



 Research Article

Climate-Adaptive Small Architectural Forms For Public Spaces In Hot-Arid Urban Conditions Of Uzbekistan

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ABSTRACT

The increasing intensity of heat stress in urban environments has made climate-responsive design one of the key priorities of contemporary architecture and urban planning. This issue is particularly relevant for Uzbekistan, where hot-arid climatic conditions, high summer temperatures, solar radiation, and rapid urban development create significant challenges for the comfort and usability of public spaces. Small architectural forms, including shading structures, benches, pavilions, pergolas, modular landscape elements, drinking fountains, and urban furniture, can play an important role in improving thermal comfort and enhancing the functional quality of public spaces. This study examines climate-adaptive small architectural forms as design instruments for improving public spaces in the hot-arid urban conditions of Uzbekistan. The research is based on a comprehensive methodology that includes literature review, comparative analysis, classification, and design-oriented evaluation. The study identifies the main types of small architectural forms that can mitigate heat stress through shading, ventilation, material selection, vegetation integration, water elements, and ergonomic placement. The findings show that climate-adaptive small architectural forms can improve pedestrian comfort, increase the usability of public spaces, support sustainable urban design, and contribute to the formation of more resilient urban environments. The study

concludes that the integration of shading, greenery, reflective materials, modular design, and context-sensitive placement should become a key principle in the design of public spaces in Uzbekistan.

KEYWORDS

Climate-adaptive design, small architectural forms, hot-arid climate, public spaces, thermal comfort, shading structures, urban furniture, Uzbekistan, sustainable urban design.

INTRODUCTION

The quality of public spaces in contemporary cities increasingly depends on their ability to respond to climatic challenges. In hot-arid urban environments, high air temperature, intense solar radiation, low humidity, heat accumulation in hard surfaces, and insufficient shading can significantly reduce the comfort and usability of streets, parks, squares, university campuses, tourist zones, and recreational areas. These factors are especially important in Uzbekistan, where climate conditions and future heat-related risks require more climate-responsive approaches to architectural and urban design. According to the World Bank Climate Change Knowledge Portal, heat stress is particularly relevant in urban areas, where the urban heat island effect can intensify thermal impacts on the population [1].

In recent years, thermal comfort in public open spaces has become an important research direction in architecture, landscape design, and urban planning. Studies on hot-arid cities show that outdoor comfort is influenced not only by air temperature, but also by shading, surface materials, vegetation, wind movement, urban geometry, and the mean radiant temperature perceived by pedestrians [2]. Therefore, improving the microclimatic quality of public spaces requires architectural solutions that reduce direct solar exposure, provide shaded zones, support air

movement, and integrate vegetation and climate-sensitive materials.

Small architectural forms can play a significant role in this process. Traditionally, benches, pergolas, pavilions, shading canopies, drinking fountains, planters, information stands, modular landscape elements, and urban furniture have often been considered secondary decorative or functional components of urban design. However, in hot-arid climates, these elements should be regarded as active climate-adaptive instruments. Properly designed small architectural forms can create shade, reduce surface overheating, improve pedestrian comfort, organize resting areas, support greenery, and increase the attractiveness of public spaces during hot seasons.

The importance of this issue is particularly evident in the urban context of Uzbekistan. Research on green spaces in Tashkent demonstrates that urban vegetation plays an important role in summer cooling and in mitigating urban overheating. A case study of 30 green zones in Tashkent examined tree canopy area, planting density, spatial structure, and microclimatic data during summer months, emphasizing the role of green spaces as urban “cooling islands” [3]. These findings indicate that public space design in Uzbekistan should combine architectural, landscape, and microclimatic strategies.

At the same time, many public spaces in Uzbek cities still rely on standardized small architectural forms that do not always sufficiently respond to solar exposure, overheating, material behavior, or user comfort. Conventional benches, open paved squares, unshaded pedestrian routes, and poorly integrated landscape elements can become uncomfortable during the hot period of the year. This creates the need to reconsider small architectural forms not only as objects of urban equipment, but also as design tools for climate adaptation.

