



BRSI

## **Motorcycle speed survey 2014**

Results of the first motorcycle speed behaviour survey in Belgium

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## EXECUTIVE SUMMARY

### Objectives and methodology

The main objectives of this study were to obtain a representative and objective measure of the speed driven by motorcyclists in Belgium and to compare their speed with that of car drivers and with the speed limits.

In this study, the speed of the motorcyclists was measured by using a handheld speed gun. Measurements were conducted at over 300 locations scattered all over Belgium. Measurements were taken at different times of the day and the week. The duration of each measurement session was one hour. All motorcycles passing these locations were measured, and, as a control group, the speed of one car after each observed motorcycle was measured as well.

7 different road types were distinguished:

- ▶ 30 km/h (zone 30)
- ▶ 30 km/h (school zone)
- ▶ 50 km/h
- ▶ 70 km/h
- ▶ 90 km/h (single lane)
- ▶ 90 km/h (double lane)
- ▶ 120 km/h (highways)

Only locations without particular properties or infrastructural measures that could impede the driven speed were chosen. For most analyses, only the observations of motorcyclists driving at 'free speed' were used.

The mean free speed, the 85<sup>th</sup> percentile of free speed (V85) and the frequency of speed infringements have been calculated for two different types of powered two-wheelers: motorbikes and scooters. Moreover, the mean free speed and the frequency of speed infringements of motorbikes and scooters have been calculated for each region, during work days and weekend days, and for riders driving alone or in a group. For motorcyclists in lane-splitting, the mean speed and the frequency of speed infringements have also been calculated. Lane-splitting refers to overtaking slow or stopped vehicles by traveling between two lanes.

### Main results

In general, the motorcyclists observed in this survey drove faster and committed more speed infringements than car drivers of the control group (see Fig. 1 on next page). On 50 km/h roads inside built-up areas, the average measured free speed of motorbikes was approximately 3 km/h higher than the average free speed of cars, and 5 km/h above the speed limit. It should be recalled that – in line with other speed measurements undertaken by BRSI – the average speed of cars in free speed is generally as well above the speed limit.

On 30 km/h roads, the average speed of all measured vehicles in free speed was about 42 km/h. Two-thirds of motorbike drivers exceeded the speed limit with more than 10 km/h.

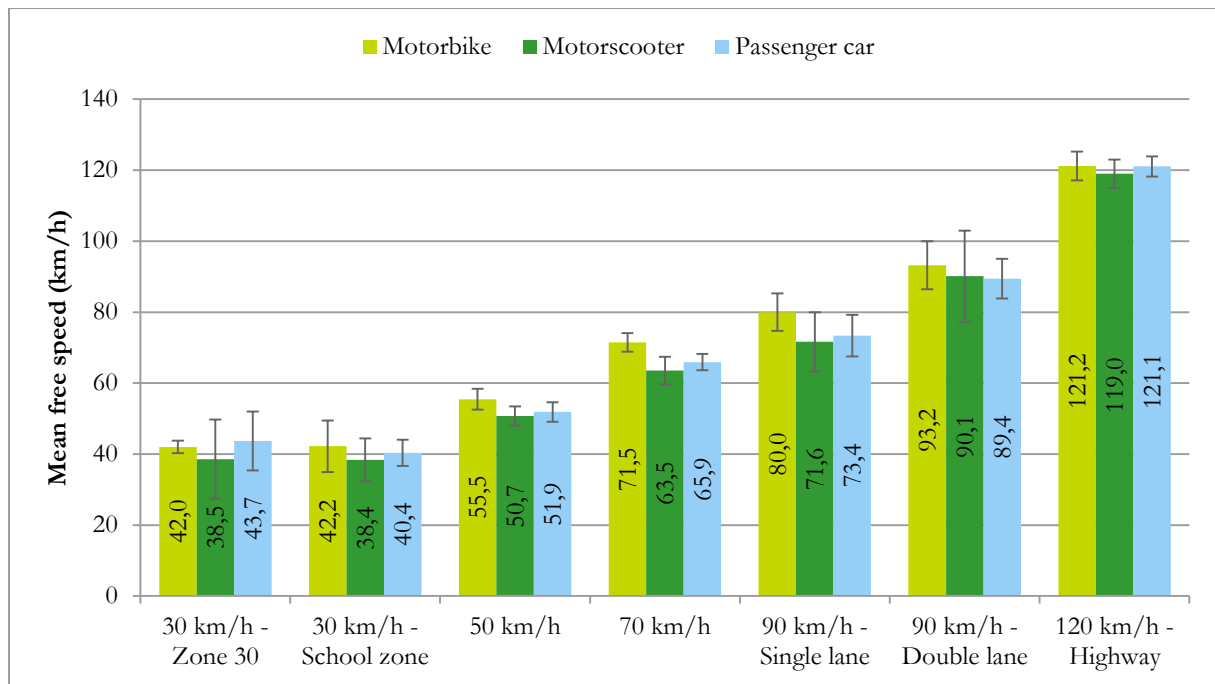
Outside built-up areas, the average free speed of motorcyclists was significantly higher than that of car drivers:

- ▶ 5 km/h on 70 km/h roads,
- ▶ 7 km/h on single lane 90 km/h roads, and
- ▶ 4 km/h on double lane 90 km/h roads.

On highways, the average free speed of both car and motorbike drivers in free speed was 121 km/h.

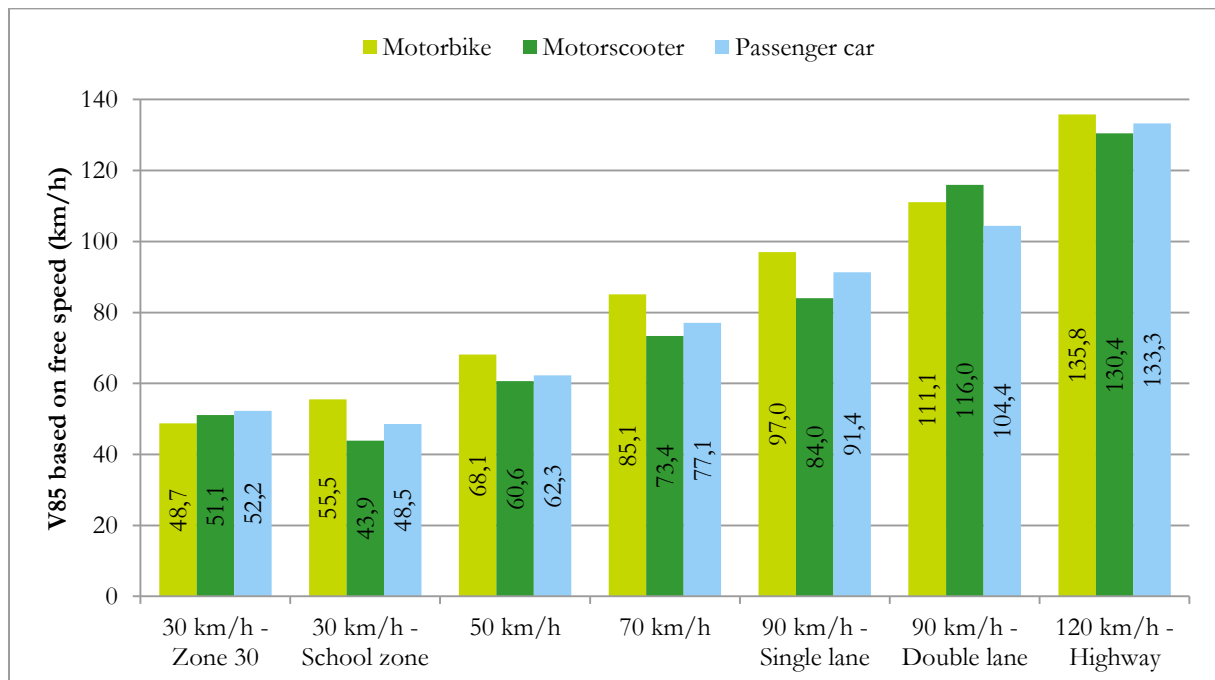
The average speed of motorscooters was lower than the average speed of motorbikes on all road types and comparable to the average speed of passenger cars.

**Fig. 1 Mean free speed per vehicle type**



The V85 speed values of motorcyclists are all above the speed limit and 7 to 18 km/h higher than the mean speed (Fig. 2). The V85 values of motorscooters are below those of motorbikes and passenger cars on most road types.

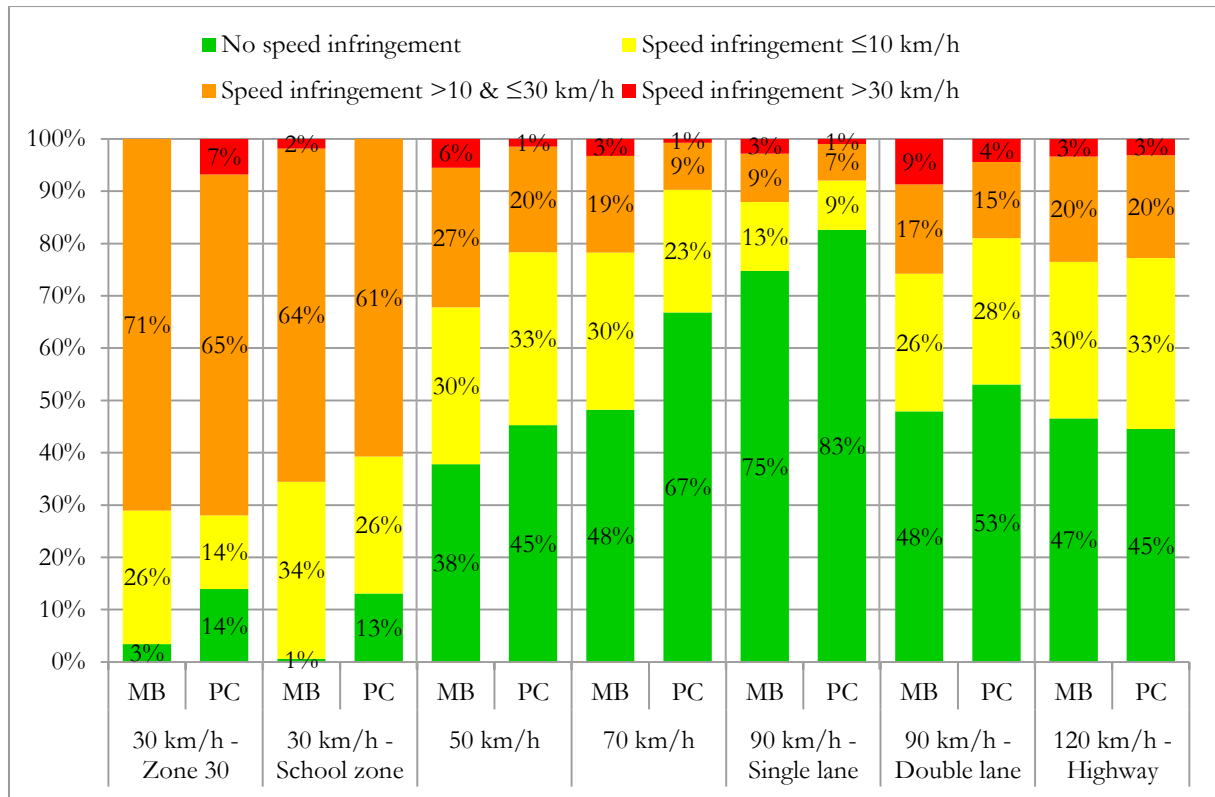
**Fig. 2 V85 per vehicle type**



There is a notable difference between motorcyclists and car drivers in the compliance with speed limits. The share of motorcyclists exceeding the 70 km/h speed limit with more than 10 km/h is twice as large the share of car drivers committing the same offence. Only on highways, motorcyclists did not commit

more speed infringements than car drivers (Fig. 3). Motorscooters are omitted from this figure for readability.

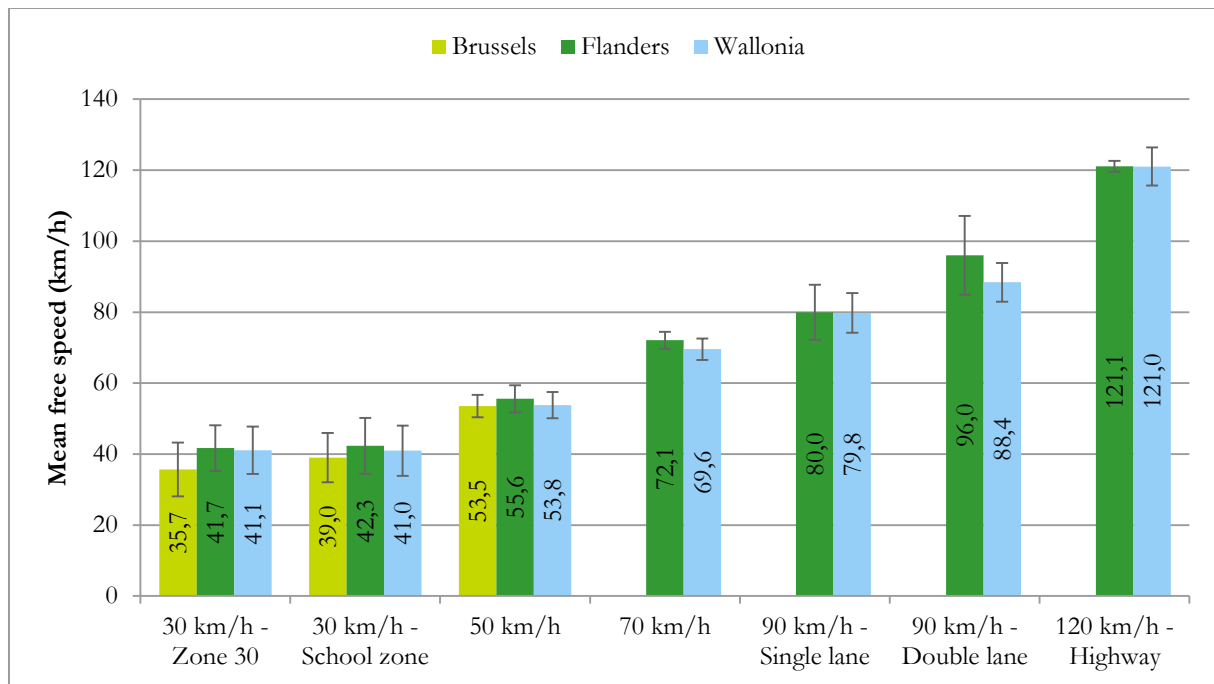
**Fig. 3 Speed infringements committed by drivers of motorbikes (MB) and passenger cars (PC)**



### Regional similarities and differences

On most road types, there was hardly any difference in mean free speed between regions. The largest difference in driving speed between regions was found on double lane 90 km/h roads. Here, the average free speed was 8 km/h higher in Flanders than in Wallonia (not statistically significant – Fig. 4).

