



TRAFFIC CONTROL ELEMENTS INFLUENCE ON ACCIDENTS, MOBILITY AND THE ENVIRONMENT

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Abstract. This paper presents the main traffic control elements, which were classified into groups. One group presents traffic control elements, which have different effects on accidents: reduce the number of accidents, do not have statistically significant effect on the number of accidents and those which appear to lead to an increased number of accidents. Next group presents traffic control elements, which have effect on mobility and the environment. Some of them can improve mobility on road, others reduce mobility on road. Presented elements, which are useful for the environment, are considered.

Keywords. Traffic control elements, accidents, mobility, the environment, reduce accidents, improving.

1. Introduction

Achievement of safety on the roads is one of the important problems in the road transportation. In Lithuania the situation in road safety has become critical, the rate of road accidents is the worst among the EU countries. Not only inhabitants suffer from road accidents but they also have influence on the mobility of traffic flows and on the environment pollution.

A properly organized control of road traffic has a major influence on the road accidentness, the movement of traffic flows and on the environment pollution.

2. Main traffic control elements

In this chart traffic control elements are presented which have influence on accidents, mobility and the environment in cities and villages. Each element can be introduced in places, where traffic safety and the environment are in a critical situation.

Traffic control elements and a short description:

1. Area-wide traffic calming. By means of traffic control measures traffic heaviness is removed.
2. Pedestrian streets. Stream of people are separated from stream of vehicles.
3. Urban play streets. Urban play areas permit mixed traffic, but traffic speed is reduced to walking speed.
4. Access control. The number of access roads is determined according to the choice of road standard class and area built-up extent.
5. Priority control and yield signs at intersections. Requiring minor road traffic to yield, the interaction between road users is simplified and the capacity of main roads is increased.
6. Stop signs at intersections. Reducing accidents by giving road users more time to observe traffic.
7. Traffic signal control at intersections. Traffic signal control at intersections separates different streams of traffic from each other and can improve the flow of traffic at intersections.
8. Signalized pedestrian crossing. Marking a pedestrian crossing does not always provide good enough safety for pedestrians; in order to improve their crossing, the crossing point can be signalized.
9. Speed limit. The speed limit states the highest permitted driving speed on a road.
10. Speed-reducing devices. Speed-reducing devices are intended to force vehicles to keep to low speeds, so that the risk of accidents is reduced and feelings of safety increase.
11. Road marking. Road markings set traffic order, signalize or give information to road users.
12. Traffic control for pedestrians and cyclists. By means of traffic control, set measures control streams of pedestrians and cyclists and improve their safety.
13. Stopping and parking control. Stopping and parking control improves residential environment and traffic flows.

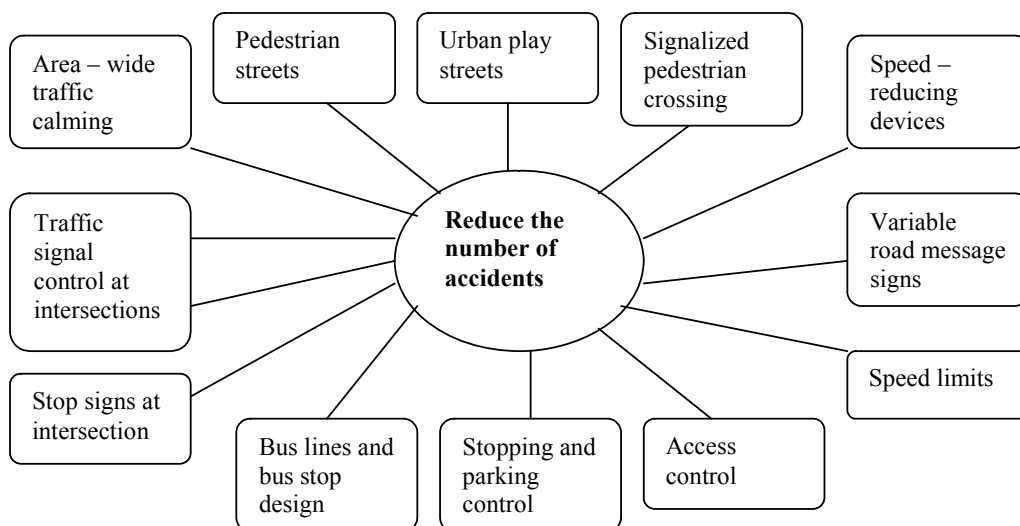


Fig. 1. Elements which reduce the number of accidents

- 14. One-way streets. The number of conflict points can be reduced, traffic stream can be regularized.
- 15. Reversible traffic lanes. Reversible traffic lanes are intended to improve the flow of traffic on main roads with an uneven direction of oncoming traffic.
- 16. Bus lines and bus stop design. Bus lines and bus stops are intended to separate buses and trams from other traffic and thus reduce the number of accidents, to increase mobility for public transport and thus shorten journey time.
- 17. Variable road message signs. Variable road signs are used for regularly recurring factors.