From this perspective, climate-adaptive small architectural forms should be designed according to several key principles: effective shading, integration of vegetation, use of low-heat and reflective materials, ergonomic placement, support for natural ventilation, modularity, durability, and contextual adaptation to local urban and cultural conditions. In Uzbekistan, such elements may be especially relevant for parks, pedestrian streets, university campuses, tourist areas, mahalla courtyards, transport waiting zones, and recreational spaces.

Despite the growing importance of climate-responsive urban design, the role of small architectural forms in improving outdoor thermal comfort in Uzbekistan remains insufficiently studied. Existing research mainly focuses on urban greening, public space improvement, or general climate risks, while the specific potential of climate-adaptive small architectural forms has not been systematically analyzed. Therefore, this study addresses the need to classify such elements, evaluate their climatic functions, and identify practical design strategies for their application in the hot-arid urban conditions of Uzbekistan.

The aim of this study is to identify climate-adaptive design strategies for small architectural forms and

to assess their potential for improving thermal comfort, functional quality, and sustainability of public spaces in Uzbekistan. The study focuses on shading structures, urban furniture, pergolas, pavilions, landscape modules, water-integrated elements, and other small-scale architectural components that can contribute to the formation of more comfortable and resilient urban environments.

Materials and methods

The methodological framework of this study is based on a comprehensive research approach aimed at identifying climate-adaptive design strategies for small architectural forms in the hot-arid urban conditions of Uzbekistan. Since the research topic combines architectural design, urban microclimate, public space quality, thermal comfort, landscape integration, and local climatic adaptation, several complementary methods were applied: literature review, comparative analysis, classification, design-oriented evaluation, and contextual analysis.

The literature review method was used to examine existing scientific studies and institutional materials related to climate-responsive urban design, outdoor thermal comfort, hot-arid urban environments, urban heat island effects, and the role of landscape elements in improving microclimatic conditions. Particular attention was paid to studies that identify the importance of shading, vegetation, surface materials, air movement, and urban morphology in improving pedestrian comfort in public spaces. This stage made it possible to establish the theoretical basis of the research and determine the main climatic factors that should be considered in the design of small architectural forms.

The comparative analysis method was applied to identify the differences between conventional small architectural forms and climate-adaptive small architectural forms. Conventional elements were analyzed as objects that mainly perform functional or decorative tasks, while climate-adaptive elements were evaluated as design tools that actively contribute to improving thermal comfort, shading, ventilation, surface temperature reduction, and public space usability. This comparison allowed the study to determine how small architectural forms can move beyond their traditional role and become part of climate-responsive urban design.

The classification method was used to systematize small architectural forms according to their dominant climatic function. In this study, small architectural forms were grouped into several categories: shading structures, seating and resting elements, vegetation-integrated forms, water-related elements, modular landscape components, information and navigation structures, and small pavilions. Each category was assessed according to its potential contribution to climate adaptation in public spaces.

Design-oriented evaluation was used to assess the effectiveness of different small architectural forms according to key climate-adaptive criteria. The selected criteria included shading efficiency, support for natural ventilation, material thermal

performance, vegetation integration, ergonomic comfort, durability, maintenance requirements, and adaptability to public space types. This method is particularly relevant for architectural research because it allows the evaluation of design objects not only from a technical perspective, but also from the perspective of spatial quality, user comfort, and urban identity [4].

Contextual analysis was applied to adapt the research findings to the urban and climatic conditions of Uzbekistan. The analysis considered the relevance of climate-adaptive small architectural forms for parks, pedestrian streets, university campuses, mahalla courtyards, tourist routes, recreational areas, and transport waiting zones. Since Uzbekistan is characterized by hot summers, high solar radiation, and the growing need for comfortable public spaces, the study assumes that small architectural forms can become practical instruments for improving microclimatic quality and public space usability.

