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## **NEED TO USE ADVANCE NOTICE FOR URBAN PUBLIC TRANSPORT DRIVERS**

**Summary.** The article presents the results of a pilot survey conducted among public transport drivers, including of buses and trolleybuses, in three cities in Poland. The research was aimed at checking the existence of the need for advance notice systems concerning traffic light signal changes. This issue was examined using information on these drivers' vehicles from countdown timers and traffic lights other than those for the lane in which the vehicles were moving. The respondents also indicated their proposals for advance notice systems for traffic light signal changes.

**Keywords:** advance notice; countdown timer; flashing green traffic light; urban public transport.

### **1. INTRODUCTION**

The safety of traffic participants at an intersection depends, among other things, on the correct organization of traffic and on compliance with traffic regulations by drivers. However, is the information provided by signs and traffic lights sufficient? The drivers of urban public transport vehicles are struggling with the problem concerning the higher inertia of buses,

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trolleybuses and trams compared to those driving cars or vans in the city. In order to send advance notice to drivers of vehicles approaching intersections, countdown timers and flashing green traffic lights are used. The literature presents many studies on the impact of countdown timers [4,6,7,8,10] on the safety and capacity of intersections, as well as flashing green traffic lights [2,3]. Researchers also suggest other solutions, such as poles, set up at a certain distance, sending advance notice that helps the driver to make the right decision in the dilemma zone [1]. Published research results indicate that the use of advance notice before traffic light signal changes significantly increases stops in the dilemma zone and gentler braking compared to the conditions prevailing at the intersections where such advance notice does not exist. Of note are publications prepared on the basis of research carried out in European countries such as Greece [5], Slovenia [6] and Poland [7,8,9]. Studies carried out in Slovenia have also involved a survey conducted among drivers of vehicles [6].

The research described in the literature has been carried out mainly on the basis of observations of driving behaviours using the technique of video recording. No publication was found that examined the opinions of drivers of urban public transport on the subject of advance notice systems for traffic light signal changes for vehicle drivers.

## 2. STUDYING URBAN PUBLIC TRANSPORT DRIVERS' OPINIONS

### 2.1. Methodology

The current study consisted of conducting an anonymous survey among urban public transport drivers. The questionnaire is presented in Table 1. The research was carried out in Opole among bus drivers with the municipal transport company in Rybnik, bus drivers from the Public Transport Institution, drivers with the municipal transport company running trolleybuses in Lublin. The questionnaire was presented in paper form.

Table 1

The questionnaire used to conduct the study	
1. Do you think that tricolour traffic lights in their present form is sufficient?	YES NO
2. Is the notice given by traffic lights for trams/buses sufficient for you?	YES NO NOT APPLICABLE
3. Is the notice provided by traffic lights for the direction in which you intend to move sufficient (I am not suggesting signals from other traffic lights)?	YES NO
4. Do you use information from other traffic lights to prepare the vehicle for start or stop procedures except the traffic lights for your moving direction?	YES NO
5. Do you use information from pedestrian traffic lights when driving an urban public transport vehicle?	YES NO
6. Do you take account of the notice from countdown timers?	YES NO

7. Do you think that the flashing end of the green traffic light signal before it turns yellow, as is the case, for example, in Austria, gives valuable information to drivers?  
YES NO
8. Do you think that advance notice before an upcoming change from a red traffic light signal to red-yellow is necessary?  
YES NO
9. Do you consider that advance notice before the approaching end of the green traffic light signal is valuable?  
YES NO
10. How can, in your opinion, advance notice before the end of a traffic light signal be sent?  
.....
11. I am  
FEMALE MALE
12. I have worked as a driver of urban public transport for ..... years.
13. I drive a  
BUS TRAM
14. Comments  
.....

