH AT BNCA

Since its inception in 2006, the students of Masters of Environmental Architecture have been carrying out extensive research as part of their dissertation. The research is presented both as a research paper and dissertation. The focus of this course is related to environmental planning as well as environmental architecture i.e building scale and component scale. Research projects also reflect this in the topics chosen.

The broad themes on which these topics are based on are as follows:

1. Environmental Planning and Sustainable Development
2. Indoor Environmental Quality
3. Natural Resource Management
4. Materials and Technology
5. Environmental Design and Behaviour

This is a brief compilation of abstracts representing the various themes giving an overview of the wide spectrum of research work done at the department.

We are further looking forward to follow it up with full paper publications of selected research papers in the years to come as well as explore new areas of research keeping in tune with the current trends.

APPLYING BIOMIMICRY TO DESIGN BUILDING ENVELOPES THAT LOWER ENERGY CONSUMPTION IN A HOT AND DRY CLIMATE

BY: ANUSHKA GANDHI (2019-2021)
GUIDE: PROF. DR. SUJATA KARVE



KEYWORDS

Biomimicry principles, building envelop, energy consumption

ABSTRACT

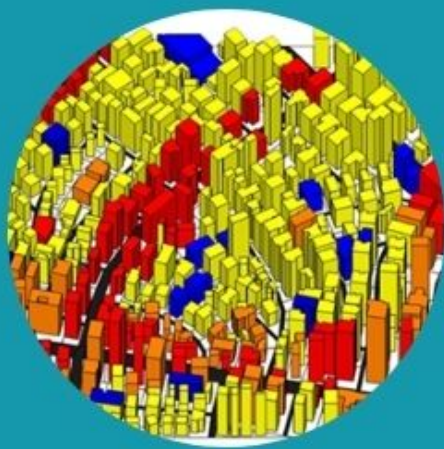
Design thinking in architecture has shifted due to environmental changes, and the role it plays in energy consumption. The building envelope is a key design element, as it mediates the maintenance of comfortable indoor temperatures. This study uses the solution-based approach for generating biomimetic architectural concepts.

This proposed biomimetic design was inspired by the adaptive strategies of the African reed frog, Polar bear and the Saharan Ant. It incorporates a mineral wool batt, Expandable polystyrene insulation and embedded phase changing material, and the use of adaptive thermal comfort. We calculated potential summertime energy savings for a small-sized office building in Ahmedabad using Design Builder/Energy Plus.

The results show a potential of up to 25-30 % reduction in the space conditioning energy use intensity mainly thanks to a decrease in cooling energy needs

EFFECT OF BUILDING BYELAWS ON DAYLIGHT AND NATURAL VENTILATION

BY: PALAK SIROYA (2019-21)
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KEYWORDS

Building bye laws, light, ventilation, redevelopment

ABSTRACT

Pressure on infrastructure due to over population has deteriorated the indoor environment causing various health issues as contributing to the sick building syndrome making huge monetary burden to economy. Public health department of the country has taken many actions to mitigate these issues however; design of the building was not taken into consideration. Optimum quantities of light and proper ventilation express the quality of indoor environment. The use of natural light and ventilation is definitely an advantage with the raising concerns regarding the cost and environmental impact of energy use ensuring safe, healthy and comfortable living conditions. Therefore, it is very important to assess indoor environment before implementing new construction or building. In this thesis, a Neighbourhood has been studied in an urban city of India where light and ventilation were analysed in accordance to the Building Byelaws. Analysis helped determine the effect of Building Byelaws on Light and ventilation in urban area. The study identified the problems of light and ventilation in the selected neighbourhood which helped the possible solutions through simulation . This analysis can be useful while redeveloping an area to improve the standard of Daylight and Ventilation in indoor environments.