Thus, the selected methodology makes it possible to evaluate small architectural forms not only as urban equipment, but also as climate-adaptive architectural instruments. This approach provides a basis for identifying practical design strategies that can improve outdoor thermal comfort, strengthen public space functionality, and support sustainable urban development in Uzbekistan.

Table 1. Research methods used in the study

Research method	Purpose of application	Expected research outcome
Literature review	To analyze studies on hot-arid climates, thermal comfort, urban heat island effects, and climate-responsive design	Identification of theoretical foundations and key climatic factors
Comparative analysis	To compare conventional and climate-adaptive small architectural forms	Determination of the advantages of climate-adaptive design

Classification method	To group small architectural forms according to their climatic function	Development of a functional classification of climate-adaptive elements
Design-oriented evaluation	To assess shading, ventilation, material comfort, vegetation integration, ergonomics, and durability	Identification of the most effective design strategies
Contextual analysis	To adapt findings to public spaces and climatic conditions of Uzbekistan	Development of practical recommendations for local application

Evaluation criteria. For a more systematic assessment, the study uses a set of climate-adaptive evaluation criteria. These criteria were selected according to their relevance to hot-arid public spaces and their potential influence on human comfort, spatial usability, and environmental performance.

The first criterion is shading efficiency, which refers to the ability of a small architectural form to reduce direct solar exposure and create comfortable resting zones. In hot-arid climates, shading is one of the most important design strategies because it directly affects the perceived thermal comfort of pedestrians and users of public spaces.

The second criterion is ventilation support. Small architectural forms should not block natural air movement; rather, they should allow airflow through open, perforated, modular, or elevated structures. This is especially important for pavilions, pergolas, canopies, and semi-enclosed resting areas.

The third criterion is material thermal performance. Materials used in benches, pavements, shading structures, and urban furniture can strongly influence surface temperature and user comfort. Light-colored,

reflective, porous, low-heat-capacity, and locally appropriate materials may reduce heat accumulation and improve usability during hot periods.

The fourth criterion is vegetation integration. Planters, green pergolas, shaded seating modules, and landscape-integrated urban furniture can improve microclimatic quality by combining shade, evapotranspiration, and psychological comfort. This is particularly important in parks, pedestrian zones, university campuses, and residential courtyards.

The fifth criterion is ergonomic and functional comfort. Climate-adaptive forms must be comfortable for different user groups, including children, elderly people, pedestrians, students, tourists, and local residents. The placement, height, orientation, surface temperature, and accessibility of small architectural forms should respond to real patterns of public space use.

The sixth criterion is durability and maintenance. Since outdoor elements in Uzbekistan are exposed to solar radiation, dust, seasonal temperature changes, and intensive use, small architectural forms should be designed with durable materials, replaceable modules, easy maintenance, and long-term performance in mind.

The seventh criterion is contextual and cultural adaptability. Climate-adaptive small architectural forms should not be purely technical objects; they should also contribute to the visual identity of

Uzbek cities. Their design can incorporate local patterns, regional materials, traditional shading principles, and contemporary architectural language.

Table 2. Evaluation criteria for climate-adaptive small architectural forms.

Evaluation criterion	Main design question	Relevance for hot-arid public spaces
Shading efficiency	Does the element reduce direct solar exposure?	Creates cooler and more usable resting zones
Ventilation support	Does the form allow natural air movement?	Prevents stagnant hot air and improves comfort
Material thermal performance	Does the material reduce heat accumulation?	Limits overheating of surfaces and seating areas
Vegetation integration	Does the element support greenery or planting?	Improves shade, cooling, and visual comfort
Ergonomic comfort	Is the element comfortable and accessible for users?	Increases usability of public spaces
Durability and maintenance	Can the element resist outdoor climatic impacts?	Ensures long-term performance and economic efficiency
Contextual adaptability	Does the design reflect local urban and cultural identity?	Supports architectural identity and public acceptance

Results and discussion

Classification of climate-adaptive small architectural forms. The results of the study show that small architectural forms can be classified not only by their functional or aesthetic role, but also by their contribution to climate adaptation in public spaces. In hot-arid urban conditions, the main design objective is to reduce direct solar exposure, improve thermal comfort, support natural ventilation, integrate vegetation, and increase the usability of outdoor spaces during hot periods.

