Amitran Checklist

The Amitran Checklist provides step-by-step guidance in performing an assessment of the impact of Intelligent Transport Systems (ITS) on CO_2 emissions. Following this step-by-step guidance ensures a structured approach and comparability with other studies in this field.

Checklist usage

The Checklist can be used by specialist in the field of modelling, assessment and transport engineering, who wish to study the effects of ITS from the basis of a specific research question, and by policy advisors and decision makers: people that are interested in CO_2 assessment in general, or commission assignments for CO_2 assessment studies of ITS. The second group can use the Checklist to judge whether the party carrying out the assessment follows the methodology properly and takes the right steps. The Amitran approach is described in detail on the Amitran Knowledge Base. More information about the Amitran project can be found on the project website.

www.amitran.eu/knowledge-base/

www.amitran.eu/

The assessment itself requires the use of models and data and the expertise to apply them. Amitran is not a 'tool' that can replace modelling or analysis. It is a methodology to aid the analysis process, and to provide guidance and examples. It also provides model interfaces and links to some datasets.

Checklist steps

The following steps outline the process to be followed. Steps 9 and 10 are optional. These steps are included in the methodology to extend to the needs of decision and policy makers.

Step 1: Define the ITS application for which you wish to study the CO_2 effects
Step 2: Define your research question
Step 3: Identify the factors and parameters influenced by your ITS application
Step 4: Identify the model types required for the assessment
Step 5: Define the data needs for the assessment
Step 6: Select and use a demand model
Step 7: Select and use a traffic simulation model
Step 8: Select and use an emission model

Optional steps:
Step 9: Scale up results to a higher level
Step 10: Carry out a cost-benefit analysis

Step 1: Define the ITS application for which you wish to study the CO_2 effects

We assume that you have a specific application and situation in mind that you want to evaluate. The application needs to be described as detailed as possible in order to be able to carry out a good assessment. Minimum issues that should be in this description are

what does the application do,
how does the application work,
what is the goal of the application, and
under which conditions does the application (not) work.

Amitran uses an existing categorisation of ITS applications. More information about these categories and ITS applications belonging to the categories can be found on the Amitran Knowledge Base.

Step 2: Define your research question

The research question defines what you want to investigate. For example: *What are the effects of Adaptive Cruise Control on CO2 emissions on the EU level when 50% of the vehicles are equipped with the system?*

Or more generally: *What are the effects of a certain system on CO2 emissions on a certain level for a certain penetration rate?*

More specific information can possibly be added to the research question, such as a future year, a specific situation (for example motorways), or different penetration rates per country. The research question has to be defined as accurately as possible, to enable an appropriate modelling approach.

Step 3: Identify the factors and parameters influenced by your ITS application

ITS applications impact CO_2 emissions indirectly in different ways, for example through influencing the route or mode choice, by having the driver adopt a more environmentally friendly driving style, or by changes in fleet management for the public transport and freight sectors. In order to choose the most appropriate modelling approach (cf. step 4) it is important to identify the parameters influenced by the relevant ITS application.

Amitran provides a complete list of parameters and factors relevant for describing traffic and, hence, CO_2 emissions.

Step 4: Identify the model types required for the assessment

With help of the factors and parameters that are influenced by your ITS application, types of models needed and the interfaces between them can be determined. This can be done with help of the Amitran framework.

The framework (see Figure 1) provides an overview on possible model types and the sequence in which they are used, including the interfaces between them. Since the Amitran approach makes use of the mechanisms by which ITS exert their influence, the parameters identified in the previous step are listed on the left of the figure. These parameters indicate the model types required for the assessment (demand, traffic simulation, emission). In general models can be classified into microscopic and macroscopic models. Microscopic models deal with movements of individual actors (e.g. vehicles/trains/vessels) and the interaction between them and with the infrastructure; while macroscopic models deal with traffic streams of

vehicles/trains/vessels in an aggregated manner such as average speed, flow and density.