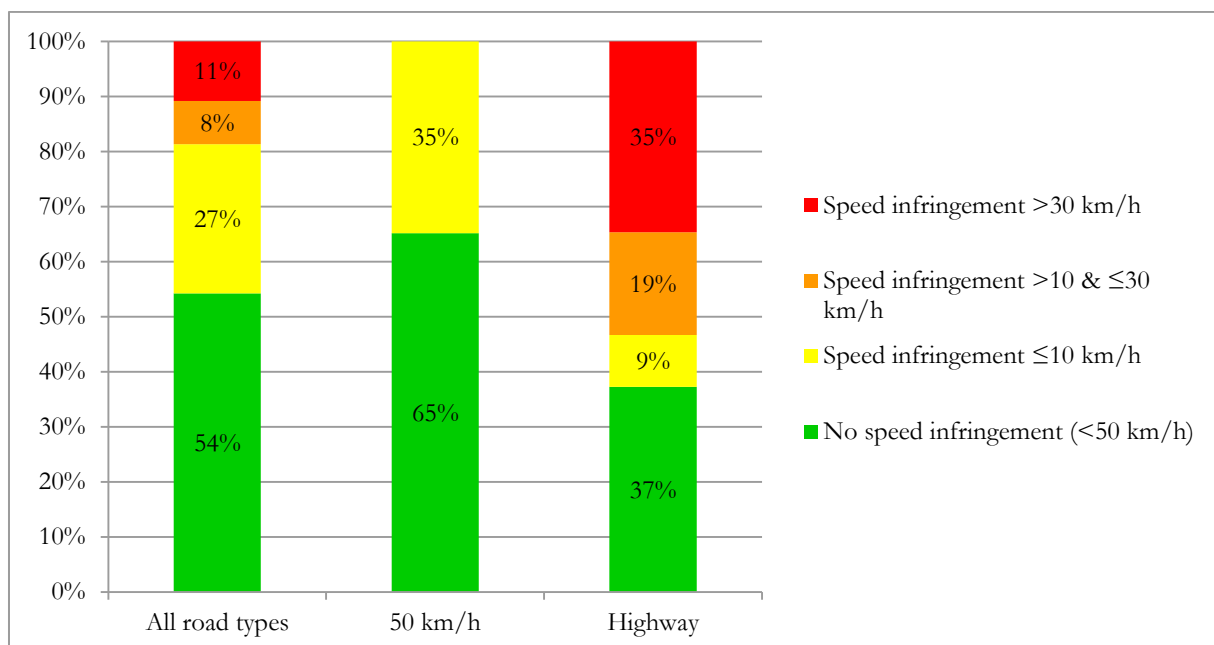
**Fig. 4 Mean free speed of motorcycles per region**



**Lane-splitting**

The most widespread offence is the non-compliance with the 50 km/h speed limit while lane-splitting. The average lane-splitting speed on highways was 70 km/h and one third of the motorcyclists drove more than 80 km/h while lane-splitting (Fig. 5).

**Fig. 5 Motorcyclists' compliance with the 50 km/h speed limit while 'lane-splitting'**

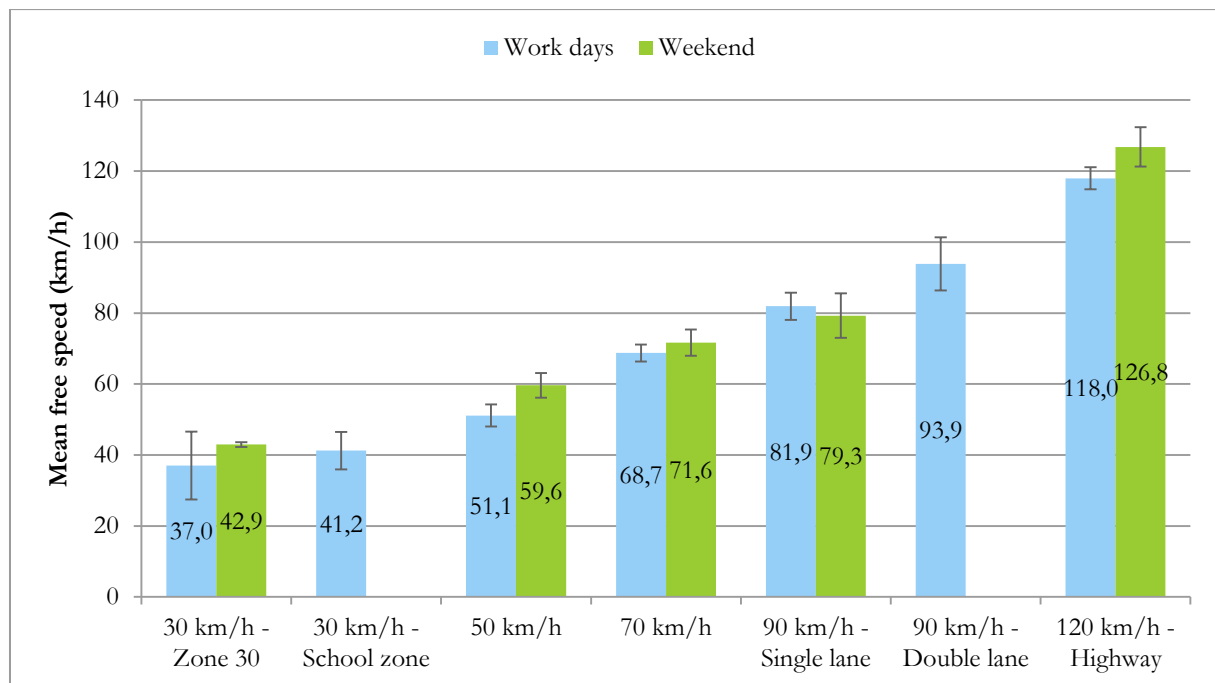


**Other findings**

Motorcyclists drove on average 4 km/h faster in group than if they drove alone on 50 km/h roads. On double lane 90 km/h roads and highways, the average speed of motorcyclists in group was lower – but not significantly – than of motorcyclists alone.

On 50 km/h roads, motorcyclists drove on average 8 km/h faster on weekend days than on work days. On highways, the average free speed of motorcyclists during weekends was 9 km/h higher than on work days, and even 7 km/h above the 120 km/h speed limit (Fig. 6). The frequency of speed infringements on 50 and 120 km/h roads is also larger during weekend than on work days.

**Fig. 6 Mean free speed of motorcycles during work days and weekend**



## Conclusion and recommendations

The study reveals that excessive speed is a widespread problem among motorcyclists, even more than among car drivers. The average free speed of motorcyclists on 50 to 90 km/h roads was significantly higher than that of car drivers (control group).

A problem that stands out is that on 70 km/h roads outside built-up areas: one fifth of the motorbike drivers exceed the speed limit with more than 10 km/h, compared to one tenth of the motorscooter and car drivers.

Another widespread offence revealed by this survey, is the non-compliance with the 50 km/h speed limit while lane-splitting on highways. The average lane-splitting speed on highways was 70 km/h and one third of the motorcyclists drove more than 80 km/h while lane-splitting.

The main recommendations emerging from this study are:

- ▶ Because of the significant difference in speed behaviour of motorcyclists compared to car drivers on rural roads, measures targeting motorcyclists would be useful, especially educative or informative campaigns on the importance of speed limits on rural roads.
- ▶ Motorcyclists should be informed and warned more systematically that lane-splitting is only allowed during congestion, at a speed of not more than 50 km/h and not more than 20 km/h faster than the vehicles around.
- ▶ Motorbikes should not be immune to speed enforcement, which may happen if the front of the vehicle is photographed (where the license plate is not visible)
- ▶ This type of survey should be repeated in the future, in order to be able to monitor whether and to what extent progress will have been achieved compared to the current situation.
- ▶ Motorcyclists should be included in behavioural surveys in order to understand better their attitudes and behaviour.



## 1 INTRODUCTION

At the end of 2013, 417.126 motorbikes were registered in Belgium. That number represents 6% of the total number of registered vehicles. Their share has slowly been increasing over the years (FEBIAC, 2014). Motorcyclists account for only 1% of the travelled distance. However, according to police registrations, they account for 6% of all slightly injured, 11% of all severely injured and 12% of all road fatalities (Martensen & Roynard, 2013). The hospital statistics show even higher numbers. In 2011, no less than 18% of all hospitalized traffic accident victims, were driving a powered two-wheeler (PTW) (Nuyttens & Van Belleghem, 2014).

Thus, motorcyclists are overrepresented amongst the traffic casualties. One of the main factors causing motorbike accidents is speeding. BRSI research has shown that in at least one third of the severe and fatal accidents in which motorbikes were involved in 2012 in Belgium, the driver was speeding (Martensen & Roynard, 2013). For fatal accidents, speeding occurred in 50% of the cases.

Even when speed is not the main cause of an accident, it may have caused the driver to react too late on a mistake of another road user or another unexpected event. Speed does not only increase the probability of having an accident, it also worsens the consequences (Elvik, 2014).

However, little is known about the actual speed of motorcyclists on our roads, and to what extent they respect speed limits. And whether this is similar or not to the behaviour of car drivers.

This study is hence the first study in Belgium analysing the actual speed behaviour of motorcyclists at the national level. Even in an international perspective the study is quite unique. With this study BRSI hopes to demystify the suspicions and prejudices around the behaviour of motorcyclists and to provide evidence on this matter. Understanding the speed behaviour may help in effectively addressing road safety issues.

## 2 METHODOLOGY

### 2.1 Intention

This behavioural survey is meant to determine how fast motorcyclists drive in Belgium, when the conditions allow a free choice. This is similar as to other speed surveys BRSI conducted in the past for cars, trucks and vans. It means that the environment is not the main factor limiting this choice. So speed is not measured on road sections with obstacles, speed cameras, traffic lights, etc. any element influencing the speeding behaviour.

The behavioural component of speed can only be isolated from traffic conditions when the choice is free. Moreover, the driving speed can be compared to the speed limit.

If one would aggregate speeds measurements at different road configurations and speed limits, one would obtain an average speed indicator that is meaningless and useless. That is why in this survey we focus on a few road types and configurations (see section 2.2).

The results presented in this report are hence only valid for the circumstances in which the measurements took place. These results do not represent overall average figures for the entire road network.

### 2.2 Sampling

The sampling methodology was similar to these used in previous surveys (Riguelle, 2012; Riguelle & Roynard, 2014). The observations were conducted on randomly selected sites across the country, supplemented with sites along popular motorcycling routes, and included various types of roads. The measurement methodology is described in section 2.5.

All locations where the speed of motorcyclists was measured were straight road sections with as little elements as possible that could impede the driving speed. There should be no reason for the driver to brake or accelerate more than usual. The locations meet, as far as possible, the following conditions:

- ▶ Uniform and straight road section
- ▶ Road surface in correct condition
- ▶ Away from steep slopes (>5%)
- ▶ Away from sharp turns
- ▶ Away from intersections
- ▶ Away from road works
- ▶ Away from changes in speed limit
- ▶ Away from speed radars (repressive or educational)

However, this does not mean that the locations are free of any danger. There remain situations such as:

- ▶ Rain and/or wet road surface
- ▶ Private accesses
- ▶ Presence of vulnerable road users

7 different road types were chosen for the speed survey:

- ▶ Zone 30 km/h
- ▶ School zone (also 30 km/h, sometimes temporary)
- ▶ 50 km/h
- ▶ 70 km/h
- ▶ 90 km/h (single lane)
- ▶ 90 km/h (double lane)

► Highways (120 km/h)

All 30 and 50 km/h roads selected were located inside built-up areas. All roads with a higher speed limit are located outside built-up areas, there is an exception for one 70 km/h site in the Brussels Capital Region. Hereafter, the 'Brussels Capital Region' will be referred to as 'Brussels'.

School zones differ substantially from regular 'Zones 30'. A regular zone 30 is usually installed in a city centre or residential area, whereas a 'School zone' is installed in a certain perimeter around a school. The road infrastructure on which the latter is in force usually allows higher speeds than 30 km/h.

On highways, only locations where the speed limit was 120 km/h were selected. Previous speed surveys (Riguelle, 2012) showed that there was no significant difference in average speed of cars between highways with 2 lanes and 3 lanes in each direction. Therefore, the results from highway locations will not be differentiated by the number of lanes.

Since an average figure for all the road types combined would not make sense, the results obtained for each of the 7 different road types will not be merged. The road types will be treated as 7 different samples.

### 2.3 Use of speed guns

For this survey, speed guns were used to measure the speed of vehicles. It is a portable device that is held and operated like a gun. It is able to measure almost instantly the speed of an approaching vehicle or from a vehicle driving away. These devices have some advantages and disadvantages compared to unmanned radars. The main advantage is that, in combination with an observer, it is possible to make a distinction between vehicle types, even if they have the same length. A disadvantage of the speed guns is that it needs the presence of an observer, and hence the volume and frequency of measurements is more restricted because of cost and resources constraints.

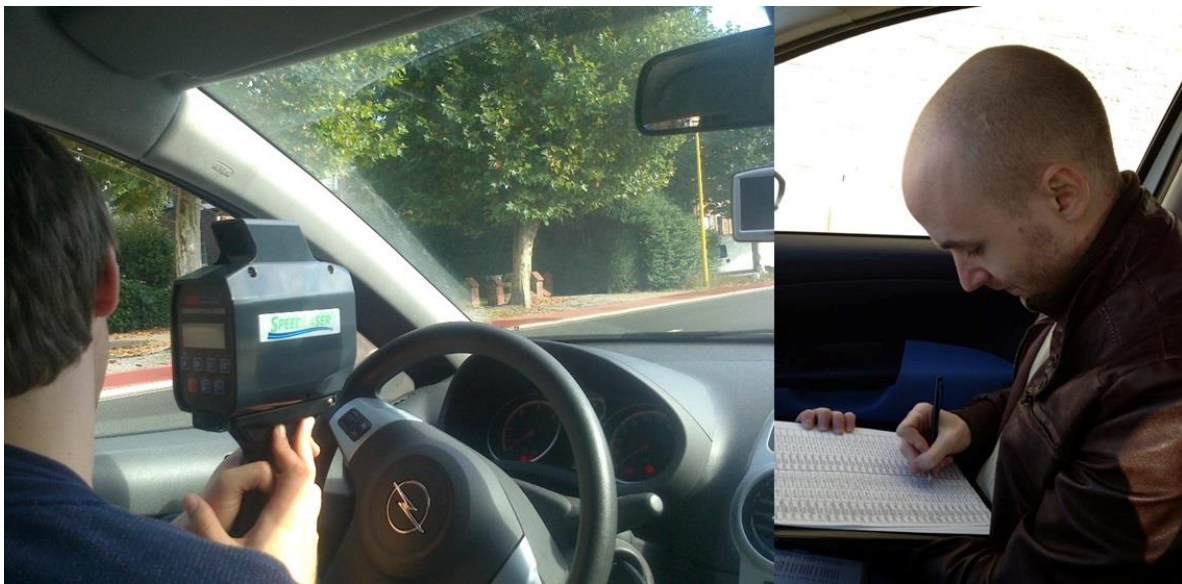
This device is not commonly used in Belgium due to the fact it is not approved by the National Metrological Department for official use. In other countries like the United States or in France it is approved and used for speed enforcement. The accuracy of these speed guns has been demonstrated in previous speed surveys (Riguelle & Roynard, 2014).

Drivers could mistake the speed guns used in this survey for devices used for enforcement. Locations of speed enforcement controls are often communicated between drivers, which can influence driving behaviour. To minimize this effect, the duration of measurement sessions was limited to 1 hour.

It is of course not possible to stand right in front of approaching vehicle or right behind one when it is driving off. Measurements are always performed from the side of the road (or from above on a bridge in case of highways). Due to this slant measurement direction, there is a small underestimation of the returned speed value. The teams were asked to provide the horizontal and vertical distance to the observed vehicles. This information allows correction of the measured values.

At all sites, except for highways, the observers installed themselves in a discrete (but legitimate) spot on the site of measurement. Most of the time, the measurements could be performed from inside the vehicle, through the windshield. One team member used speed gun, the other member one wrote down the results (Figure 1).

