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Sint Hubert and the infamous N264

A Substantiation document

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Abstract

This research was conducted on behalf of the village council of Sint-Hubert, represented by Han Lavrijsen, to investigate how traffic on the N264 affects the liveability of the village and its approximately 1,400 residents. The main focus was placed on noise pollution and road safety. A mixed-methods approach was used, combining desk research, sensor data collection by means of Telraam and manual noise measurements using the Decibel X application and Tygron, and a participatory Maptionnaire survey which received 188 responses.

The findings show that the N264 is a heavily used regional transit route, with over 378,600 vehicles recorded in 44 days, of which more than 24,000 were heavy goods vehicles. Noise levels at certain locations along the road were recorded at levels much higher than the allowed 65 dB, which is above the so called "geluidsplafond". Survey results indicate that a large part of the residents experience the road as busy and noisy, and that many people find crossing the N264 difficult or unsafe. At the same time, not all residents report equal levels of disturbance, which shows that the impact is unevenly distributed across the village.

Based on these findings, it is concluded that the N264 has a significant and ongoing negative impact on the liveability of Sint-Hubert. Recommendations include the construction of a bypass road, restrictions on freight traffic, improvements to pedestrian crossings, and better enforcement of speed limits.

Introduction

Every village has a story, and in this instance, that story runs straight through the middle of it. For Sint-Hubert, the N264 is the centerpiece of current-day problems which it's residents experience on a daily basis. What was once a quiet provincial road, has grown our to be an significant arterial road so to speak, connecting regional distribution centers and two highways, creating a measurable disturbance of daily life for roughly 1,400 residents.

This report is the final product of a twenty-week research project carried out on behalf of the village council of Sint-Hubert, represented by Han Lavrijsen. The client's core wish was straightforward: to gain a clearer, evidence-based picture of how traffic on the N264 affects the livability of Sint-Hubert, with a particular focus on noise pollution and safety. Beyond just producing numbers, the client wanted something actionable findings that municipal advisors and provincial authorities could actually use.

To make that happen, The Sint-Hubert projectgroup from HAS green academy, structured their work around four phases: preparation and research, data collection, data analysis, and finally the recommendations and reporting stage which you are reading now. The planning has been tracked and managed throughout using a Kanban-style Trello board, which made it possible for all stakeholders to follow progress in real time if desired. The board tracked tasks across the full project timeline. With it's starting point from the submission of the first plan of approach in week three all the way through to final deliverables in week seventeen and eighteen. Milestones of note in this process include: submitting the final plan of approach version, work on the Maptionnaire and it's campaign, sensor installation, quality checks, processing of the results and bi-weekly meetings with Han Lavrijssen.

In terms of what the Sint-Hubert projectgroup has produced: the project resulted in a Maptionnaie survey distributed to residents of Sint-Hubert with over 180 respondents, printed flyers and a back-

up communication campaign, posters, inspiration for a news article, banner concepts and additional research in the form of manual measurements. These measurements took place to supplement sensor data collected via Telraam, a 3D visualization of the area in Tygron, an interactive ArcGIS dashboard, an experience builder with interactive (story)maps and the supporting research document you are currently navigating. These products all together form the backbone of what follows in this report.

Sint-Hubert

Sint-Hubert is a small village situated in the Dutch province of North Brabant. The municipality of Land van Cuijk was formed in 2022 through the merger of the former municipalities of Boxmeer, Cuijk, Grave, Mill en Sint Hubert, and Sint Anthonis. Sint-Hubert became one of its 33 constituent villages as a result. In 2026, the village had approximately 1,396 inhabitants. Population figures show a decline from 1,515 residents in 2013 to 1,385 in 2025, a drop of around 8.6% over that period (AlleCijfers, 2026). With only one primary school and relatively limited local facilities, Sint-Hubert is a typical example of a small North Brabant village being shaped by external pressures rather than internal growth.

The dominant external pressure is guided to the village via the N264-road. The N264 serves as the connecting road between the A50 near Uden, running through Haps and linking to the A73 and N271 near Gennep (inMill.nl, 2021). This positions Sint-Hubert directly along both a regional freight and commuter corridor. On a regular weekday, approximately 10,000 to 12,000 vehicles pass through the village, with roughly 20% being trucks (Tromp, et al., 2026). Provincial regulations set a maximum noise level of 65 dB for roads of this type, yet measurements at certain locations within Sint-Hubert reportedly reach an average of 69 dB, exceeding that standard (Tromp, et al., 2026). The true reality of these values will come to light later in this research.

The road has been a community concern for years. Residents along the N264 have argued that too many vehicles are being funneled through Sint-Hubert, and that this number is only expected to grow in the future (inMill.nl, 2018). Efforts to address the situation have been made at both local and provincial level. Following extensive consultation with the neighbourhood and the village council, the province committed to restructuring the N264 to reduce vehicle speeds and improve the living environment (inMill.nl, 2021). A reconstruction within the village was completed in 2021, introducing bends and narrowed sections to slow traffic. Despite this, vehicles typically still travel at around 50 km/h rather than the intended 30 km/h. The Sint-Hubert projectgroup has tracked these speeds alongside the N264 and has been made visible by means of ArcGIS Experience Builder Dashboards.

More recently, major maintenance works were carried out on the N264 in late 2025 by contractor Heijmans Infra B.V., including work on the road section near Sint-Hubert's eastern village boundary (Provincie Noord-Brabant, 2025). Damage caused by heavy freight vehicles to the road's concrete edges had been found to generate noise nuisance for residents, prompting targeted repair work (inMill.nl, 2024).

The Sint-Hubert project enters the ever so lively and ongoing conversation within the borders of Sint-Hubert and beyond, using hard sensor data, soft resident survey input, and a structured methodology, aiming to give the village council and relevant authorities the tools to take the next step on making Sint-Hubert more liveable for her residents.

Geographical context

The geographical lessons cycle, taught by Erik Dietvorst and Huub Bruens, covered during the 2nd semester at HAS green academy's AARD course offers a useful lens for understanding what the Sint-Hubert project is truely about, beyond simply measuring traffic and noise.

A central theme in the lessons was the evolution of smart cities and how urban environments have increasingly become computable entities, managed through sensors, data platforms, and real-time analytics. While Sint-Hubert is obviously not a city, this project applies precisely those principles at a village scale. Telraam sensors and municipal noise meters collect continuous data streams; that data flows through platforms like Samen Meten and the Tygron model and the outputs appear in an interactive ArcGIS dashboard. This is, in miniature, the kind of data-driven decision-making infrastructure that smart city theory describes.

The lessons also addressed the tension between top-down and bottom-up approaches to urban and spatial planning. This project deliberately tries to do both. The sensor data and technical analysis represent the top-down, measurable perspective both objective and systematic. The Maptionnaire survey represents the bottom-up layer by giving residents a voice and letting their spatial perceptions inform the analysis. This mirrors frameworks discussed in the lessons, such as Fred Kent's placemaking principles, where local residents are treated as the real experts on their environment, and participatory tools like citizen surveys and e-participation platforms are seen as essential to legitimate planning.

Privacy and data governance were also prominent in the lessons. In collecting survey data and sensor measurements from a residential area, this project had to consider informed consent, data minimization, and the Dutch AVG (GDPR). The survey was designed with anonymity as a priority, and participants were clearly informed about the research purpose, including a privacy statement with the possibility to reach the project group. These measures have been implemented of the principle of transparency that the lessons identified as a cornerstone of ethical data collection.

Methodology

Deskresearch:

Sint Hubert is a village with approximately 1400 inhabitants, located within the municipality of Land van Cuijk, which consists of 33 towns. It lies between the regional distribution centres in Haps and Wanroij, meaning that a steady flow of traffic passes through the village, including heavy freight vehicles transporting goods between these areas. The village's position on this route contributes to traffic safety and noise pollution.

Like many rural villages in the Netherlands, Sint Hubert has seen its population quietly shrink over the past decade, with an 8.6% decline between 2013 and 2025. The village is largely home to older, long-term residents. The most common age group falls between 45 and 65, followed closely by those aged 65 and above. Younger generations are underrepresented, with the 15 to 25 age group being the smallest in the village (allecijfers.nl, 2026). This is directly relevant to the project since older residents tend to be home during the day and are therefore exposed to traffic noise for longer stretches.

As of 2025, the community is predominantly Dutch, with around 94% of residents having Dutch origins and only 6% born outside the Netherlands. Most households are made up of families or couples, with 44.4% of residents being married. The village has a relatively educated population, with just over half holding a medium level of education, and roughly a quarter being highly educated and 22.6% have a low level of education. The village has only one primary school which reflects the small size and aging population (allecijfers.nl, 2026)

Figure (1, 2) – Housing alongside the provincial N264 road

In Sint Hubert, 75% are owner-occupied while 19% are rental houses (allecijfers.nl, 2026). Property values for homes have an average WOZ-waarde of €398,000 in 2025 (allecijfers.nl, 2026) and an average asking price of approximately €532,999, around €3,859 per square metre (huispedia.nl, 2025). Many of the homes along the N264 are detached and have relatively large backyards with several properties located close to the road. Sint Hubert has an average income per inhabitant of 32,300 € while. This is slightly below the national average of 48,000 €, but still relatively close to it.

Mobility

Sint Hubert is well connected to the surrounding villages and urban areas in the region. The N264 is the main road running through the village, and it serves as an important route linking destinations such as Uden and Veghel to the west with Boxmeer and Gennep to the east. For many drivers, Sint Hubert is not a destination it is simply a route. This reality is reflected in the structure of the village itself. The main residential area sits to the north of the road, separated from the flow of through-traffic. The road through Sint-Hubert is the shortest route between the A73 motorway at Haps and the A50 at Uden, which is why drivers keep using it despite the narrow layout (Verkuijlen, 2022). Along the road there are only two pedestrian crossing and no traffic lights for cars, suggesting a layout shaped around passing traffic. In 2022, the province redesigned the road with hedges, road narrowing, chicanes, and flowers to reduce the nuisance from heavy traffic.

The municipality of Land van Cuijk has recognised the importance of sustainable and liveable mobility in the region and has developed a Mobility Plan 2040, in which Sint Hubert is included (Mobiliteitsplan Land van Cuijk, gemeente Land van Cuijk, 2023). The plan's goal is to balance through-traffic with the quality of life of the communities it passes through. This shows that the noise and safety issues this project addressed are officially recognised.

Safety

There has been a rise in traffic accidents. The graph below shows the total amounts of accidents. The number of deadly incidents remains low, with only two causes reported in 2008 and 2014.

The N264 was redesigned between 2021-2022 with the aim of slowing traffic down. Bends were introduced and side sections were added. The road was also deliberately narrowed in places to reduce the speed limit. The effort has had some effects because before the reconstruction, vehicles were regularly travelling at up to 80 km/h. After the changes, the average speeds dropped noticeably. The speed limit in the village is 50 km/h and most vehicles now travel to that

Figure (3) – Traffic accidents

(Dorpsraad Sint Hubert, 2020). By 2022, measurements showed a further gradual reduction, and recent data from 2023 to 2024 confirms that vehicles inside the built-up area are now travelling between roughly 47.9 and 49 km/h on average. The V85, the speed that 85% of drivers travel do not exceed, sits between 47.6 and 48.6 km/h (Telraam data, 2023 to 2024). That is a reduction of around 3.3 to 3.5 km/h compared to before the reconstruction.

