Combined air quality and noise evaluation of transport policies: methodology and feedbacks

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Abstract

This article is about the evaluation of transport policies, for example, relating to PPA 'Atmosfer Protection Plan'.

In France, the environmental assessment includes the four key principles of the code of the environment (Article L. 110-1): the principles of integration, participation, precaution and prevention. The negative effects of a project must be avoided, reduced or compensated.

The evaluation of transport policies is really important, first to know the expected impacts on population exposition and then to quantify the real efficacy of these policies. Few publications and feedbacks are published about methodology for environmental evaluation of transport policies. One other challenge of these evaluations is to reach a coherence between air quality and noise evaluation, by using similar methodologies.

The article describes necessary input data, models used and common methodology for the two thematics. Difficulties and ways to improve methodology will be traited from feedback on two operational projects. The first project studied was evaluated from modeling and the second one from measurements.

The first project concerns the PPA (Atmosfer Protection Plan) of the Île-de-France region which mentions that road transport is responsible for 54% of NOx emissions, 25% of PM10 and PM2.5. Trucks are contributing to 30 and 10% of these emissions respectively. Restrictions on heavy trucks transit in the dense heart of the Paris agglomeration exist as a regulatory measure in case of pollution peak. This policy has to be used continuously. Cerema has established a methodology to measure the effects of these project on noise and pollutants, in correlation with traffic data and based on air and noise modellisation results.

The second project is about VDTB (Dedicated ways for Taxis and Bus) on roadways.The VDTB have vocation to be developed as part of Master Plans of Transportation. The DRIEA has planned to set up an experimental VDTB on the highway A1, to facilitate the connection between Roissy airport and Paris. The project consists in dedicating the left lane for taxis and buses, between Bourget and Landy tunnel, direction province-Paris, from 06:30 to 10 am every day.

In this second project, the use of emission models is really impossible to evaluate air and noise impacts because of the difficulties for having a prospective scenario on traffic data; the evaluation is based on measurements.

This work should answer to these important questions about transport policies evaluation:

-What are the important data to use for a good evaluation on air quality and noise?

-How can we improve the common methodology about air quality and noise impacts?

Keywords *: evaluation, impact, transport policies, environment, traffic, air quality, noise*

Résumé

Le sujet de cet article est l'évaluation des politiques de transports à travers d'exemples comme un Plan de Protection de l'Atmosphère.

En France, l'évaluation environnementale comprend les quatre principes clés du code de l'environnement (article L. 110-1) : les principes d'intégration, de participation, de précaution et de prévention. Les effets négatifs d'un projet doivent être évités, réduits ou compensés.

L'évaluation des politiques de transport est importante pour connaître les impacts attendus sur l'exposition de la population puis quantifier l'efficacité réelle de ces politiques. Peu de publications et de retours d'expérience ont été publiés sur une méthodologie à mettre en place pour l'évaluation environnementale des politiques de transport. Un autre défi de ces évaluations, est de parvenir à une cohérence entre les études sur la qualité de l'air d'une part et les études acoustiques d'autre part, en utilisant des méthodologies identiques.

L'article décrit les données d'entrée nécessaires, les modèles utilisés et les méthodologies communes pour les deux thématiques. Les difficultés et les pistes d'amélioration sont évoquées suite à un retour d'expérience sur deux projets opérationnels. La première étude a été évaluée à partir d'une modélisation et la seconde à partir de mesures.

La première étude concerne le PPA (Plan de Protection de l'Atmosphère) de la région Île-de-France, qui relate que le transport routier est responsable de 54% des émissions de NOx, 25% des PM10 et PM2,5. Les poids-lourds contribuent respectivement à 30 et 10% de ces émissions.

Les restrictions sur les poids-lourds en transit dans le cœur dense de l'agglomération parisienne existent en tant que mesure réglementaire en cas de pic de pollution. Cette mesure doit être mise en place de manière permanente. Le Cerema a mis en place une méthodologie basée sur la modélisation pour mesurer les effets du projet sur le bruit et les polluants atmosphériques, en corrélant avec les données de trafic.

La deuxième étude porte sur une VDTB (voies dédiées pour les taxis et bus) sur une voie autoroutière.

Les VDTB ont vocation à être développées dans le cadre des Schémas Directeurs des Transports. La DRIEA a prévu de mettre en place une VDTB expérimentale sur l'autoroute A1, afin de faciliter la connexion entre l'aéroport de Roissy et Paris. Le projet consiste à dédier la voie de gauche pour les taxis et les bus. La zone concernée se situe entre Le Bourget et le tunnel du Landy, dans le sens province-Paris et de 06h30 à 10h00 tous les jours.

Pour ce projet, l'utilisation de modèles d'émission est quasiment impossible de par les difficultés d'avoir un scénario prospectif sur les données de trafic.