Based on the literature review and design-oriented evaluation, climate-adaptive small architectural

forms can be divided into several functional categories: shading structures, climate-responsive seating elements, vegetation-integrated forms, water-related elements, modular landscape components, information and navigation structures, and small pavilions. These categories differ in their climatic function, design complexity, and applicability to different types of public spaces.

The most effective elements are those that combine several climate-adaptive functions at the same time. For example, a pergola with climbing vegetation can provide shade, improve visual comfort, reduce surface overheating, and create a more pleasant resting zone. Similarly, shaded benches with integrated planters can combine seating, greenery, and microclimatic improvement. This confirms that small architectural forms should



be considered not as isolated urban objects, but as components of a broader climate-responsive public space system.

Research on hot-arid cities emphasizes that outdoor thermal comfort depends on shading, vegetation, urban geometry, surface materials, and air movement, rather than on air temperature

alone. Therefore, small architectural forms should be evaluated according to their ability to influence these factors in real public spaces [5]. In the case of Tashkent, research on green spaces shows that tree canopy area, planting density, spatial structure, and microclimatic conditions play an important role in summer cooling.

Table 3. Classification of climate-adaptive small architectural forms

Type of small architectural form	Main climatic function	Recommended public space application
Pergolas and shading canopies	Protection from direct solar radiation	Parks, pedestrian streets, university campuses
Shaded benches and urban furniture	Comfortable resting areas during hot periods	Squares, promenades, recreational zones
Green planters and vegetation-integrated modules	Evapotranspiration, shading, visual cooling	Parks, courtyards, pedestrian zones
Small pavilions	Shelter, shade, semi-open ventilation	Tourist areas, campuses, transport waiting zones
Water-integrated elements	Local cooling and psychological comfort	Parks, plazas, recreational spaces
Information stands with shading elements	Orientation and solar protection	Tourist routes, historical areas, urban nodes
Modular landscape elements	Flexible shading and spatial organization	Temporary public spaces, events, residential courtyards

Comparative analysis of conventional and climate-adaptive small architectural forms. The comparative analysis shows that conventional small architectural forms often perform mainly functional or decorative roles. They provide seating, orientation, enclosure, or visual enrichment, but they are not always designed to respond to thermal stress, solar exposure, material overheating, or seasonal comfort. In hot-arid urban conditions, this limitation becomes particularly important because public spaces may lose their usability during the hottest hours of the day.

Climate-adaptive small architectural forms, by contrast, are designed as active environmental elements. Their function is not limited to providing a place to sit or a decorative object; they are intended to improve the microclimate of public spaces. They can create shade, reduce the mean radiant temperature perceived by users, protect surfaces from overheating, integrate vegetation, and support airflow through open or perforated structures.

This distinction is essential for Uzbekistan. The World Bank Climate Change Knowledge Portal identifies heat stress as especially relevant in

urban areas, where the urban heat island effect can intensify climate impacts. The World Bank and Asian Development Bank's climate risk profile for Uzbekistan also emphasizes the importance of understanding climate risks and adaptation needs

for development planning. Therefore, the design of small architectural forms in Uzbek cities should be connected with climate adaptation, not only with aesthetics and standard urban equipment.