Traffic composition has also changed over time. In the period from January to October 2020 the share of heavy goods vehicles increased compared to the same period the year before. This may likely be explained by a stronger reduction in passenger transport during the COVID-19 crisis. A similar pattern was observed in 2022, where a slight increase in the share of heavy goods vehicles was recorded compared to early in that year, when the effects of the pandemic were still more pronounced.

Despite this progress, the road still falls short because the residents were to lower the speed limit tp 30 km/h. Most vehicles continue to travel at around 50 km/h, and the combination of heavy freight, limited sight lines, and a narrow road corridor leaves little room for error. Sidewalks and bicycle paths are cramped, and the proximity of homes to the road means that a moment's inattention can have serious consequences. The accident history of the area reflects this tension. In 2024 alone, eight traffic accidents were recorded in Sint Hubert (CBS Verkeersongevallen, 2024). Over the years, incidents have occurred near a prominent white house in the village, at two locations just outside the village boundary, and more recently on the road toward Uden near the roundabout. While the number of fatal accidents has remained low, with only two deadly incidents recorded in 2008 and 2014. The overall trend of total accidents has been rising, and that trend is a source of genuine concern for the community (CBS Verkeersongevallen, 2003 to 2024). Traffic not only affects safety, but it also shapes daily life through noise.

Noise Pollution

If traffic safety is the visible problem in Sint Hubert, noise pollution is the invisible one and is present at all hours. On an average day, between 10,000 and 12,000 vehicles pass through Sint Hubert along the N264 and about 20% are trucks (Verkuijlen, 2022). These vehicles rumble through the village at all hours, connecting the distribution centres in Haps and Wanroij with the wider region.

Provincial regulations set a maximum permissible noise level of 65 dB for new roads, with ambitions to lower that threshold to 60 dB in the future. According to the Geluidregister, the measurements at certain locations in Sint Hubert have recorded average levels of around 69 dB, clearly exceeding the standard (Province Noord Brabant, n.d). The provincial noise map shows, regulated and recorded noise levels from roads and other infrastructures, showing where the noise limits are set and how they are distributed spatially.

The experience of living with that noise is not uniform across the village. Some residents report that their homes are well insulated, and that the sound fades into the background once the windows are closed. While others close their windows at night in order to get a decent night's sleep, especially in less well insulated houses. The difference in experience often comes down to where a house sits, how it is built, and how much of the road is visible and audible from inside. The safety issues matter to the project because they stem from the same source as the noise. The heavy traffic that makes the road dangerous is also what makes.

Statistics:

Before sending out the maptionnaire survey, we had to calculate how many respondents we needed for a reliable result. To determine the required number, a sample size calculation was performed using the following formula:

$$n \geq \frac{z^2}{4 * a^2}$$

Collecting enough respondents was important because the sample size directly affects how well the results represent the wider population. With too few respondents, the findings would be more strongly influenced by random variation and individual outlines, making it difficult to draw a reliable conclusion. A larger sample reduced the margin of error and increased the chance that the results reflect the actual experience of residents around N264 rather than the opinions of only a few people.

For the calculation, a confidence level of 95% was chosen. This was done because a 95% confidence level is the standard and provides an ideal, practical balance between certainty and precision. This confidence level translates to a Z value of 1,96. Furthermore a margin error of 0,08 was used. Using these values in the sample size formula, the calculation resulted in a required sample of 150 participants. By the end of the survey, 188 responses had been collected, which is above the required sample size. This means the survey reached enough people to give a reliable picture of how residents experience noise and safety around the n264.

To relate to our own noise measurement to legal noise limit we compared each of the 24 measured points against the maximum permissible level. To determine how many points exceeded the

standard, following approach was used: (measured noise level – legal limit), counted across all 24 points.

Comparing the measurements against legal limit was important because it shows whether the noise along the N264 actually breaches the standard rather than simply describing the road as noisy. The maximum permissible noise level for this type of road is 65 db. We took measurements and they were taken at 24 different points along the road. At each point the readings were averaged to give the combined average value for that point. Each of these 24 values was then checked against the limit and a point was counted as too high if the value was above 65 db. Too see how far the worst point went over, the limit was subtracted from its measured value. The average noise was calculated by summing the combined average values of all 24 points and dividing by 24, giving 54.0 db. The standard deviation was then calculated to measure how much the individual points resulting in 9.5 db. We found the average of all points and then subtracted the average from each value, then squared the result. This high standard deviation shows that noise levels vary a lot from point to point along the road instead of being even.

Of the 24 points 3 (12.5%) went over the 65db limit while other 21 (87.5%) stayed at or below it. These percentages were found by dividing the number of points in each group by the total of 45. The highest point reached 76.8 db which is 11.8 dB above the limit. The points that were over the limit (75.3, 76.8 AND 65.18 db), did so by subtracting 65 from each of these three values and taking the mean of those differences. Keep in mind that these are indicative measurements taken with a mobile app and the time was limited. By doing this calculation it shows the difference in noise levels between the measured points and a high standard deviation which means the noise varies a lot from point to point, while a low level would mean the levels are similar everywhere.

A planned comparison between age groups and residential zones was not carried out as these variables were excluded during data cleaning. This is a limitation as it means group level difference in how the N264 is experienced could not be assessed.

Data collection:

Hard data is gathered from airquality No2, telraam, samenmeten, noise

This research examined the impact of traffic on the N264 on residents of Sint Hubert, focusing primarily on noise pollution while also considering road safety. The research was limited to Sint Hubert and surrounding areas affected by the N264. The data that was collected during this period consisted of hard and soft data. The hard data was collected using the telraam sensors, noise sensors and the decibel X.

The soft data was collected using Maptionaire. Maptionaire is a digital geo-referenced survey that can be used to collect public data. The purpose of the survey was to collect data from residents regarding quality of life, traffic noise, safety, and public space usage within the boundaries of Sint-Hubert.

Telraam:

The telraam sensors record traffic volume, vehicle types and vehicle speed. This data is collected continously and updated every 15 minutes on their website via a dashboard. Two Telraam sensors were installed at different locations on April 18th. The sensors were placed at two separate houses, one at the beginning of Sint Hubert (point 1) and the other at the end (point 2) (Image …..). These locations were chosen to compare traffic data and to measure the volume of cars traveling through Sint Hubert versus those entering the town itself. Because Telraam sensors require a second-floor installation with a clear view unobstructed by trees, the two properties chosen were the most suitable candidates.

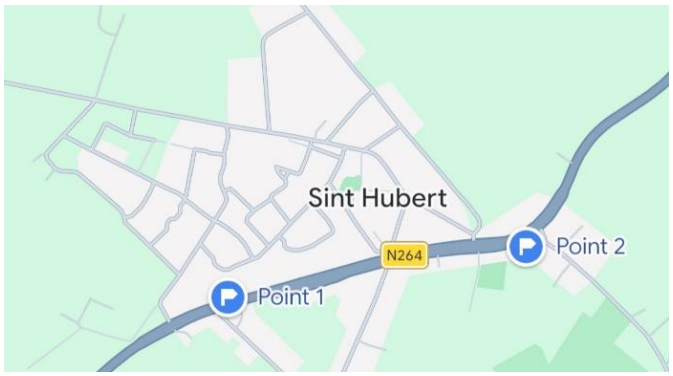

Figure (4) – Telraam Sensors in the Extent of Sint Hubert

During the research period the data from sensor 1 and 2 was evaluated. During this evaluation sensor at point 1 generated different results than the sensor at point 2. The variance in vehicle count between these 2 points consisted of a difference of almost 400 vehicles. To test out the reliability of the 2 sensors, vehicles were counted for a duration of 15 minutes at a location near the road at Sint Hubert. The amount of vehicles counted was then compared to the sensor data. The sensor at point 1 did not have the same amount of vehicles that were manually counted and point 2 did. Because of this it is led to believe that the sensor at point 1 is faulty. The sensor at point 1 has also fallen from the window on multiple occasions leading to the data having gaps where no data has been recorded. Because of these reasons it has been chosen to not include the data from the sensor at point 1 in this research. Due to these reasons it was chosen to install a third sensor at a different location (point 3) which was still near point 1. This third sensor was successfully installed on a second floor, maintaining the original goal of comparing its data with Point 1, as both are located at the beginning of the street.

Figure (5) – Telraam sensors alongside the N264

Unfortunately the sensor at point 3 was not measuring the vehicle amount correctly. This was due to the positioning of the sensor. The sensor was placed at the second floor of the location but due to the size of the front yard, the house is a bit further away from the road. This in combination with the angle of the sensor camera resulted in the sensor only measuring vehicles on a small part of the road. Because of this it has been chosen to not include the data from the sensor at point 3 in this research. The sensors were removed at the end of May. Due to the lack of data from the sensors at point 1 and 3 a comparison could not be made on the total amount of vehicles going into and leaving the town of Sint Hubert itself. The data from point 2 only gives results on the amount of vehicles that make use of the N264 and leave the town of Sint Hubert to go in the direction of Haps. The sensor at point 2 collected data for a total of 44 days.

Samen meten:

The samen meten website provides data on sound, air and water quality, which can be collected via the dashboard available on their website The sound sensors collect data continuously which is then displayed in real-time graphs with one-minute intervals. In Sint Hubert there are 4 sound sensors placed at different locations with 2 of them being along the N264.The data for each of the 4 sensors was downloaded as a CSV file. This was done due to the API link not containing the data needed to make the comparison. The downloaded CSV files contained data from the same day that the Decibel X measurements were done.

Figure (6) – Samen Meten Sensors.

Maptionnaire:

The maptionnaire questionaire was active from the 14th of april till the 21st of may and consisted of 6 pages focusing on noise nuisance, perceived crossing ability and safety. The maptionnaire was designed to consist of 5-10 questions, with the most important questions placed at the beginning. This was done to ensure higher engagement and completion rates. Additionally, the questionnaire was optimized to function correctly on desktop and mobile devices to ensure accessibility so that respondents could easily complete the survey. The questions were formulated in such a manner that they consisted of short, direct phrases to prevent complexity and ensure accessibility for all respondents.

Page 1 consisted of an introduction page with a description of the objectives of the questionnaire and how the results were going to be used. This page also included a privacy policy section with information on how personal information woud be processed during the research period and the respondants rights under the AVG law. To participate in the questionnaire, respondant had to agree and consent to the privacy policy terms and to the collection of their personal data. The policy ensures transparency regarding data processing and reduce legal risks. Lastly an optional field was available where respondants could provide their email if they wished to receive information on the research and future insights.

Page 2 focused on questions related to noise nuisance caused by the N264 and consisted of three main questions: whether respondents experienced noise nuisance, where it was most severe, and how it influenced their daily lives. If the respondant chose "yes" or "sometimes" for the first question, two additional questions would appear to gain further insight in what the main causes were and during what time of day these were being experienced. For the question regarding the type of noise nuisance respondents could choose from the three most common modes of transport: cars, trucks and motorcycles. An “other” option was included to allow respondants to fill in other types of vehicles that causes noise nuisance. This gives an insight on whether there are other vehicles that should also be taken in to consideration. The question regarding timing of noise nuisance identifies when peak periods are present and whether these are during the weekdays or in the weekends. With this information further investigation could be done on the amount of vehicles and noise nuisance during these peak periods and possible solutions for these problems.

The question regarding the noise severity is a map question. Respondants can indicate as much locations as they wanted were they experience the most noise nuisance across the town of Sint Hubert. This question was formulated to track areas where noise nuisance is most common and to determine if other areas in Sint Hubert (that are not in direct vicinity of the N264) get affected by the road. The last question regarding impact of noise on daily life could be filled in using a slider bar. This slider option allows respondants to determine the impact based on personal experience without the constraint of predefined categories.