## 2.2. Results of survey carried out in Opole

Completed questionnaires were received from 100 bus drivers, two of which were rejected due to ambiguous nature of the respondents' answers. In some cases, respondents did not answer all the questions, so the sum of responses may not be equal to the number of questionnaires included. Despite the vast majority of respondents answered Questions 1 to 5 with 'YES', it turned out that, in most cases, respondents use information from countdown timers. This is evidenced by the almost 100% response rate for Question 6. This is further confirmed by answers to Questions 7-9 with a response rate of over 98%.

Table 2

Answer	Answers to Questions 1-9 in Opole								
	Question								
	1	2	3	4	5	6	7	8	9
Yes	83	21	66	86	86	96	91	83	96
No	14	7	25	12	12	2	6	13	2
Not applicable	-	60	-	-	-	-	-	-	-
Yes	85%	21%	67%	88%	88%	98%	93%	85%	98%
No	14%	7%	26%	12%	12%	2%	6%	13%	2%
Not applicable	-	61%	-	-	-	-	-	-	-

Respondents, on being asked to propose an advance notice system for traffic light signal changes (Table 3), indicated that a flashing end of the green traffic light signal in 11% of cases, countdown timers in 38% of cases and both solutions in 12% of cases would be helpful.

In addition, three respondents indicated the need for a greater number of green conditional 'turn right' arrows in the city of Opole.

Table 3

Answers to Question 10 in Opole		
Answer	Amount	Percentage
Flashing end of green traffic light signal	11	11%
Countdown timers	37	38%
Flashing end of green traffic light signal and countdown timers	13	13%

Among the examined persons, six were women and 90 were men. Two people did not state their gender (Table 4).

Table 4

Gender of respondents in Opole		
Gender	Amount	Percentage
Female	6	6%
Male	90	92%

The majority of the respondents were people who have worked as drivers of urban public transport vehicles for under five years. The second group comprised drivers who have worked for between five and 10 years and between 15 and 25 years (Table 5).

Table 5

Experience of respondents in Opole						
Experience [years]						
<5	<10	<15	<20	<25	<30	>30
37	14	6	13	11	4	8
38%	14%	6%	13%	11%	4%	8%

It is worth noting that countdown timers are used in Opole at intersections through which public transport buses pass. The conducted study indicated that there is a need for advance notice systems for public transport drivers. The respondents indicated two solutions to this problem. It is believed that this is due to the fact only these two solutions were presented in the questionnaire.

### 2.3. Results of survey carried out in Rybnik

Concerning the survey conducted in Rybnik, 62 completed questionnaires were submitted out of 80 urban public transport vehicle drivers. Despite the affirmative answers to Question 6 regarding the use of countdown timers, the bus drivers are not able to use this information due to the lack of these devices at intersections in the city (Table 6). Answers to the questions, however, unequivocally indicate that the bus drivers are looking for additional information (advance notice) in order to make decisions when they reach an intersection with traffic lights.

Table 6

Answers to Questions 1-9 in Rybnik									
Answer	Question								
	1	2	3	4	5	6	7	8	9
Yes	34	17	40	45	45	32	54	57	58
No	26	2	19	16	16	27	7	4	3
Not applicable	-	39	-	-	-	-	-	-	-
Yes	55%	27%	65%	73%	73%	52%	87%	92%	94%
No	42%	3%	31%	26%	26%	44%	11%	6%	5%
Not applicable	-	63%	-	-	-	-	-	-	-

Concerning the proposal for an advance notice system, similar to the response from Opole drivers, they indicated that countdown timers and the flashing end of green traffic light signals would be useful (Table 7). The proposal was accepted by 17 people, or 28% of the respondents.

Table 7

Answers to Question 10 in Rybnik		
Answer	Amount	Percentage
Flashing end of green traffic light signal	5	8%
Countdown timers	9	15%
Flashing end of green traffic light signal and countdown timers	3	5%

The majority of the surveyed drivers were women (56%). One person did not state their gender (Table 8).