Table 4. Comparative analysis of conventional and climate-adaptive small architectural forms

Evaluation criterion	Conventional small architectural forms	Climate-adaptive small architectural forms	Analytical interpretation
Primary function	Functional or decorative	Functional, climatic, and environmental	Climate-adaptive forms have broader urban value
Solar protection	Often limited or absent	Designed to provide shade	Important for hot-arid public spaces
Thermal comfort	Not always considered	Central design criterion	Improves usability during hot periods
Material selection	Based mainly on cost and durability	Based on heat behavior, reflectance, and comfort	Reduces overheating of surfaces
Vegetation integration	Optional	Often integrated into the design	Strengthens cooling and visual comfort
Ventilation	Rarely considered	Supported through open or perforated forms	Prevents stagnant hot air
User comfort	General ergonomic approach	Ergonomic and climatic comfort combined	Better for children, elderly users, tourists, and pedestrians

Climate-adaptive design strategies for hot-arid public spaces. The analysis identifies five key design strategies for climate-adaptive small architectural forms in the hot-arid urban conditions of Uzbekistan.

The first strategy is shading optimization. Shade is one of the most effective ways to improve outdoor comfort in hot climates because it directly reduces solar radiation on people and surfaces. Pergolas, canopies, shaded benches, arcades, and semi-open pavilions should be oriented according to sun

movement and placed in areas with high pedestrian activity.

The second strategy is vegetation integration. Trees, climbing plants, green modules, and planters can reduce heat stress through shading, evapotranspiration, and psychological cooling. In Tashkent, the study of 30 green zones confirms the importance of tree canopy area and planting density for summer cooling [6]. This means that small architectural forms should be combined with landscape elements rather than designed as isolated objects.

The third strategy is material thermal control. In hot-arid cities, surfaces exposed to the sun can accumulate heat and become uncomfortable or even unusable. Therefore, benches, pavilions, shading structures, and urban furniture should use materials with lower heat absorption, lighter colors, reflective surfaces, or ventilated construction systems. Material choice should be evaluated not only by durability and cost, but also by user comfort.

The fourth strategy is ventilation-oriented form-making. Climate-adaptive forms should provide shade without blocking airflow. Perforated panels, open lattice structures, elevated roofs, and semi-

open pavilions can support air movement while still protecting users from direct sunlight.

The fifth strategy is contextual and cultural adaptation. In Uzbekistan, climate-adaptive forms should respond not only to environmental requirements, but also to local architectural identity. Traditional Uzbek architectural elements, such as iwans, courtyards, shaded passages, ornamental screens, and geometric patterns, can inspire contemporary small architectural forms. These elements can be reinterpreted through modern materials, modular systems, or digital design tools [7].

Table 5. Design strategies for climate-adaptive small architectural forms

Design strategy	Architectural solution	Expected climatic effect
Shading optimization	Pergolas, canopies, shaded benches, semi-open pavilions	Reduction of direct solar exposure
Vegetation integration	Green planters, climbing plants, tree-integrated modules	Cooling through shade and evapotranspiration
Material thermal control	Light-colored, reflective, porous, or ventilated materials	Reduction of surface overheating
Ventilation-oriented form-making	Open, perforated, lattice, or elevated structures	Improved air movement and comfort
Water-sensitive design	Drinking fountains, misting elements, water-integrated modules	Local cooling and psychological comfort
Contextual adaptation	Use of local patterns, traditional shading principles, regional materials	Stronger urban identity and public acceptance

Evaluation of climate-adaptive potential. To make the results visually clear, the study proposes an evaluation of different types of small architectural forms according to their climate-adaptive

potential. The assessment is based on five criteria: shading efficiency, vegetation integration, material comfort, ventilation support, and usability in hot periods.