Page 3 regards the perceived crossing ability of the N264 through 3 main questions ease of crossing, overall traffic experience within the village, and perceived safety during crossings. If the respondant chose “sometimes” or “no” at the first question, additional questions would appear with one question asking for an explanation and another regarding potential road improvements. The question “Can you explain why you don’t find it easy?” consisted of predefined options that the respondants could choose from (too much traffic, too much trucks, vehicles driving too fast, no crossing paths or other). These predefined options were chosen due to these being the most common reasons and complaints regarding the N264.

The question regarding road improvement also consisted of predefined options (speed bumps, traffic lights, improved crossing paths, speed reduction, driving ban for trucks or other). These options are based on standard traffic measures designed to reduce vehicle speed and promote safer driving. The last two main questions regarding traffic intensity and safety can be filled in by using a slider bar. This format was chosen for the same reason as mentioned at the slider bar from page 2 of the questionnaire.

Page 4 is a continuation of page 3 and consists of two map questions:Where do you often cross the N264? And Where do you find crossing the road the most dangerous?. Respondants can indicate as much locations as they wanted in the buffer zone created around the N264. This ensures that the data collected is focused on the areas surrounding the N264 and prevents the placement of accidental of misplaced markers outside of the N264 study area.

Page 5 consisted of 6 questions regarding the demographics of respondents and their experiences with the N264. The questions are related to age, residence duration in Sint Hubert, living zone, the areas of home that are most affected by noise nuisance, general remarks and positive aspects of the road.

These questions were formulated to analyze and evaluate how the responses vary across different demographic based on the experience and location. This analysis can highlight issues that require further attention. The question regarding age was split in different age brackets. The age bracket was split based on the municipal demographic data that was available, making the datasets easier to use for analysis and demographic comparison. Respondants could select their residential zones rather than their specific adress.This ensures data anonymity and protects the respondants privacy, while still being able to do a spatial analysis.

Page 6 is the end of the questionnaire and consists of a message thanking respondants for their time. On this page respondants could also fill in their email to enter a giveaway to win vouchers for the purchase of consumables at the local community center. This option was displayed on the last page to ensure that this option was only available to respondants who completed the entire questionnaire.This was aimed to boost the questionnaire completion rates but also to engage local businesses in the project. Once page 6 is closed it redirects respondants to the village councill's website. This was done due to the village council being one of the partners in this research. The redirection serves as a way to conclude the questionnaire in a professional matter while also guiding respondants to further community resources.

Maptionnaire promo:

The promotion of the maptionnaire was conducted using flyers, posters and a news article. Several flyer examples were made and discussed with the client. The design of the flyer focused on letting the public know that their experiences are valueble and needed for the research. To grab the attention of the residents the phrase “Geef jouw mening” is portrayed in large letters against bright backgrounds. Pictures of trucks were incorporated to give the residents an idea of the survey’s context and a short text was included to inform the residents about the purpose, completion time, and giveaway incentive. Furthermore there was a QR-code that directed residents to the maptionnaire page once this was scanned.

A news article was written to promote and give insight in the research. The article contained information on the use of sensor data, the survey, research partners and first impressions of the N264. The article was published three weeks after the survey was made available to the public. This was done to re-engage residents who had not yet participated.

Additionally roadside banners were also designed to further promote the maptionnaire. The banners would be placed along the roadsides to reminded passing vehicles of the questionnaire. To prevent distraction and mobile use for the drivers, the banners design included minimal tekst, were more straight to the point and the website of the village council was shown instead of a QR code. The website was displayed to inform drivers where they could access the questionnaire. Ultimately the banners were not placed due to scheduling conflicts with other local events. The banners, flyers and news article can be seen in the appendix.

Once the questionnaire was published the flyers were distributed together with the morning newspaper. Distributing the flyer with the newspaper ensured that every household in Sint Hubert received information regarding the questionnaire. Additionally larger versions of the flyers were placed at different “high traffic” locations recommended by the client (school, church, community center, football club and a local store). The posters served as a visual reminder to complete the questionnaire.

Once the questionaire period was over the results of the maptionnaire results was exported and the relevancy of each column was evaluated. Table 1 Consists of each column name, its relevancy to the research and the reasoning behind this. Once the CSV file was cleaned up the dataset was exported for integration in the dashboards and experience builder.

Name	Keep	Reason	Relevant
Respondent ID	No	Not relevant for users to know/privacy concerns	Irrelevant
Submitted	No	No added value	Irrelevant
First Active Time	No	No added value	Irrelevant
Wilt u op de hoogte blijven van dit onderzoek? Vul dan hier uw e-mailadres in	No	No added value	Irrelevant
Ervaart u geluidsoverlast van de N264?	Yes	Can be used for graphs	Relevant
Wat voor geluidsoverlast ervaart u?:	Yes	Can be used for graphs, grouping	Relevant

Wanneer ervaart u de meeste geluidsoverlast?:	Yes	Can be used for graphs, grouping	Relevant
Heeft de geluidsoverlast invloed op uw dagelijks leven? (ja-nee)	Yes	Can be used for graphs	Relevant
Vindt u het gemakkelijk om de N264 over te steken?	Yes	Can be used for graphs	Relevant
Kunt u uitleggen waarom u het niet gemakkelijk vindt?:	Yes	Can be used for graphs, grouping	Relevant
Wat kan er volgens u verbeterd worden aan de weg?:	Yes	Can be used for graphs, grouping	Relevant
Hoe ervaart u het verkeer in het dorp? (Rustig - Te druk)	Yes	Can be used for graphs, big differences	Relevant
Hoe veilig voelt u zich bij het oversteken van de weg? (Veilig - Onveilig)	Yes	Can be used for graphs	Relevant
Wat is uw leeftijd?	No	No added value	Irrelevant
Hoe lang woont u al in Sint Hubert?	No	No added value	Irrelevant
Bekijk de kaart en geef aan in welke gebied u woont (van noord naar zuid: A t/m E).	No	No added value/privacy concerns	Irrerevant
In welke ruimte of plek ervaart u de meeste geluidsoverlast?: Slaapkamer, etc.	No	No added value	Irrelevant
Zijn er verder nog zaken die u kwijt wilt over dit onderwerp?	No	Complex to analyse, open question	Irrelevant
Zijn er ook nog positieve aspecten van de N264 in uw dagelijks leven?	No	Complex to analyse, open question	Irrelevant
Wilt u kans maken op tegoed dat u in het gemeenschapshuis kunt gebruiken?	No	No added value	Irrelevant
Submitted Time	No	No added value	Irrelevant
Last Active Time	No	No added value	Irrelevant
Publication Consent	No	No added value	Irrelevant
Participatory Consent	No	No added value	Irrelevant
Hidden By Moderator	No	No added value	Irrelevant
Approved By Moderator	No	No added value	Irrelevant
Is Linked to Registered Account	No	No added value	Irrelevant
Language Code	No	No added value	Irrelevant

Table (1) – Maptionnaire Dataset

Public Participation

The foundation of Maptionnaire and Sint-Hubert project group's spatial survey is based on Public Participation. Using so called "PPGIS", the group has aimed to fulfill their soft data needs not only by gaining meaningful soft data through text and multiple choice questions, but also by adding a geographic component. This geographic component enables the Sint-Hubert project group to analyze and compare soft data to hard data by using GIS.
It is important to note that the residents who have filled in the survey have been informed that their role in this process is merely for information and consultation purposes, as there are different levels to public participation. According to the IAP2 specified by Engagement Institute (n.d.), spectrum of public participation, this indicates a low levels of public participation.

On the 2026 AARD fieldtrip to Estonia and Finland, the Sint-Hubert group have been presented the opportunity by Erik Dietvorst to present the issue at hand in Sint-Hubert to the CEO and founder of Maptionnaire, Marketta Kytta. By means of this presentation, the project group has raised extra awareness on the topic towards the representatives of Aalto University and their classmates alike. The key insight gained from this experience is the fact that, according to Marketta, interaction with the target audience by physical means is just as important as simply launching a survey amongst the target audience. For this reason, the Sint-Hubert group has attempted to arrange both an intermediate meeting and a walk-in evening for the residents of Sint-Hubert. The walk-in evening, is to be organized from 16:00-18:30 at the community center in Sint-Hubert.

Another means of delivering information and consultation which the project group has utilized within the village of SInt-Hubert is by simply talking to the residents.
Throughout the campaign, the project group has talked with people all throughout the village, from the residents, to shop employees willing to hang our posters, to those involved with the sensors and the campaign. The true definition of Public Participation is marked by the deep intrinsic involvement of the residents on a topic, verly close to home.
By having conversations with the residents, it has become evident that among most of the people who live in Sint-Hubert, the N264-road is a topic which brings about feelings of annoyance and hopelessness. Stories of organized protests, blocking the N264 in Sint-Hubert are not unheard of. People don't have faith in the current ways those who are in charge are dealing with the problem. The top-down approach which has been used throughout the years, does not seems to resonate with the people who are most affected by the issue at hand.
A higher level of Public participation, such as real citizen engagement, involvement and collaboration might just bring about solutions which haven't been thought possible for all involved stakeholders.

"Public participation in the process of government is the essence of democracy." — Lyndon B. Johnson

Additional research

Aside from the Deskresearch and the Maptionnaire survey, the Sint-Hubert project group has conducted an additional research to add on noise pollution data created by the group through means of analysis via a manual collective research method by means of the Decibel X application. Considering both the wishes of the client, the worries of the Sint-Hubert residents on noise nuisance, as has been shown by the Maptionnaire responses, the additional research aims to translate and project real-time sampled peak hour measurements alongside the N264 in Sint-Hubert.

The Decibel X application was chosen by the Sint-Hubert project group as the most viable option on the market. The reasoning for this was based on it's cost-effectiveness, accuracy, precision, the option to choose different frequencies and it's user-friendly exporting capabilities. The application has been utilized to collect indicative noise measurements in the area surrounding the N264 in Sint-Hubert. Measurements were conducted using the group members' own mobile devices, allowing for a flexible and accessible method of data collection across multiple locations.

The measurements have taken place on wednesday, may 13th, between 5-6pm at 24 predefined locations on the left, middle and right most sides of the urban area of the village, to ensure a balanced spatial distribution in relation to the road. (See image 7).