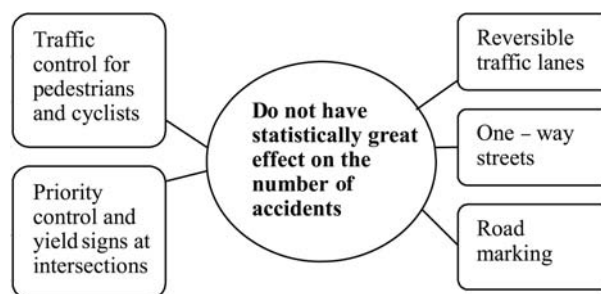


Fig. 2. Elements which do not have statistically great effects

3. Main elements with effect on accidents

Traffic control elements have varying effects on the number of accidents. Elements which reduce the number of accidents, which do not have statistically significant effect on the number of accidents and elements which appear to lead to an increased number of accidents are shown in Figs. 1, 2 and 3.

Area-wide traffic calming by Faure (1992) shows that most of the reduction in the number of accidents in residential streets is due to reduced traffic. The reduction in the number of accidents on main streets is largely due to

a reduced accident rate. Pedestrian streets are associated with a large reduction in the number of accidents in the pedestrian streets themselves. This decrease is primarily due to a significant reduction in car traffic and speed limit in the street. Also, due to reduction of speed limit and traffic streams, situation in urban play streets is better.

Main road, with no private access roads, with access control leads to reduction of accidents, see research by Arund (2005). The number of access roads in the main road must be minimal. Stop signs at junctions are intended to reduce accidents by giving road users more time to observe traffic before entering the junction. Traffic signal controls at intersections improve the traffic safety. At

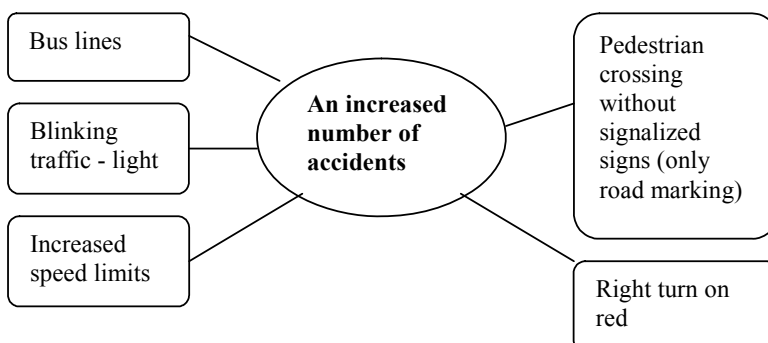


Fig. 3. Elements which appear to lead to an increased number of accidents

non-controlled intersections accidents often happen between drivers crashing into each other, between drivers, pedestrians and bicyclists.

Signalized pedestrian crossings reduce the number of injury accidents by around 5 to 10 %, this presented by Faure (1992). However, signalized pedestrian crossings which come as a surprise to drivers, can lead to abrupt breaking and more rear-end collisions. Good signposting can prevent this.

Speed limit results by Baum (1990): raising existing speed limits, reducing of existing speed limits and reducing speed limits: transition from unrestricted speed to speed limits. Speed limits are for reducing accidents and their heavy outcomes. Speed-reducing devices include: humps, raised pedestrian crossings and intersections, rumble strips, narrow road width, bollards to prevent cars, mini roundabouts, etc. All devices using a combination of different measures zone appear to reduce the number of injury accidents by around 25 %. Introducing parking restrictions on streets appears to reduce the number of accidents by 20–25 %.

Yield signs at intersections do not appear to have any statistically significant effect on the number of accidents. The explanation may be that speed increases. Yielding behaviour, on the other hand, becomes more consistent as evidenced by the fact that more people observe the yield rule than the right hand priority rule.

Traffic control for pedestrians and cyclists includes measures by Faure (1992): marking pedestrian crossings, traffic signal control at crossings, raised crossings, refuges (traffic islands), pedestrians guard rails, crossing patrols, pavement widening at intersections, marking cycle lanes on the carriageway. These measures have no statistically raised effects on the number of accidents.

It may seem that traffic control elements primarily intended to increase mobility or improve traffic flow (increased speed limits, right turn on red, etc.) do not necessarily reduce the number of accidents. On the other hand, by World report on road ... (2005), traffic control elements which reduce speed or otherwise simplify the road users tasks (lower speed limits, traffic signs, etc.) often appear to lead to fewer accidents.

4. Main elements with effect on mobility

The choice of traffic control measures is always a compromise between mobility and traffic safety. Other consideration, such as accessibility, environmental conditions and costs also influence choices.

