



## INVESTIGATION AND EVALUATION OF NOISE LEVEL IN THE NORTHERN PART OF KLAIPĖDA CITY

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**Abstract.** The problem of noise is topical not only in Lithuania but the world over as well. The northern part of Klaipėda city is distinct for its industry and heavy traffic in the streets. Noise research was carried out in 17 selected measurement locations in the northern part of Klaipėda city. Noise measurements were taken in May, June, July, August, September, October and November. The measurements were made three times during the day: in the day time from 6 a.m. till 6 p.m., in the evening from 6 p.m. till 10 p.m. and at night from 10 p.m. till 6 a.m. The locations of the measurements are marked on the map. In order to distinguish the source of bigger noise between industry and transport, the northern part was divided into two belts. Industry is prevalent in the first belt, whereas the main troublemakers in the second belt are motor vehicles. The measured noise level is compared with permissible standards in measurement locations, where noise level is usually exceeded, and the analysis of noise levels is presented.

In order to show the spread of noise in Klaipėda at all three times of the day more vividly, maps of isolines were compiled.

**Keywords:** noise level, the highest permissible noise level, equivalent permissible noise level.

### 1. Introduction

Motor transport is one of the basic sources of noise, having negative effect on the environment and its components. However, too little notice has been taken to this problem so far. The facts collected by the World Health Organization (WHO) suggest that 26 per cent of the population of Europe bear the impact of noise level higher than 65 dB(A) (Oškinis *et al.* 2004). It has been proved that on average general noise level increases from 1 to 3 decibels per year. What is more, it is forecasted that noise level can double in the nearest fifteen years (Oškinis *et al.* 2004).

Basic source of noise is the flow of motor transport in streets. In some cases motor transport constitutes up to 80% of the general noise level within the confines of the city (Maarseveen, Zuidgesst 2003). The essential cause of noise can be a continuously increasing number of old, technically negligent motor vehicles and expanding activities of enterprises engaged in motor transport. The flow of transport in Lithuania has increased by 2.4 times in the last ten years. These factors caused the increase of road accidents, the formation of longer transport queues and growing sense of time loss waiting in traffic jams. (Kinduryte 2003). The consequences amount to considerably greater pollution of the environment by exhaust gas and far bigger noise caused by vehicles (Vasarevičius, Graudinytė 2004).

The Green Book of the European Union on the policy of application of the measures of environmental pro-

tection from overcoming noise maintains, that approximately 20% of the total population of the European Union states, which constitutes 80 million, are suffering from the impact of noise on their health (Gražulevičienė, Deikus 1998). Noise monitoring policy pursued by the European states is headed at reducing the noise, caused by the overriding products supplied to the market, namely, by overground vehicles, airplanes and outdoor equipment. For this reason, noise caused by new motor vehicles has been reduced quite effectively since 1970 (Bottazzi 2003). Despite these attempts, however, the impact of noise on citizens health has not reduced substantially in the last ten years because traffic load of motor vehicles is still on the increase (Žeromskas 2000).

Contrary to recently receding industrial noise, traffic noise in streets has been intensified by the increase of the amount of transport. Permanent sound intensity depends on the extent of emission, state and speed of a motor vehicle, pavement and parking. Noise increases by 3 dB(A) with the double amount of transport and double speed makes the noise increase by 12 dB(A). The engine makes the biggest noise in first gear, the sound of wheel is heard from the speed of 50 km/h, whereas lorry engine constantly makes rumbling noise (Vasarevičius, Graudinytė 2004).

Industrial buildings spread noise during the time of various technological processes, as well as during loading and unloading of lorries or vans with goods or freight (Jagniatinskis *et al.* 2005; Crocke 1999).

To investigate and evaluate the noise level in Klaipėda, three initial measurement locations in the northern part of the city were selected. In these areas noise level is determined by the process of loading and unloading of cargoes administered by the freight forwarding company Klasco (later 'Klasco') situated in the neighbourhood. Noise level produced by the forwarding company gets especially intensive during train junction and van unloading (Baltrėnas *et al.* 2006; Grubliauskas *et al.* 2006).

Noise damping wall has been constructed near the terminal, but it is not effective as being not high or long enough (Baltrėnas *et al.* 2007 a; b).

This study was aimed to identify the distribution of noise level throughout the belts and compare them to permitted standards, identify locations where noise level is exceeded most commonly and analyze the causes determining the excess of noise level (Environmental... 2003; Stansfield *et al.* 2000).

## 2. Methodology

To measure the noise level, several sample locations, situated proportionately at a distance of 200 m from each other, were chosen within the confines of the whole northern part of Klaipėda city. 17 measurement locations were sampled in Švyturio, Sportininkų, Gulbių, Šimkaus, Puodžių, Jūros, Naujojo Uosto, I Kanto and Karklų streets. The research estimated maximum and equivalent levels of noise.

