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Geographic Information System Based Traffic Noise Measurement, Mapping, Modelling in a Historic Settlement Area Included in Cittaslow Network in Türkiye

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Abstract

The objective of this study is to present an investigation into the use of MAPANDGIS and ArcGIS, a Geographic Information System (GIS) software, in estimating traffic noise levels at varying intervals in the district centre of Seferihisar, a 3000-year-old settlement. The measurement of traffic noise levels was conducted using a Type 1 noise measuring device. The range of noise levels was determined to be from 51.7 dBA to 82.4 dBA at 55 locations where noise measurements were conducted. The noise levels at 14 different measurement stations on the İzmir-Seferihisar highway were 72.7 dB(A) on average between 7:00 and 9:00 in the morning, 74.1 dB(A) on average between 12:00 and 14:00 in the afternoon, and 76.5 dB(A) on average between 19:00 and 21:00 in the evening. It has been demonstrated that noise maps prepared at varying intervals reveal that location in close proximity to thoroughfares and commercial buildings experience elevated noise levels due to increased traffic from vehicles and pedestrians. Practicable recommendations are presented from a technical, urban design, and behavioural perspective with a view to minimising the negative impact of traffic-related noise levels on human health. The study under discussion highlights the potential importance of the proposed MAPANDGIS software prediction model in noise mapping as a vital tool for estimating traffic noise levels and establishing noise reduction strategies in a pilot-scale residential area in Türkiye.

Keywords: Urban traffic; Thematic noise map; Seferihisar; Noise pollution; Acoustic

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1. Introduction

Noise pollution is the creation of unwanted or disturbing sounds in the environment; it disrupts regular activities and has a negative impact on quality of life. The impact of rapid urbanisation and industrialisation, coupled with a growing population, has resulted in environmental noise becoming a potential threat to human health, leading to various physiological and psychological illnesses [1]. In recent years, noise pollution has been identified as the second most significant environmental health threat by the World Health Organization (WHO), surpassed only by air and water pollution [2,3]. Current environmental noise studies have also demonstrated that noise pollution remains a significant problem in Europe. As can be seen in Figure 1, more than 20% of the population lives in areas where transport noise levels are detrimental to health when measured against the thresholds set in the Environmental Noise Directive. When applied to the more stringent WHO thresholds, this figure rises to over 30%. Road traffic has been identified as the primary source of noise pollution in both urban and rural areas across Europe. The data presented as part of the 2022 Environmental Noise Directive noise mapping round indicates that approximately 87 million people are exposed to road noise levels of 55 dB or higher during the day, evening, and night (Figure 1).

A fundamental commitment on the part of the European Commission's zero pollution target is to reduce the proportion of the population that is chronically bothered by transport noise by 30% by 2030, in comparison with the 2017 figures. Figures show that approximately 64 million people in the EU-27 are exposed to harmful levels of road traffic noise in urban areas. In the 32 European Economic Area member states (excluding Türkiye), this figure is approximately 67 million. Comparisons between urban areas are difficult because the extent of mapped roads varies (for example, some countries map all streets in cities, while others map only the busiest streets). However, it is evident that a significant proportion of the European population residing in urban areas is exposed to levels of road traffic noise that are detrimental to their health [4]. The primary

source of traffic noise originates at the interface between vehicle tires and the road surface, and traffic volume, vehicle speed, and road geometry contribute significantly to the overall noise generated by traffic. The rapid advancement of passenger transport contributes to increased noise exposure. This is likely due to the broader infrastructure coverage of road traffic compared to rail or air transport [5-10]. The advent of noise pollution has prompted a plethora of scientific studies to be conducted on the subject by academics from various professional backgrounds worldwide, including in Türkiye [11]. A review of the extant literature indicates that research on noise pollution has commenced in numerous Turkish cities [12-23]. Research has demonstrated that a reduction in exposure to traffic-related noise, particularly in urban areas, can engender significant health and well-being benefits. In order to combat noise in urban areas, it is first necessary to understand the sources of noise and its impact [24].

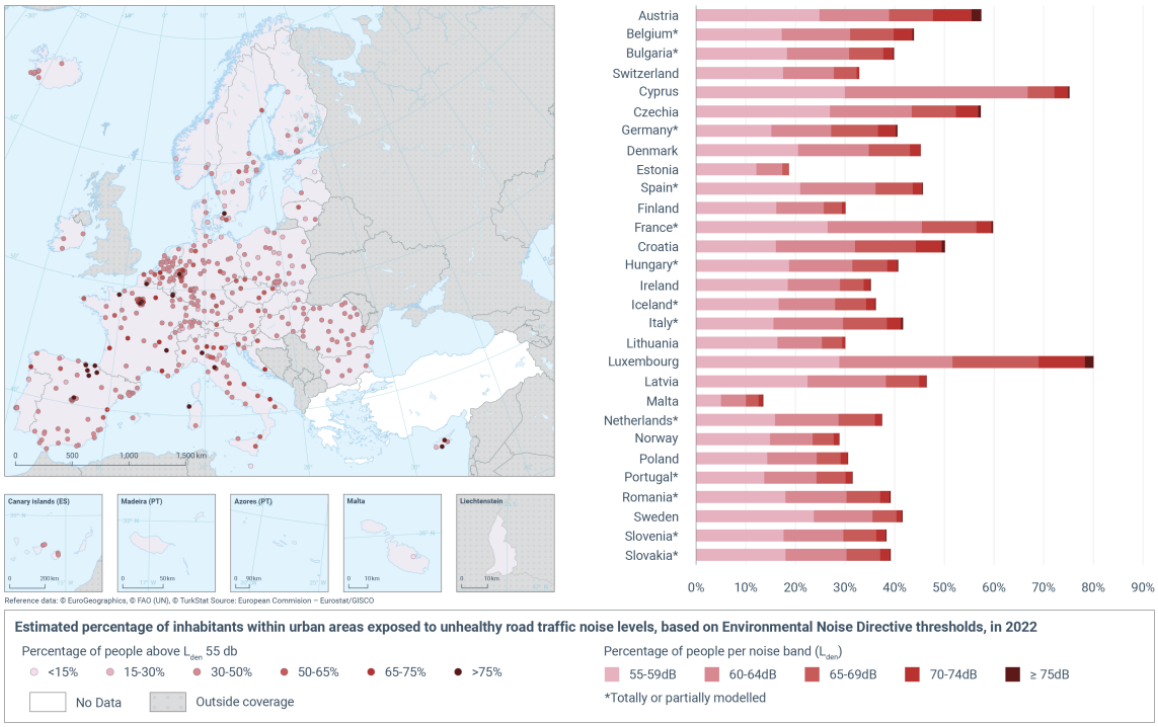

Figure 1. Estimated percentage of residents exposed to unhealthy road traffic noise levels in urban areas [4].

