DELIVERABLE 2.6

CONTRACT N°	TIP4-CT-2005-516420
PROJECT N°	FP6-516420
ACRONYM	QCITY
TITLE	Quiet City Transport
Subproject 2	Perception of Vehicle Noise Sources
Work Package 2.3	Evaluate Noise Mitigation Measures

Driver behaviour measures for vehicles: Basic concepts

Written by: Pia Sundbergh, Staffan Algers — KTH

Date of issue of this report: 2006-02-13

PROJECT CO-ORDINATOR
PARTNERS

Acoustic Control	ACL	SE
Accon	ACC	DE
Akron	AKR	BE
Amec Spie Rail	AMEC	FR
Alfa Products & Technologies	APT	BE
Banverket	BAN	SE
Composite Damping Material	CDM	BE
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PROJECT START DATE: February 1, 2005
DURATION: 48 months

Project funded by the European Community under the
SIXTH FRAMEWORK PROGRAMME
PRIORITY 6
Sustainable development, global change & ecosystems

This deliverable has been quality checked and approved by QCITY Coordinator
Nils-Åke Nilsson

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0 EXECUTIVE SUMMARY

0.1 OBJECTIVE OF THE DELIVERABLE

The objective of deliverable 2.6 is to describe the basic concepts of the methods used when studying driver behaviour impacts on noise levels. It gives an introduction to the concept of traffic forecasting and describes briefly the microscopic traffic simulation model as well as the noise mapping software used in the studies. In addition it describes the interface between of the two modules under development and the building of a simulation model of the study area Järva, Stockholm.

0.2 STRATEGY USED AND/OR A DESCRIPTION OF THE METHODS (TECHNIQUES) USED WITH THE JUSTIFICATION THEREOF

Traffic is a result of people's choices. Where to travel, in what kind of mode, on which route and at what time, are all choices we make for a journey. With traffic models we try to simulate these choices using people's values derived from actual behaviour in traffic. To evaluate effects of a change in the traffic system like a new road or introduction of tolls, traffic models are helpful tools. Consequently traffic forecasts are often used to support decision-makers when evaluating different solutions of current traffic problems or future scenarios.

The objective in work package 2.3.3 is to evaluate noise mitigation measures related to driver behaviour. Our method is to use a traffic simulation model, to model different types of drivers and study the impact of aggressive and less aggressive behaviour on noise levels. The changes in speed and flows that occur for different scenarios will be used as input to create related noise maps. In addition measures to make traffic run smoother may have an impact. Here we will analyse an introduction of Intelligent Speed Adaptation systems, affecting individual acceleration and deceleration behaviour.

In the studies the microscopic simulation environment Aimsun NG (TSS, Spain) is used. It is a dynamic model where each vehicle is simulated individually. Road networks are built in detail and the concept of sections and intersections are used to describe actual roads and junctions. In addition traffic controls such as traffic signals and yield signs are modelled. A part of a model network is illustrated in Figure1. Each simulation step, every vehicle position and speed is updated using behavioural models such as "Car-following Model", "Gap acceptance" and "Lane-Changing Model". The algorithms use vehicle attributes like acceleration, deceleration, reaction times, minimum distance to the vehicle in front and speed acceptance to simulate the movements. Each simulation gives a range of simulation outputs such as average speed, queue lengths and density of a section. Simulation results are stored in databases and a network can be formatted to a shape file used in GIS applications and it is possible to add results to the shape file's associated database file.

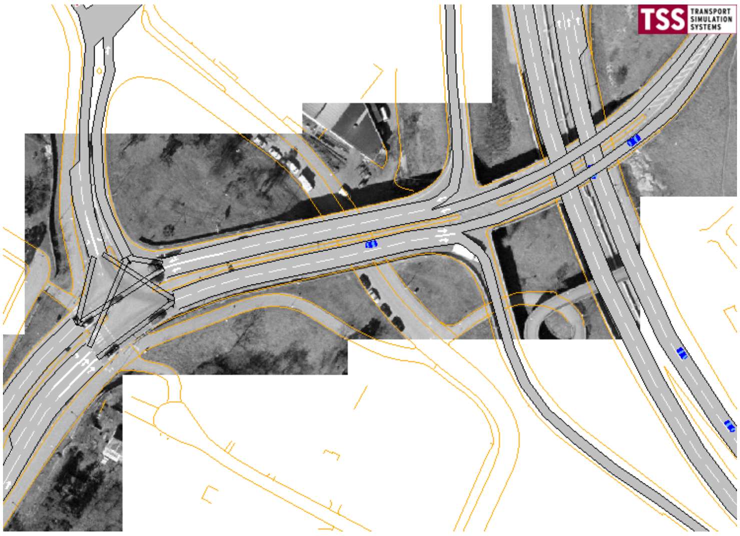

Figure1 Example of a model network.

To create noise maps the software CadnaA (Datakustik GmbH, Munich) will be used. Traffic data used as input is average speed and mean flow of each section and share of heavy vehicles if trucks and busses are modelled. Moreover shape files created by Aimsun NG will be used as input describing the geographic location of the road network.

A model network is built for a study area in Stockholm. A suburban area called Järva has been selected with road types varying from local streets to European highways. Thus hot spots and quiet areas will most likely be found in the model. Figure 2 shows an orthographic photo over Stockholm Municipality and the study area encircled in black.