Noise level is regulated in dwelling-houses and public buildings as well as in the neighbourhood territories from 6 a.m. till 6 p.m. (day time), from 6 p.m. till 10 p.m. (evening time) and from 10 p.m. till 6 a.m. (night time). Therefore, noise level had to be measured three times (in the daytime, in the evening and at night) at each sample location and the duration of single measurement was not shorter than 30 min.

Before starting the measurements of noise level, meteorological weather conditions are gauged: relative humidity, weather temperature and wind speed. The possibility of measurements is considered with the data available. Measurements are impossible in the rain, fog and snow or in cases, when wind speed is bigger than 5 m/sec. If wind speed is ranging from 1 to 5 m/sec, the microphone is enveloped in a special screen.

Noise is measured at the distance of 1–2 m from the front of the building, the microphone being held at the height of 1,5 m from the ground but not less than 0,5 m away from the person taking measurements. The microphone is targeted at the source of noise.

Maximum noise level is considered to be the biggest value received during measurements.

Measurements were made using a digital noise gauge Bruel & Kjaer.

The end results of noise level were estimated by comparing them with the sanitary standards applied to the settlements. (Triukšmo... 2002).

The measurement locations from No. 1 to No. 3 were situated in the neighbourhood of 'Klasco' in the territory, where freight loading works are executed producing noise and causing complains of the residents. Other measure-

ment locations were selected in the most relevant places for the residents and are represented in Fig. 1. A, where a brief description of measurement locations is given.

The first three measurement locations were spread in the vicinity of the forwarding company 'Klasco', where loading works produce a lot of noise.

The measurement locations No. 1 and No. 2 are situated in Švyturio Street, close to a five-storey block of flats. The measurements were made at a distance of 1,5 m from the front of the building. This location is situated at a distance of 150 m from the ring-fence of the company 'Klasco'. The measurement location No. 3 is 10 metres far away from the dwelling-house No. 10 in Švyturio Street. All the measurement locations No. 1, 2 and 3 are in the vicinity of 'Klasco'. Up to 15 motor cars passed these places during the measurement-takings in the daytime and in the evening. Just a few cars passed along these locations during measurements at night.

The location No. 4 is in Gulbių Street near the dwelling-house No. 5. The given measurement location is in the hereabouts of Naujojo Uosto and Dariaus ir Girėno Streets, roads with heavy volume of traffic.

The measurement location No. 5 is disposed close to the domain of the Naval Forces at 24 Naujojo Uosto Street.

The location No. 6 is situated close to the building No. 16 of 'Lietuvos Bankas' in Naujojo Uosto Street. The location No. 7 is near the building No. 23 of the hotel in Jūros St., approximately 5 metres away from the busy Naujojo Uosto Street. Up to 800 motor cars and 40 lorries passed along the measurement locations No. 4–7 during measurement-takings in the daytime and up to 100 cars passed along these locations during the measurements at night.

The measurement location No. 8 involves measurements taken at 17A Puodžių Street, near Klaipėda Church of the Christ King. The measurement location is situated in a remote and quiet place in the vicinity of Bokštų Street. Up to 20 motor cars passed this place during the measurement-takings in the daytime and in the evening. Just a few cars passed along this location at night. The measurement location No. 9 is at 9 in Šimkaus Street in the hereabouts of the Registry Office. Up to 30 motor cars passed along this measurement location during the measurement-takings in the daytime and in the evening. Meanwhile, just a few cars passed along this place at night. However, motor cars were in and out of the parking lot situated 30 metres away from there. The measurement location No. 10 is near the building No. 5 of the school in Daukanto Street. This measurement location is at a distance of 30–40 metres from the crossing of I. Kanto Street and Daukanto Street. Up to 150 motor cars and a few lorries passed along this measurement location in the daytime and in the evening. Meanwhile, up to 20 cars passed along this place at night. The measurement location No. 11 is at 2 Karklų Street, near Klaipėda University student hostel. Up to 20 motor cars passed along Kalvos Street at the measurement during measurement-takings in the daytime and in the evening, meanwhile a few cars passed along this place at night. The Measurement location No. 12 is close to the dwelling-house No. 13 in I. Kanto Street. The given street is