ENVIRONMENTAL AUDIT AND ANALYSIS OF AN INSTITUTIONAL CAMPUS

BY: VAIBHAVI SAKKARWAR (2019-21)
GUIDE: PROF. DR. SUJATA KARVE



KEYWORDS

Environmental audit, green campus

ABSTRACT

The rapid urbanization and economic development at local, regional and global level has led to several environmental and ecological crises. On this background it becomes essential to adopt the system of the Green Campus for the institute which will lead for sustainable development. The purpose of the audit was to ensure that the practices followed in the campus are in accordance with the Green Policy adopted by the institution. The methodology included: preparation and filling up of questionnaire, physical inspection of the campus, observation and review of the documentation, interviewing key persons and data analysis, measurements and recommendations. It works on the several facets of 'Green Campus' including Water Conservation, Waste Management, Energy conservation. With this in mind, the specific objectives of the audit were to evaluate the adequacy of the management control framework of environment sustainability as well as the Departments are in compliance with the applicable regulations and standards. It can make a tremendous impact on student health and learning college operational costs and the environment. The criteria, methods and recommendations used in the audit were based on the identified risks.

COMPARATIVE CARBON FOOTPRINT EVALUATION OF AN INSTITUTIONAL CAMPUS, PUNE

BY: AKANKSHA SHENDE (2019-21)

GUIDE: PROF. PRAJAKTA DALAL-KULKARNI

Understanding Carbon



KEYWORDS

Carbon Footprint, Pandemic, institutional campus, emissions, carbon sequestration.

ABSTRACT

Carbon footprint determines the measure of extent of greenhouse gases (GHGs) emitted from any organization or activity. Carbon footprint evaluation of an educational institute helps in identifying the areas and sources responsible for emission. An institutional campus in Pune was selected as the study area. The advent of COVID-19 pandemic caused an impact on every sector around the world. This forced the human society to maintain social distancing and shift to work from home mode. Hence this study assesses the comparative carbon footprint evaluation before and during pandemic of an institutional campus in Pune. The architecture college building, mechanical engineering college building and information technology college building are named as Case 1, Case 2 and Case 3 respectively for study purpose. Years 2019-2020 and 2020-2021 are selected for carbon footprint evaluation as major variations are observed due to the advent of pandemic. An overall reduction of nearly 50.81% was observed in the year 2020-2021. Though a reduction was seen Cases 1 and 2 case 3 showed an increase in scope 3 emissions in the year 2020-2021. It was concluded that online lectures during pandemic reduced the scope 1 and scope 2 emissions of the institutional campus and its buildings.

STUDY OF OCCUPANT WELL-BEING IN THE RESIDENTIAL BUILT ENVIRONMENT

BY: CHETANA AIRANI (2019-21)

GUIDE: PROF. NAMRATA DHAMANKAR- JADHAV



KEYWORDS

Occupant environmental satisfaction, occupant comfort, psychological wellness, cognitive health, well-being, indoor environment.

ABSTRACT

With the increasing demand in residential typology of buildings in urban and rural areas, and the time we spend indoors, it has become crucial to understand the impact of built environment on our health and well-being. Due to the current Corona virus pandemic, people are forced to spend most of their time at home, but are also expected to work or/and study and function like we were before the pandemic. With the upcoming Green Building Rating systems which claim to produce healthier buildings and occupants than conventional buildings, there is a need to assess and quantify the parameters of built environment which affect our environmental comfort. The paper examines which evaluated indoor environmental parameters and building features mostly affect occupants' satisfaction in residential buildings. The objective of this study was to understand how the environment around us affects our cognitive responses, and quantifying these responses. Results suggest that most occupant comfort parameters are significantly related to their health and psychological well-being, with thermal comfort being the major aspect of health outcomes. Satisfaction with comfort parameters may not necessarily mean correlation with real time data for every case suggesting that their significance on the final health outcome of the occupant is not considerable.

