BOOK OF PROCEEDINGS

2nd INTERNATIONAL CONFERENCE ON HOUSING, PLANNING, AND RESILIENT DEVELOPMENT OF THE TERRITORY

TOWARDS EURO-MEDITERRANEAN PERSPECTIVES

OCTOBER 16th-17th, 2025

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2^{nd} International Conference on Housing, Planning, and Resilient Development of the Territory

Towards Euro-Mediterranean Perspectives

Conference Theme and Rationale

This conference returned for the second time within the Albanian and Mediterranean academic context, aiming to build a tradition of collaboration centered on scientific research and academia. Following the success of the first edition held on October 13^{th}-14^{th}, 2023, where proceedings were published in the Book of Proceedings, Albanica journal, and various international academic platforms, POLIS University and the Academy of Sciences of Albania relaunched this important event. The 2025 edition focused on housing, urban planning, and resilient territorial development, offering a platform for researchers, policymakers, and experts from the region and beyond.

Albania and the Western Balkans have faced major transformations in urbanization, spatial planning, and environmental management. Demographic changes, economic pressures, and environmental challenges created a need for new strategies in architecture, planning, and governance. This conference brought together diverse voices to explore these themes and promote resilient and sustainable development.

Key topics included architecture and the city, with emphasis on urban form, housing typologies, and the role of cultural heritage in modern urban design; urban mobility, addressing traffic challenges, public transport, and the use of technologies like GIS and AI in planning; and new housing models, focusing on affordability, energy efficiency, and innovative materials.

Discussions also covered demography and economy, exploring territorial governance, smart cities, social enterprises, and digital technologies such as AI, VR, and the Metaverse in urban management. Finally, the urban and natural environment was addressed through topics like pollution, adaptive planning, and nature-based solutions for climate resilience.

Through this conference, POLIS University and the Academy of Sciences of Albania aimed to foster a broad interdisciplinary debate on these pressing issues, combining academic and practical perspectives to offer concrete recommendations for future urban and territorial development policies and projects.

Organizers' Announcement

The International Scientific Conference on Housing, Urban Planning, and Resilient Territorial Development: Toward Euro-Mediterranean Approaches was held on October 16th-17th, 2025, in Tirana, Albania. Organized by POLIS University in collaboration with the Academy of Sciences of Albania and supported by national and international partners, including the University of Ferrara and Co-PLAN, Institute for Habitat Development, the event brought together researchers, academics, policymakers, and professionals to address key challenges in urban development, with a focus on resilience and sustainability in the Euro-Mediterranean region. The first day of the conference took place at the Academy of Sciences, while the second day was hosted at POLIS University.

The conference explored five main themes:

I. Architecture and the City, which investigated the typological and morphological dimensions of urban form, the evolution of collective and individual housing types, the relationship between architectural design and urban identity, and the role of historical and cultural heritage in shaping contemporary cities;

II. Urban Mobility and Resilient Cities, which addressed traffic congestion, infrastructure challenges, and public transportation, while also promoting the redesign of public spaces – such as streets, squares, and pedestrian zones – to improve accessibility and mobility; it also explored the integration of digital technologies like GIS, AI, and simulation tools to enhance planning, automation, and infrastructure management;

III. New Housing Models, which examined innovative approaches to affordable and social housing in response to demographic shifts and technological change, along with energy efficiency strategies, passive energy systems, and the application of new sustainable materials and construction technologies;

IV. Demography and Economy, which focused on macro-regional and national dynamics impacting territorial development, including urban governance, disaster risk reduction, and the rise of smart and inclusive cities; it also explored how emerging technologies – such as AI, VR, and the Metaverse – along with social enterprises and circular economy practices, could foster more equitable and adaptive urban systems; and

V. Urban and Natural Environment, which analyzed environmental degradation in urban settings, including air, water, and soil pollution, and promoted nature-based solutions, ecosystem-based planning, and adaptive strategies to enhance environmental sustainability and climate resilience.

