Traffic Simulator Tool as Reliable Effort for Environmental Estimation at Road Intersection

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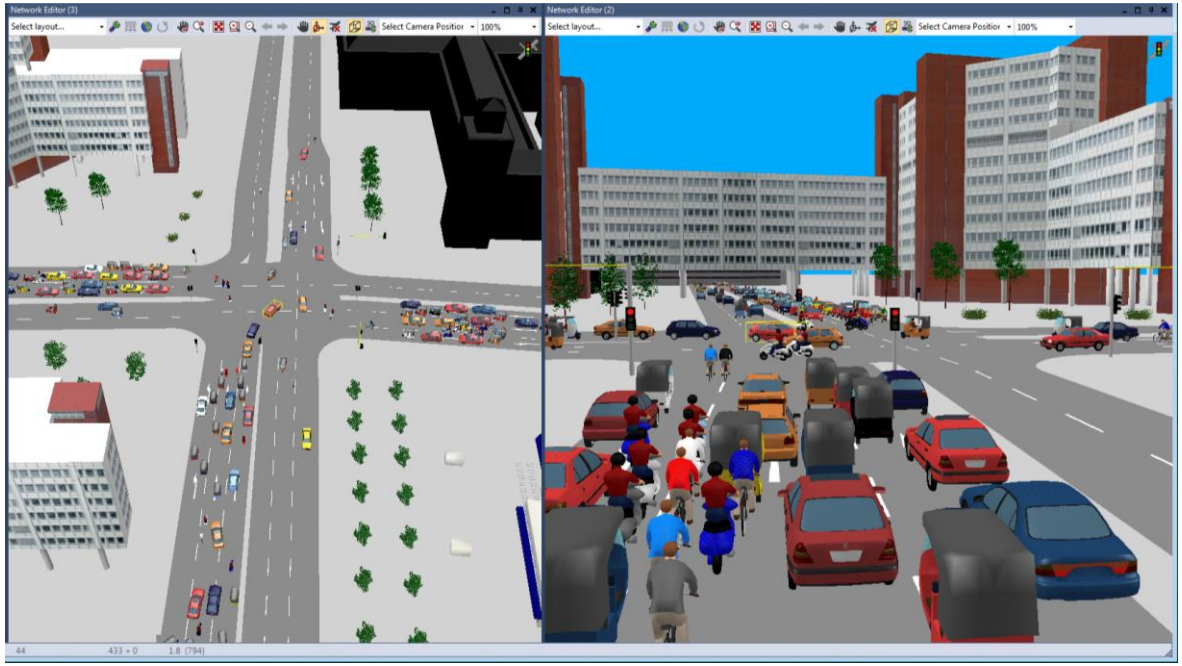

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Motivation

This paper investigates the simulation framework to model the effects of the local air quality on a road operational layout for its relationship to the people health.

The results of traffic micro simulation are inputs of micro emission model.

- More than 60% of the analyzed studies include only road traffic modeling or emission modeling
- The binomial air quality modeling / traffic simulation models were investigated on 30% of the studies analyzed (Abou-Senna, H. et alii, 2013)

Background

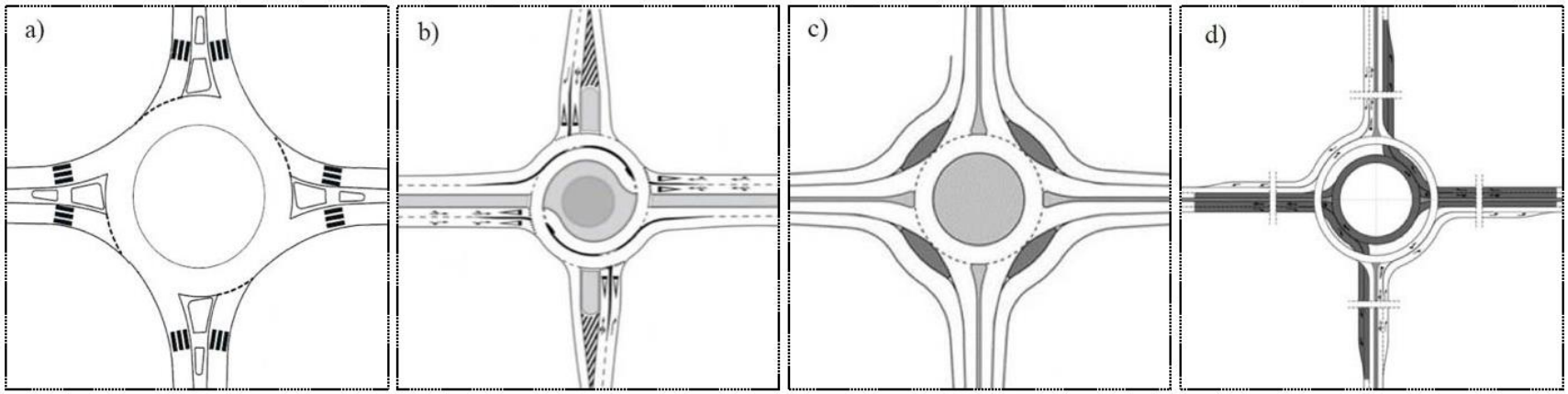
The highest fuel consumption on urban arteries is associated with driving in congested traffic, characterized by higher speed fluctuations and frequent stops at intersections.