**Figure 1 Illustration of the data collection procedure and material**



On highways, the measurements were performed from a bridge over the highway. The investigators were standing on the side of the bridge that could not be seen by the oncoming drivers, and measured the vehicles from behind. In some cases, vehicles in both directions could be measured.

In order to be able to compare the speed of motorcyclists with that of cars at the same locations (and with car speeds measured in other BRSI surveys), the speed of each passenger car that came directly after each measured motorcycle was also registered.

## 2.4 Data collected

For each measurement site, the team filled in a 'description form'. It contains general information about the location such as the speed limit, traffic calming measures or irregular circumstances in the vicinity, weather conditions and the date and time span of measurement.

The description form is included in Appendix A.

The following variables were collected for each observation:

- ▶ Vehicle type: Motorbike/Motorscooter/Passenger car
- ▶ Free speed: Yes/No
- ▶ Measured speed
- ▶ Group size: 1 rider /2 to 5 riders /5+ riders
- ▶ Between lanes: Yes/No

These variables are described below.

If observations were made in both directions of the road, an additional parameter A or B was added to indicate the principal direction or the opposite one respectively.

The measurements were written down in the 'observation form' (Figure 2).

Figure 2 Observation form

Site		Date			Timing					
Vehicle	Freespeed	Speed	Grpe	Interfile		Vehicle	Freespeed	Speed	Grpe	Interfile
Moto	yes		1	yes		Moto	yes		1	yes
Scooter	no		2-5	no		Scooter	no		2-5	no
Auto			5+			Auto			5+	
Moto	yes		1	yes		Moto	yes		1	yes
Scooter	no		2-5	no		Scooter	no		2-5	no
Auto			5+			Auto			5+	
Moto	yes		1	yes		Moto	yes		1	yes
Scooter	no		2-5	no		Scooter	no		2-5	no
Auto			5+			Auto			5+	
Moto	yes		1	yes		Moto	yes		1	yes
Scooter	no		2-5	no		Scooter	no		2-5	no
Auto			5+			Auto			5+	

Three **vehicle types** were distinguished: motorbikes, motorscooters and passenger cars.

This study includes all powered two-wheelers (PTW) with an engine larger than 50 cm<sup>3</sup>. These can easily be recognised by their license plate. At the time of the measurements, very few PTWs with an engine smaller than 50 cm<sup>3</sup> had a license plate, since it is only mandatory for vehicles bought since the 31<sup>st</sup> of march 2014. Two types of PTW are distinguished according to their design: motorbikes and motorscooters. The latter are equipped with a ‘floor’.



Motorbike



Motorscooter

It was decided to distinguish these two types of PTW's due to the important differences in:

- ▶ Power
- ▶ Usage (trip purpose)
- ▶ Driver characteristics (driver's license, preference for more/less powerful vehicle)

‘**Free speed**’ means that the driver was able to freely choose its speed with no vehicle in a predefined space in front of him. This space is equivalent to the distance travelled in 5 seconds circulating at the speed allowed on the site (Table 1).

Table 1 Distance travelled in 5 seconds at different speeds

Speed	Distance travelled in 5 seconds
30 km/h	42 m
50 km/h	69 m
70 km/h	97 m
90 km/h	125 m
120 km/h	167 m

‘**Speed**’ is the vehicle speed measured with the speed gun.

'Group size' is the number of motorbikes driving in group. 1 corresponds to single vehicle, 2-5 to a group of maximum 5 PTWs, 5+ to a group with more than 5 PTWs.

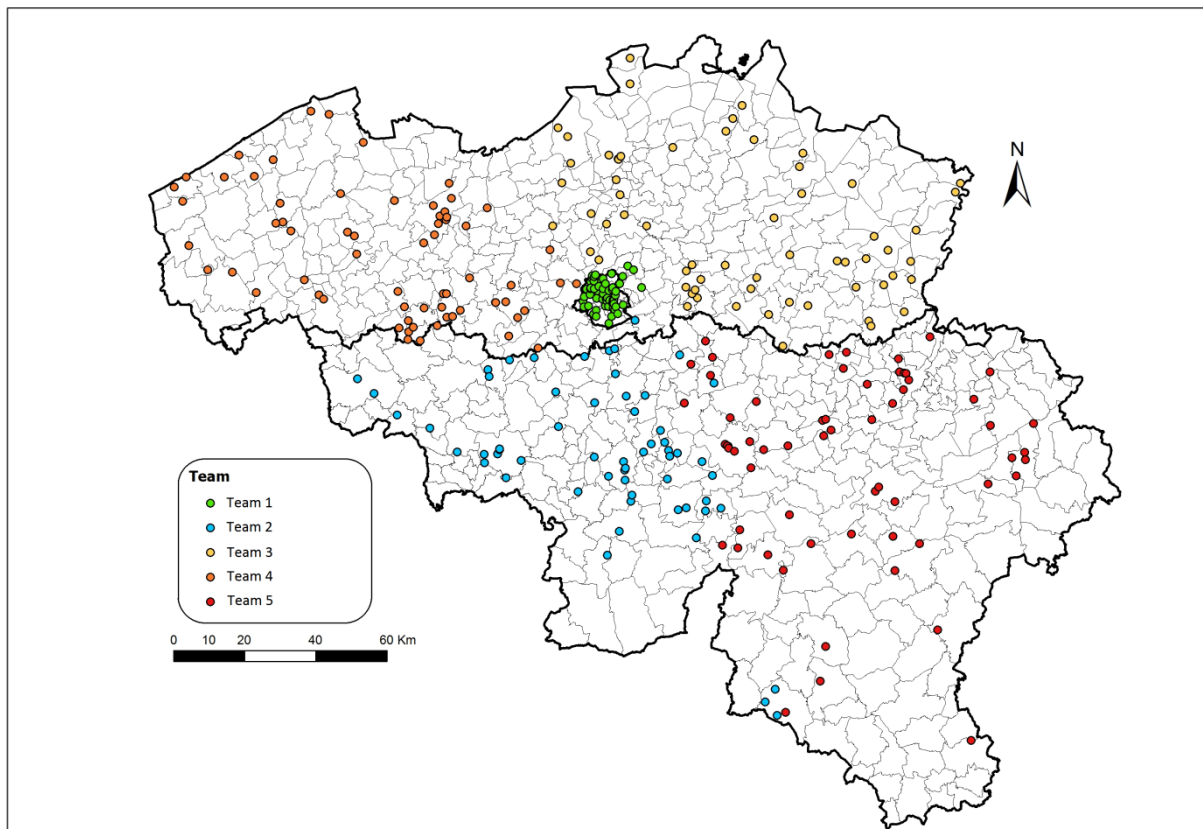
'Interfile' means that the motorcyclist was driving in between lanes. The Belgian traffic regulations allows this manoeuver since September 2011 in specific traffic conditions: traffic must be congested, the motorcyclist may not drive faster than 50 km/h and the speed gap between the PTW and the other vehicles cannot be higher than 20 km/h. On highways, it is only allowed between the two most left lanes. The manoeuver (travelling between 2 lanes) is not considered as overtaking. This variable is not relevant for cars.

## 2.5 Observations

The speed measurements took place in June 2014. The measurements were executed by 5 teams of 2 trained observers. Each team operated in a particular region (Figure 3):

- ▶ Brussels and periphery: 1 team
- ▶ Flanders: 2 teams
- ▶ Wallonia: 2 teams

**Figure 3** Map of selected observation sites per team



Each team performed 3 to 5 measurement sessions of 1 hour per day, depending on the schedule and travel times between sites. All measurements were performed between 7:30 and 18:00. The days of measurement and the number of observation sessions and observed PTWs are listed in 2.5.

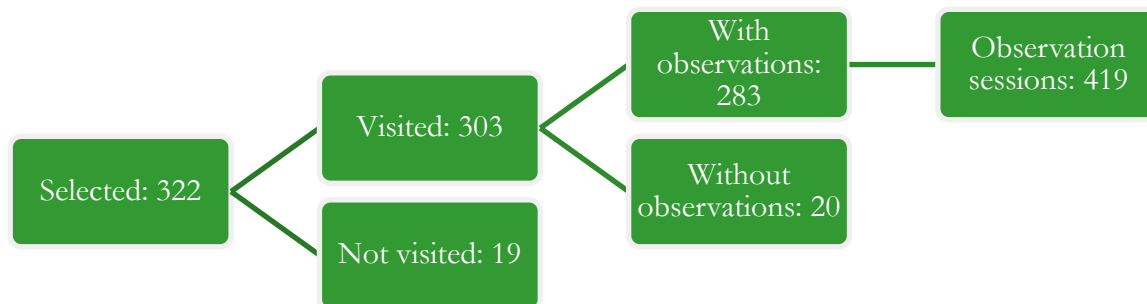
Table 2 contains the distribution of observation sites selected for this survey, over the different road types and regions.

**Table 2 Initial number of locations, per road type and region**

Road type	Brussels	Flanders	Wallonia	Total
30 (Zone 30)	7	6	4	17
30 (School zone)	8	6	5	19
50	53	29	24	106
70	1	47	27	75
90 (Single lane)	0	11	33	44
90 (Double lane)	0	10	10	20
120	0	25	16	41
All	69	134	119	322

After selection of the sites, some of the planned sites appeared not to be accessible, some observation sessions did not return results (no motorcyclist traffic) and sometimes a site could not be visited due to unforeseen meteorological circumstances or traffic congestion. This concerned about 39 out of the 322 sites originally selected. Several locations were visited a second time, especially the ones that return a substantial amount of observations. In total, more than 400 observation sessions were performed (Figure 4).

**Figure 4 Number of observation sites and sessions**



The resulting number of observation sessions is given in Table 3.

**Table 3 Effective number of observation sessions, per road type and region**

Road type	Brussels	Flanders	Wallonia	Total
30 (Zone 30)	5	8	2	15
30 (School zone)	8	5	4	17
50	67	36	30	133
70	1	70	39	110
90 (Single lane)	0	13	48	61
90 (Double lane)	0	13	11	24
120	0	37	22	59
All	81	182	156	419

Only one location in Brussels with a 70 km/h speed limit was observed, which does not provide reliable results. This site is therefore omitted from the analyses and charts.

## 2.6 Sample description

In this study, the driving speed of 7509 vehicles was measured, consisting of:

- ▶ 3183 motorbikes
- ▶ 690 motorscooters
- ▶ 3636 cars (control sample)

Since all passing motorcycles and motorscooters were measured, the distribution among these 2 categories in the sample also reflects the actual distribution of the PTW population.

The speed of a passenger car was measured after each two-wheeler as a control sample. After a group of motorcycles, an equal number of cars was measured. In principle the sum of the number of motorbikes and motorscooters should correspond to the number of cars. There is however a small difference in the number of two-wheelers measured (3873) and the number of cars (3636). This is due to the fact that in some cases, given the amount of motorcycles or the absence of cars, the observation of a number of PTWs was not followed by the observation of an equal number of cars.

The observations were carried out in June 2014. Table 4 shows the number of observation sessions and observed PTWs for each day. The rows in green are Saturdays and Sundays.

During work days, 2364 PTWs were observed during 275 sessions, which results in an average of 8.6 PTWs per session. On Saturdays and Sundays, 1509 PTWs were observed during 144 sessions, which results in an average of 10.5 PTWs per session.

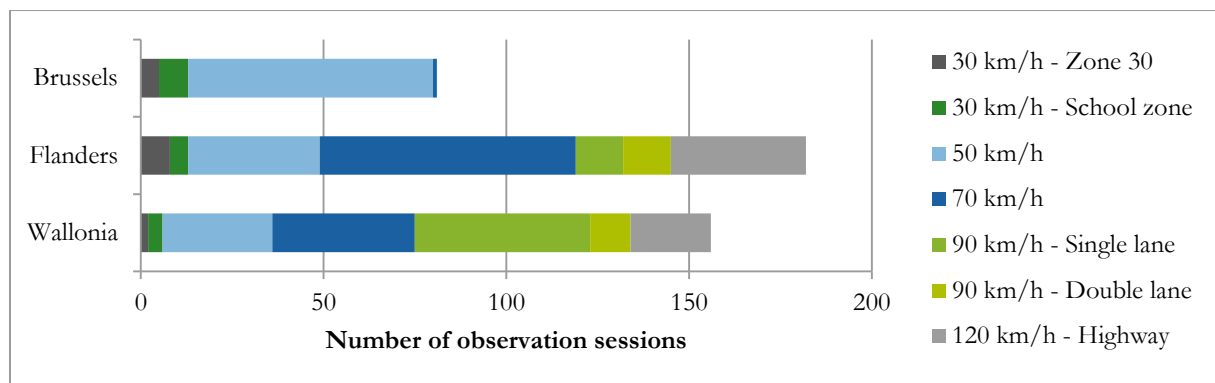
**Table 4** Distribution of observation sessions and observed PTWs by date

Date	Number of observation sessions	Number of observed PTWs	Average number of observed PTWs per session (rounded to units)
2014-06-03	19	248	13
2014-06-04	1	10	10
2014-06-05	16	103	6
2014-06-06	27	219	8
2014-06-07	22	231	11
2014-06-08	21	270	13
2014-06-09	3	15	5
2014-06-10	16	69	4
2014-06-11	16	177	11
2014-06-12	16	193	12
2014-06-13	4	27	7
2014-06-14	21	171	8
2014-06-15	21	203	10
2014-06-16	17	134	8
2014-06-17	22	109	5
2014-06-18	17	133	8
2014-06-19	4	45	11
2014-06-20	21	240	11
2014-06-21	21	184	9
2014-06-22	18	367	20
2014-06-23	15	156	10
2014-06-24	21	197	9
2014-06-25	5	67	13
2014-06-26	19	140	7
2014-06-27	16	82	5
2014-06-28	10	48	5
2014-06-29	10	35	4



Figure 5 shows the distribution of the number of observation sessions by road type and region.

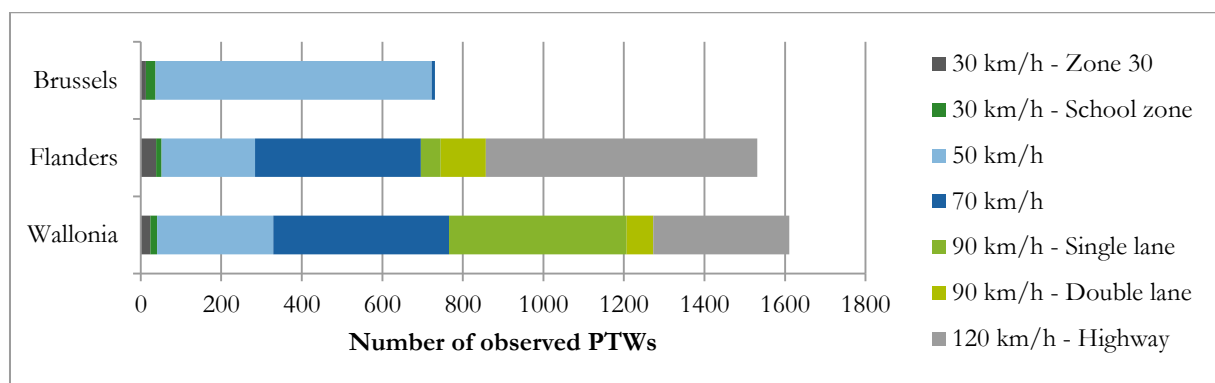
**Figure 5 Distribution of observation sessions by road type and region**



82.7% of the observation sessions in Brussels Capital region were conducted on 50km/h roads versus 19.7% in Flanders and 19.2% in Wallonia. 38.4% of sessions in Flanders are on 70 km/h roads versus 25.7% in Wallonia.