The impact of sound on individuals varies depending on their personal sensitivity to acoustic stimuli within the range of 30 to 60 decibels (dBA). It has been observed that the adverse effects of sound exposure intensify at higher levels of intensity [25]. Noise levels between 30 and 65 dBA cause discomfort, annoyance, feelings of boredom, anger, and difficulty concentrating and sleeping. Research has demonstrated that noise levels ranging from 30 to 65 decibels (dBA) can induce sensations of discomfort, annoyance, boredom, anger, and impaired concentration and sleep quality. Research has demonstrated that noise levels ranging between 65 and 90 decibels (dBA) can induce alterations in heart rate, augmented respiration, and diminished brain pressure. Conversely, noise levels exceeding 120 dBA have been shown to potentially result in damage to the inner ear and the rupture of the eardrum [26]. Indeed, various studies on human health have also indicated that prolonged exposure to high noise levels can lead to negative effects such as increased stress levels, hypertension, hearing loss, difficulty concentrating, and sleep disorders, as well as affecting the nervous system and myocardium, and even causing cerebrovascular changes [27, 28]. In addition to these deleterious effects of noise pollution, it has been reported to cause an increase in heart rate, constriction/shortening of blood vessels, stomach problems, hormonal disorders, and various psychological problems, as well as non-health-related negative effects such as inefficiency in the workplace and decreased performance [29]. Despite this, many people are unaware of the harmful effects of noise pollution, especially in urban environments [30]. This study therefore involved the measurement and modelling of noise pollution in the Seferihisar district of Izmir Province, a locale which is part of the Cittaslow International movement. The objective of this study was to raise awareness about the harmful effects of noise pollution. In the context of noise modelling studies, the accuracy rate is observed to exhibit variability, contingent upon the extent to which the employed methodology aligns with international standards. A unique approach is recommended, utilising experimental noise data collected from multiple locations to develop a robust noise propagation prediction model [10]. This study aims to evaluate the accuracy of estimated traffic noise levels using MAPANDGIS (v2.0.0.6) software and the Geographic Information Systems (GIS) model (ArcGIS), to raise public awareness about noise pollution, and to create a dataset for public institutions, organizations, and civil society organizations working in this field.

2. Materials and methods

2.1 Study area

The district of Seferihisar in the province of İzmir, Türkiye, which has a long history with the Cittaslow International movement, has been selected as the working area. Izmir's downtown is 45 kilometers from Seferihisar area. The district of Seferihisar is situated in the Aegean Region between latitudes 38°17'00" and 38°02'00" north and longitudes 26°45'00" and 27°01'30" east (Figure 2). The district is located in a geographical area that is bordered by Urla to the north, Guzelyurt and Karabağlar to the northeast, Menderes to the east, and the Aegean Sea to the south and west. Seferihisar, which was awarded the title of Türkiye's first Slow City (Cittaslow) in 2009, has adopted a peaceful lifestyle that is significantly removed from the stress of fast-paced living that is often found in large cities. The Cittaslow movement has been instrumental in promoting a more leisurely pace and a focus on local initiatives in Seferihisar, a settlement with a history dating back 3,000 years. Moreover, the adoption of this concept has led to its increased dissemination [31].

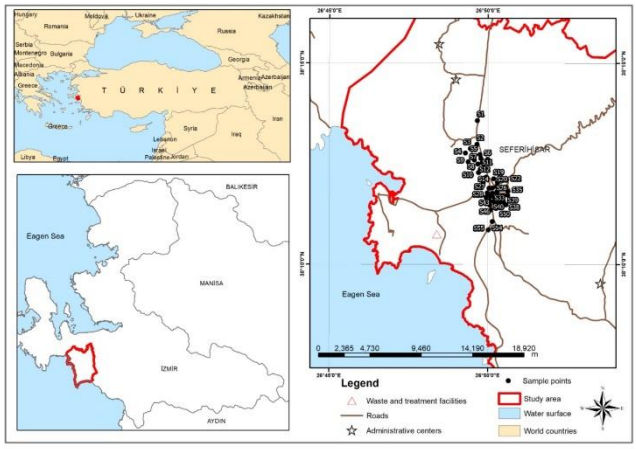

Figure 2. Study area.

2.2 Methods

55 distinct measurement stations were set up along the market center, workplaces, and busy main roads, intersections, and connecting roads in the Seferihisar district center to determine the noise levels caused by traffic. By using a Magellan Triton 1500 handheld GPS receiver, the measurement stations' geographic location was determined (Table 1). Within the scope of the study, the noise level was measured as the Leq value (dBA), which expresses the equivalent noise level [32]. The noise level measurements were conducted using a Svantek 971 brand Type 1 noise level measuring device. Prior to the measurement of noise, the noise device was calibrated using a Svantek SV 33 model calibrator. The noise measurements were carried out in accordance with TS ISO 1996-2 and ISO 9613-2 standards [3,26]. Noise measurements were obtained at a total of 55 measurement stations during the months of July and August 2025. In accordance with the findings of the literature review, acoustic measurements were conducted at a height of 1.5 metres above ground level on the pedestrian pathways that faced the thoroughfare or intersection at which the noise level was to be gauged [3,33,34,35] (Figure 3). In the Seferihisar district centre, measurements were taken on streets and boulevards where road vehicle noise is intense, both on weekdays and weekends. The measurements were taken during mornings between 7:00 a.m. and 9:00 a.m., midday between 12:00 p.m. and 2:00 p.m., and evenings between 7:00 p.m. Each measurement point was measured five times for 10 minutes in the morning, afternoon, and evening, and the averages were taken. Noise maps are a key tool in combating community exposure to road traffic noise. They are essential for assessing the current situation and developing noise action plans by showing the distribution of noise exposure [33,36,37,14]. Consequently, the noise measurement results were processed in ArcGIS software to create a two-dimensional combined thematic spatial noise distribution map. This map shows the arithmetic average of morning, afternoon, and evening measurements. Furthermore, a three-dimensional noise pollution modelling map was created and an in-depth analysis was conducted using MAPANDGIS (v2.0.0.6) software developed by Kramer Schalltechnik GmbH. Kramer Schalltechnik GmbH, the developer of this software, is a German engineering firm that specialises in environmental noise analysis, building acoustics, transportation and recreational noise, acoustic measurement technologies, and noise modelling.

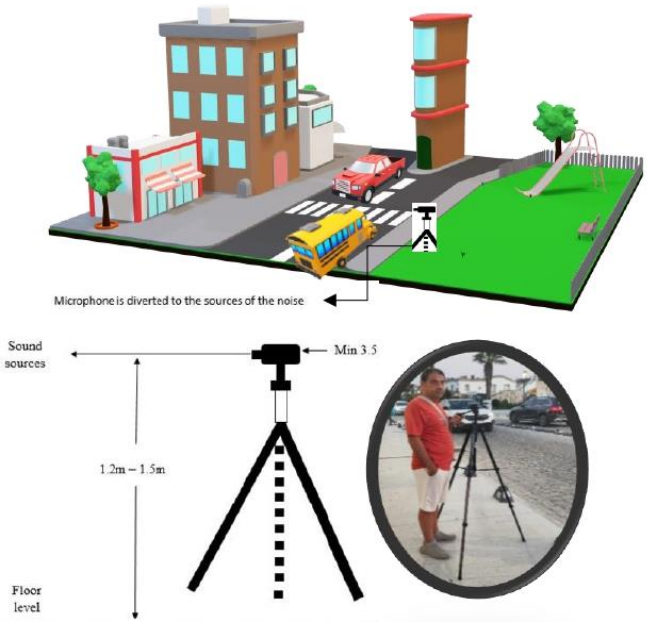

Figure 3. Schematic representation of noise level measurement sampling (Adapted from[38]).

