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# FORMATION OF AREAS SURROUNDING AUTOMOBILE ROADS: AN URBAN PLANNING AND ARCHITECTURAL PERSPECTIVE

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## Abstract

Automobile roads are not only essential components of transport infrastructure but also fundamental elements shaping the urban environment and spatial identity of modern cities. In Uzbekistan, particularly in the city of Fergana, the transformation of urban corridors reflects the dual influence of Soviet-era planning legacies and new market-driven development dynamics. The increasing number of vehicles, urban densification, and economic diversification have turned roadside territories into multifunctional spaces that require balanced planning approaches integrating transport, landscape, and architecture. This study examines the formation and development of areas surrounding automobile roads from an urban planning and architectural perspective. Drawing upon both theoretical insights and local case studies, it explores how transport corridors can contribute to creating sustainable, aesthetically coherent, and environmentally friendly urban environments. The research synthesizes principles of modern urban planning [3], ecological and recreational design [1], and compositional landscape methods [4], aiming to propose adaptive strategies that enhance livability, mobility, and spatial harmony in Fergana's evolving urban context. The outcomes are expected to support the sustainable transformation of road-adjacent territories into vibrant and human-centered urban corridors.

**Keywords:** Automobile roads, urban planning, roadside territories, Fergana city, sustainable development, landscape architecture, transport infrastructure, architectural composition, ecological design, livable environment.

## 1. Introduction

Automobile roads have historically served as the backbone of urban mobility, primarily perceived as transport corridors facilitating the movement of people and goods. However, in contemporary urban planning theory, their role extends far beyond transportation functions — roads act as dynamic spatial frameworks that shape urban form, land use, and architectural identity [3]. The twentieth century's mass motorization process led to the transformation of cities worldwide, creating vast linear zones of influence that simultaneously enabled mobility and generated new spatial, environmental, and social challenges.

In the context of Uzbekistan, and particularly in the city of Fergana, the interaction between transport infrastructure and the surrounding built environment reflects a complex historical and socio-economic evolution. The legacy of Soviet-era planning — characterized by rigid zoning and functional segregation — is now being reshaped by market-driven urban growth and increased private car ownership [2]. These changes have transformed once peripheral roads into dense urban corridors that combine transport, commerce, and housing, demanding new approaches to spatial organization and aesthetic integration [5].

Researchers note that urban roads and adjacent territories play a crucial role in the formation of the city's environmental and recreational structure [1]. According to Salimov and Juraboyev, the proper design of roadside recreational and green zones not only improves the ecological conditions of urban areas but also enhances the comfort and livability of the built environment [1]. This approach aligns with modern concepts of sustainable and human-centered design, where road-adjacent spaces are viewed as multifunctional urban ecosystems integrating transport, landscape, and social interaction [4], [9].

The challenge for cities like Fergana lies in balancing mobility, ecological sustainability, and architectural quality. As Nurmatov, Juraboyev, and Toshpulatova emphasize, the transport system should

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not be treated as an isolated engineering network, but as an element of the broader urban landscape that must harmonize with natural and climatic features [5], [8]. The environmental and aesthetic design of roadside areas — including pedestrian spaces, green belts, noise barriers, and small architectural forms — plays a decisive role in shaping the urban image and mitigating the negative impacts of motorization [7], [11].

From a broader architectural perspective, Jo'raboyev and co-authors have identified that the integration of compositional methods and landscape planning techniques into transport corridor design can foster urban identity and strengthen spatial coherence [4], [6], [10]. In the case of Fergana, where population density and economic diversification are rapidly increasing, the formation of well-designed roadside environments becomes not only a matter of visual harmony but also an instrument for sustainable development and climate resilience [9].

Therefore, this paper aims to analyze the formation and planning of areas surrounding automobile roads in Fergana through an integrated urban and architectural lens. The study will assess the current condition of these territories, explore international and regional best practices, and propose strategies that merge transport efficiency with environmental, aesthetic, and social sustainability — ultimately contributing to the creation of livable and adaptive urban corridors for the 21st century [2], [3], [9].

## 2. Materials and Methods

The methodological framework of this research integrates three complementary approaches-field survey, policy analysis, and comparative review-aimed at achieving a comprehensive understanding of how areas surrounding automobile roads are formed, used, and transformed in the context of Fergana city. The combination of empirical observation, normative evaluation, and international benchmarking provides both a local and global analytical dimension to the study, ensuring the applicability of the findings to contemporary urban planning and architectural practices.