Table 8

Gender of respondents in Rybnik		
Gender	Amount	Percentage
Female	7	11%
Male	53	85%

The distribution of seniority is noteworthy in the case of those surveyed in Rybnik. In four of the seven ranges, there are 10 or 11 respondents, or 16% or 18% of respondents (Table 9).

Table 9

Experience of respondents in Rybnik						
Experience [years]						
<5	<10	<15	<20	<25	<30	>30
11	11	7	10	7	5	10
18%	18%	11%	16%	11%	8%	16%

#### 2.4. The result of survey carried out in Lublin

Among the drivers of trolleybuses in Lublin, 68 people out of 230 were surveyed. Lublin is the second city among those investigated in which no countdown timers are installed at intersections. The respondents also indicated the need for advance notice before traffic light signal changes (Table 10). The problem referred to in Question 6, in the case of drivers from Rybnik, concerned the lack of countdown timers in the city. The drivers who responded affirmatively pointed to driving in other cities.

Table 10

Answers to Questions 1-9 in Lublin									
Answer	Question								
	1	2	3	4	5	6	7	8	9
Yes	51	8	50	62	64	35	62	62	64
No	14	0	15	3	2	29	4	4	2
Not applicable	-	52	-	-	-	-	-	-	-
Yes	77%	12%	76%	94%	97%	53%	94%	94%	97%
No	21%	0%	23%	5%	3%	44%	6%	6%	3%
Not applicable	-	79%	-	-	-	-	-	-	-

When asked for a proposal for an advance notice system, the drivers from Lublin also indicated countdown timers or the flashing end of traffic light signals (Table 11). 58% of respondents answered this question.

Table 11

Answer to Question 10 in Lublin		
Answer	Amount	Percentage
Flashing end of green traffic light signal	12	18%
Countdown timers	19	29%
Flashing end of green traffic light signal and countdown timers	7	11%

The vast majority of respondents were men (57), who constituted 86% of the respondents, while seven were women; two people did not state their gender (Table 12).

Table 12  
Gender of respondents in Lublin

Gender	Amount	Percentage
Female	7	11%
Male	57	86%

Among the respondents, the largest group (48%) comprised people with a seniority between 10 and 15 years (Table 13). However, drivers with less than 10 years of experience were the second-largest group of respondents at 27%.

Table 13

## Experience of respondents in Lublin

Experience [years]						
<5	<10	<15	<20	<25	<30	>30
8	10	32	3	2	1	0
12%	15%	48%	5%	3%	2%	0%

## 2.5. Summary

In total, 228 questionnaires were used for analysis, of which 160 were surveys filled in by urban public bus drivers and 66 by trolleybus drivers. Answers to Questions 4 and 5 clearly show that these drivers use more information than that provided by traffic light, e.g., they observe pedestrian signals (Table 14). In addition, they indicate the need for advance notice before the end of both the green and the red phase of traffic light signals, as evidenced by answers to Questions 8 and 9. In the cities where traffic lights intended for public transport buses are not used, most of the answers to Question 2 stated “not applicable”. The respondents were not previously informed about the content of the survey. There was also no training given on advance notice systems before traffic light signal changes, which explains the 170 answers to the first question. Moving onto more specific questions, respondents gave a negative answer to Question 1.

Table 14

## Answers to Questions 1-9 in total

Answer	Question								
	1	2	3	4	5	6	7	8	9
Yes	168	46	156	193	195	163	207	202	218
No	54	9	59	31	30	58	17	21	7
Not applicable	-	151	-	-	-	-	-	-	-
Yes	74%	20%	68%	85%	86%	71%	91%	89%	96%
No	24%	4%	26%	14%	13%	25%	7%	9%	3%
Not applicable	-	66%	-	-	-	-	-	-	-

In the conducted research, 51% of the surveyed drivers presented proposals for an advance notice system (Table 15). The accepted proposals were the flashing end of green traffic light signals and countdown timer. It can be concluded that these are well-known systems and give good results according to the respondents.