The conference was conducted in English and Albanian (with self-translated texts where applicable) and was free of charge, with all registration fees fully covered by POLIS University in support of open academic exchange. Key deadlines included abstract submission by June 15th, acceptance notification by June 30th, first draft of papers by September 15th, and final submissions by October 31st.

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New technologies in planning (GIS, AI, etc.) / Modeling, simulation, and digitalization / Co-progress in regenerative urban development / Automation of planning, architectural, and engineering processes.

How does the form of road infrastructure impact the propagation of traffic-induced noise in urban areas of Tirana?

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Abstract

Over the years, Tirana has undergone rapid development, particularly after the 1990s, when at least one-third of the country's population migrated from peripheral and rural areas toward the capital and larger urban centers.

This phenomenon, combined with the fast pace of globalization, the introduction of a market economy, and the increasing accessibility of private car ownership, has gradually led to a significant rise in road traffic – now the main contributor to urban noise pollution. The level of acoustic pollution (which exceeds the standards set by the EU) is not only a current reality in Tirana but also a growing concern, directly affecting the quality of life and the health and well-being of those exposed to it. While many studies have explored the impact of mobility on noise pollution levels, few have examined the influence of road infrastructure design and form on noise propagation.

This study aims to analyze the extent to which the urban road infrastructure form influences the level of acoustic pollution in high-traffic areas in Tirana. By combining quantitative and qualitative measurements, the study investigates the distribution of acoustic pollution in these traffic-dense zones. The areas are compared through a Multi-Criteria Assessment (MCA), using key criteria such as road infrastructure form, presence and typology of noise barriers, height and distance of surrounding buildings, among others.

The results reveal significant differences between urban forms in how noise spreads. The study concludes with a set of strategic and specific proposals for improving infrastructural and urban design elements, showing that certain urban forms and road designs can be more effective than others in containing noise pollution within urban spaces.

Keywords

Sound propagation, urban noise, acoustic landscape, urban morphology, traffic, Multi Criteria Assessment – MCA

1. Introduction

1.1. Background

Urban noise pollution has become a pressing environmental and public-health concern in many European cities, and Tirana is no exception. Rapid development after the 1990s transformed the capital into the primary destination for internal migration, accommodating nearly one-third of Albania's population. This demographic shift, accompanied by globalization, economic liberalization, increased car accessibility, and expansion of urban infrastructure, has resulted in unprecedented vehicular flow. Today, traffic constitutes the leading source of noise pollution in the city.

Noise levels in Tirana regularly surpass EU standards, affecting residents' well-being, sleep quality, mental health, and overall quality of life. Although noise is often treated as an inevitable by-product of urbanization, research increasingly shows that it is a design problem as much as it is a mobility problem. In addition to traffic intensity, urban form, building arrangement, street width, vegetation, and noise barriers play critical roles in shaping the propagation of sound.

Despite this, Tirana lacks comprehensive research analyzing how road-infrastructure form specifically influences noise propagation patterns. This gap represents both a scientific challenge and an opportunity for evidence-based urban design intervention.

1.2. Identified research problem

Previous studies in Albania focus primarily on mobility, exposure to noise, or general environmental assessments. What is missing is a detailed comparison of how distinct infrastructural morphologies influence the spatial distribution and intensity of acoustic pollution. In dense urban areas with heavy traffic, noise does not spread uniformly; instead, it interacts with physical elements such as building height, façade distance, street geometry, and roadside obstacles.

Thus, the driving research question becomes:

How does the form of road infrastructure influence the propagation of traffic-induced noise in high-traffic urban zones of Tirana?

1.3. Aims and research questions

The study aims to investigate the relationship between road-infrastructure morphology and noise propagation. More specifically, it seeks to determine whether certain infrastructural forms inherently amplify or reduce acoustic pollution, even when traffic volumes are similar.

Core research questions include:

1. How do different street forms and building configurations influence noise propagation?
2. How does the presence or absence of noise barriers affect acoustic levels?
3. To what extent do road-width, sidewalk geometry, and vegetation contribute to noise mitigation?
4. Which infrastructural form among the four case areas performs best in limiting noise diffusion?