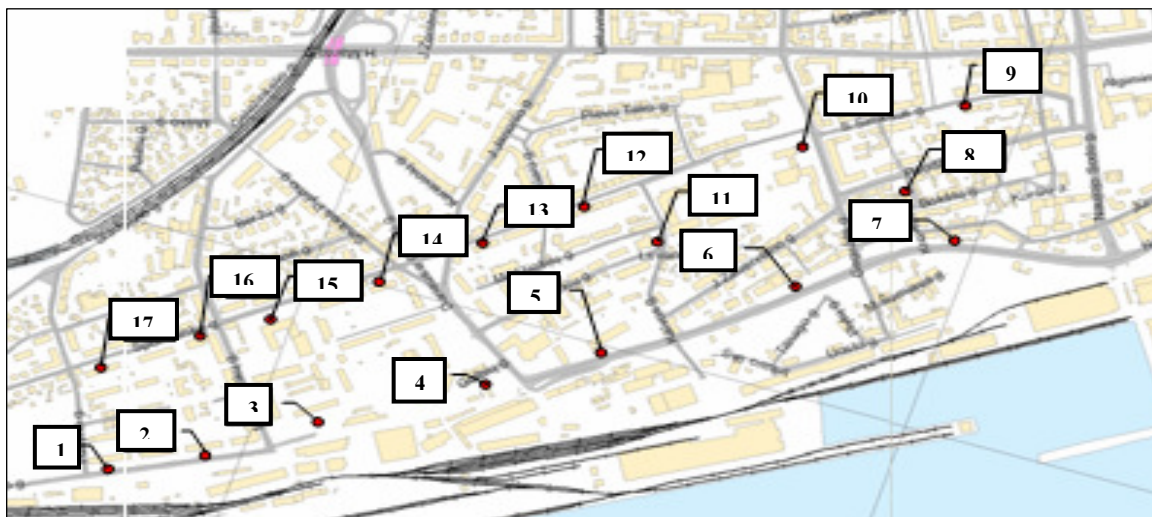


Fig. 1. Measurement points of noise level in Klaipėda city

pebbled and the rows of houses run along both sides of the street. This location is close to the five-storey block of flats No. 21 in I. Kanto Street. Up to 30 motor cars passed along the measurement locations No. 12 and No. 13 during the measurement-takings in the daytime and in the evening. Although, a few cars passed along these places at night. The measurements in the measurement location No. 14 were made near the house No. 5 in Sportininkų Street. This measurement location is situated in the vicinity of the bustling crossing of Sportininkų Street and Dariaus ir Girėno Street. Up to 200 motor cars passed along this location during measurement-takings in the daytime and in the evening. Also up to 30 cars passed along this place at night. The point No. 15 is at 13 Sportininkų St., near the staff building. Motor cars driving along Sportininkų Street had the biggest influence on the noise level in the given measurement location. Up to 100 motor cars passed along this point during the measurement-takings in the daytime and in the evening. The places No. 16 and No. 17 are close to a five-storey block of flats in Sportininkų Street. Up to 150 motor cars passed along this street during the day and in the evening and up to 20 cars drove along this place at night. All measurement locations are presented in Fig. 1.

### 3. Findings of the research and their analysis

While analyzing the findings and seeking to highlight problematic measurement locations, diagrams were compiled indicating the occasions of the excess of permissible noise level throughout the investigated area.

Fig. 2 shows the exceeded noise level in the daytime registered during the measurement-takings. Noise level in the first measurement point was exceeded only once while the excess of permissible noise level was not recorded at the second and third measurement locations.

It was determined, that in the first, second and the third measurement places noise is mainly produced by the company ‘Klasco’. Permissible noise level at the fourth measurement location was exceeded twice in the autumn. Higher noise level was caused by heavier motor traffic. Noise level at the fifth and the seventh measurement loca-

tions exceeded the permissible standard throughout the measurement-takings. A very heavy stream of motor cars and lorries driving along Naujojo Uosto Street was the cause of the noise level. In July permissible noise level in the daytime was not exceeded at the measurement location No. 6 which is situated close to a bank. High level of noise in the given measurement locations is determined by a heavy stream of traffic passing along Naujojo Uosto Street, which is in the neighbourhood.

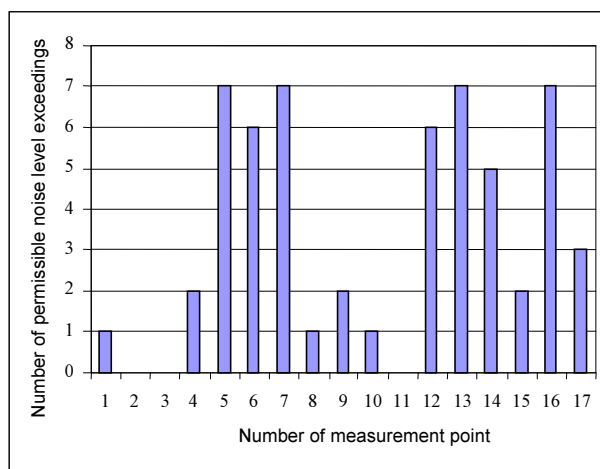
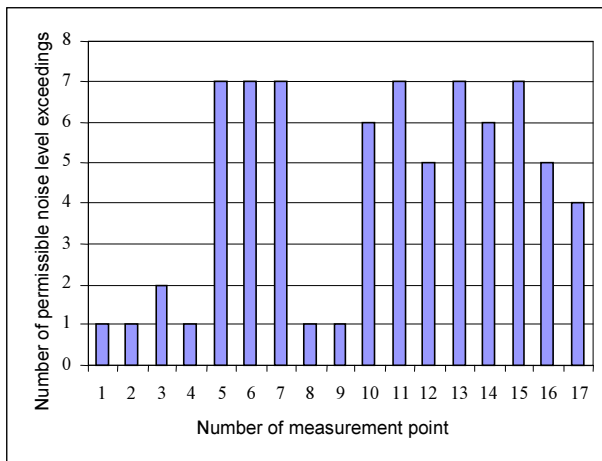