Ce travail devrait répondre à ces questions importantes sur l'évaluation des politiques de transport :

-Quels sont les données importantes à utiliser pour une bonne évaluation de la qualité de l'air et du bruit ?

-Comment pouvons-nous améliorer la méthodologie commune sur les impacts de la qualité de l'air et du bruit ?

***Mots-clés :** évaluation, impact, politiques de transport, environnement, trafic, qualité de l'air, bruit*

Background

Transportation of people and goods interact in three areas of sustainable development: economic, social and environmental, including greenhouse gases emissions (GHG) and noise pollution.

Public transport policies should support sustainable development. They play a role in the organization and management of transport. They must attempt to reduce transport demand by including town and country planning, behaviour and lifestyles.

In France, these are organised on a regional scale, mainly at departmental level, with national and European coordination.

They are the subject of public debate through regional integrated development plans (Schémas de Cohérence Territoriale - SCOT) and transport framework plans.

Limiting environmental impact is one of the key objectives. To do this, it is appropriate to assess these inconveniences.

In France, environmental assessment includes integration, participation, precaution and prevention (article L. 110-1 of the Environment Code). Environmental and health aspects should be examined as early as possible. The negative effects of a project should be avoided, reduced or compensated for.

The evaluation of public transport policies is important in order to learn the effects of exposure of the population and to quantify the real impact of these policies.

CEREMA Nord-Picardie performs these environmental studies, especially on the topics of air quality and noise. Joint air and noise studies began in 2001. These studies, as part of project evaluation, are not yet often carried out using homogenized approaches.

Air-noise evaluations can be made by on-site measurement and/or modelling, the ideal solution being to use both. The article describes the methodologies used in the context of two studies in the Ile-de-France (Paris) region: the HGV diversion in the Ile de France region as part of the Ile de France Atmospheric Protection Plan (PPA) (evaluation by modelling) and creating a taxi and bus dedicated lane on the A1 (evaluation by measurements).

Feedback is presented on the difficulties of combining air and noise initiatives and the expected areas for improvement.

1. Theoretical notions

A sound is quantified by the amplitude of pressure fluctuations and is expressed in decibels (dB). The decibel is a ratio between a measured quantity and a reference level.

Its scale is logarithmic. A weighting called A is applied in order to approximate to human auditory perception.

Frequencies audible by humans range from 20 to 20,000 Hz. These figures may vary according to age and the people concerned. Below 20 Hz are infrasounds and above 20 kHz, ultrasounds. These do not give any sensation of sound. The human ear is more sensitive to midrange and high frequencies corresponding to the frequencies of the voice (from 500 to 10,000 Hz). To account for this sensitivity that varies with frequency, a type A weighting is applied.

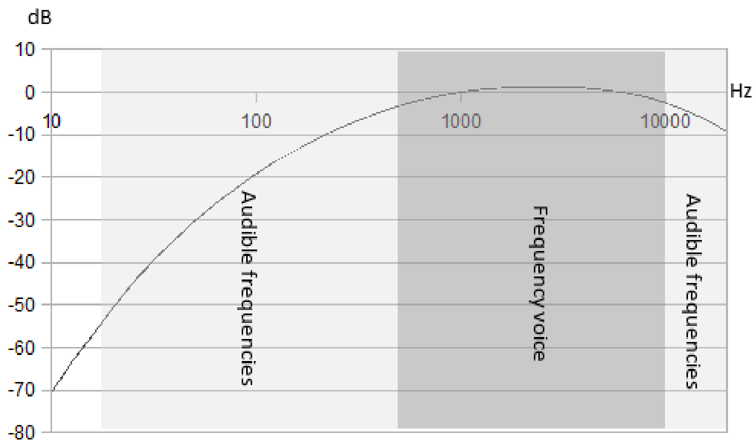

Figure 1. Type A acoustic weighting (dB according to frequency in Hz)

The propagation of sound in air is uniform in all directions. It is related to a number of factors, some of which are in common with air quality:

- geometric divergence
- atmospheric absorption
- topography
- ground effect
- weather conditions

In theory, doubling the distance in an open field and in normal sound propagation conditions, reduces the noise level by 3dB(A), loss by geometric divergence. Under these conditions, the decrease in sound level between a distance d1 from the road and a point distant from d2 is expressed in the form:

In fact, the perceived loudness away from a noise source (> 200m) is very much influenced by the ground effect and atmospheric absorption (weather).

If there is an obstacle, part of the sound is reflected, part absorbed, and the rest will be transmitted through the obstacle or diffracted.

The influence of weather conditions on propagation may be great: they influence the shape of the acoustic radiation (depending on the temperature gradient, speed and wind direction).

