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IMAGINE

Improved Methods for the Assessment of the Generic Impact of Noise in the Environment

IMAGINE – userinterface database

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EXECUTIVE SUMMARY

One part of workpackage 6, task 4 of the IMAGINE project is to create a database structure allowing source terms to be stored and efficiently accessed for general purposes, and to feed the HARMONOISE/IMAGINE prediction procedures for noise mapping.

The database will be populated with all data acquired during the project, either by measurement or by access to existing databases.

The IMAGINE database is based on the database structure defined in the Harmonoise project. This report describes a possible user interface on this database. The user interface can be entered on three levels: level 0 (basic level), level 1 (advanced level) and level 2 (expert level).

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1 Introduction

One part of workpackage 6, task 4 of the IMAGINE project is to create a database structure allowing source terms to be stored and efficiently accessed for general purposes, and to feed the HARMONOISE/IMAGINE prediction procedures for noise mapping.

The database will be populated with all data acquired during the project, either by measurement or by access to existing databases.

Figure 1 presents the end user process for propagation calculations using the HARMONOISE WP3 model and WP1.2 railway emission data.

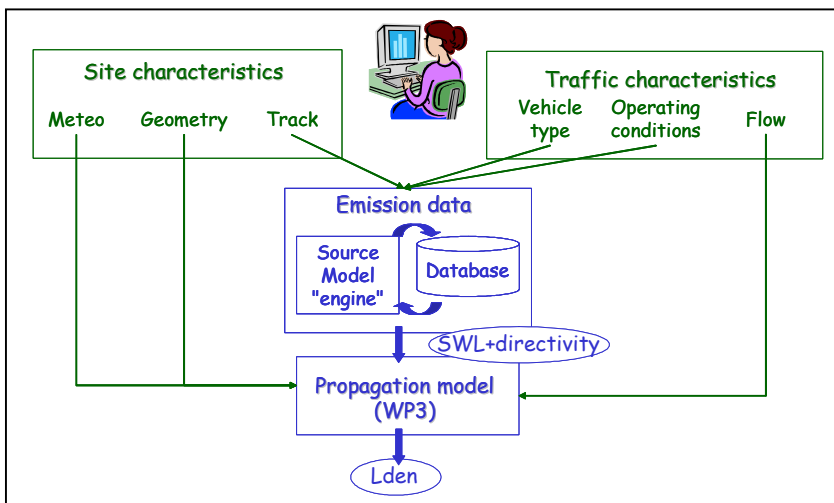


Figure 1. End user calculation process as described in HARMONOISE WP 1.2

Harmonoise provides a draft database structure and a description of the source model “engine”, the formulas with which to calculate the noise emission.

The output of the emission data useful as input of the propagation calculation is:

- The sound power level of equivalent moving point sources for five fixed heights
- The associated directivity, both in third octave bands.

Figure 2 describes the different source positions, which have been chosen for a good description of railway vehicles.

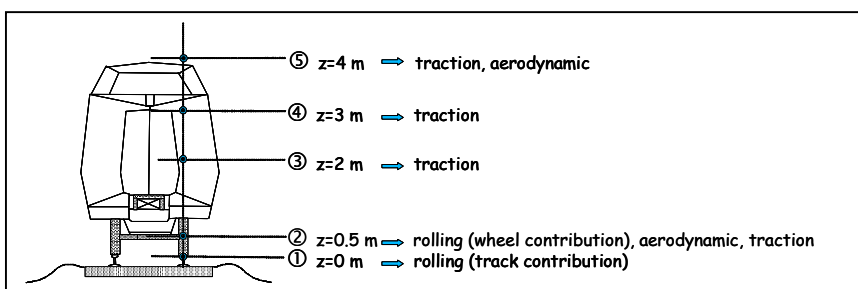


Figure 2. Sources positions for railway as defined in HARMONOISE WP1.2

The main criteria that have lead to the choice for the source position are the following:

- The rolling noise source is split into track (at $z=0$) and wheel (at $z=0.5\text{m}$) contributions. It seems that it is more accurate for treating for example the case of low barriers.
- The traction noise which includes several physical types of sources (traction motors, auxiliary systems, exhausts...) should be spread over the whole height of the train [traction]. Four of the five positions could be used to put a traction noise source, at 0.5m, 2m, 3m or 4 m.
- The aerodynamic noise is split into two contributions, one contribution for the bogie aerodynamic source which can be put at $z=0.5\text{m}$, one contribution at 4m for the equivalent source of the pantograph and if any the recess of the pantograph. It has been verified [Olivier Maurin, position] that the aerodynamic source of the bogie area, which is physically closer to 0.8m can be put at 0.5m without increasing the uncertainty. It has been verified as well that the pantograph noise which is physically closer to 5m can be put at 4m without increasing the uncertainty, even with high noise barriers.