Fig. 2. Number of the excesses of permissible noise level in the daytime

Noise level at the measurement locations No. 8–17 did not exceed the permissible standards, only at the measurement location No. 11 which, is close to Klaipėda University student hostel, in the vicinity of a quiet street unencumbered with motor vehicles. This street was passed along by up to 20 motor cars throughout the measurement-takings. There was an occasion when permissible noise level was exceeded at the measurement points No. 8 and No. 10. In May and June measurement-takings, permissible noise level was exceeded twice at the measurement locations No. 9 and No. 15. This was determined by a hyper-heavy stream of motor cars driving along the streets situated in the hereabouts. Permissible

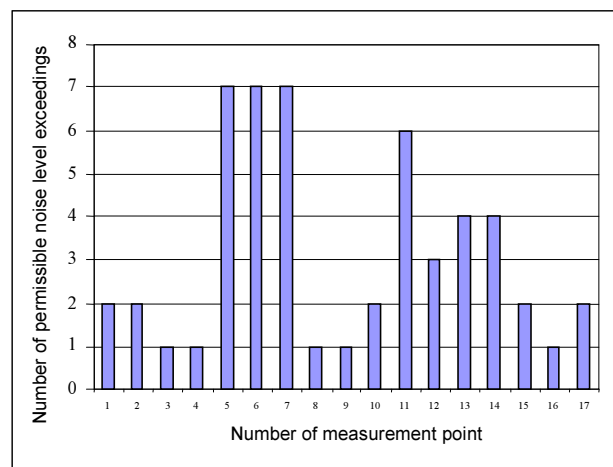
sound level was exceeded three times at the measurement location No. 17 in the daytime. Noise level was exceeded on six occasions at the measurement location No. 12, where high volume of noise is caused by the pebbled street with the rows of dwelling-houses running along both sides of it. Motor cars passing along this street even at low speed produce high level of noise. Noise level at the measurement locations No. 13 and No. 16 was exceeded throughout the measurement-takings. High noise level at the this location is determined by the traffic in I. Kanto Street and a flow of music from a café, located opposite the dwelling houses, as well as by motor cars parking nearby in summer time.



**Fig. 3.** Number of the excesses of permissible noise level in the evening

Permissible noise level at the measurement locations No. 1 and No. 2 was exceeded only once in the evening loading of ferroalloys (Vasarevičius, Graudinytė 2004). Permissible noise level was exceeded twice at the measurement location No. 3 during shipment time. Permissible noise level was exceeded on one occasion at the measurement location No. 4 in October, when the pavement was moist. Noise level was exceeded throughout the measurement-takings at the measurement locations No. 5, 6 and 7 in the daytime. High level of noise in the given locations is determined by a heavy stream of the traffic passing along Naujojo Uosto Street. Sound level was exceeded once at the measurement points No. 8 and No. 9. In May there were no occasions of the exceeded noise level at the measurement location No. 10. Exceeded noise level was not recorded at the measurement location No. 11 in the day-time, though excess of noise level was measured throughout evening measurement-takings. This point is situated close to the students' hostel. Noise level was not exceeded at the measurement location No. 12 in May and June due to moderate traffic. The record was made of continuously exceeded noise level at the measurement location No. 13 due to the café situated opposite and motor cars going in and out of the café parking lot. Permissible noise level was exceeded on one occasion at the measurement place No. 14 due to the nearby bustling crossing. Permissible noise level was exceeded four or five times at the locations No. 16 and No. 17 respectively.

In the evenings, noise level used to exceed the permissible standard in many measurement locations because of the traffic increase and the lower permissible noise level in the evening.



**Fig. 4.** Number of the excesses of permissible noise level at night

Noise level continuously exceeded the permissible standard at the measurement locations No. 5, 6 and 7 in the first measurement belt in the night time. This was determined by an intensive stream of motor cars similarly to the heavy traffic along Naujojo Uosto Street in the daytime and in the evening. The excess of noise level was measured twice at the measurement locations No. 1 and No. 2 at night. Exceeded sound level was produced by the forwarding company 'Klasco' during the shipment process. Similarly to the evening measurement-takings, noise level was exceeded at the measurement location No. 4 in October measurement-takings, when the pavement was moist at night.

The excess of noise level at night was less in comparison with the day time and evenings. This factor was determined by reduced streams of motor vehicles in the streets. Noise level was continuously exceeded at the measurement location No. 11 near the students' hostel at night. Sound standard got exceeded by just a few passing motor cars at the measurement locations in I. Kanto Street due to the pebbled street. Noise level was exceeded at the measurement locations No. 15, 16 and 17 disposed in the vicinity of Sportininkų Street at night during summer time when stream of motor vehicles increased.

