

CURRENT STATUS OF TRAFFIC NOISE POLLUTION ON NATIONAL HIGHWAY 1A PASSING THROUGH THE CENTER OF HUE CITY

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ABSTRACT

This paper presents the findings of a study on the impact of traffic noise on residents living along National Highway 1A in Hue City. The results indicate that noise levels at the monitoring sites exceeded the limits of the National Technical Regulation on Noise (QCVN 26:2010/BTNMT), particularly at locations near bus stations and road intersections. During peak hours, high traffic density results in elevated noise levels. According to the survey data, 37.5% of people were affected by road traffic noise, mainly headaches and sleep problems, while the remaining 62.5% said they did not experience any health effects. In addition, noise also affects people's daily activities such as talking, phone calls, watching television, reading books, resting, and sleeping; however, the level of influence is negligible.

Keywords: Hue city, noise level, noise pollution, road traffic.

1. INTRODUCTION

Traffic noise pollution is a common problem in many cities around the world. Nowadays, due to urbanization, there has been a rapid increase in the number of vehicles on the road and a decline in the sound quality of the environment in urban areas [1].

Noise pollution is a form of environmental pollution; noise creates sound vibrations in the range of sound frequencies that can have negative impacts on human safety and health. Noise significantly impacts the community, yet people often underestimate the stress it causes on a daily basis. If exposed regularly, it can cause high blood pressure, stress, tinnitus, hearing loss, sleep disorders, and other harmful effects. Noise causes significant impacts on human health and daily activities. The authors'

studies on traffic noise hinder daily activities, leading to discomfort [2], hearing damage [3], [4], [5], sleep disorders [6], and impaired learning ability **Error! Reference source not found.**

In developing countries, the growth and planning of transport infrastructure and residential locations are often not synchronized. This mainly leads to households being concentrated around transport infrastructure such as highways and stations, thereby increasing the time and frequency of people's exposure to noise [8].

Most studies have focused on controlling the noise levels of transportation sources [9]. Some authors have studied the relationship between traffic noise and physical, psychological, and physiological outcomes [4]. However, studies on the relationship between traffic noise and annoyance are still mostly limited to developed countries, with very few studies in developing and underdeveloped countries.

Not only in big cities like Hanoi, Ho Chi Minh City, and Da Nang, which have long experienced high traffic volumes, but also in Hue City, is significantly affected by traffic noise due to the increasing number of vehicles. With the current rapid urbanization speed, the number of vehicles in Thua Thien Hue province in general and Hue city in particular has also increased significantly, which is also a source of noise pollution in Hue city, especially on National Highway 1A, where the large number of vehicles affects the lives of people living on both sides of the road.

Therefore, the purpose of the article "The current status of traffic noise pollution on National Highway 1A through Hue city" is to assess the current status of traffic noise the and its impact on people's health.

2. STUDY METHODS

2.1. Sociological survey

Conduct direct interviews using structured questionnaires with 100 people living along both sides of the traffic road. The content of the questionnaire includes (i) Information related to the interviewees, such as full name, age, gender, address, occupation, and number of family members. (ii) The effects of traffic noise on people's health and life. Health symptoms that people experience are affected by the noise of participating vehicles. (iii) Measures that people use to deal with road traffic noise.

The selection of houses in the research area for investigation was done randomly for houses located on National Highway 1A running through Hue city, and only investigated houses close to the road, around the location of the noise meter. The selected areas, with different population characteristics, aim to reflect relatively fully the impact of traffic noise on the lives and health of people along National Highway 1A.

2.2. Noise level measurement

(i) Noise measurement locations: Noise levels were measured at 7 locations along both sides of traffic routes on National Highway 1A, running through Hue City. Location information and noise measurement points are shown in Table 1 and Figure 1. The basis for selecting noise measurement locations is based on the following criteria: There is a residential area; Affected by noise from traffic activities and less affected by other noise sources; and Locations with high traffic density. In addition, the selection of measurement points is considered based on safety factors, standard measurement conditions and geographical - urban - traffic representativeness.

(ii) Noise meter arrangement: Place one noise meter near the road and another inside people's homes to measure noise simultaneously. The meter is placed at a height of 1.5m above the ground.

(iii) Measurement method: At locations, measure the equivalent noise level according to characteristic A within 15 minutes ($L_{Aeq,1h}$) at different times of the day.

For each measurement position, repeat the measurement 3 times and repeat on weekdays and holidays. Use the Rion NL-32 noise meter to measure noise levels at locations.

