BOOK OF PROCEEDINGS

# 1st International Conference on Built Environment

# ICBE 2026

MAY 08th-09th, 2026
POLIS University, Tiranë

ISBN: 9789928347282

DOI: 10.37199/c4100031

CIP Katalogimi në botim BK Tiranë

Universiteti Polis

1st international conference on built environment (icbe) :

may 08th-09th, 2026 : book of proceedings / POLIS University,

Tirane. - Tiranë : Universiteti Polis, 2026. 1 burim në linjë (... f.)

ISBN 9789928347282

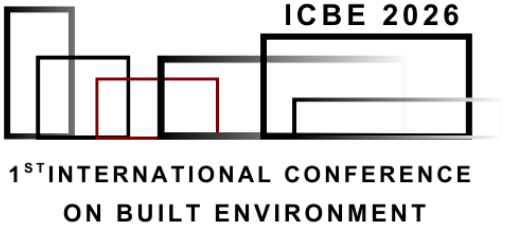
1.Arkitektura 2.Konferenca

72 (062)

BOOK OF PROCEEDINGS

1st International Conference on Built Environment

# ICBE 2026




MAY 08th-09th, 2026
POLIS University, Tiranë

ISBN: 9789928347282

DOI: 10.37199/c4100031

# 1st International Conference on Built Environment

# ICBE 2026

## Conference Theme and Rationale

The 1st International Conference on Built Environment (ICBE 2026) was conceived as an international and interdisciplinary forum for advancing knowledge, critical discussion, and innovation across architecture, urban planning, engineering, construction, materials, design, and the wider built environment. Organized by POLIS University in collaboration with the National Agency for Scientific Research and Innovation in Albania (AKKSHI), the Academy of Sciences of Albania and the University of Ferrara in Italy, the conference brought together academics, researchers, practitioners, students, and industry representatives to exchange research findings, professional experience, and emerging perspectives on the transformation of contemporary cities and territories.

The conference theme reflected the increasingly complex challenges shaping the built environment, with particular attention to sustainability, resilience, technological innovation, heritage preservation, and socially responsive design. Contributions addressed sustainable architecture and green building, innovative construction technologies and materials, climate-responsive and energy-efficient design, disaster risk reduction, circular approaches to construction, and the integration of renewable energy. Equal emphasis was placed on digital transformation through Building Information Modeling, Geographic Information Systems, artificial intelligence, data analytics, automated solutions, digital fabrication, and advanced manufacturing.

ICBE 2026 also recognized that the future of the built environment cannot be approached through technological innovation alone. Urban transformation, cultural heritage, adaptive reuse, inclusive design, ecological thinking, art, and interdisciplinary research were therefore integral to the conference rationale. The scientific sessions examined topics ranging from seismic resilience, geotechnical engineering, and structural safety to urban fragmentation, public space, heritage conservation, adaptive environments, and new relationships between human and non-human systems.

Through keynote lectures, scientific presentations, case studies, and interdisciplinary debate, the conference encouraged connections between research and practice while promoting approaches capable of responding to environmental, social, cultural, and technological change. The breadth of contributions demonstrated the value of bringing engineering, architecture, urbanism, design, heritage, and emerging technologies into a shared academic framework for more resilient, sustainable, adaptive, and human-centered environments.

Held on 8-9 May 2026 at POLIS University in Tirana, with in-person and online participation, ICBE 2026 welcomed guest speakers and participants from Albanian and international universities, research institutions, professional organizations, and industry. Its sessions established a platform for presenting current research, exchanging expertise, strengthening meaningful collaboration, and identifying future directions for the built environment.

## The event

The **1st International Conference on Built Environment (ICBE 2026)** is an interdisciplinary academic and professional forum dedicated to exploring contemporary challenges, emerging research, and innovative approaches shaping the future of the built environment. Bringing together researchers, academics, architects, engineers, urban planners, designers, practitioners, and industry professionals, the conference promotes the exchange of knowledge and encourages collaboration across traditionally interconnected disciplines. Its thematic scope encompasses sustainable and resilient construction, technological innovation, advanced building materials, urban transformation, cultural heritage, and interdisciplinary design approaches. Particular attention is given to the growing role of digital technologies, data-driven methodologies, intelligent design processes, and advanced analytical tools in supporting more informed and responsive approaches to architecture, engineering, and urban development. At the same time, ICBE 2026 recognizes the importance of environmental responsibility, cultural identity, social needs, and human-centered design in shaping contemporary cities and territories. Through keynote lectures, scientific sessions, case studies, and interdisciplinary exchange, the conference provides a platform for presenting current research, discussing professional experiences, and developing new perspectives capable of contributing to **safer, more sustainable, adaptive, inclusive, and resilient built environments**.

## Objectives

- Promote interdisciplinary collaboration among researchers, academics, practitioners, and professionals in architecture, engineering, urban planning, construction, design, heritage, and related fields of the built environment.
- Advance the use of digital technologies and innovative methodologies, including BIM, GIS, artificial intelligence, data analytics, digital fabrication, and parametric approaches, in research and professional practice.
- Encourage sustainable, resilient, and climate-responsive approaches to architecture, construction, and urban development through innovative materials, energy-efficient strategies, and environmentally responsible design.
- Address contemporary challenges affecting cities, buildings, and infrastructure through scientific research, applied case studies, evidence-based approaches, and innovative design solutions.
- Promote the conservation, transformation, and adaptive reuse of cultural heritage, balancing cultural identity, contemporary needs, structural safety, and responsible urban development.
- Support human-centered and socially responsive urban transformation, considering public space, mobility, ecological systems, community needs, and the wider social and economic impacts of the built environment.
- Provide a platform for knowledge exchange and emerging research, enabling scholars, young researchers, professionals, and students to present innovative ideas, strengthen international collaboration, and contribute to future directions in the built environment.

## Main Conference Themes

- Sustainable architecture and green building practices.
- Innovations in construction technologies and materials.
- Heritage preservation and adaptive reuse in the built environment.
- Digital tools and smart technologies in architecture and construction (e.g., BIM, GIS).
- Climate-responsive and energy-efficient design.
- Disaster risk reduction and resilience in the built environment.
- Circular economy approaches in construction and material usage.
- Integration of AI and data analytics in building design.
- Acoustic and thermal performance in building design.
- Renewable energy integration in building systems.
- Advanced manufacturing techniques in construction, such as 3D printing.
- Innovations in construction technologies and materials.
- Heritage preservation and adaptive reuse in the built environment.
- Disaster risk reduction and resilience in the built environment.
- Digital tools and smart technologies in architecture and construction.
- Advanced manufacturing techniques in construction.
- Geotechnical Engineering for Sustainable Development.
- Cartography and Geographic Information System.
- Computer Automated Solutions for Built Environment.
- Reliability in Civil Engineering.
- Urban planning strategies for resilient cities.
- Climate-responsive and energy-efficient design.
- Regulatory frameworks and policies impacting construction and urban development.
- Design in the Era of Anthropocene (Rethinking the Relation between Human and Non-Human Species)
- Speculative Design (with Attention to “Discursive” and “Critical” Design)
- Design and Cross-Disciplinarity (with Emphasis on Processes rather than Design Outputs)
- Inclusive Design
- Art and Urban Regeneration (Focus on Participatory, Collaborative, and Research-Based Practice)
- Relational Art and Architecture
- Monuments and ‘Anti-Monuments’ (Particular Attention to the Process of Designing and Building the City)