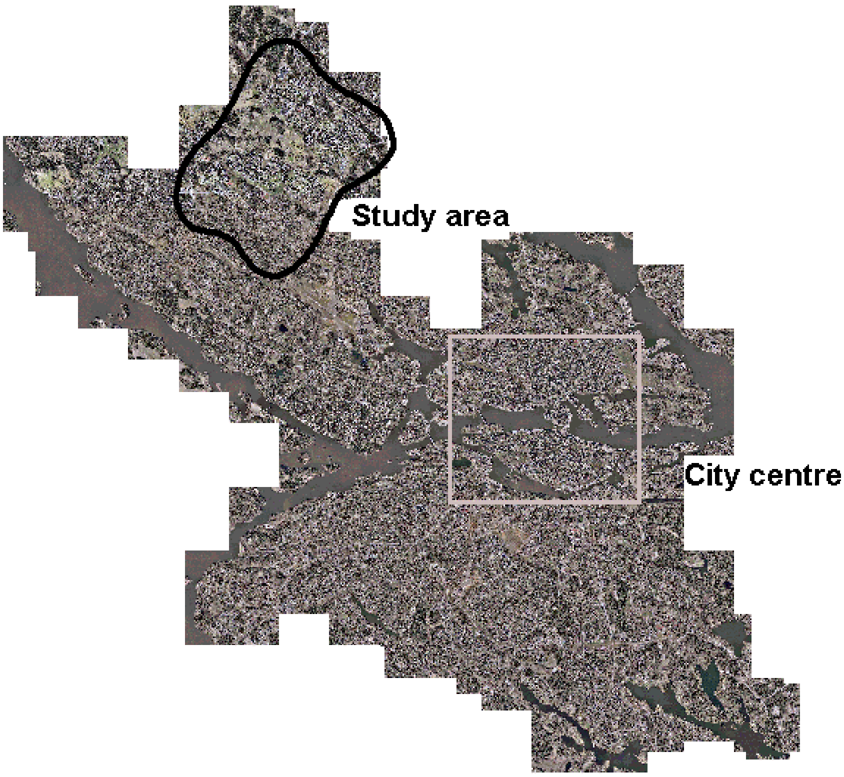

Figure 2 Stockholm Municipality and location of the study area Järva.

The model has been built using orthographic photos of the area and traffic signals have been added according to actual function plans. Moreover speed limits of each section have been set and stop and yield signs are included. Our next step is to apply traffic demand to the model, that is the number of vehicles that want to travel between different places in the network and to set parameters describing different driver types. Figure 3 illustrates an overview picture of the complete study network where different road colours represents different speed limits. Black: 30 km/h, Red: 50 km/h, Blue: 70 km/h, Purple: 90 km/h and Green: 110 km/h.

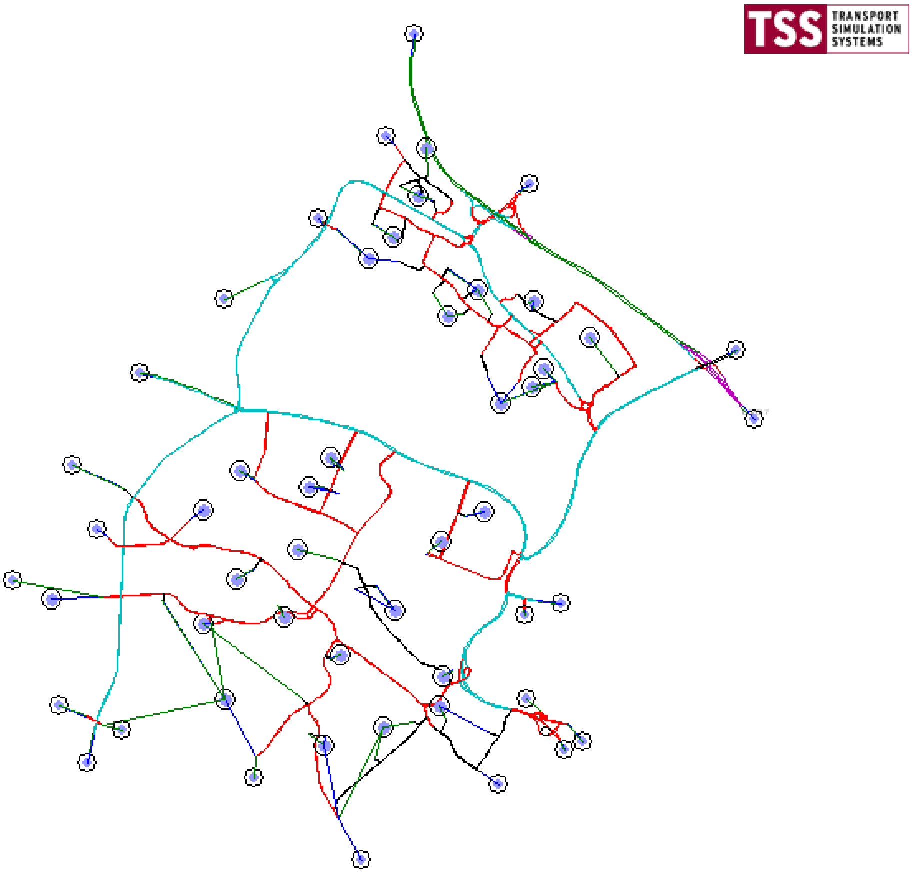

Figure 3 Model network of the study area Järva, Stockholm

The idea to study driver behaviour impacts on noise levels is to define vehicle types with different characteristics of driver behaviour and evaluate influences on traffic statistics and consequently noise levels. An example is to model Intelligent Speed Adaptation (ISA), affecting individual acceleration and deceleration behaviour by changing the speed acceptance parameter (a value greater than 1 implies that at free flow the driver exceeds the speed limits of a section). An assumption is that ISA will make traffic flow smoother and decrease the mean speed of a section and as a consequence decrease the noise level.

In a first step we will model two different vehicle types, aggressive car drivers and car drivers with more calm behaviour describing the average driver. Most likely we will only vary a few driver behaviour parameters like acceleration and deceleration attributes and keep all others equal for both types. Our concept to create related noise maps is to store simulation results and create a shape file with an associated database file containing simulation results of each vehicle type. In CadnaA both shape files can be used as input and thus the method is to work with parallel line sources. To capture the dynamic feature between the two vehicle types, correction factors can be added to the noise levels calculated from traffic data of aggressive drivers.

Furthermore, in CadnaA it is possible to create noise maps calculated for the time periods day, evening and night. An idea is to model traffic for these three time periods with different characteristics according to traffic demand and traffic signal functions. When analysing related noise maps it is possible to observe at what time of the day driver behaviour has most impact on noise levels.