The acoustic impact of road infrastructure is dependent on traffic, traffic speed, emitter-receiver distance and angle of view. For example, in open fabric (building) and regardless of the nature of soils and topography, the following formula can be used to estimate the noise level on house front:

$$LAeq = 20 + 10 * \log(Qe) + 20 * \log(V) - 12 * \log\left(d + \frac{Lc}{3}\right) + 10\log\left(\frac{Téta}{180}\right)$$

LAeq: the equivalent A-weighted noise level in dB (A)

Qe: the equivalent representative hourly flow of traffic LV-HGV in veh/h

V: speed, in km/h

d: the distance between the receiver and the side of the roadway in m

Lc: the width of the roadway in m

Theta: angle at which the source is seen in degrees

It should be remembered that of air pollutant emissions can be quantified by the following equation for a traffic source:

E= FE*Qe

with: E: Pollutant emission per time step, in g/h

FE: Unit emission factor of pollutant per kilometre, at a given speed (g/km)

Qe: the hourly rate of equivalent traffic, in veh/h (LVs, as HGVs are often expressed as a percentage of traffic)

The relation between pollutant emission and traffic is linear.

Evolution equation of chemical species "i" in 3D model:

$$\frac{\partial C_i}{\partial t} + \underbrace{u_x \frac{\partial C_i}{\partial x} + u_y \frac{\partial C_i}{\partial y} + u_z \frac{\partial C_i}{\partial z}}_{\text{advection}} = \underbrace{\frac{\partial}{\partial x}\left(K_{xx}\frac{\partial C_i}{\partial x}\right) + \frac{\partial}{\partial y}\left(K_{yy}\frac{\partial C_i}{\partial y}\right) + \frac{\partial}{\partial z}\left(K_{zz}\frac{\partial C_i}{\partial z}\right)}_{\text{diffusion}} +$$

$$\underbrace{R_i(c_1, c_2, \ldots, c_n)}_{\text{chimie}} + \underbrace{E_i(x,y,z,t)}_{\substack{\text{sources} \\ \text{(émis.)}}} - \underbrace{S_i(x,y,z,t)}_{\substack{\text{puits} \\ \text{(dépôt)}}}$$

2. Importance of taking co-exposure into account

First, multi-exposure and co-exposure must be distinguished. Multi-exposure is the exposure of a receiver, in our case the population, to the same type of inconvenience (air quality, noise or vibration) from several sources: for example, a resident subject to noise from a road, a railway line and a factory. Co-exposure is exposure of a receiver to multiple inconveniences from the same source.

Air quality and noise affect the health of people living near road, rail and airport infrastructure (HEI 2010).

People living close to road, rail and aircraft noise are likely to experience negative health effects.

For air pollution, in addition to the risk of cancer, acute effects must be distinguished from chronic effects. Road traffic is a major source of pollution. Epidemiological models indicate that cardiovascular and respiratory systems are most affected by oxidative stress and inflammation. Other organs may also be affected.

Health effects of air pollution can be distinguished to acute, chronic not including cancer and cancerous. Epidemiological and animal model data indicate that primarily affected systems are the cardiovascular and the respiratory system. However, the function of several other organs can be also influenced (Kunzli and al, 2000; Cohen and al., 2005; Huang and Ghio, 2006).

Long-term noise exposure may lead to problems with their heart and circulatory (cardiovascular) system and night-time noise is particularly disruptive of sleep patterns, which in turn may lead to cardiovascular health problems (Münzel and al, 2014). Traffic noise can cause numerous health problems such as sleep disturbance, high bloodpressure and psycho-physiological symptoms (King and al, 2003; WHO, 2011)

Noise is defined as a sound without regular harmony, which affects the health of man and his physical, mental and social well-being. Different people perceive it differently according to its components. Excess noise has an impact on hearing, with effects ranging from simple ear fatigue to hearing loss. Over the long term, the cardiovascular system is also affected. Night-time discomfort disrupts sleep and increases cardiovascular risks (ANSES 2013).

Studies on health and noise are more numerous and have allowed the World Health Organization (WHO) to determine guideline values for the specific effects of noise on health. A day sound level (Lday) of 57.5 dB(A) can lead to cardiovascular events. By night (Lnight) sound levels from 40 to 55 dB (A) can generate a risk of hypertension and myocardial infarction or cardiovascular effects above 55 dB (A).

Although the mechanisms leading to an impairment of the cardiovascular system do not always follow the same pattern, it has been shown that there may be an interaction between the two sources of inconvenience - air quality and noise - and cardiovascular risk.

Some studies exist about potential cofounders between air pollution and noise in studies about association between air pollution due to traffic and CVD or noise due to traffic and CVD (Selander and al, 2009; Beelen and al, 2008)

Moreover, it may be appropriate to take into account co-exposure to other elements such as drugs (e.g. ototoxic for noise, antihistamine for air), population age and health, vibration, etc.

