

# Analysis of Relationships Between Drivers' Perception of Road Infrastructure in Poland and their Involvement in Road Accidents and Collisions

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Road accidents and collisions are very common in Poland and, although for the last several years their number has been constantly decreasing, it is still one of the highest in Europe.

This article attempts to provide an answer to the question whether drivers' overrating the changes in the Polish road transport infrastructure might contribute to the status quo – the factor that has so far been left uninvestigated. In [21] the authors demonstrate that drivers take notice of the changes and perceive them as changes for the better.

**Keywords:** road accident, collision, road transport infrastructure, driver.

## 1. INTRODUCTION

Road accidents are a serious problem in the modern world. Road transport is the most dangerous of all transport modes and brings the greatest loss expressed in the number of fatalities. An estimated 90% of all transport fatalities are due to road accidents [17].

According to the United Nations data, 1.2 million people die in traffic crashes globally every year, which makes more than 3,000 per day. Many more, 30-50 million, are injured. The World Health Organisation (WHO) estimates traffic accidents take the 9th place in the list of causes of death, whereby in the European Union they are now the first cause of death among people aged up to 45. According to the same organization, road accidents will be the leading cause of premature death by 2020 [12].

Road safety statistics published by the European Commission in 2015 support the statement that European roads remain the most dangerous ones in the world. The EC report indicates that in 2015 26,000 people were killed in the UE as a consequence of road collisions, i.e., 5,500 people fewer compared with 2010 levels, but with no improvement registered relative to 2014. Average road mortality in the EU states was 51.5 deaths per million inhabitants in 2015, and has not changed for the last two years.

Poland has reduced the number of deaths over the last decade (Fig. 1). Despite this downward trend, Poland has one of the highest number of fatalities in Europe, well above the EU average, with nearly two times more fatalities, i.e., 11 deaths per 100 accidents, than in other EU countries, 5 deaths per 100 accidents [11].

In most cases of road accidents, drivers are at fault. Fig. 2 shows the number of accidents caused by drivers in Poland between 2007 and 2016. Poor driving skills together with inability to properly assess the situation, intentional violations, excessive speed, reckless driving and drunk driving are the most common causes of accidents, with drug use [2, 5, 19, 23, 24, 26, 28], fatigue, stress and aggression [1, 4, 6, 7, 8, 9, 10, 15, 16, 18, 22, 25, 27] observed over the recent years.

The relationship between the perception of infrastructure condition and drivers' participation in road accidents and collisions as perpetrators and victims has not yet been investigated. Undoubtedly, the condition of Polish road infrastructure has been improving steadily for the past 16 years. In 2000, the country's road network consisted of 398 km of motorways and 192 km of expressways, which in 2016 increased by 1 243 km of motorways and 1 382 km of expressways respectively. Subsequent figures, i.e., 3, 4, and 5, show the data on the motorway and expressway infrastructure in Poland between 2000-2016.

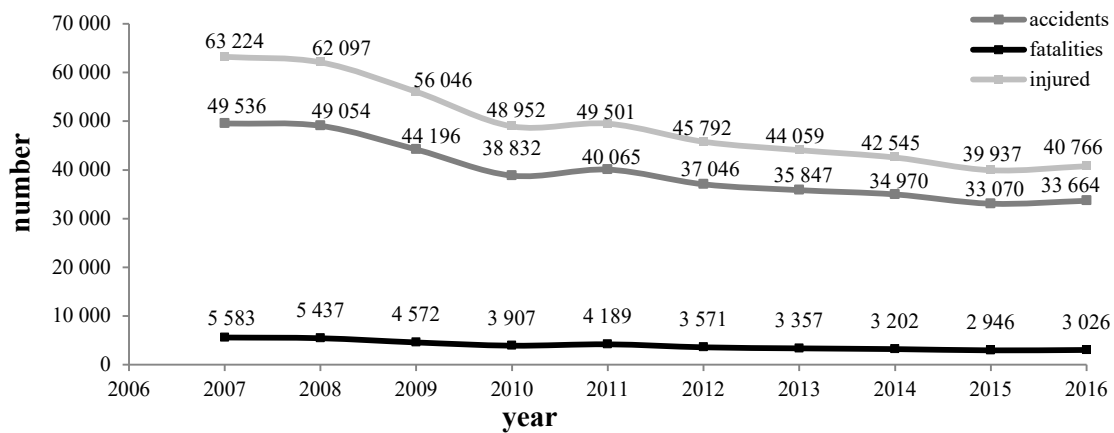


Fig. 1. Number of road accidents in Poland between 2007 and 2016.