1.4. Practical contribution

The study helps urban planning in a practical way by pointing out which parts of the infrastructure tend to make noise worse, which design choices help keep it down, and by giving concrete evidence for improving certain road sections. It also lays out clear suggestions for policymakers and designers who want to make Tirana a quieter and more pleasant place to live.

2. Context

2.1. Urbanization and noise in Tirana

Tirana's rapid and often unregulated urban expansion has produced a complex mix of infrastructural typologies. Historic areas coexist with wide boulevards, informal settlements, newly reconstructed corridors, and hybrid mixed-use zones. This heterogeneity results in significant variation in acoustic conditions across neighborhoods.

International evidence shows a few clear patterns: narrow streets lined with tall buildings tend to trap and reflect noise; open intersections help sound spread out and fade; green buffers can noticeably reduce mid-frequency noise; and dense traffic corridors create a constant, wide-band noise that often reaches high decibel levels.

All of this is directly relevant to Tirana, where traffic is heavy but the infrastructure has done little to address the noise issue.

2.2. Theoretical concepts used

The study is built on a few key ideas. First, it looks at how sound moves through the city — basically, noise travels as pressure waves and reacts to whatever it hits. It can bounce off surfaces, get absorbed, bend around corners, or pass through materials. In a city, tall buildings act like mirrors for sound, while busy roads keep producing steady low- and mid-frequency noise.

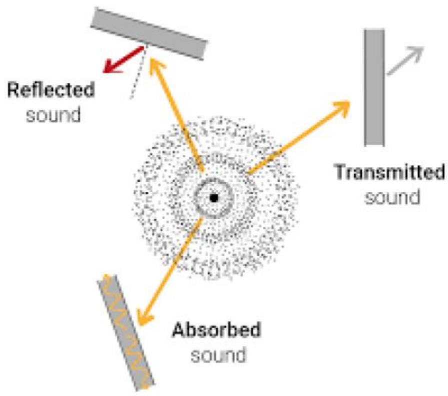

Figure 1. *Behavior of sound when interacting with different materials.*
Source: AtelierCrescedo (2024).

It also considers what long-term traffic noise does to people. Reports from the European Environment Agency show that constant exposure to loud roads is linked to stress, heart problems, poor sleep, and even learning issues in children.

Finally, the study breaks down what counts as road infrastructure: things like lane width, sidewalks, barriers, crossings, greenery, and the layout of nearby buildings. Put together, these features shape the "acoustic character" of a street – basically, how that space sounds and behaves when noise moves through it.

2.3. International illustrative studies

Three external studies support the theoretical framework:

1. Sound design in public squares (Steel et al., 2019) **–** shows natural soundscapes reduce perceived noise even when measured dB levels remain similar.
2. Traffic flow and noise in Skopje (Domazetovska et al., 2020) **–** demonstrates noise peaks at 1000 Hz and is primarily linked to tire-road interaction.
3. Trees as noise barriers via 3D modeling (Yean et al., 2024) **–** confirms vegetation plays a significant role in mid-frequency noise reduction.

These findings validate the need to examine sound propagation in Tirana through both measurement and morphological analysis.

3. Methodology

3.1. Research design

The methodological structure of this study was developed to capture the complex relationship between traffic-generated sound and the physical form of road infrastructure in Tirana. Noise in urban environments is not the result of a single variable; it emerges from an interaction of traffic intensity, street geometry, building configuration, and the presence or absence of natural or artificial barriers. Because of this multidimensional character, a combined methodological approach was considered essential.

The research design therefore integrates both quantitative and qualitative elements. Objective measurements were used to establish the acoustic profile of each selected area, while perceptual data helped reveal how noise is experienced by individuals who use or inhabit these spaces. At the same time, a morphological assessment of each road segment provided insight into the physical factors that either amplify or reduce noise propagation. Finally, a Multi-Criteria Assessment (MCA) was employed to synthesise all indicators into a comparative framework that reveals which infrastructural forms perform better or worse in managing noise diffusion. The strength of this combined approach lies in its ability to show not only how much noise is produced, but why it spreads differently across areas with similar traffic levels.