When selecting an "optimal" type of intersection, the environmental criterion is extremely important.

Roundabouts are efficient in terms of vehicle emissions and fuel consumption, increasing positive effects on the environment.
The situation seems to be much better in the case of alternative types of roundabouts

Background

Some of them are already in frequent use all over the world (*hamburger, dumb-bell*), and some of them are recent and have only been implemented within certain countries (i.e. turbo, dog-bone, compact semi two-lane circle) or are still in the development phase (i.e. turbo-square, flower roundabout, target roundabout, four flyover roundabout).



Environmental analysis of different road intersection layouts

A comparison of different road intersection layout considering the use of traffic micro simulation tool and varying the traffic flow range (i.e. Daily Total Traffic flow) as described below:

- DTT flow <10,000 vehicles/day
- 10,000<DTT<15,000
- 15,000<DTT<20,000
- 20,000<DTT<30,000

The impact of road geometry design was used as the input in the microscopic traffic models by VISSIM and AIMSUN tools

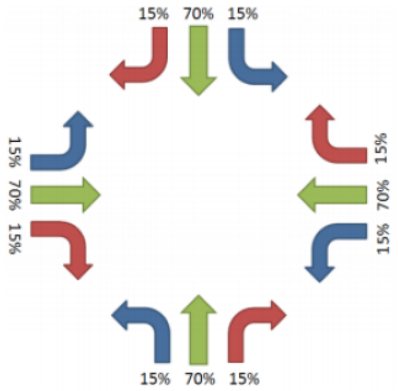
Environmental analysis of different road intersection layouts

The O/D matrix considers an equal distribution on main and secondary direction with:

- 15% of vehicles turn right;
- 70% of vehicles cross;
- 15% of vehicles turn left.

Maximum entry capacity was considered as the volumes corresponding with a V/c factor of 0.8 of total theoretical capacity.

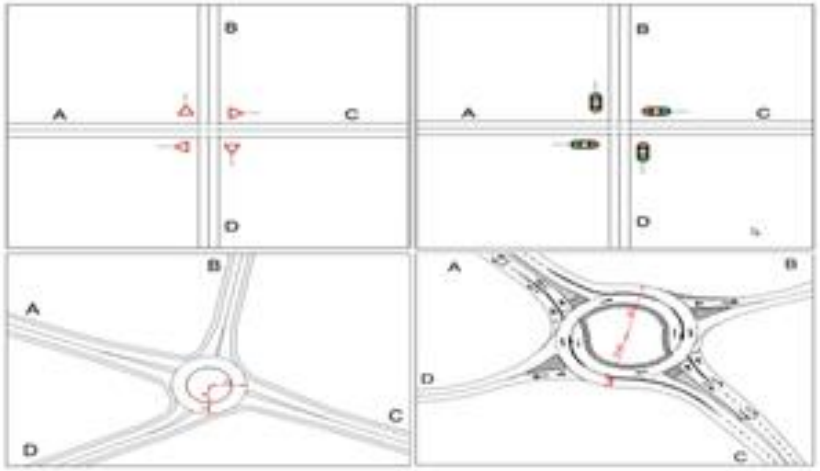
Matrix q
with
15% of vehicles turn right
70% of vehicles cross
15% of vehicles turn left

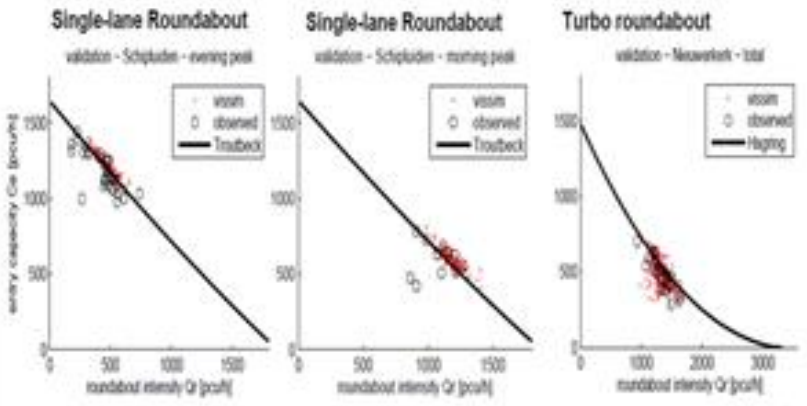


Environmental analysis of different road intersection layouts

Investigated intersection schemes were: A. unsignalized intersection; B. signalized intersection; C. single lane roundabout; D. turbo-roundabout;

