A case study to determine the feasibility of using the CNOSSOS model for estimating traffic noise in Bankstown, Sydney

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Contents

1 Abstract

We demonstrate the feasibility of using the CNOSSOS (Common NOise aSSessment MethOdS) noise modelling framework in Australia. To do this, we implemented the code prepared by Morley *et al.* (2015) using data sources for Bankstown, NSW. We discuss the limitations of the available data in the Australian context and identify enhancements which may be useful if the model were to be applied across Australia.

2 Introduction

Traffic noise is detrimentally linked to several health outcomes (Babisch (2006), Van Kempen & Babisch (2012), Björk *et al.* (2006), Sorensen *et al.* (2012)). Consequently, traffic noise modelling is increasingly important for understanding exposure and the impact on human health. This report examines the feasibility of extending the CNOSSOS framework as implemented by Morley *et al.* (2015) to an Australian context. In this paper, Morley *et al.* compare the results achieved using 6 different levels of detailed data, an include code for the lowest and higest models.

We used the code published with this paper, along with data for Bankstown, NSW to demonstrate the CNOSSOS model can feasibly be used in Australia. Included alongside this report, we have created a PostGIS server with access to the source data and scripts which run the analysis. Because some of the datasets are restricted, these are not published in the public domain. Instead they have been made available through the Centre for Air pollution, energy and health Research (CAR) Data Analysis Technology (DAT) platform (http://cardat.github.io/). Access to this can be requested through the CAR data team (car.data@sydney.edu.au).

We highlight a few issues and potential ways in which results may be improved upon. Primarily there would need to be careful consideration of data inputs, including overcoming any differences in data across the states and territories.

Additionally, there are several other papers that could feasibly be used to enhance data inputs into the CNOSSOS code. For example, Morley & Gulliver (2016) describes ways in which traffic flows on minor roads can be modelled which could improve the CNOSSOS model which uses constant hourly traffic rates for all minor roads.

3 Methods

3.1 Implementation of CNOSSOS code from Morley 2015

In Morley *et al.* (2015), a number of different models are described (A through F), which rely on differing levels of detail in the input data. The authors provided code for two of these models in their github repository, located at https://github.com/dwmorley/BioshareCNOSSOS_EU.

As this project was a feasibility study we implemented the lowest resolution model (F), starting from the code in Morley's repository. We then deviated from the original scripts in the following ways:

- Updated deprecated functions
  - ST_Line_Interpolate_Point updated to ST_LineInterpolatePoint
  - ST_Line_Locate_Point updated to ST_LineLocatePoint
- Reorganised SQL scripts so that they were modularised in a logical order catering to code dependencies

3.2 Software

We implemented this on a PostGIS database (version ????) and did the analysis with SQL functions and scripts.

3.3 Data sources

The data sources used for the low resolution code in this study are outlined in the table below with comparison to those used by Morley.

Input	Bankstown Data Source	Morley 2015 Data Source
Landcover	NSW LEP Land Zoning 2010 NSW State Government of NSW and Office of Environment and Heritage (OEH) (2017)	CORINE 2006 v16 (~100 m precision) European Environment Agency (2015)
Building heights		
Road network	StreetPro Navigation 2012 Pitney Bowes (2012)	
Traffic flow		

Input	Bankstown Data Source	Morley 2015 Data Source
Traffic composition		
Traffic speed	StreetPro Navigation 2012 Pitney Bowes (2012)	
Topography		
Meteorological data	**wind data** fictional data **temperature data** downloaded from BoM	

3.4 Data mapping

The Topograpy data used in our feasibility study was mapped to the CORINE codes used by the CNOSSOS model as follows:

LEP Landzoning value	CORINE code	CORINE description
Business Development	121	Industrial or commercial units
Business Park	121	Industrial or commercial units
Enterprise Corridor	121	Industrial or commercial units
General Industrial	121	Industrial or commercial units
Infrastructure	121	Industrial or commercial units
Light Industrial	121	Industrial or commercial units
Primary Production Small Lots	121	Industrial or commercial units
Unzoned land	133	Construction sites
High Density Residential	111	Continuous urban fabric
Medium Density Residential	111	Continuous urban fabric
Local Centre	111	Continuous urban fabric
Mixed Use	111	Continuous urban fabric
Neighbourhood Centre	111	Continuous urban fabric
Low Density Residential	112	Discontinuous urban fabric
National Parks and Nature Reserves	313	Mixed forest

LEP Landzoning value	CORINE code	CORINE description
Private Recreation	142	Sport and leisure facilities (Artificial, non-agricultural vegetated areas)
Public Recreation	142	Sport and leisure facilities (Artificial, non-agricultural vegetated areas)
Special Activities	142	Sport and leisure facilities (Artificial, non-agricultural vegetated areas)
Natural Waterways	511	Water courses

A full list of the CORINE Land Cover nomenclature conversion to Land Cover Classification system codes can be found here http://dd.eionet.europa.eu/vocabulary/landcover/clc

4 Results

4.1 Creation of PostGIS server and data sources

As a deliverable we have set up a PostGIS (version ????) database with several schemas for the source data, and a public schema for the CNOSSOS tables and code. This database incorporates the Bankstown data, and along with the SQL scripts and readme in the scripts_and_analysis folder in this repository can be used to run the low resolution model.