3.2. Strategy for selecting the study areas

The selection of the four study areas – QSUT, Zogu i Zi, 21 Dhjetori, and Kthesa e Kamzës – was guided by the intention to compare distinct urban morphologies rather than to simply examine four busy intersections. The objective was to identify representative samples of different road configurations that exist within Tirana's urban fabric and to analyse how these configurations influence the behaviour of traffic-related noise.

Each area embodies a unique spatial typology. QSUT, for example, is a hospital-service zone where traffic is influenced not only by private vehicles but also by ambulances and service cars. This produces a sound environment marked by both continuous traffic noise and sudden impulsive sounds such as sirens. This specificity made QSUT an important case for understanding how emergency-related traffic contributes to the overall acoustic climate.

Zogu i Zi and 21 Dhjetori represent highly dense urban corridors, characterized by narrow building distances, mixed-use functions, and intense traffic flow during most hours of the day. Their morphology is typical of Tirana's post-1990 development trajectory, where rapid construction, limited spatial regulation, and the proximity of high-rise buildings create "urban canyons" that intensify sound reflection. These areas were chosen because they exemplify the type of spatial enclosure that tends to trap noise and amplify its intensity.

Kthesa e Kamzës was selected for a different reason. Unlike the previous two zones, this area has a more open road profile, with greater distances between building façades, more vegetation, and fewer acoustically reflective surfaces. Such characteristics made it an ideal case for evaluating whether an open infrastructure layout contributes to the dissipation of sound, even when traffic volume remains high.

The four zones thus form a comparative set representing different combinations of street width, building height, vegetation presence, and functional context. This deliberate contrast allowed the study to determine whether morphological differences are capable of producing measurable differences in noise propagation, independent of traffic load.

3.3. Data collection methods

3.3.1. Acoustic measurements

To establish a reliable acoustic profile for each area, measurements were conducted during three key intervals of the day: morning, midday, and evening. These intervals were chosen because they reflect distinct phases of urban activity, where fluctuations in traffic volume and flow patterns influence sound levels. Measurements were taken at standardised heights and distances to ensure comparability across the study zones.

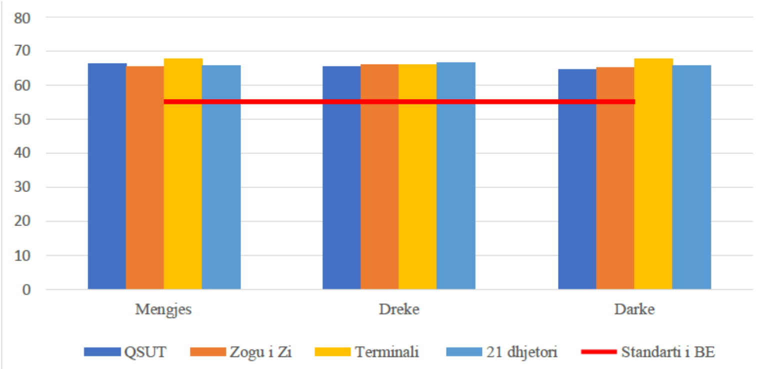

Figure 2. *Average level of acoustic pollution expressed in dB.*
Source: Author.

The main metric used was LAeq, representing the average sound level over a given time period. In several cases, a second measurement point was established deeper inside adjacent residential areas to evaluate how much of the noise penetrated beyond the immediate roadside environment. This made it possible to assess the extent to which the built environment either attenuated or enhanced sound propagation.