Equivalent noise level is lower in summer time compared with the same in the autumn. Permissible equivalent noise level was marginally exceeded up to 5 dBA, at the measurement locations from No. 12 to No. 17. It was determined by heavy transport in those areas. Permissible noise level was not exceeded at the measurement locations No. 1, 2 and 3. Noise level in these places is being determined by motor cars driving along Švyturio Street and noise emanating from the territory of 'Klasco'. However, loading works at the enterprise were not executed during the measurement-takings and 10 motor cars passed along the street. The most striking excess of noise level was recorded at the measurement locations No. 4, 5, 6 and 7.

These locations are situated in the hereabouts of Naujojo Uosto Street, where traffic is very heavy. Permissible noise level was exceeded by 10 dBA at the measurement location No. 4 in the autumn, whereas in summer time the standard was preserved. Permissible equivalent noise level was exceeded by approximately 10 dBA at the measurement points No. 5 and No. 6 and by 11 dBA at the measurement location No. 7 in the seasons of summer and autumn. The measurement location is situated at a distance of about 5 m from busy Naujojo Uosto Street. Noise level at the given measurement location was mostly influenced by the stream of transport going along Naujojo Uosto Street. Up to 600 motor cars and 40 trucks passed along these places throughout the measurement-takings. Therefore, higher noise level is caused by the vehicles at these measurement locations, as the given places are in the vicinity of the street. The excess of twelve decibels was indicated at the measurement location No. 10 in the autumn. This was determined by motor vehicles driving along I. Kanto Street and Daukanto Street.

The highest equivalent noise level in the daytime was established in the autumn, meanwhile the lowest values were measured in summer time. The measurement difference between noise levels in the summer and autumn amounts to several decibels. Permissible equivalent noise level is most considerably exceeded in the autumn.

Equivalent noise level reached the highest values in the evening as well as in the daytime in the autumn. Permissible noise level was exceeded up to 13 dBA in summer and up to 15 dBA in the autumn. The highest noise level was gauged in the seventh measurement location. In the evening, permissible noise level was not exceeded only at the measurement locations No. 4, 9 and 11. Permissible equivalent noise level was exceeded up to 5 dBA at the locations No. 1, 2 and 3 in the evening. These places are situated close to 'Klasco'. The influence on noise level exceeding the permissible standards at the given measurement locations was made by loading works at 'Klasco'. The stream of vehicles consisted of up to 10 motor cars during the measurement-takings. Permissible sound level was exceeded up to 5 dBA at the measurement locations No. 12, 13 and 14 which are disposed in the vicinity of a less crowded street. Approximately 30–40 motor cars used to pass along these places throughout the measurement-takings. Permissible equivalent noise level was exceeded at the measurement location No. 8 only in the autumn, this factor being influenced by only a few motor cars passing by and the activated alarm system of cars. The excess of permissible noise level reached over 5 dBA at the measurement locations No. 5, 6 and 7. This was caused by a very heavy stream of motor cars and trucks going along Naujojo Uosto Street. Permissible noise level was exceeded by more than 5 dBA at the measurement locations No. 10 and No. 17 in the autumn. The highest values of noise level in the evening, as well as in the daytime, were recorded at the measurement locations No. 5, 6 and 7 in the autumn and summer time.

Permissible noise level was exceeded from a few to 16 decibels at the seventh measurement location during measurement-takings at night. Equivalent noise level at

night is lower in spring, summer season compared to the cold period of the year. Permissible noise level was not exceeded in the whereabouts of 'Klasco' in the summer, whereas in the autumn permissible noise level was exceeded by 8 dBA at the measurement locations No. 1 and No. 2. The permissible standard was exceeded by 7 decibels at the measurement location No. 3, this being influenced by the noise coming from 'Klasco'. Approximately 5 motor cars passed along Svyturio Street at night. Permissible noise level was exceeded at the fourth measurement location only in the autumn. The highest excess of noise level at night was established at the measurement locations No. 5, 6 and 7. This was determined by an intensive stream of transport going along Naujojo Uosto Street. 50 motor cars and 5 lorries passed along this street at night during the measurement-takings. Permissible noise level was exceeded at the measurement locations No. 8 and No. 11 only in autumn season. In the same season, noise level was considerably exceeded (by 8 dBA) at the measurement locations No. 9 and No. 10, which are situated in the second measurement belt. In summer time, the record of the excess of 12 dBA was taken at the measurement location No. 12.

The biggest impact on noise level at the measurement location No. 13 was produced by pebbled I. Kanto Street. Furthermore, two rows of buildings running along both sides of the narrow street creates noise reverberations. Therefore even motor cars driving along this street at a low speed produce high noise level. There is a two-fold way of noise spread: direct, i.e. from the source of noise to the measurement location, and indirect, i.e. reflected from the obstacles existent in the territory.

#### 4. Graphic representation of noise spread

Seeking to better analyse the differences between noise levels in the first and the second belts, the estimated values of noise levels were coded in digitals and processed graphically and mathematically using a computer modelling program.