# Committees

## Scientific Committee

Prof. Dr. José Turmo / Universitat Politècnica de Catalunya · BarcelonaTech (UPC), Spain
Prof. Dr. José Antonio Lozano-Galant / University of Castilla-La Mancha (UCLM), Spain
Assoc. Prof. Dr. Francisco Javier Castilla Pascual / University of Castilla-La Mancha (UCLM), Spain
Prof. Emeritus Dr. Pantoleon Skayannis / University of Thessaly, Greece - POLIS University
Acad. Prof. Dr. Gëzim Hoxha / Academy of Sciences of Albania
Acad. Prof. Dr. Stefan Çapaliku / Center for Arts Studies, Academy of Sciences of Albania
Prof. Dr. Roberto Di Giulio / Department of Architecture, University of Ferrara, Italy
Assoc. Prof. Dr. Theo Zaffagnini / Department of Architecture, University of Ferrara, Italy
Prof. Emeritus Dr. Sherif Lushaj / POLIS University
Prof. Thoma Thomai / POLIS University
Prof. Dr. Besnik Aliaj / POLIS University
Assoc. Prof. Dr. Mario Ferrari / POLIS University
Dr. Elona Karafili / POLIS University
Assoc. Prof. Dr. Merita Toska / POLIS University
Dr. Manjola Hoxha / POLIS University
Assoc. Prof. Dr. Skënder Luarasi / POLIS University
Assoc. Prof. Dr. Llazar Kumaraku / POLIS University
Adjunct Prof. Dr. Svetlana Brzev / University of British Columbia, Canada
Andrew Charleson, Adjunct Research Fellow / Victoria University of Wellington, New Zealand
Dr. Seyyed Behrad Emadi / Imperial College London
Dr. habil. Eng. Jarosław Górecki / Bydgoszcz University of Science and Technology, Poland
Prof. Giuseppe Mincolleli / Department of Architecture, University of Ferrara, Italy
Prof. Dr. Panagiotis Kyriatsis / University of Western Macedonia, Greece
Dr. Ledian Bregasi / POLIS University
Assoc. Prof. Dr. Merita Guri / POLIS University
Dr. Sonia Jojiç / POLIS University
Dr. Ilda Rusi / POLIS University
Dr. Klodjan Xhexhi / POLIS University
Dr. Keti Hoxha / POLIS University
Dr. Kristiana Meço / POLIS University
Dr. Endri Duro / POLIS University
Dr. Malvina Istrefaj / POLIS University
Dr. Ornela Sen / POLIS University
Dr. Nikolla Vesho / POLIS University
Dr. Blerim Nika / POLIS University
Dr. Genti Avdija / POLIS University
Dr. Marsela Plyku Demaj / POLIS University

## Organizer Committee

Chairs:

Dr. Ilda Rusi / POLIS University

Dr. Klodjan Xhexhi / POLIS University

Dr. Sonia Jojiç / POLIS University

Co-Chairs:

Dr. Endri Duro / POLIS University

Dr. Kristiana Meço / POLIS University

Members:

Acad. Assoc. Prof. Dr. Rrapo Ormeni / Academy of Sciences of Albania

Acad. Prof. Dr. Gëzim Hoxha / Academy of Sciences of Albania

Acad. Prof. Dr. Stefan Çapaliku / Center for Arts Studies, Academy of Sciences of Albania

Mirela Muça, MA / General Director, National Agency of Scientific Research and Innovation (AKKSHI), Albania

Assoc. Prof. Dr. Sotir Dhamo / POLIS University

Assoc. Prof. Dr. Merita Guri / POLIS University

Dr. Ledian Bregasi / POLIS University

## Keynote Speakers

Adjunct Prof. Dr. Svetlana Brzev / University of British Columbia, Canada

Assoc. Prof. Dr. Markel Baballëku / Polytechnic University of Tirana, Albania

Eng. Daniel Naterop / DNGeo Consulting - SISGEO, Switzerland

Eng. Skënder Allkja / ALTEA & GEOSTUDIO 2000, Albania

Dr. Stefano Romano / Center for Arts Studies, Academy of Sciences of Albania

Assoc. Prof. Dr. Alessandro Massarente / Department of Architecture, University of Ferrara, Italy

## Industry & Construction Partners

**Lindner Albania** / Interior Fit-Out, Building Envelope & Construction Solutions

**Saint-Gobain Albania** / Sustainable Construction Materials & Building Solutions

**ALUMIL Albania SHPK** / Architectural Aluminum Systems & Building Envelope Solutions

## Scientific Secretariat

Dr. Kristiana Meço / POLIS University

Msc. Eng. Erjon Çobani / POLIS University

Msc. Tekla Tasho / POLIS University

Msc. Vjola Ziu / POLIS University

## Web Designer

Msc. Altin Sula / POLIS University

MSc. Nikol Doda / POLIS University

The conference is structured around six thematic sessions, each addressing a specific area of research and practice within the built environment.
Each session is coordinated by experts in the relevant disciplinary field and is open to professors, researchers, PhD candidates, and other scholars and professionals contributing to the conference themes.

### SESSION I
### Urban Planning and Societal Impact

**Chair:** Dr. Gent Avdija

This session examines the relationship between urban transformation, spatial development, and their social implications within contemporary cities. Contributions address rapid urbanization, urban fragmentation, the transformation and loss of public space, informal and spontaneous development, and the challenges associated with balancing growth and modernization with human-scale urban environments. Particular attention is given to the evolving conditions of Albanian cities and to planning approaches capable of supporting more inclusive, sustainable, socially responsive, and livable urban environments.

### SESSION II
### Sustainable Materials, Resilient Construction & Smart Design

**Chair:** Dr. Endri Duro

This session explores innovative approaches to sustainable construction, resilient structural systems, and environmentally responsive design. Particular attention is given to sustainable materials, energy-efficient and climate-responsive strategies, prefabricated and lightweight construction technologies, and human-centered approaches to structural and architectural design. The session investigates how material innovation, technological development, and responsible design practices can contribute to safer, more efficient, adaptable, and environmentally sustainable built environments.

### SESSION III
### Technological Advancements and Seismic Design for Resilient Places

**Chairs:** Dr. Seyyed Behrad Emadi & Dr. Ornela Şen

This session examines the role of technological innovation and advanced engineering methodologies in developing safer, more resilient, and adaptable built environments. Contributions address seismic hazard and risk assessment, digital fabrication, parametric and computational approaches, transformations of building envelopes and prefabricated housing systems, and emerging concepts for future urban mobility. The session highlights how the integration of engineering knowledge, digital technologies, and resilience-oriented design can strengthen the capacity of buildings, infrastructure, and urban environments to respond to contemporary and future challenges.

## SESSION IV

### Cultural Heritage

**Chairs:** Dr. Nikolla Vesho & Dr. Marsela Demaj

This session addresses the preservation, interpretation, and transformation of cultural heritage within contemporary architectural and urban contexts. Contributions explore conservation strategies for historic buildings and sacred architecture, seismic assessment and strengthening of heritage structures, adaptive reuse, and the social implications of urban regeneration and heritage loss. Particular emphasis is placed on achieving a responsible balance between conservation ethics, cultural identity, structural safety, and the evolving functional requirements of historic buildings and urban environments.

## SESSION V

### Spaces of Connection: Art and Design for an Interspecies and Interdisciplinary Environment

**Chair:** Dr. Francesco Scasciamacchia

This session explores the intersections of art, architecture, design, technology, and the built environment through interdisciplinary and experimental perspectives. It investigates changing relationships between human and non-human systems, spatial perception, adaptive reuse, post-industrial landscapes, urban representation, digital heritage, and environmentally and socially engaged design practices. Through critical, speculative, participatory, and research-based approaches, the session examines how art and design can generate new forms of connection, reinterpret existing environments, and contribute to emerging cultural and spatial narratives within contemporary cities.