The next chart shows the number of observed PTWs for each region and road type.

**Figure 6 Distribution of observed PTWs by road type and region**



This graph illustrates that in Brussels, 93.8% of the PTWs were observed in 50 km/h roads versus 15.2% in Flanders and 17.9% in Wallonia. In Flanders 44.0% of the PTWs were observed on highways and 26.9% on 70 km/h roads. In Wallonia, 21.0% of the PTWs were observed on highways, 27.4% on single lane 90 km/h roads, and 27.1% on 70 km/h roads.

## 2.7 Weighting

The statistical models applied to the observations in this study are based on the assumption that every driver has the same probability to be included in the sample.

The selection of drivers observed in this study was obtained by adopting the following approach:

1. A wide variety of locations in Belgium were selected, in order to include several locations for each combination of road category and region.
2. At these locations, all motorcyclists were observed at certain moments.

To ensure that the sample accurately represents the motorcycling driving population, a weighing factor is attributed to each observation session. This factor is the same for each observation of that session and is taken into account while analysing the results.

The calculation of this factor consists of the following steps:

1. The ratio 'M/m' corrects for the fact that the number of sites sampled in each region is not proportional to the lengths of the respective road types in these regions. 'M' is a multiplication of the relative road length of the region and the relative road length of the road category in that region (Table 5). 'm' is the number of observation sites matching the given criteria

2. The ratio 'D/d' corrects for any differences in duration of the observation sessions by dividing 60 minutes (D) by the actual number of minutes observed (d).

The weighting applied to each observation is  $M/m \times D/d$ . The result is saved as an additional parameter for each observation. Each indicator was computed with the program 'Stata' taking these weighing factors into account

Official statistics of the Belgian road network (FOD Mobiliteit, 2014) provide the length of the road network per region (Table 5).

**Table 5** Length of road network per region

Region	Absolute length of road network	Relative length of road network
Brussels	1881 km	1,217%
Flanders	71487 km	46,247%
Wallonia	81207 km	52,536%
Total	154575 km	100%

Source: (FOD Mobiliteit, 2014)

## 2.8 Analysis

Microsoft Excel was used for data input, correction of the measured speed, calculation of the weighing factor and sample description.

The confidence intervals and the weighed values were calculated by using the software Stata. The 'Adjusted Wald Test' was used to verify the significance of the results regarding the mean (free) speed. The results of all significance tests are given in Appendix B.

As we did in all speed behaviour measurements, only the observations which were indicated as 'free speed' were used, since only such speed measurements reflect voluntary behaviour. As a consequence, the average speeds given in the results further in this report are slightly higher than the average speed that would include all situations and circumstances. For example, the overall average speed measured in zone 30 was 38 km/h, compare to 41 km/h when only selecting the observations at free speed.

The charts in this chapter are based on the observations in free speed only, unless mentioned otherwise. The weighing factor explained in section 2.3 is taken into account for each analysis. The error bars in the charts represent the 95% confidence interval.

In the charts, categories with a low number of observations are labelled with asterisks. These results should be interpreted with care. The number of asterisks mean the following:

- ▶ \* if the sample size is smaller than 30, but larger than 20
- ▶ \*\* if the sample size is smaller than 20, but larger than 10

The confidence levels are given for results that are significantly different, for example  $p < 0,05$  means that the values are significantly different on a confidence level of 95%. The smaller the value of 'p', the more significant the difference. The results of all significance tests are listed in Appendix B.

The V85 indicated the speed which was respected by 85% of the drivers. In other words, 15% of the drivers drove faster than the V85. This indicator enables us to exclude the outliers but also demonstrates the spread of the speeds driven. If on a certain location the V85 is close to the average speed, the driven speeds are rather homogenous. On the other hand, if the V85 is much higher than the average speed, a substantial share of drivers is driving faster than the norm. The 85<sup>th</sup> percentile is also based on the observations in free speed.

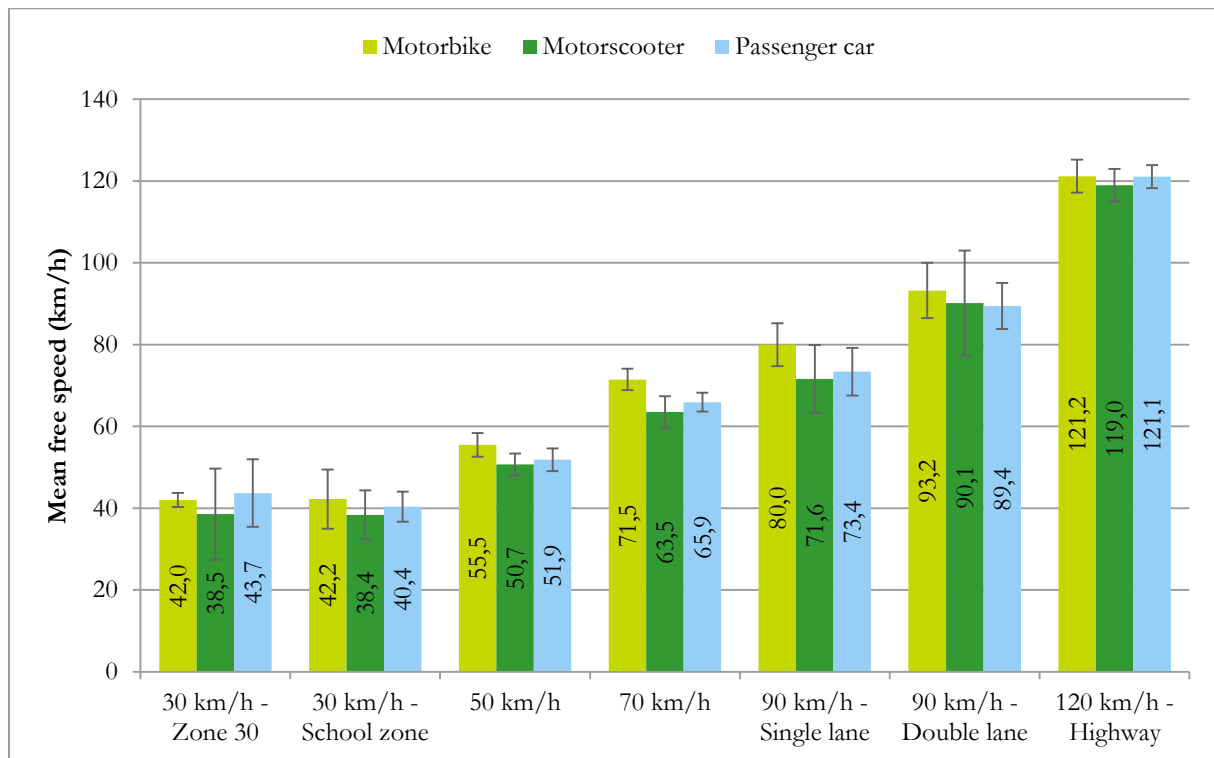
### 3 RESULTS OF THE SPEED MEASUREMENTS

#### 3.1 Main results

##### 3.1.1 Average speed per vehicle type

Figure 7 displays the mean free speed of motorbikes, motorscooters and cars, based on the measurements undertaken for the 7 road types.

**Figure 7 Mean free speed per vehicle type**



On most road types, the average free speed of motorcyclists is slightly above the speed limit. This means that probably more than half of the drivers exceed the speed limit. Only on single lane 90 km/h roads, the average speed of motorcyclists is lower than the speed limit.

The average driving speeds on 30 km/h roads was more than 40 km/h for both motorcyclists and car drivers. The average speed of motorbikes was slightly above the speed limit on 50, 70, double lane 90 km/h roads and highways.

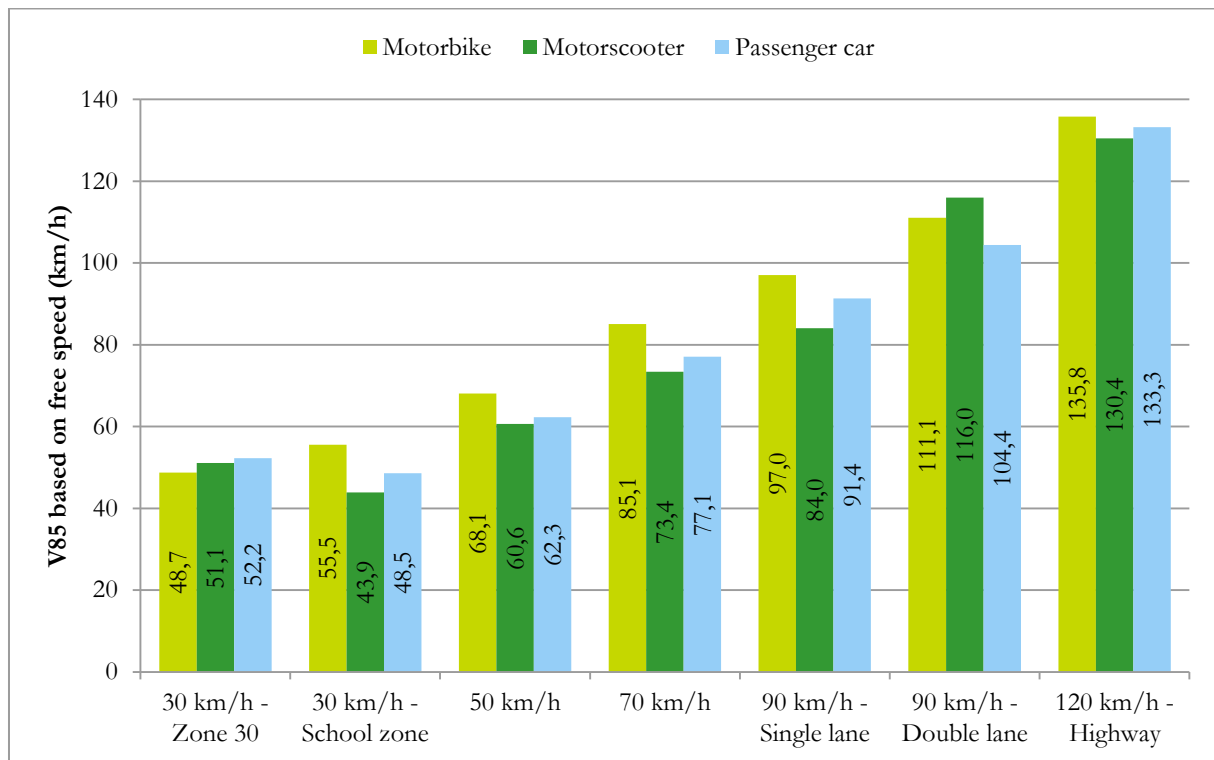
In general, the mean free speed of motorbikes is higher than of cars, whereas the mean free speed of motorscooters is equal to or even lower than of cars. However, on highways and 30 km/h roads, there is hardly any difference between the free speed of motorbikes and cars.

The largest differences in driving speed between motorbikes and cars were found on 70 and 90 km/h single lane roads, where motorcyclists drive on average 5 and 7 km/h faster than car drivers (respectively  $p < 0,005$  and  $p < 0,05$ ). On 50 km/h roads, the average speed of motorcyclists was about 3 km/h higher than that of car drivers ( $p < 0,001$ ).

### 3.1.2 V85 per vehicle type

Figure 8 shows the V85 for the three vehicle types.

**Figure 8 V85 per vehicle type**



The V85-values for motorcyclists are all above the speed limit and in general 7 to 14 km/h higher than the mean speed. On single lane and double lane 90 km/h roads, the V85 of motorcyclists is respectively 17 and 18 km/h higher than the average speed. On 50 km/h roads, the V85 is 68 km/h.

For passenger cars, the difference between the mean speed and the V85 ranges from 8 km/h (for both 30 km/h road types) to 18 km/h (for single lane 90 km/h roads).

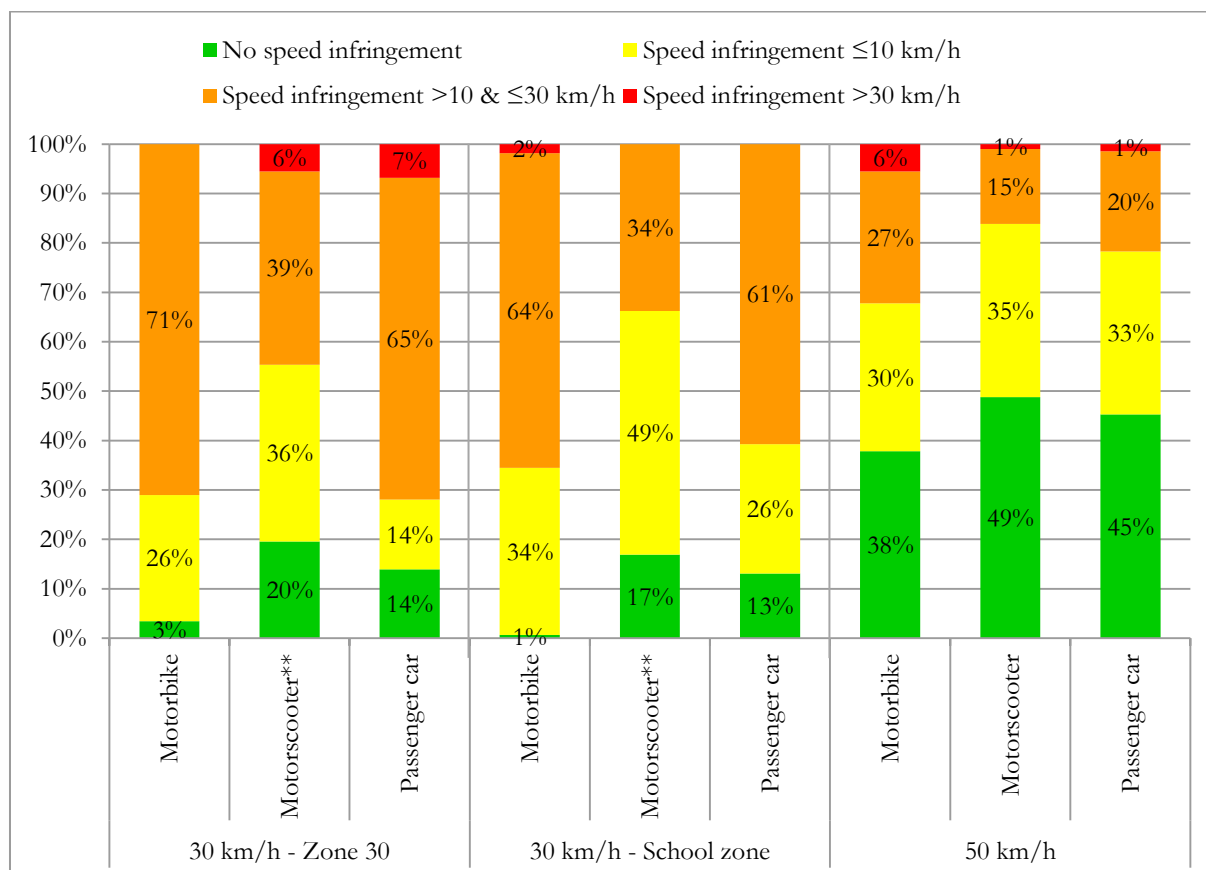
The difference between the average free speed and the V85 is on most road types a bit larger for motorbikes than for passenger cars, which indicates a less homogenous spread of speed for motorbikes than for passenger cars.