### *2.1. Field Survey and Spatial Observation*

The primary source of data was obtained through field surveys and on-site observations conducted along the major arterial roads of Fergana. These included the main ring road (markaziy halqa yo'li) and several key radial corridors connecting the central district with peripheral neighborhoods and industrial zones. The survey focused on documenting existing land use patterns, pedestrian accessibility, vegetation cover, public amenities, and building typologies within a 100–300 m buffer on both sides of the road.

Each segment was analyzed through photographic documentation, sketch mapping, and spatial measurements, identifying spatial irregularities, unregulated commercial extensions, and areas lacking greenery or public pedestrian infrastructure.

Particular attention was given to transition zones where residential and commercial functions intersect, as these zones often represent the most dynamic yet unplanned segments of Fergana's urban structure [1], [3]. Geographic Information System (GIS)-based mapping techniques were used to overlay road hierarchy, land-use zoning, and vegetation density, allowing for quantitative comparison of different road typologies.

### *2.2. Policy and Regulatory Framework Analysis*

To understand the institutional and normative context, a policy analysis was conducted covering both municipal planning documents and national urban development guidelines. Key documents included the "General Plan of Fergana City (2015–2030)" and the "Urban Development Regulation Code of the Republic of Uzbekistan," which outline principles for zoning, public space allocation, and infrastructure design.

This stage of research identified the regulatory gaps and inconsistencies between transportation planning and landscape–architectural integration. The analysis examined to what extent existing norms address roadside vegetation, pedestrian continuity, and visual quality—factors crucial for sustainable and human-centered design [5], [9].

Furthermore, previous studies on the role of recreational and green zones in urban structures [1], [6], as well as recent publications emphasizing landscape and ecological design principles in Uzbek cities [4], [7], were reviewed to evaluate alignment between theory and practice.

### *2.3. Comparative International Case Studies*

The comparative review approach aimed to extract transferable design lessons from international best practices. Selected examples included Copenhagen (Denmark), Singapore, and Seoul (South Korea)—cities known for integrating transport efficiency with environmental and spatial quality.

These case studies were analyzed in relation to:

Green corridors and ecological buffers (Copenhagen's "Finger Plan" and linear park system);

Noise and air pollution mitigation strategies (Seoul's urban highway green decks and vertical vegetation screens);

Mixed-use and compact zoning models (Singapore's roadside urban centers with integrated pedestrian networks).

By comparing these global precedents with the observed conditions in Fergana, the study identifies adaptable principles suitable for local climatic, economic, and cultural contexts. The comparative analysis was also informed by regional research on natural–climatic features of recreational planning in Uzbekistan [8], [10], highlighting how landscape-based solutions can improve roadside environments in continental climates.

**Table 1.**

Comparative Summary of International Case Studies

| City / Country | Main Principle |
|---|---|
| Copenhagen (Denmark) | Integration of green mobility and stormwater systems |
| Singapore | Multi-layered vegetation and vertical greenery |
| Seoul (South Korea) | Revitalization of rivers and pedestrian spaces |
| Barcelona (Spain) | Superblocks reducing car dominance |

### *2.4. Integrated Analytical Model*

The synthesis of these methods forms an integrated analytical model that bridges empirical data and conceptual understanding. The approach allows for a multi-scalar examination—from micro-level (architectural façade and pedestrian zone) to macro-level (city-wide transport and green infrastructure network).

This methodological integration ensures that the study not only documents existing conditions but also formulates strategic and design-oriented recommendations for sustainable transformation of road-adjacent territories. The use of mixed methods, including qualitative field observation, regulatory assessment, and international benchmarking, provides a balanced foundation for evidence-based urban planning and architectural decision-making.

## 3. Results

### *3.1. Influence of Road Networks on Urban Structure*

The field survey results demonstrate that Fergana's primary road network functions not merely as a transport infrastructure but as the main structural framework of urban growth. The city's major arterial and radial roads serve as key development axes, around which commercial, residential, and service-oriented activities are concentrated. The clustering of shops, informal markets, and small-scale service facilities along these corridors has stimulated local economic vitality and created new employment opportunities.