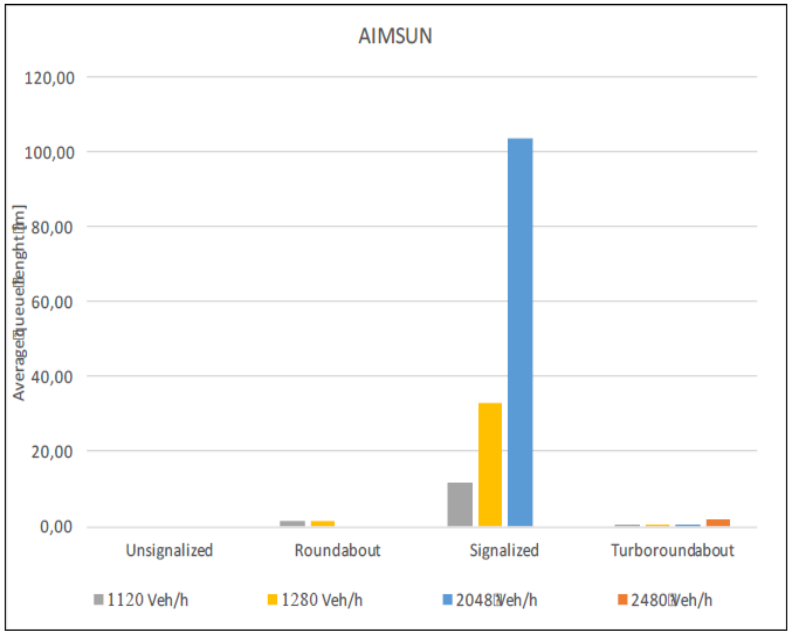
Validation of capacity for single lane roundabout and turbo-roundabout was considered as derived in the Netherlands.