### 3.1.3 Part of drivers exceeding speed limits

The following two figures show the percentage of speed offenders on each road type.

Please note that the number of observed motorscooters on 30 and 90 km/h roads is insufficient to draw reliable conclusions on speeding behaviour.

**Figure 9 Speeding offences per vehicle type (1/2)**

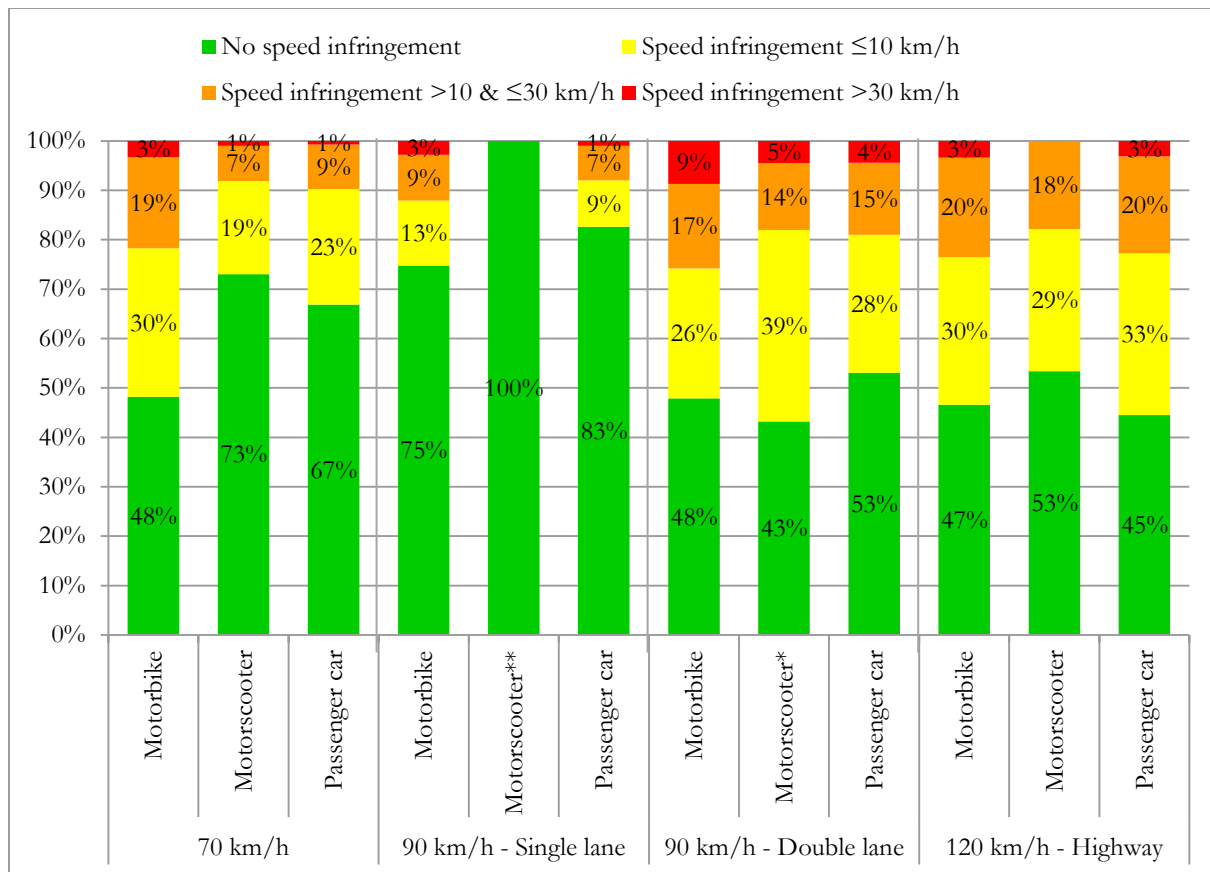


\*\* :  $10 \leq n < 20$

The share of motorcyclists exceeding the speed limit was a bit larger than the share of car drivers doing so. This difference was significant on every type of road except on 30 km/h roads. But the general problem on the latter type of road was that all vehicle types displayed a very high percentage of speed offences. About two third of the motorbike drivers exceeded the 30 km/h speed limit with more than 10 km/h (Figure 9).

On 50 km/h roads, motorcyclists complied less than car drivers to the speed limit and exceeded the speed limit with 10 to 30 km/h more often than car drivers ( $p < 0,05$ ).

Figure 10 Speeding offences per vehicle type (2/2)



\* : 20 ≤ n < 30; \*\* : 10 ≤ n < 20

Similar to the situation on 50 km/h roads, motorbike drivers complied less with the 70 km/h speed limit than car drivers (Figure 10). Only 48% of the motorbike drivers respected the 70 km/h speed limit, versus 67% of the car drivers ( $p < 0,001$ ). The share of motorbike drivers exceeding the 70 km/h speed limit with more than 10 km/h was twice the size of the share of motorscooter and car drivers committing the same speed infringement.

On 90 and 120 km/h roads, the difference between motorbikes and cars was much smaller and not significant.

9% of motorbike drivers drove more than 120 km/h on double lane 90 km/h roads. This was the road type with the highest frequency of >30 km/h speeding offences by motorcyclists.

### 3.1.4 Comparison with other speed surveys

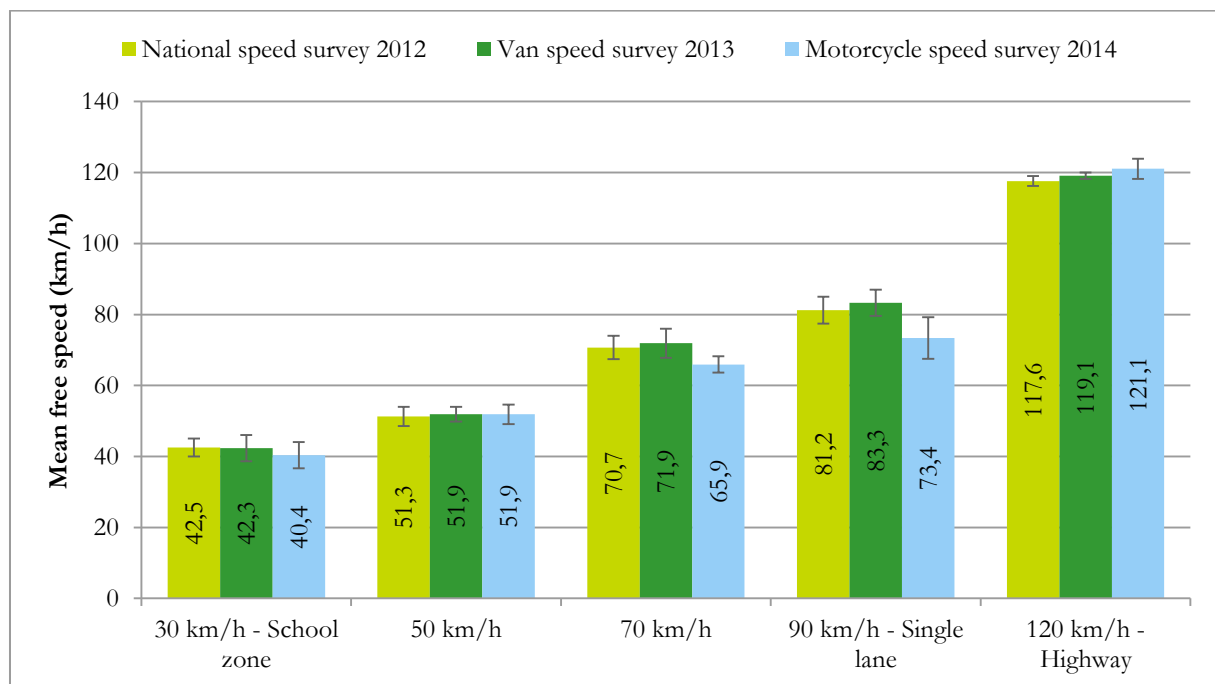
In order to verify the consistency and representativeness of the results of this study, they are compared to the results of the two latest speed surveys executed by the BRSI (Figure 11).

This comparison includes the free speed measurements of passenger cars from these three surveys: the 2012 national speed survey (Riguelle, 2013), the 2013 van speed survey (Riguelle & Roynard, 2014), and this one.

Note that the 2012 speed survey uses a different data collection method, as well as a different set of locations, than the 2013 van speed survey and this motorcycle speed survey.

The speed survey of 2012 did not include Zone 30 and 90 km/h double lane roads. These two road types are therefore excluded from this comparison.

**Figure 11 Comparison of mean free speed of car drivers with previous speed surveys**



On single lane 90 km/h roads, the average free speed of cars found in this survey, is significantly lower than in previous surveys. Also on 70 km/h roads, the average free speed of cars was significantly lower than before. These differences were likely due to the different sample of measuring locations. For the 2014 motorcycle speed survey, several sites with high motorcycle traffic were included. These sites are often located on touristic winding<sup>1</sup> roads, where driving speeds tend to be lower than on other rural single-lane roads. It means that the speed of motorcyclists measured on 70 and 90 km/h roads during this survey cannot be compared to the speeds of cars measured during other BRSI surveys. However, there is no problem to compare the speeds of motorbikes and cars of the 2014 survey, as both vehicle types have been measured in the same conditions on the same road sections.

The other road types revealed no significant difference in mean speed of car drivers.

<sup>1</sup> As mentioned in the methodology, the speed measurements were carried out on straight sections of these roads, but these straight sections were rather short comparing to those of most typical rural roads.

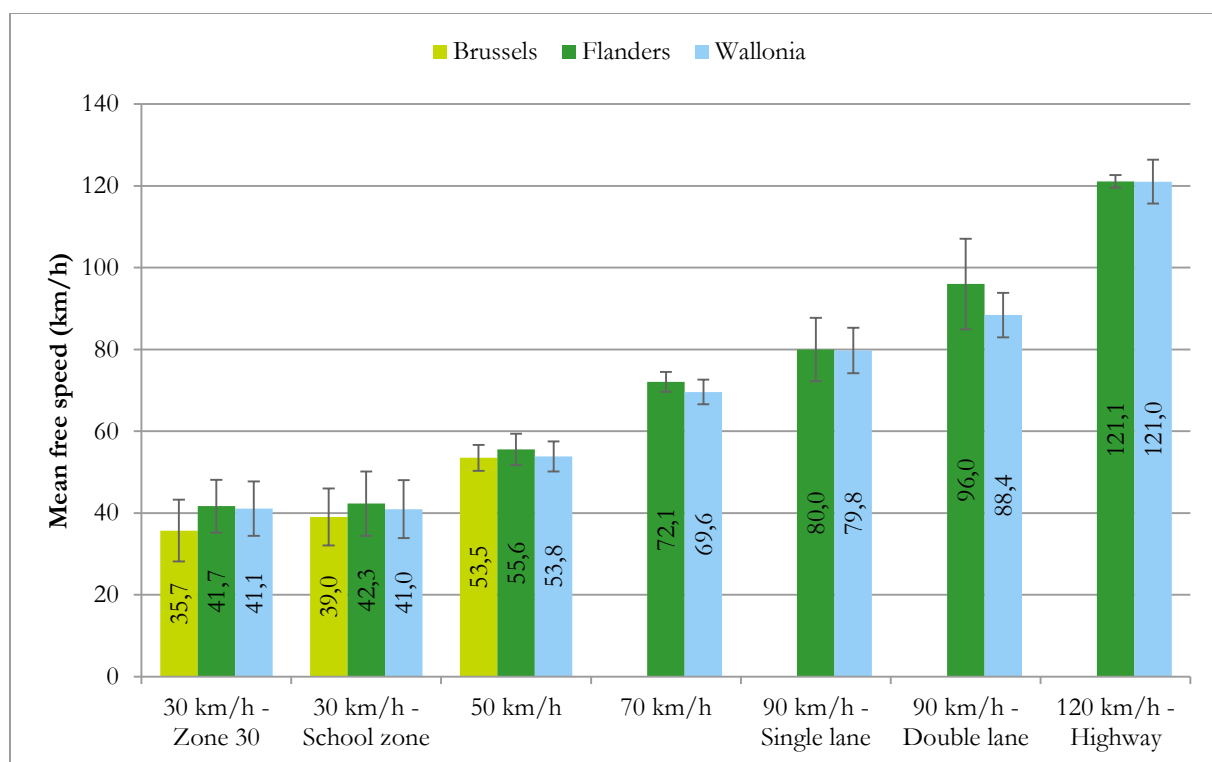
## 3.2 Results per region

### 3.2.1 Average speed of motorcyclists

The following sections provide information on how the speeding behaviour varies from a region to another. Regions are authorized to define the norms and guidelines for infrastructure and maintenance; regions and municipalities can set speed limits on their roads. All of this may impact on speeding behaviour. But differences between regions should also be interpreted with care. The driving population in a region is not only constituted by inhabitants of this region. Drivers travel outside their 'own' region or even country. Possible differences in speed compliance could be the result of differences in speed limit policy, road infrastructure, geographical and environmental factors, the purpose of the trip, the volume of traffic, etc. Such factors were not taken into consideration in this study.

Figure 12 shows the differences between the 3 regions in Belgium for the average speed of motorcycles (motorbikes and motorscooters combined).

**Figure 12 Mean free speed of motorcycles per region**



In general, the average speed driven in the three regions was comparable. The average speed inside built-up areas was a bit lower in Brussels than in Flanders and Wallonia, but not significantly. The urban context in the region of Brussels was rather different from the average built-up area in the other regions.

On most road types outside built-up areas, the average free speed in Flanders and Wallonia were very comparable.

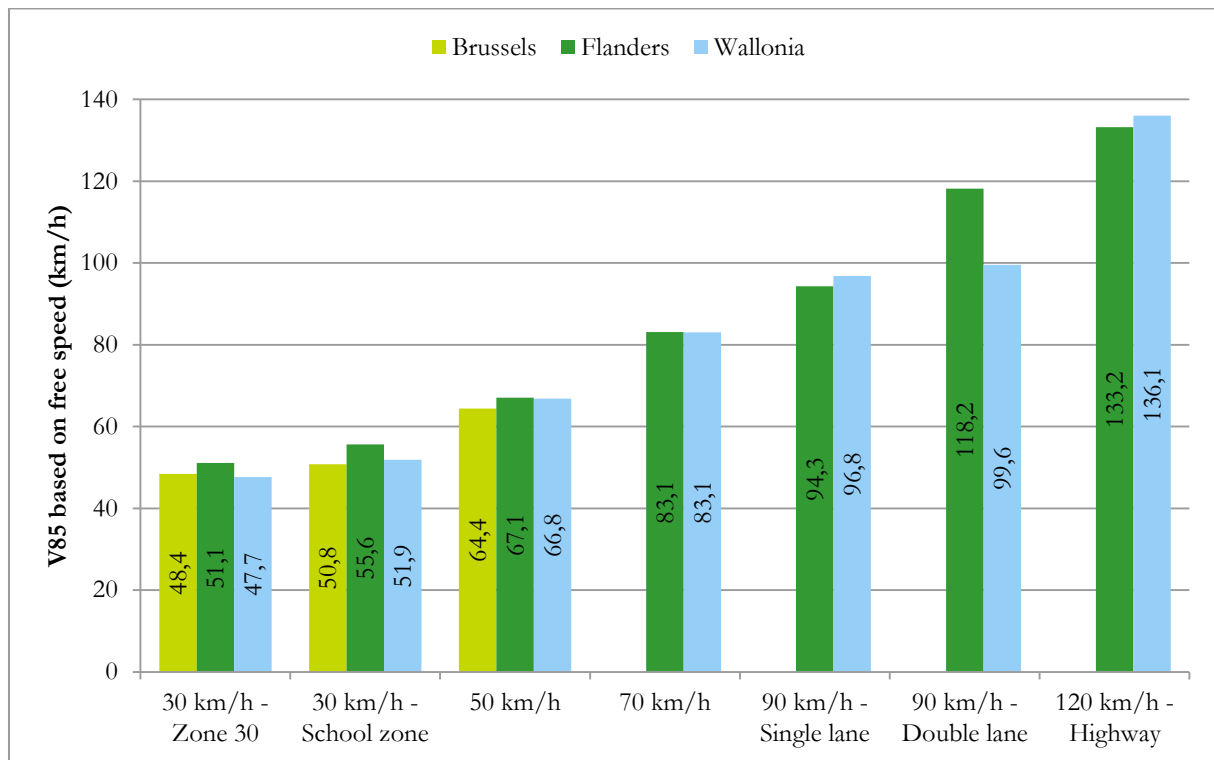
The largest difference in driving speed between regions was found on double lane 90 km/h roads (Figure 12). On these roads, the average free speed was 8 km/h higher in Flanders than in Wallonia. However, this difference is not significant.