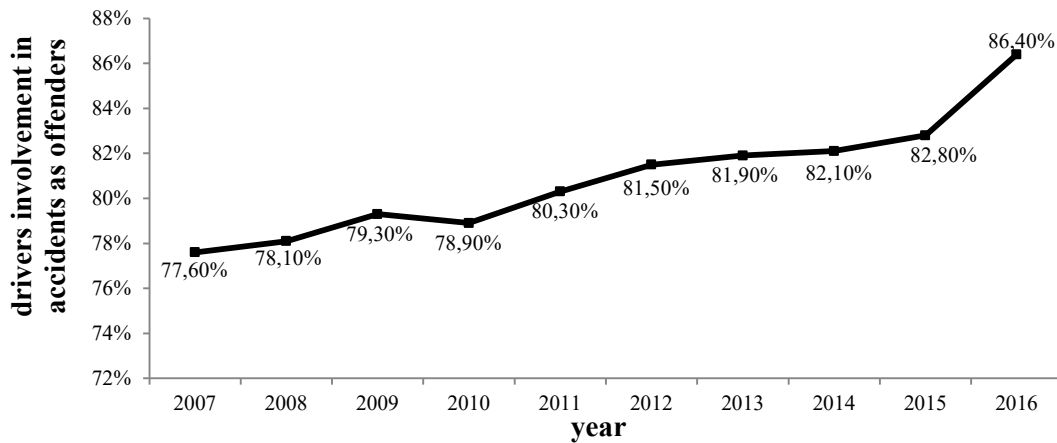


Fig. 2. Number of road accidents caused by drivers in Poland between 2007 and 2016.

In [21], the authors report their findings from the analysis of drivers' perception of Polish road infrastructure, in terms of road pavements, markings, parking lots, toilets, filling stations and road networks, conducted for the last 15 years, as shown in Fig. 6.

Their conclusions indicate that drivers take notice of the Polish road infrastructure changes and, it is important to highlight, perceive them as changes for the better, regardless of whether they are asked about pavements, markings, parking spaces, toilet or road network. Over these 15 years, drivers have observed the largest developments in the road network, with the smallest improvements in road markings.

On average, respondents evaluated the existing condition of the infrastructure, including road marking, network, parking spaces, and filling stations, as good.

Drivers may overrate the infrastructure condition which, along with overrating their own

competences [20], constitutes another contributing factor to a greater risk of being involved in an accident.



Fig. 3. Expressway and motorway network in Poland a) in 2000, b) in 2016 [13].

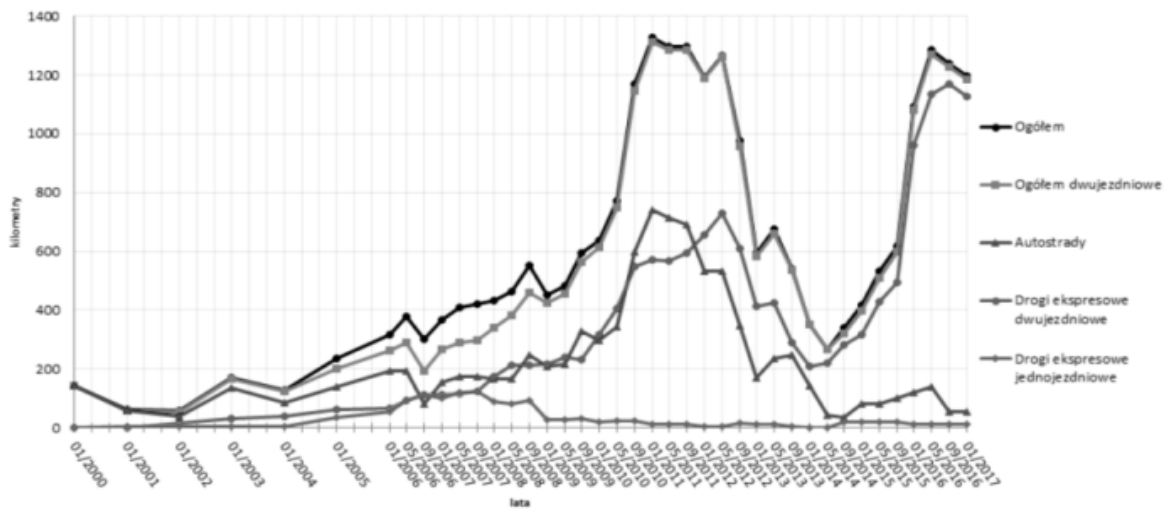


Fig. 4. Kilometres of motorways and expressways in Poland between 2000-2017 [14].