3. Feedback from the Ile de France PPA

Presentation of the study on the Ile de France PPA

The Atmospheric Protection Plan for the Île-de-France region for the period 2005-2010 was approved in 2006 and its revision approved on March 25, 2013. It notes that road transport is responsible for 54% of NOx emissions, 25% of PM10 and PM2.5 emissions. HGVs account for 30 and 10% respectively.

As part of the 2013 revision of the Île-de-France PPA, a study entrusted to Cerema focused on assessing the real impact of a bypass for HGVs in transit in the heart of the Ile-de-France region as it could actually be implemented, subject to a study on the legal basis and means of controlling it.

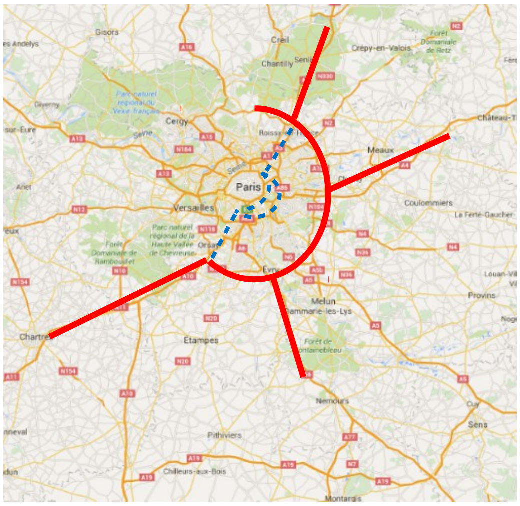

Figure 2. Bypass project for HGVs in transit

The studies by Cerema Nord-Picardie focus on human exposure to the effects of air quality and noise.

Study methodology

The field of study of the project is large and complex. This conditioned the choice of a methodology based primarily on air and noise modelling, using available traffic data, with and without the project.

Ideally, measurements to reinforce the initial draft-project diagnosis would have been required, but the time available for the study and the complexity of the terrain did not allow this measurement process to be completed.

The study is one relative to a baseline scenario and not an accurate model of pollutant and noise emission levels.

For noise, the routes affected by the HGV bypass were acoustically characterized (Paris ring road, A86 and Francilienne).

An enumeration of the population exposed to changes in sound levels, and especially to "significant" changes in sound levels, was made.

An assessment of the degree of sensitivity of routes was performed using predefined exposure limits and the risk of exposure to multi-sources noise, mainly airport and railway noise.

The study is one relative to a baseline scenario and not an accurate model of noise levels.

The proposed methodology is based on an estimate of noise levels from traffic according to the noise guide. It has limits which are listed below:

- the choice of the reference road section with the maximum sound level for the exposure study
- increased noise level is calculated at the infrastructure level, at the place where it is theoretically maximum. This causes noise levels to be overestimated
- propagation: a section A, noisier (95 dB (A) for example) than a section B (94.9 dB (A) for example) is taken into account, whereas a building may be located at 290m from section A and 10m from section B.
- existing noise protection (screens or mounds) and indirect protection related to the presence of buildings of different heights are not taken into account
- the difference in maximum acoustic levels selected for buildings is the effect of the buffer with the highest sound level of the baseline scenario encompassing the building. The sound level of the section is considered as having greater impact in terms of discomfort that the effect related to changes in traffic.

Sound emissions of the routes concerned are calculated as relative values from the land-based transport noise guide - forecasting sound levels (CETUR November 1980) and 2020 traffic, according to the steps listed below,

Step	Action
Calculation of traffic	$Q=Q_{LV} + 10Q_{HGV}$
Choice of speed	$V=Max (V_{LV} ;V_{HGV})$
Finding one-way streets	If Q=0 and V=0 then $LAeq_{AB}=0$
Noise levels in U streets	If V<50km/h then $LAeq_{AB}=55+10log(Q)$
Noise levels in open fabric	If V>50km/h then $Laeq_{AB}=20+10log(Q)+20log(V)$
Addition of both directions of travel	$LAeq=LAeq_{AB}+LAeq_{BA}$
Acoustic impact	$I=LA_{eqf} – La_{eqi}$, if LA_{eqf} ou LA_{eqi} = 0 then I not considered

For each road segment, the emissions are calculated for periods of Day and Night.

The differences in noise levels compared to the baseline are sorted by class, as is the case for air quality.

The class boundaries chosen correspond to:

- a significant noise reduction impact [-5 dB, -2dB[(positive impact)
- a perceptible noise reduction impact [-2 dB, -0.5dB[(positive impact)
- a negligible variation [-0.5dB, +0.5dB].
- a perceptible noise increase impact]+0.5, +2dB] (negative impact)
- a significant noise increase impact]+2dB, +5dB] (negative impact)

The limit of 2 dB (A) was chosen in reference to the noise law which defines this threshold as a significant change and forces the manager to protect residents from reaching or exceeding this threshold (protection at source or at the façade).