### 3.2.2 V85 of motorcyclists

Figure 13 compares the V85 driven by motorcyclists in each region.

**Figure 13 V85 of motorcycles per region**

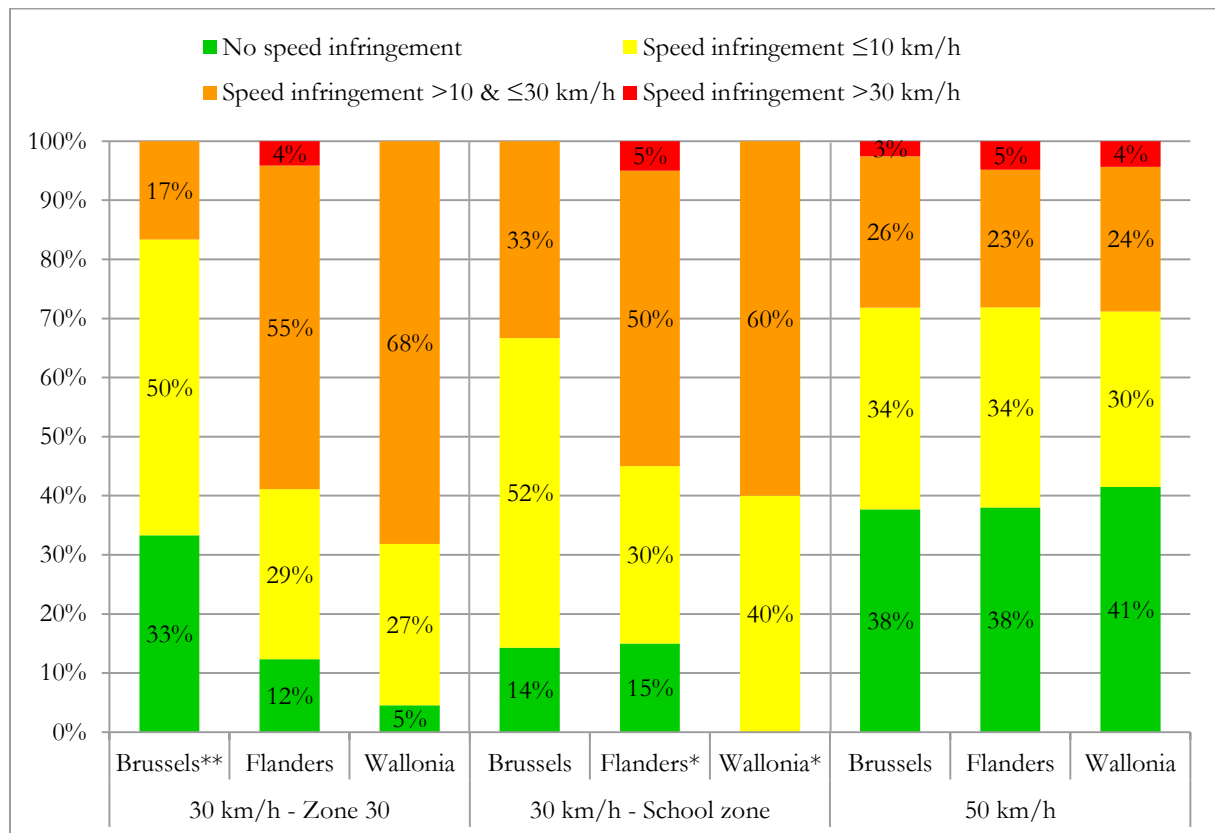


Similar to the mean speed per region, the differences between regions were very small except for double lane 90 km/h roads. On these roads, the V85 is 99.6 km/h in Wallonia and 118.2 km/h in Flanders. The difference in V85 between Flanders and Wallonia on these roads was almost 19 km/h, compared to a 8 km/h difference in mean speed. This means that the speed driven by motorcyclists on 90 km/h double lane roads was less homogenous in Flanders than in Wallonia.

### 3.2.3 Part of motorcyclists exceeding speed limits

The next two figures show the frequency of speeding offences by drivers of motorbikes and motorscooter for each region.

**Figure 14 Speeding offences by motorcyclists per region (1/2)**

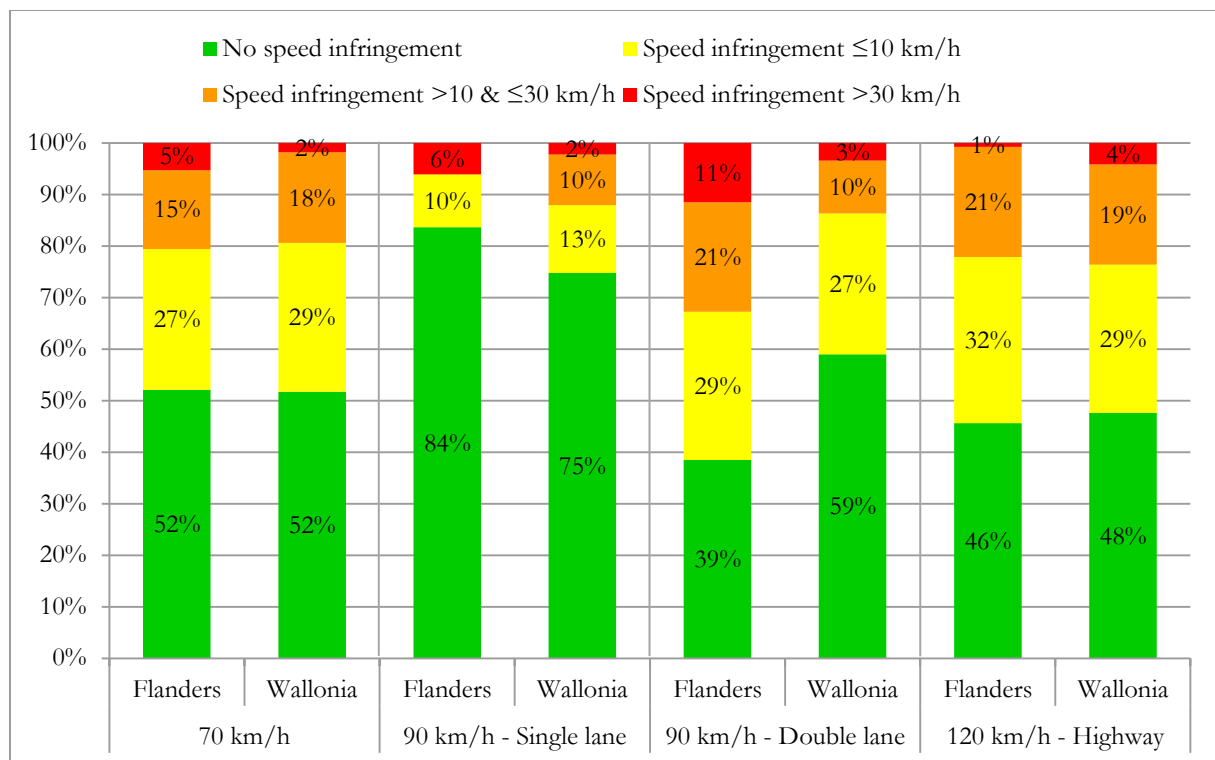


\* :  $20 \leq n < 30$ ; \*\* :  $10 \leq n < 20$

As can be seen from Figure 14 there was hardly a difference between the three regions concerning speeding offences on roads with a 50 km/h speed limit. On the other hand, on roads with a 30 km/h speed limit – both ‘zone 30’ and ‘school zone’ – much more speeding offences occurred in Wallonia than in Brussels. The situation in Flanders was in between the two other regions, but seemed to be more comparable to the situation in Wallonia than Brussels. Only the difference in speeding offence frequency in zone 30 between Brussels and Wallonia was significant ( $p < 0,05$ ).

In Wallonia, 66% of the motorcyclists were driving between 40 and 60 km/h in 30 km/h areas. 31% were driving somewhere between 30 and 40 km/h. A mere 3% complied with the 30 km/h speed limit. In Brussels, only 30% of motorcyclists drove faster than 40 km/h in 30 km/h areas.

Figure 15 Speeding offences by motorcyclists per region (2/2)



Only the amount of speeding offences on 90 km/h double lane roads showed a notable, but not significant, difference between Flanders and Wallonia. 32% of motorcyclists exceeded the 90 km/h speed limit with more than 10 km/h on double lane roads in Flanders, versus 13% in Wallonia (Figure 15).

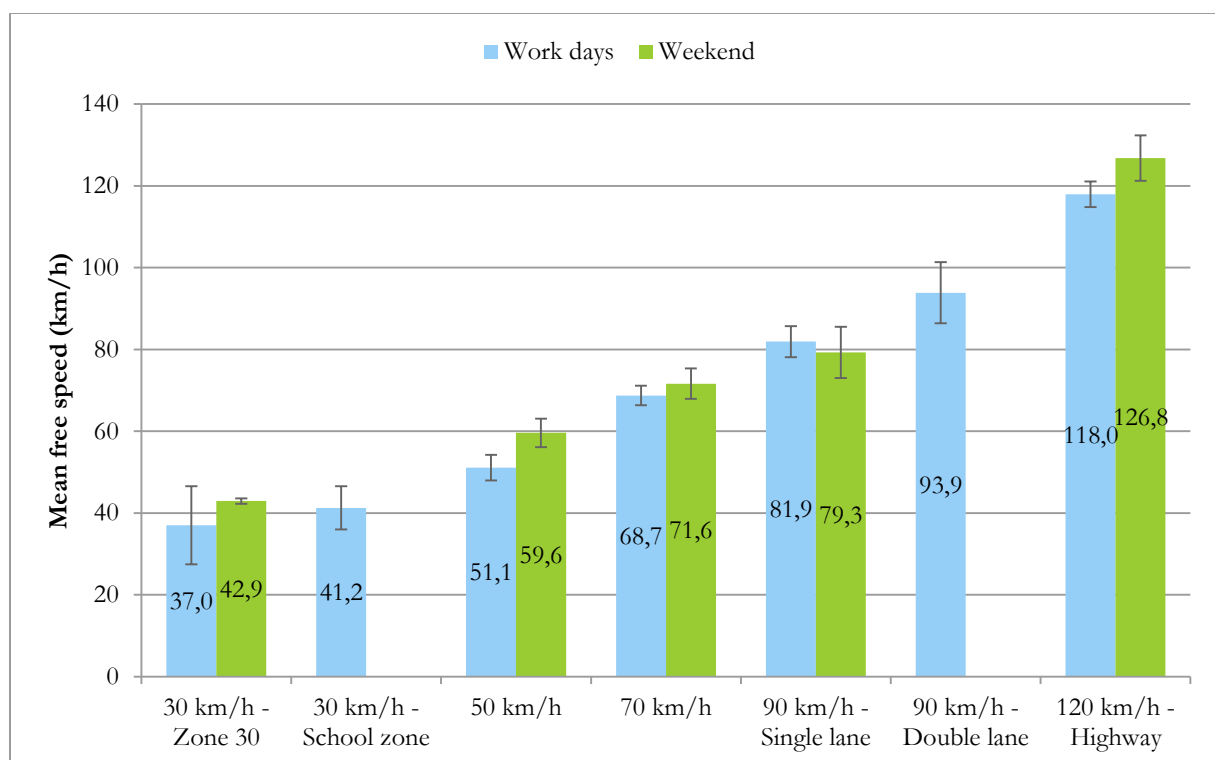
### 3.3 Other analyses

#### 3.3.1 Differences in speed behaviour during work days and weekends

We also investigated whether motorcyclists behave differently during work days and weekends. This comparison is not straightforward. The set of observation locations was not identical during work days and weekends. Also, the number of observations during weekends on 30 and 90 km/h double lane roads is very limited. No school zone with a permanent 30 km/h speed limit was surveyed during a weekend. Only one site on a 90 km/h double lane road was visited during weekend. Consequently, the results of this combination were omitted. The effect of congestion is largely excluded due to the selection of observations at free speed only.

In general, average driving speeds of motorcyclists were about 3 to 8 km/h higher during weekends compared to work days (Figure 16). On highways, this difference was almost 9 km/h. These results are statistically significant for 50 km/h roads ( $p < 0,001$ ) and highways ( $p < 0,01$ ).

**Figure 16 Mean free speed of motorcycles during work days and weekend**

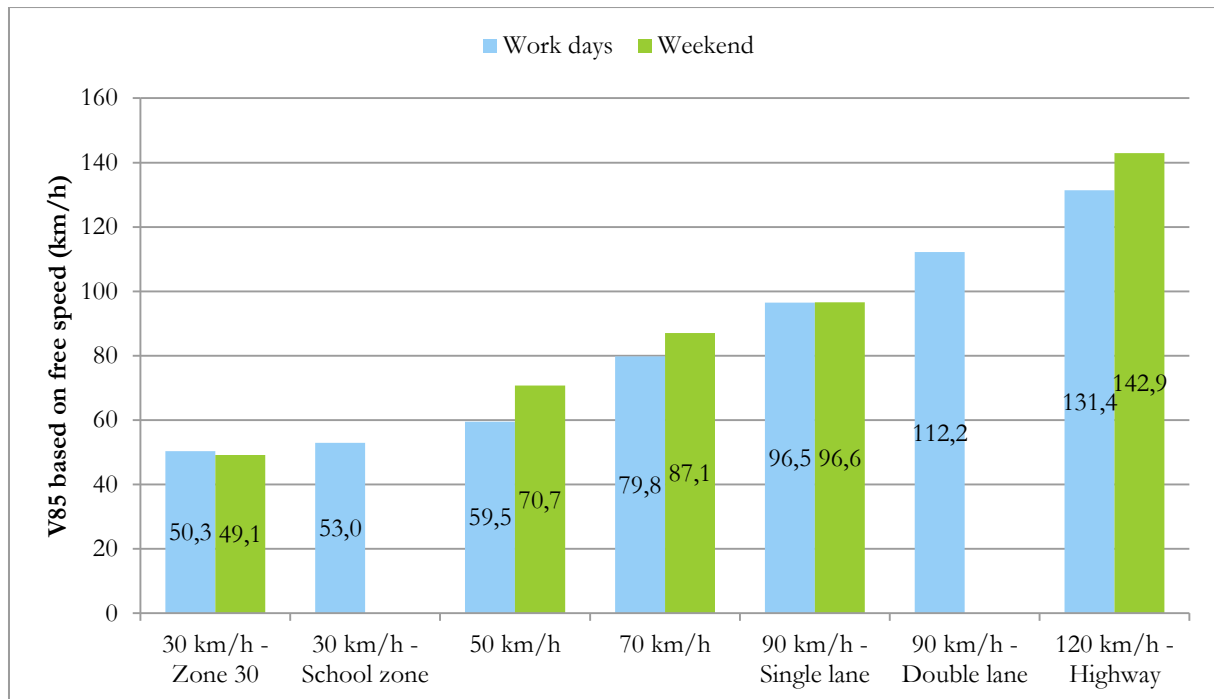


The lower average speed on single lane 90 km/h roads could be a result of a different route choice or a different trip purpose. On work days, a larger share of motorcyclists commutes, and for that chooses a route that will quickly lead them to their destination. During weekend, motorbikes are more often used for leisure. At that time, motorcyclists may prefer curvy rural roads, where the 90 km/h speed limit is often not a constraint. On top of that, there is less time pressure during leisure trips.