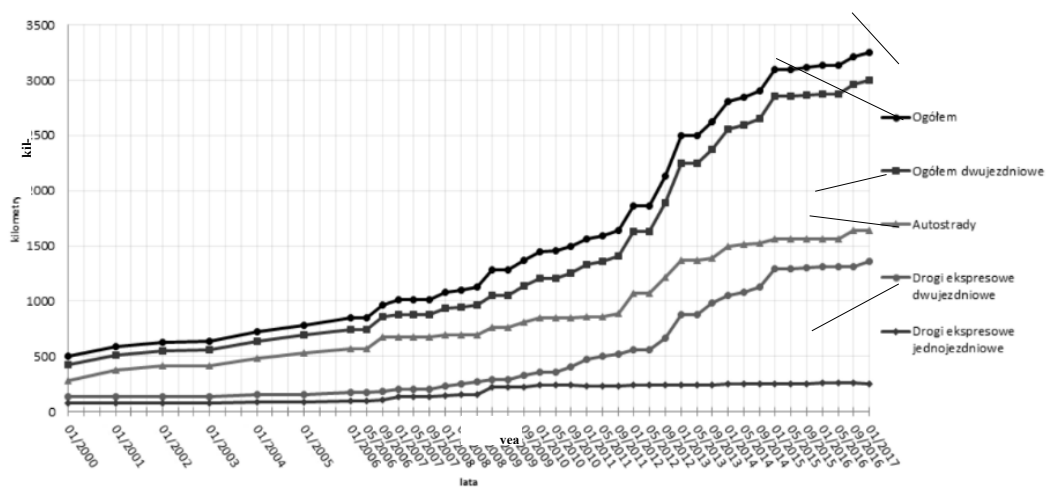


Fig. 5. Kilometres of motorways and expressways operating in Poland between 2000 and 2017 [14].

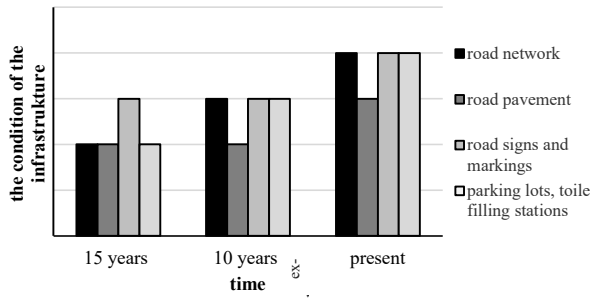


Fig. 6. Average perception of road infrastructure in Poland by respondents [21].

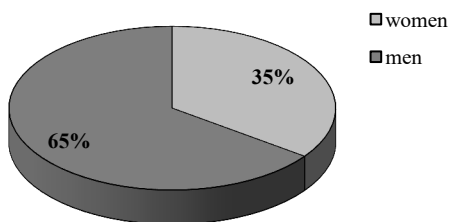
2. OWN STUDY

2.1. DESCRIPTION OF THE RESEARCH OBJECT

Analysis in this study was based on the results of a quantitative survey questionnaire (hard copy) conducted among 103 drivers in November 2015.

Respondents answered, anonymously and voluntarily, questions about the condition of transport infrastructure in Poland and about their own involvement in road accidents. Selection of the participants was random, with the only condition of being a holder of a driving licence.

a)



b)

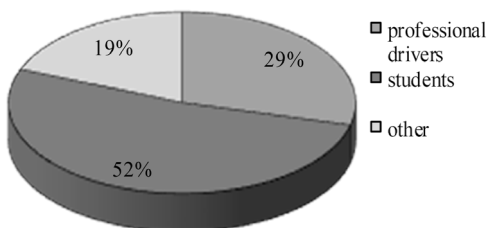


Fig. 7. Number of respondents split by  
a) genre,  
b) professional status.

The basic tool of the survey, the questionnaire, consisted of two parts: respondent demographics and a set of questions.

The first part asked about the sex, age, professional status of the respondent, his or her place of residence, period of holding driving licence and the frequency of driving.