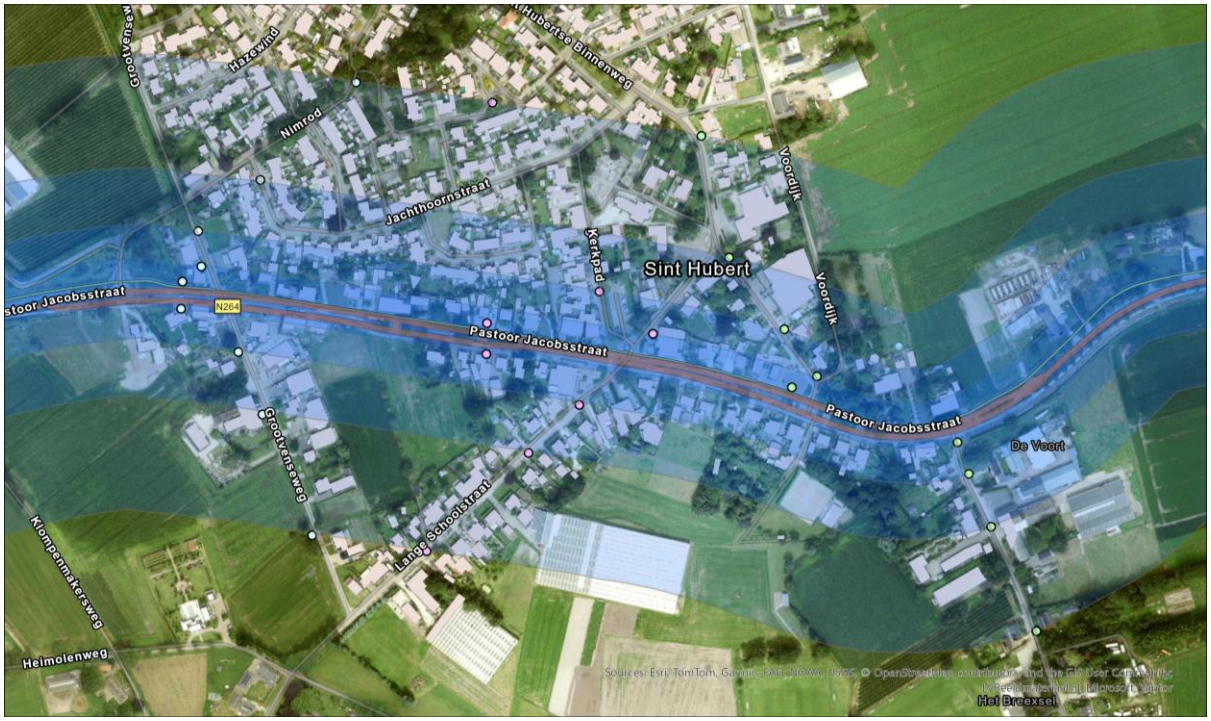

Figure (7) – Noise Measurement Plan

These locations shown in the image were chosen based on the current wind direction conditions (mild eastern wind), relevancy and it's analytical capabilities for an interpolation analysis using Tygron. The peak-hour timing has been chosen, as noise nuisance, is experienced most in it's most noisy moments, being the peak hour.
Each group member was assigned to a specific location to carry out the recordings simultaneously. This was done to maintain consistency in environmental conditions as much as possible. At each location, noise levels were recorded and later filtered to overlap the same duration of 150 seconds, with intervals of one to three minutes between recordings to capture variations in traffic flow and ambient noise.

The results were exported from the application in both CSV and PDF formats and included information such as the start and end time of each recording, geographic coordinates, graphical representations of noise levels over time, and minimum (MIN), average (AVG), and maximum (MAX) decibel values. The choice of frequency weighting (A, B, or Z) was also taken in to consideration when conducting the additional research. During the measurements the A-weighting was the most suitable option due to its alignment with human auditory perception and because of its common use in environmental noise assessments.

The collected data has been presented on the comparisons page of Sint-Hubert's ArcGIS Experience builder. It has been utilized with the broader dataset, enabling the results of the additional results to be compared with soft data gathered through the Maptionnaire. The final results have been displayed here by means of an interactive map, allowing for a clear and accessible representation of the temporal spatial noise patterns in Sint-Hubert. The intended goal of this approach is to contribute to a more comprehensive understanding of noise nuisance in relation to the N264 and to enable all stakeholders to compare both factual(hard) and experienced(soft) data in a user-friendly manner.

Data quality Check:

Throughout the data collection period, data quality was checked frequently. Telraam traffic data was monitored through the Telraam dashboard, while the noise data was monitored through the Samen Meten platform. This ongoing monitoring made it possible to spot problems early. When the Telraam sensor at point 1 failed, we spotted it through the dashboard and the sensor was replaced quickly, which kept the data gap small. We also had a backup plan in case a sensor broke or damaged so any gap could be fixed quickly without losing much data.

Survey responses were also monitored and when it looked like we might not reach the target, we spread the survey through multiple local channels and community representatives. For the decibel X recordings were taken under conditions kept as similar as possible and followed the same setup at every location, so the measurements stayed comparable. These mobile recordings were also used to cross-check the Samen Meten sensors. Finally, we kept a log of any data we cleaned or removed, giving a clear record of every change.

The research used a mix of hard sensor data and soft data from residents and stakeholders. The table on the next page gives an overview of each source and its main characteristics.

Data collected	Source	Hard / Soft data	Format	Period	Characteristics
Traffic counts & speed	Telraam sensors	Hard data	API	18th April – 18th May	Two sensors at the start and end of village, with a third added on 13. May replace the faulty one. Recorded counted traffic volume (vehicles per hour), classified vehicle type (car, truck, bike, pedestrian) measured speed including v85
Noise & air quality	Samen Meten	Hard data	API	18th April – 18th May	Stationary sensors measuring noise (in db) and air quality continuously throughout the whole measurement period
Noise	Devibel X app	Hard data	Csv	13th May	Mobile noise measurements at 24 locations across the village, around 150 seconds each, recording minimum, average and maximum sound levels (in db) with time.
Resident's opinions	Maptionnaire survey	Soft data	GeoJSON/shapefile (georefreenced), with excel survey responses	14th April – 21st May	A map-based survey of residents' views on quality of life, traffic noise, safety and public space use. Each response was linked to a location on the map. The survey received 188 responses above the target of 150.
Stakeholder insights	Interview & observations	Soft data	Notes	18th April – 18th May	Input from stakeholders and on-site observations, adding local knowledge and context that the sensor data could not provide.

Table (2) – Data Quality

Analysis & Visualization

3D scenes & Tygron:

We used tygron to model traffic noise pollution from traffic data we collected with our own sensors and fed into the model. The 3D scenes illustrate the traffic noise, but they also function as a decision-support product by connecting modelled noise to residents' own experiences. Within the 3D scenes the modelled noise is used as a base layer with the maptionnaire survey points displayed on top. These points indicate the locations where residents feel the noise pollution comes from. In the maptionnaire survey we asked the residents whether they experience noise nuisance from the N264: yes, sometimes or no. Because the two layers are aligned, the user can directly compare where the residents say they experience noise against where the model predicts it to be. The scenes are interactive, the user can explore the map themselves, zoom in on streets, inspect specific households and check whether perceived and modelled noise match. This makes the map useful for several audiences where the residents can see how their own street is affected, while the client gets a clearer data-based overview of where the noise problem is located. When the two layers were compared, many of the residents' points aligned with the areas the model predicted to be noisiest. This shows that the model fits what residents actually experience, which makes the advice to the client stronger.

From these 3D scenes we also produced two videos comparing traffic and noise impact. The videos show how the noise pollution spreads out in the area and how it changes over the course of the day. One video covers weekdays and the other covers the weekend. Comparing them reveals a difference between weekday and weekend noise levels where the weekday has higher noise pollution.

Before modeling, we cleaned the dataset by removing the period from April 25 to May 5th. The May holiday produced traffic volumes that were not representative of a normal period and would have distorted the results. The results are therefore modelled scenarios, since the traffic data is input, and the noise is calculated rather than measured directly. We made several deliberate designs choices to keep the model accurate and believable. Because the two directions of the road carry different amounts of traffic, we modelled the cars going towards Haps separately from those going towards Mill. Combining them would have smoothed out and hidden the difference. We also created separate scenes for weekdays and weekends, because the amount of traffic differs between them, which also changes the noise.

Dashboards

To demonstrate the results of the maptionnaire and the telraam sensors, three different dashboards were developed: Noise nuisance, road crossing and telraam data. The dashboards ensure that information is easily visible in a centralized location and that users can scan through the collected data. The content of the dashboards was made based on user personas and the MoSCoW prioritization matrix. The personas and the matrix determined that the dashboard needed to display information on vehicle distribution, traffic trends over time, peak hours, vehicle count, vehicle types, traffic volume per period and total responses. Due to the maptionnaire consisting of two parts the decision was made to split the data in to two seperate dashboards. This was done to further focus on the data acquired for each section. The required items were then distributed among the three dashboards based on availability, relevance, and the dashboard's specific objective. To display the dashboard items, data expressions were used to gather the required information from the maps connected CSV files. This was done due to the CSV file not being able to display certain information directly. The data expression allows the data to be combined and filtered withouth changing the original file.

The noise nuisance dashboard consists of data from the maptionnaire and features four sections: a map of recorded noise nuisance, the type of noise nuisance, the period and time of nuisance, and the impact of noise nuisance on daily life. The experienced noise nuisance is displayed in a gauge with the amount ranging from the lowest to the highest. Users can switch through the options between weekday/weekend and daytime/nighttime. The data for the map is aggregated in to clusters and is shown as a heatmap. The different clusters display the density of responses with yellow being high density and purple being low density. This makes it easy for users to identify areas that experience the most noise nuisance. The type of noise nuisance is displayed in a pie chart using percentages and gives an immediate overview on the size of each category. Users can hover over the individual slices to see the total amount of respondants for each type. Due to the question regarding the impact of noise nuisance on daily life being a slider question with responses ranging from 0 to 100 it was chosen to display the data in a line diagram. The responses are displayed in a line and shows the severity of noise based on the total amount of respondants.

The road crossing dashboard also uses data from the maptionnaire and consists of four sections: a map displaying common crossing points, a pie chart which shows how easy it is to cross the road, a graph that shows the variables that pose a risk to pedestrians crossing the road, and two line diagrams that depict the sense of safety when crossing and resident perception scores regarding village traffic. In the road crossing dashboard users can click on one of the piechart slices to filter the map and graphs based on the answers chosen. A small text underneath the pie chart informs users of this possibility. For this dashboard a heatmap was also chosen to show the most common crossing points. The data from the questions regarding sense of safety and perception of village traffic was portrayed in a line diagram for the same reasons as the noise nuisance dashboard, due to it being a way to display continuous data trends across a scale. Variables posing a risk was displayed in a bar chart to let the user visualize and compare the different options against one another. This highlights which variables are perceived as the most dangerous at a single glance.

The telraam dashboards consisted of seven sections parts: vehicle amount, the number of days measured, sensor location map, vehicle types, vehicle speed, and a graph depicting the amount of vehicles entering and leaving Sint Hubert. This dashboard includes a selector which lets the user filter the data to a certain day of the week. The graphs are then updated and display data corelating to the chosen day. This allows users to compare traffic patterns across different days. When no option is chosen in the selector, the graphs and indicators show the total amount for each section during the whole measurement period. The average vehicle speed is shown in a bar chart due to the data being split in different speed intervals. The colors in the graph become more gradual as the speed increases to communicate the severity of the traffic speeds with the user. The indicator visualizes the amount of vehicles captured during the monitoring period. This gives the user an idea of the sample size and average traffic volume for each day. For the data regarding information on vehicles entering and leaving Sint Hubert a bar chart was chosen for the same reason as the bar chart for vehicle speed. The bar chart organizes the different vehicle types in categories that can easily be compared to each other.

Experience builder & Storytelling

The experience builder is used to display the results and foundings of the case study due to its flexibility and customizable layout options. The users are able to move through sections in a fixed order, with each section focusing on a specific part of the data. This makes it easier for users to first understand each topic separately before correlating them into a single picture. The experience builder features 6 pages: homepage, introduction, interactive map, dashboards, comparison and insights.

The homepage consists of a short introduction on the case study and presents the main research questions, methodology and tools used. Through storytelling it presents an image of Sint Hubert and how the N264 impacts the area and its residents. This gives users an overview/context of the case study and the current situation in the village. The homepage consists of two navigation elements: an arrow button displayed at the bottom and a navigation bar at the top of the screen. The color of the navigation elements change when hovered over or when the user is on a page. This lets users know that the elements are clickable and it also serves to indicate the users current location in the experience builder. Additionaly the home page also features the logo of the has and Sint Hubert, a contact button and a link to the facebook page of Sint Hubert.