Table 1. Road traffic noise measurement locations

Location	Coordinates		Characteristic
	East longitude	North Latitude	
K1	107° 36' 53.2"	16° 26' 40.1"	An Duong Vuong Street (near the intersection between Hue city and Huong Thuy town)
K2	107° 36' 12.9"	16° 27' 07.0"	An Duong Vuong Street (near the Southern bus station)
K3	107° 35' 51"	16° 27' 38.4"	Hung Vuong Street (Pedagogical College)
K4	107° 35' 21.7"	16° 27' 50.1"	Hanoi Street (opposite Kim Dong Park)
K5	107° 35' 02.3"	16° 28' 00.6"	Le Duan Street (near the bus station on Nguyen Hoang side)
K6	107° 34' 07.0"	16 ° 27' 51.4"	Le Duan Street (opposite the railway)
K7	107 ° 31' 56.4"	16 ° 29' 39.2"	Near the intersection between Hue city and Huong Tra town

12:25 – 12:40	12:00- 12:15	T4	C4
14:00 – 14:15	14:25 - 14:40	T5	C5
16:45 – 17:00	17:10 - 17:25	T6	C6
19:00 – 19:15	19:25 - 19:40	T7	C7

2.4. Evaluation method

Conducting an assessment of road traffic noise according to the National technical regulations on noise (QCVN 26/2010/BTNMT). The level of impact of road traffic noise on people is assessed based on the percentage of people affected by health and the percentage of people feeling disturbed at different levels when exposed to noise caused by road vehicles. The levels of disturbance are assessed according to the 5-point verbal scale of ICBEN (International Commission on Biological Effects of Noise) [10].

Table 3. ICBEN 5-point scale

Level of annoyance	Vietnamese	English
1	Absolutely not	Not at all
2	Somewhat	Slightly
3	Not too much	Moderately
4	Much	Very
5	Extremely	Extremely

2.5. Statistical methods of data processing

Utilize MS Excel tools to support the processing and analysis of data collected from noise monitoring points and surveys conducted with individuals regarding the impact of noise.

3. RESULTS AND DISCUSSION

3.1. Characteristics of road traffic noise in Hue City

The characteristics of road traffic noise in Hue City are similar to other cities in the country. The main sources of noise pollution are from motorbike and car engines. In addition, the noise level is also related to the use of horns (electric horns and air horns) by vehicle owners.

❖ *Noise level variation at measuring points in the area on weekdays:*

The graph shows the noise levels at measuring points in the area on weekdays in the following figures:

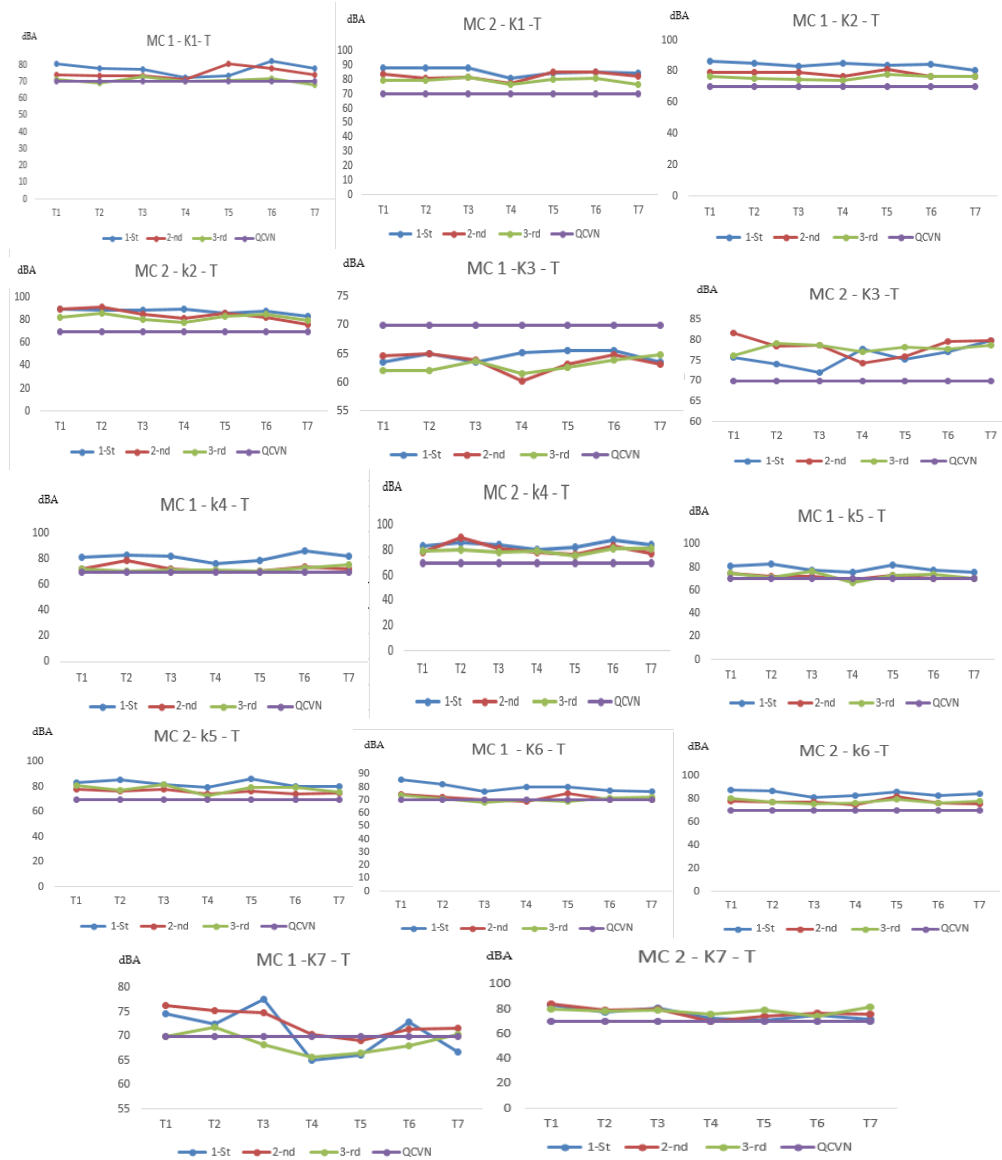


Figure 2. Weekday noise level distribution across surveyed locations

The results of noise level measurements on weekdays at the research locations in Figure 2 show insignificant fluctuations at different times of the day, however, most of the measurement points exceed QCVN 26/2010/BTNMT, specifically:

From 6:00 to 21:00, at 7 research locations, the noise level fluctuated between 71,0-95,6 dBA. At all locations inside residential houses, the noise level exceeded QCVN 26/2010/BTNMT, which allows less than 70 dBA.

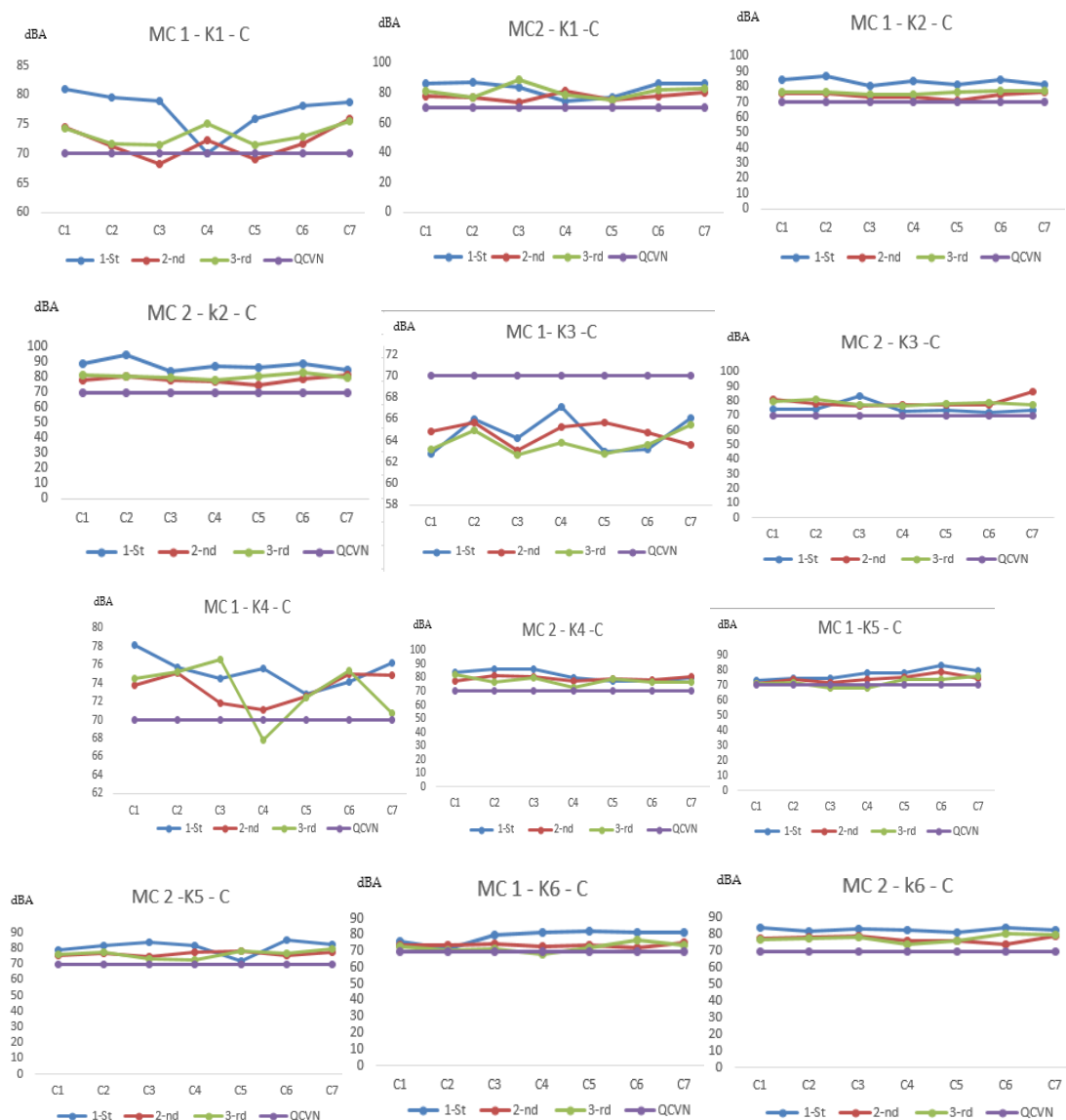
The results show that during rush hours (6:30 – 6:45, 11:00 – 11:15), the noise level is much higher than at other hours. This can be explained by the fact that these are the hours when people start going to work and return home, so the traffic density is high, making the noise level higher.