3. Results and discussions

Table 1 below provides the coordinates of the measuring stations used to take ambient noise readings in the Seferihisar district center. Figure 4 displays the map with the noise measurement sites on it. As a result of the fieldwork, three equivalent noise measurements were made at each measurement point. The noise levels of the measurement stations were determined by finding the arithmetic average of the equivalent noise measurement levels (Leq: Equivalent Continuous Sound Level).

Table 1. Coordinates of the noise measurement stations

Station No	Coordinates Latitude / Longitude		Station No	Coordinates Latitude / Longitude	
S1	38.226315	26.827803	**S29**	38.194562	26.832373
S2	38.216454	26.827674	**S30**	38.195038	26.834229
S3	38.214697	26.824191	**S31**	38.195007	26.835396
S4	38.212880	26.821527	**S32**	38.196277	26.835917
S5	38.211972	26.824941	**S33**	38.196963	26.838229
S6	38.212253	26.829195	**S34**	38.195275	26.838434
S7	38.210667	26.829706	**S35**	38.197023	26.843920
S8	38.209994	26.826338	**S36**	38.195132	26.841562
S9	38.209193	26.822979	**S37**	38.195399	26.843831
S10	38.206525	26.825422	**S38**	38.193098	26.844740
S11	38.208335	26.828131	**S39**	38.192666	26.841646
S12	38.208851	26.830339	**S40**	38.193312	26.840339
S13	38.210279	26.833256	**S41**	38.193779	26.838096
S14	38.204763	26.828454	**S42**	38.192773	26.837853
S15	38.206271	26.829421	**S43**	38.192899	26.836464
S16	38.206786	26.831082	**S44**	38.194150	26.837036
S17	38.202850	26.832511	**S45**	38.193059	26.834262
S18	38.200755	26.830925	**S46**	38.191376	26.834392
S19	38.202208	26.836469	**S47**	38.192236	26.836960
S20	38.204694	26.839538	**S48**	38.191641	26.837754
S21	38.200702	26.838370	**S49**	38.19160	26.839365
S22	38.201659	26.843170	**S50**	38.19028	26.839702
S23	38.198852	26.842699	**S51**	38.191468	26.842939
S24	38.198711	26.839889	**S52**	38.189895	26.837625
S25	38.199016	26.838054	**S53**	38.189340	26.834869
S26	38.198374	26.835842	**S54**	38.184491	26.835745
S27	38.198286	26.833916	**S55**	38.181078	26.833649
S28	38.196406	26.833086			

In the Seferihisar district center, noise measurements were conducted at 55 stations, 14 of which are on the İzmir-Seferihisar highway. The noise levels at 14 different measurement stations on the İzmir-Seferihisar highway were 72.7 dB(A) on average between 7:00 and 9:00 in the morning, 74.1 dB(A) on average between 12:00 and 14:00 in the afternoon, and 76.5 dB(A) on average between 19:00 and 21:00 in the evening. World Health Organization guidelines state that noise levels in quiet areas should not be higher than 55 dB in residential areas, 65 dB in commercial areas, 75 dB in industrial areas, and 50 dB during the day and 45, 55, and 65 dB at night, respectively. Noise levels over 70 dB are deemed uncomfortable and may be harmful to people's health. In this respect, the EPA has likewise embraced the WHO norm [39]. It is evident that the research area's traffic noise level on the İzmir-Seferihisar route is higher than both EPA and WHO guidelines (Figure 5).

Surveys conducted on environmental noise complaints in city centre living spaces revealed that 98.4% of respondents indicated that noise negatively impacts their lives, and 68.9% expressed a willingness to implement noise barriers in their living spaces. A study was conducted on the implementation of an ecological corridor with a noise-blocking barrier. The study revealed that measurements taken immediately behind the noise barriers indicated that the plastic barriers reduced noise by approximately 20 dB(A) at all measurement points [40]. For this reason, it is recommended that noise barriers be installed along the Izmir-Seferihisar highway to protect residents from the negative effects of traffic noise.

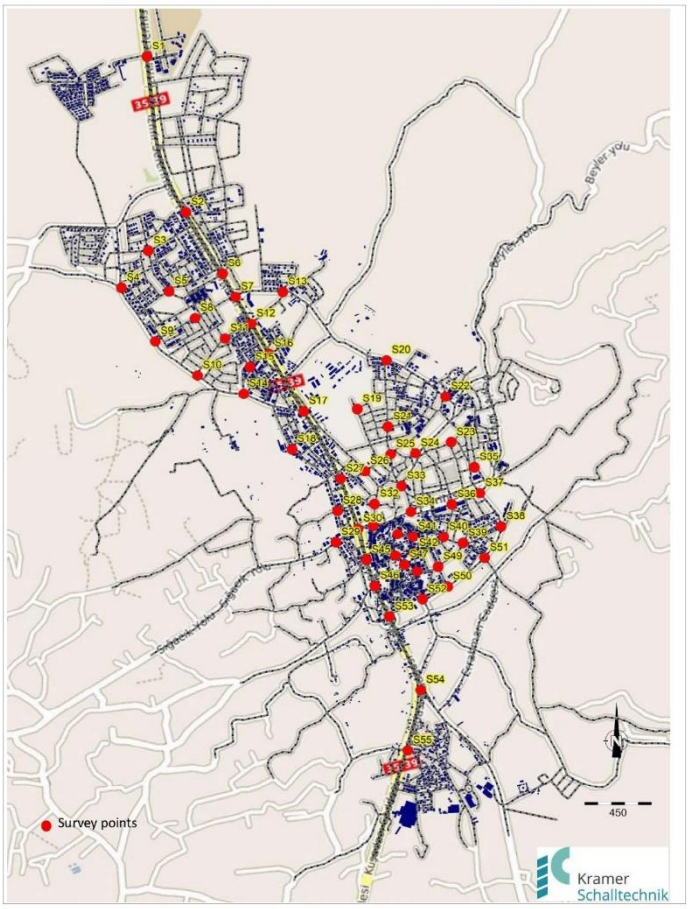

Figure 4. Seferihisar district center noise measurement stations.

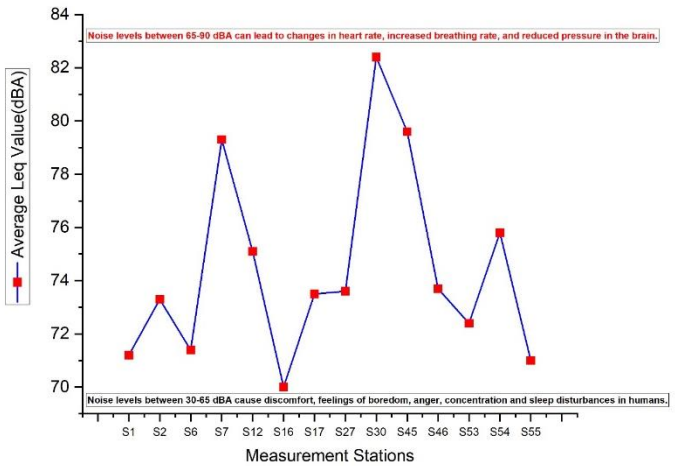

Figure 5. Possible health effects of traffic noise level on the research area's Izmir-Seferihisar route.