Although only the observations at free speed are included, the influence of traffic volume differences between work days and weekends cannot be completely excluded.

The next chart shows the V85 of motorcyclists during work days and weekend.

**Figure 17 V85 of motorcycles during work days and weekend**



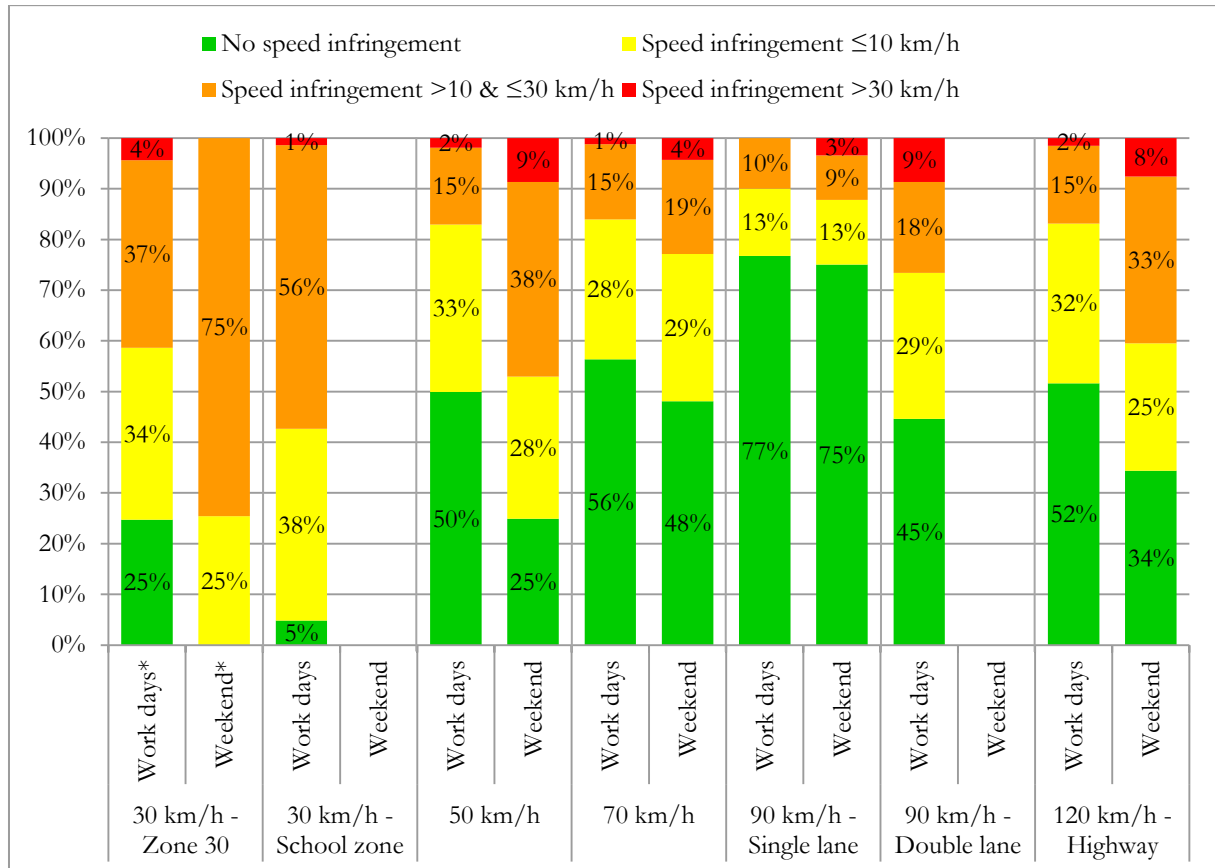
The differences in V85 between work days and weekend for most road types was the same as the differences in mean speed, except in zone 30. On these roads, the V85 during work days was substantially higher than the mean speed, whereas during weekends, the V85 was close to the mean speed. This means that, in zone 30, there was more variation in motorcyclists' driving speed during on days than during weekends.

On 50 km/h roads, there was a clearly larger share of speeding offences with more than 10 km/h and even more than 30 km/h during weekends (Figure 18). On work days, 50% of the drivers complied with the 50 km/h speed limit and 17% exceeded this limit with more than 10 km/h, versus 25% of compliance and 47% of exceeding with more than 10 km/h during weekend ( $p < 0,001$ ).

On 70 km/h roads and single lane 90 km/h roads, there was not much difference in speed compliance between work days and weekend.

The greatest difference between work days and weekends was observed on highways. Only 34% of the motorcyclists complied with the speed limit of 120 km/h during weekend, versus 52% on work days. ( $p < 0,05$ ).

**Figure 18 Speeding offences by motorcyclists during work days and weekend**

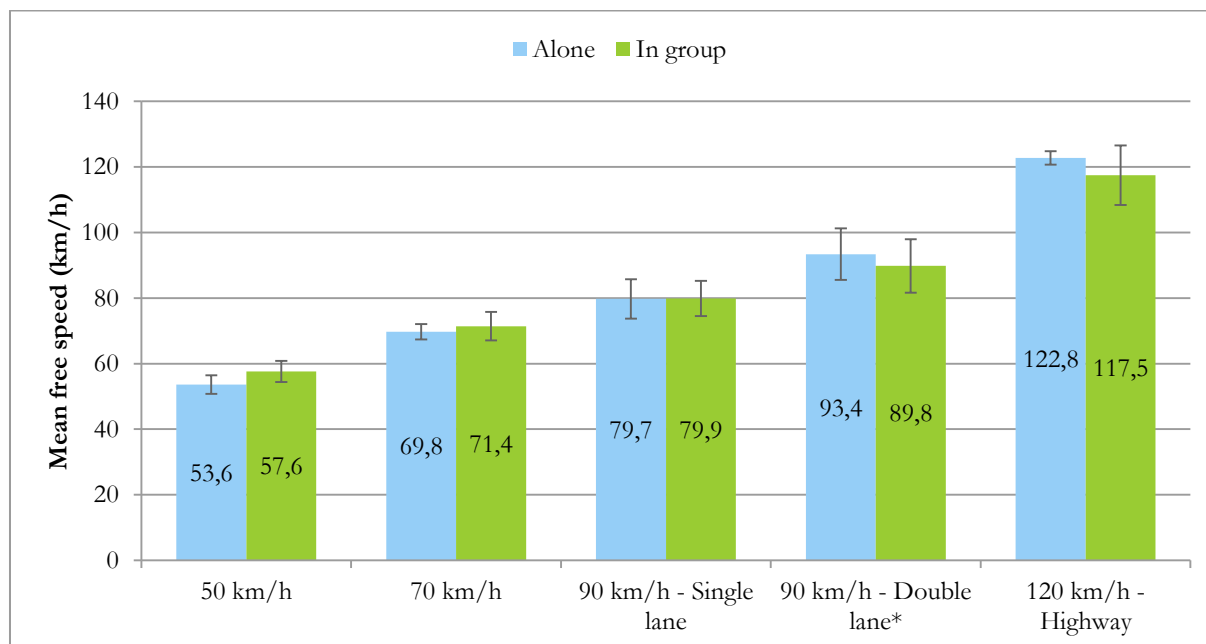


\* : 20 ≤ n < 30

### 3.3.2 Differences between single motorcyclists and groups of riders

On 50 km/h roads, motorcyclists in group drove on average 4 km/h faster than individual motorcyclists ( $p < 0,05$ ). Motorcyclists in group seemed to drive 3 km/h slower than individual motorcyclists on double lane 90 km/h roads and highways. However, these differences were not significant.

**Figure 19 Mean free speed of motorcyclists alone and in group**



\* :  $20 \leq n < 30$

The variable ‘Group size’ had 3 possible values. However, due to an insufficient number of observations of motorcycles in group, both group sizes had to be merged, leaving two possibilities: ‘alone’ and ‘in group’. The “in-group” results should not be interpreted as a measure of the behaviour of large groups of motorcyclists riding during an organised motorcycling event, as this kind of group has been seldom observed during the survey.

The number of observed PTWs in group on 30 km/h roads was insufficient for reliable analysis. On 90 km/h double lane roads, only 24 motorcyclists in group were observed, so this result should be interpreted with care.

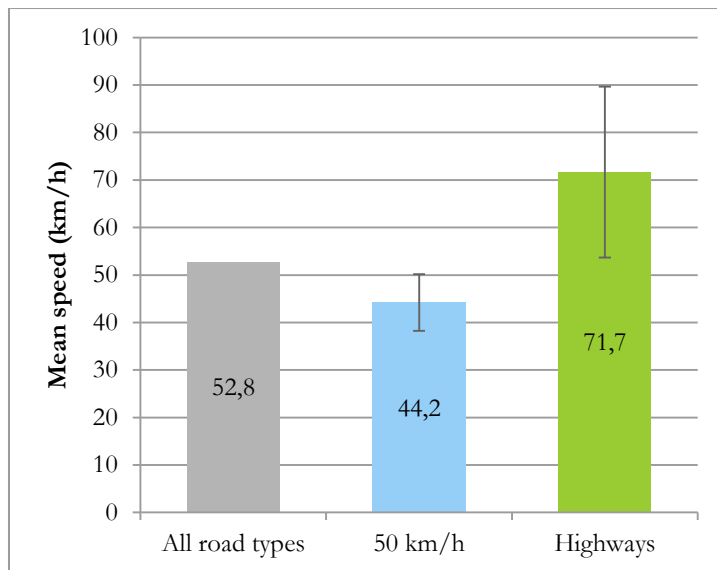
### 3.3.3 Speed of motorcyclists driving between lanes

Since September 2011, article 16.2bis of the Belgian highway code allows drivers of motorbikes to drive between lanes in times of congestion. It is not considered as overtaking. In those cases, motorcyclists may not drive faster than 50 km/h and not more than 20 km/h faster than the vehicles/traffic around them.

In order to analyse whether and to what extent these rules were respected, the observations were filtered on basis of the variable ‘between lanes’ instead of ‘free speed’. This resulted in 428 observed PTWs, from which 205 on 50 km/h roads and 190 on highways. Only 50 km/h roads and highways had a sufficient number of observed PTWs to allow computing reliable results.

When driving between lanes on 50 km/h roads, most of the drivers remained below the speed limit. The average measured speed was 44 km/h. On highways however, this average was about 72 km/h, well above the maximum authorised lane splitting speed of 50 km/h (Figure 20).

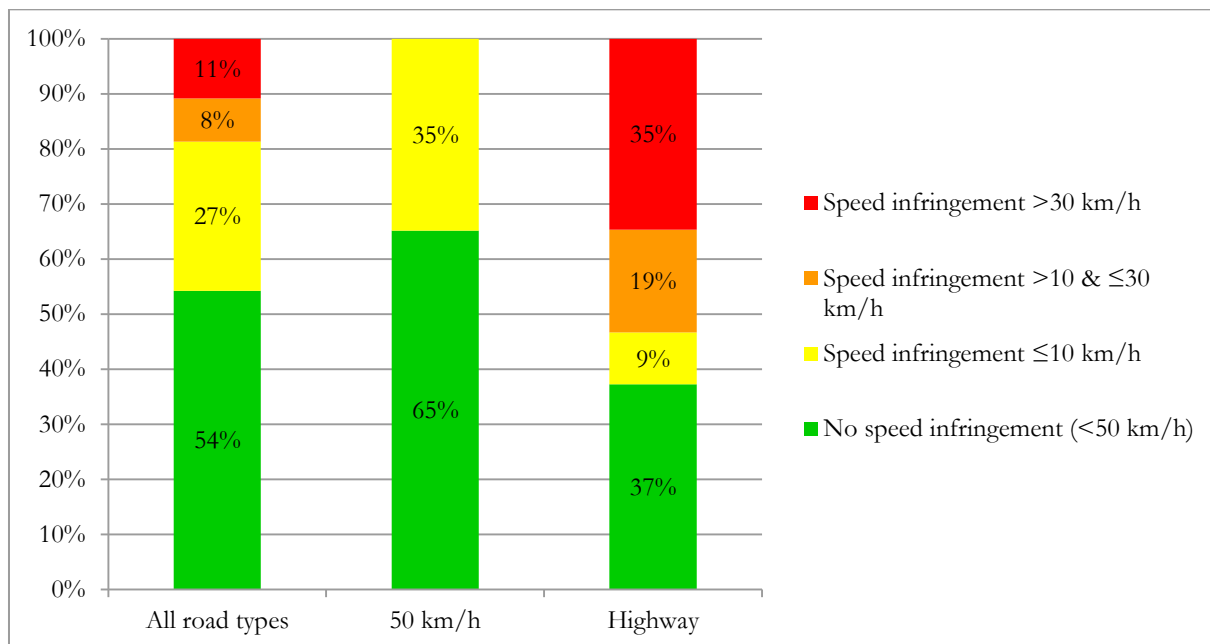
**Figure 20 Mean speed of 'lane splitting' motorcyclists**



On 50 km/h roads, 65% of the motorcyclist did not drive faster than 50 km/h while lane splitting. 35% drove between 50 and 60 km/h.

On highways, this speed limit was much less respected. 35% of motorcyclists were driving between lanes (lane-splitting) at more than 80 km/h, and only 37% respected the maximum authorised lane splitting speed of 50 km/h (Figure 21).

**Figure 21 Motorcyclists' compliance with the 50 km/h speed limit while "lane-splitting"**



The difficulty in enforcing this 50 km/h speed limit could be one of the reasons for this behaviour. These offences may also be caused by an insufficient knowledge of the (fairly recent) regulation.

Only one aspect of the regulation (maximum speed of 50 km/h) could be evaluated during this survey. We could not collect any data on the differential of speed between lane-splitting motorcyclists and the surrounding vehicles. Among the 54% of motorcyclists driving below 50 km/h, some of them are likely not respecting the maximum allowed speed gap of 20 km/h. The total percentage of motorcyclists complying with the lane splitting regulation is thus lower than 54%.