During non-rush hours, traffic volume decreases, so noise levels also tend to decrease during these times (8:00 – 8:30, 14:00 – 14:30).

The cause is explained by traffic participants using the horn for the wrong purpose, using a horn that is not suitable for the vehicle being driven.

❖ *Noise level variation at measuring points in the area on holidays:*

The graphs show noise levels at measurement points in the area on holidays in Figure 3.



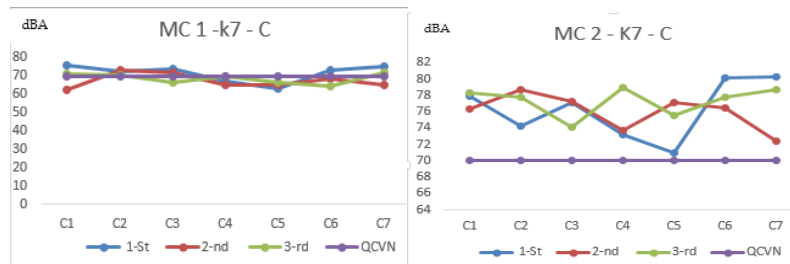


Figure 3. Holiday noise level distribution across surveyed locations

The results of noise level measurements on weekdays at the above research locations show insignificant fluctuations at different times of the day, however, most of the measured values exceed QCVN 26/2010/BTNMT, specifically:

Compared to normal days, the noise level variation on holidays is not much different from normal days. Noise levels between research locations are not different.

Similar to normal days, the noise levels measured on holidays are also quite high and mostly exceed the allowable limit. From 6 am to 9 pm, at 7 research locations, the noise level fluctuates between 70 – 91,6 dBA. At all locations inside residential houses, the noise level exceeds QCVN 26/2010/BTNMT, which allows less than 70 dBA.

On holidays, noise levels tend to increase at night (6 am - 8 pm), because on weekends people tend to go out more, leading to increased traffic and increased noise levels.

3.2. Impact of road traffic noise on people's health

Through the survey and interviews with people in the research area (see Figure 4), it was found that 41% of people said that their health was affected by road traffic noise, the remaining 59% said that their health was not affected by this source of impact. Thus, traffic noise on National Highway 1A through Hue city still has an impact on the health of people living along the road.