The Ministry of Environment, Urbanization, and Climate Change published the "Environmental Noise Control Regulation" in the Official Gazette on November 30, 2022, with the number 32029. This regulation mandates the creation of noise maps for provincial centers and areas with a population density of over 1000 persons per square kilometer. Because Seferihisar District has a population density of 147.90 persons per km^2, which is less than 1000 people per square kilometer [41]. The Ministry of Environment, Urbanization and Climate Change has not commissioned a noise mapping study. Furthermore, as understood from the literature review, no noise pollution mapping study has been conducted in the Seferihisar district center to date. The noise pollution thematic spatial analysis map showing noise levels in the Seferihisar district center, prepared as part of this study, is presented in Figure 6. The thematic spatial distribution analysis was conducted utilising ArcGIS software, thereby yielding a continuous surface for the designated study area through the implementation of the inverse distance weighted (IDW) interpolation technique. This approach is predicated on the idea that sampling locations within the study region are both spatially dispersed and connected [42-46].In MAPANDGIS noise modeling, the grid calculation approach was used as the interpolation method.

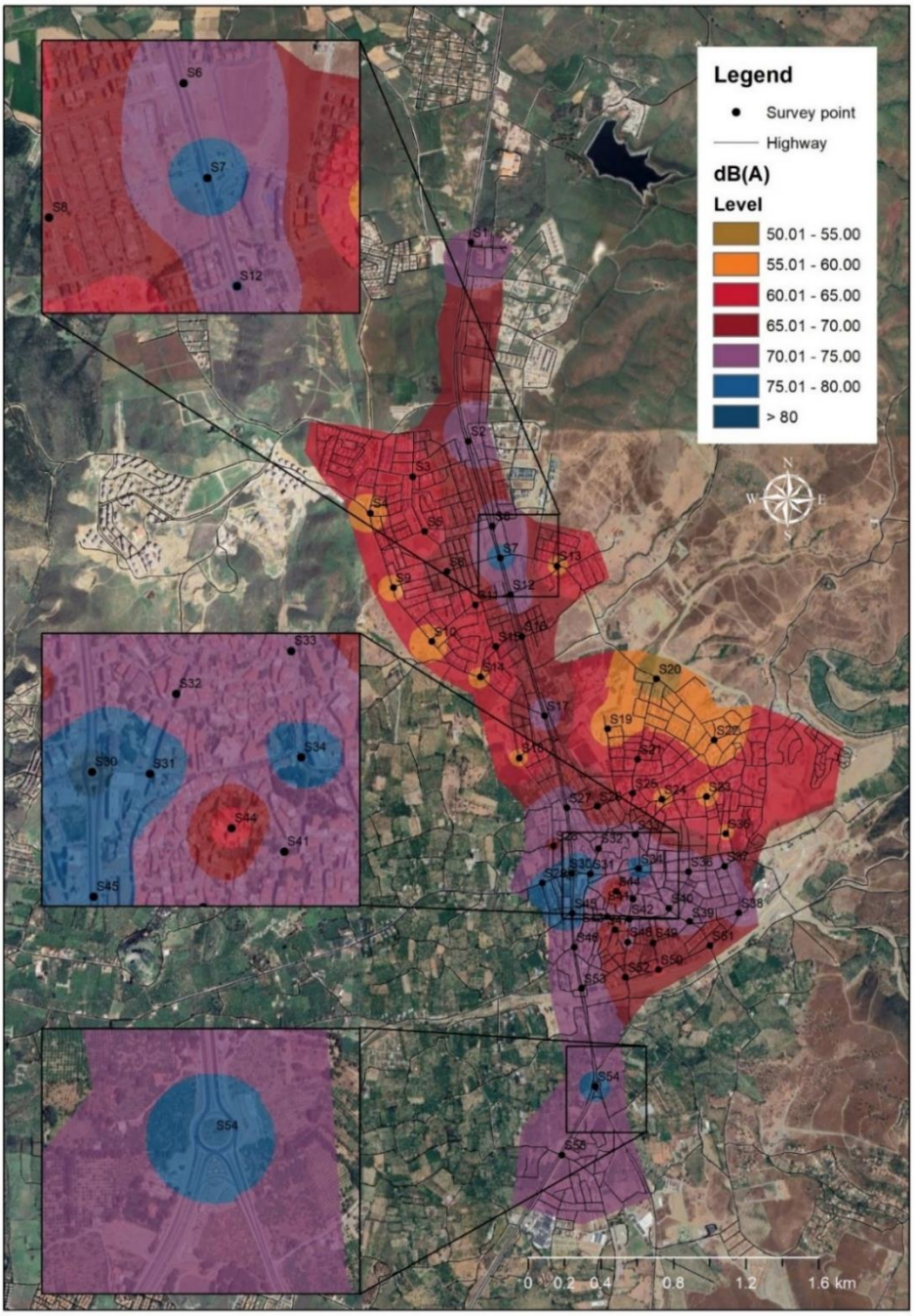

Figure 6. Thematic spatial analysis (ArcGIS) map of noise pollution.

As shown in Figure 6, the primary source of noise in the Seferihisar district center is traffic noise. The increasing tourism-related road transport to the Sığacık neighbourhood in Seferihisar, coupled with the widespread use of various land vehicles, has also had a detrimental effect on traffic noise levels on the İzmir-Seferihisar highway and in the district centre. There is a lack of adequate parking in the city center. The existing primary thoroughfares within the district centre are characterised by their narrow width and high traffic density. This inadequate street width results in traffic disruptions, unnecessary honking, and roadside parking, leading to increased traffic congestion. Vehicles park haphazardly on streets and squares, or drive around unnecessarily to park, thus contributing to noise. Therefore, the urgent construction of multi-storey car parks in the district center is recommended. No noise barriers, noise attenuation with living plant elements, or planting efforts have been implemented to reduce noise at the source along the highways. On the İzmir-Seferihisar highway and along the main streets in the district center, green belt afforestation work is advised in order to benefit from the noise-absorbing qualities of living plant elements. A study conducted with evergreen plant species indeed found that a green belt of large shrubs reduced noise by more than 6 dB(A) at distances of less than 5 m. Furthermore, a group of trees and shrubs reduced noise by 3-5.9 dB(A) at distances of 6-19 m, while a group of sparse trees and shrubs reduced noise by less than 2.9 dB(A) at distances of 20 m. [47]. In a study conducted in Ankara, it was determined that the application of a 3-row noise curtain provided a reduction in the amount of noise of approximately 5 dB(A) [48].

Figures 7 and 8 show three-dimensional noise propagation modeling maps created with MAPANDGIS (v2.0.0.6) software. At the intersection of Nejat Hepkon Street and Sığacık Street and İzmir Street and Atatürk Street, on Atatürk Street, a place in the district center where businesses, cars, and pedestrian traffic are concentrated, the 78 dB(A) value was surpassed, as shown in Figures 7 and 8. The noise level on İnönü Street was higher than 73 dBA. The noise level on İnönü Street has been determined to be caused by both vehicle and pedestrian traffic as well as local commercial activities.

Similar to this study, a traffic-related noise measurement and geographic information system mapping study conducted at 99 locations in Giresun found that industrial, entertainment, and traffic noise in the city mix and increase in intensity due to the location of the port within the city and the location of cafes and wedding halls within residential areas. The value exceeded 68 dBA on three streets [14]. Additionally, mapping studies and traffic-related noise measurements using a geographic information system at 60 stations in Nevşehir's city center revealed that the results of measurements on major arteries were harmful to human health and that it would be very advantageous to put the identified measures into action as soon as possible to safeguard the health of those who live there [33]. In a separate study conducted at 24 points throughout the Avanos town centre, it was determined that the equivalent noise measurement levels ranged from 79 to 85 dB(A) during the day. The maximum noise levels on the highways entering and exiting the town were found to be L_(max) 109 dB(A), while the minimum noise levels were recorded at L_(min) 82 dB(A) [24].