ASSESSING THE INDOOR ENVIRONMENTAL QUALITY OF SHOPPING CENTRES IN A HOT-DRY CLIMATE – A CASE OF AMRAVATI, INDIA

BY: ARPITA DESHMUKH (2019-21)
GUIDE: PROF. RAHUL NAWLE



KEYWORDS

Thermal comfort, built environment, shopping centres

ABSTRACT

Aspects such as built environmental quality and thermal comfort have gained relevance as environmental consciousness and standard of life have improved. The built environment's role has evolved from simply providing shelter to also providing a comfortable and healthy environment. The health of the occupants and the use of the space are directly affected by the indoor environmental quality and thermal comfort. Unlike malls, these shopping centres were constructed as open spaces with natural lighting and ventilation, making them more energy efficient.

The environment that is generated has an impact on the commercial performance of retail buildings. It is necessary to examine and identify the challenges related with these energy efficient forms in order to continue using them. These issues can then be eliminating by appropriate retrofit recommendations. Amravati is a city with a variety of retail options, including street markets, shopping centres, and malls. The study's goal is to assess the environmental quality of shopping centers in Amravati. Field measurements of environmental quality parameters such as air temperature, relative humidity, wind speeds, light levels, were carried out in various shopping centres. The study examines issues and design concerns related to shopping centres. The study mentioned above would provide insight into how design might improve environmental quality.

ANALYSIS OF EMBODIED AND OPERATIONAL EMISSIONS OF A BUILDING STOCK IN A NEIGHBOURHOOD

A CASE OF IDEAL COLONY NEIGHBOURHOOD IN PUNE

BY: HARSHADA AKOLKAR (2019-21)

GUIDE: PROF. PRAJAKTA DALAL KULKARNI



KEYWORDS

Building sector emissions, emission intensity of neighbourhood, low carbon scenario

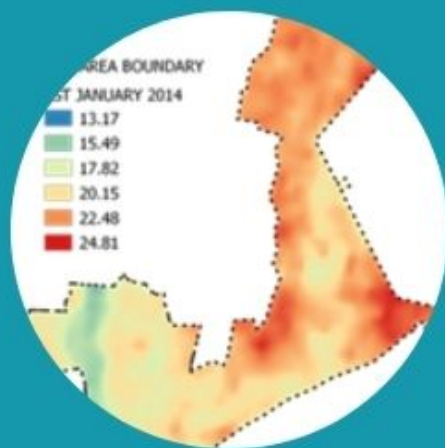
ABSTRACT

Growing population, urbanization, changing lifestyles, inward migration in metro cities etc. are some of the driving factors for growing real estate sector. Building sector has a critical share of GHG emissions in a buildings' lifetime. The current real-estate trends suggest that new development along with redevelopment of old buildings is resulting in the densification of neighbourhoods. This rate of densification should be looked at as an opportunity to facilitate low carbon future through large scale awareness on urgent adoption of low carbon techniques, energy efficient technologies, low embodied carbon materials and methods etc. In this study, Ideal Colony neighborhood located in the southwestern suburb of Pune city is studied as a representative of all the suburban neighbourhoods that currently have majority of the buildings which are in the range of 30-40 years in to their lifespan. This study is carried out with a specific aim to evaluate and analyze long term changes in emission intensity of a building stock in the neighbourhood. This study tests the hypothesis 'Selection of the construction materials and energy efficient technology both have a significant impact on the emission intensity of a building stock'.