The formulas which describe the source model engine are given in section 2.2 of report *Railway source database User manual*. [1]

2 Standalone User Interface

2.1 General description

In order to make the database accessible for the end-user, a proper userinterface is needed. The userinterface could be combined with a calculation module. For developing purposes in IMAGINE (a prototype) this frontend application is written in Access 2000 and VBA (visual Basic for Applications). If functionality is fixed, the application can be written in Visual Basic as an executable (not provided in IMAGINE).

The database developed in HARMONOISE is in Access2000 format.

The userinterface contains 3 user levels:

- Level 0 / choose predefined track and trains.
By choosing a predefined track and predefined train, by example standard track with concrete sleepers and a freight train, the noise emission LW1 to LW5 can be calculated at a given speed.
- Level 1 / define new track or train with default track and train characteristics, the noise emission LW1 to LW5 can be calculated at a given speed.
- Level 2 / import new track and train characteristics data. Define new track or train with this imported data and calculate noise emission LW1 to LW5 at a given speed.

Level 0 requires basic understanding of railacoustics, Level 1 requires fundamental knowledge of railacoustics, and level 2 requires expert knowledge of railacoustics, railroughness and measurements [2] .Level 2 will also be used for updating the data.

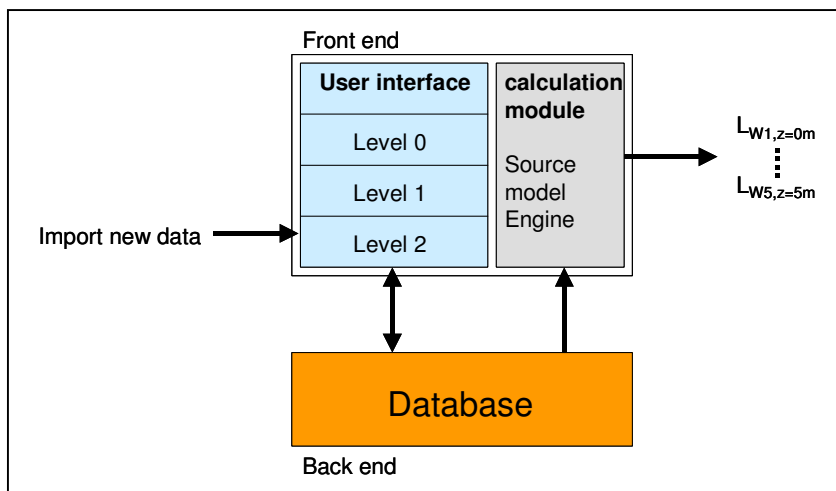


Figure 3. Standalone IMAGINE Database and userinterface.

The formulas which describe the source model engine and the layout of the database are given in section 2 of report *Railway source database User manual*. [1]. All dialogs are fully compatible with the definition of this so called source model engine.

2.2 Draft design prototype user interface

For developing purposes a prototype of the interface is made in Access 2000. In Access2000 it is relatively easy to create menu's, integrate query's and to create subroutines in VBA (Visual Basic for Applications). In this draft only rolling noise is included. The prototype is expandable to traction noise and earodynamic noise.

2.2.1 User level 0 (basic) and calculation

This dialog is the toplevel (level 0, basic) dialog. It is also the dialog from which to start the calculation.

The user is able to choose a predefined track and a predefined train. This predefined track (b.e. "Pierelatte") is defined by a wheel roughness (smooth), Impact noise term (none), track transfer function (UIC60+concrete bibloc) and bridge noise term (none).

On this level, the user cannot change this definition. The same methodology applies to the chosen vehicle type.

After selecting a track and vehicle, the user has to enter a trainspeed, and the noise emission can be calculated. The backgrounds of the calculation are described in section 2.2.4.