Table 15

## Answer to Question 10 in total

Answer	Amount	Percentage
Flashing end of green traffic light signal	28	12%
Countdown timers	65	29%
Flashing end of green traffic light signal and countdown timers	23	10%

Among the respondents, 9% were women and 88% were men; six people did not state their gender (Table 16).

Table 16  
Gender of respondents in total

Gender	Amount	Percentage
Female	20	9%
Male	200	88%

To sum up the seniority of the respondents, the largest group comprised drivers with experience of under five years (Table 17). Those with a seniority of under 15 years constituted 51% of respondents.

Table 17  
Experience of respondents in total

Experience [years]						
<5	<10	<15	<20	<25	<30	>30
56	35	26	20	10	18	0
25%	15%	11%	9%	4%	8%	0%

Comparing the percentage of respondents' proposals with the breakdown in seniority intervals, Figure 1 was obtained. In order to obtain a percentage share, the number of proposals, e.g., countdown timers, was divided by the sum of all proposals in a given interval of seniority.

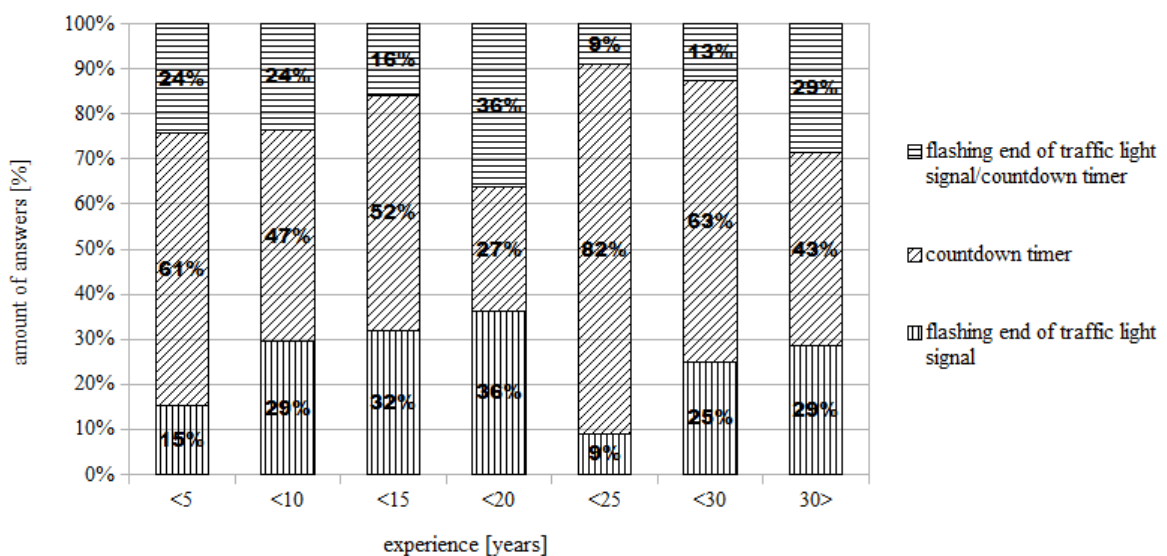


Fig. 1. Percentage of survey proposals concerning advance notice systems before traffic light signal changes according to work seniority intervals



### 3. CONCLUSION

The aim of the conducted research was a pilot check of the opinions of urban public transport vehicles drivers on advance notice before traffic light signal change. The research results clearly indicate the need for this information, especially for drivers of urban public transport vehicles, which are characterized by lower acceleration and deceleration compared to cars. The drivers of this type of vehicles, before deciding to stop the vehicle or to prepare it to move from place, observe the traffic lights at an intersection if there are no countdown timers installed. While conducting the survey were no other advance notice system presented the respondents such as the use of the at a certain distance from intersection set poles which send notice to drivers before traffic light signal change. It is suggested to conduct a broader study on a larger sample of drivers, including motorman of trams. In the comments of the respondents, they emphasized that systems of advance notice before traffic light signal change have a big impact on the safety of transported passengers.

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