STUDY OF HEAT ISLAND EFFECT

A CASE OF INDUSTRIAL AREA IN COMPOSITE CLIMATE

BY: NIKITA DATE (2019-21)
GUIDE: PROF. SONALI RAJWADE



KEYWORDS

Heat Island Effect, Industrial area, Land Surface Temperature, LST, Envi-met

ABSTRACT

Certain human activities like industrialization and urbanization have caused irreversible environmental impacts to the world. Industries play a very important role in development of the country in spite of their environmental impacts. All these changes affect an area's local meteorology, and one of the consequences is the heat island phenomenon. Heat islands are areas that experience higher temperatures than outlying areas. Its major impact is observed during the daytime and night time after three to five hours of sunset in urban and semi-urban areas. Hence, earlier prediction of HI effect is required in order to mitigate its hazardous effect. Most of the urban heat island (UHI) studies are carried out in densely populated cities but core industrial areas are also potential sites of heat island effect despite having a comparatively lower population. In the present study, heat island assessment has been carried out for Nagpur Hingna MIDC industrial area which is one of the oldest industrial areas of Maharashtra and is still undergoing a transformation to accommodate more industries. The present study assesses surface heat islands both at the macro and micro scale.

SUSTAINABLE ADAPTIVE REUSE AND RETROFIT OF A HERITAGE BUILDING

BY: KANIKA SATHE (2019-21)

GUIDE: PROF. SONALI RAJWADE

CO-GUIDE: DR. SHARVEY DHONGDE



KEYWORDS

Sustainability, reuse, embodied energy)

ABSTRACT

Sustainability involves a collective responsibility to advance and strengthen the interdependent and mutually reinforcing pillars of sustainable development: economic development, social development and environmental protection at local, national, regional and global levels.” (Johannesburg Declaration of the Three Pillars of Sustainable Development)

Heritage buildings are a built manifestation of social and cultural values, thus rendering them an asset to be preserved. Moreover, heritage buildings are built with durable materials and construction techniques, which make them cost effective and functional in reducing embodied energy and carbon emissions arising from new construction. This approach helps save exponential amounts of embodied energy by reusing an existing building to its full potential. Thus, adaptive reuse of such heritage buildings is an intrinsically sustainable that holistically caters to the three pillars of sustainability: social, economic and environmental. The focus of this study is to provide a sustainable adaptive reuse solution for a heritage building. It aims to explore the benefits of revitalizing an old heritage structure and quantify the conservation of cost and embodied energy consumed in new construction processes.

MICROCLIMATE STUDY OF KHOTACHIWADI NEIGHBOURHOOD WITH RESPECT TO THE IMPACT OF HERITAGE CONSERVATION CONTROL

BY: KOMAL JADHAV (2019-21)

GUIDE: PROF. RAHUL NAWLE

CO-GUIDE: DR. CHETAN SAHASRABUDHE



KEYWORDS

Microclimate, Khotachiwadi, Heritage conservation, Morphology, Environmental parameters, Simulation, Outdoor Climate

ABSTRACT

Microclimate plays an important role in understanding the thermal and the environmental comfortability of a given city or a neighbourhood, area . Khotachiwadi is a heritage neighbourhood that is nestled among the urban fabric of Girgaon, in South Mumbai, India. Over the past 2 decades because of rapid urbanization in the Mumbai city, the neighbourhood is under constant threat. This neighbourhood is worthy of preservation and the area has been declared as a Heritage Precinct as per for Greater Mumbai, 1995. The thesis aims to map out the different changes in the built form of the neighbourhood from the past to the present and how the neighbourhood has been sustaining itself in the present. It aims to understand built and unbuilt spaces and its climatic responses and study the current scenario, regulation and the various environmental parameters of the neighbourhood analysing for the climatic performances. The past and the present morphology have been studies through various parameters such as the built and unbuilt spaces, orientation of the streets, types of streets, Shadow pattern analysis, vegetation, characteristic of the buildings, building materials etc. The microclimate of Khotachiwadi neighbourhood has been analysed though simulation software ,ENVI-met.