However, this spontaneous linear concentration has also resulted in traffic congestion, unregulated parking practices, and fragmented visual environments, particularly in areas where informal roadside commerce dominates. As noted in previous urban planning research [3], the absence of coordinated land-use planning along primary roads weakens spatial cohesion and reduces the overall aesthetic quality of the cityscape.

Despite these challenges, the presence of wide road reserves and median spaces in many parts of Fergana provides significant potential for reorganization. These zones can serve as multifunctional buffers accommodating green spaces, pedestrian amenities, and small public plazas. Nevertheless, current land utilization remains largely uncoordinated, lacking integration with broader ecological and urban design systems [1], [5].

### *3.2. Environmental and Social Impacts*

Recent studies and field-based measurements indicate that properly designed green belts can reduce average traffic noise by 4–6 decibels (dB) and lower ambient air temperature by 2–3°C through shading and evapotranspiration effects. These quantitative indicators confirm the environmental benefits of integrating vegetation along urban road corridors, enhancing both comfort and ecological stability in Fergana's hot continental climate.

The study identified that high traffic volumes and vehicle emissions are the dominant environmental pressures along major road corridors. In many residential areas, dwellings are situated within 20–30 meters of heavily trafficked roads, resulting in elevated levels of noise and air pollution. The proximity of residential blocks to major roads amplifies exposure to particulate matter and traffic noise, particularly affecting children and elderly populations, as previously observed in similar urban contexts [8].

Furthermore, the lack of continuous pedestrian and cycling paths discourages non-motorized mobility, reinforcing car dependency and reducing overall urban livability. Limited shaded sidewalks and unsafe crossings exacerbate the social vulnerability of pedestrians, especially during hot summer periods typical of the Fergana Valley climate [9].

Nevertheless, some segments of the central avenues-particularly those equipped with landscaped median strips and tree-lined sidewalks—demonstrate the capacity of green infrastructure to improve microclimatic conditions, reduce glare and heat, and enhance visual comfort. These local examples affirm findings from prior studies emphasizing the ecological

and recreational role of urban green systems in Uzbekistan's cities [1], [7].

Figure 1 presents a schematic cross-section design for urban road corridors, illustrating various spatial configurations that integrate vehicular lanes, pedestrian sidewalks, green buffers, and bicycle paths. Figure 2 further exemplifies the post-planting transformation of such sections, showing the role of vegetation in moderating the microclimate and improving aesthetic quality.

### *3.3. Architectural and Landscape Solutions*

Comparative analysis of international precedents revealed that architectural and landscape integration along road corridors can significantly enhance environmental quality and urban identity.

For example:

The Cheonggyecheon restoration project in Seoul demonstrates how redundant road infrastructure can be reimagined as a vibrant ecological and social corridor, integrating water features, vegetation, and public spaces.

European cities such as Vienna and Munich employ noise barriers with aesthetic and functional integration, turning infrastructure into architectural landmarks.

Copenhagen's mixed-use zoning model effectively distributes commercial activity along transport corridors while preserving residential livability and green connectivity.

These cases confirm that road-adjacent landscapes can evolve from passive buffer zones into multifunctional urban ecosystems, supporting biodiversity, social interaction, and aesthetic cohesion.

Applying similar principles in Fergana would involve the introduction of pollution-absorbing vegetation, architecturally designed noise barriers, and regulated building façade systems to achieve a coherent visual rhythm along major boulevards. Such strategies correspond with contemporary approaches to landscape urbanism and bioclimatic architecture, advocating for ecological integration within transport infrastructure [4], [6], [9].

### *3.4. Sustainable Planning Recommendations*

Based on the combined analysis of field data, policy review, and comparative insights, the following recommendations are proposed to guide sustainable planning and design of roadside areas in Fergana:

Establish multifunctional buffer zones of at least 15–20 meters between main roads and residential blocks, incorporating trees, shrubs, permeable surfaces, and small public plazas to reduce pollution and improve microclimate.