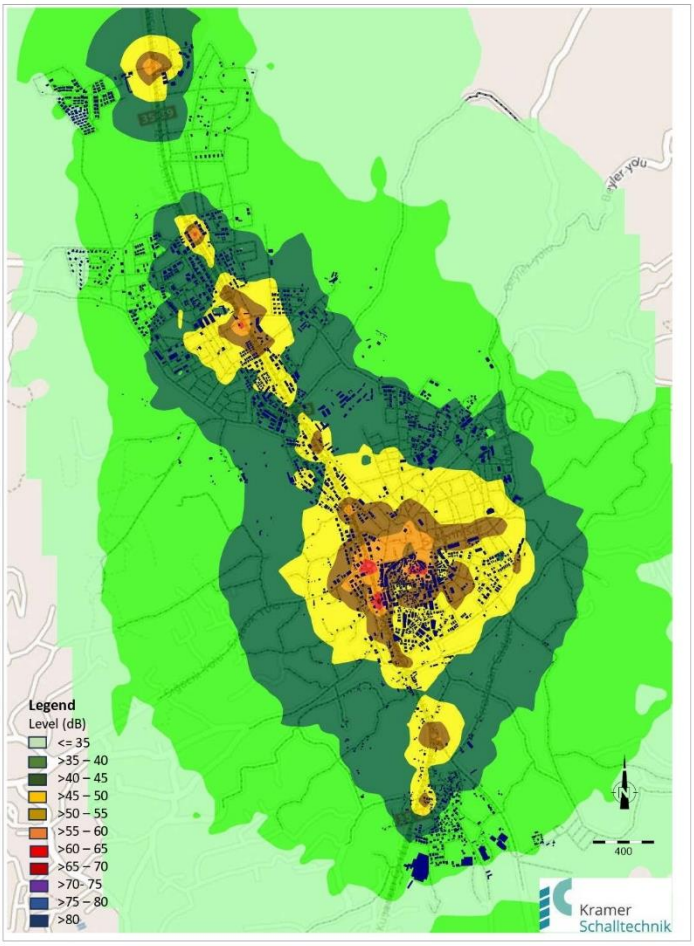

Figure 7. Thematic spatial analysis (MAPANDGIS -v2.0.0.6) map of noise pollution.

It is advised that shopping centers in the Seferihisar district center be built exclusively for pedestrian traffic, devoid of motor cars, in order to reduce the detrimental effects of noise and enhance urban living. The general consensus in recent years has been that many European city centers can be planned to reduce the noise and pollution caused by the high density of motor vehicles, offer safe, healthy, and comfortable pedestrian mobility, enhance urban social life, and encourage social integration among inhabitants [49-53].

The narrow sidewalks designated for pedestrian use in the Seferihisar district centre are inadequate for this purpose, especially during the busy tourist months of July and August. Businesses display their products on the pavements, which are shared spaces, thus occupying the sidewalks. Pedestrians are compelled to descend from the pavements onto the thoroughfares, thereby disrupting vehicular traffic and engendering an increase in noise levels. Therefore, it is recommended that physical renovations be undertaken on Atatürk Street, Hükümet Street, Cumhuriyet Street, Nejat Hepkon Street, and 11 Eylül Street, all of which are densely populated by shopping and commercial establishments in the district center. The Municipality should prevent sidewalk encroachment

by businesses, replace street pavements, and incorporate landscaping elements in these areas. Special sound-absorbing asphalt types (e.g., "silent asphalt") should be used to reduce tire-road contact noise. Furthermore, the promotion of light transportation, such as the improvement of public transportation systems and the augmentation of service frequency, will result in a reduction in private car usage and, consequently, a decrease in urban noise levels. It is recommended that bicycle paths and pedestrian-first areas be expanded in the district centre, and that bicycle paths and pedestrian streets be created to reduce vehicle traffic. The implementation of a congestion charge, analogous to that which has been successfully implemented in London, should be initiated with immediate effect in the Seferihisar district centre, encompassing Atatürk Avenue, Hükümet Avenue, Cumhuriyet Avenue, and Nejat Hepkon Avenue. This will assist in the reduction of heavy traffic flow and the promotion of public transportation use. Moreover, the implementation of a prohibition on vehicle entry during designated hours on these heavily trafficked streets within the district centre would prove to be a highly advantageous measure, contributing to the mitigation of both noise and air pollution. In areas characterised by high levels of noise, as illustrated in Figure 7, the establishment of "quiet zones" is recommended, providing designated spaces for individuals to unwind. In areas where there is a high volume of pedestrian and vehicular traffic, including commercial buildings, it is recommended that restrictions be imposed on the use of horns during specific hours. It is imperative that road vehicles with loud exhausts and defective engines are subject to rigorous inspection, with appropriate penalties to be implemented for any contraventions. It is imperative that a "Seferihisar District Noise Action Plan" is formulated under the auspices of the Seferihisar District Municipality, in conjunction with pertinent public institutions and the University. The identification of priority intervention areas is also crucial. The proposed plan entails the implementation of sanctions for the transgression of acceptable limits during designated time intervals.

While the areas exposed to the highest noise in the Seferihisar district center were determined to be in the city center where motor vehicle traffic and pedestrian traffic are the most intense, the lowest noise measurement values were measured in the neighborhoods located on the outskirts of the district (Göksüzler Avenue, 93rd Street, Mektep Avenue, 21st Street, Kocaçay Avenue, Gazi Avenue) (Figure 9). Because there aren't many cars, companies, or residential areas in this area, there isn't much pedestrian traffic, which contributes to the low noise levels at these stations. Businesses that produce noise in the district center, such as car washes, entertainment venues, cafes, restaurants, hazelnut factories, and bread factories, should not be allowed on the ground floors of homes or close to them. It is imperative that existing workplaces are subject to inspection in order to ensure that the requisite noise insulation measures are in place. In the context of new constructions, insulation should be accorded a high priority, and the utilisation of sound-absorbing materials during the construction process should be promoted and monitored. It is incumbent upon the District Police Department to ensure that vehicles do not form convoys, that horns are not honked, and that explosives are not thrown during events such as weddings, military service ceremonies and football matches within the city. Furthermore, the playing of loud music in vehicles should be prohibited [24].