EXPLORING THE POSSIBLE RE-USES OF USED CIGARETTE BUTTS IN THE CONSTRUCTION PRODUCTS

BY: AISHWARYA PALWE (2019-21)

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KEYWORDS

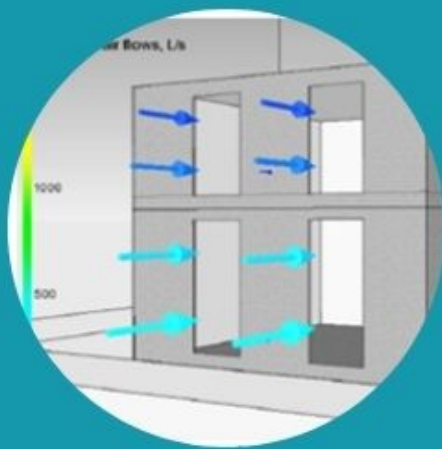
•cigarette filters, construction material, environmental hazard

ABSTRACT

Filters are intended to reduce the harm caused by smoking by reducing harmful elements inhaled by smokers. However, they do not make cigarettes safer. While laboratory tests show a reduction of "tar" and nicotine smoke, filters are inefficient at removing gases of low molecular weight, such as carbon monoxide. The main reason behind smoking cigarette is nicotine. When any person takes a cigarette after smoking, the last part remains called "filter/butts" and now butts can be seen littered almost everywhere. The real environmental culprit is the filter. The main ingredient in the manufacture of cigarette filters is a product called cellulose acetate, a type of slow-biodegrading toxic plastic. The aim of this study is to explore the possible reuses of used cigarette butts in construction products. In order to achieve this aim, it's important to study and understand the properties of Cellulose Acetate and Cigarette Butt Filters so that they can further be experimented in the construction products. It was observed that the key properties of these materials are that the material has good toughness, deep gloss, and high transparency and has a feel that can be described as 'natural'.

EVALUATING BUILDING PERFORMANCE: A CASE OF LOW-TECH BUILDING 2226 RELOCATED IN KORTRIJK, BELGIUM

BY: JYOTIKA GIRDHAR (2019-21)
GUIDE: PROF. NAMRATA DHAMANKAR-JADHAV



KEYWORDS

ABSTRACT

Buildings are responsible for approximately 40% of energy consumption and 36% of CO2 emissions in the EU. Currently, about 35% of the EU's buildings are over 50 years old and almost 75% of the building stock is energy inefficient, while only 0.4-1.2% (depending on the country) of the building stock is renovated each year (Energy Performance of Buildings Directive (EPBD)). In 2005, Belgium's residential & commercial buildings were responsible for 35% of primary energy demand out of which commercial accounted for about 27%. Hence, there's a need to study the concept of low-tech buildings, which is defined as a highly efficient building characterized by simple, very durable, and resource-saving structural components that exist throughout the entire life cycle. This concept is being explored through a Case study of 2226 building. In order to understand the concept of low-tech, a building has been considered in Belgium to implement the concepts. Therefore, the low-tech building 2226 of Lustenau, Austria was visualized and assumed to be at Kortrijk, Belgium. To study the concept of low-tech buildings, areas like energy efficiency, optimal human comfort, etc. were studied. Parameters like Building Envelope, Visual & Thermal comfort were studied to be part of the solution interventions.

CLIMATE RESILIENT RESIDENTIAL NEIGHBOURHOOD AT BHALSWA URBAN VILLAGE

BY: URVASHI SHROFF (2019-21)
GUIDE: PROF. RAHUL NAWLE



KEYWORDS

Resilience, Sustainability,
Affordable housing, 20 minute
Neighbourhood

ABSTRACT

Climate breakdown and global temperature rise present an existential threat to the human race. They require a unified global response across all levels of society. If these emissions are not appropriately addressed the world will become increasingly vulnerable to the adverse impacts of climate change. Cities are where we must focus our efforts for a transition to a green and just future. This thesis aims at planning a climate resilient residential neighbourhood at Bhalswa urban village. The harsh effects of GHG gases and climate change has affected health and well-being of people dwelling around Bhalswa. This thesis will look into the relation between affordability and resilience and other urban design principles to curb the issue of sustainability.