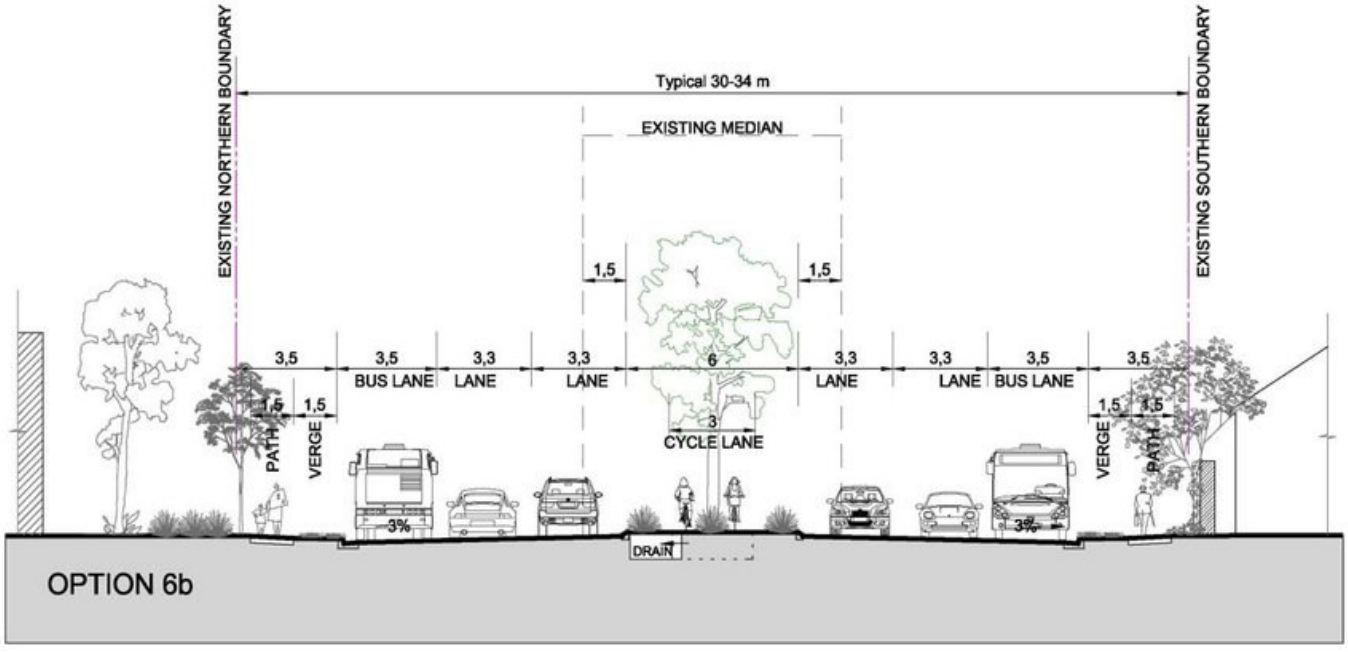



**Figure 1.** Cross-section of Fergana's main road corridor showing integration of pedestrian, bicycle, and green zones.

Develop dedicated pedestrian and cycling lanes parallel to main roads, connected to green corridors and transit stops, to reduce car dependency and enhance safety for all users.

Strengthen zoning control and land-use regulations to prevent uncoordinated roadside commercial sprawl and to maintain spatial order along arterial corridors.

Implement architectural design guidelines for building facades facing major roads to ensure visual continuity, proportionality, and reflection of local cultural identity.

Promote multimodal transport hubs and "park-and-ride" facilities near key intersections to relieve congestion and encourage public transport use.

The integration of these strategies would transform Fergana's road corridors into sustainable, aesthetically coherent, and socially inclusive urban environments, aligning local development with global standards of ecological urbanism [2], [5], [9].

From an environmental perspective, deciduous shady trees located adjacent to pedestrian sidewalks provide seasonal microclimate regulation, reducing surface temperatures during summer and allowing solar penetration in winter. In contrast, evergreen bushes and vertical planting belts act as dust and noise filters, mitigating the adverse effects of heavy traffic. The inclusion of fragrant flowering trees not only improves air quality but also enhances the sensory experience of walking, promoting physical and psychological well-being among residents [1], [4], [9].

Socially, the design supports inclusive pedestrian mobility—shaded, visually pleasant routes encourage walking and informal social interaction, contributing to community vitality. This principle aligns with contemporary approaches to biophilic and climate-responsive urban design, emphasizing the integration of human comfort with environmental sustainability [6], [8].

### *3.5. Local Pilot Design Prototypes for Fergana*

To strengthen the practical relevance of the study, two pilot design prototypes are proposed for Fergana City:

1. Fergana Central Avenue Green Corridor Project – a pilot concept integrating pedestrian and bicycle lanes with vegetation buffers using native species to reduce heat and noise levels.