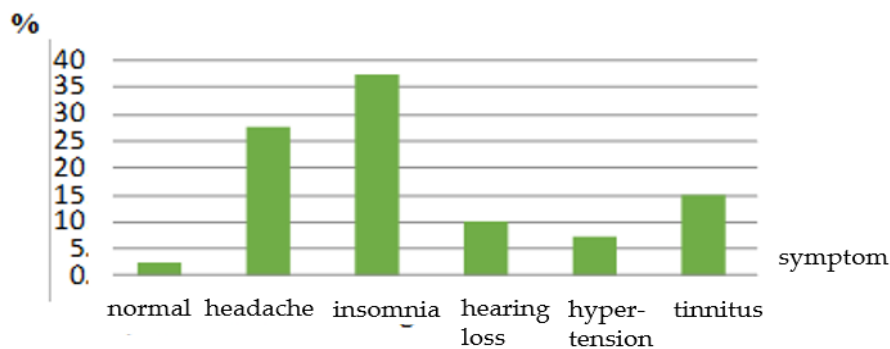


Figure 4. Prevalence of noise-related health symptoms among respondents

Road traffic noise has a great impact on people; this impact is considered according to the following factors:

❖ Demographic characteristics

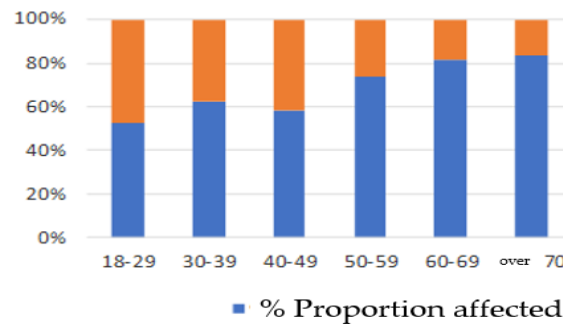


Figure 5. Proportion of affected individuals according to age categories

From Figure 5, it can be seen that the impact of noise on each age group is very different. People aged 50-69 and over 70 are more affected by road traffic noise than those who are not. Meanwhile, people aged 18-49 are less affected. This shows that people aged 18-49 have a higher tolerance; the older they are, the more uncomfortable they feel with the impact of noise. The percentage affected in all age groups is higher than 50%, so road traffic noise has a great impact on people's health.

❖ Lifetime

The impact of road traffic noise on people's health also depends on how long people have lived (see Figure 6). The survey results found that there are differences in noise tolerance levels related to how long people have lived. People who have lived near traffic for a longer time have a higher tolerance to noise than those who have lived for a shorter time.

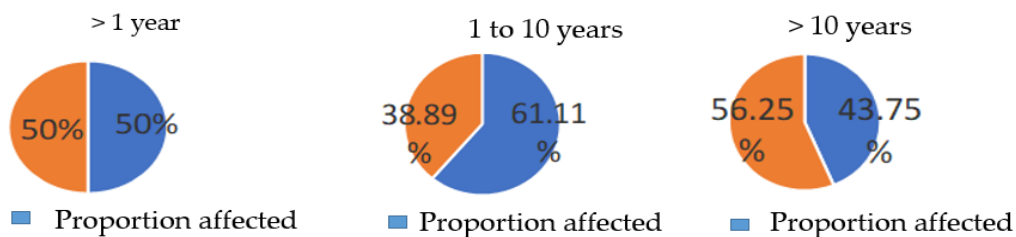


Figure 6. Proportion of individuals affected and unaffected by noise exposure over their lifetime.

3.3. Impact of road traffic noise on people's daily activities

The results of the investigation on the impact of traffic noise on people's daily activities are shown in Figure 7.

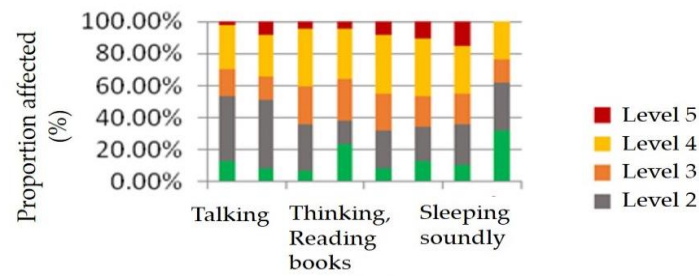


Figure 7. Proportion of respondents experiencing varying degrees of daily activity disruption due to road traffic noise

Noise from road traffic has a major impact on people's daily activities. Figure 7 shows the impact of road traffic noise on activities such as talking, answering the phone, watching TV, thinking, reading, resting, falling asleep, falling asleep, and opening windows.