DATA DRIVEN INVESTIGATION OF THERMAL COMFORT IN AN INFORMAL SETTLEMENT - A CASE OF MUMBAI

BY: DIVYA CHAUDHARI (2019-21)
GUIDE: PROF. NAMRATA DHAMANKAR-JADHAV



KEYWORDS

Informal settlements, thermal comfort, outdoor comfort

ABSTRACT

Today, more than 50% of the world's population resides in urban areas with staggering growth rate. Of this growing population, about 90% population growth will take place in Asian and African cities. This growing urbanization will see a demand for infrastructure and urban services, thereby creating a burden on climate and environment amongst others. With growing urbanization, informal settlements and urban poor is a common sight especially in emerging economies. Amongst the worst affected population in terms of climate impacts are the urban poor. UN-Habitat in 2016 reported that 30% of urban residents dwell in informal settlements. Various studies related with socio cultural aspects, encroachments and authorizations, sanitation improvement etc. have been focused on quite extensively. . The aim of this research is to study the impacts of environmental parameters along with personal parameters of behaviour on thermal comfort in these informal settlements. The study will investigate this in a selected informal settlement in Mumbai city by on site data collected through data loggers installed in dwelling units.

ENVIRONMENTAL STUDY OF KHAZAN ECOSYSTEMS OF GOA: RESILIENCE MEASURES FOR COASTAL AREAS AGAINST CLIMATE CHANGE IMPACT OF SEA LEVEL RISE

BY: ELSA FERNANDES (2019-21)
GUIDE: PROF. SUJATA KARVE



KEYWORDS

Goa, Khazan, Coastal, Tiswadi, Climate change

ABSTRACT

Climate has been impacting all ecosystems in many different ways. Moreover, in recent times climate change has been in focus through the Decade of Action 2020-2030 for sustainable development by the United Nations. The global ecosystems are all affected by these developments and more sensitively so the coastal ecosystems as they are the most sensitive and vulnerable at the same time. On these lines the unique traditional vernacular coastal Khazan ecosystems of Goa have sustained the local communities for thousands of years now and in view of the global risks need attention in analysing its vulnerability and adapting resilience measures for sustaining the coastal communities which is the scope of this study. The Goa state action plan on climate change also has highlighted the need for building resilience of the coastal infrastructure sustaining these ecosystems. The study area for this project has been considered as the Tiswadi taluka being identified as the most vulnerable, being the lowest in Elevation and so with highest possibility of submergence. Further, the Khazan ecosystems of Tiswadi has been explored in detail against the possibility of flooding due to various coastal hazard risks of climate change like tidal variations, daily rainfall causing sea level rise.

STRATEGIC SUSTAINABLE DEVELOPMENT PLAN FOR THE NEWLY MERGED VILLAGES – CASE OF PUNE

BY:KAJAL SAWANT (2019-21)
GUIDE: PROF. RAHUL NAWLE



KEYWORDS

Sustainable development,
merged villages, strategies

ABSTRACT

Growing population and the increased need for shelter, one of the basic needs, leads to development which could be haphazard. Unavailability of affordable development in the cities pushes the development towards the fringe areas. Due to the migration of the people for better employment opportunities the fringe areas of the metropolitan cities develop on a large scale. The increasing development is one of the parameters contributing to the increase in emission of greenhouse gases and global warming. So, there is a need for sustainable development of these areas to avoid the adverse effect of development. Pune city is one of the fastest growing cities in Maharashtra, India, spread over an area of 7.74 sq.km. Recently in 2020 23 new villages were merged into the Municipal Corporation limits increasing its area to 416 sq.km making it one of the biggest municipal corporations in India. The aim was to study and propose strategies for sustainable development of the newly merged villages in Pune City. The proposal was to plan sustainable strategies to achieve reduction in emission of greenhouse gases and carbon footprint for merged villages, and making them self-sustainable. The study was carried out by studying all 23 villages based on parameters like existing land use and analysing the internal and external development stress on them. One or two villages were then selected as cases for formulating sustainable development strategies.

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