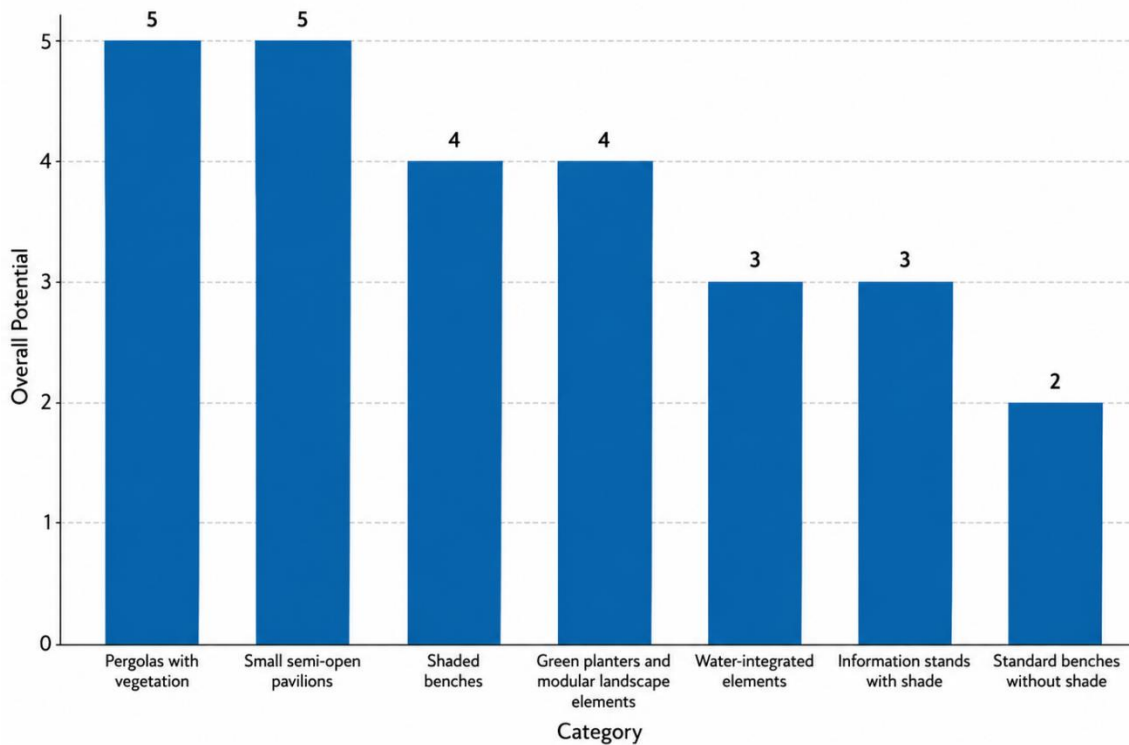


Figure 1. Climate-adaptive potential of selected small architectural forms

Discussion of key findings

The results indicate that climate-adaptive small architectural forms can become an effective design instrument for improving public spaces in Uzbekistan. Their value lies in the fact that they operate at the human scale and directly influence the everyday experience of pedestrians, students, tourists, children, elderly people, and local residents. Unlike large-scale urban interventions, small architectural forms can be implemented gradually, tested in specific locations, and adapted according to user behavior and climatic performance.

The most important finding is that shading should be considered the primary design requirement for public spaces in hot-arid cities. Without shade, benches, plazas, pedestrian routes, and

recreational zones may become uncomfortable during the hottest periods. Therefore, seating elements should not be designed separately from shading structures. A bench without shade may have limited practical value in summer, while a shaded bench integrated with greenery or a canopy can significantly improve public space usability.

Another important finding is the role of vegetation-integrated forms. Green modules, tree-integrated benches, planters, and pergolas with climbing plants can create a combined effect of shade, cooling, visual comfort, and spatial identity. For Uzbekistan, where urban greening and public space improvement are becoming increasingly important, such forms can support both climate adaptation and landscape quality. The Tashkent green-space study supports the importance of tree canopy and planting density in summer cooling.

The analysis also shows that material choice is critical. In hot climates, metal, dark stone, and dense concrete surfaces exposed to the sun may become thermally uncomfortable. Therefore, climate-adaptive small architectural forms should use materials and surface treatments that reduce heat accumulation. Light-colored finishes, ventilated construction, timber, composite materials, porous surfaces, and shaded placement can improve comfort and durability.

Finally, the study confirms that climate-adaptive small architectural forms should be integrated into urban planning and architectural design as part of a wider microclimatic strategy. They should not be placed randomly or selected only from standard catalogues. Their form, orientation, material, shading capacity, and relationship with greenery should be determined according to the specific public space, sun path, pedestrian flow, and local cultural context.