## SESSION VI

### Next-Generation Pioneers of the Built Environment

**Chair:** Dr. Flogerta Krosi

This session provides a dedicated platform for emerging researchers and students to present innovative, experimental, and forward-looking approaches to the built environment. Contributions span architecture, engineering, urban planning, environmental resilience, design, and related creative disciplines, reflecting the interdisciplinary character of a new generation of researchers and practitioners. Through projects addressing topics such as bioclimatic design, flood-risk management, structural technologies, architecture-inspired design, and critical interpretations of objects and social space, the session encourages critical inquiry, experimentation, and new perspectives on the future of the built environment.

**Layout & Design:**

Dr. Kristiana Meço

Msc. Erjon Çobani

## POLIS University Contact:

Rr. Bylis 12, Autostrada Tiranë-Durrës, Km 5, Kashar

Kodi Postar 1051, Kutia Postare 2995

Tiranë, Albania

Tel: +355.(0)4.2407420 / +355.(0)4.2407421

Fax: +355. (0)4.2407422

Mob: +355 (0) 69 40 88 111

Email: contact@universitetipolis.edu.al

Website: www.universitetipolis.edu.al

# Table of Contents


**SESSION I** ..... 14

**Urban Planning and Societal Impact** ..... 14

**The Fading Public Realm:** ..... 5

From Expansive Open Spaces to Morphological Compression in Durres' Rapid Urban Growth

**Arjola SAVA** ..... 5

**Spontaneous Architecture as Adaptive Metabolism in Post-Socialist Cities Renis Batalli** ..... 18

**The ground floor as an urban interface: the human-building relationship and the Loss of Urban Contact Avrili MESHI** ..... 35

**Urban Blueprint and Compatible Growth:** ..... 45

A Multi-Scalar Morphological Method for Sustainable Transformation in ..... 45

Erseke, Albania **Mario DINE** ..... 45

**Examining the Internal Anatomy of Socialist-Era Hotels in Albania:** ..... 58

Spatial organisation, Geometry, Structure, Circulation, and Function**Malvina Istrefaj(KOLIÇI)** 58

**Urban Construction Through Destruction Sotir DHAMO** ..... 73

**SESSION II** ..... 87

**Sustainable Materials, Resilient Construction & Smart Design** ..... 87

**Human Centered Design in Civil Engineering Ilda RUSI, Albi ALLIAJ** ..... 88

**The courtyard as a climate-responsive and resilient spatial strategy: the case of Novi Pazar Elma MAHMUTOVIĆ, Dragana KONSTANTINOVIĆ** ..... 103

**Numerical assessment of the thermal performance of a heated and cooled floor containing upgraded phase change materials Oumayma BABAHARRA, Khadija CHOUKAIRY** ..... 121

**Eco-Friendly Building Envelopes:** ..... 132

Thermal, Energy, Cost, and Time Performance of Prefabricated Lightweight MRC Panels in Residential Construction **Erjon ÇOBANI, Flogerta KROSI, Ornela ŞEN** ..... 132

**SESSION III** ..... 156

**Technological Advancements and Seismic Design for Resilient Places** ..... 156

**Identification and assessment of resident-driven façade interventions in prefabricated large panel buildings:** ..... 157

**the case of Tirana Flogerta KROSI, Alma GJONAJ, Merita GURI, Ornela ŞEN, Endri DURO** ..... 157

**Tirana_ toward a (non) resilient city of the future** ..... 173

Re-shaping mobility and bring back "La raison d'être of the city" **Ina MUSAI** ..... 173

**A Seismic Hazard Model of Albania** ..... 187

Case study: Kukes, Berat and Himarë **Anila XHAHYSA, Neki KUKA** ..... 187

**Phenomeno-Parametrism:** ..... 203

Translating Place Experience into Parametric **Markeljan LLESHI** ..... 203

**SESSION IV** ..... 217

**Cultural Heritage** ..... 217

**Preserving and Adapting Sacred Architecture:** ..... 218

A Case Study of the Jazak Monastery **Una RADIVOJEVIĆ**.....218

**Monumentality Reconsidered:** Heritage Preservation and Adaptive Reuse through the Theories of Robert Venturi and Aldo Rossi **Harika SHEHABI** .....233

**Seismic Performance Assessment of Historic Stone Masonry Buildings:** .....245

The Case of the Angonate Residence, Gjirokastër **Alma GJONAJ, Merita GURI, Endri DURO**... .....245

**Future Heritage by Design:** .....258

New Design Approaches to Heritage Reuse **Gregor ANDONI, Kristiana MEÇO** .....258

**SESSION V**.....267

**Spaces of Connection: Art and Design for an Interspecies and Interdisciplinary Environment** 267

**Heritage as Narrative:**.....268

Building City Image Through Adaptive Reuse in Durrës **Vjola ZIU, Remijon PRONJA** .....268

**The Extraordinary Everyday** Children's Spatial Agency as Anti Monumental Practice **Xhoi MUSLIAKA** .....281

**'Liminal Architectural Bodies' in Post-Industrial Kuçova:**.....298

From an Ecological Perspective to an Aesthetic realm **Dorina XHERIMEJA, Aishe BITRI**.....298

**IN Illyria, Episode I: Apollonia** .....311

A Pixel-Art Game Framework for Archaeological Interpretation and Cultural Heritage Learning **David KRYEMADHI, Nikolla VESHO, Skervi BAUSHI, Remijon PRONJA, Kujtim HALILI**.....311

**In the Age of Material Transformation:** Textile Design and Upcycling **Armela LAMAJ**.....326

**AI as a Designer:**.....336

The Future of Taste and Creativity in Automotive Design **Gregor ANDONI** .....336

**The Secondary Archive:** .....342

Collective Memory, Mental Images and AI-Assisted Representations in a Transforming Tirana **Dejvi DAUTI** .....342

**SESSION VI**.....352

**Next-Generation Pioneers of the Built Environment** .....352

**Performance-Based Bioclimatic Design of a Kindergarten in Tirana:** Integration of Passive Systems and Dynamic Simulation **Erald MEÇE, Afërdita MUHAMEDI, Verona HYSI, Klodjan XHEXHI**.....353

**Integrated Flood Risk Management in Albania:** .....363

Human drivers, Basin dynamics and Policy gaps **Zejd BUSHATI, Esad MALAJ, Erjon ÇOBANI, Merita GURI** .....363

**Steel frame technology for residential buildings:**.....383

A comparative thesis-antithesis study versus reinforced concrete systems **Elton AHMETAJ, Erjon ÇOBANI, Merita GURI** .....383

**DOUBLE SKIN:**.....394

How does the "Double Skin" concept interact with our body in the field of fashion design? **Desara LLESHI**.....394

**Chairs as instruments in the construction of social roles and human bodies Aurora BALLA** 401

**Autonomy as a Value:**.....409

Design and Branding in the Post-Fordist Era **Irena ALIAJ, Erson RAMAJ**.....409

# SESSION VI

## Next-Generation Pioneers of the Built Environment

Emerging research and experimental design: Student research / Young scholars / Innovative methodologies / Experimental approaches to the built environment.

Sustainable and bioclimatic design: Bioclimatic architecture / Climate-responsive design / Environmental performance / Sustainable building concepts.

Resilience and risk management: Flood-risk management / Environmental resilience / Disaster-aware planning / Adaptive urban strategies.

Structural and technological innovation: Steel-frame technologies / Construction systems / Emerging building technologies / Engineering innovation.

Architecture, design and society: Architecture-inspired design / Fashion and spatial concepts / Objects and social space / Interdisciplinary creative practice.

Future-oriented thinking: Innovation / Critical inquiry / Interdisciplinary experimentation / New professional perspectives / Future built environments.

