6. Quality of the acoustic environment

6A. Current situation

Nijmegen bases its noise nuisance policy on the Spatial Structural Vision (updated version 2013) and on the Ecopolis strategy. Dynamic developments are concentrated on junctions and along main infrastructure, therefore also with the concentration of sources of sound. In addition, in this spatial structure we are battling, in accordance with the Nijmegen Sustainability Agenda and Noise Action Plan 2015-2018, noise nuisance successively with source approach, limiting transfer and limiting effect. Nijmegen is densely populated, comparable to cities in the Randstad metropolis (West Netherlands). South of the Waal the area is entirely urban. North of the Waal it will soon be fully occupied.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Unit</th>
<th>Year of data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part of the population exposed to total noise values of Lden above 55 dB (A)</td>
<td>35 %</td>
<td>2011</td>
</tr>
<tr>
<td>Part of the population exposed to total noise values of Lden above 65 dB (A)</td>
<td>6.8 %</td>
<td>2011</td>
</tr>
<tr>
<td>Part of the population exposed to total noise value Ln (night noise indicator) above 45 dB (A)</td>
<td>20 %</td>
<td>2011</td>
</tr>
<tr>
<td>Part of the population exposed to total noise values of Ln (night noise indicator) above 55 dB (A)</td>
<td>7 %</td>
<td>2011</td>
</tr>
<tr>
<td>Percentage of civilians living within 300 m of silent areas</td>
<td>98 %</td>
<td>2015</td>
</tr>
</tbody>
</table>

Work traffic is the greatest source of noise nuisance. Of the 700 kilometres of road, 630 kilometres now have a maximum speed of 30 km/hour: this dealt with the source of noise in all residential areas, simultaneously, the districts are extremely traffic safe, with good air quality.

Nijmegen is compartmented by rivers, channel and railways: this means strongly conditioned traffic streams. Bridges lead to bundling main traffic streams. In the compartments lie seven districts with a diffuse traffic structure, ideal for cycling and walking.

Until 2013 Nijmegen had just one traffic bridge over the Waal; this resulted in a high traffic intensity around the centre and near houses and residential areas along radians. The Nijmegen traffic structure is more balanced since the opening of city bridge ‘De Oversteek’ (end of 2013). Now Nijmegen has a ring road. Industrial estates in Nijmegen West and Nijmegen South are now accessible without passing traffic streams through/along densely populated districts of Nijmegen West (figure 1).

The objective of our Sustainability Agenda is limiting traffic nuisance as much as possible, with quieter and cleaner modes of transport, more and better public transport and the laying of cycle superhighways.

In 2010 the municipality of Nijmegen became a national ‘Green Public Procurement’ role model thanks to the Netherlands’ greenest concession by far: Regional public transport 2012-2022 (260 buses). The public transport bus fleet uses biogas and make less noise compared to diesel buses.

Nijmegen has three bike bridges (and two car bridges) over the Waal; furthermore there are cycle paths along all 50 km/hour roads, the majority of which are separated. The regional network of cycle superhighways (objective 79 kilometres; 43 kilometres realised) promotes bike traffic.

Where source approach is impossible, we are working on limiting the transfer and effect. ‘De Oversteek’ leads to the bundling of traffic on the ring road. ‘De Oversteek’ and adjoining main access roads have whispering asphalt, there are sound screens and traffic is led by Dynamic Traffic Control, focusing on circulation (braking and accelerating as little as possible).

The objective is that noise impacting does not increase compared to before the opening of ‘De Oversteek’. In consultation with residents, the 2014-2018 measurement programme for sound (and air) was set up. This non-statutory approach is unique for the Netherlands! €1 million has been aside for possible necessary measures.
The State obliged Nijmegen to construct 12,000 houses, to be built in Nijmegen-North. To limit noise nuisance, traffic speed on the former four-lane motorway has been reduced from 100 to 50 kilometres/hour, and noiseless asphalt has been laid on the main roads. In spite of this, we can only build house within zones with a high noise production. We are also taking on the effect here: these new houses are perfectly insulated. On the basis of our local noise policy we make extra demands: a low noise side with a garden and at least one bedroom. The houses are also designed in such a way that they form a screen for the area behind it.