The introduction page features a storymap that provides information on Sint Hubert. It consists of demographics, historical timeline, surrounding areas, pollution, safety concerns regarding the N264, data collection methods used in the case study and a bibliography. Furthermore maps and visuals are included to support the information being presented. The introduction page serves as a mean to provide a better understanding of the history and issue being researched to people who are unfamiliar with the area. The topics for the experience builder were created based on the persona's, the MoSCoW prioritization matrix and the wireframes.

The interactive map page features the total number of maptionnaire respondants and four different maps containing data from the maptionnaire and car accident records. Users can click through and view a brief explanation of each map and the data being presented. Each map contains a zoom function, home button, and a legend. The legend ensures that users get a better understanding of the symbology used and the home button ensures that users can easily return to the main extent if they become lost. The map on noise disturbance and dangerous areas is displayed as a heat map while the road crossing and accidents map is displayed as points on the map. This allows users to see the exact location of crossing points, accident locations and the corresponding severity.

The dashboard page serves as a centralized area for the three dashboards on noise nuisance, road crossing and telraam data. This reduces cognitive load on the user, prevents overcrowding of the navigation bar and preserves a clean user interface. On this page each dashboard contains a brief explanation of the visualized data, along with a navigation button to the corresponding dashboard.

The comparison page features maps and graphs that show the comparison between hard and soft data collected during this case study. It includes maps created with the tygron platform that illustrates traffic difference between weekdays and weekend over a 24 hour cycle. The graphs feature data on the hourly truck volume traveling to the west and east. This page is meant to combine the data collected and evaluate whether the maps of the tygron platform align with the data collected and to highlight the differences or changes.

The insights page features a quick overview of the statistics and key findings paired with a storymap covering the results of traffic, noise pollution and the maptionnaire. The storymap also features the final conclusion of the case study and recommendations for future implementations. This page serves as a closing page and provides an overview of what has been achieved with the case study and the steps that need to be taken moving forward.

Results and Recommendations:

Traffic volume & flow (sensor data)

The sensor data from the three Telraam sensors shows clear patterns in truck movements in both directions between Haps and Mill.

In the direction from Haps to Mill, the average number of trucks is highest at around 10:00 on weekdays, with approximately 202 trucks recorded. Between 07:00 and 16:00, the number generally stays between 100 and 150 trucks. In the weekend, the peak occurs earlier, around 09:00, with an average of 66 trucks, after which the numbers gradually decrease throughout the day.

In the opposite direction, from Mill to Haps, the pattern is different. On weekdays, the highest number is reached around 16:00, with about 68 trucks. Between 07:00 and 09:00 the number is around 45, while between 11:00 and 16:00 it fluctuates between 50 and 65 trucks. In the weekend, the peak is around 11:00, with about 37 trucks, followed by a gradual decrease.

Overall, the Haps to Mill direction shows higher truck volumes than the reverse direction. This is likely linked to the presence of several distribution centres in Haps, which generate freight traffic towards the A50 near Uden. The other reason for higher truck volumes from haps to mill is due to polish/ foreign trucks being able to conduct 3 times in the netherlands. These trucks come in via Gelderland and go to other cities such as rotterdam, etc and exit the country via other transit points (CBS, 2025). The data also shows a clear difference between weekdays and weekends, with significantly lower volumes during the weekend and slightly shifted peak hours.

Resident perception

The residents' opinions were collected through a Maptionnaire survey. In total, 188 people completed the Maptionnaire, while 244 people opened the survey at least once. Not everyone who started the survey actually finished it.

The responses came in a few clear waves. The first and biggest wave was around April 25, when 36 people filled in the survey. After that, there was another smaller peak on May 5 with 11 responses. Later, there were two smaller waves with about five responses each, which were spread out over the rest of the survey period.

Noise

When asked whether they experience noise disturbance from the N264, most respondents (72 people, around 42%) said they do not experience any noise disturbance. 55 respondents (about 32%) do experience noise disturbance, while 44 respondents (around 26%) said they sometimes experience it.

Main source of disturbance: freight traffic

Most respondents see freight traffic as the main source of noise. 96 out of 101 respondents mentioned this. In many cases, it is not the only source, but it is usually combined with other traffic.

Other sources mentioned

Besides freight traffic, cars and motorcycles are also often mentioned:

- Cars: 44 respondents experience noise from passenger cars
- Motorcycles: 42 respondents experience disturbance from motorcycles
- Other: 10 respondents mentioned other types of sources that do not fit in the given categories

Summary of extra open answers (10 responses)

A small group of respondents gave more detailed explanations in an open question about noise sources.

Agricultural traffic

The most common point here is agricultural traffic. 7 out of 10 respondents mention tractors, farm machinery, and other agricultural vehicles as a source of noise.

Heavy traffic and engine noise

Several respondents complain about noise from heavy vehicles and engines that are not well muffled. They mention things like accelerating, braking, and low-frequency engine noise. Some also find the sound of flapping truck tarpaulins annoying.

Traffic flow on certain routes

A few respondents mention that there is a constant flow of traffic between the A73 and A50, which leads to a lot of noise in general.

Environmental factors

Some respondents say that wind direction makes a difference, since noise can carry further into residential areas depending on the conditions.

Possible solution

One respondent suggests using noise-reducing asphalt to reduce traffic noise.

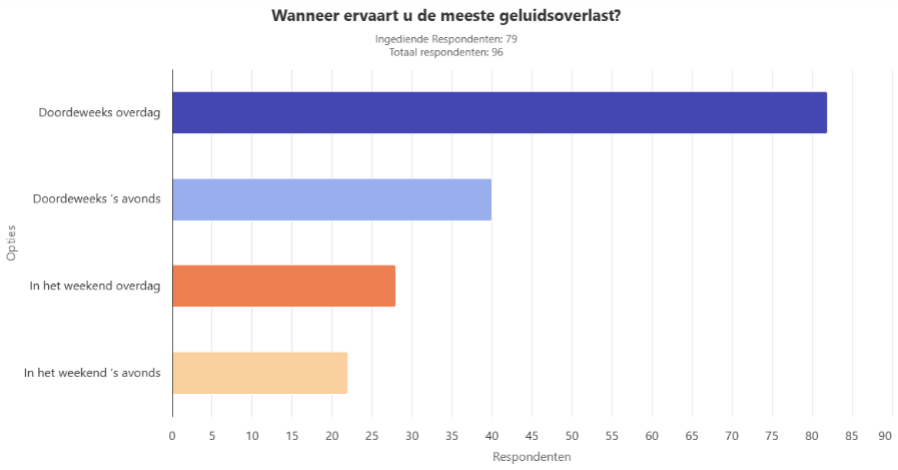

Figure (8) – Noise Nuisance Timing Questionnaire Graph

Noise disturbance affecting daily life

The responses show a wide spread in how people experience noise in daily life. About 15% gave a score of 0, meaning no impact at all. A lot of answers are also in the lower range (1–5), which suggests the impact is small for many people.

On the other side, a smaller group reports a lot of disturbance. Seven people gave the maximum score of 100, and there are also several high scores between 80 and 98. This shows that for some residents, noise really affects their daily life.

Overall, the results are quite split. Many people report little to no impact, while another group clearly experiences a lot of disturbance. There are not many answers in the middle, so moderate experiences seem less common.

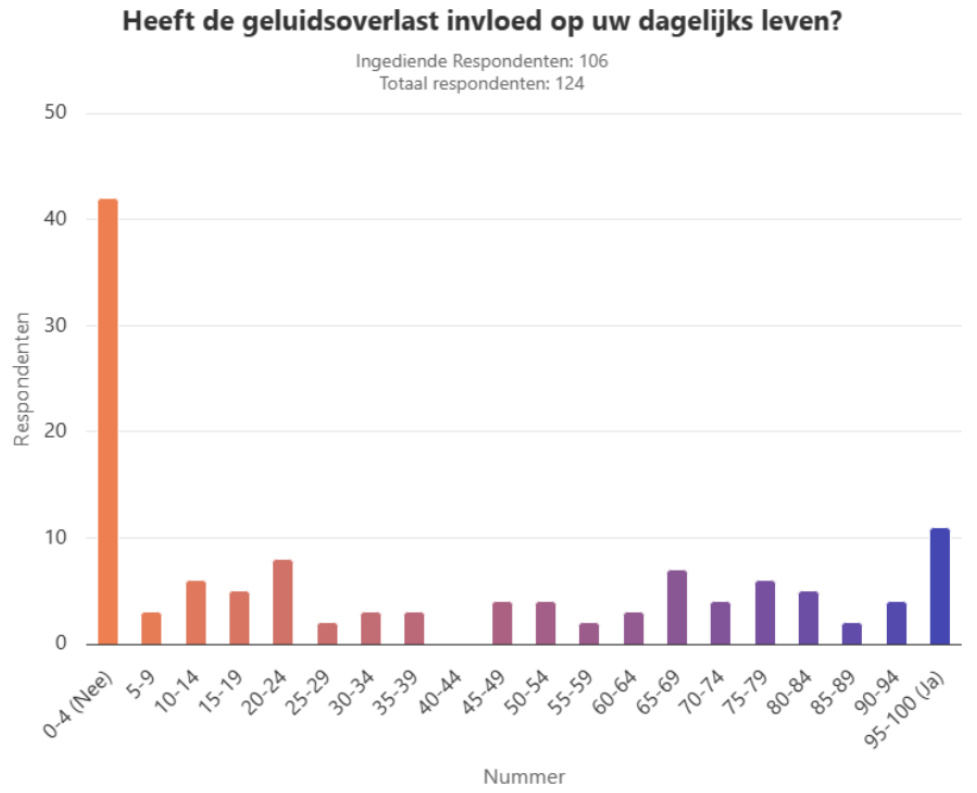

Figure (9) – Noise Nuisance Impact on Daily Life Questionnaire Graph

Crossing the N264

The responses show that many people experience difficulties when crossing the N264. The most common answer was “No”. In total, 70 respondents (about 43.5%) said they do not find it easy to cross the road, which is the largest group.

A smaller group, 48 respondents (around 29.8%), answered “Sometimes”. This suggests that how easy it is to cross depends on things like traffic at that moment or the exact place along the road.

Only 43 respondents (about 26.7%) said they find it easy to cross the N264. This is the smallest group in the results.