3.3.2. Traffic observations

Since traffic is the primary generator of noise, detailed traffic observations accompanied the acoustic measurements. These included the number of vehicles passing per minute, the pace of traffic flow, and the frequency of horn usage. The latter is an important variable in the context of Tirana, where the horn is frequently used as a means of communication or impatience, often independent of necessity. Horn sounds, being impulsive and high-intensity, contribute disproportionately to acoustic disturbance, which made their documentation essential.

Figure 3. *Monitoring point locations and their average values expressed in dB, QSUT area.*
Source: Author.

Figure 4. *Monitoring point locations and their average values expressed in dB, 21 Dhjetori area.*
Source: Author.

Figure 5. *Monitoring point locations and their average values expressed in dB, Zogu Zi area.* Source: Author.

Figure 6. *Monitoring point locations and their average values expressed in dB, Terminal area.* Source: Author.

3.3.3. Morphological analysis

A thorough morphological reading of each road segment was conducted to identify the physical characteristics that might influence sound behaviour. Elements such as the width of the carriageway, sidewalk dimensions, building height and materials, façade continuity, and the presence of trees or vegetated strips were all examined. The role of these elements lies in the way they shape the acoustic field: narrow streets with continuous building fronts tend to reflect and concentrate noise, while open spaces or vegetated edges may diffuse or absorb it.

This analysis helped establish a spatial narrative for each zone, explaining the physical reasons behind the acoustic patterns observed in the measurements.

3.3.4. Qualitative component

To understand how noise is felt rather than merely measured, a qualitative component was added through surveys conducted with residents, pedestrians, and frequent users of each area. Respondents were asked to describe their daily experience with noise, the times of day they found most disturbing, the types of sounds they found hardest to tolerate, and the effects noise had on their well-being, concentration, or sleep.

These accounts provided a human perspective that complemented the objective measurements, revealing how living in a high-noise environment shapes daily life. The qualitative dimension was particularly useful because noise perception is influenced by familiarity, tolerance thresholds, and personal sensitivity – factors that cannot be fully captured through decibels alone.

3.3.5. Multi-Criteria Assessment (MCA)

Once the quantitative and qualitative data were gathered, they were integrated into a Multi-Criteria Assessment framework. The MCA enabled the evaluation of each zone across a set of unified indicators, such as sound levels, building distances, vegetation, traffic characteristics, and residents' perceptions. Each criterion was assigned a relative weight based on its presumed influence on noise propagation. The final scores offered a synthesized comparison of the four zones, showing which infrastructural forms performed better and why.

3.4. Limitations of the study

Despite the breadth of the methodological approach, several limitations must be acknowledged. First, the measurements were collected within a limited time frame and do not include seasonal variations, which can significantly affect sound levels. Weather conditions such as wind and humidity might also have influenced some measurements. Second, the perception-based data rely on subjective accounts, which, although valuable for understanding lived experience, cannot always be generalized. Third, the MCA method involves the assignment of weights that, even when reasoned, still contain an element of subjectivity. Nevertheless, the triangulation of multiple sources of data mitigates these limitations and allows for credible interpretations.

4. Results and discussion

4.1. General findings

Across all four study areas, noise levels consistently exceeded the European Union's recommended threshold of 55 dB, ranging between 64 and 68 dB throughout the day. Although these values seem similar at first glance, the way noise behaves in each area is remarkably different. This difference cannot be attributed solely to traffic volume; instead, it is largely influenced by the morphological character of the surrounding infrastructure. The results show that the physical configuration of streets – such as width, building height, and presence of vegetation – plays a decisive role in shaping the acoustic environment.

	Dimensionet e zonës & bimësia si barrierë akustike					
Zonat	Distanca ndërtesave paralele	Distanca e ndërtesave përballë	Gjerësia e karrexhatës	Gjerësia e trotuarit	Lloji i pemëve	Nr. i pemëve
"21 dhjetori"	5.5m	28 m	22m	2.5 m	Pema Penjë	106
"Zogu i zi"	11m	45m	22m	3m	Pema Capëz	104
QSUT	5m	20m	10m	5m	Pema Gështenjë	51
Kthesa e Kamzës	22m	74m	15 m	2.5 m	Pema Palmë	18

Table 1. The MCA analysis of the objects surrounding the study areas.