Figure 1: Decrease (green) and increase (red) effect of traffic new bridge “Oversteek”

Nijmegen has one of the Netherlands’ largest inner city industrial zones (TPN-West), also with major environmental impact (power plant, asphalt centre and iron foundry). This area has a noise zone, in municipal management. The impact on the living climate was a point of contention for many years between authorities, the business world, inhabitants and conservation groups. During the 2005-2010 period there was intensive consultation and research into how to improve the provision of information and how to combat hindrance together. Since then the municipality has been regularly consulting with pressure groups and reports annually on the environmental situation in Nijmegen-West, among others on the basis of measurements, on a website that can be seen by all civilians. With this, Nijmegen was one of the first communities to respond to the Aarhus Convention (actively providing environmental information).

For the whole municipality, noise nuisance caused by road traffic, rail traffic and industrial estates is recorded in noise nuisance maps, with the average noise impact/24 hours (figure 3 and 4). There are also maps for the average nightly noise impact. Since 1984 the municipality of Nijmegen has provided 1,400 houses with extra sound insulation, houses built before 1986 with poor sound insulation and noise impact of at least 68 dB Lden. Houses built after 1986 have sufficient sound insulation and a quiet interior level.
Figure 2: Road traffic noise: number of houses and occupants, number of persons suffering from nuisance and severe nuisance Lden 2011.

Figure 3: Lden: Average noise levels in Nijmegen 2011
Figure 4: Ln: Night noise levels in Nijmegen 2011
Zone of silence

Figure 3 shows the municipal area with noise impact lower than 45 dB L_{den}, accessible for 98% of inhabitants of Nijmegen in the immediate proximity to their houses. Nijmegen does not have official areas of silence, but we have a good impression of the sound situation in residential areas and places associated with quietness, such as parks and cemeteries.

The city of Nijmegen is a compact urban area and is surrounded by green and agricultural areas outside the municipal border. The Province of Gelderland has attributed the status of an official zone of silence to natural areas around the city (of which Ooijpolder borders the city centre directly), and can be reached by bike in 15 minutes.

Figure 4 shows the nightly noise impact. Approx. 20% of the house noise impact above 45 dB L_{n}. In this regard Nijmegen is similar to other Dutch cities. Figure 5 shows the number of sleep deprived.

<table>
<thead>
<tr>
<th>Klasse</th>
<th>50 - 55</th>
<th>55 - 60</th>
<th>60 - 65</th>
<th>65 - 70</th>
<th>Meer dan 70</th>
<th>Eindtotaal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woningen</td>
<td>9.194</td>
<td>4.871</td>
<td>247</td>
<td>0</td>
<td>0</td>
<td>14.312</td>
</tr>
<tr>
<td>Personen</td>
<td>21.146</td>
<td>11.203</td>
<td>568</td>
<td>0</td>
<td>0</td>
<td>32.918</td>
</tr>
<tr>
<td>Aantal slaapgestoorde personen</td>
<td>1.480</td>
<td>1.120</td>
<td>74</td>
<td>0</td>
<td>0</td>
<td>2.674</td>
</tr>
</tbody>
</table>

[Class, More than 70, Grand total, Houses, People, Number of sleep deprived people]

Figure 5: Ln: Road traffic noise: houses, number of occupants and number of person with sleep-deprivation 2011

6B. Past performance targets

The municipality is responsible for the execution of the Noise Nuisance Act, carries out acoustic research and offers advice in zoning plans, traffic plans, building permits, environmental permits and outdoor events. These recommendations and regulations are intended to recognise possible noise nuisance at a very early stage, prevent it or limit it. Apart from our legal tasks, we have stringent requirements of construction activities and events in public spaces. We maintain noise requirements with measurements. The population is consulted when drawing up noise level maps and the Noise Action Programme. We regularly carry out company research on specific subjects, such as the perception of hinder of the A73 motorway or the effectiveness of silent roads.