## 4 CONCLUSIONS AND RECOMMENDATIONS

### 4.1 Conclusions

The main results of this speed measurement survey can be summarised as follows:

- (1) On most roads, less than half of the motorcyclists respected the speed limit when they are driving at “free speed”. This result should not come as a surprise since previous speed measurements by BRSI on speeding of cars, trucks and vans have also showed that significant numbers of drivers of these vehicles did not respect the speed limits either.
- (2) Yet, this new study has also revealed that on most roads, motorcyclists drove faster than car drivers. This was the case on 50, 70 and single lane 90 km/h roads. On average, motorcyclist drove 3, 5 and 7 km/h faster than car drivers on 50, 70 and single lane 90 km/h roads respectively. On highways, there was no difference in average speed between motorcyclists and car drivers.
- (3) The 85<sup>th</sup> percentile of the free speed (V85) by motorcyclists was 7 to 18 km/h higher than their mean free speed. The figures for the V85 of car drivers were similar. On some road types however, the difference between the mean speed and V85 was larger for motorbikes than for passenger cars. This indicates a less homogenous spread for the speed of motorbikes.
- (4) Motorcyclists also committed more speeding offences than car drivers in 50 and 70 km/h speed regimes. In 30 km/h areas, a lower compliance with speed limits could be noted as well; however, this difference was not significant. On highways, there was no difference in the frequency of speeding offences between motorcyclists and car drivers.
- (5) The average speed of ‘motorscooters’ (motorbikes with a ‘floor’) was in most cases equal to or a bit lower than that of cars. A lot of these motorscooters are equipped with a 125 cm<sup>3</sup> engine. They have a lower power-to-weight ratio and are often driven by drivers with a B license.
- (6) On most roads inside built-up areas, only about one third motorcyclists complied with the speed limits. On roads outside built-up areas about half of the motorcyclists complied with the speed limits. There were very few speeding offences on single lane 90 km/h roads. The large difference in measured speeds between single lane and double lane 90 km/h roads was probably related to the completely different lay-out.
- (7) On most road types, no significant differences between regions have been found in mean speed of PTWs or frequency of speeding offences by PTW drivers. However, there were significantly more speeding offences in ‘zone 30’ in Wallonia than in Brussels. The situation in Flanders was somewhere in between.
- (8) PTWs drove at a higher speed during weekends on 50 km/h roads and on highways. On the other hand, the average speed of PTWs on single lane 90 km/h roads was significantly lower during weekends than during work days. During weekends, there was a significantly higher frequency of speeding offences by PTW drivers on most road types, except for 70 and 90 km/h roads.
- (9) On most road types, there was no significant difference between the average free speed of motorcyclists driving alone and those driving as part of a group. Only on 50 km/h roads, motorcyclists in group drove on average 4 km/h faster than those driving alone. Thus, we did not identify any kind of “peer effect” among motorcyclist which would bring them to behave – on average – differently when they drive in group.
- (10) On highways, a lot of motorcyclists drove too fast when moving between lanes. The average ‘lane-splitting’ speed on highways was 72 km/h. 35% of motorcyclists were driving between lanes (lane-splitting) at more than 80 km/h, which is more than 30 km/h above the authorised lane-splitting speed of 50 km/h.

## 4.2 Recommendations

### Awareness raising amongst motorcyclists

Overall, motorcyclist should be made more aware of the risks related to speeding. Because their vehicle does not offer the same level of protection as cars do, speed has a huge impact on the consequences of a crash. This could be the subject of a campaign.

Because of the significant difference in speed behaviour of motorcyclists compared to car drivers on rural roads, measures targeting motorcyclists would be useful, especially educative or informative campaigns on the importance of speed limits on rural roads.

According to the results of BRSI's motorcycle accident causation study (MOTAC) (Martensen & Roynard, 2013) these campaigns should give priority to target either young drivers of a sports type motorbike or middle-aged drivers of a touring bike. These two target groups show the highest accident rates relative to their travelled distance.

The risks related to overtaking, limited visibility and inadequate speed should be considered as the subject of campaigns (Martensen & Roynard, 2013).

Another widespread offence revealed by this survey, is the non-compliance with the 50 km/h speed limit while lane-splitting on highways. The average lane-splitting speed on highways was 70 km/h and one third of the motorcyclists drove more than 80 km/h while lane-splitting. Motorcyclists should be informed and warned more systematically that lane-splitting is only allowed during congestion, at a speed of not more than 50 km/h and not more than 20 km/h faster than the vehicles around.

### Enforcement

Motorcyclists should be as susceptible for speed enforcement as car drivers. Please note that since motorbikes only have a license plate at the back, they cannot be penalized if the picture is taken from the front. Also, their license plate is smaller than that of cars, which makes them unreadable for certain camera systems. These technical issues should be resolved.

Large differences in average speed were observed between work days and weekend. On highways, the average free speed of PTW's during weekends was 9 km/h higher than on work days, and even 7 km/h above the 120 km/h speed limit. The frequency of speeding offences on 50 and 120 km/h roads is also larger during weekend than on work days. These figures show that the detection rate for speeding offences by motorcyclists should be higher, especially during weekends.

Enforcement of the lane-splitting speed limit is also necessary but might be a bit of challenging because of the deviant speed limit and the dense traffic. It would however reduce the number of infringements.

### Infrastructure

Road administrators should strive towards consistency between the design of the road and its speed limit.

Especially on rural roads, variations in speed limits often appear inconsistent to motorcyclists and other drivers. Speed limits that do not seem to be in accordance with the lay-out of the roads and the surrounding area are not only confusing to the road users but may also reinforce an attitude that 'speed limits should not be taken seriously'.

### Technology

The development of Advanced Driver Assistance Systems (ADAS) for motorcycles has not advanced as far as with passenger cars. However, such systems could eventually improve the safety of motorcyclists in traffic (Morsink, 2007).

In the future, technologies such as adaptive cruise control (ACC) and intelligent speed assistance (ISA – closed or half open) could contribute to better restrain the speed of motorbikes. These are currently on the political agenda but not generally available.

Development difficulties include compact and lightweight designs and a Human Machine Interface suitable for use on a PTW. Whatsoever, also the adoption of such systems will require time due to their cost and the limited support from the motorcyclists community (Van Elslande, et al., 2014).

### 4.3 Need for further research

Overall, it has to be recognized that not much research results are available about the attitudes and the behaviour of motorcyclists. Hence, more research should be undertaken in this area, in order to develop appropriate policies and to be able to measure the progress achieved thanks to particular measures taken.

In particular, we see a need for the following:

- This type of survey, measuring the speed of motorcyclists, should be repeated every 3 years.
- Future speed surveys and research projects should also pay attention to road lay-outs and to the combinations of speed limits and lay-outs.
- Further research is needed concerning the speed adopted when lane-splitting, including an assessment of the accidents risks for both motorcyclists and car drivers.
- More research is needed on the attitudes of motorcyclists and the reasons why they are speeding.

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## REFERENCES

- Elvik, R. (2014). *Speed and road safety – new models*. Oslo, NO: Institute of Transport Economics.
- FEBIAC. (2014). *Datadigest 2014*. Retrieved from FEBIAC:  
<http://www.febiac.be/public/statistics.aspx?FID=23&lang=NL>
- FOD Mobiliteit. (2014). *Statistieken van het wegverkeer*. Retrieved from FOD Mobiliteit:  
<http://www.mobiliteit.belgium.be/nl/mobiliteit/cijfers/statistieken/>
- Martensen, H., & Roynard, M. (2013). *MOTAC – Motorcycle accident causation. Diepteanalyse van zware en dodelijke ongevallen waarin motorfietsers betrokken waren*. Brussel, BE: Belgisch Instituut voor de Verkeersveiligheid – Kenniscentrum Verkeersveiligheid.
- Morsink, P. L. (2007). *Gemotoriseerde tweewielers en verkeersveiligheid : inventarisatie en positionering in Duurzaam Veilig*. Leidschendam, NL: Stichting Wetenschappelijk Onderzoek Verkeersveiligheid (SWOV).
- Nuyttens, N., & Van Belleghem, G. (2014). *Hoe ernstig zijn de verwondingen van verkeersslachtoffers? Analyse van de MAIS-ernstscore van verkeersslachtoffers opgenomen in de Belgische ziekenhuizen in de periode 2004-2011*. Brussel, BE: Belgisch Instituut voor de Verkeersveiligheid – Kenniscentrum voor de Verkeersveiligheid & Vrije Universiteit Brussel – Interuniversity Centre for Health Economics Research.
- Riguelle, F. (2012). *Mesure nationale de comportement « vitesse sur autoroute » – 2011*. Bruxelles, BE: Institut Belge pour la Sécurité Routière – Centre de Connaissance.
- Riguelle, F. (2013). *Mesure nationale de comportement en matière de vitesse – 2012*. Bruxelles, BE: Institut Belge pour la Sécurité Routière – Centre de Connaissance.
- Riguelle, F., & Roynard, M. (2014). *Les camionnettes roulent-elles trop vite ? Résultats de la première mesure de la vitesse des camionnettes en Belgique*. Bruxelles, BE: Institut Belge pour la Sécurité Routière – Centre de Connaissance.
- Van Elslande, P., Feypell-de la Beaumelle, V., Holgate, J., Redant, K., de Solère, H., Margaritis, D., . . . Granström, P.-O. (2014). *Mobility and safety of powered two-wheelers in the OECD countries*. Paris, FR: Transport Research Arena.

## APPENDIX A: DESCRIPTION FORM

<b>DESCRIPTION DE SITE - PLAATSBSCHRIJVING</b>
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Code du site / Code van de site:

Site modifié ? Gewisselde locatie?  Oui / Ja  Non / Neen

Coordonnées du site (compléter si changement) / Beschrijving van de locatie (invullen indien veranderd):

- Commune / Gemeente : ..... Num + Rue / Straat + num: .....
- Direction / Richting: .....
- Coordonnées GPS / GPS coördinaten: N..... E.....
- Autre information / Andere informatie: .....

Caractéristiques de la voie / Kenmerken van de weg:

- Nombre de directions / Aantal richtingen: .....
- Nombre de voies dans la direction mesurée / Aantal rijstroken in de gemeten richting: .....
- Nombre de voies dans la direction opposée / Aantal rijstroken in de andere richting: .....
- Piste cyclable / Fietspad  Marquée sur la route / Gemarkeerd  
 Séparée de la route / Vrijliggend  
 Non / Neen

Vitesse autorisée / Snelheidsbeperking: .....km/h

Infrastructure susceptible d'influencer le comportement vitesse / Infrastructuur dat de snelheid kan beïnvloeden:

- Ralentisseur / Verkeersdrempel
- Rétrécissement / Wegversmalling
- Arrêt transport en commun / Halte openbaar vervoer
- Panneau indicateur de vitesse / Snelheidsbord
- Autre / Andere : .....

Mesures temporaires susceptibles d'influencer la vitesse / Tijdelijke omstandigheden die de snelheid kunnen beïnvloeden:

- Voitures parkées / Geparkeerde voertuigen  Travaux / wegenwerken
- Déviation / Omleiding  Autre / Andere : .....

Distance estimée à l'élément perturbateur / Geschatte afstand tot de verstoring .....m

Conditions météo / Weersomstandigheden:

- Sec / Droog  Pluie modérée / Matige regen  Pluie forte / Hevige regen
- Brouillard / Mist  Autre / andere : .....

<b>Date mesure / datum meting:</b>	...../06/2014
<b>Heure début (1) / Startuur (1)</b>	.....
<b>Heure fin (1) / Einduur (1)</b>	.....
<b>Heure début (2) / Startuur (2)*</b>	.....
<b>Heure fin (2) / Einduur (2)</b>	.....
<b>Heure début (3) / Startuur (3)**</b>	.....
<b>Heure fin (3) / Einduur (3)</b>	.....
<b>Remarques générales : Algemene opmerkingen</b>	
<b>Distance avec le milieu de la route : Afstand tot het midden van de weg</b>	..... m
<b>Distance avec les véhicules mesurés : Afstand tot de gemeten voertuigen</b>	..... m

\*Si la mesure a été interrompue où pour la deuxième bande des autoroutes/ Als de meting onderbroken werd of voor de tweede rijstrook van autosnelwegen

\*\*Pour la troisième bande des autoroutes / Voor de derde rijstrook van autosnelwegen

**APPENDIX B: SIGNIFICANCE TEST RESULTS**

Differences in mean free speed between vehicle types:

Significance of differences between:	30 km/h Zone 30	30 km/h School zone	30 km/h All	50 km/h	70 km/h	90 km/h Single lane	90 km/h Double lane	120 km/h Highway
MB <> MS	p>0,1	p>0,1	p>0,1	p<0,005	p<0,005	p>0,1	p>0,1	p>0,1
MB <> PC	p>0,5	p>0,1	p>0,5	p<0,001	p<0,001	p<0,005	p<0,05	p>0,5
MS <> PC	p>0,1	p>0,5	p>0,1	p>0,1	p>0,1	p>0,5	p>0,5	p>0,1

Differences in speeding offences between vehicle types:

Significance of differences between:	30 km/h Zone 30	30 km/h School zone	30 km/h All	50 km/h	70 km/h	90 km/h Single lane	90 km/h Double lane	120 km/h Highway
MB <> MS	p>0,1	p>0,1	p>0,05	p>0,1	p<0,001	p<0,001	p>0,5	p>0,1
MB <> PC	p>0,1	p>0,1	p>0,05	p<0,05	p<0,001	p>0,05	p>0,1	p>0,5
MS <> PC	p>0,5	p>0,5	p>0,5	p>0,5	p>0,1	p<0,001	p>0,1	p>0,1

Differences in mean free speed of motorcycles between regions:

Significance of differences between:	30 km/h Zone 30	30 km/h School zone	30 km/h All	50 km/h	70 km/h	90 km/h Single lane	90 km/h Double lane	120 km/h Highway
Brussels <> Flanders	p>0,1	p>0,5	p>0,1	p>0,1	-	-	-	-
Brussels <> Wallonia	p>0,1	p>0,5	p>0,1	p>0,5	-	-	-	-
Flanders <> Wallonia	p>0,5	p>0,5	p>0,5	p>0,5	p>0,1	p>0,5	p>0,1	p>0,5

Differences in speeding offences by motorcycles between regions:

Significance of differences between:	30 km/h Zone 30	30 km/h School zone	30 km/h All	50 km/h	70 km/h	90 km/h Single lane	90 km/h Double lane	120 km/h Highway
Brussels <> Flanders	p>0,1	p>0,5	p>0,5	p>0,5	-	-	-	-
Brussels <> Wallonia	p<0,05	p>0,1	p>0,1	p>0,5	-	-	-	-
Flanders <> Wallonia	p>0,1	p>0,1	p>0,1	p>0,5	p>0,5	p>0,1	p>0,1	p>0,5

Differences in mean free speed of motorcycles between work days and weekend:

Significance of differences between:	30 km/h Zone 30	30 km/h School zone	30 km/h All	50 km/h	70 km/h	90 km/h Single lane	90 km/h Double lane	120 km/h Highway
Work days <> Weekend	p>0,1	-	p>0,1	p<0,001	p>0,1	p>0,1	-	p<0,01

Differences in speeding offences by motorcycles between work days and weekend:

Significance of differences between:	30 km/h Zone 30	30 km/h School zone	30 km/h All	50 km/h	70 km/h	90 km/h Single lane	90 km/h Double lane	120 km/h Highway
Work days <> Weekend	p<0,05	-	p<0,05	p<0,005	p>0,1	p>0,5	-	p<0,05

Differences in mean free speed between motorcyclists alone and in group:

Significance of differences between:	50 km/h	70 km/h	90 km/h Single lane	90 km/h Double lane	120 km/h Highway
Alone <> In group	p<0,05	p>0,1	p>0,5	p>0,1	p>0,1



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