The results of the acoustic study are cross-referenced with land use in terms of buildings and population in a buffer area of 300m around the roads examined in the main network.

The population data are identical to those used for the air quality study.

The choice of acoustic impact per building is made as follows:

- find the buffer corresponding to the road with the highest noise level (baseline scenario) containing the building
- take the difference in sound levels associated with the maximum sound level chosen

The Bruitparif association makes noise maps for the Ile de France region available to the public. They give an idea of the original acoustic status in the area examined.

The Bruitparif maps show areas already highly affected by noise pollution, and areas identified as potentially affected by the proposed HGV diversion as part of the PPA. Adding traffic would be likely to cause buildings to be defined as noise black spots with compulsory protection for local residents. Crossing railways and the Le Bourget airport area need to be analysed in more detail also with regard to multi-source sound exposure of these sectors.

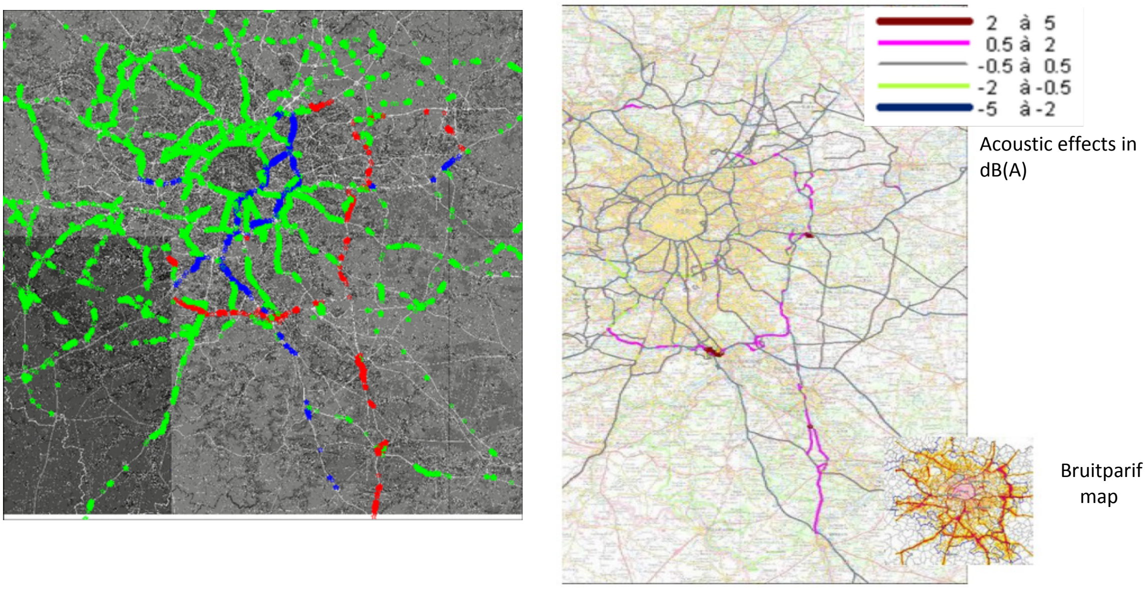

Figure 3. Acoustic and air impacts of the diversion project (in dB(A))

For air quality, the work focused on nitrogen oxides NOx and particulate matter (PM10) and especially:

- modelling NOx and PM emissions along major routes,
- an assessment of populations exposed to these pollutants (number of people affected by a rise or fall of emissions, and a "significant" increase or reduction in emissions),
- an assessment of the impact on CO2 emissions will also be conducted across the region (irrespective of areas that have no meaning for this component, the effect of which is not local).

The calculation of emissions from road traffic is performed using COPCETE software developed by Cerema as part of the Scientific and Technical Network of the French Ministry of Ecology, Energy, Sustainable Development and the Sea.

This software is based on the COPERT 4 methodology. Traffic data used are AADT (Annual Average Daily Traffic). Only the main road network was taken into account, because of the density of road infrastructure in this area.

The unit emissions factors correspond to the mass of pollutant emitted by a vehicle for a given trip length. They are expressed in kg/km/vehicle.

The composition of the motor vehicle fleet taken into account in this study is that established by IFSTTAR (French Institute of Science and Technology for Transport, Development and Networks), which provides a distribution based on age and fuel for each vehicle class, and also the gross vehicle weight rating for HGVs.