0.3 BACKGROUND INFO AVAILABLE AND THE INNOVATIVE ELEMENTS WHICH WERE DEVELOPED

The concept to study driver behaviour impacts on noise levels using traffic simulation models and noise mapping software is new to our knowledge. Thus the total method and the interface between the two modules are innovative elements.

0.4 PROBLEMS ENCOUNTERED

During the model and interface development we have not encountered any major problems that have made us reconsider the overall approach of the studies.

0.5 PARTNERS INVOLVED AND THEIR CONTRIBUTION

Partners involved in WP 2.3.3 have been the Royal Institute of Technology (KTH) and Acoustic Control (ACL). KTH handles the traffic modeling where as Acoustic Control will create noise maps with traffic data obtained from simulations. Moreover the interface between the two modules is developed using experience and expertise of both partners.

0.6 CONCLUSIONS

The basic concepts to use in work package 2.3.3 are clear. Different vehicles with related driver behaviour will be modelled in a microscopic traffic simulation environment and the simulation outputs will be used as input to create related noise maps. Throughout the model and interface development we have not encountered any major problems that have made us reconsider the overall approach of the studies.

The remaining work before conclusions on driver behaviour effects can be drawn contains the important task of calibrating the model and set parameters that give simulation results in accordance with actual behaviour and traffic conditions. Details on how to use the simulation outputs to calculate noise effects of different vehicle types in CadnaA will also be further discussed.

0.7 RELATION WITH THE OTHER DELIVERABLES (INPUT/OUTPUT/TIMING)

Selected outputs of our simulation model will be used as input to the Traffic Noise Auraliser developed in SP5.

The noise mitigation measures developed in this sub work package will be analyzed in WP 2.3.6 where all measures studied in WP 2.3 will be ranked considering performance/cost, general applicability and general acceptance.

1 INTRODUCTION

This document describes the basic concepts used in work package 2.3.3 when studying driver behaviour impacts on noise levels. In collaboration with acousticians at Acoustic Control we are developing a procedure for using traffic simulation models and a noise mapping software as tools.

1.1 BACKGROUND

QCity is a project in EU's sixth framework programme. The aim is to develop an integrated technology infrastructure for efficient control of road and rail ambient noise by considering the attenuation of noise creation at source at both vehicle/infrastructure levels. The project will support European noise policy to eliminate harmful effects of noise exposure and decrease levels of transport noise creation, especially in urban areas. A major objective is to provide municipalities with tools to establish noise maps and action plans (Directive 2002/49/EC) and to provide them with a broad range of validated technical solutions for the specific hot-spot problems they encounter in their specific city.

1.2 TASK DESCRIPTION

The objective in sub work package 2.3.3 is to evaluate noise mitigation measures related to driver behaviour. Our method is to use a microscopic traffic simulation model, to model different types of drivers and study the impact of aggressive and less aggressive behaviour on noise levels. The changes in speed and flows that occur for different scenarios will be used as input to create related noise maps. In addition measures to make traffic run smoother may have an impact. Here we will analyse an introduction of Intelligent Speed Adaptation systems, affecting individual speed keeping, acceleration and deceleration behaviour.

A model network is built for a study area in Stockholm. A suburban area called Järva has been selected with road types varying from local streets to European highways. Thus hot spots and quiet areas will most likely be found in the model. Figure 4 shows an orthographic photo over Stockholm Municipality with the study area encircled in black.

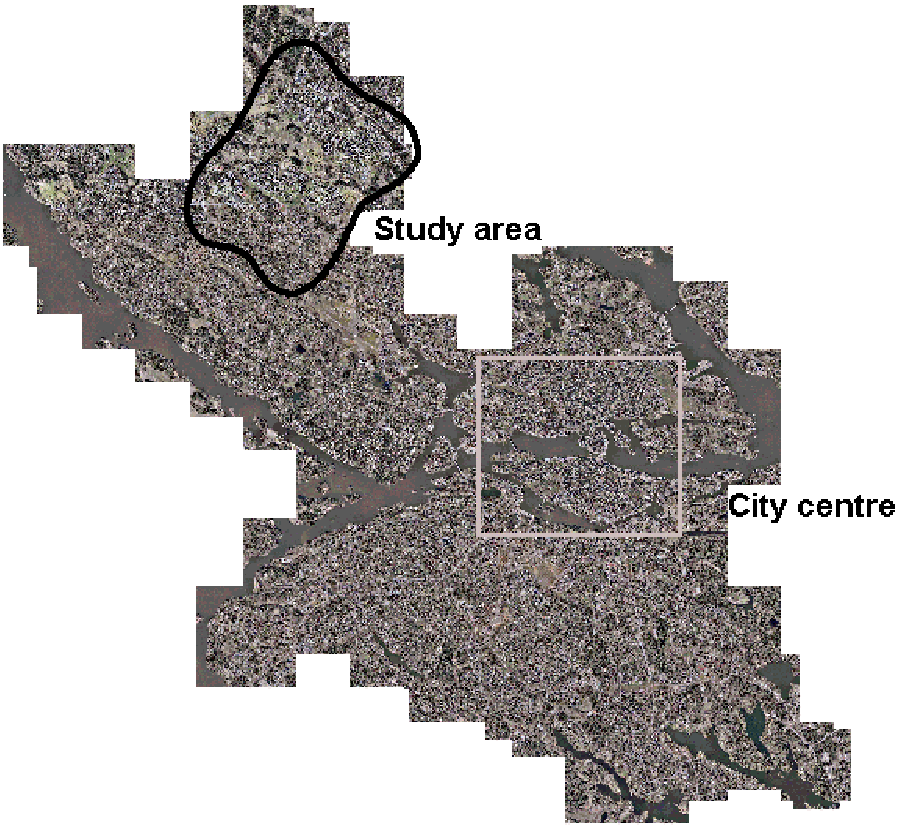

Figure 4 Stockholm Municipality and location of the study area Järva.