Kronenburger Forum

District Nijmegen-West and the nearby village Weurt have an exceptional situation with regard to environmental aspects, also with regard to noise nuisance (figure 6). This large inner city industrial estate has an extremely delicate history of the influence of the vicinity on health. Almost nowhere in the Netherlands is the expertise of the public so well-organised as in Nijmegen-West and Weurt: the so-called Kronenburger Forum. In a typically Nijmegen, open process members of the action group ‘West wil Groene Buffer’ (West wants a Green Buffer) and representatives of district associations explored how/where measurements can best be taken.

Residents could make use of their own, independent sound specialist, paid for by the local authority. The Kronenburger Forum is also involved in this consultation. On the basis of the many measurement results, residents and the local authority discussed where the norm is exceeded. An open process was also agreed for this. The municipality set aside €1 million: If no measures turn out to be necessary, this budget goes to extra district green in consultation with residents.
Figure 6: View on brownfield Waalfront (riverfront) and industrial area (back) with electricity plant that will shut down in January 2016.

Figure 7: Noise Contour zoning (50 dB line, purple) around industrial activities
Zone management industrial estates
The municipality of Nijmegen has three ‘zoned’ industrial estates: Nijmegen-West/Weurt, Winkelsteeg and concrete industry De Hamer. There is a noise zone around these areas. The zone is the area between the industrial estate and the 50 dB(A) contour. In this contour, building houses is only allowed under strict conditions. The noise zone as a buffer between living and working. This guarantees liveability in the surrounding districts and gives companies economic certainty. Because of ‘zone management’ the municipality actively ensures that noise limits are not exceeded (figure 7).

Sustainably safe
Since 1980, the Nijmegen road network’s structure has seriously changed: Of the 700 kilometres of road (in residential areas), 630 kilometres now has a maximum speed of 30 km/hour; on 70 km main roads the maximum is 50 km/hour (figure 8). Main roads have cycle paths, which are largely separated. Traffic streams are bundled on the main roads (and guided using dynamic traffic control), residential areas are relieved from unwanted traffic (safety, noise nuisance, air quality). Also see 6A.

Sound insulation in existing houses
The municipality of Nijmegen has been carrying out sound insulation projects on behalf of the national government for 30 years. Houses that are eligible for subsidised sound insulation on the basis of the Noise Nuisance Act are provided with extra project-based sound insulation. These houses are mainly situated along busy approach roads and railways of Nijmegen. Since 1984 around 1,400 houses have been reorganised.

Silent roads
Nijmegen currently has 25 kilometres of silent roads (see figure 9). Part is laid on the basis of the silent roads stimulation arrangement for which the State has granted subsidies. Because of this, the facade burden of a large number of houses was reduced by approx. 3 dB. In addition, silent roads have been laid in new developments, in accordance with the Noise Nuisance Act.
High Values policy
Since 2007 the city of Nijmegen has had policy guidelines that state under which strict conditions higher noise impact is allowed. These non-statutory policy guidelines enable demanding compensating the high noise impact on a house and thus guaranteeing the liveability for the residents. A house that meets our policy guidelines, has a low noise side in addition to the required sound insulation on the basis of the Building Decree (Building Decree is national legislation). In gardens and on balconies situated on the low-noise side, the noise impact is without doubt acceptable. Thanks to bedrooms on the low-noise side, we prevent sleep disturbance.

Nijmegen-North
On the new main access roads in Nijmegen-North, the Vinex location where approx. 12,000 houses are being built, noise-reducing roads are (being) laid. Most of these roads have already been laid. The noise reductions comprise 1.5 to 3 dB compared to dense asphalt concrete. In addition, the maximum speed is 50 kilometres/hour.