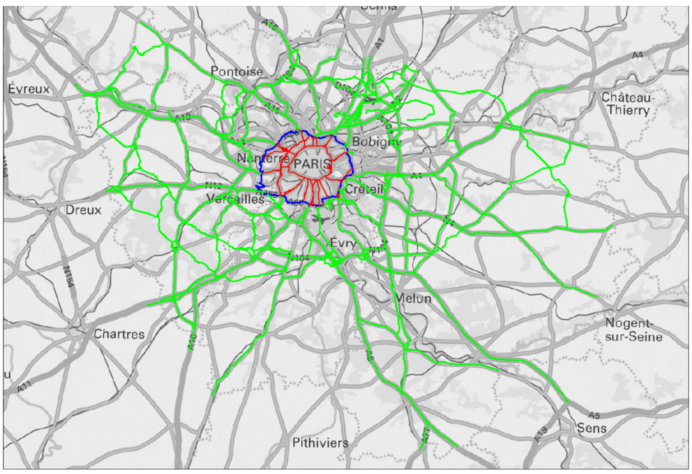

Figure 4. Main network taken into consideration in calculating population exposure

The population was enumerated by plot in a study strip of 300m around each road of the main network.

For NOx, the affected population taken into account is that present in this 300m buffer area. For PM, only the population within a 150m buffer area around the roads was considered (the is the particle impact distance).

First, the slight changes in emission percentages (increasing or decreasing) may largely result from uncertainties in modelling. It is necessary to be careful when interpreting these lower data, which are at the limit of the models. Out of 27,393 sections examined, only 2,981 did not vary between the different scenarios. The project does not however concern all the sections which show a variation: these are modelling uncertainties.

The affected population is distributed according to the roads into 3 classes. Insignificant changes in emissions were defined on the basis of calculations of the excess concentrations produced. Below an emission of 100 g/km (positive or negative) for a road section, we were able to consider the over-concentration as negligible.

- population affected by falling significant emissions (positive impact) greater than -100g/km for a road section and by pollutant,
- population not affected or affected by insignificant changes in emissions for a road section and by pollutant; the insignificant emissions are in the range [-100, 100] in g/km,
- population affected by rising significant emissions (negative impact) greater than 100g/km for a road section and by pollutant.

Excess concentrations of pollutants were modelled from emissions, knowing that a change in emissions may seem significant without resulting in a significant excess concentration. In addition, the excess concentrations do not accumulate in one zone, unlike emissions.

4. Feedback on the VDTB- A1

Presentation of the VDTB-A1 study

On the A1 motorway, an experimental lane dedicated to taxis and buses (VDTB) was set up to facilitate the connection with Roissy airport in Paris.

The development involves dedicating the left-hand lane for taxis and buses, between Le Bourget and the Le Landy tunnel, in the province-Paris direction, from 06:30 to 10:00 am. The dedicated lane runs from La Courneuve to the Le Landy tunnel.

The move from three to two lanes creates additional congestion on the A1 motorway. To make it easier for vehicles from the A1 to get onto the Paris ring road and limit congestion, the right-hand lane of the ring road will be closed at the level of Porte de la Chapelle, increasing the insertion distance. This arrangement should make traffic on the A1 more fluid.

The VDTB will be activated by a dynamic system of road signs.

An initial experimental phase was carried out in 2008-2009 with the study of traffic, greenhouse gas emissions and noise impact.

Cerema was asked to conduct a more complex assessment of the impact of the arrangement in order to better understand the effects on exposure. The traffic studies are also entrusted to Cerema.

The study extends to the length of the A1 concerned and to the ring road from Porte de la Chapelle to Porte de Bagnolet.

Study methodology

The assessment for this project was made by means of measurement campaigns. The use of models is almost impossible because of the difficulties in obtaining a prospective scenario on traffic data.

An initial status report, before implementing the measurement has been made, followed by a conclusion after commissioning (not yet done).

The aim is to establish a methodology for measuring the impact of setting up the VDTB at the level of the A1 on significant noise and pollutants in the Île-de-France region, from measurements made in situ. The challenge is a substantial one because VDTBs are likely to develop as part of the urban framework transport plan.