2 METHOD

In the EU-project IMAGINE (Improved Methods for the Assessment of the Generic Impact of Noise in the Environment), the suitability of traffic models for noise modelling was considered (Report 2.2 Suitability of traffic models for noise modelling). The conclusions were in short that “There is no superior type of traffic model to deliver input for traffic noise models. Depending on the study area (e.g. major roads, or agglomerations), several traffic model types are capable to deliver the required output.” Each model has its own strengths and weaknesses, and in the QCITY project therefore different types of traffic models are used in different applications. In each case, the practical situation in terms of data and model availability needs to be taken into account.

This chapter introduces the basic concept of traffic forecasting and describes the traffic model environment as well as the noise mapping software and methods used in this task. An important feature is the interface to handle inputs and outputs between the two modules, which is explained and discussed in paragraph 2.3 and 2.4. Further paragraph 2.5 describes the work on building a model for the study area.

2.1 TRAFFIC FORECASTING

Traffic is a result of people’s choices. Where to travel, in what kind of mode, on which route and at what time, are all choices we make for a journey. With traffic models we try to simulate these choices using people’s values derived from actual behaviour in traffic. To evaluate effects of a change in the traffic system like a new road or introduction of tolls, traffic models are helpful tools. Consequently traffic forecasts are often used to support decision-makers when evaluating different solutions of current traffic problems or future scenarios.

Traffic models are based on two important components, traffic demand and traffic supply. The individuals that travel through the network in different modes constitute traffic demand whereas traffic supply is defined by the traffic network and the public transport system the travellers can use making their trip.

Depending on the sort of traffic scenario to be studied different traffic simulation models to model supply are used. There are three main types of models, macroscopic, microscopic and mesoscopic. A macro simulation model describes the traffic at a high level of aggregation based on flows. It is a static model that takes a “snapshot” of traffic flows, and the network is simplified to a representation of links and nodes. Micro simulation models are dynamic models where each vehicle is simulated individually. The network is built in detail and traffic controls such as traffic signals and yield signs are modelled. Both macroscopic and microscopic models apply behavioural models to simulate how vehicles interact in the system, though micro simulation models model driver behaviour at a higher level of detail. In short a mesoscopic model is a combination of macroscopic and microscopic models.

2.1.1 Micro simulation models – Aimsun NG

To be able to model driver behaviour impacts on noise levels in a credible way we must use a microscopic model. In Qcity the microscopic simulation environment in Aimsun NG (TSS, Spain) is used. It is a relatively new product though the simulation models included are well documented and used in their previously released simulation packages. In order to describe how we use the environment the next paragraphs gives a more detailed description of micro simulation models and Aimsun NG in particular related to traffic supply, traffic demand, simulation and output results.

2.1.1.1 Traffic supply

In a micro simulation model the concept of sections and intersections are used to describe actual roads and junctions. Sections are associated to a road type and are modelled with attributes like number of lanes, capacity per lane and maximum speed. Allowed turnings and traffic controls define intersections. The network is visualised very close to reality showing e.g. the number of lanes and side lanes. By working with layers it is possible to show traffic on roads of different height levels. In Aimsun NG it is also doable to model the altitudes of a section, which will have effects on a vehicle's breaking and acceleration behaviour. Ortho photos and dxf-files can be used as background to make it easier to build a network of a study area. In Figure 5 a part of the traffic network built for our study area of Järva is illustrated.

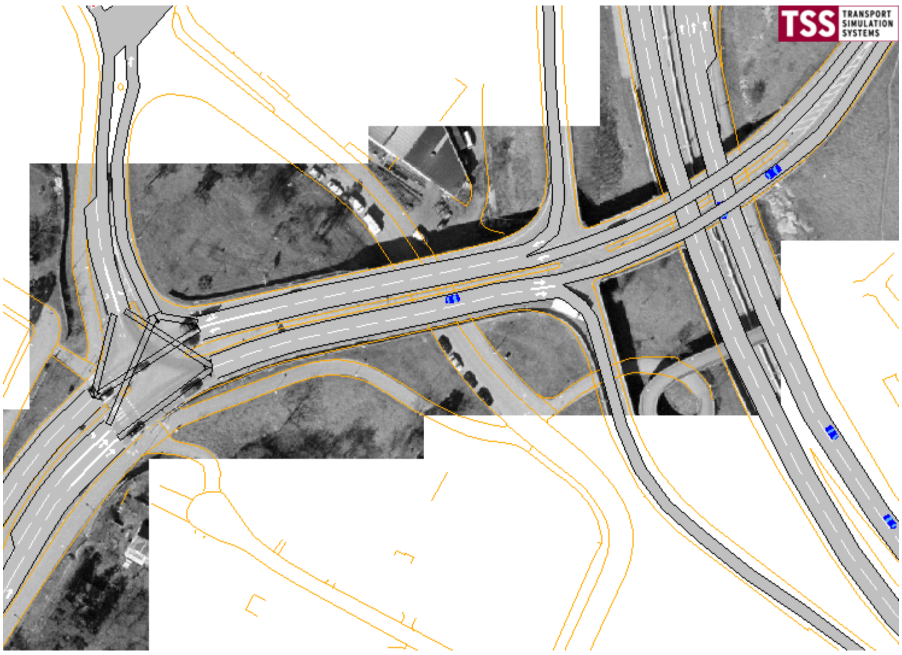

Figure 5 Example of a micro simulation network

Since a micro simulation model models each vehicle individually and simulates the interactions between the vehicles, one of the inputs needed is traffic control. Turnings are specified for each junction and can be controlled by traffic signals or yield and/or stop signs. It is also possible to ad solid lines.

Moreover in Aimsun NG bus lines and trains can be modelled. Each transit line has a route and timetable. A timetable is defined by a departure schedule, type of vehicle and stop times (mean and deviation) for each stop. Buss stops are added to the network and the user can reserve lanes for public transport.

2.1.2.1 Traffic Demand

Traffic demand in Aimsun NG is related to vehicles and there are two options to model traffic demand. One is based on input flows and turning percentages and the other is based on OD-matrices and route paths. Data needed might be a result of a calculation made in a traffic forecasting system (see paragraph 2.5.2), possibly adjusted with data collected from traffic detectors.