The main part of the questionnaire comprised 16 questions relating to, among others, respondents' perception of Polish infrastructure and involvement in accidents. The questions were of closed type, and included 14 disjunctive questions and 2 conjunctive questions.

In order to analyse the relationship between drivers' perception of Polish road infrastructure and their accidents, they were divided into two groups: the drivers who were responsible for traffic accidents and collisions, and those who were never involved in any road accidents and collisions. The respondents were expected to refer to the condition of road surfaces and road markings by selecting one of the following options: terrible, poor, average, good and excellent. The drivers evaluated the present condition of infrastructure and that of 10 and 15 years ago.

By assigning each response rank as 1 - terrible, 2 - poor, 3 - average, 4 - good - 5 - excellent, the arithmetic mean of the answers given was determined and then, comparing its values for successive periods, absolute increase was established. By counting these dynamic measures for the base period, the "present" period was assumed.

If the magnitude of the studied phenomenon, determined in this case by the arithmetic mean, in the base period is denoted by  $x_0$  and its size over the period under analysis by  $x_1$ , then the absolute increase assumes positive values when the level being studied is lower than that in the base period ( $x_1 < x_0$ ).

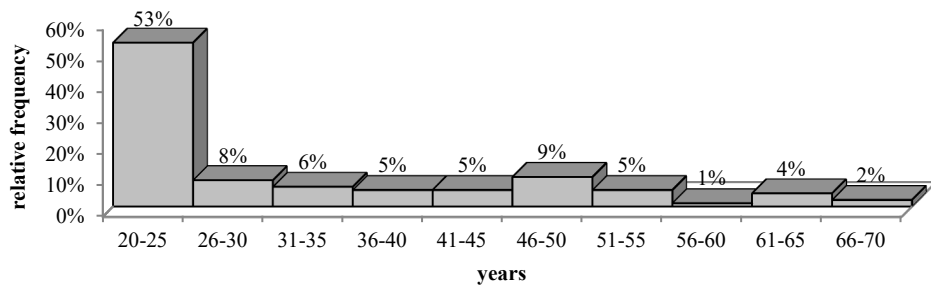


Fig. 8. Age of respondents.

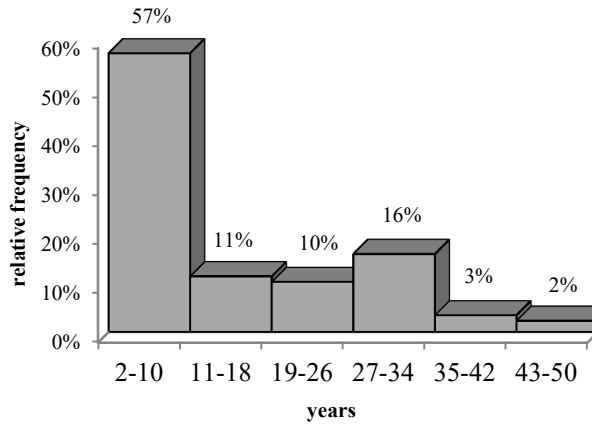


Fig. 9. Period of holding a driving licence by respondents.



Fig. 10. Driving frequency.

Figures 11÷18 show the values of absolute increases for different elements of road transport infrastructure.

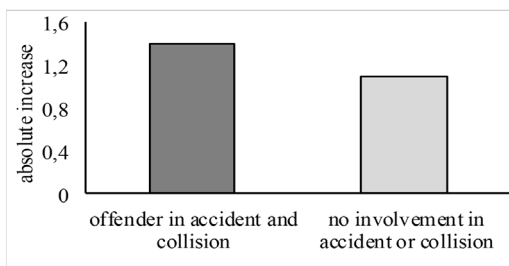


Fig. 11. Perception of the current road network condition compared with the condition 10 years ago.

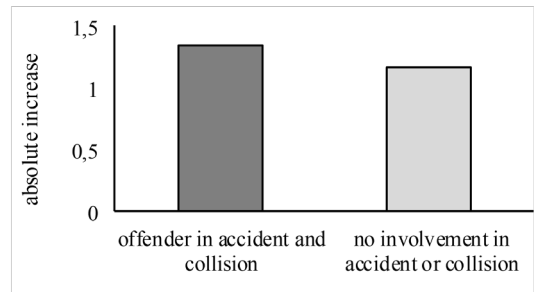


Fig. 12. Perception of the current road pavement condition compared with the condition 10 years ago.