4.2 Data visualisation from QGIS

The data from each of the layers can be visualised through QGIS. Below are some examples of data used in this report.

5 Discussion

5.1 Limitations on data

Data availability across Australia can be inconsistent due largely to the extremely diverse population densities. While this means it may not be possible to apply the model in many areas, it is likely that there would

Figure 1: Bankstown roads and ten randomly generated receptor points

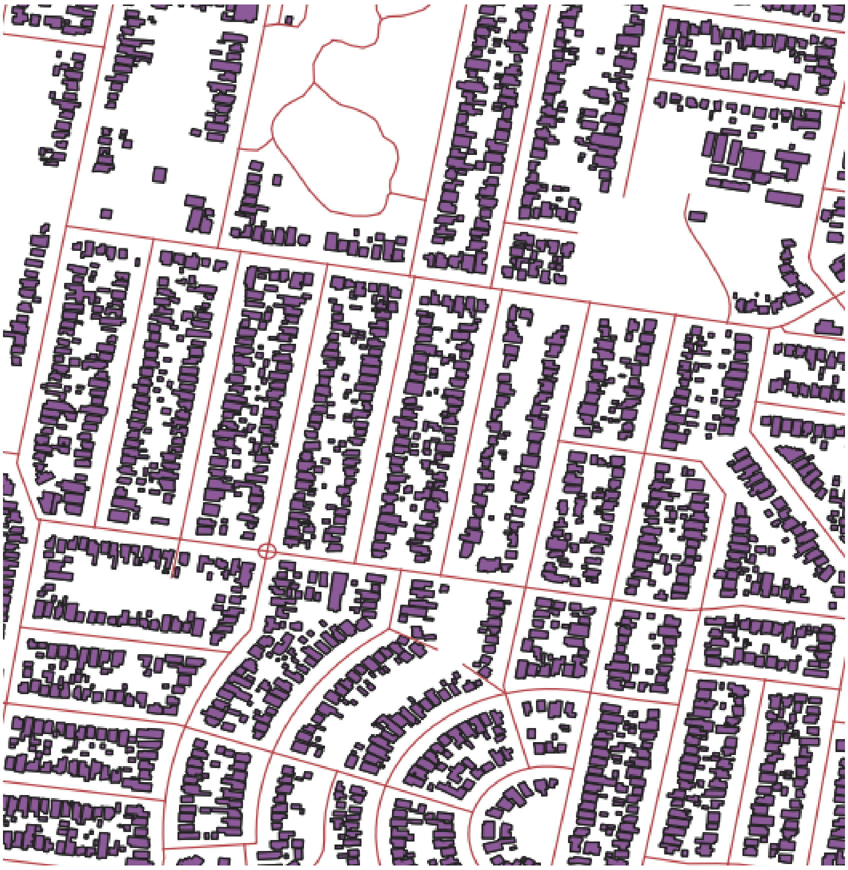

Figure 2: Bankstown roads and ten randomly generated receptor points

be sufficient data to operate the model in areas of interest (i.e. populated regions).

Even where data is available, however, the lack of national standards means that the data may not be measured or represented consistently. These differences mean that mapping exercises may be necessary to achieve consistent outcomes from the model.

5.2 Issues and proposed enhancements

In implementing this model we encountered a number of issues with the orginal code. These included:

- Lack of sample data which made it difficult to ensure new data sources met the requirements of the model. It also made it difficult to debug issues that could have been related to the input data.
- Documentation of code was provided, but very minimal and often difficult to understand without detailed knowledge of the accompanying paper.
- There were a couple of deprecated functions which needed to be updated to get the code to run in the more recent version of PostGIS.

The choice of platform and code language (PostGIS and SQL) were difficult choices for re-implementing this model. The lack of code breakpoints and Integrated Development Environment made debugging issues with code difficult. Were the study to be extended further, it might be worth considering an alternative analysis environment (e.g. R or Python).

This study has not tested for scale and only uses 10 receptor points which are randomly generated, expanding the results to larger areas could result in poor performance.

6 Conclusion

It is possible to use the CNOSSOS noise modelling framework in Australia, at least in major cities for which we have data.

If this study were to be expanded to cover more of Australia, it would be worth taking the time to consider the differences in data across states and territories and to plan how they can be mapped effectively.

Further work would need to be done to establish the validity of the results, and the feasibilty of substantially increasing the scale of data.

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