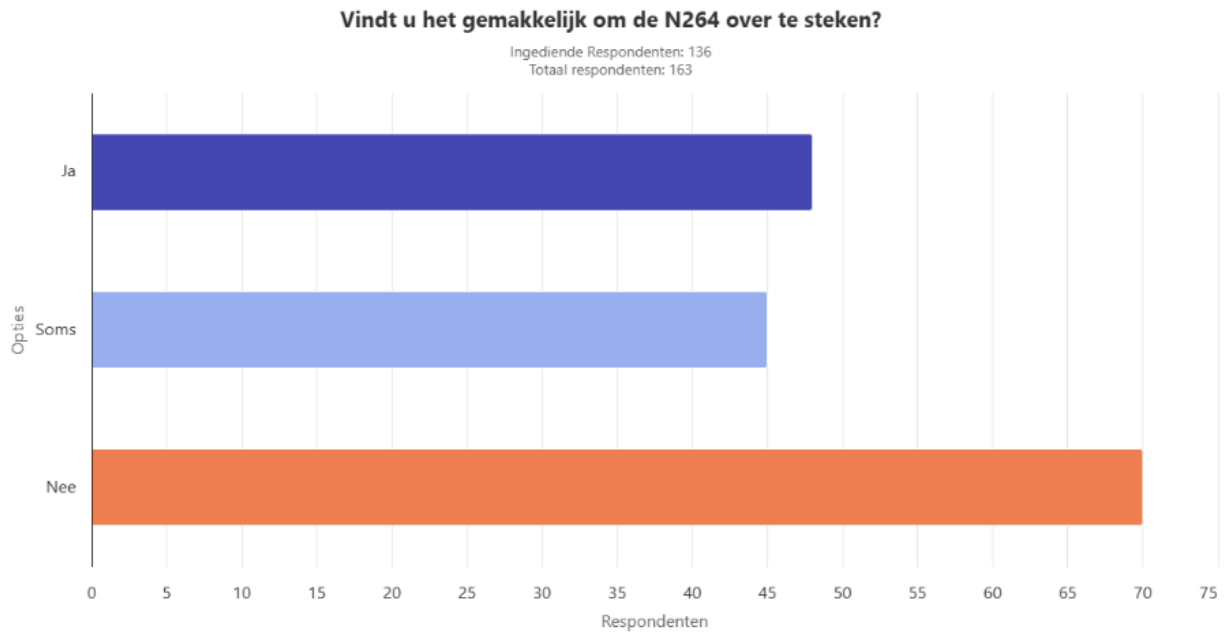

Figure (10) – Walkability Crossing Questionnaire Graph

Why crossing the N264 is not easy

Most respondents say the traffic situation is the main problem. The most common reason for finding it difficult to cross the N264 is the amount of traffic. Many people describe the road as very busy, which leads to long waiting times and a feeling that it is not very safe.

Freight traffic is also mentioned a lot. Several respondents say that the number of trucks makes it harder to see what is going on and adds to the sense of unsafe conditions.

Another point that comes up often is speed. Many people feel that vehicles are driving too fast, which makes it harder to judge when it is safe to cross or merge into traffic.

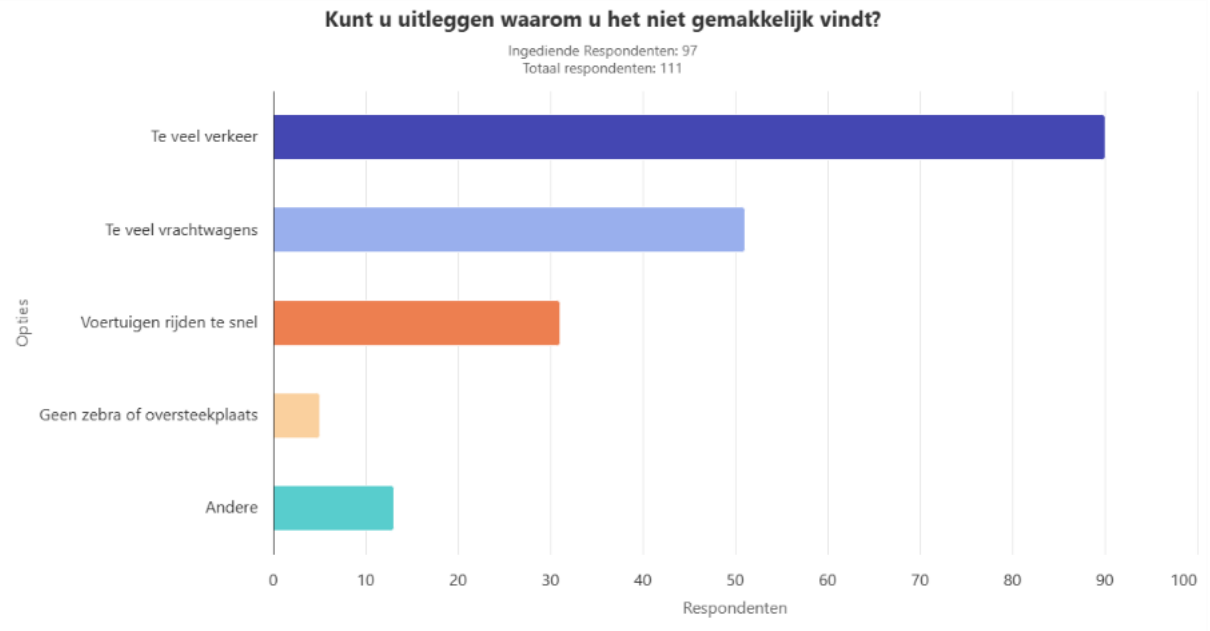

Figure (11) – Walkability Crossing Explanation Questionnaire Graph

Additional specific concerns

In addition to the main categories, respondents also mention a few more specific problems with the traffic situation.

Some people point out issues at pedestrian crossings. They say drivers do not always stop at zebra crossings. A few crossings are also described as hard to see, for example because of low sun or because they are placed in unclear spots.

Rush hour is also mentioned often. During the morning and evening peak, the road is seen as very busy, which makes it difficult to cross or enter safely.

There are also comments about confusing junctions, especially around Voortsestraat. These places are described as unclear and difficult to judge when it comes to safety.

Finally, a few respondents mention problems with the road layout itself. They talk about narrow entry lanes and changes after recent upgrades, which make it harder to estimate the speed of oncoming traffic.

What improvements could be made to the road?

Many respondents feel that there needs to be a more permanent solution for through traffic. The most common suggestions are a truck ban and building a bypass road.

Proposed structural measures

A bypass road is widely supported. Many respondents suggest redirecting traffic around the village, similar to what has been done in Haps. Some specific ideas include extending the A73 towards the A50 or creating a connection in the direction of Erica.

A truck ban is the most frequently chosen option in the multiple-choice question. Many residents say they experience a lot of disturbance from heavy goods vehicles driving through the village centre.

In addition, some respondents suggest reducing through traffic more broadly. The idea is to make the road less attractive as a transit route so drivers will naturally choose other routes instead.

Traffic safety and road design

There is also strong support for lowering the speed limit. Respondents also call for more enforcement, since current measures like chicanes are sometimes seen as leading to risky driving instead of improving safety.

Pedestrian crossings are another concern. Several respondents say there should be more zebra crossings, and that they should be better lit. They specifically mention locations near the former jeweller's shop and the Nimrod side road.

Finally, some residents are critical of the current road design. They describe the road as too narrow for heavy goods vehicles and agricultural traffic, which in some cases leads to unsafe situations. Some also comment on the appearance of the road, saying the landscaping and greenery could be improved.

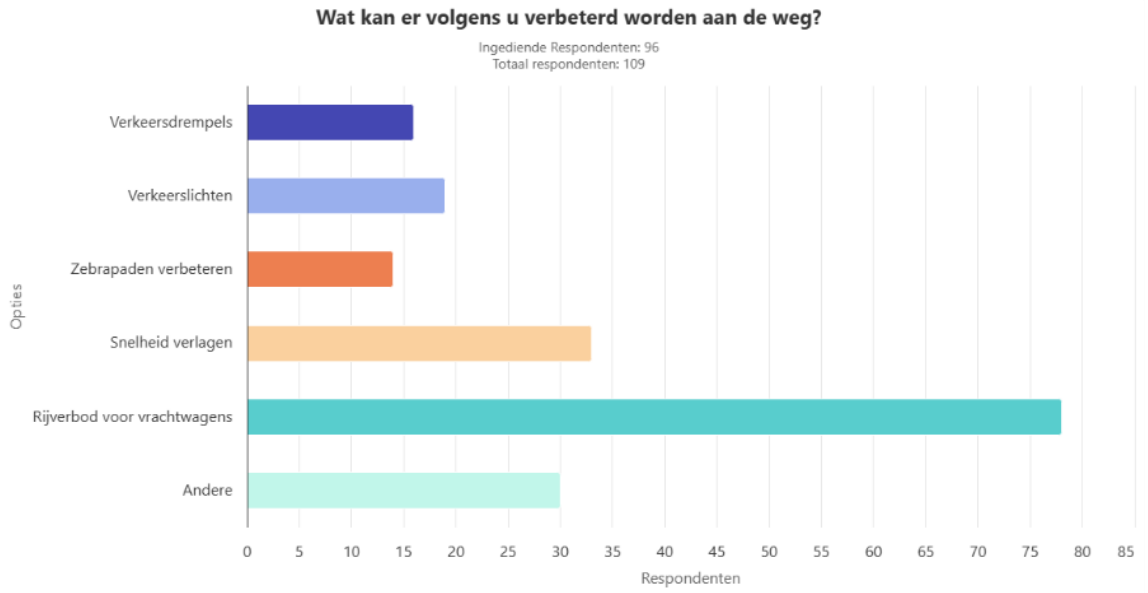

Figure (12) – Road Improvements Questionnaire Graph

Strong demand for a bypass road

The most common suggestion is building a bypass road around the village to reduce through traffic. Several respondents refer to the solution in Haps as an example. They suggest rerouting the road, for example towards the A73, A50, so that freight and through traffic no longer have to pass through the village centre.

Concerns about traffic safety and road design

Many participants are not satisfied with the current road layout. The roads are often described as too narrow for trucks and agricultural vehicles, which in some cases leads to unsafe situations and unnecessary braking and accelerating.

Some respondents also say that the bends and chicanes do not always work as intended. Instead of improving safety, they are sometimes seen as unsafe or even as encouraging speeding.

There is also some criticism of the appearance of the road, including the planting and the general visual design.

Request for improved crossings and enforcement

Safe pedestrian crossings are an important concern for respondents. They call for more zebra crossings, especially near the Nimrod side road and the former Verlinden jeweller's shop.

Respondents also stress the need for better enforcement of speed limits and for drivers to respect pedestrian priority at crossings. Some also suggest more speed controls to deal with speeding behaviour.

Restrictions on freight traffic

Besides a full bypass road, there is also strong support for limiting freight traffic in the village centre. Heavy goods vehicles are seen as a major source of nuisance and congestion.

Diverging opinions

Not all respondents have the same view. One respondent says they do not experience any nuisance and feel the recent changes to the road are enough. Another respondent prefers the old layout of the road, without the current sharp bends.

How do you experience traffic in the village?

General perception

Overall, the perception of traffic in the village is skewed towards the higher end of the scale. The average score is about 74, which suggests that most respondents experience the traffic as heavy, busy, or very present.

Distribution of scores

The scores are distributed as follows:

The largest group falls in the high range (75–100), with around 60% of respondents. The score of 100 is the most common single answer, chosen by 26 respondents. This suggests that a relatively large group experiences the traffic as very intense.

About 25% of respondents fall in the moderate range (40–74). They experience the traffic as moderately to strongly disruptive. A smaller group, around 15%, reports low scores (0–39). In this group, three respondents gave a score of 0, meaning they do not experience traffic impact or see it as very limited.

Notable observations

The distribution is clearly concentrated at the high end of the scale. The scores are not evenly spread, but instead most respondents fall in the highest range (75–100). There is also a clear peak at the maximum score of 100.