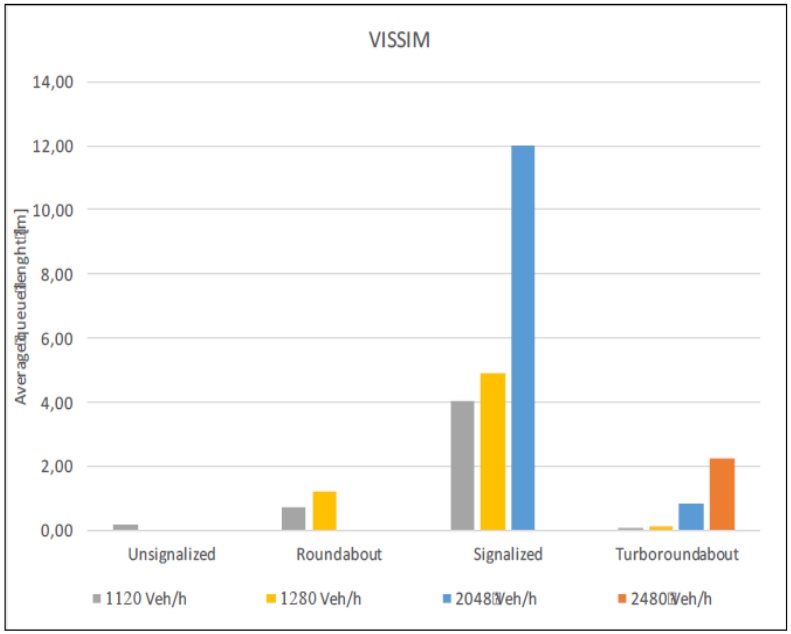




Operational performance of different road intersection layouts

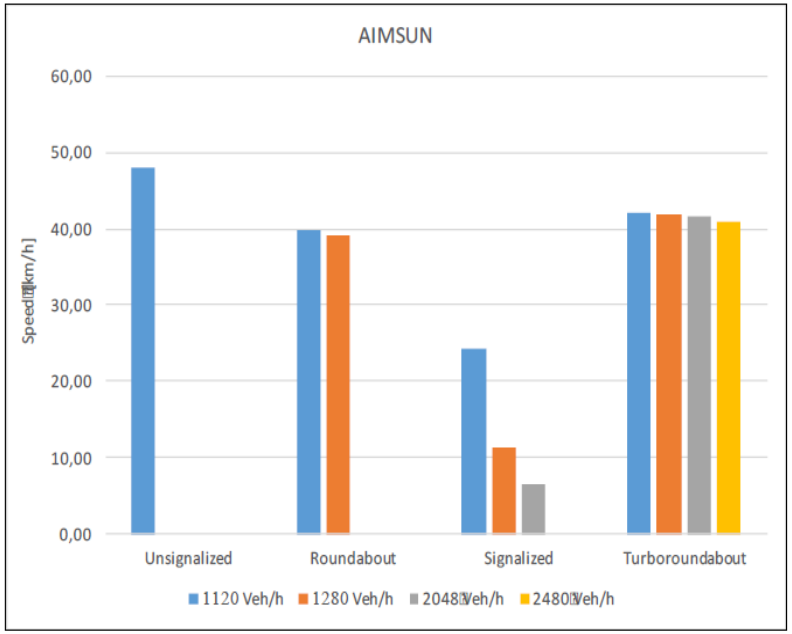
Comparison of the queue length for different road intersections layout

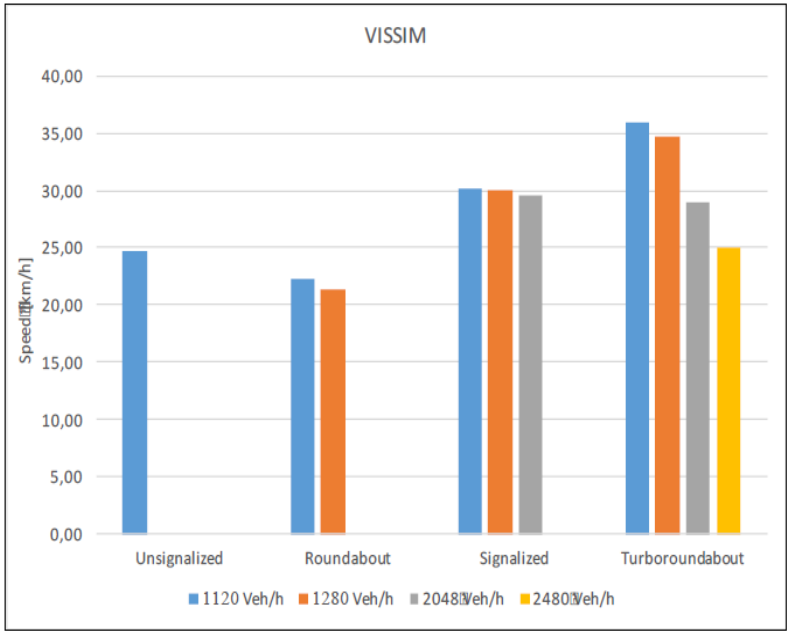




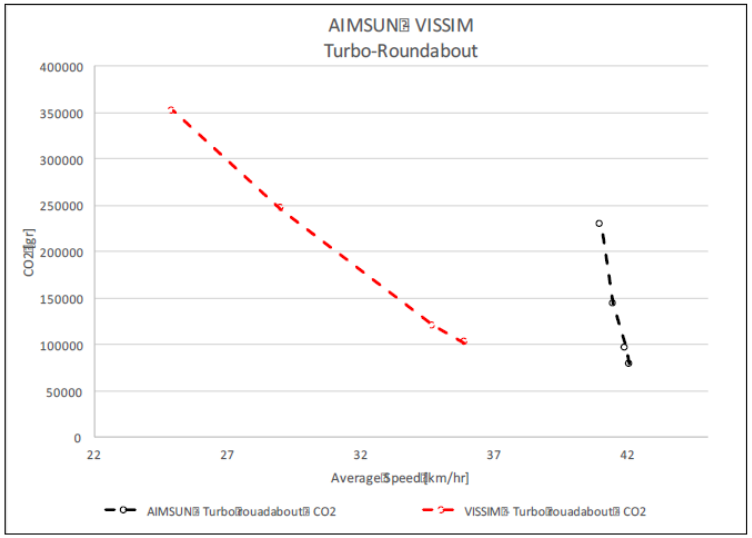
Operational performance of different road intersection layouts