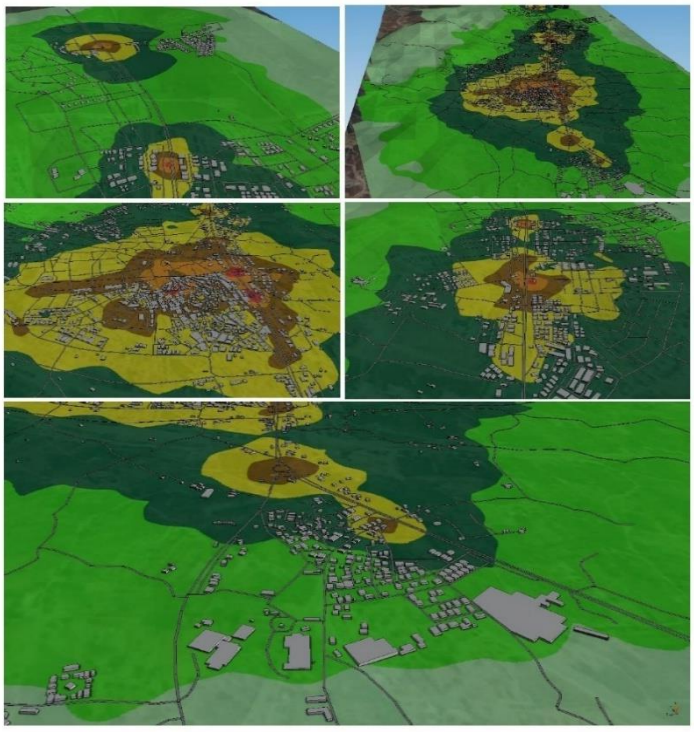

Figure 8. Three-dimensional modeling (MAPANDGIS -v2.0.0.6) map of noise pollution.

Noise levels on streets in the district center (Atatürk Avenue, Hükümet Avenue, Cumhuriyet Avenue, and Nejat Hepkon Avenue) were found to be 3-5 dBA higher during weekday measurements than on weekends. Similar to the results of this study, another study reported that noise levels were 3-4 dBA higher during weekday measurements than on weekends. This was attributed to the lower traffic density due to the weekend being a holiday [16]. Indeed, vehicles are exposed to various resistances while traveling; some of these are air resistance, acceleration resistance, and road resistance. Air resistance causes energy fluctuations on the surface of vehicles, wheels, and other equipment, leading to noise [54]. Lower traffic density has resulted in a decrease in the number of vehicles generating noise.

A study conducted by Sezgin and Mutlu (2017) found that noise was not considered a form of environmental pollution, and that participants' awareness of noise and the penalties for causing it were low. It was also determined that, although participants did not view noise as an environmental problem, they complained extensively about it and believed it was not being adequately addressed. It has been reported that people who are not aware of and knowledgeable about environmental problems cannot be expected to find solutions to these problems or to change their attitudes and actions that cause problems [29]. In this case, it is clear that an urgent education campaign about the negative effects of traffic noise on health and the precautions that can be taken should be carried out in Seferihisar city centre to reduce noise pollution.

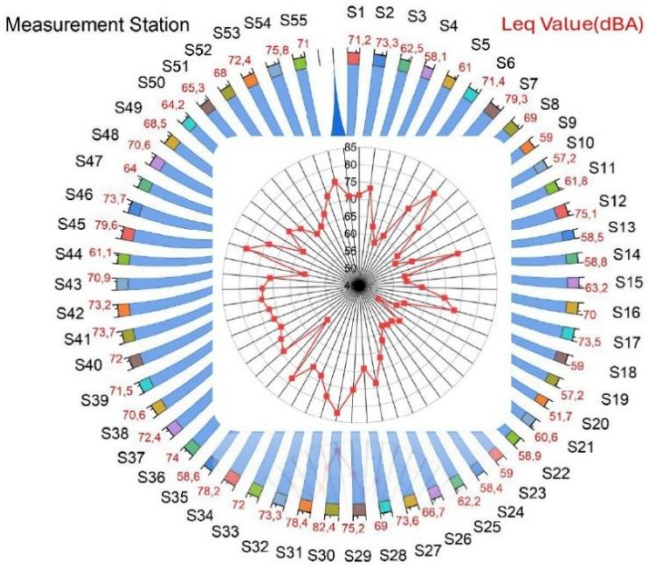

Figure 9. Noise level (average Leq value) distribution values according to measurement stations.

4. Conclusions

In recent years, Türkiye, a developing nation, has seen a sharp rise in the number of automobiles on its roads. Residents' public health is at risk, and their general quality of life suffers as a result of the increased traffic noise, especially in large cities with strong industrial and tourism potential. Traffic-related noise pollution in urban centers is an environmental problem that must be handled at human, psychological, social, and environmental levels. In addition to infrastructure improvements and legislative restrictions, public awareness, efficient oversight, planning, and sustainable transportation policies can all help find long-term solutions to this problem. Significant noise pollution is produced in the Seferihisar district center, where the pilot study was carried out, by the summertime population growth brought on by domestic and foreign tourists, the frequent honking of horns because of the small and insufficient roads, and heavy vehicle traffic. There is more vehicle and pedestrian activity in the vicinity as a result of the fruit and vegetable market on 52/1st Street, especially on Tuesdays and Fridays, which raises noise levels. On weekends, people from Izmir frequently visit beaches in Seferihisar, Sığacık, Doğanbey, Ürkmez, and the nearby districts. As a result, there is more noise due to traffic congestion on the Seferihisar-Kuşadası route. It is advised that parking spaces be built in the city center and that the essential noise reduction measures be immediately put into place along the key thoroughfares in the Seferihisar district core, combining natural and artificial features. As part of inspection and awareness-raising efforts, horn use should be monitored, and sanctions should be implemented to prevent unnecessary noise pollution. Vehicle maintenance inspections should be conducted, and noisy vehicles should be banned from traffic. Awareness campaigns should be conducted through relevant institutions and organizations, as well as civil society organizations, to inform residents about the impact of noise pollution. These recommendations must be addressed with a holistic approach to make the city center more livable.

Long-term noise pollution reduction in Türkiye and Europe will be greatly aided by public awareness campaigns, people-centered city center planning, efficient monitoring, and the promotion of sustainable transportation. The noise map for the Seferihisar district was efficiently modeled and computed using the MAPANDGIS (v2.0.0.6) program, which was based on ISO 9613-2: Acoustics – Calculation of attenuation of sound propagation in open air – Part 2: General approach. The technical infrastructure and software support provided by Kramer Schalltechnik GmbH contributed to the scientific accuracy and reliability of the study. This software models the criteria (geometric propagation, atmospheric absorption, ground effects, effects of obstacles, meteorological conditions, source height, and receiver location) used in calculations based on ISO 9613-2, one of the most important globally accepted standards for calculating sound propagation in outdoor environments. MAPANDGIS calculates reflection and shadowing based on building height, precisely applies the acoustic properties of the ground, and accurately simulates the propagation of sound in the environment, taking into account the effects of atmospheric factors (wind and temperature gradients) on sound propagation. This holistic approach sets this extensible software apart from conventional Geographic Information Systems (GIS) software. As well as performing calculations on geographic data, it fulfils all the requirements of acoustics. The resulting noise maps are highly scientifically accurate and reliable. This pilot study will raise public awareness of increasing traffic-related noise pollution in all countries, and if implemented in densely populated cities, it will improve quality of life for many citizens. The noise modelling developed using this software allows for a more accurate and comprehensive assessment of the public health impacts of noise and will assist local governments in addressing the adverse health effects of traffic noise and implementing preventative measures.

Conflict of Interest Statement

The authors declare that there is no conflict of interest in the study.