When designing the Vinex location, account was explicitly taken of traffic noise. For instance, primary construction along the Prins Maurits singel and the Vrouwe Udasingel has been given a noise protection function for the houses at the back. Of these 12,000 houses only 15% gets a noise impact higher than 48 dB Lden. In addition, sound screens have been included along the Nijmegen-Arnhem railway line. Across the Netherlands this is because of scarce space. Especially in cities with densities such as in Nijmegen it is very hard to establish residential areas without higher values. This is why sound screens largely determine the Dutch urban landscape. Thanks to the Higher Values policy document we are still creating an attractive residential climate. Figure 10 shows on a detailed level what such a sustainable urban development looks like: the Prins Maurits singel (Nijmegen-North), with, among others, whispering asphalt, speed reduction and adequate building volumes.
Other policies
The city of Nijmegen has an events policy in which the duration, number of events and the maximum sound levels per event location have been laid down. This provides clarity for the organisers of events as well as for local residents.

The city of Nijmegen has policy guidelines to limit the noise nuisance caused by construction activities. Activities that can cause a lot of noise should preferably be carried out during the day. In case of extremely annoying night activities the causer may be forced to offer local residents night accommodation. This occurs on average twice a year.

Every two years surveys are sent to the people of Nijmegen in which they are asked about the extent to which they experience noise nuisance from neighbours, events and traffic. The results are used to substantiate extra measures.

Dynamic traffic control on the arterial routes (aligned traffic lights, route information signs, traffic control centre) provides better circulation. The DTC infrastructure was laid in 2013 and 2014.
6C. Plans for the future

Nijmegen is focusing on sustainable development according to the Structural Vision 2013 (figure 11). The policy remains focused on the concentration of economic dynamism on junctions and along main roads. The production of noise and possible noise nuisance remain concentrated here. The approach to noise production caused by traffic remains priority number 1.

Our Sustainability Agenda (figure 12) has five pillars along which the city of Nijmegen is working on promoting sustainable development (among others, more energy neutrality by 2045). The ‘mobility’ pillar and the ‘sustainable city’ pillar form the main pillars for noise production and noise nuisance policy. In view of its importance, we divide this policy into main outlines.

**Sustainable city and mobility**

The priorities of Sustainability in Execution 2014-2017 are: more cycle superhighways, even better public transport and better logistics. In relation to sustainable urban development: bicycle promoting spatial planning, climate-proof city and an improvement of the living environment.

**Short-term cycling measures**

- Laying 14 km cycle superhighway Nijmegen-Mook-Cuijk (€14.2 million).
- Laying cycle superhighway Beuningen – campus Heyendaal (4 kilometres, in realisation).
- Improved alignment traffic lights, prioritising modes of transport within central ring road.
- Widening/upgrading cycle path old Waal bridge.
- Renewing cycle superhighways, 16 kilometres (€5,000,000 municipal credit).

**Programme High Frequency Railway (HFR),** with fast, high frequent train services; investments in/around Central Station and vicinity of the station, approx. €75 million national government; contribution municipality €5.5 million.

- Upgrading Station Heyendaal (university campus Heyendaal)
- Maas line (Nijmegen-Venlo) (now diesel trains) will be electrified
- Extension referral system to 10,000 bicycle parking spaces Central Station.
- Extension HOV lines, improvement of circulation infrastructure, improving reliability.

**Car traffic distribution**

These past few years a lot has been invested in urban main roads, including the new city bridge. This offers opportunities for extra sustainability measures, cycling measures and public transport. ‘De Oversteek’ prevents unnecessary through traffic. Our next step is traffic calming. Traffic calming comprises, among others that we want to increase the 30 kilometre zones and ensure that the traffic on main roads is smoother and calmer.