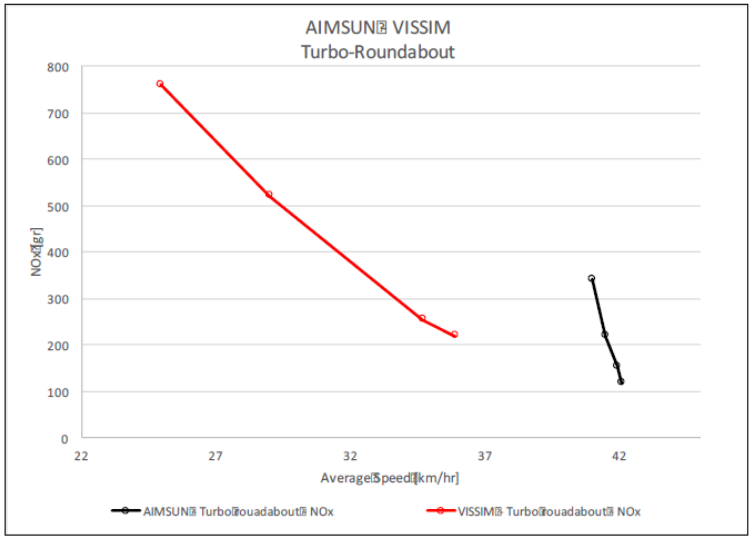
Comparison of the average speed for different road intersections layout

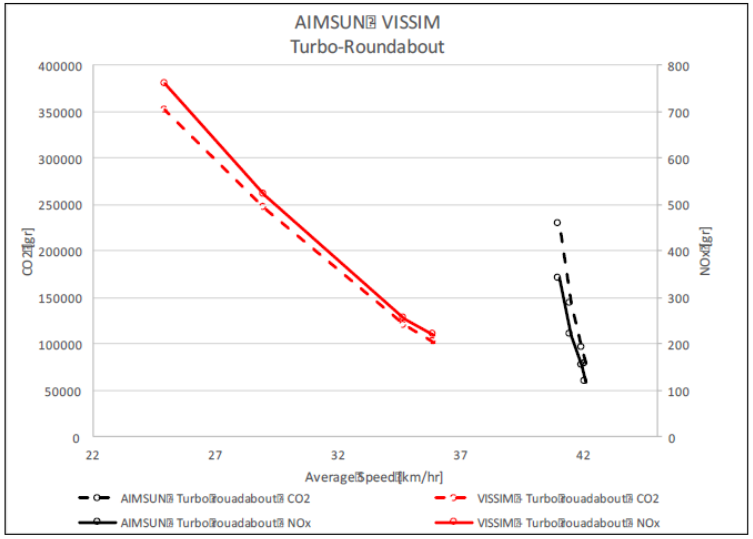


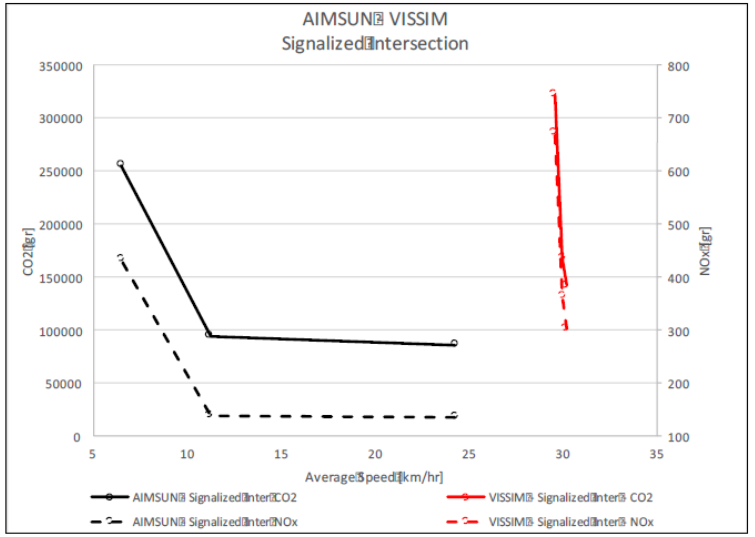


Environmental performance at high capacity level









Highlights

It can be underline that the two traffic microsimulator tools investigated, Aimsun and Vissim, seem to use the same parameter for turbo-roundabout layout varying the traffic flow.

By the opposite side, the model of signalized intersection executed by the two traffic microsimulator is very incomparable both in terms of trend and of absolute value (average speed, queue length and delay time).

Overlook

The problem of evaluating the relative performance of four different intersection configurations was investigated: an unsignalized intersection, a signalized intersection, a single-lane roundabout and a turbo-roundabout.

These intersection schemes are always characterized by different accident rates; then, the designer chooses them taking into account both their functionality and the safety aspect.

These preliminary findings would promise interesting criteria in order to enhance intersection design and to assess evaluation by multi-approach methods.

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