Simulation of Observed Traffic Conditions on Roundabouts by Dedicated Software

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Abstract

This study presents a calibration procedure between observed performances of a roundabout and performances obtained by the use of simulation software. Two sets of scenarios different among them only for the traffic flow distribution were analyzed: Free Flow Condition (FFC), from which to derive the average speed profiles along a through movement; and Saturation Flow Condition (SFC), to determine the average stop-line delay along a branch. A multitude of scenarios for single-lane roundabouts has been composed and analyzed in order to evaluate the best combinations of software parameters in the simulation and to minimize errors between observed and simulated performances.

Keywords: Roundabouts, Microsimulation Models, Stop-line Delays, Calibration Procedure.

1. Introduction

Microscopic simulation models have become useful tools for transportation engineers because they can be used in studying road intersections, in particular roundabouts, through a dynamic approach, in order to design and evaluate traffic management and junction performances (Capacity, Levels of Service, Stop-line delay etc).

Several analytical and micro-simulation models now offer options of roundabout analysis. They are currently more and more popular and other new ones are continually being developed. However, correct calibration procedures first against field data or against other validated analytical models very often are omitted. Microscopic simulation models offer flexible and user-definable methodology to evaluate traffic operations of roundabouts.

They contain a lot of independent parameters trough which driver behaviour and traffic control operations are described. These same parameters have a reference value for each model that can be changed by users in order to

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represent local traffic conditions. For this reason, it is important for models users to know the real sensitivity of each package on the key input and output parameters which are of interest to the practitioners (researchers, engineers, planners, etc.).

2. Literature review

Several software packages provide roundabout analysis capabilities, using various theoretical methods and requiring a variety of input parameters [1–2]. However, only a few of these parameters usually have significant effects on analysis results. Several previous studies examined the influence of these factors in different roundabout simulation models from field data. A comparison between software findings constitute a preliminary remark for statement of calibration problem between observed reality (OR) and simulated reality (SR).

In [3] is presented a study that involved the analysis of roundabouts using a gap-acceptance micro simulation model (VISSIM) and an empirical-based model (RODEL). Four different traffic scenarios and two geometric conditions (a single-lane and a dual-lane roundabout) were evaluated. The analysis of results showed that the capacity estimates from VISSIM were consistently lower than the estimates from RODEL for both single and dual-lane roundabouts. In particular, the authors found that VISSIM estimations of Circulating + Entering Merge Capacity (Veh/Hour) were lower than RODEL estimations of about 20% for a single-lane roundabout and of more than 25% for a dual-lane. At the same time the mean ADT Capacity (Total Entering Veh/Day, All Approaches) estimated with VISSIM was lower than the one estimated with RODEL of about 25% for single lane and of around 30% for dual-lane roundabouts. The results were consistent with the findings of [4].

Ambadipudi [5] provided some guidelines for multi-lane roundabout operational analysis making a comparison of results between VISSIM and other two popular microscopic traffic simulation tools: RODEL and SIDRA. The modeling procedure outlined in the paper also tried to take advantage of the merits of each program used. This study led to several conclusions: any alternative that had no good performance (Volume/Capacity > 0.85 for any approach) in RODEL also performed poorly in SIDRA. Moreover, RODEL reported the lowest delays and queue lengths for all the approaches analyzed. Both RODEL and SIDRA provided very reasonable values for volume to capacity ratios. The queue lengths observed in VISSIM were higher than both SIDRA and RODEL. RODEL reported minimal or no queues on the approaches. This result appeared unrealistic for the authors, also considering the volumes serviced by the roundabout.

Chen and Ming [6] evaluated how well different software packages such as RODEL, SIDRA and VISSIM predict capacity, queue length and delay for congested roundabouts, using data from East Dowling Road Roundabouts in Alaska. The authors made the following conclusions: RODEL, SIDRA and VISSIM all overestimated the capacities, however VISSIM had the best estimation; RODEL overestimated the average delays and the average queue lengths for most approaches whereas SIDRA and VISSIM underestimated delays and queues; SIDRA had the best delays and queues length estimations overall.