Nijmegen is densely populated, comparable to cities in the Randstad. South of the Waal the area is entirely in urban use, north of the Waal it will soon be fully occupied. In Nijmegen-North residential areas are enclosed by water and green structures. The production of noise on north-south-oriented main road structure is being limited as much as possible as well as the effect. With the introduction of cleaner engines and fuels, we are expecting the production of noise to be generally reduced over the next decades.
[Existing green areas, Waal and Maas-Waal-Channel, Search areas inner city green, Investing in green in and around the city, Investing in blue structures, Water safety, Search areas wind energy, Heat network line, Areas of special interest climate (heat and flooding, HOV, cycle superhighway, Park & Ride, Development location Waalfront/Waalsprong]

Figure 11: Sustainable Urban Development (Structural vision 2013)
Figure 12: Sustainability Agenda five sustainability pillars and the programmes (blue)
Noise Action Plan
In accordance with the Nijmegen Sustainability Agenda (and the Sustainability in Execution 2014-2017 programme that is based on this) and the Noise Action Plan 2015-2018, we are fighting, within the context, noise nuisance through successively 1-source approach, 2-limiting transfer and 3-limiting effect.

Reduction of traffic noise is possible through driving electric cars. Nijmegen now has 30 charging points; 40 more will be added over the next few years.

The laying of silent asphalt remains an important means over the next few years to reduce traffic noise. In the event of major maintenance the standard dense asphalt concrete will be replaced by a more silent type, as laid down in our Noise Action Plan 2015-2018. This action plan is a result of the EU Ambient Noise Directive. This leads to a noise reduction of approx. 1.5 dB. Naturally, we are following the innovations in asphalt and are applying new, more silent alternatives if this is technically (and financially) feasible. Figure 13 shows which roads in the near future will get silent asphalt (approx. 20 kilometres). It concerns roads that are part of the 70 kilometre main road network with maximum speed 50 km/hour. After completion, 45 kilometres of the main road network will have silent asphalt.
The next six to seven years the municipality is focusing on the completion of the housing improvement list (another 1,000 houses). An amount of €3,000,000 has been set aside for 550 houses. Most of these houses have a façade impact between 55 and 65 dB Ldn.

Together with residents, we are monitoring the effects of the laying of ‘De Oversteek’ and ring road. If there is a reason for this, we will invest in measures, for which already €1 million is estimated. The basic assumption is that the situation compared to 2012 (before opening of ‘De Oversteek’) is not worsening.

Since 2012 ProRail has been responsible for managing and controlling noise coming from rail traffic. The Ministry of Waterways and Public Works and the province of Gelderland manage and control noise coming from national trunk roads and provincial roads. The municipality must of course take account of noise coming from these sources, but does not have control of the execution of the measures.

Surveillance and enforcement remain essential: To prevent nuisance situations we are testing all spatial developments, festivities and building activities against the law and the municipal noise policy. Through zone management we ensure that the noise coming from industrial estates remains within the determined norms. As of 2016 we will also be testing and advising our neighbouring community Beuningen.

We promote sustainable and clean city dispatch. In line with this we are realising the national Green Deal Zero emission urban logistics, which is also effecting the limitation of noise production.

With the state programme Better Using Cars follow-up (2015-1017), a measures package is being developed together with socially involved organisations and companies, with which the traffic participant can take his own behavioural decisions to avoid traffic jams during rush hour. The traffic participant thus becomes aware of the impact car use during rush hour has on the accessibility and liveability, and the contribution he can make.

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6D. References
Structural vision 2013
http://www2.nijmegen.nl/wonen/ontwikkeling/visies_op_stadsontwikkeling/Structural vision

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| **Kronenburger Forum** | www.westenweurt.nl |


Dyke repositioning
http://www.ruimtevoorderivier.nl/waar-doen-we-dit/projecten/gelderland/dijkteruglegging-lent/