Monitorimi i zhurmave & përpunimi i të dhënave						
Zonat	Niveli i dB për 7 min	Raporti dB për automjet	Raporti bories për automjet	Niveli i dB pas vijës së parë të ndërtimit	Niveli i dB pas vijës së dytë të ndërtimit	Perceptimi i banorëve mbi ndotjen
"21 dhjetori"	65.5	0.35	62	50.4	48.4	3.55
"Zogu i zi"	65.1	0.32	99	49.9	46.4	4
QSUT	64.6	0.63	13	49.8	47.5	2.75
"Kthesa e Kamzës"	67.8	0.31	36	55.3	51.6	4

Table 2. *Acoustic pollution level and the ratio per number of vehicles.*

4.2. Detailed results

QSUT exhibited a unique acoustic pattern dominated by sudden peaks of noise produced by ambulances and emergency vehicles. These impulsive, high-intensity sounds made the environment feel more disturbing than the average decibel level might suggest. The narrow alignment between road and hospital buildings created reflective surfaces that prolonged and intensified sound. Respondents emphasized that the unpredictability of noise, rather than its average volume, caused the greatest discomfort, often disrupting concentration and rest.

Zogu i Zi demonstrated a different, yet equally challenging, acoustic behaviour. Here, noise persists almost continuously due to the area's canyon-like morphology. Tall, uninterrupted façades positioned close to the carriageway create an environment where sound becomes trapped. Even during off-peak periods, noise levels did not drop proportionally, revealing that the physical form of the corridor maintains high acoustic pressure regardless of traffic fluctuations. Residents commonly described the zone as "always loud," reflecting the constancy of the measured noise.

At 21 Dhjetori, a combination of heavy traffic and mixed commercial-residential activity produced a multi-layered soundscape. Delivery vehicles, buses, and motorcycles introduce highly variable noise frequencies. The arrangement of surrounding buildings forms semi-enclosed pockets where noise travels deeper into residential areas than expected. These interior spaces act as acoustic chambers that store sound and prolong its presence throughout the day. Consequently, many residents experience noise even when physically removed from the main road.

Kthesa e Kamzës, meanwhile, showed a comparatively more balanced and less aggressive noise pattern. Despite handling similar volumes of traffic, the wider road dimensions, irregular building lines, and presence of trees allowed sound to dissipate more effectively. Vegetation partly absorbed and dispersed sound, reducing both reflection and perceived intensity. Respondents described the noise as "moderate" and "manageable," highlighting the positive influence of open spatial configurations.

4.3. Comparative discussion

Vlerësimi i kritereve & pikët përkatëse						
Zonat	Niveli mesatar i ndotjes akustike	Raporti dB për automjet	Raporti bori. për automjet	Niveli i dB pas vijës së parë të ndërtimit	Niveli i dB pas vijës së dytë të ndërtimit	Perceptimi i banorëve mbi ndotjen
"21 dhjetori"	7	3	4	5	4	7
"Zogu i zi"	7	3	1	5	4	10
QSUT	7	6	9	5	4	4
"Kthesa e Kamzës"	7	3	6	6	5	10
Pikësimi	0.1	0.2	0.2	0.05	0.05	0.1

Table 3. *Evaluation of the MCA criteria, matrix 1.*

Vlerësimi i kritereve & pikët përkatëse						
Zonat	Niveli mesatar i ndotjes akustike	Raporti dB për automjet	Raporti bori. për automjet	Niveli i dB pas vijës së parë të ndërtimit	Niveli i dB pas vijës së dytë të ndërtimit	Perceptimi i banorëve mbi ndotjen
"21 dhjetori"	7	3	4	5	4	7
"Zogu i zi"	7	3	1	5	4	10
QSUT	7	6	9	5	4	4
"Kthesa e Kamzës"	7	3	6	6	5	10
Pikësimi	0.1	0.2	0.2	0.05	0.05	0.1