Smith et al. [7] studied a four way single-lane roundabout in the city of Nashua, New Hampshire comparing three different micro-simulation software: AaSIDRA, RODEL and PARAMICS. The study led to the following results: AaSIDRA estimates were close to the field measurements, whereas RODEL seemed to overestimate the delay. On the other hand, PARAMICS appeared to underestimate delay when the exiting and/or the circulating volumes are high compared to entering volumes.

Nikolic et al. [8] analyzed six roundabout evaluation tools (AIMSUN, PARAMICS, VISSIM, SIDRA, NCHRP, RODEL and ARCADY) by applying them to five case-study locations and comparing delay estimations with field data. Both single and double-lane roundabouts were evaluated. The authors concluded that there was no significant difference between the delay estimates given by the six software packages used at low moderate traffic volumes, whereas PARAMICS, VISSIM and AIMSUN showed more reasonable prediction results at higher traffic volumes. Among the micro-simulations model analyzed AIMSUN and VISSIM provided the best results.
After this brief digression, it is clear how important it is to understand the definition and the impact of each input parameter in simulation models. Therefore, in this study the authors evaluate the effect of kinematic and behavioral parameters (mainly in terms of acceptable gap) in the simulation of single-lane roundabouts through a calibration procedure both in free flow that close to saturation conditions.

3. Organization of experiment and case study description

The experimental planning was organized according to the flowchart shown in Figure 1.

![Flowchart of the experimental planning](image)

Beginning from a preliminary analysis it has been identified a geometrically regular roundabout and its geometric features. This roundabout was video-recorded by two cameras at different times and for several days in order to collect traffic data. In particular two special configurations were identified: “SFC” Saturation Flow Configuration during the peak volume of the afternoon (from 1:00 pm to 2:00 pm) and “FFC” Free Flow Configuration during the lowest traffic period of the morning (from 10:00 am to 11:00 am). The first configuration allowed us to analyze the roundabout, with traffic-flow close to saturation, in terms of stop-line delays, critical gaps and times of service.

The second one has instead ensured the acquisition of data relating to the free flow speed along the crossing movement on roundabout. Therefore 216 microsimulation scenarios were designed both for SFC and for FFC. In this way the calibration procedure of Vissim software was conducted by comparing the speed profiles along the crossing movement A-C during the FFC and the stop-line delays on the branch A during the SFC. Finally, considering the previous analysis, the best scenarios for both traffic-flow conditions were identified.

The roundabout, studied in this paper, is placed in the University Campus of Arcavacata, Cosenza, Italy. The roundabout geometric properties are shown in table 1 and in figure 2.
Table 1. Roundabout geometric properties

<table>
<thead>
<tr>
<th>Entry</th>
<th>Exit</th>
<th>Splitter Island</th>
<th>Dimensions of Circle:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Radius</td>
<td>Width</td>
<td>Radius</td>
</tr>
<tr>
<td>Approach A</td>
<td>8.00 m</td>
<td>4.22 m</td>
<td>28.32 m</td>
</tr>
<tr>
<td>Approach B</td>
<td>14.20 m</td>
<td>4.13 m</td>
<td>8.00 m</td>
</tr>
<tr>
<td>Approach C</td>
<td>5.65 m</td>
<td>5.01 m</td>
<td>14.20 m</td>
</tr>
<tr>
<td>Approach D</td>
<td>28.32 m</td>
<td>5.38 m</td>
<td>5.65 m</td>
</tr>
</tbody>
</table>

4. Data Collection

4.1 Saturation Flow Configuration (SFC)

The roundabout was video-taped by two cameras during different days. Historically the peak volumes occurred in the morning from 8:00 am to 9:00 am and in the afternoon from 1:00 pm to 2:00 pm (SFC). In particular this recording was conducted from 1:00 pm to 2:00 pm, during the peak volume of the afternoon (SFC). The following data were extracted from this video-tape: (i) the volume of traffic entering, exiting and circulating for each approach; (ii) the stop-line delay for the approach A; (iii) the time of service and the drivers’ headways for each entry; (iv) the acceptable gaps.

All the information was collected for 1-minute time increments, based on vehicle entry of the roundabout. 5-minute volume intervals were created by combining sets of five concurrent 1-minute values. 5-minute periods served as the building blocks for one hour periods used in the analysis.
The O/D matrix, obtained from the analysis of this recording (SFC) and homogenized in vehicle per hour by the coefficients present in [9], is summarized in table 2.