CRediT Author Statement

Erkan Kalıpcı: Conceptualization, Writing-original draft, Validation, **Hüseyin Cüce:** Conceptualization, Supervision, **Mehmet Ali Dereli:** Data curation, Formal analysis, Visualization; **Salih Sancar Tural:** Data curation, Visualization

References

[1] Thakre C, Laxmi V, Kalawapudi K, Motghare V M, Vijay R. Noise Mapping and Impact of Land Use Land Cover on Urban Soundscape. MAPAN. 2025;40(1):59-75. https://doi.org/10.1007/s12647-024-00782-x

[2] Coşkun S, Sava B, Şahin C. Isparta Kent Merkezi Hastane Yerleşkelerinin Gürültü Kirliliği Açısından İncelenmesi. Kent Akademisi Dergisi.2022;15(2):848-860. https://doi.org/10.35674/kent.1051483

[3] Sava B, Kuş Şahin C, Coşkun S. Isparta İli Eğirdir İlçesinde Gürültü Kirliliğinin İrdelenmesi Üzerine Bir Araştırma. Turkish J of Forest

Science. 2025; 9(1): 59-74. https://doi.org/10.32328/turkjforsci.1549844

[4] European Environment Agency, https://www.eea.europa.eu/en/analysis/indicators/exposure-of-europe-population-to-noise (Date of access: 12.05.2025, Date of time:10.05).

[5] Jamrah A, Al-Omari A, Sharabi R. Evaluation of Traffic Noise Pollution in Amman, Jordan. Environmental Monitoring and Assessment.2006;120:499-525.https://doi.org/10.1007/s10661-005-9077-5

[6] Licitra G, Teti L, Cerchiai M, Bianco F. The influence of Tyres on The Use of The CPX Method For Evaluating The Effectiveness of A Noise Mitigation Action Based on Low-Noise Road Surfaces. Transportation Research Part D: Transport and Environment. 2017;55: 217-226. https://doi.org/10.1016/j.trd.2017.07.002

[7] De Paiva Vianna, K M Cardoso, M R A, Rodrigues R M C. Noise Pollution and Annoyance: An Urban Soundscapes Study. Noise and Health.2015;17(76):125-133. https://doi.org/10.4103/1463-1741.155833

[8] Yadav A, Parida M, Kumar B. Statistical Modelling of Traffic Noise at Intersections in A Mid-Sized City, India. Noise Mapping. 2023;10(1): 20220164. https://doi.org/10.1515/noise-2022-0164

[9] Shukla A K, Jain S S, Parida M, Srivastava J B. Performance of FHWA Model For Predicting Traffic Noise: A Case Study Of Metropolitan City, Lucknow (India). Transport. 2009;24(3): 234-240. https://doi.org/10.3846/1648-4142.2009.24.234-240

[10]Tiwari S K, Kumaraswamidhas L A, Patel R, Garg N, Vallisree S. Traffic Noise Measurement, Mapping, And Modeling Using Soft Computing Techniques For Mid-Sized Smart Indian City. Measurement: Sensors. 2024;33: 101203. https://doi.org/10.1016/j.measen.2024.101203

[11]Vural H Bingöl. Kent Merkezi Çevresel Gürültü Kaynakları, Düzeyleri ve Etkileri Üzerine Ön Araştırma. Türk Tarım ve Doğa Bilimleri Dergisi. 2024;11(4):1069-1082. https://doi.org/10.30910/turkjans.1539516

[12]Yılmaz H, Özer S. Evaluation and Analysis Of Environmental Noise Pollution In The City Of Erzurum, Turkey. International Journal of Environment and Pollution. 2005;23(4): 438-448. https://doi.org/10.1504/IJEP.2005.007606

[13]Kalıpcı E, Arslan F. Determination of Noise Pollution Knowledge In The Sport Centres of Konya City. Journal of International Environmental Application & Science. 2007;2(1):64-70.

[14]Kalıpcı E, Dursun Ş. Presentation of Giresun City Traffic Noise Pollution Map Via Geographical Information System. Journal of Applied Sciences. 2009;9(3):479-487.

[15]Bayraktar ÖM., Mutlu A. Balikesir Üniversitesi kampüsüne ait gürültü seviyelerinin Cadnaa ile modellenmesi. Uludağ Üniversitesi Mühendislik Fakültesi Dergisi.2021;*26*(3):813-828. https://doi.org/10.3923/jas.2009.479.487

[16]Ilgun A, Cogurcu M T, Ozdemir C, Kalipci E, Sahinkaya S. Determination of Sound Transfer Coefficient of Boron Added Waste Cellulosic And Paper Mixture Panels. Scientific Research and Essays. 2010;5(12):1530-1535.

[17]Dal H. Sakarya Ili Şehir Merkezinin Gürültü Kirliliği Üzerine Bir Ön Çalışma. Sakarya Uni J of Sci. 2012;16(2):83-91.

[18]Cansaran D. Gürültü Kirliliği Düzeyini Belirlemeye Yönelik Bir Çalışma: Amasya Ili Örneği. Ankara Üni SBF Dergisi. 2019;74(1): 89-108. https://doi.org/10.33630/ausbf.523208

[19]Deveci S, Yorulmaz F. Edirne Il Merkezinde Çevresel Gürültünün Değerlendirilmesi. Mersin Üni Sağlık Bilimleri Dergisi. 2022;15(2): 234-244. https://doi.org/10.26559/mersinsbd.1070709

[20]Şahin K. Atakum (Samsun) Şehrinde Çevresel Gürültü Kirliliği. J of Int Social Research. 2014;7(29):722-730.

[21]Ünver E. Trafik ve Rekreasyonel Kullanım Kaynaklı Gürültü Kirliliğinin Belirlenmesi: Çorlu Örneği (Master's thesis, Namık Kemal Üniversitesi). 2018.

[22]Kaya G K. Gaziantep'in Yoğun Trafik Bölgelerindeki Gürültü Seviyelerinin Belirlenmesi Ve Çevresel Etkileri (Master's thesis, Hasan Kalyoncu Üniversitesi). 2020.

[23]Kılıç M Y, Kılıç İ, Adalı S. Kentsel Yerleşim Alanlarında Çevresel Gürültünün Belirlenmesi: Bursa Dikkaldırım Mahallesi Örneği. Gümüşhane Üni. Fen Bilimleri Dergisi. 2021;11(3):792-804. https://doi.org/10.17714/gumusfenbil.884575

[24]Özkurt N, Oğuz M N T, Sarı D, Hamamcı S F, Erdöl M, Çakmak E G, ..., Gençer F. Karayollarında Gürültü Bariyer Sistemleri Uygulanabilir Potansiyel Kesitlerin Belirlenmesi. Gazi Üniversitesi Mühendislik Mimarlık Fakültesi Dergisi. 2024;39(2):1003-1016. https://doi.org/10.17341/gazimmfd.1127730

[25]Kalıpcı E. Avanos Ilçe Merkezinde Trafik Kaynaklı Gürültü Kirliliğinin Mekânsal Analizi. Nevşehir Bilim ve Teknoloji Dergisi. 2017;6(1):20-29. https://doi.org/10.17100/nevbiltek.309489

[26]Özdemir C, Burdurlu Y. Boyutları ve Etkileri Açısından Gürültü Kirliliği', Çevre Sempozyumu. S.Ü.Çevre Mühendisliği Bölümü, Konya. 1994.