To use OD-matrices centroids must be added to the network. A centroid represents a zone that generates and/or attracts trips, that can e.g. be a dwelling area or working sites. An OD-matrix defines for each origin to every destination the number of vehicles that want to travel between each origin and destination pair. As the model describes how the traffic evolves with time, this demand needs to be assigned to the network with respect to time. During a simulation vehicles are therefore randomly added to the system following an arrival distribution (e.g. exponential distribution). When a vehicle is generated at an origin centroid it will be assigned to one of the available routes connecting this centroid to the vehicle’s destination. The vehicle will follow this path unless it is allowed to change its route en-route when a better route exists from its current position to its destination.

There are several alternatives to model the path selection using Shortest Path algorithms and Route Choice models. The underlying theory is that a driver wants to use the route with lowest cost for example defined as shortest travel time.

When traffic is defined by traffic flows and turnings vehicles are generated to the network via input sections and distributed randomly in accordance with the turning percentages defined for each junction. Thus when a vehicle enters the system is does not have a route to follow, they only “know” its next turning movement.

It is possible to model different vehicle types. Traffic demand is defined for each kind. A vehicle type can be a car, truck, police-car, sports car etc. Each vehicle type has physical characteristics and driver attributes like length, speed acceptance, acceleration and deceleration. These parameters may be set with mean, minimum, maximum and deviation values and the characteristics are sampled from a truncated normal distribution. Thus in a simulation all vehicles in a vehicle type do not necessarily behave in the same way.

2.1.3.1 Simulation

Before starting a simulation the user sets the simulation time, like a morning peak period. When running a simulation the time is divided into small time intervals, simulation steps. Each simulation step every vehicle position and speed is updated using behavioural models such as “Car-following Model”, “Gap acceptance” and “Lane-Changing Model”. The algorithms use vehicle attributes like acceleration, deceleration, minimum distance to the vehicle in front and speed acceptance to simulate the movements. The speed acceptance parameter describes a driver’s degree of desire to follow speed limits. A value greater than 1 implies that at free flow the driver exceeds the speed limits of a section. Thus behavioural models also depend on section parameters. Important section parameters used are distance parameters, these parameters describe the distance in time to the next junction and are e.g. used when a vehicle must change lane to be able to make a turn.

Micro simulation models include a lot of stochastic models and stochastic data, e.g. vehicles' arrival distribution, vehicle parameters, or the random distribution of vehicles at turns when using flows and turning percentages as traffic demand. Thus to get credible results of an experiment a number of replications must be simulated. After simulating, an average of all replications can be calculated. The number of replications to use is an issue to handle when calibrating and validating the model. For a more in depth description of traffic simulation, see for example Kitamura and Kuwahara (2005).

2.1.4.1 Simulation Results and Outputs

Statistics of a simulation in microscopic models can be collected at different levels of output e.g. system, section, or OD-matrix level. Statistics can be calculated for each vehicle type or aggregated to a vehicle level. Presented in the list bellow is a selection of the statistic outputs provided by Aimsun NG at the section level (taken from the Aimsun 5.0 User's Manual). It is possible to get results of each replication but most important are the average results of the replications of an experiment.

Section Statistics

- *Mean flow*: average number of vehicles per hour that have crossed the section during the simulation period.
- *Density*: average number of vehicles per kilometre in section.
- *Mean speed*: average speed for all vehicles that have traversed the section. This is calculated using the mean speed for the section journey for each vehicle.
- *Travel time*: average travel time a vehicle needs to cross the section. This is the mean of all the single travel times of every vehicle that has left the section.
- *Delay time*: average delay time per vehicle. This is the difference between the expected travel time (time it would take to traverse the section under ideal conditions) and the travel time. It is calculated as the average of all vehicles.
- *Stop time*: average time at a standstill per vehicle while travelling in the section.
- *Number of Stops*: average number of stops per vehicle while travelling in the section.
- *Mean Queue Length*: average length of queue in that section, expressed as number of vehicles per lane.
- *Maximum Queue Length*: maximum length of the queue in this section, expressed as number of vehicles per lane.

In addition to these statistics it is possible to place detectors in the network and gather supplementary data. A detector can be placed anywhere at a section and includes measuring capabilities as vehicle count, speed and headway between vehicles crossing the detector.

Simulation results are stored in databases. By using Aimsun NG a network can be formatted to a shape file used in GIS applications and it is possible to add results to the shape file's associated database file.

Finally, to build a credible traffic simulation model it is important to follow a structure when input data parameters and driver behaviour models are chosen and calibrated. Figure 6 illustrates the different steps when making a simulation study (Law and Kelton 1991).

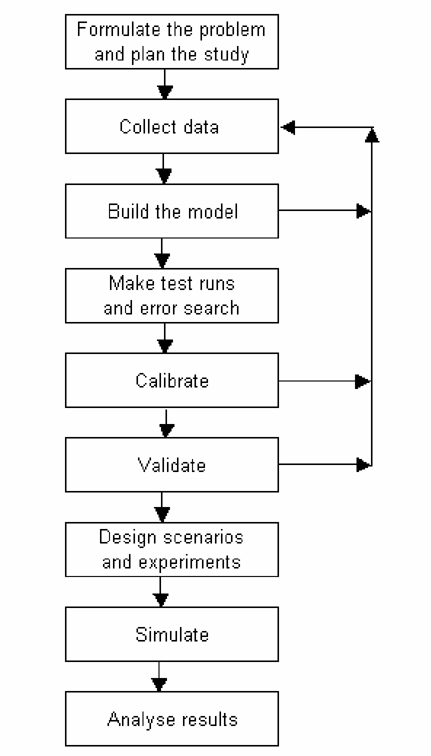

Figure 6 Procedure when making a simulation study

2.2 THE NOISE MAPPING SOFTWARE CADNAA

When creating noise maps CadnaA (developed by Datakustik GmbH, Munich) will be used. CadnaA is a commercial software, continually updated and improved with the latest prediction methods and calculation algorithms.