Table 2. Volume of traffic for SFC

<table>
<thead>
<tr>
<th>[Veh/h]</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>7</td>
<td>185</td>
<td>297</td>
<td>147</td>
</tr>
<tr>
<td>B</td>
<td>23</td>
<td>0</td>
<td>4</td>
<td>36</td>
</tr>
<tr>
<td>C</td>
<td>169</td>
<td>14</td>
<td>5</td>
<td>61</td>
</tr>
<tr>
<td>D</td>
<td>141</td>
<td>111</td>
<td>47</td>
<td>3</td>
</tr>
</tbody>
</table>

The capacity of the approach A has been calculated according to [10], using this traffic flow distribution and considering the geometric features of the roundabout:

\[
C_A = (1330 - 0.7 \cdot Q_d) \cdot [1 + 0.1 \cdot (ENT - 35)]
\]

\[
C_A = 828 \text{ veh/h}; \quad Q_eA = 636 \text{ veh/h}; \quad RC_A = \frac{C_A - Q_eA}{C_A} \cdot 100 \geq 23\%
\]

where: \( C_A \) = Capacity of the entry A; \( Q_d \) = Conflicting flow of the branch A; \( ENT \) = Width of the entry A; \( Q_eA \) = Entering flow of the branch A; \( RC_A \) = Reserve of Capacity of the entry A.

As regards the Time of Service, in order to obtain the final formulation (3), all the data were collected per 1-minute time increments for each approach during the Saturation Flow Configuration as reported by [11].

\[
T_s = 1.9327 \cdot e^{0.0028 \cdot Q_e} \quad \text{with: } R^2 = 0.8841
\]

It is possible to note that there is an exponential relationship between the time of service and the circulating flow, in accord with other researches present in literature [12–13].

The other data obtained from the recordings are the acceptable gaps, that represent, according to [14], the time-gap between two consecutive vehicles in the circulating roadway which is accepted by a driver placed at the entry of the roundabout so that he can make his movement in safe conditions.

The acceptable gaps were collected during the peak periods as reported by [15]. All the acceptable gaps, recorded for all the four entries of the roundabout, follow a log-normal distribution.

\[
N = \frac{1}{A \cdot \sigma^2 \cdot \sqrt{2\pi}} \cdot e^{-\frac{(\ln A - \mu)^2}{2\sigma^2}}
\]

where: \( A \) = Random variable; \( \mu \) = Mean; \( \sigma^2 \) = Variance.

In particular the range 2.0-4.5s represents 50% of all acceptable gaps.

Finally for the SFC, the field stop-line delay of the approach A has been evaluated. Usually it is more difficult to estimate this delay for roundabouts than at signalized intersections, because many cars did not stop, but slowed down before entering in the roundabout. In order to measure the stop-line delay for the approach A of the roundabout, was defined a ‘travel zone’ by a known point upstream of any queuing to the yield sign. Approach travel time was measured for each vehicle completing the travel zone trip.

According to [16], the average stop-line delay was then calculated by subtracting the free flow time from the average total travel time determined from the analysis of recordings, as shown in (5).

\[
\text{Stop \_ Line \ Delay} = \text{Measured Travel Time} - \text{Free Flow Travel Time}
\]
Free flow travel time was measured by timing vehicles that encountered no obstacles to entering the roundabout using the data obtained from the videos. Average delay values were measured in one-minute increments, based on vehicle entry to the roundabout. The 5-minute period delays were then derived from the weighted average of five 1-minute periods. Five minute delays were likewise averaged to create one hour delays corresponding to the hourly volume periods.

4.2 Free Flow Configuration (FFC)

The analysis of the recordings during the lowest traffic period allowed helpful information to be obtained about the speed distribution used by drivers across the roundabout. In particular attention was focused on the through movement A-C. So, the desired speed profile was extracted during a low traffic period (Free Flow Configuration, FFC) recorded from 10.00 a.m. to 11.00 a.m.

According to [11], the values of 85th percentile and average speed are shown in figure 3. The zero point of the x-axis was considered next to the middle of the splitter island of the approach B.