# Performance-Based Bioclimatic Design of a Kindergarten in Tirana: Integration of Passive Systems and Dynamic Simulation

**DOI:** 10.37199/c4100057

**Erald MEÇE**
Architecture Student, POLIS University, Albania
erald_mece@universitetipolis.edu.al

**Afërdita MUHAMEDI**
Architecture Student, POLIS University, Albania
aferdita_muhamedi@universitetipolis.edu.al

**Verona HYSI**
Architecture Student, POLIS University, Albania
verona_hysi@universitetipolis.edu.al

**Klodjan XHEXHI**
ORCID 0000-0002-0260-2609
POLIS University, Albania
klodjan_xhexhi@universitetipolis.edu.al

**Abstract**

*Contemporary buildings are increasingly energy-intensive due to rising requirements for heating, cooling, lighting, and ventilation. This article presents the bioclimatic design of a kindergarten for children aged 1–4 years in Tirana, Albania, developed in response to local climatic conditions and supported by digital simulation tools.*

*Tirana has a Mediterranean climate, characterized by hot summers and mild, humid winters. Climate data and solar radiation analyses were conducted for winter and summer solstices using Design Builder software, allowing evaluation of solar exposure, shading effects, and overheating risks. The site, located near Kavaja's Street, is surrounded by buildings up to 18 m high, resulting in approximately 60% shading. To optimize solar gains, the kindergarten was designed as a two-story building.*

*Two passive systems were integrated. The Barra–Costantini passive solar system provides winter heating through a glazed façade, metal thermal mass, and controlled air circulation, effectively serving spaces up to 12 m along the north–south axis. For summer conditions, a Canadian Well (earth–air heat exchanger) supports cooling and natural ventilation.*

*Design Builder simulations revealed increased solar radiation during the summer solstice,*

*leading to potential indoor overheating. This was mitigated through cantilevered floor slabs designed to block solar rays at a 75° angle, combined with adjustable shading devices responsive to solar angles. The study demonstrates that climate-responsive design supported by simulation-based solar analysis can significantly reduce energy demand and improve thermal comfort in early childhood educational buildings in Tirana.*

***Keywords:*** *Bioclimatic architecture, Passive solar systems, Design Builder simulation, Mediterranean climate, Energy-efficient kindergartens*

## 1. INTRODUCTION

In climate context of Tirana, which is characterized by hot summers, mild winters and high solar radiation the application of bioclimatic design becomes important for indoor thermal comfort and minimizing energy consumption. This study is based on the analysis of local climatic conditions and the implementation of passive design strategies such as optimal building orientation, natural ventilation, solar exposure and shading in based in different seasons to see the difference of temperature indication in building comfort, and the use of materials with high thermal mass using Design Builder V.6.1 software for analysis to see how this strategies can improve comfort inside of building.[1]

The central research explores how bioclimatic design principles can be adapted to improve building energy performance under the Mediterranean climatic conditions of Tirana.[2]

The main objective of this study is to identify the most effective bioclimatic design strategies suitable for Mediterranean climate in Tirana and to evaluate their potential in reducing energy demand while enhancing indoor environmental comfort in a kindergarten.

## 2. LITERATURE REVIEW

Bioclimatic design has been studied as an effective strategy for increasing environmental performance and energy efficiency off buildings. Many studies highlight the importance of climate responsive architecture, particularly in regions with mediterranean climatic conditions with high solar radiation. Research on sustainable building design emphasize the role of passive design strategies as optimal building orientation, natural ventilation and solar shading devices can reduce energy consumption for heating and cooling.[3]

Many existing studies focus on broader regional climates or on other Mediterranean cities with different urban structures and environmental conditions.[4] Therefore, more research is needed to examine how bioclimatic design strategies can be used to the specific climatic characteristics and urban environment like Tirana.

## 3. METHODOLOGY

This study adopts a qualitative research approach to investigate the application of bioclimatic design principles in relation to the climatic condition of Tirana.The research is based on climate analysis and using of passive strategies that work in Tirana's environmental conditions.The study aims to show how environmental design can improve energy efficiency and indoor comfort in Tirana's buildings.

Data collection for this research is based on secondary sources , including scientific articles and other architectural bioclimatic designs and weather E.[5][6]Climatic data like temperatures , solar radiation angle and wind rose are examined to identify the factors that influence building performance. In addition , other architectural projects and studies on Mediterranean climate strategies are reviewed to understand commonly applied passive design strategies.[7]

Two passive systems were integrated. The Barra–Costantini passive solar system provides winter heating through a glazed façade, metal thermal mass, and controlled air circulation, effectively serving spaces up to 12 m along the north–south axis. For summer conditions, a Canadian Well (earth–air heat exchanger) supports cooling and natural ventilation.[8]

DesignBuilder V.6.1 simulations shows increased solar radiation during the summer solstice, leading to potential indoor overheating.[Figure 1] This was mitigated through cantilevered floor slabs designed to block solar rays at a 75° angle, combined with adjustable shading devices responsive to solar angles. [Figure 2] The study demonstrates that climate-responsive design supported by simulation-based solar analysis can significantly reduce energy demand and improve thermal comfort in early childhood educational buildings in Tirana.

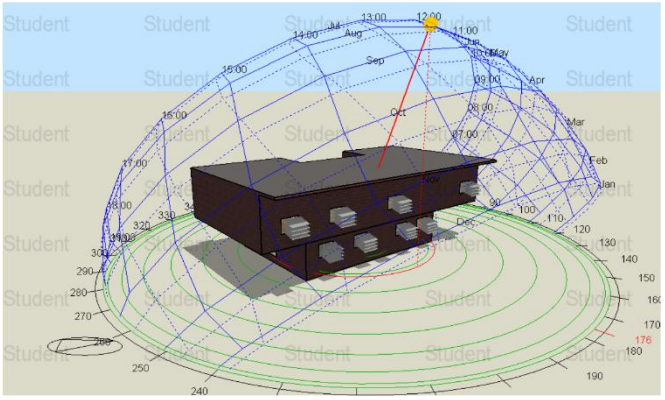


Figure 1. Solar radiation (25 July 12:00 PM) Design Builder simulation

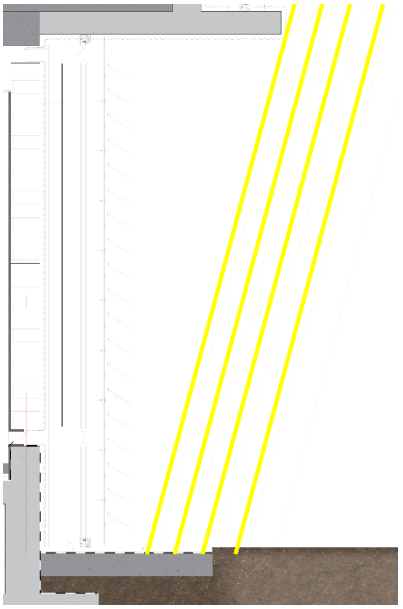


Figure 2. Solar rays (25 July 12:00 PM) 75° angle

## 4. PROJECT DEVELOPMENT

The project started with the analysis of the existing kindergarten no. 26 on Kavaja Street, that due to the buildings surrounding it, which reached up to 18 meters, there was not enough sunlight, especially during the winter season. [Figure 3 , 4 , 5]

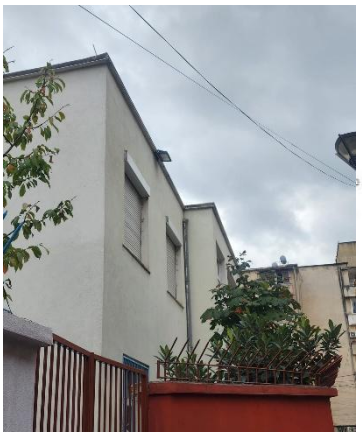


Figure 3. The existing situation

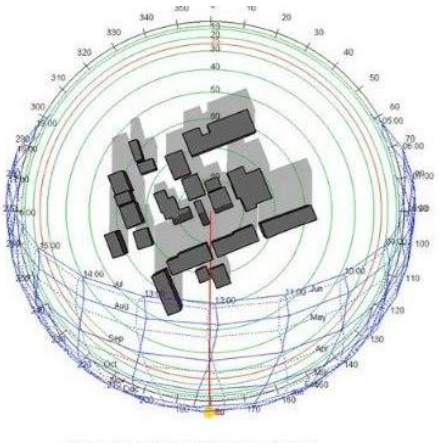


Figure 4. Sun Path (25 December 12:00 PM) Design Builder simulation



Figure 5. The existing situation

After analyzing the solar radiation of the area, despite the challenging problems, it was proposed that in order to maximize solar radiation, a new building be placed on the northern edge of the site and raised to a height that would allow for solar radiation in the winter season when the sun shines at an angle of 25 degrees.