[27]Öden M K, Bilgin İ. Sarayönü Ilçe Merkezinde Trafik Kaynaklı Gürültü Kirliliğinin Araştırılması. Çukurova Üniversitesi Mühendislik-Mimarlık Fakültesi Dergisi. 2019;34(1):103-114. https://doi.org/10.21605/cukurovaummfd.601324

[28]Agreda Oña J L, Moreno Ávila A S, Mendoza Poma M R. Study of Sound Pressure Levels Through The Creation Of Noise Maps In The Urban Area Of Latacunga City Using Plithogenic N-Superhypergraphs. Neutrosophic Sets and Systems. 2024;74(1):14.

[29]Bernat-Ponce E, Gil-Delgado J A, López-Iborra G M. Recreational Noise Pollution Of Traditional Festivals Reduces The Juvenile Productivity Of An Avian Urban Bioindicator. Environmental Pollution. 2021;286:117247. https://doi.org/10.1016/j.envpol.2021.117247

[30]Sezgin S, Mutlu A. Ülkemizde Gürültü Farkındalığı Sorunu: Şişli Örneği. Gazi Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi. 2017;19(2):725-741.

[31]Razavi-Termeh S V, Sadeghi-Niaraki A, Jelokhani-Niaraki M, Choi S M. Exploring Multi-Pollution Variability In The Urban Environment: Geospatial AI-Driven Modeling Of Air And Noise. International Journal of Digital Earth. 2024;17(1):2378819. https://doi.org/10.1080/17538947.2024.2378819

[32]Seferihisar Belediyesi, https://web.archive.org/web/20170421082814/http://seferihisar.bel.tr/cittaslow-seferihisar/ (Date of access: 12.05.2025, Date of time:11.25).

[33]Baffoe P E, Duker A A, Senkyire-Kwarteng E V. Assessment of Health Impacts Of Noise Pollution In The Tarkwa Mining Community Of Ghana Using Noise Mapping Techniques. Global

Health Journal.2022;6(1):19-29. https://doi.org/10.1016/j.glohj.2022.01.005

[34]Kalıpcı E, Bilgen İ, Cüce H. Nevsehir City Center Spatial Analysis of Noise Pollution By Using Geographical Information System. Karadeniz Fen Bilimleri Dergisi. 2020;10(2):253-265. https://doi.org/10.31466/kfbd.777168

[35]Koushkı P A, Al-Saleh O, Alı S Y. Traffic Noise In Kuwait: Profiles And Modeling Residents' Perceptions. Journal of urban planning and development.1999;125.3:101-109. https://doi.org/10.1061/(ASCE)0733-9488(1999)125:3(1

[36]Baaj M Hadi, et al. Modeling Noise At Elevated Highways In Urban Areas: A Practical Application. Journal of Urban Planning and Development.2001;127.4:169-180. https://doi.org/10.1061/(ASCE)0733-9488(2001)127:4(16

[37]Fredianelli L, Carpita S, Bernardini M, Del Pizzo L G, Brocchi F, Bianco F, Licitra G. Traffic Flow Detection Using Camera Images And Machine Learning Methods In ITS For Noise Map And Action Plan Optimization. Sensors. 2022; 22(5):1929. https://doi.org/10.3390/s22051929

[38]Özdemir C, Savur A, Kalıpcı E, Sahinkaya S, Demirci M T. Determination And Control Of Noise Pollution Risk Points At The Level Of Touristic Hotels. Middle-East Journal of Scientific Research. 2011;7(1):95-102.

[39]Abdullah S, Fuad M F A, Dom N C, Ahmed A N, Yusof K M K K, Zulkifli M F R, ... & Ismail M. Effects of Environmental Noise Pollution Towards School Children. Malaysian Journal of Medicine & Health Sciences. 2021;17(3):38-44.

[40]Mesene M, Meskele M, Mengistu T. The Proliferation Of Noise Pollution As An Urban Social Problem In Wolaita Sodo City, Wolaita Zone, Ethiopia. Cogent Social Sciences. 2022;8(1):2103280. https://doi.org/10.1080/23311886.2022.2103280

[41]Aksu A. Erzurum Kent Merkezi Karayolu Güzergahında Ekolojik Koridor Kapsamında Gürültü Önleme Bariyeri Planlaması. Atatürk Üniversitesi, Fen Bilimleri Enstitüsü, Peyzaj Mimarlığı Anabilim Dalı, Doktora Tezi, Erzurum. 2023.

[42]Endeksa, https://www.endeksa.com/tr/analiz/turkiye/izmir/seferihisar/demografi (Date of access: 23.05.2025, Date of time:11.05).

[43]Debnath A, Singh P K. Environmental Traffic Noise Modelling Of Dhanbad Township Area–A Mathematical Based Approach. Applied Acoustics.2018;129:161-172. https://doi.org/10.1016/j.apacoust.2017.07.023

[44]Shukla K, Kumar P, Mann G S, Khare M. Mapping Spatial Distribution Of Particulate Matter Using Kriging And Inverse Distance Weighting At Supersites Of Megacity Delhi. Sustainable Cities and Society. 2020;54:101997. https://doi.org/10.1016/j.scs.2019.101997

[45]Yalcin M, Gul FK. A GIS-based multi criteria decision analysis approach for exploring geothermal resources: Akarcay basin (Afyonkarahisar). Geothermics.2017;*67*:18-28. https://doi.org/10.1016/j.geothermics.2017.01.002

[46]Yalcin M. A GIS-based multi-criteria decision analysis model for determining glacier vulnerability. *ISPRS International Journal of Geo-Information*.2020; *9*(3):180. https://doi.org/10.3390/ijgi9030180

[47]Tercan E, Dereli M A. Development of A Land Suitability Model For Citrus Cultivation Using GIS And Multi-Criteria Assessment Techniques In Antalya Province of Turkey. Ecological Indicators. 2020;117:106549. https://doi.org/10.1016/j.ecolind.2020.106549

[48]Fang C F, Ling D L. Investigation Of The Noise Reduction Provided By Tree Belts. Landscape And Urban Planning. 2003;63(4):187-195. https://doi.org/10.1016/S0169-2046(02)00190-1

[49]Erdoğan E, Yazgan M E. Kentlerde Trafik Gürültüsü Sorununu Azaltmada Peyzaj Mimarlığı Çalışmaları: Ankara Örneği. Tekirdağ Ziraat Fakültesi Dergisi. 2007;4(2):201-201.

[50]Isaacs R. The Urban Picturesque: An Aesthetic Experience of Urban Pedestrian Places, Journal of Urban Design. 2000;5:2:145-180. https://doi.org/10.1080/713683961

[51]Zacharias, J. Pedestrian Behavior and Perception in Urban Walking Environments. Journal of Planning Literature. 2001;16:1:3-18. https://doi.org/10.1177/08854120122093249

[52]Yıldız E V. Araçtan Arındırılmış Yerleşimler: Viyana-Floridsdorf (Avusturya) Örneği, Gazi Üniversitesi Mühendislik Mimarlık Fakültesi Dergisi. 2005;20(4):537-548.

[53]Birol Özerk G. Kente Dönüş, Kentsel Yaşama Dönüş: Balıkesir Milli Kuvvetler Caddesinde Kısmi Yayalaştırma Projesi, Megaron Balıkesir. Mimarlar Odası Balıkesir Şubesi Dergisi. 2011:6-15.

[54]Karagöz M, Tuncay B. An Engine Mount Design and Vibration Analysis. International Journal of Automotive Science and Technology. 2020; 4(3):164-170.