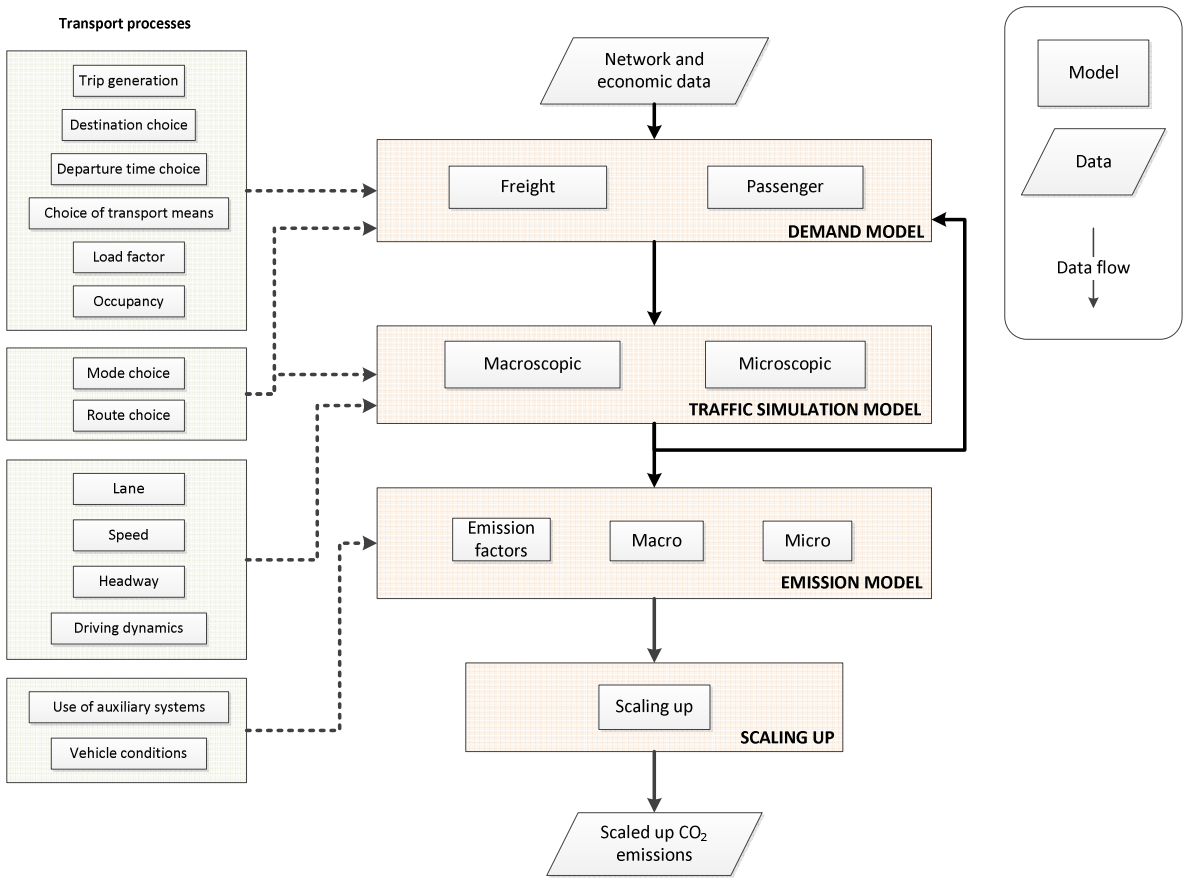

Figure 1 Amitran framework

Step 5: Define the data needs for the assessment

Importantly, any assessment requires that various data sets are available. The needed data sets depend mainly on your specific ITS application, your research question and the models that you will use. Data types, for which you will need data, are:

Situational or context data: data on transport supply (i.e. road network data, possibly including data on the traffic management and control) and structural data (i.e. population, economy, etc.)
Data needed for the estimation and calibration of models
Data on the reaction of users to an ITS application
Data on the frequency and probability of incidents
(only for certain scenarios)

Possible data sources are literature, driver simulator studies, experiments and direct measurements, data from earlier projects like Field Operational Test (FOT) data, publicly available sources, stated preference surveys, etc. When no data sources are available, input might be based on expert judgment.

Step 6: Select and use a demand model

The demand model is used to create the demand in terms of trips from origins to destinations; it provides trip numbers between zones or cells of a network per time slice and mode. The application of a demand model requires the network to be defined and as input, socio-economic data are needed.

For a complete estimation of transport demand, models may be required for both freight and passenger traffic. Depending on the ITS application it might be sufficient to assume constant demand from one or the other of these, and to limit the modelling to passenger or freight. Cross-impacts between passenger and freight demand, however, cannot be adequately estimated in this case. The output of the demand model is used by traffic simulation models (Step 7).

Step 7: Select and use a traffic simulation model

The traffic simulation model links the demand to the traffic network; it uses the data provided by the demand model to create the traffic flow. It calculates link based traffic data (macroscopic model) or trajectory information for individual vehicles (microscopic model). The Amitran framework provides indications which type (macroscopic or microscopic) is required.

This step includes the application of the model including calibration, validation and execution for scenarios. The output is used by emission models (Step 8).

Step 8: Select and use an emission model

The emission model uses the data provided by the traffic model to calculate emissions. Additional input may be the division of the whole vehicle fleet into emission classes if this is not yet covered by the traffic models' output. Calibration is normally not required since these models are available in an already calibrated form. Emission models can be based on emission factors, on a macroscopic approach or on a microscopic approach.

Step 9: Scale up results to a higher level (optional)

Projects, simulations, experiments and other type of tests often deliver results at a local scale (e.g. for a link, small network or city). However, policy and business decisions are usually taken based on expected effects at a more global level. Therefore results might need to be scaled up to a higher level. Scaling up refers to the extrapolation of effects from a smaller scale to a larger (geographical) scale. The level to which the scaling up is carried out depends on the user of the methodology and the research question he or she wants to address. This can for example be country level or EU level. Scaling up is not something that can be done by simply following some steps: it is a very project-specific procedure and requires in-depth knowledge on the project results and on the level you want to scale up to.

In Amitran, two methods for scaling up are distinguished. Choose one of the following two:

Scaling up using statistics, with the use of data (some of which is made available through the Amitran statistical knowledge base - www.amitran.eu/Knowledge_Base: follow the link to EU and national statistical data (Statistical Knowledge Base))
Scaling up using a macroscopic multimodal traffic model on the desired scale (using the model is similar to Step 7)

Step 10: Carry out a cost-benefit analysis (optional)

To evaluate the effects, a Cost-benefit analysis (CBA) and a Cost-effectiveness analysis (CEA) can be carried out.

A ***CBA*** forms a comprehensive and unified approach to estimate the costs and benefits of different ITS applications with a consistent use of parameters, assumptions, etc. The approach makes use of scientific and transparent methodologies and state-of-the-art information to generate the results. The Amitran framework applies CBA as the most prominent economic assessment tool to prove the profitability of ITS applications on society level.
A ***CEA*** provides a straightforward and simple methodology to rank ITS applications on their main effect: the reduction in CO_2 (or other type of) emissions. By using the CEA methodology the most cost-effective project/measure with regard to decreasing the CO_2 emissions can be identified.

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