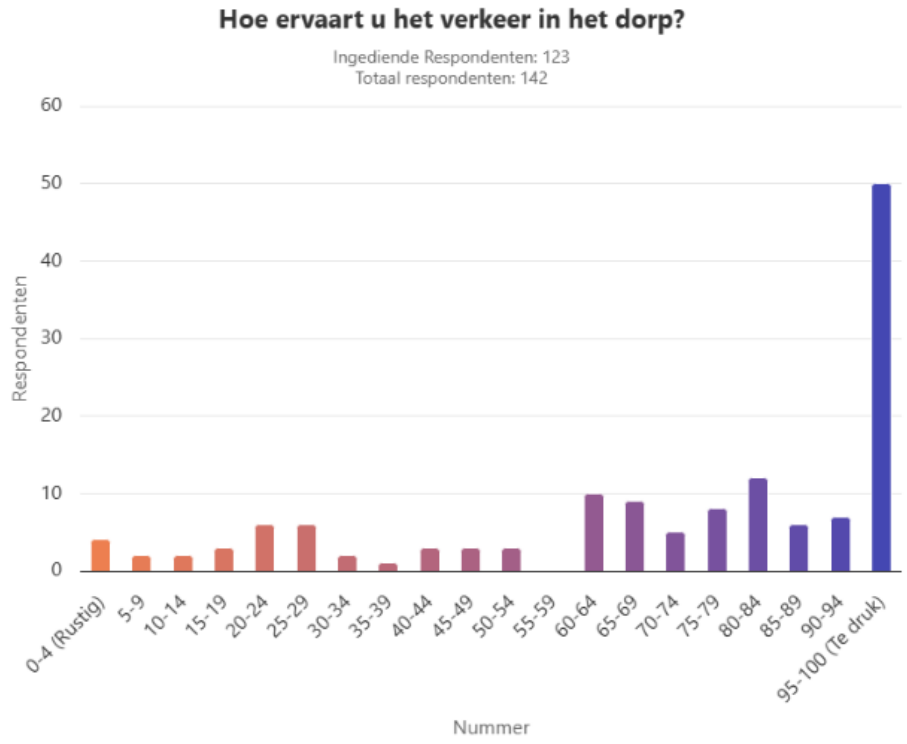

Figure (13) – Traffic Experience in Sint Hubert Questionnaire Graph

How safe do you feel when crossing the road?

The average safety score is about 61 out of 100. This is slightly above the middle of the scale, but the individual responses show a more mixed picture, with quite a lot of variation between respondents.

Key findings

A relatively large group of respondents reports a high sense of safety. 18 participants gave the maximum score of 100, and overall about 40% of respondents gave a score of 80 or higher. This suggests that a substantial group feels very safe when crossing the road.

At the other end of the scale, there is also a clear group that feels unsafe. 10 respondents gave a score of 0, which indicates a very low sense of safety. In total, around 18% of respondents gave a score of 20 or lower.

Distribution and pattern

The results suggest a somewhat polarised distribution. Responses tend to cluster at the extremes (very safe or very unsafe), as well as in the higher mid-range between 60 and 80. Relatively few respondents selected scores around 50, indicating that moderate perceptions are less common.

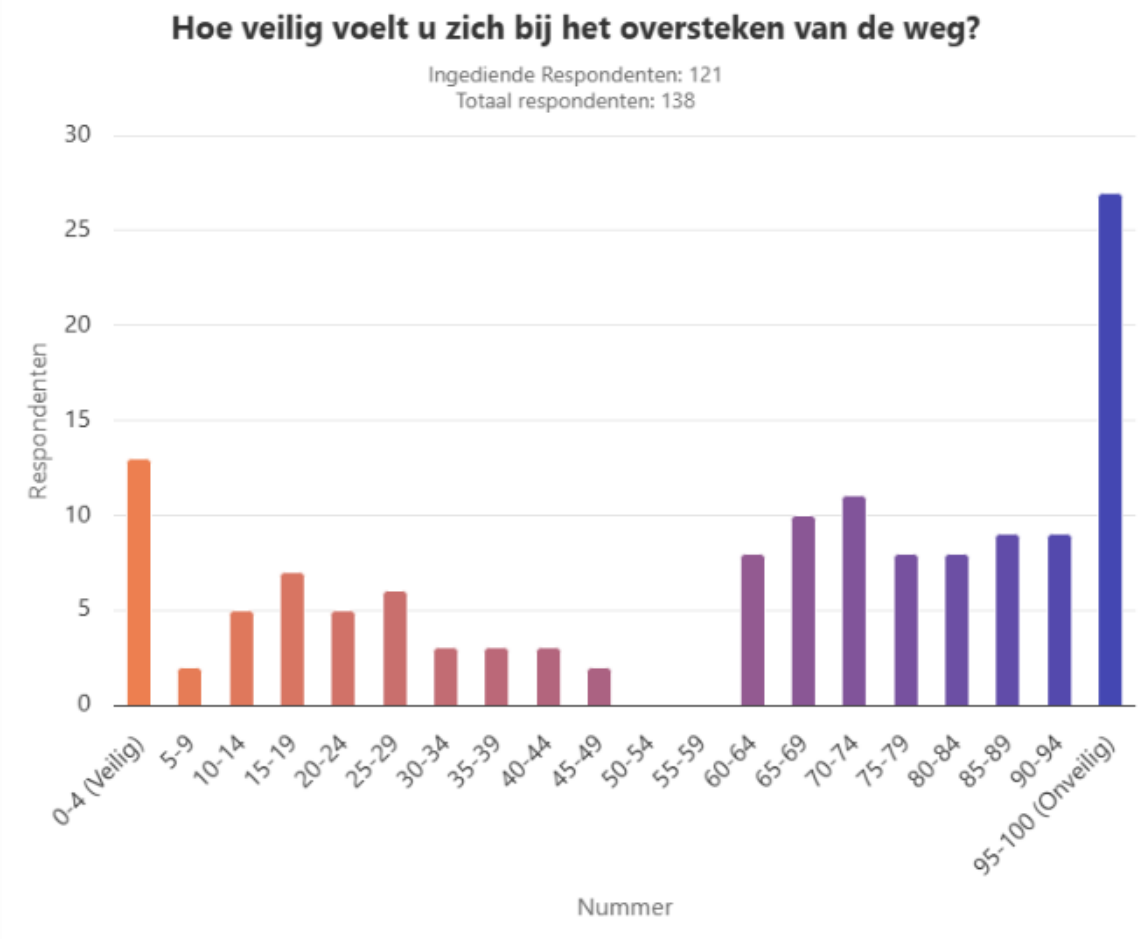

Figure (14) – Safety Road Crossing Questionnaire Graph

Background information

The vast majority of respondents have lived in Sint Hubert for a long time. More than half of the participants (78 people) indicated that they have lived in the village for over 30 years. The remaining respondents are fairly evenly spread across the other categories, with 35 people living there for less than 10 years and 31 people having lived there between 10 and 30 years.

Age distribution of respondents

The questionnaire was mainly completed by residents aged 45 and older. The largest group of respondents (59 people) falls in the 45–64 age group. The 65+ group is also well represented, with 46 respondents. In comparison, 36 participants are between 25 and 44 years old. The youngest group (under 24 years old) is very small, with only 3 respondents taking part in the study.

General conclusion

The study mainly reflects the views of long-term and older residents of Sint Hubert. Younger residents and people who have lived in the village for less than 10 years are less represented in the dataset.

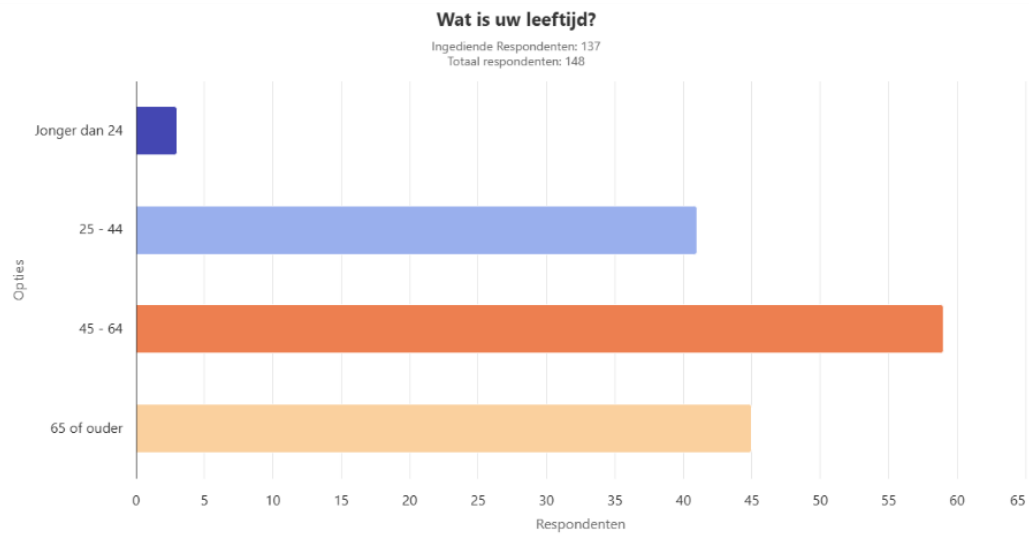

Figure (15) – Age Questionnaire Graph

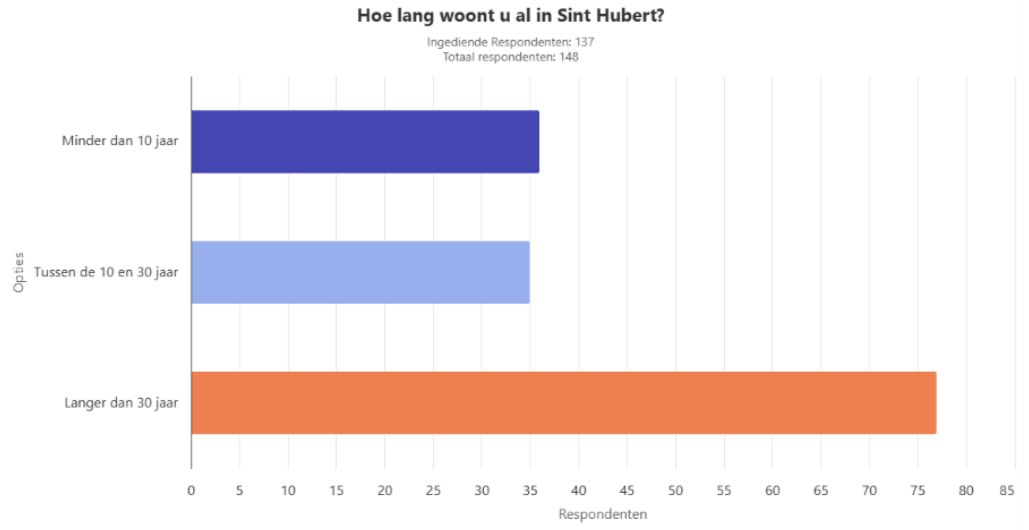

Figure (16) – Inhabitation Questionnaire Graph

Residential location and perceived disturbance

Residential distribution of respondents

Most respondents live in the northern part of the study area. The distribution across the different zones is as follows:

Area A (light blue) has the most respondents. Area B (blue) and Area C (orange) also have a relatively large number of residents. Area D (green) and Area E (purple) have the fewest respondents in the dataset.

Locations of noise disturbance

Respondents could select multiple places where they experience noise disturbance. The garden and bedroom are mentioned most often.

The back garden is by far the most common location where people report disturbance.

The bedroom and front garden are also mentioned a lot, which suggests that outside noise often affects indoor spaces as well.

The living room is also mentioned by quite a number of respondents.

Under “other”, respondents give different answers, often referring to being outside (like walking or cycling) or saying they do not experience any disturbance.

The kitchen and hallway are only mentioned by a small group of respondents.