Table 4. *Evaluation of the MCA criteria, matrix 2.*

The comparison between the four areas reveals clear relationships between morphological traits and acoustic performance. Zogu i Zi and 21 Dhjetori – areas with narrow profiles, continuous façades, and limited vegetation – demonstrated the highest and most persistent noise levels. Their structural enclosure amplifies and retains sound. QSUT emerged as a particular case where morphological conditions are compounded by the irregular acoustic impact of emergency traffic. Kthesa e Kamzës, benefiting from an open layout and natural elements, performed the best acoustically, showing how spatial openness contributes to noise reduction even without decreased traffic intensity.

The Multi-Criteria Assessment further validated these observations. Kthesa e Kamzës scored highest due to favourable spatial characteristics, while Zogu i Zi consistently ranked lowest because of its enclosed and reflective morphology. These findings confirm that the form of urban infrastructure significantly shapes how noise is generated, reflected, and perceived.

5. Conclusion and recommendations

5.1. Conclusions

The study concludes that traffic noise in Tirana is strongly conditioned by the physical form of the urban environment. Although high traffic volumes contribute to elevated noise levels, it is the geometry, materiality, and arrangement of buildings and open spaces that determine how sound spreads and accumulates. Enclosed corridors intensify and prolong noise, while open and vegetated areas enable more effective dissipation. Thus, urban noise must be understood not only as a transportation problem but as a broader urban design issue that can be mitigated through thoughtful spatial planning.

5.2. Recommendations

To improve the city's acoustic environment, new infrastructure projects should integrate noise-sensitive design principles from the outset. Widening certain street sections, breaking long reflective façades, and introducing more consistent vegetation could significantly reduce noise propagation. Traffic calming strategies may also help limit impulsive noise sources, particularly horn usage. Most importantly, local planning policies should formally recognise acoustic quality as a key component of urban well-being. By embedding noise criteria within regulatory frameworks, Tirana can gradually transform its public spaces into healthier and more comfortable environments, even under the pressure of increasing traffic.

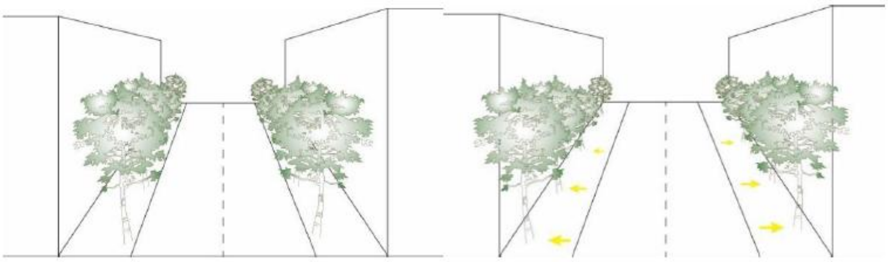

Figure 7. *Repositioning of trees near the façades.*
Source: Author.

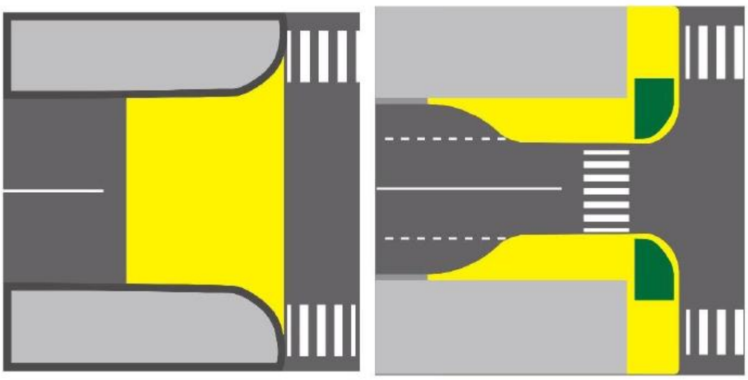

Figure 8. *Implementation of speed-reduction strategies in urban infrastructure.*
Source: Author.

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