Fig. 3. Graph of speed profile for the through movement A-C
As before, the O/D matrix, obtained from the analysis of this condition (FFC) and homogenized in vehicle per hour by the coefficients present in [9], is summarized in table 3.

Table 3. Volume of traffic for FFC

<table>
<thead>
<tr>
<th>[Veh/h]</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>45</td>
<td>194</td>
<td>60</td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>0</td>
<td>4</td>
<td>55</td>
</tr>
<tr>
<td>C</td>
<td>85</td>
<td>4</td>
<td>0</td>
<td>42</td>
</tr>
<tr>
<td>D</td>
<td>60</td>
<td>38</td>
<td>32</td>
<td>0</td>
</tr>
</tbody>
</table>

The capacity of the approach A has been calculated according to (1) for the Free Flow Configuration too:

\[
C_A = 787 \text{ veh/h}; \quad Q_e_A = 299 \text{ veh/h}; \quad RC_A = \left[ \frac{C_A - Q_e_A}{C_A} \right] \cdot 100 \approx 62\% \quad (6)
\]

It is possible to note that the reserve of capacity of the entry A is over 60% for this traffic condition.

5. Simulation of observed traffic conditions: Scenarios design

Using the data collected during the different recordings, a calibration procedure of VISSIM microsimulation tool was carried out. In particular we have used two different objective configurations: a first set of scenarios for the evaluation of the speed profiles along the crossing movement A-C for the FFC and then a second set of scenarios (the only difference is the O/D matrix) in order to calculate the average stop-line delay for the SFC. It is important to note that the stop-line delay obtained from VISSIM is directly comparable to the approach delay measured with (5).

So, for the design of scenarios, the following parameters were considered:

- assignment of traffic flow: O/D matrix collected during the lowest traffic periods (FFC) for the speed profiles and O/D matrix derived from peak volume of the afternoon (SFC) for the average stop-line delays;
- choice of speed distribution for approach speed, reduced speed area, circulatory speed and exiting speed still considering the FFC;
- definition of minimum gap and headway for the priority rules starting from the data collected during the SFC;
- driver behaviour parameters: according to [17], this tool uses a psycho-physical car-following model and a rule-based algorithm for lateral movements realized by Wiedemann '74. As regards the Wiedemann model, the default setting reported by the software and shown in table 4 was used.

The variables used for the design of the scenarios were chosen through a careful analysis about the most significant input parameters for the variation of output results, as reported by [1].

In total, 432 scenarios for single-lane roundabouts were composed and analyzed (216 for the speed profiles and 216 for the stop-line delay). The imposed values to input data are summarized in table 5.
Table 4. Default parameters of Wiedemann '74 model used in Vissim

<table>
<thead>
<tr>
<th>Car-following model</th>
<th>Look ahead distance</th>
<th>0.00 m - 250.00 m</th>
<th>General behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average standstill distance</td>
<td>2.00 m</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Additive part of desired safety distance</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Multiple part of desired safety distance</td>
<td>3.00</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lane Change</th>
<th>Max Deceleration</th>
<th>Own</th>
<th>-4.00 m/s²</th>
<th>Trailing Vehicle</th>
<th>-3.00 m/s²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Accepted Deceleration</td>
<td>-1.00 m/s²</td>
<td></td>
<td>-1.00 m/s²</td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Summary of the imposed values to input data

<table>
<thead>
<tr>
<th>Type</th>
<th>Parameters</th>
<th>Input data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
<td>Traffic Flow</td>
<td>O/D₁ for FFC; O/D₂ for SFC</td>
</tr>
<tr>
<td>Variables</td>
<td>Desired Approach Speed</td>
<td>Sp₁=30-55km/h; Sp₂=25-50km/h; Sp₃=20-45km/h.</td>
</tr>
<tr>
<td>Variables</td>
<td>Length of reduced speed area</td>
<td>L₁=0m; L₂=2m; L₃=6m; L₄=8m; L₅=10m; L₆=12m.</td>
</tr>
<tr>
<td>Variables</td>
<td>Position of Desired Speed at Exit</td>
<td>Ex₁=0m; Ex₂=6m; Ex₃=12m.</td>
</tr>
<tr>
<td>Variables</td>
<td>Time Gap</td>
<td>G₁=2.5s; G₂=3.0s; G₃=3.5s; G₄=4.0s; // Headway =5m</td>
</tr>
<tr>
<td>Fix value</td>
<td>Desired Speed range on circulatory roadway</td>
<td>S= 10-25km/h.</td>
</tr>
<tr>
<td>Fix value</td>
<td>Speed range in the reduction speed area</td>
<td>S= 15-25km/h.</td>
</tr>
</tbody>
</table>