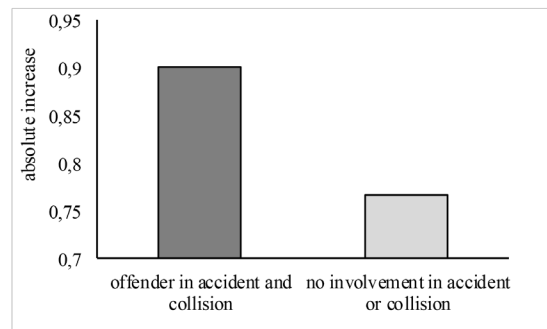


Fig. 13. Perception of the current road marking compared to road marking 10 years ago.



Fig. 14. Perception of the current infrastructure (parking lots, toilets, filling stations) compared to the infrastructure 10 years ago.

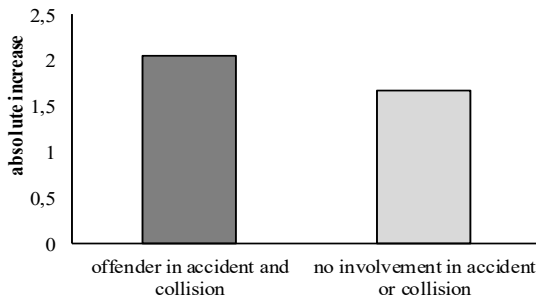


Fig. 15. Perception of the current road network condition compared with the condition 15 years ago.

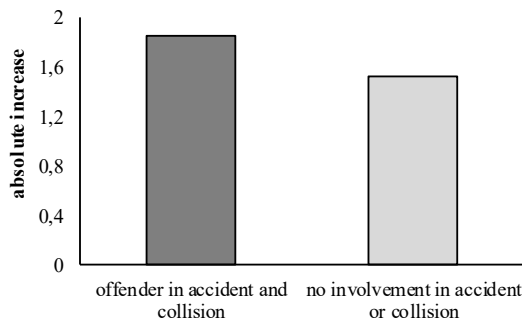


Fig. 16. Perception of the current road pavement condition compared with the condition 15 years ago.

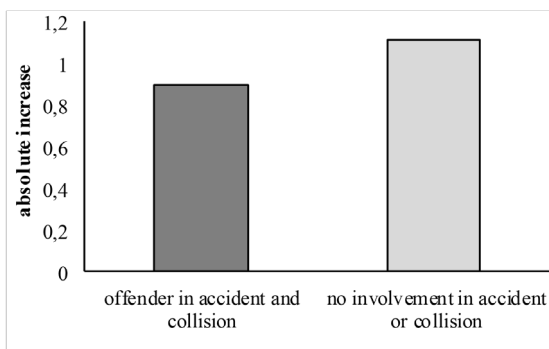


Fig. 17. Perception of the current road marking compared to road marking 15 years ago.

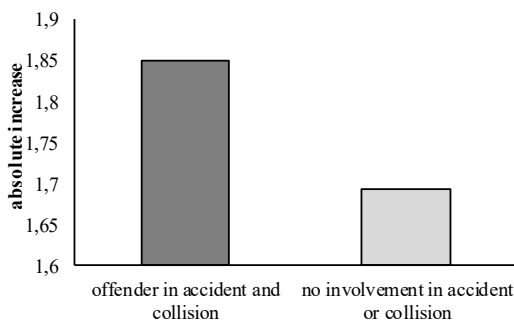


Fig. 18. Perception of the current infrastructure (parking lots, toilets, filling stations) compared to the infrastructure 15 years ago.

The largest number of positive changes in the road transport infrastructure over the last fifteen years is reported by drivers who have been offenders in a collision or an accident.

They perceive road network development as most advantageous, as evidenced by the highest value of absolute increase for the period "10 years ago" ( $x_1 - x_0 = 1.4$ ) and "15 years ago" ( $x_1 - x_0 = 2.05$ ). The responses given by the drivers who have not been involved in an accident or traffic collision indicate absolute increase values of 1.08 and 1.67 respectively. This proves that their assessment of changes in road network development in Poland over the last 15 years is not as good as that of drivers once responsible for a traffic accident or collision. Similar opinions are expressed with respect to changes to other infrastructure elements, such as road surface condition, parking lots, toilets, petrol stations. And again, while comparing the present condition to the situation 10 and 15 years ago, drivers in the first group rank them higher. There is only one exception. The drivers who have not been involved in any accidents express better opinions on road markings now and 15 years ago.