The building frame is reinforced concrete. The external walls are 25cm-thick masonry brick, 10cm-thick thermal insulation, plaster, and wood cover. The internal walls are 10cm-thick masonry brick wall, plaster, and paint. The roof is inclined reinforced concrete, with 15cm-thick thermal insulation, water barrier, and fine gravel. The windows are aluminium profile, triple glazed, have low emissivity, and argon filled. Also, the floors are composed of ceramic tiles.



Figure 6. Proposed building

The ground floor is organized to include a nursing room, a kitchen, the main office, a reception area, a meeting room and toilets. [Figure 6]

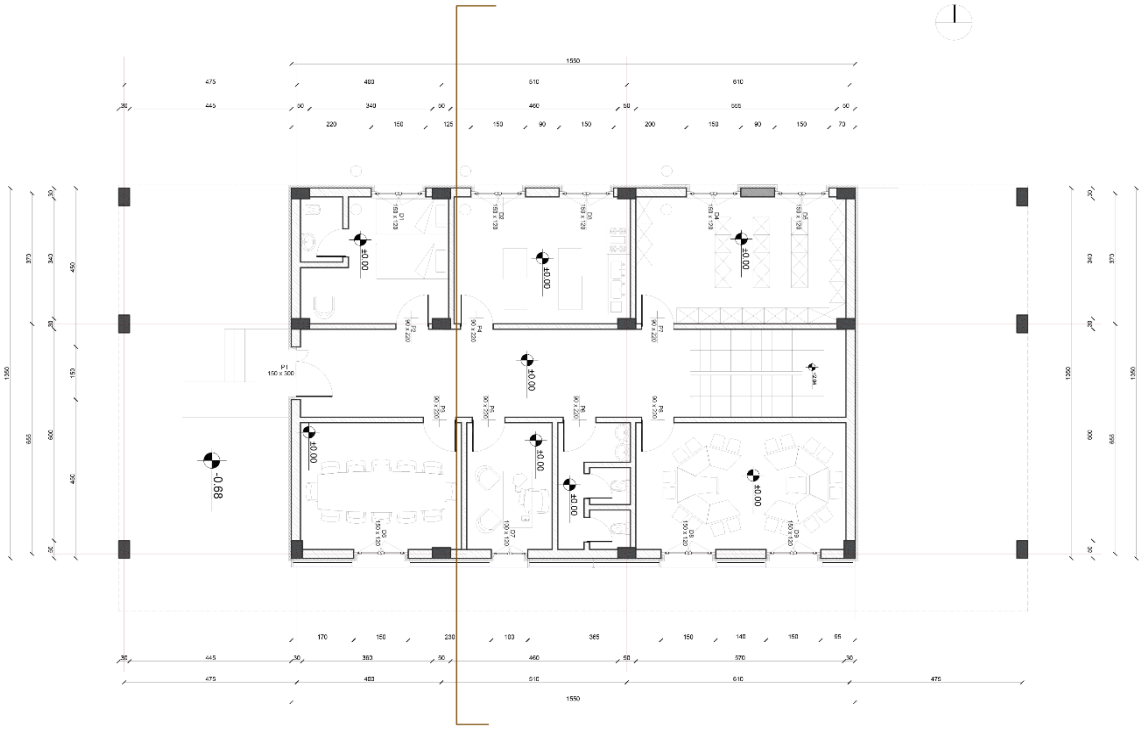


Figure 7. Ground floor plan

The second floor is organized to include classrooms for 3 groups of children, including toilets and sleeping areas within each classroom. [Figure 7]

Winter and summer scenarios were also analyzed during the day and night to show how warm and cold air circulates throughout the building.