Parameter	Value
track description	Pierelatte
vehicle type	passenger coach
speed	80 km/h
wheel roughness (left)	smooth
Impact noise	none
transfer Function	UIC60+concrete bibl
bridge noise	none
wheel roughness (right)	cast iron braked
Contact filter	10ton
brakenoise	none
squeal noise	none
transfer function (wheel radiation)	800-920 mm

Figure 4. Level 0 user interface dialog

To go to level 1(advanced), the user can choose “add vehicle or track” (see section 2.2.2). To go to level 2 (expert), the user can choose “import new data” (see section 2.2.3).

2.2.2 User level 1 (advanced)

At this level the user is able to define a new type of track, formed from default track parameters and vehicle parameters. For rail roughness the user can choose between smooth and corrugated, for the transfer function the user can choose from a list of descriptions. A transfer function is connected to each description. The same methodology applies to defining a new vehicle.

After defining a new track and/or a new vehicle, the user has to return to the dialog of level 0. In this dialog the user has to select the new defined track and train, after which the noise emission can be calculated.

The screenshot shows a software dialog box titled "User_level_1 : Form". The window contains the text "userinterface Imagine database" and "Paul van der Stap - version v1_build05". The main heading is "level 1:add track or train with default data". The dialog is split into two sections: "track description:" and "vehicle type:". Each section has two radio button options: "copy existing" and "give new name:". Under "track description:", the "give new name:" option is selected with the text "track with joints". Below are dropdown menus for "rail roughness:" (set to "corrugated"), "impact noise:" (set to "rail joint"), "transfer function:" (set to "UIC60+concrete"), and "bridge noise:" (set to "steel bridge"). Under "vehicle type:", the "give new name:" option is selected with the text "freight type 2". Below are dropdown menus for "wheel roughness:" (set to "cast iron braked"), "Contact Filter:" (set to "10ton"), "Brake noise:" (set to "block brake"), "Squeal noise:" (set to "curve with radius le"), and "Transfer function: (wheel radiation)" (set to ">920 mm"). At the bottom of each section are buttons for "save new track/vehicle" and "delete track/vehicle". A "Close" button is located at the bottom right of the dialog.

Figure 5. Level 1 user interface dialog

2.2.3 User level 2 (expert)

At this level the user is able to import new spectra for each track and train parameter. By example a new track transfer function can be imported. A description is added to this new transfer function, and can be used in level 1 as parameter.

2.2.4 Default data and user data

Data will be divided into a "basic part". The other is the "user defined part", which is empty when the database is delivered and can vary with time according to user's definition.

The basic part will contain default values as defined in the IMAGINE report *Work Package 6 IMAGINE railway noise source model, measurement protocol and default source data* [3].

Under some step of using the user-interface, user may make a choice from the optional parameter values. These optional parameter values are based on the basic part and also the user-defined-part. The latter one will vary with time which means a saved user-defined parameter value will increase one optional value in the relevant part.

A user can make an input and save it if he or she is satisfied with the result; or not save it. A saved input parameter value will make a change in the user defined part of the database. And, this saved input parameter value can be used afterwards.

For example, if a user defines a new track: wooden + UIC 60, and saves it into the user defined part. Next time, at level 0, the user (or other user) using the database can choose one type of tracks which includes this new type track.

This also means that the delivered databases (of some version) are the same. But, after using, different person/group can define its/their user-defined-part in a different way than the effective databases can be different for different used databases. After time, experts will decide how to make a new version.

2.2.5 Calculation methodology and output

At the current stage of development of the prototype, only a calculation for rolling noise is implemented. This calculation is conform section 2.2.2. of [1]. A conversion from wavelength to frequency domain is also included.

The calculation results for L_{WRN1} and L_{WRN2} is basically stored in an array from 25 Hz to 10.000Hz. These values are written to a .log-file, together with intermediate results for testing purposes.

3 Dynamic Linked Library (DLL)

The IMAGINE model can also be implemented in a noise modeling application. In this case the database has to be linked to a dynamic linked library (.dll). With this setup it is easy to update to a new version of the database with new values. Importing of new data is not possible in this setup; this has to be done with the Standalone interface. A prototype of a dll is not provided by this work package.