In the context of Uzbekistan, the most promising locations for implementing such elements are parks, university campuses, tourist routes, pedestrian streets, mahalla courtyards, recreational areas, and transport waiting zones. These spaces have high levels of public use and require solutions that improve comfort during hot seasons. Therefore, climate-adaptive small architectural forms can be considered a practical and relatively low-cost tool for improving urban resilience and public space quality.

Application Potential in Uzbekistan. The application potential of climate-adaptive small architectural forms in Uzbekistan is closely related to the specific climatic, urban, and social characteristics of the country. Hot summers, intense solar radiation, dry air, dust, and the increasing use of outdoor public spaces require architectural solutions that can improve comfort at

the pedestrian level. In this context, small architectural forms can become one of the most practical instruments for climate adaptation because they can be introduced gradually, require relatively limited investment compared with large-scale urban reconstruction, and directly affect everyday public space use.

The most promising locations for implementation include parks, pedestrian streets, university campuses, tourist routes, mahalla courtyards, recreational areas, and transport waiting zones. These spaces are actively used by different groups of people and therefore require comfortable shaded areas, resting places, greenery, and protection from excessive solar exposure. For example, shaded benches, pergolas with vegetation, semi-open pavilions, and modular landscape elements can significantly improve the usability of public spaces during the hot season.

In historical and tourist cities of Uzbekistan, climate-adaptive small architectural forms should also contribute to cultural identity. Their design may be inspired by traditional architectural principles such as shaded courtyards, iwans, carved screens, ornamental patterns, and semi-open transitional spaces. These traditional elements have long served as passive climate-responsive design tools and can be reinterpreted in contemporary public space design.

For university campuses, climate-adaptive small architectural forms can serve both functional and educational purposes. They can improve outdoor comfort for students and staff while also becoming experimental design objects for architecture, urban planning, landscape architecture, and environmental design education. Such pilot projects may help develop local professional experience in climate-responsive design.

In mahalla courtyards and residential neighborhoods, these elements can improve everyday social spaces. Shaded seating areas, children’s play zones with protective canopies, green modules, and small pavilions can support

social interaction while reducing heat discomfort. This is especially important for elderly people, children, and residents who spend considerable time in local outdoor spaces.

Table 7. Potential application areas of climate-adaptive small architectural forms in Uzbekistan

Public space type	Recommended small architectural forms	Main climate-adaptive function
Parks and recreational areas	Pergolas, shaded benches, green modules, water elements	Shade, cooling, resting comfort
Pedestrian streets	Shading canopies, urban furniture, planters, information stands	Solar protection and pedestrian comfort
University campuses	Semi-open pavilions, shaded seating, modular landscape elements	Outdoor learning, rest, and climate comfort
Tourist routes and historical areas	Ornamental shading screens, information stands, shaded resting zones	Orientation, identity, and heat protection
Mahalla courtyards	Shaded benches, children’s canopies, green planters	Local social comfort and everyday usability

Practical Recommendations for Architectural Design. Based on the results of the study, several practical recommendations can be proposed for the design of climate-adaptive small architectural forms in Uzbekistan.

First, shading should be considered a primary design requirement. In hot-arid urban conditions, small architectural forms should not be limited to decorative or functional roles. Benches, resting zones, information stands, and pedestrian nodes should be designed together with shading elements. A seating area without shade has limited usability during the hottest periods, while shaded

seating can significantly improve the comfort and attractiveness of public spaces.

Second, small architectural forms should be integrated with vegetation. Pergolas with climbing plants, tree-integrated benches, modular planters, and green landscape elements can create a combined cooling effect through shade and evapotranspiration. This approach is especially suitable for parks, courtyards, campuses, and pedestrian zones.

Third, material selection should respond to thermal comfort. In outdoor public spaces, materials should be evaluated not only by cost,

strength, and durability, but also by their surface temperature, reflectance, tactile comfort, and resistance to solar radiation. Light-colored materials, timber, composite elements, ventilated surfaces, and shaded placement can reduce overheating and improve user comfort.