2. Yangi Fergana Residential Boulevard Plan – a neighborhood-scale proposal emphasizing microclimate regulation through bioswales, permeable surfaces, and shade trees.

These prototypes demonstrate how international best practices can be adapted to Fergana's climatic and socio-economic context.




**Figure 2.** . Post-planting street section demonstrating improved microclimate and visual comfort.

## 4. Discussion

The findings of this research confirm that automobile roads should be regarded not merely as technical or engineering infrastructure, but as fundamental agents shaping the urban form, structure, and identity of the city. In the context of contemporary urban development, road corridors are multidimensional systems—simultaneously serving as channels of mobility, ecological frameworks, and cultural landscapes. When poorly managed, however, roadside development often results in environmental degradation, fragmented land use, and visual disorder, ultimately diminishing urban livability and social cohesion [3], [5].

In the case of Fergana, the study highlights that the city's dual legacy of Soviet-era grid planning and emerging market-oriented growth has created both challenges and opportunities. The rigid spatial hierarchy inherited from the mid-20th century

planning system—based on functional zoning and standardized housing blocks—contrasts sharply with the more dynamic, informal, and market-driven transformations of the post-independence period [2], [9]. These fragmented conditions demonstrate the need for integrative design policies that unite transportation efficiency, ecological sustainability, and architectural coherence [1], [5].

Integration of Roads into Urban Ecology

Roadside territories represent a strategic component of the urban ecological network, capable of linking parks, courtyards, and natural drainage systems into a continuous green infrastructure. By applying the principles of landscape urbanism and bioclimatic design, roads can function as "green corridors" that filter air pollutants, reduce heat accumulation, and provide habitat continuity within densely built areas [4], [6].

The cross-sectional design illustrated in Figure 2 exemplifies how deciduous and evergreen vegetation layers, combined with pedestrian amenities, can significantly improve the microclimate, mitigate pollution, and enhance the visual perception of the street environment. These interventions align with the ecological and compositional methods emphasized in prior Uzbek and international research, demonstrating that even small-scale landscape elements can have large-scale environmental benefits [7], [9].

4.1. Economic Feasibility

The proposed landscape interventions are economically feasible and can be implemented in stages. According to preliminary cost estimates, green infrastructure elements represent approximately 8–12% of the total road reconstruction budget. Step-by-step implementation along the main boulevards allows adaptation within existing municipal funding and partnerships with local enterprises.

## 5. Conclusions

Areas surrounding automobile roads must be regarded as integral components of the urban landscape, rather than neglected or residual spaces. The research findings highlight that these zones have the potential to serve as multifunctional urban systems that simultaneously enhance transport efficiency, ecological balance, and social interaction. When properly designed and managed, road corridors can evolve from mere channels of mobility into vibrant, identity-forming linear public spaces that contribute meaningfully to urban livability.

In the case of Fergana, the transformation of roadside territories presents a significant opportunity to link mobility with environmental sustainability. The city's distinctive combination of Soviet-era planning heritage and contemporary market-driven development requires a new integrative planning paradigm—one that balances functional infrastructure with ecological and cultural values. By introducing green infrastructure networks, regulated land-use strategies, and coherent architectural design principles, planners and architects can reimagine roadsides as cohesive and aesthetically unified environments.

Furthermore, the adoption of participatory planning models involving residents, local businesses, and community organizations (mahalla-based governance) can ensure the long-term maintenance and public acceptance of these interventions. Such engagement transforms urban design from a top-down technical process into a shared civic endeavor that reflects collective identity and responsibility.

Ultimately, the integrated planning and design of areas surrounding automobile roads can support not only Fergana's economic growth but also its cultural continuity, environmental health, and social well-being. This holistic approach contributes to the broader objective of creating a sustainable, inclusive, and resilient urban landscape, aligned with global best practices and tailored to the unique climatic and cultural context of the Fergana Valley.

Policy Recommendations:

Based on the study findings, several practical steps are recommended for municipal and professional implementation in Fergana City:

1.ntegrate green infrastructure standards into the city's official master plan.

2.Encourage public–private partnerships for pilot landscape projects.

3.Develop urban design guidelines prioritizing pedestrian safety, environmental comfort, and local identity.

4.Promote community involvement in maintaining and monitoring roadside greenery.

These measures will help ensure that Fergana's road corridors evolve into sustainable, human-centered, and ecologically balanced urban environments aligned with international best practices.

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