Figure 7 shows that the activities of talking, listening to the phone, watching TV, thinking, reading, resting, starting to sleep, and falling asleep appear from level 1 to level 5. Of which, level 4 accounts for a much higher proportion than the other levels. The percentages at level 4 of the activities are 27.66%, 25.53%, 36.17%, 31.91%, 36.17%, 36.17%, 29.79%, respectively. Thus, noise bothers people when watching TV, resting, and falling asleep. In particular, when starting to sleep and falling asleep, level 5 accounts for a higher proportion than other affected activities, specifically 10.64% and 14.89%. According to the survey results, people feel very uncomfortable when they are about to fall asleep and are awakened by noise from vehicles, proving that road traffic noise significantly affects people's sleep in Hue city.

Due to time and equipment limitations, the results obtained are only preliminary. The research results were only measured between 6 am and 8 pm, so the noise level in the study area has not been fully assessed. Therefore, to have more comprehensive results for further studies, we have the following recommendations:

- Measure the equivalent A-characteristic noise level (LAeq, 24h) to get a more comprehensive assessment of the noise levels people experience throughout the day.
- Increase the number of survey samples to assess more accurately. In addition, it is necessary to expand the survey's age range to see the impact of road traffic noise on people of different ages.

4. CONCLUSION

The equivalent noise level according to characteristic A measured within 15 minutes in the study area ranges from 70,3 dBA to 95,1 dBA (weekday and day off), depending on traffic volume and distance from the machine. Most of the noise levels measured at the locations exceed the limits of QCVN 26:2010/BTNMT. Especially during peak hours, the noise levels measured at locations K1, K2, K3, and K4 exceed allowable limits compared to QCVN 26:2010/BTNMT. At locations K5, K6, and K7, traffic volume is lower, so the noise level is lower than the remaining locations; however, the measured noise level still exceeds QCVN 26:2010/BTNMT.

On weekdays, traffic volume and noise level are higher than on holidays. Traffic volume and noise levels are positively correlated, with higher traffic volume corresponding to increased noise levels. The difference between weekdays and holidays is not large.

Road traffic noise affects the health of people living along National Highway 1A running through Hue City. This impact varies according to age, gender, length of stay, and surrounding environment. The rate of people affected by the health impact of road noise is 62.5%, and the health impact is 37.5%. Road traffic noise causes various health impacts on people, but mainly headaches and difficulty sleeping. The proportion of people with headaches and difficulty sleeping due to noise is 37.5% and 30.5%, respectively.

Road traffic noise also causes discomfort to people's daily activities, especially when resting and watching TV. The percentages affected at level 4 (high) for these two activities are 39% and 35%, respectively.

The research results based on experimental measurements and social surveys clarify the current picture of noise pollution on key traffic routes, thereby emphasizing the urgent need to develop effective noise management solutions. Recommendations include: establishing sound protection corridors, using soundproofing materials in residential buildings along the route, and reviewing urban traffic planning towards sustainability and community health.

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THỰC TRẠNG Ô NHIỄM TIẾNG ỒN GIAO THÔNG TRÊN TUYẾN QUỐC LỘ 1A ĐOẠN QUA TRUNG TÂM THÀNH PHỐ HUẾ

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TÓM TẮT

Bài báo trình bày kết quả nghiên cứu về tác động của tiếng ồn từ hoạt động giao thông đường bộ đối với người dân sống dọc tuyến quốc lộ 1A đoạn qua thành phố Huế. Kết quả cho thấy, mức ồn tại các vị trí quan trắc đều vượt quá quy chuẩn cho phép theo Quy chuẩn kỹ thuật quốc gia về tiếng ồn (QCVN 26:2010/BTNMT), nhất là tại các vị trí gần các bến xe và các nút giao thông. Vào giờ cao điểm mật độ xe lưu thông lớn, kéo theo mức ồn đo được rất cao. Kết quả điều tra cho thấy, có đến 37,5% người dân bị ảnh hưởng về sức khỏe do tiếng ồn giao thông đường bộ, chủ yếu là đau đầu và khó ngủ, 62,5% còn lại cho rằng họ không bị ảnh hưởng về mặt sức khỏe bởi tiếng ồn này. Bên cạnh đó, tiếng ồn còn ảnh hưởng đến các hoạt động sinh hoạt hằng ngày của người dân như: trò chuyện, nghe điện thoại, xem tivi, đọc sách, nghỉ ngơi, ảnh hưởng đến giấc ngủ và việc mở cửa sổ của người dân... tuy nhiên mức độ ảnh hưởng không đáng kể.

Từ khóa: thành phố Huế, mức ồn, giao thông đường bộ, ô nhiễm tiếng ồn.



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