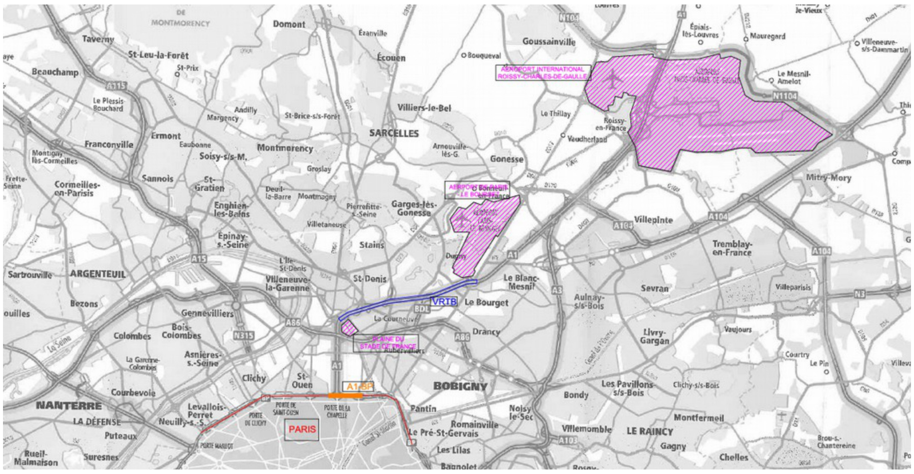

Figure 5. The VDTB on the A1, between Roissy and Paris

For noise, measurement points are set up throughout the length of the proposed VDTB, mainly on the province-Paris side (the direction of the VDTB) and in keeping with the site and safety imperatives.

The measurement campaigns were broken up by route: A1 and ring road.

The site is highly urbanized with much road infrastructure. A quiet area extends along the project: the Georges Valbon park in La Courneuve.

On the A1 motorway, three sound-level meters have been installed for 24h measurements. Acoustic mapping is complemented by short-term measurements (30 minutes) readjusted to the 24h points. On the ring road, 3 sound-level meters are also in use for 24h measurements.

The study focuses mainly on the period 6:00 am to 10:00 am, corresponding to the period when the signage for the VDTB is in use.

The measurements are validated on the basis of meteorological data - wind and rainfall - from the nearest Météo-France weather station.

Sound levels measured hourly and modelled for different cross sections before and after commissioning the VDTB, are adjusted according to hourly traffic road by road, then compared.

The study of the initial status by measurements is based on the same measurement sites as for the air and noise studies, while respecting the specific imperatives of each of the two subjects. These respective imperatives reduce the choice of potential sites to be instrumented, which may ultimately, but only in certain cases, lead to a decrease in measurement quality for one of the subjects. Care therefore needs to be taken with the choice of air-noise sites.

The approach to representativeness of the measurements compared to the annual situation for example is not based on the same methodology as for the noise field: measurements are recalculated taking into account the hourly traffic measured in terms of AADT.

Despite the efforts made in this study to achieve as uniform an air-noise assessment as possible, the duration of the air and noise measurements, taking into account the equipment and the respective methodologies in use, are different.

The initial assessment presented will be reproduced as soon as measurement has been implemented in a stabilized manner to make it possible to determine the impact of the proposed VDTB.

The impact on air quality of the project is characterized by means of measurements points by passive tubes. They are installed along the A1 motorway and the ring road. These passive tubes are placed there for two weeks. The pollutant measured will be NO_2, the tracer for car pollution.

AirPointer, a multi-pollutant measurement unit, is installed alongside the A1 and is used to display concentrations during the measurement period and also outside this period, with a fine time step. The unit measures O_3, NO_2 and PM10.

Six passive tubes will be placed along the A1, including one on the Airparif measuring station and one on the Airpointer. Three passive tubes have been installed on the ring road.

Measurements by passive tubes take place over a period of one week, with fitting on Monday and removal the following Monday.

Airpointer measurements take place over a two-week period.

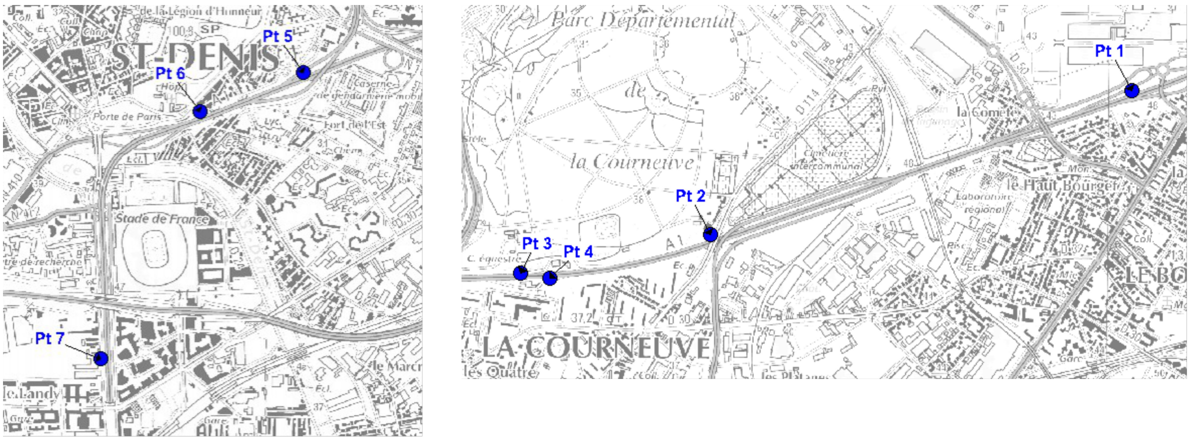

Figure 7. Acoustic and air measurement points on the A1

5. Experience feedback and suggestions for improvement of air-noise co-exposure studies

This feedback is done from the studies presented in this article and, in addition, many other studies conducted by Cerema Nord-Picardie as part of road projects, improvements to waterways and urban development.