Fig. 5 presents the distribution of equivalent noise level in the northern part of Klaipėda city in the daytime in the summer. As one can see, the highest noise level amounting to 66 decibels has been recorded at the junction of Gegužės Street and Naujoji Street. Noise level in

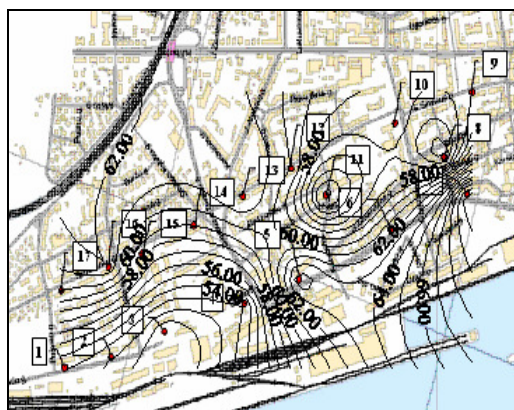


Fig. 5. Noise spread in the northern part of Klaipėda city in the daytime in summer

the first belt reaches 66 dBA and exceeds the permissible standard by 6 decibels. Sound level gets lower towards the second belt reaching 58 decibels. The lowest noise level was gauged at the measurement locations No. 1, 2 and 3. Level of 60 dBA was established at the measurement locations No. 15, 16 and 17.

Fig. 6 indicates the distribution of equivalent noise level in the northern part of Klaipėda city in the daytime in the autumn. The highest noise level was measured in the vicinity of M. Šerniaus Street and was declining in the north-eastern direction. The lowest noise was measured at the corner of Malūnininkų Street.

Permissible sound level was exceeded by 8 dBA in the area near Naujojo Uosto Street and by 4 dBA in the hereabouts of I. Kanto Street. On the contrary, permissible level was not exceeded at the first three measurement locations and in the points No. 8 and No. 11 likewise.

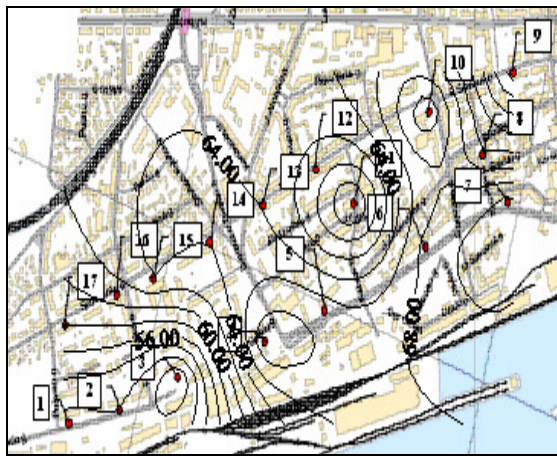


Fig. 6. Noise spread in the northern part of Klaipėda city in the daytime in autumn

Fig. 7 shows the distribution of equivalent noise level in the northern part of Klaipėda city in the evening in the summer. Permissible equivalent noise level was exceeded by 3 dBA at the first three measurement locations. Permissible noise level was exceeded by 10 dBA in the hereabouts of Naujojo Uosto Street, meanwhile it was not exceeded at the measurement locations No. 8 and No. 11. Permissible level was exceeded by 5 dBA in the hereabouts of Sportininkų Street. Moreover, it was exceeded by 4 dBA in I. Kanto Street.

Fig. 8 depicts the spread of equivalent noise level in the northern part of Klaipėda city in the evening in autumn. Permissible noise level was not exceeded in the hereabouts of Švyturio Street. Permissible noise level was exceeded by 8 dBA in the hereabouts of Naujojo Uosto Street and by 4 dBA in I. Kanto Street. Permissible equivalent noise level was exceeded by 5 dBA in the vicinity of Sportininkų Street. Similarly to the location of the highest noise level in summer time, in autumn the highest noise level was established in the surroundings of Naujojo Uosto Street.

Fig. 9 presents the distribution of equivalent noise level in the northern part of Klaipėda city at night in the summer. Permissible noise level was exceeded by 2 dBA

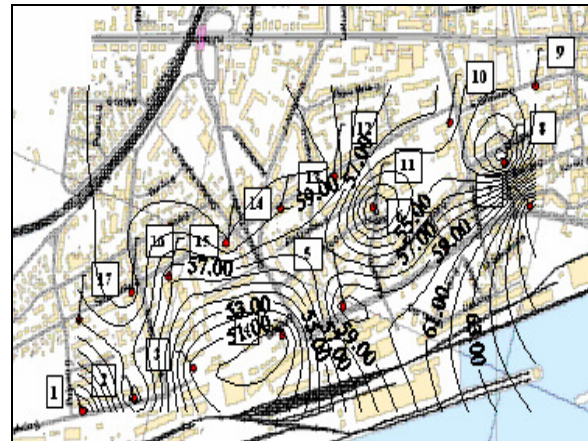


Fig. 7. Noise spread in the northern part of Klaipėda city in the evening in summer