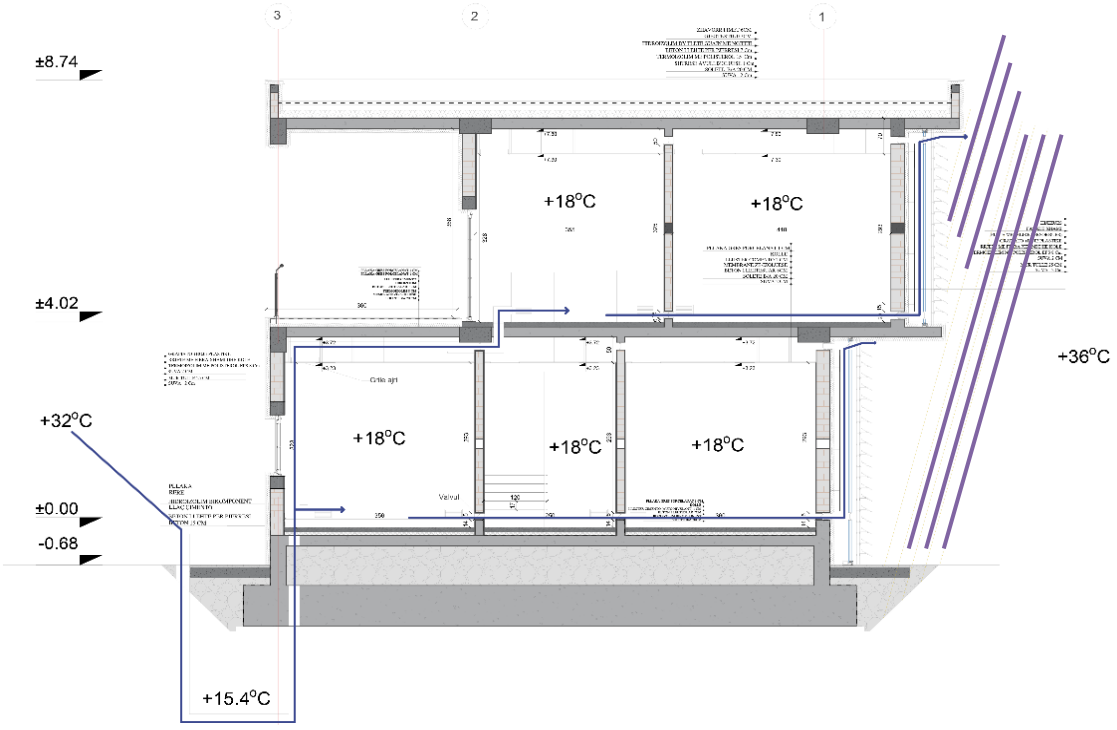



Figure 8. Scenario summer - day

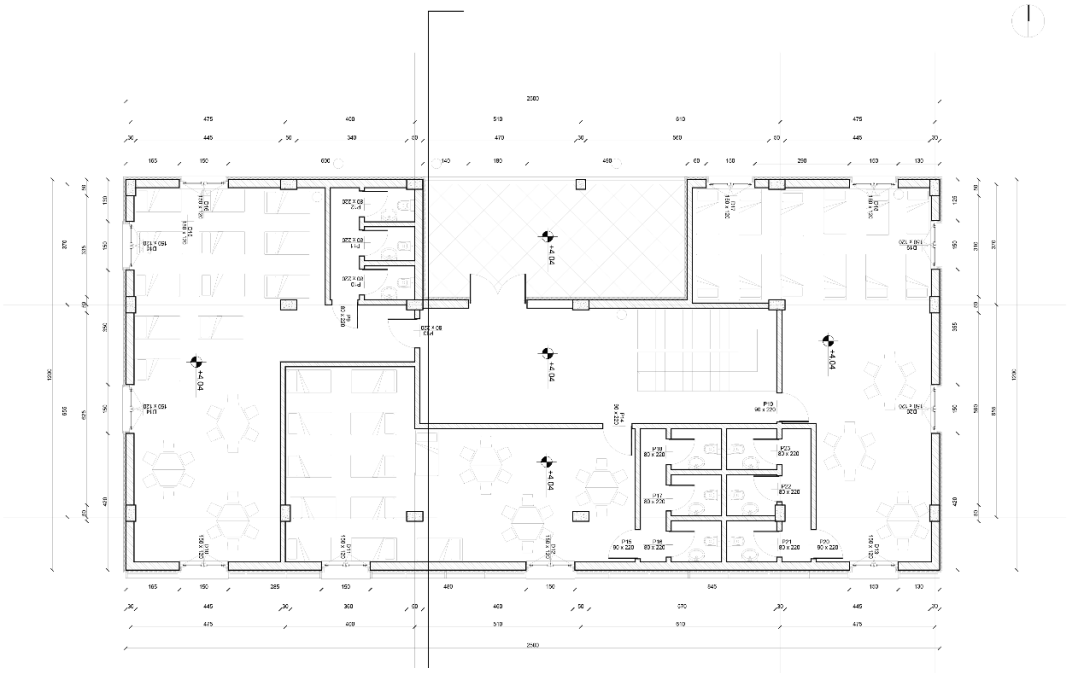


Figure 9. Second floor plan

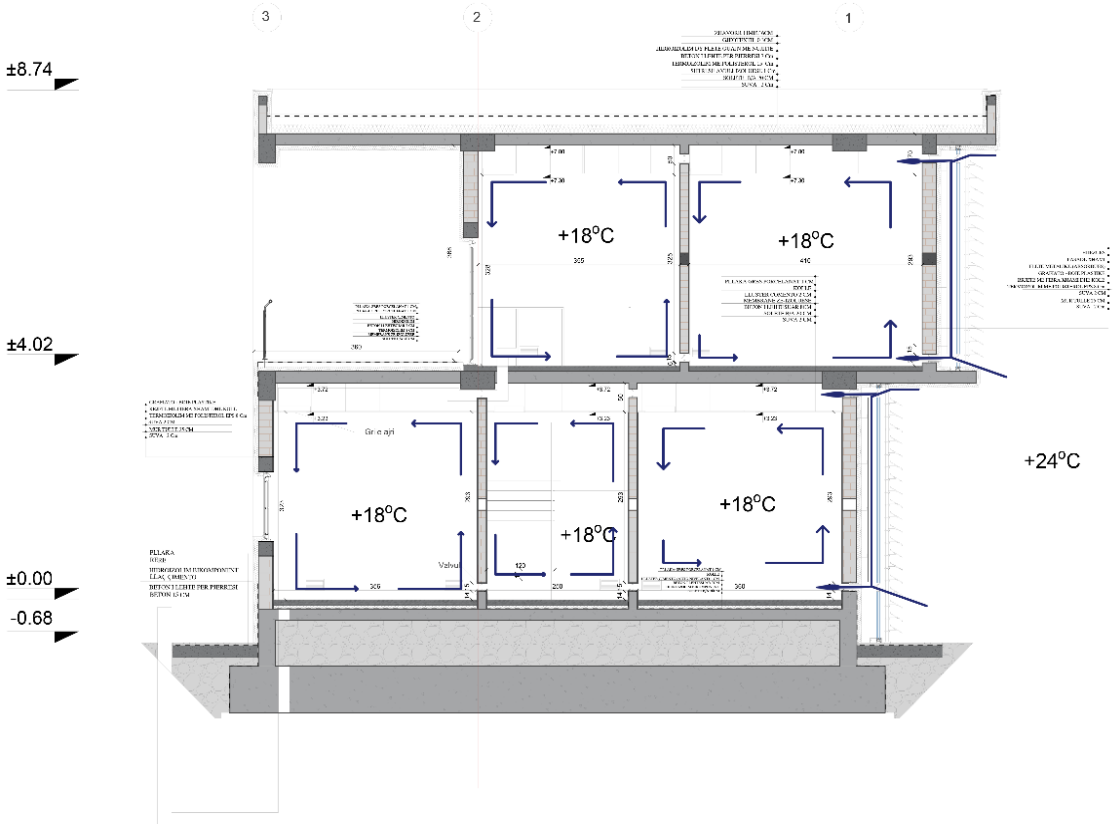



Figure 10. Scenario winter - day

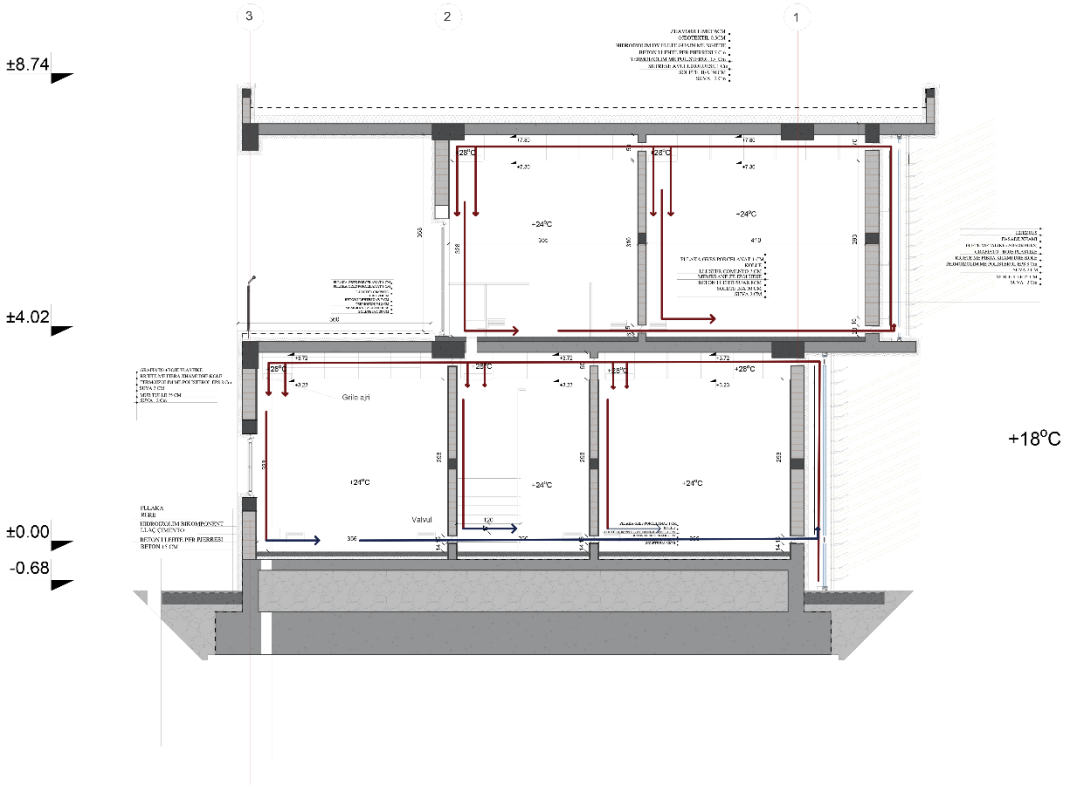



Figure 11. Scenario winter - night