Calculations will be performed according to official Nordic prediction methods for respective source. For road traffic noise the Nordic prediction method for road traffic noise, rev. 1996, will be used.

The CadnaA software automatically manages the effects of ground absorption, screening, reflections etc. according to the official prediction method.

Calculations demand a 3 dimensional map (Data Terrain Model, DTM) as well as data for the different kinds of sources, e.g. the amount of traffic on a specific road or the sound spectrum for a specific source.

The terrain model is built with contour lines defining the height along the line. Locations of larger wooded areas, lakes shore lines, locations of buildings and screens as well as their height are then implemented to complete the digital terrain model (DTM).

The 24 hours representing the day is divided according to the EU directive 2002/49/EC;

- Day 06 - 18
- Evening 18 - 22
- Night 22 – 06

Traffic data needed to calculate noise levels is speed, flow and share of heavy vehicles of a road represented per time period. In addition it is possible to calculate noise levels of each period separately.

The roads as well as the railways are fitted to the DTM. The bridges and overpasses are taken into account by letting the road “float” at the defined height. No source are placed when roads or railway are in a tunnel.

When the sources are in place the calculations result in a grid showing the calculated sound pressure level. For the study are Järva in Stockholm the grid will have a receiver spacing of 10 by 10 meter and a receiver height of 4 meter.

More information about CadnaA can be found on the webpage www.cadna.de.

2.3 ADAPTING TRAFFIC FORECASTS TO A NOISE MAPPING SOFTWARE

To enable a use of simulation outputs of Aimsun NG as input to CadnaA we have to create an interface. This is made using the Geographic Information system program ArcView GIS (ESRI, USA) and SweTrans (SWEGIS, Sweden) a program to transfer GIS shape files to different geographic reference systems.

2.3.1 Geogeographical input

Via a GIS application in Aimsun NG the study area network is exported to numerous shape files describing e.g. sections, turns and nodes. When studying noise levels most important are traffic data of sections, consequently the section shape file is transformed from the geographic reference system used in Aimsun NG (RT90 2,5 gon V 0:-65) to the reference system used in CadnaA (ST74). Comparing this shape file with a shape file Acoustic Control use when creating noise maps for the same area, it is clear that they are very similar, see Figure 7. Hence we decide to use the Aimsun NG shape file as import to CadnaA instead of the shape file used by ACL. This simplifies the work of making an interface significantly as we do not need create a key between our model network and the network to use in CadnaA.

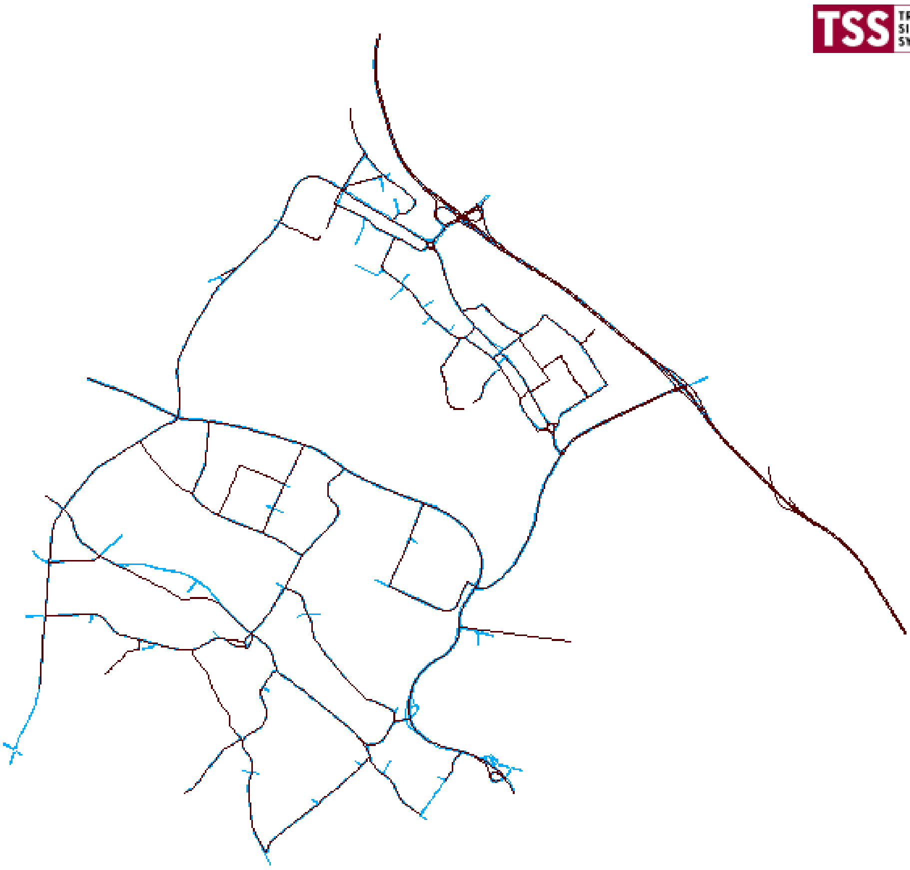

Figure 7 The Aimsun network in blue, the file used by the Stockholm Environmental and Health Administration in red.

2.3.2 Traffic data interface

In our studies we choose to store results at a vehicle type level, as different driver behaviour will be modelled by different vehicle types. In addition, if we choose to model trucks and buses it will be an easy task to calculate the share of heavy vehicles of each section. From the result databases we select the mean speed and mean flow for each section represented per vehicle type (derived from the average results of all replications simulated.) Storing the results in separate ASCII-files or txt-files we are able to connect the data to the attribute list of the section shape file using section id-number as key.

2.4 A METHOD TO STUDY DRIVER BEHAVIOUR IMPACTS ON NOISE LEVELS

The idea to study driver behaviour impacts on noise levels is to define vehicle types with different characteristics of driver behaviour and evaluate influences on traffic statistics and consequently noise levels. An example is to model Intelligent Speed Adaptation (ISA), affecting individual acceleration and deceleration behaviour by changing the speed acceptance parameter. A hypothesis is that ISA will make traffic flow smoother and decrease the mean speed of a section and as a consequence decrease the noise level.