It should answer these important questions about the assessment of transport policies:

- ➢ What are the important data to be used for proper assessment of air quality and noise?
- ➢ How can the common methodology for air quality and noise impacts be improved?

The various input data common to both themes are given below:

- The project and any variants,
- Traffic (annual average daily traffic, speed, percentage of HGVs),
- The population,
- Sensitive institutions such as schools and hospitals,
- The various sources of pollution present (other infrastructure, industries),
- The topography,
- Buildings,
- Meteorology observed over the long term on the field examined and that observed during any measurement campaigns.

All of these are necessary for environmental impact surveys and air and noise modelling. It is imperative that these data come from the same data sources for air and noise, which is not always the case.

In general, complying with regulatory requirements or recommendations in the strict sense on air and noise may lead to a heterogeneous approach that may be detrimental. It is often necessary go beyond regulatory requirements in order to achieve a consistency of approach. The main points requiring care relate to the points listed below:

- the study field or area

Implementing an assessment in a common air and noise study field or area. The 2005 air health circular concerning road infrastructure impact studies recommends taking into account a field of study consisting of the project examined and all roads whose traffic varies by plus or minus 10% as a result of implementation of the project. Noise regulations require an assessment around the project only

- time frame of the study

In a study on the impact of a development project, noise regulations require an assessment of this impact at a time equal to "commissioning date + 20 years". The annex to the circular of 12/12/1997 relating to the consideration of noise in the construction of new roads or the development of existing roads in the national system actually indicates that compliance with maximum permitted noise levels is compulsory throughout the service life of the infrastructure.

In practice, noise levels will be evaluated, in general, 20 years after commissioning, taking into account the high-case estimates of traffic growth. As regards air quality, no study time frame is imposed.

It would therefore seem appropriate to keep the study time frame imposed by the acoustic requirements. This time frame, however, is not what has the greatest impact on air quality, because of favourable technological developments for reducing unit emissions factors and also because of uncertainties about the way the motor vehicle fleet is changing. Commissioning the project may in fact be the scenario that has the most impact for air quality due to favourable technological developments.

For noise, the increased traffic expected for a "commissioning date + 20 years" scenario will have more impact than during commissioning.

- measurement periods

During in situ measurements, the measurement periods for air quality and noise are often different, particularly because of imperatives relating to the equipment. Moreover, regarding air quality, good measurement representativeness makes it necessary to measure concentration levels for at least 8 weeks distributed over the year, in different seasons.

As far as noise is concerned, NFS31-085 standard describes the in situ measurement method for noise resulting from road traffic on existing infrastructure. Three methods are described: observation measurement, measurement and estimation of a traffic long-term sound level, measurement and interpretation of a long-term sound level with respect to long-term weather conditions.

For the last two methods which make it possible to obtain an annual type representation of the measurement, it is possible to readjust measurements in relation to traffic data representative of a long-term situation, or even with representative meteorological data.

This approach is different from that for air quality: the representativeness of air measurements is based on a measurement time, without analysis of the observed traffic.

- protection devices

For noise, acoustic protections of the sound barrier type are taken into account as part of the modelling done. These protections have an impact on air quality which is most often not taken into account in the appropriate models. But they do have a potential impact on the dispersion of gaseous and particulate pollutants, for residents of the infrastructure concerned.

Moreover, in the study phase, it is increasingly necessary to analyse a common approach to air and noise, leading to an optimized assessment of the impacts of a project on population exposure. Attempting to achieve good air quality in an urban type sector for example can actually cause a significant increase in noise levels following the shift in traffic, leading to a risk of complaints and additional costs related to the protections that need to be fitted. For example, for the Ile de France PPA, the diversion of HGVs in transit, would generate discomfort greater than 2 dB(A), in the night-time, on an estimated population of 30,000 people.

These air and noise studies have shown the recurring need for a good relationship with departments that have competency in the field of traffic. Communication between air quality, acoustic and traffic departments would require a common glossary (technical terms and units of measurement) to be drawn up. Common databases, using topography, buildings, traffic, population, etc., must be standardized. Projects are under way such as the Shared Assistance Environmental Diagnosis platform by Cerema (PLAteforme Mutualisé d'Aide au Diagnostic Environnemental - PLAMADE). These databases must ultimately be used on both a regional and a local scale (district, development, diversion).

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