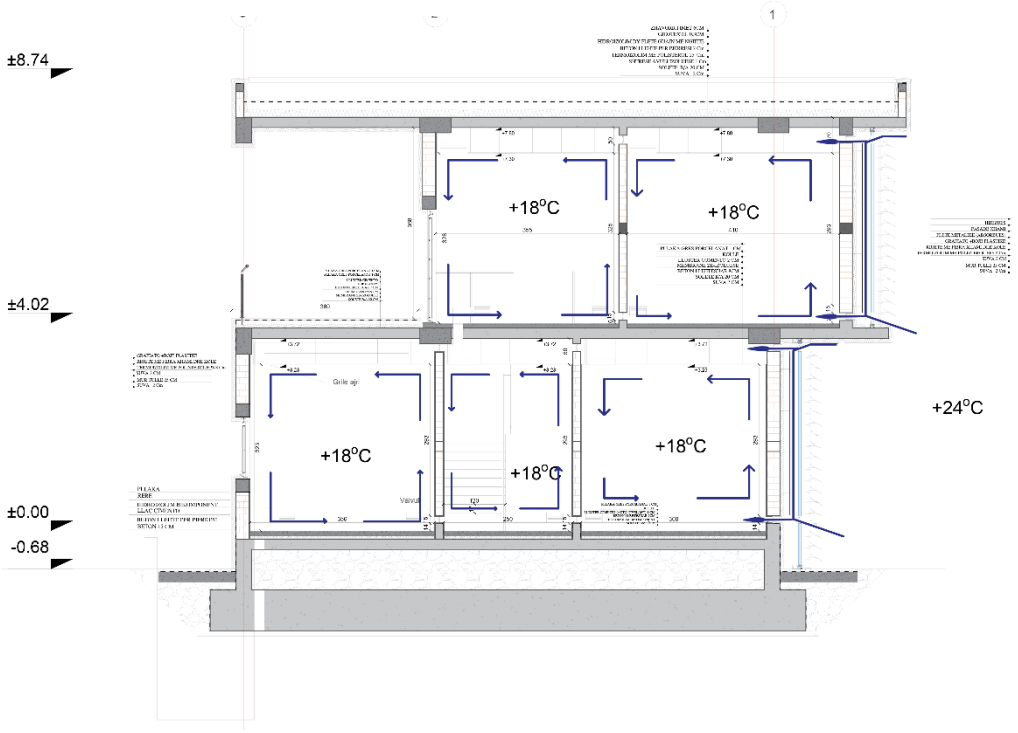



Figure 12. Scenario summer - night

Through the Canadian well, natural ventilation of the building is possible, as well as cooling of the building during the winter season using a constant ground temperature.

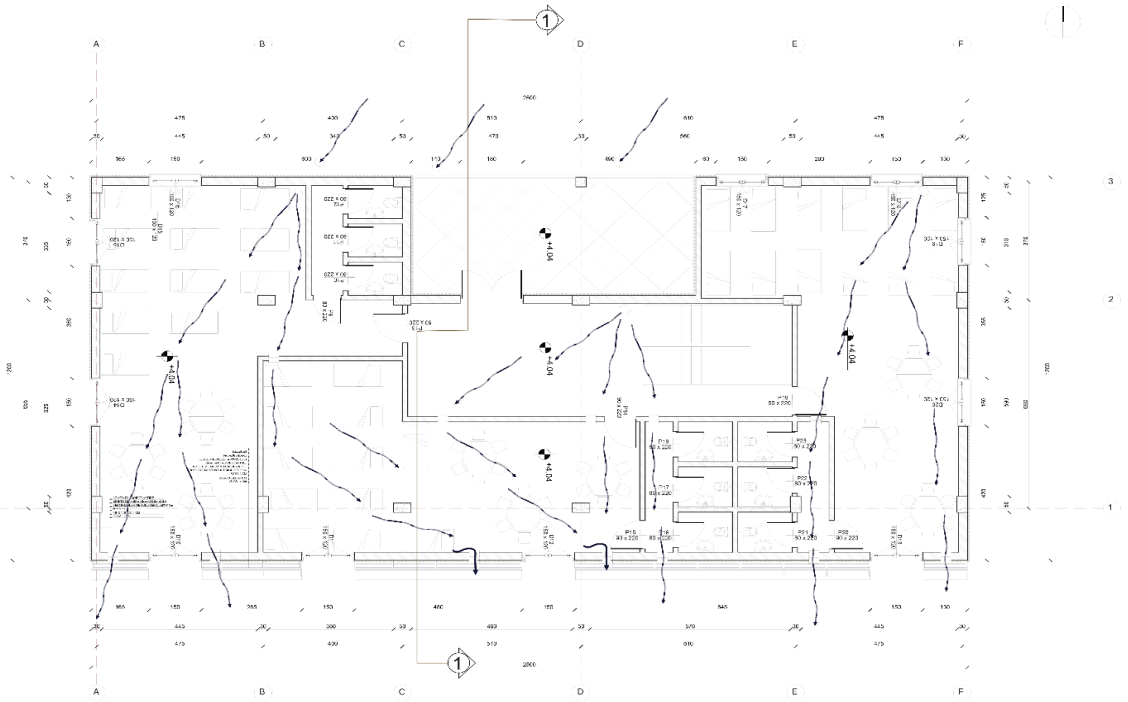
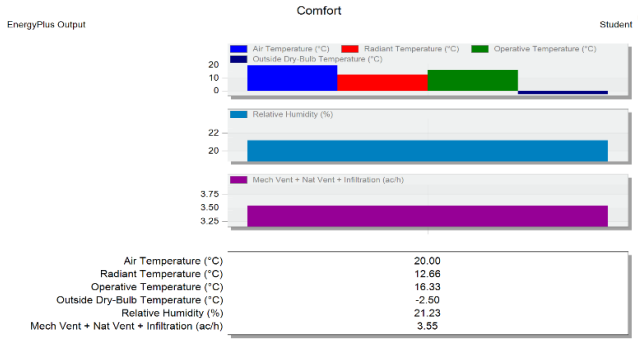