Bellow is a list of descriptions of important driver behaviour parameters that are possible to vary and examples of parameter influences on simulation outputs (see also the Aimsun 5.0 User's Manual).

Maximum desired speed:

Mean, deviation, maximum and minimum values.

The maximum speed this type of vehicle can travel at any point in the network.

Influence: Speed, flow, travel times, etc.

Acceleration:

Mean, deviation, maximum and minimum values.

The maximum acceleration, in m/s^2 a vehicle can achieve. The parameter is used in the car-following model.

Influence: Speed, flow, queue discharge, etc.

Deceleration:

Mean, deviation, maximum and minimum values.

The maximum deceleration, in m/s^2 a vehicle can achieve. The parameter is used in the car-following model.

Influence: Speed, flow, density, etc.

Speed acceptance:

Mean, deviation, maximum and minimum values.

The degree of acceptance of speed limits. A value greater than 1 means that the vehicle will take as maximum speed for a section a value greater than the speed limit, while a value less than 1 means that the vehicle will use a lower speed limit.

Influence: Speed, flow, queue discharge, etc.

Minimum distance between vehicles:

Mean, deviation, maximum and minimum values.

The distance in meters a vehicle keeps between itself and the preceding vehicle when stopped.

Influence: Flow, queue lengths.

Maximum give-way time:

Mean, deviation, maximum and minimum values.

This parameter is used when modelling gap-acceptance and describes the time a vehicle will wait at a give-way situation e.g. a Yield sign in a junction or a on-ramp at a freeway before it becomes more aggressive and reduces the acceptance margins in order to make a cross or merge. It is also used in Lane-Changing models as the time a vehicle accept being at a standstill while waiting for a gap to be created in the desired turning lane before giving up and continuing ahead.

Influence: Yield and On-Ramp capacity, lane changing blockages and consequently flow.

Driver's reaction time:

The time it takes for a moving vehicle to react to speed changes of the preceding vehicle. It is used in the car-following model and can either be fixed for all vehicle types or variable. In case of variable, a discrete probability function for each vehicle type is defined.

Influence: Flow, speed, etc.

Reaction times at stop:

The time it takes for a stopped vehicle to react to the acceleration of a vehicle in front, or to a traffic light changing to green. Like Reaction Time it can be fixed or variable.

Influence: Queue measures, flow.

In a first step we will model two different vehicle types, aggressive car drivers and car drivers with more calm behaviour describing the average driver. Most likely we will only vary a few driver behaviour parameters like acceleration and deceleration attributes and keep all others equal for both types. Our concept to create related noise maps is to store simulation results and create a network shape file with an associated database file containing simulation results of each vehicle type. In CadnaA the two identical road networks with different traffic data can be used as input to calculate the total noise levels from both noise sources. To capture the dynamic feature between the two vehicle types, correction factors can be added to the noise levels calculated from traffic data of aggressive drivers. Together with acousticians at Acoustic Control we will further discuss how to define factors that correspond to the difference in acceleration behaviour for the two driver types.

Furthermore, in CadnaA it is possible to create noise maps calculated for the time periods day, evening and night. An idea is to model traffic for these three time periods with different characteristics according to traffic demand and traffic signal functions. When analysing related noise maps it is possible to observe at what time of the day driver behaviour has most impact on noise levels.

2.5 BUILDING A MODEL OF THE STUDY AREA IN AIMSUN NG

As no micro simulation network exists of the study area selected we have taken on the task to build a model starting from zero. We are now at the stage where the network has been built and tested for errors and critical traffic signals are added. The next step is to add traffic demand and set parameters for different vehicle types. Hence following the structure in Figure 6 we are in the loop between collecting data and building the model.

2.5.1 Traffic supply

Using a dxf-file and Ortho-photos exported from the database Kartago with maps over the City of Stockholm we built the traffic network in the geographic reference system RT90 2,5 gon V 0:-65. The dxf-file illustrates road contours in the area of year 2005 and the Ortho-photos were taken in 2002. If a road had been rebuilt since 2002 we followed the dxf-file.

Solid lines were added in accordance to the Ortho-photos but may have to be shortened, lengthened or removed when the model is calibrated. Moreover with knowledge of the study area together with Ortho-photos turns, stop signs and give way signs were included.

Study trips have been made on two occasions, the first in purpose to select the most important traffic signals to model and the second to examine speed limits of the area.

For the chosen signals, function plans and signal plans for each junction were provided by the Swedish Road Administration and the Stockholm Traffic Administration. The documents describe allowed turns of a junction, signal groups and signal phases. The function plan in specific describes green time, red time and yellow time for each phase. With assistance from two students the signals were added to the traffic network according to documents describing phases for morning traffic.

Road types with different characteristics and speed limit have been set and related to each section. As Aimsun NG does not handle reduction in speed due to sharp turns, sections describing e.g. on and off-ramps to freeways have been assigned lower speed restriction than formally allowed as an attempt to model more realistic driver behaviour. In addition, all sections are considered being horizontal, thus no altitude parameters have been set. Figure 8 illustrates an over view picture of the complete study network where different road colours represents different speed limits. Black: 30 km/h, Red: 50 km/h, Blue: 70 km/h, Purple: 90 km/h and Green: 110 km/h.