![Diagram of Vissim modelled roundabout](image)

Fig. 4. A Vissim screenshot of the modelled roundabout used for simulations

The figure 4 shows a Vissim screenshot of the modelled roundabout, pointing out (with different colours) particular features such as: desired approach speed sections, length of reduced speed areas, stop lines and position of desired exiting speed.

In particular the input values used for the priority rules are summarized in Table 6.
### Table 6. Summary of the imposed values for priority rules

<table>
<thead>
<tr>
<th>Circulatory speed</th>
<th>Conflict Marker 1</th>
<th>Conflict Marker 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>15÷50 km/h</td>
<td>2.5 s ÷ 3.0 s ÷ 3.5 s ÷ 4.0 s</td>
<td>0 s</td>
</tr>
<tr>
<td>≤ 15 km/h</td>
<td>5 m</td>
<td>5 m</td>
</tr>
</tbody>
</table>

These rules are based on two fundamental parameters: minimum gap time and minimum headway.

A vehicle, which is standing at the stop-line, enters the circulatory roadway only when the time gap and headway, measured from the conflict markers are greater than the relative minimum values. A priority rule is usually composed of a stop line and one or more conflict markers (two in this case).

In particular, the conflict marker 1 is used to set the minimum gap time and the minimum headway for normal traffic conditions; while the conflict marker 2 is used to define only the minimum headway for congested conditions, as reported by [1].

### 6. Results and analysis of calibration ability

Considering the crossing movement A-C and the calibration parameters used to set scenarios (table 5), the simulation results of the first 216 scenarios (Traffic-Flow = O/D1, for FFC) were analyzed in terms of average speed for the through movement and compared with the experimental data collected along the same path during the lowest traffic period. According to [11], therefore it was possible to calculate an average percent error for each simulation: this one was the average of all the percent error calculated on 10 measuring sections.

Since Vissim is a stochastic model whose results vary depending on the random seed number used, it was necessary to run each scenario multiple times and average the results; therefore, each scenario was run 10 times in order to provide a 95% confidence in reported speed with a confidence interval of ± 0.50 Km/h, as reported by [11].

Furthermore considering a statistic analysis by software dedicated, for this first set of scenarios, an Analysis of Variance (ANOVA) was performed to determine which factors (critical gap \( G_i \), length of reduced speed area \( L_i \), position of desired exiting speed section \( E_x_i \) and approach speed \( S_p_i \)) significantly affect the average speed along the through movement A-C. According to [11], these results show that all the four factors had statistically significant at the 5% level on the average speed across the roundabout.

So, marking each scenario with an acronym \( S_{p_i} L_{i} G_{i} E_{x_i} \) derived from the variable parameters used for the setting (table 5) and, as reported by [11], considering an error rate according to the following formula:

\[
Er\% = \frac{1}{N} \sum_{i=1}^{N} \frac{S_{SR_i} - S_{OR_i}}{S_{OR_i}} \times 100 \quad \text{with} \ i = 1, \ldots, 10
\]

It is possible to identify the following best six scenarios considering an error rate for the speed profiles along the ten measuring sections less than 6% (an average error about 1.30 Km/h and a maximum error equal to 2.50 Km/h):
From this table, it is possible to make these considerations:

- the values of Critical Gap 3.0 s and 3.5 s give the lowest average percent errors;
- in order to obtain the best fitting between observed reality and simulated reality it is necessary the addition of a reduced speed zone for each entry; in particular it is preferable to use a length of reduced speed zone between 6 m and 10 m;
- it is good for the position of the desired exiting speed section to be placed immediately after the exit from the roundabout next to the top of the splitter island (figure 4);
- the ranges of approach speed 30-55 Km/h and 25-50 Km/h seem to give the best setting for the through movement.

The same procedure was repeated for the other set of scenarios.