Figure 13. refresh scheme

| Time | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Air Temperature (°C) | 28.84 | 27.71 | 23.00 | 23.00 | 23.00 | 23.00 | 23.00 | 23.00 | 33.44 | 34.63 | 32.07 |
| Radiant Temperature (°C) | 29.31 | 28.23 | 26.80 | 28.44 | 31.49 | 34.01 | 35.62 | 35.51 | 35.69 | 34.47 | 32.26 |
| Operative Temperature (°C) | 29.07 | 27.97 | 24.90 | 25.72 | 27.24 | 28.51 | 29.31 | 29.25 | 34.57 | 34.55 | 32.17 |
| Outside Dry-Bulb Temperature (°C) | 21.50 | 20.68 | 20.68 | 23.99 | 28.96 | 32.41 | 34.20 | 33.37 | 30.89 | 27.30 | 24.82 |
| Glazing (kW) | -0.57 | -0.55 | 0.23 | 0.38 | 0.57 | 0.51 | 0.58 | 0.40 | 0.03 | -0.59 | -0.58 |
| Walls (kW) | 6.90 | 7.85 | 11.61 | 4.59 | -2.48 | -5.60 | -7.26 | -4.10 | -12.83 | -5.41 | 1.46 |
| Ground Floors (kW) | 0.09 | 0.74 | 2.34 | 0.47 | -1.77 | -3.03 | -3.94 | -3.24 | -5.79 | -4.21 | -1.99 |
| Roofs (kW) | -5.85 | -7.50 | -5.56 | 2.21 | 18.18 | 34.22 | 41.51 | 40.15 | 22.04 | 9.01 | 1.21 |
| Floors (ext) (kW) | -0.24 | -0.26 | -0.19 | -0.07 | 0.24 | 0.57 | 0.72 | 0.73 | -0.12 | 0.01 | -0.11 |
| External Infiltration (kW) | -1.28 | -1.23 | -0.41 | 0.17 | 1.00 | 1.57 | 1.86 | 1.73 | -0.43 | -1.25 | -1.25 |
| External Vent. (kW) | 0.00 | 0.00 | 0.00 | 0.55 | 13.22 | 10.43 | 24.84 | 11.50 | 0.00 | 0.00 | 0.00 |
| General Lighting (kW) | 0.00 | 0.00 | 0.00 | 4.91 | 4.91 | 4.91 | 4.91 | 4.91 | 0.00 | 0.00 | 0.00 |
| Computer + Equip (kW) | 0.08 | 0.08 | 0.08 | 1.54 | 1.54 | 1.54 | 1.54 | 1.54 | 1.54 | 1.54 | 0.08 |
| Occupancy (kW) | 0.00 | 0.00 | 0.00 | 3.39 | 13.56 | 6.78 | 13.56 | 6.78 | 0.00 | 0.00 | 0.00 |
| Solar Gains Exterior Windows (kW) | 0.00 | 0.00 | 2.37 | 2.56 | 2.13 | 1.73 | 1.69 | 1.34 | 1.27 | 0.00 | 0.00 |
| Zone Sensible Cooling (kW) | 0.00 | 0.00 | -10.43 | -19.95 | -37.57 | -42.95 | -54.92 | -50.14 | 0.00 | 0.00 | 0.00 |
| Sensible Cooling (kW) | 0.00 | 0.00 | -10.43 | -20.60 | -51.35 | -53.74 | -80.55 | -62.02 | 0.00 | 0.00 | 0.00 |
| Total Cooling (kW) | 0.00 | 0.00 | -12.02 | -37.66 | -109.36 | -87.53 | -140.57 | -95.54 | 0.00 | 0.00 | 0.00 |
| Relative Humidity (%) | 66.04 | 68.94 | 54.32 | 57.10 | 58.47 | 54.70 | 55.78 | 53.92 | 33.20 | 37.75 | 49.20 |
| Mech Vent + Nat Vent + Infiltration (ac/h) | 0.31 | 0.31 | 0.30 | 1.26 | 4.15 | 2.22 | 4.15 | 2.22 | 0.30 | 0.30 | 0.30 |

Figure 14. Internal comfort analyses Design Builder simulation

After completing the entire project on paper, the building was modeled in Design Builder and several analyses were performed regarding thermal comfort and air temperature. [9]




| | |
|---|---|
| Air Temperature (°C) | 20.00 |
| Radiant Temperature (°C) | 12.66 |
| Operative Temperature (°C) | 16.33 |
| Outside Dry-Bulb Temperature (°C) | -2.50 |
| Relative Humidity (%) | 21.23 |
| Mech Vent + Nat Vent + Infiltration (ac/h) | 3.55 |

Figure 15. Thermal comfort analyses Design Builder simulation

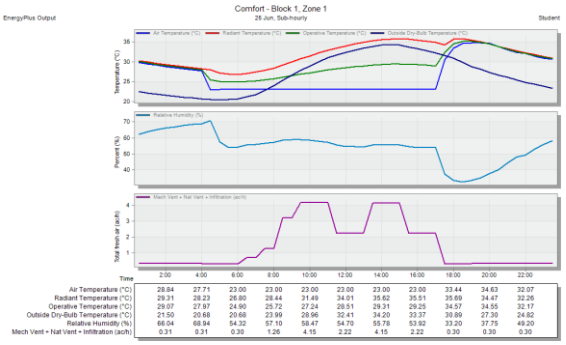



Figure 16. Cooling design Design Builder simulation

## 5. RESULTS AND DISCUSSIONS

From the analysis , it become clear that several factors affect building performance and indoor comfort in Tirana .The climate here has hot summers, relatively mild winters , and quite high solar radiation, which has a direct impact on how buildings behave thermally.

Because of this , passive systems such as the Barra Costandini and the Canadian Well become particularly important . They help reduce overheating during summer, especially on July in 12:00PM where from 34° C outside it becomes 24°C while still allowing useful solar gains during winter.

It can also be noticed that building orientation plays a key role . Buildings oriented along the east-west axis , with the main facade facing south , can take better advantage of winter sun where indore temperature goes aruynd 20°C. At the same time, shading devices help limit excessive solar radiation during the summer months.

The use of the Canadian Well improves indoor air circulation and contributes to cooling during warmer periods. In addiction , cross-ventilation and proper window placement further enhance natural cooling inside the building .

Another important aspect is the use of shading systems such as cantilevered floors and external louvres . These reduce direct solar gains in summer. Materials with high thermal mass also play a role , as they absorb heat during the day and release it slowly at night . Together , these strategies help reduce the need for mechanical heating and cooling systems.

## 6. CONCLUSIONS AND RECOMMENDATIONS

This study examined how bioclimatic design strategies can improve building performance and indoor comfort in the climate of Tirana.

The result suggest that combining different passive strategies – such as proper orientation , natural ventilation , solar shading , and the use of thermal mass- can significantly reduce energy demand for heating and cooling. These approaches help maintain more stable indoor temperatures and reduce dependence on mechanical systems.

Adapting architectural design to local climatic conditions appears to be essential for achieving better performance . In case of Tirana , this means carefully considering solar exposure , ventilation , and material selection.

In conclusion , integrating bioclimatic principles into both architectural design and urban planning can support more sustainable development . These strategies not only improve energy efficiency but also enhance indoor environmental quality.

## 7. REFERENCES

Design Builder Software V.6.1 https://designbuilder.co.uk/download/previous-versions-of-designbuilder

Climate Data https://en.climate-data.org/europe/albania/tirana/tirana-714992/

Tzikopoulos A, Karatza M, Paravantis J: Modeling energy efficiency of bioclimatic buildings. Energy and Building. 2005;37:529–544. 10.1016/j.enbuild.2004.09.002 https://www.sciencedirect.com/science/article/abs/pii/S0378778804002944

Atiyat D: Architecture Building Treatments in the Mediterranean Climate From an Environmental Perspective: Case Study of Amman Jordan. J Archit Eng Tec. 2015;04:2. 10.4172/2168-9717.1000151 https://www.researchgate.net/profile/Diala-Atiyat/publication/286476411_Architecture_Building_Treatments_in_the_Mediterranean_Climate_From_an_Environmental_Perspective_Case_Study_of_Amman_AAA_Jordan/links/576f068608ae842225a8856d/Architecture-Building-Treatments-in-the-Mediterranean-Climate-From-an-Environmental-Perspective-Case-Study-of-Amman-AAA-Jordan.pdf?_sg%5B0%5D=started_experiment_milestone&origin=journalDetail

Huang X, Ma X, Zhang Q: Effect of building interface form on thermal comfort in gymnasiums in hot and humid climates. Frontiers of Architectural Res. 2019;37:529–544. 10.1016/j.enbuild.2004.09.002 https://www.sciencedirect.com/science/article/pii/S209526351830075X

Tirana weather EPW file: climate.onebuilding.org

MeteoBlue https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/tirana_albania_3183875

Passive systems https://www.yourhome.gov.au/passive-design

Psychrometric chart adapted from Givoni. https://pmc.ncbi.nlm.nih.gov/articles/PMC10616657/figure/f1/