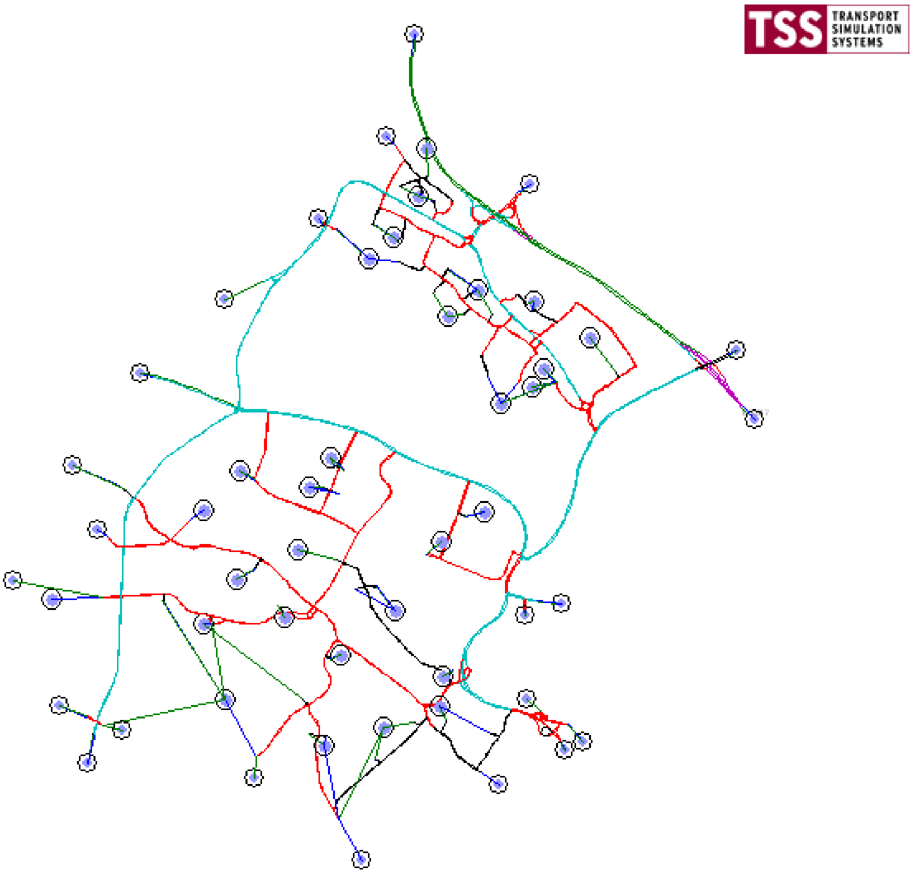

Figure 8 The model network

2.5.2 Traffic demand

Traffic demand will be based on OD-matrixes and route choice. The matrix will be provided using the macroscopic traffic forecast system Sampers (Transek, Sweden) and its integrated network assignment package Emme/2 (Inro, Canada). (A description of the program modules is found in deliverable 2.4). With Sampers a scenario for a network describing the whole region of Stockholm including our study area will be set and simulated describing trips and traffic flows on an aggregated level. Figure 9 illustrates the entire network and Figure 10 a part of the network where our study area is encircled in red. In Figure 10 green points and lines illustrates centroids and connectors respectively. Connectors are fictive links on which traffic demand is connected to the network.

Figure 9 The macroscopic road network, study area encircled in red.

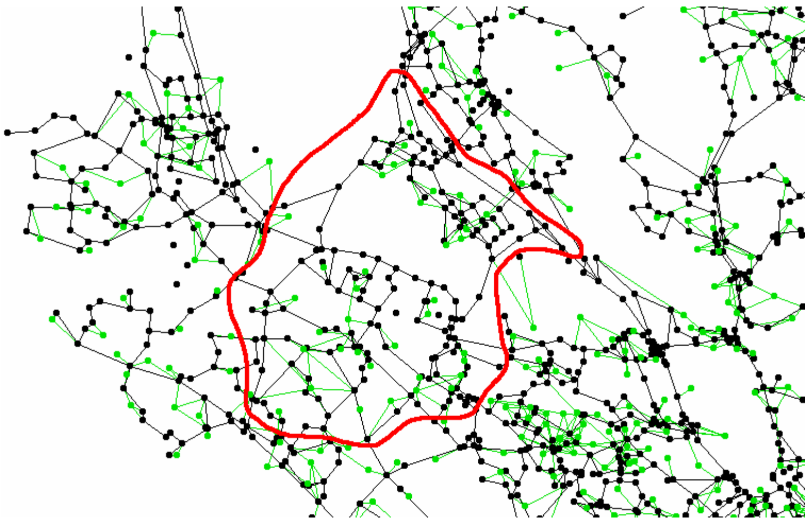

Figure 10 The study area Järva

Using the "Traversal matrix" feature in Emme/2 we are able to extract a matrix describing traffic demand for a subarea of the macroscopic network, i.e. trips traversing, ending, starting and taking place within a subarea. Thus for our microscopic model we have added centroids in accordance to the centroids and links describing origins and destinations of the subarea of Järva. The centroids have been assigned external id-numbers equal to the ones used in Emme/2 to enable an import of the traversal matrix to Aimsun NG. Further the centroids are attached to the system via fictive connection links, illustrated in Figure 8.

When the traffic demand is ready the next step is to model different vehicle types with different vehicle characteristics and driver behaviour. Public transport with numerous transit lines will not be modelled though vehicle types characterising trucks and busses may be set. Most important is to create and calibrate a model to obtain a credible base scenario to which we can adapt measures to make traffic run smoother and study their impacts on noise levels.

3 CONCLUSIONS

The basic concepts to use in work package 2.3.3 are clear. Different vehicles with related driver behaviour will be modelled in a microscopic traffic simulation environment and the simulation outputs will be used as input to create related noise maps. Throughout the model and interface development we have not encountered any major problems that have made us reconsider the overall approach of the studies.

The remaining work before conclusions on driver behaviour effects can be drawn contains the important task of calibrating the model and set parameters that give simulation results in accordance with actual behaviour and traffic conditions. Details on how to use the simulation outputs to calculate noise effects of different vehicle types in CadnaA will also be further discussed.

4 RELATION WITH THE OTHER DELIVERABLES (INPUT/OUTPUT/TIMING)

Selected outputs of our simulation model will be used as input to the Traffic Noise Synthesizer developed in SP5.

The noise mitigation measures developed in this sub work package will be analyzed in WP 2.3.6 where all measures studied in WP 2.3 will be ranked considering performance/cost, general applicability and general acceptance.

5 REFERENCES

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