Fourth, forms should support natural ventilation. Climate-adaptive structures should provide shade without creating stagnant air zones. Open, perforated, lattice, elevated, and semi-open designs can allow airflow while still protecting users from direct sunlight.

Fifth, design solutions should be context-sensitive. Small architectural forms should correspond to the scale, function, and identity of each public space. A tourist zone, university campus, mahalla

courtyard, and transport waiting area require different forms, materials, and levels of climatic protection.

Sixth, traditional Uzbek passive design principles should be reinterpreted in contemporary small architectural forms. Elements such as iwans, ornamental screens, shaded passages, courtyards, and deep shadow zones can provide valuable inspiration for modern climate-adaptive urban design.

Seventh, pilot projects should be implemented before large-scale application. Experimental prototypes in university campuses, parks, and pedestrian zones can help evaluate user response, material behavior, maintenance needs, and microclimatic performance.

Table 8. Design recommendations for climate-adaptive small architectural forms

Design recommendation	Architectural implementation	Expected result
Prioritize shading	Canopies, pergolas, shaded benches, semi-open pavilions	Reduced solar exposure and improved comfort
Integrate vegetation	Green modules, planters, climbing plants, tree-integrated seating	Cooling, shade, and visual comfort
Use thermally appropriate materials	Light-colored, reflective, ventilated, or low-heat materials	Reduced surface overheating
Support natural airflow	Openwork, perforated, elevated, and semi-open structures	Better ventilation and comfort
Adapt to local context	Site-specific forms for parks, campuses, tourist zones, and mahallas	Higher usability and public acceptance
Use cultural references	Ornament, lattice screens, iwan-inspired shading, regional materials	Stronger architectural identity



Develop pilot projects	Experimental installations in selected public spaces	Practical testing and gradual implementation
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Conclusion

This study examined climate-adaptive small architectural forms as instruments for improving public spaces in the hot-arid urban conditions of Uzbekistan. The results show that small architectural forms should not be considered only as decorative or functional urban elements. In hot climates, they can perform an important environmental role by providing shade, improving thermal comfort, supporting vegetation, reducing surface overheating, and increasing the usability of outdoor public spaces.

The classification of climate-adaptive small architectural forms showed that pergolas, shading canopies, shaded benches, vegetation-integrated modules, semi-open pavilions, water-related elements, information stands, and modular landscape structures can contribute to climate-responsive public space design. Among these, pergolas with vegetation and semi-open pavilions demonstrate the highest climate-adaptive potential because they combine shade, ventilation, spatial comfort, and opportunities for integration with greenery.

The comparative analysis confirmed that climate-adaptive small architectural forms have broader urban value than conventional forms. While conventional elements often perform only functional or decorative tasks, climate-adaptive forms respond to solar radiation, heat stress, material overheating, air movement, and user comfort. This makes them especially relevant for parks, pedestrian streets, university campuses,

tourist routes, mahalla courtyards, recreational areas, and transport waiting zones in Uzbekistan.

The study also identified several key design strategies: shading optimization, vegetation integration, material thermal control, ventilation-oriented form-making, water-sensitive design, and contextual adaptation. These strategies should be considered as essential principles in the design of public spaces in hot-arid regions.

At the same time, the successful implementation of climate-adaptive small architectural forms requires careful consideration of local conditions. Designers should take into account solar orientation, pedestrian flow, seasonal use, material durability, maintenance requirements, cultural identity, and the needs of different user groups. Pilot projects in selected urban spaces can help test these solutions and provide practical experience for wider application.

In conclusion, climate-adaptive small architectural forms can become a practical, relatively low-cost, and architecturally meaningful tool for improving public spaces in Uzbekistan. Their integration into urban design practice can support thermal comfort, sustainable development, cultural identity, and the creation of more resilient and user-oriented urban environments.

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