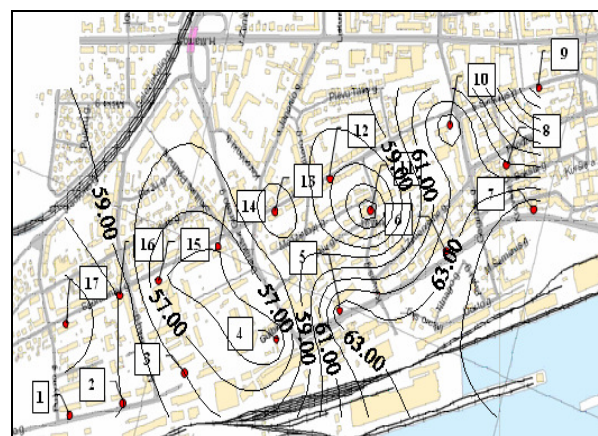


Fig. 8. Noise spread in the northern part of Klaipėda city in the evening in autumn

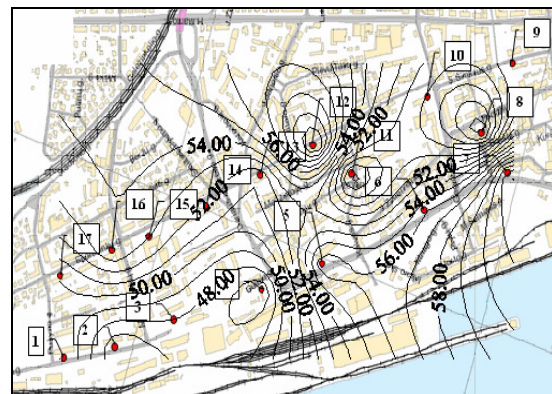
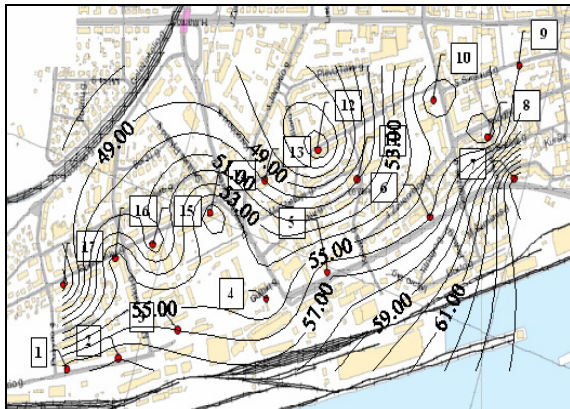


Fig. 9. Noise spread in the northern part of Klaipėda city at night in summer

in the hereabouts of Švyturio Street. The highest excess of noise level amounted to 8 dBA was in Naujojo Uosto Street. Permissible noise level was not exceeded at the measurement location No. 8 in Puodžių Street. Permissible noise level was exceeded by 2 dBA at the measurement locations No. 9 and No. 10. Sound level was also exceeded up to 6 dBA in I. Kanto Street. Permissible noise level was exceeded by 4 dBA in Sportininkų Street.

Fig. 10 shows the distribution of equivalent noise level in the northern part of Klaipėda city at night in the autumn. Permissible noise level was exceeded by 5 dBA in the hereabouts of Švyturio Street.



**Fig. 10.** Noise spread in the northern part of Klaipėda city at night in autumn

The highest excess of noise level amounted to 11 dBA was in the vicinity of Naujojo Uosto Street. Permissible noise level was exceeded by 2 dBA at the measurement location No. 8 in Puodžių Street. Permissible noise level was exceeded by 5 dBA at the measurement locations No. 9 and No. 10. Permissible noise level was exceeded up to 6 dBA in I. Kanto Street. Permissible noise level was exceeded by 5 dBA in Sportininkų Street.

At night, higher noise level was prevalent in the first measurement belt, exceeding the permissible standard up to 11 dBA in autumn season. In comparison with summer season, noise level is lower in the autumn in the second belt. This is determined by a more intensive stream of transport at night in summer.

## 5. Conclusions

1. Reviewing noise level measurements accomplished in the northern part of Klaipėda city, it was established that the highest noise level was recorded at the measurement location No. 7 (in the residential territory of the dwelling-house No. 23 in Jūros Street). Likewise, permissible equivalent noise level was exceeded (up to 6 dBA) in the other measurement locations: No. 16 (17 Sportininkų St.), No. 14 (5 Sportininkų St.), No. 13 (21 I. Kanto St.), No. 12 (13 I. Kanto St.), No. 5 (24 Naujojo Uosto St.), No. 6 (24 Naujojo Uosto St.).

2. The average of 71 dBA was established for equivalent noise level at the measurement location No. 7 (23 Jūros St.) in the daytime. This was influenced by the position of the measurement point: it was situated in the vicinity of the busy two lane Naujojo Uosto Street and at a distance of 100 metres from the crossing with Gegužės Street. What is more, the street has two rows of houses running along both sides of it and thus creating noise reverberations.