As for the current condition of infrastructure in terms of road network, only drivers in the first group think that it is excellent (Figure 19). None of them finds it terrible or poor. The drivers of the second group are more critical in their assessment and rate the road network at best as good. Some of these drivers describe the current network of roads as poor.

As many as 80% first group drivers think road pavement condition is good, whereas only 38% of the second group drivers say so. Another 38% believe it is average, 18% - poor and 7% - terrible. This situation is illustrated in Fig. 20. While evaluating the current road markings and the infrastructure in terms of car parks, toilets, filling stations, only the drivers who have never caused a collision or road accident, believe that it is excellent. Some drivers in this group marked "poor" and "terrible" (Fig. 21, Fig. 22). None of the accident or collision offenders think it is "terrible".

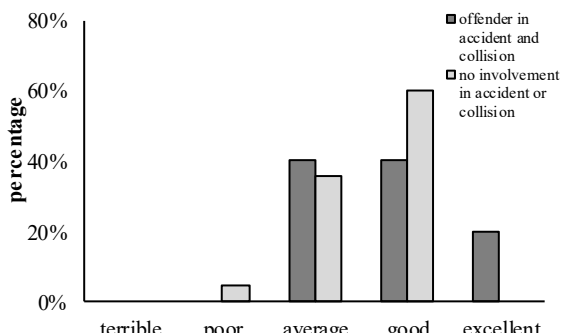


Fig. 19. Assessment of current road network in Poland.

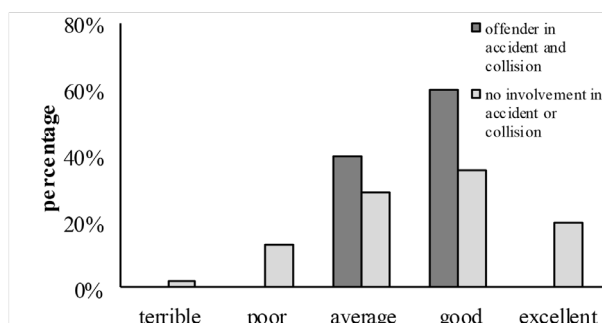


Fig. 20. Assessment of current road pavement condition in Poland.

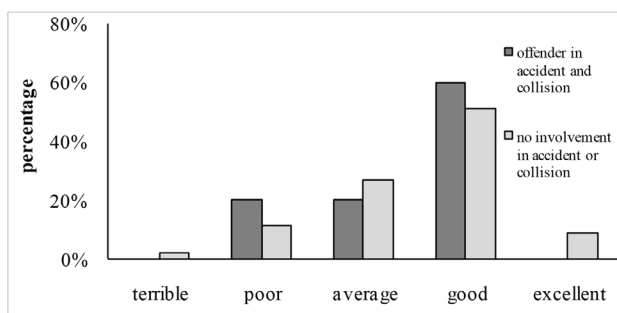


Fig. 21. Assessment of current road pavement marking in Poland.

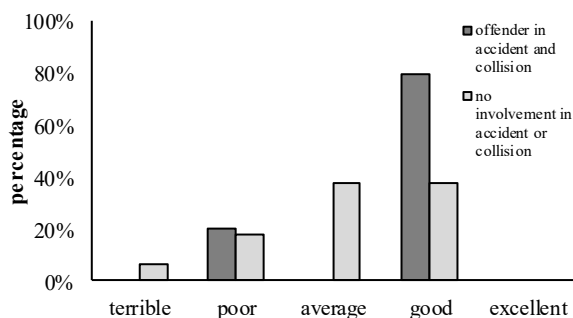


Fig. 22. Assessment of current infrastructure (car parks, toilets, filling stations) in Poland.

### 3. CONCLUSIONS

Analysis of the data collected indicates that drivers in both groups observe the development of road transport infrastructure in Poland and perceive it as a change for the better. However, the changes are ranked higher by the drivers who have caused an accident or a collision at least once, as shown in the absolute increase values.

The same drivers rate the current condition of infrastructure, i.e., the road network or road pavements, higher than those who has never been involved in an accident. None of the respondents in the first group think the infrastructure is “terrible”.

To confirm these findings, the author of this paper is planning to conduct a similar study but with a larger sample size and over the whole territory of Poland.

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