Therefore, considering the measuring sections placed along the approach A and the calibration parameters reported in table 5, the simulation results of the second 216 scenarios (Traffic-Flow = O/D₂, for SFC) were analyzed in terms of average stop-line delay and compared with the experimental approach delay of the entry A obtained from recordings during the SFC. So it was possible to determine an average percent error for each scenario:

\[
Er_{\text{Delay}}\% = \left| \frac{\text{Delay}_{\text{Vissim}} - \text{Delay}_{\text{Field}}}{{\text{Delay}_{\text{Field}}}} \right| \times 100
\]  

(8)

where:

- \( \text{Delay}_{\text{Vissim}} \): Average Stop-line delay for entry A obtained from the single Scenario
- \( \text{Delay}_{\text{Field}} \): Approach delay for entry A measured with (5) during the SFC

Always bearing in mind that Vissim results depend on the random seed number used, it was necessary to run each scenario 10 times in order to provide a 95% confidence in reported stop-line delay with a confidence interval of \( \pm 0.75 \) s.

Furthermore, for this second set of scenarios, the ANOVA has determined that, between the main factors used for the setting of simulations, only the approach speed (Sp₁) had not statistically significant at the 5% level on the average stop-line delay of entry A.

In particular, the average stop-line delay error, the standard deviation (deriving from the average of the 10 simulations for each scenario) and the percent error obtained by (8) are reported in table 8. In this table only scenarios with an error rate for the stop-line delay less than 10% (an average error less than 0.75%) were considered.
From the analysis of the values reported in the table 8, it is possible to note that:

- as previously determined by ANOVA, the approach speed does not affect the stop-line delay;
- the position of the desired exiting speed section slightly influences the stop-line delay;
- the values of Critical Gap 2.5s and 3.0s assure the lowest average percent errors;
- it is necessary the use of a reduced speed zone for each entry with a length between 2 and 10 meters.

At this point, intersecting the data of table 7, which give the best fit about the crossing speed of the roundabout, with the data of table 8, which instead provide the lowest gap between observed and simulated delay for entry A, it is possible to identify only 4 scenarios (marked with (*) in table 7 and in table 8), as shown in figure 5.
A careful analysis of the main parameters that characterize the four scenarios of figure 5 for this case study, allows us to draw some considerations:

- the ranges of approach speed 30-55 Km/h and 25-50 Km/h give the best fit both for the average speed along the through movement A-C and for average stop-line delay of entry A;
- in order to obtain the best fitting between observed reality and simulated reality it is necessary the addition of a reduced speed zone for each entry with length between 6 m and 10 m;
- the only value of critical gap that provides speed profiles and delays comparable with real data is 3.0 s;
- the desired exiting speed section must be placed immediately after the exit from the roundabout next to the top of the splitter island (figure 4).

In figure 6 the average observed speed profile along the though movement A-C is compared with the speed profiles obtained from the four best simulations. It is possible to underline that all the speed profiles are very close to real one.

![Comparison among speed profiles](image)

Fig. 6. Speed profiles for the through movement A-C obtained from the four best setting scenarios and the real speed profile.

7. Conclusions and future researches

The analysis presented in this paper starts from the need to find a correct calibration procedure of microsimulation process in roundabout by using VISSIM software.

The calibration procedure emerges as strategical for an accurate use of microsimulation software. In this paper the Authors present a comparative approach between observed performances and performances obtained by the use of VISSIM software in order to evaluate the effect of kinematic and behavioural parameters in the simulation process of roundabouts.
Considering only the results presented in this study, it is possible to estimate the sensitivity of some VISSIM input parameters, such as:

- the ranges of approach speed 30-55 Km/h and 25-50 Km/h give the best fit both for the average speed along the through movement A-C and for average stop-line delay of entry A;
- in order to obtain the best fitting between observed reality and simulated reality it is necessary the addition of a reduced speed zone for each entry with length between 6 m and 10 m;
- the only value of critical gap that provides speed profiles and delays comparable with real data is 3.0 s;
- the desired exiting speed section must be placed immediately after the exit from the roundabout next to the top of the splitter island.

The future development of this research will be focuses on the opportunity to apply this calibration procedure on roundabouts with geometric features and traffic conditions different from this case study.

References