Little or no disturbance

A notable share of respondents say they experience little to no noise disturbance from the N264. Some mention that other nearby roads cause more noise, while others say they do not find the road disturbing at all.

Specific sources of noise

When disturbance is experienced, it is often linked to specific situations or sources:

- Vehicle types: accelerating engines and emergency sirens are most frequently mentioned as disturbing.
- Wind direction: several respondents say that how much they are bothered depends on the wind.
- Outdoor exposure: disturbance is mostly experienced outside, for example while cycling or walking near the road or in the village centre, rather than indoors.
- Fine dust: a small number of respondents also mention fine dust as an additional negative effect of the road.

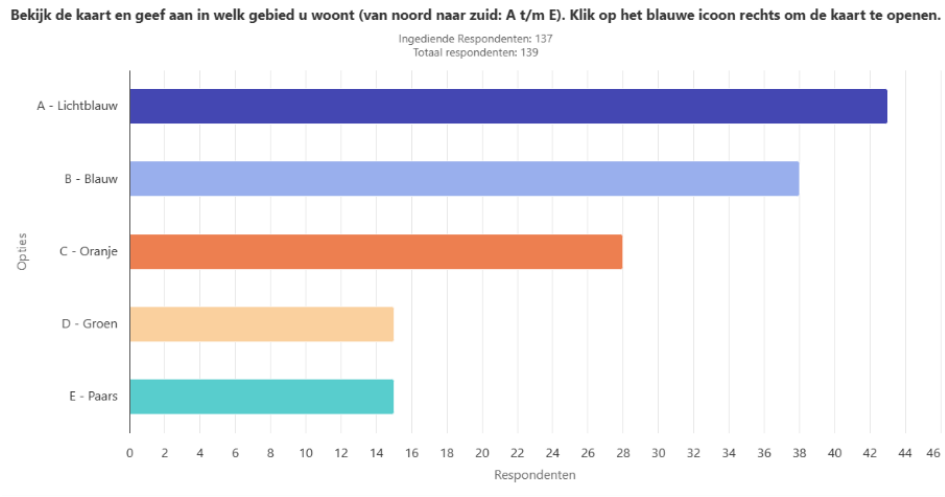

Figure (17) – Sint-Hubert Questionnaire Buffer Graph

Figure (18) – Sint-Hubert Questionnaire Buffer Map

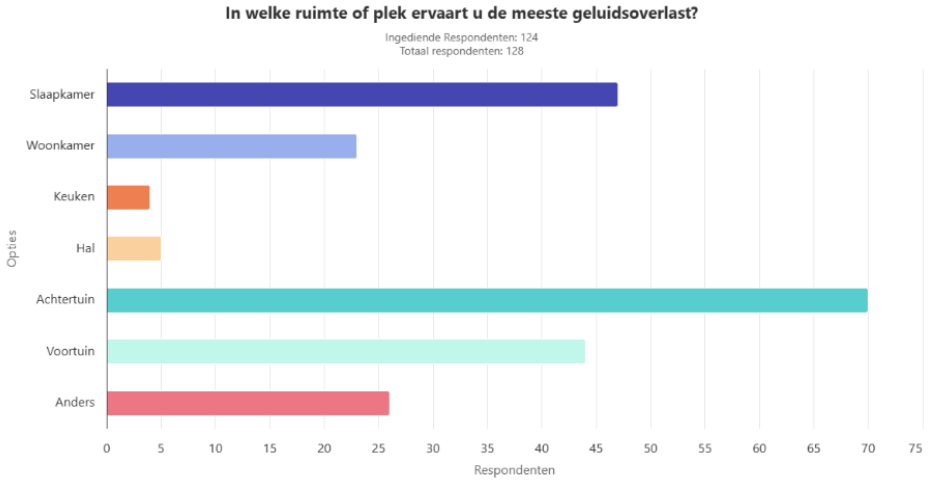

Figure (19) – Noise Nuisance Location Questionnaire Graph

Credit for the community center

Most respondents (86, about 64%) were not interested. A smaller group (48, about 36%) did indicate interest in receiving credit for use in the community centre.

Additional comments

Respondents were also asked if they had any additional comments on the topic.

Traffic volume and freight transport

The most frequently mentioned concern is the high amount of traffic, especially heavy goods vehicles. Many respondents see the road as a busy through-route between the A73 and A50 that does not really fit the village setting. A lot of people therefore call for a ban on through freight traffic, or for it to be redirected away from the village. Rush hour is often described as a time when it is almost impossible to safely enter the road from side streets.

Traffic safety and speed

Many residents are concerned about road safety, especially when crossing the road. They say drivers often don't stop at pedestrian crossings, or that the crossings are hard to see. The situation is seen as especially risky for children.

Speeding is also mentioned a lot as an ongoing problem, both for cars and trucks. Many respondents suggest more enforcement, for example speed cameras, as a possible solution.

Noise, vibrations and environment

Noise pollution is widely reported as a major issue. Residents say they often cannot open their windows or use their gardens comfortably. Besides engine noise, there are also complaints about honking trucks and vibrations in homes since the recent roadworks. Air pollution, especially fine dust and its impact on health and gardens, is also mentioned several times.

Maintenance and road design

There is quite a bit of criticism about the recent redesign of the road. Some respondents call it "wasted money", saying it hasn't solved the main problems like traffic volume and speeding. The maintenance of greenery is also criticised. People mention overgrown vegetation along the verges, which makes the area look untidy. Tall plants are also said to block visibility at crossings and side roads, which can create safety risks.

Possible solutions

Views on a bypass road are mixed. Many see it as the only real long-term solution to improve liveability, while others worry it would just move the problem to nearby rural areas. Other suggestions include:

- Building a tunnel under the village
- Installing traffic lights at pedestrian crossings
- Extending the A77 towards the A50 to fully relieve the village

Nuance

Not all respondents experience problems. A small group reports no issues or says they are used to the current road conditions.

Positive aspects of the N264 in daily life

Accessibility and connectivity

The most commonly mentioned advantage is the good connectivity and quick access to the A50 and A73, as well as nearby towns like Uden, Haps, and Mill. Many respondents appreciate being able to reach their destination or workplace quickly. The road is seen as an important regional route within the Land van Cuijk

Infrastructure and road design

Several residents are positive about the recent road improvements. The green design, including planted central reservations with flowers and trees, is appreciated for its appearance. The use of low-noise asphalt and clear signage is also mentioned as a positive point.

Safety for cyclists and pedestrians

Some respondents mention improvements for cyclists and pedestrians. The cycle paths are described as wide and comfortable, and the central crossing areas with waiting zones are seen as an improvement by some people.

Village vitality

A number of respondents see the traffic as a sign of vitality. Instead of being purely negative, they say it stops the village from becoming “dead” and keeps Sint Hubert visible and active. Some also see it as good for local businesses and the village’s profile.

Public transport

A small number of respondents specifically mention bus connections.

Negative or sceptical views

A notable share of respondents (about a quarter) say they do not see any positive aspects. They simply answer “no” or “none” or say that livability and safety have got worse because of traffic levels and the road design (for example, tall hedges blocking visibility). For this group, the disadvantages outweigh the benefits of accessibility.

Objective vs subjective data

The results show a clear relationship between the objective sensor data and the subjective responses from residents. The Telraam and environmental sensors indicate that the N264 carries a continuous and relatively high volume of traffic, with clear peak periods during the day and a constant presence of vehicles throughout the rest of the day.

The Maptionnaire survey results reflect this same general pattern, as many respondents describe the road as busy and heavily used. High levels of perceived traffic intensity, noise disturbance, and safety concerns correspond with the objectively measured traffic flow and environmental impact.

At the same time, the subjective data shows a stronger emotional response than the sensor data alone suggests. While the objective measurements describe traffic volume and noise levels, residents frequently report feelings of insecurity, annoyance, and reduced livability. This indicates that the perceived impact of the road is influenced not only by measured exposure, but also by factors such as road design, speed perception, and personal experience.

Overall, the comparison shows consistency between measured traffic conditions and resident perceptions but also highlights that subjective impact is experienced more strongly than what objective data alone would indicate.

Discussion

To check whether the sensors were working correctly, a manual count was carried out. This matched the sensor data exactly. However, it is still possible that some vehicles were missed, and the measurement period is not representative of the whole year.

Because it is a relatively small village that mainly functions as a through-route, we considered three sensors to be sufficient. These were placed at different locations, although unfortunately two of the sensors did not operate properly for the full duration of the study.

The results clearly show a high number of freight vehicles. Since the road runs directly through the village, it is understandable that residents experience this as disturbing. During our own site visits as well, we observed that trucks were passing continuously.

The sensor data formed an important part of this research and was checked again to ensure reliability. However, the data does not provide all the desired information, such as detailed vehicle characteristics. A combination with other data sources could have provided additional insights, but much of this information had already been covered through Tygron and existing government data.

The sensors also collected data during the May holiday period, which may have slightly influenced the observed patterns. Traffic behavior during holiday periods can differ from regular weeks, meaning the results may not fully reflect typical weekday conditions.

In addition, no use was made of the “Samen Meten” data. This was mainly because we did not see added value for our analysis, as most of the relevant insights were already derived from the sensor data. It was also not entirely clear how both datasets could be meaningfully linked within this study. As a result, the focus was placed on completing a consistent and complete dataset using the available sensor information.

Overall, the sensor data formed the main basis of the analysis. While this provides clear insights into traffic volumes and patterns, it is important to note that the dataset has limitations. The measurement period is relatively short and may not represent long-term conditions, and some external data sources that could have provided additional context were not included in the final analysis.

Conclusion

This study set out to understand how the N264 affects Sint-Hubert, focusing on traffic, noise and road safety, and how these are experienced by residents.

The results show a road that is structurally very busy. Over a 44-day period, more than 378,600 vehicles were recorded, including over 24,000 heavy goods vehicles. Traffic is not evenly spread across the day, but clearly peaks during weekday morning and afternoon rush hours. Outside these peaks, the road remains continuously active, confirming that the N264 functions as a regional transit and freight route rather than a local village road.

Heavy goods traffic is a consistent part of this pattern and is closely linked to logistics activity in the wider area, especially around Haps. The directional flow of trucks also changes throughout the day, which reflects commuting and freight schedules rather than local movement within the village itself.

When this is compared with the survey results, a clear pattern appears. Many residents experience the N264 as busy and intrusive in daily life. Noise disturbance is widely reported, and a large share of respondents indicate that they have difficulty crossing the road safely. Almost half of the participants say they feel unsafe when crossing, mainly due to traffic volume, speeding, and the presence of trucks. The locations where people report problems also match the busiest and most exposed parts of the road.

The same link is visible in the timing of complaints. Peak nuisance periods in the survey align with the highest measured traffic and freight volumes in the sensor data. This strengthens the connection between heavy traffic and how the road is experienced by residents.

At the same time, not all residents report problems. A smaller group experiences little to no disturbance, often depending on where they live or how well their homes are insulated. These differences show that the impact of the road is uneven across the village, but still clearly present overall.

Some limitations should be taken into account. Part of the sensor setup did not function as intended, which limited full directional comparison. In addition, the measurement period included holiday weeks, which may have influenced traffic patterns slightly. Even so, the different data sources still show a consistent overall picture.

In conclusion, the N264 plays an important role as a regional connection, but it also has a clear and continuous impact on the liveability of Sint-Hubert. The main issues are not only the total amount of traffic, but especially the combination of heavy goods vehicles, peak-hour congestion, and the timing of traffic in relation to daily village life. These factors together explain why the road is widely experienced as noisy, busy, and unsafe.

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