3. The biggest noise was produced by motor cars passing along the pebbled I. Kanto Street at the measurement locations No. 13 (21 I. Kanto St.) and No. 12 (13

I. Kanto St.). The contact of the car wheels with the pavement creates high level of noise. In addition, noise level is determined by the fact that dwelling-houses are in close proximity to the street, creating noise reverberations and increasing noise level up to 3–5 decibels.

4. The lowest sound level (50–57 decibels) during the day was measured at the measurement points, situated in the vicinity of Švyturio Street and further away, reaching Gulbių Street, i.e. lengthwise the domain of AB ‘Klasco’. The main sources of noise at these measurement locations were rare single motor cars and the noise produced by loading works in the territory of AB ‘Klasco’.

5. Permissible noise level was seldom exceeded at the measurement locations No. 8 (17 Puodžių St.) and No. 11 (2 Karklų St.) due to the distance of these measurement locations from the busy Sportininkų, Naujojo Uosto Streets and cobbled I. Kanto Street.

6. In the daytime permissible noise level was not exceeded at the measurement location No. 9, which is situated amid S. Šimkaus Street and Puodžių Street. In the evening, however, permissible equivalent noise level was exceeded in this location. This was influenced by the bustling bars and night clubs, situated in the hereabouts of the given measurement location in the evening time.

7. In the daytime and in the evening, the lowest equivalent noise level was gauged in the residential area in Švyturio Street and at the measurement locations: No. 8 (17a Puodžių St.) and No. 11 (2 Karklų St.), which are remote from busy streets.

8. Reviewing the findings of noise level research, carried out at night, some analogies can be discerned between the measurements made at night and in the evening. During the periods, the highest noise levels were established at the measurement locations in Naujojo Uosto Street. The permissible standard was exceeded by 4–10 dBA in these places. Similarly, excess of 3 dBA was registered at the measurement locations in Sportininkų Street.

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## TRIUKŠMO LYGIO ŠIAURINĖJE KLAIPĖDOS MIESTO DALYJE TYRIMAI IR ĮVERTINIMAS

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### Santrauka

Triukšmas – ne tik Lietuvoje, bet ir visame pasaulyje aktuali problema. Klaipėdos miesto šiaurinė dalis yra išskirtinė savo pramone ir intensyviu eismu gatvėse. Triukšmo tyrimai atlikti šiaurinėje Klaipėdos miesto dalyje, 17-oje pasirinktų matavimo vietų. Triukšmas matuotas gegužės, birželio, liepos, rugpjūčio, rugsėjo, spalio ir lapkričio mėnesiais. Matavimai atlikti trimis paros laikais: dieną nuo 6–18 valandos, vakare nuo 18–22 valandos ir naktį nuo 22–6 valandos. Matavimo vietos pateiktos žemėlapyje. Siekiant nustatyti, kas kelia didesnę triukšmą – pramonė ar transportas, šiaurinė miesto dalis suskirstyta į dvi zonas. Pirmojoje zonoje vyrauja pramonė, o antrojoje zonoje pagrindinis triukšmo šaltinis automobiliai. Išmatuotas triukšmo lygis palygintas su leistinosiomis normomis. Pateikta matavimo vietų, kuriose dažniausiai viršijamas triukšmo lygis, triukšmo lygių analizė.

Siekiant aiškiau parodyti, kaip triukšmas pasiskirsto Klaipėdos mieste visais trimis paros laikais, sudaryti izolinijų žemėlapius.

**Reikšminiai žodžiai:** triukšmo lygis, didžiausias leistinasis triukšmo lygis, ekvivalentinis leistinasis triukšmo lygis.

## ИССЛЕДОВАНИЕ И АНАЛИЗ ШУМОВОГО УРОВНЯ В СЕВЕРНОЙ ЧАСТИ ГОРОДА КЛАЙПЕДЫ

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### Резюме

Шум является актуальной проблемой не только в Литве, но и во всем мире. Северная часть города Клайпеды является промышленным районом с интенсивным транспортным движением. Для исследования шума в этой части города было выбрано 17 мест замера. Шум измерялся с мая по ноябрь. Измерения проводились 3 раза в разное время суток: днем в 6–18 ч, вечером в 18–22 ч и ночью в 22–6 ч. Места замеров показаны на карте. С целью установить, что является большим источником шума – промышленные предприятия или транспортные средства, северная часть города была поделена на две зоны. В первой зоне преобладали промышленные предприятия, а во второй – транспорт. Измеренный уровень шума сравнивался с разрешенными нормами. Для мест замеров, в которых чаще всего уровень шума превышал норму, предлагался анализ уровня шума. Для лучшего представления о распределении шума в городе Клайпед в разное время суток были созданы карты изолиний.

**Ключевые слова:** уровень шума, наивысший допустимый уровень шума, допустимый эквивалентный уровень шума.

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