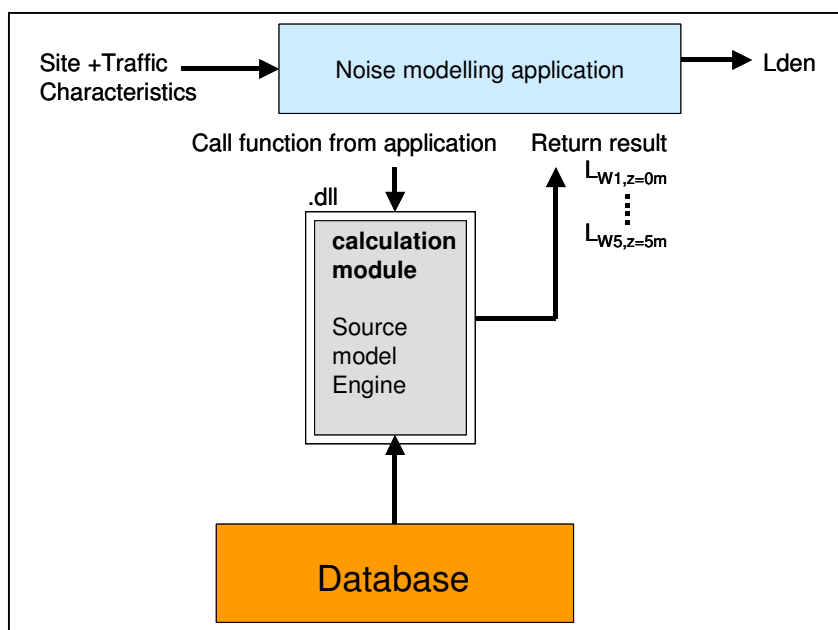


Figure 6. implementation of .Dll into mapping software

4 Mapping

The module described in chapter 3 can be used in a noise modeling application or mapping software. A typical situation is shown in the figure below.

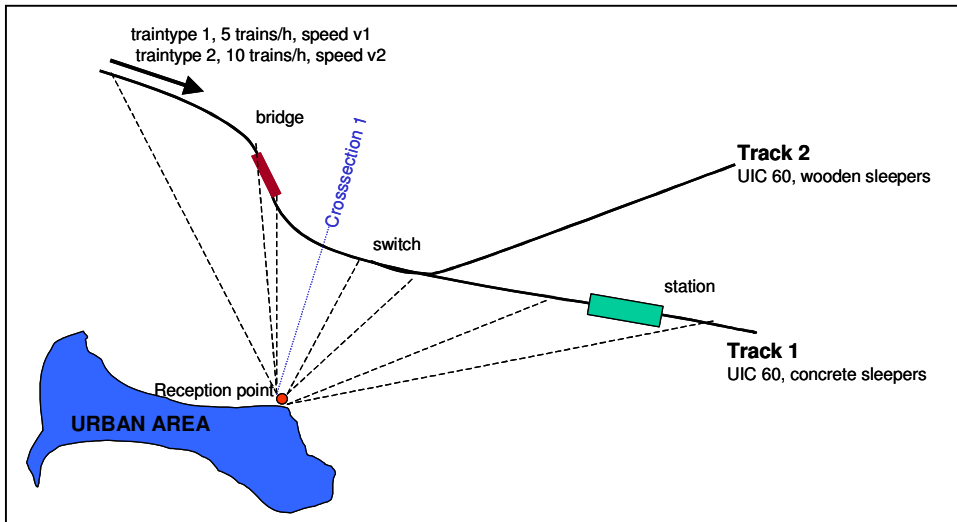


Figure 7. noise mapping example

In this example, the reception point is located on the edge of an urban area. The mapping software calculates the L_{den} , taking into account the noise emission from the train on the track, trackparts within the angle of view from the reception point, and the propagation between track and reception point.

For every part of the track with constant track construction and constant traffic flow (traintype, number of trains/traintype and trainspeed), a noise emission has to be calculated. In Harmonoise and Imagine, this emission is given as a sound power level on 5 source heights (see section 1, figure 2). The total emission on a certain part of the track (b.e. cross section 1 in figure above) can be decomposed to a noise emission per meter track and per train type, as equivalent moving point sources.

5 Database administration

This chapter will contain information on how to administrate new data input during the IMAGINE project.

6 Literature

1] *Railway source database User manual*. HAR12TR-040112-SNCF02.doc. Deliverable D13 part1 Harmonoise, C. Talotte, SNCF

2] *Measurement protocol Harmonoise, practical ways to fill the database*. HAR12TR-031203-AEA5.doc. Deliverable D13 part 2 Harmonoise, Paul van der Stap e.o.

3] *Work Package 6 IMAGINE railway noise source model, measurement protocol and default source data (DRAFT)* IMA6TR-040927-TNO01, M. Dittrich