Priority control of roads (for road users on priority roads, which normally have the heaviest traffic) is improving mobility in the streets. At intersections with heavy traffic, traffic signal control will reduce waiting time for all traffic movements taken together. Coordinating traffic signals, by Arund (2005), can reduce waiting time and considerably increase the average speed in city streets with traffic flow problems.

In cities on-street parking is common. This may prevent access to service vehicles (public transport, emergency vehicle), maintenance and snow clearance. Bans on on-street parking can increase access to such means of transport. One-way streets can lead to an increase in speed, so the throughput of street can increase. Reversible traffic lanes improve the flow of traffic in the direction where capacity increases, do not lead to an increase in the total amount of traffic and shorten the total journey time for both directions (Fig. 4).

Travel time on different routes within the traffic calming areas increases. This is due to the fact that one-way streets increase the length of some routes and this reduces speed limits and other speed reducing devices lead to lower speeds along a given route. Yield signs at intersections lead to increased speed on the main road and reduced speed on the approaches subject to the yield rule.

Signalized pedestrian crossing makes lower mobility. An ordinary, marked pedestrian crossing gives the shortest waiting time for pedestrians, at all levels of vehicle traffic. This result is probably based on the assumption that drivers observe the duty to give way to pedestrians at crossings. At crossings with refuges, the waiting time is longer than at ordinary crossings. This may be due to the fact that a number of pedestrians choose to cross the road in two stages and wait at the refuge for a gap in the traffic. All forms of signalized pedestrian crossings result

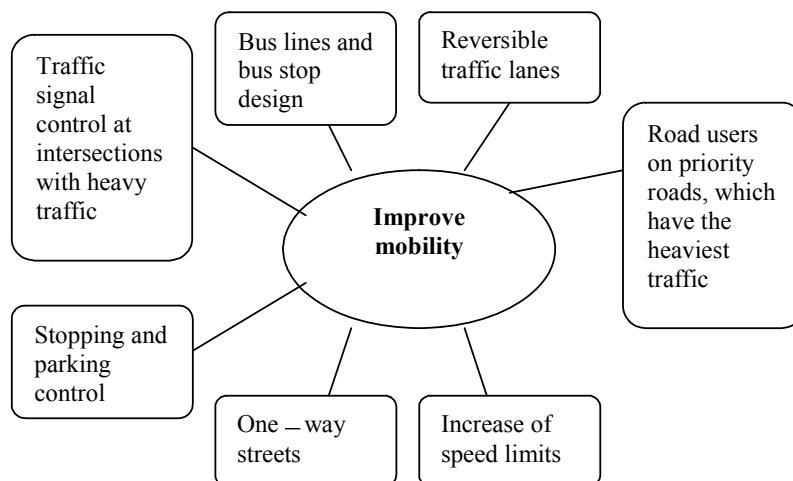


Fig. 4. Elements which improve mobility on road

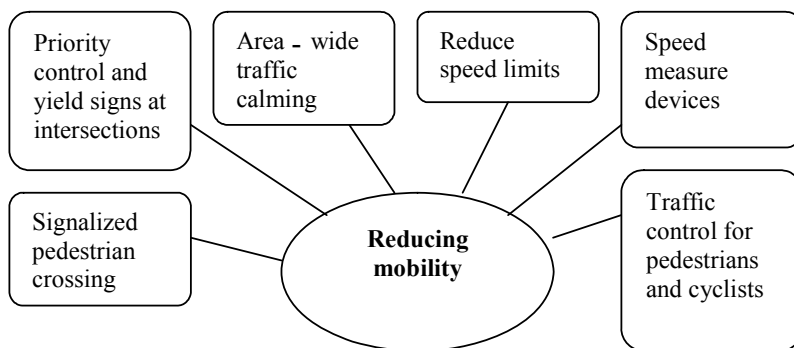


Fig. 5. Elements which reduce mobility on road

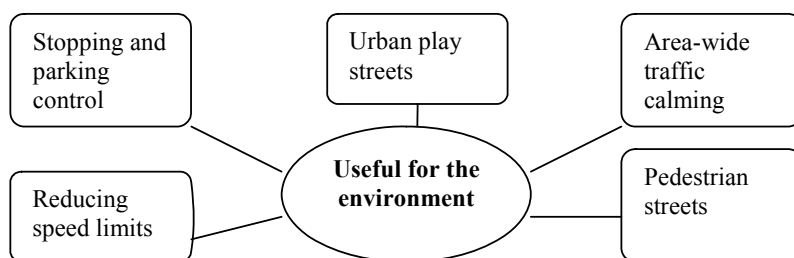


Fig. 6. Elements which are useful for the environment

in longer waiting time for pedestrians because the light must change before people can cross.

All speed-reducing devices reduce mobility with the result that speed is reduced, so travelling time and number of vehicles are raised by Baum (1990). The speed-reducing measures also may deter traffic. More equal distribution of speed between vehicles in a traffic stream can theoretically increase the capacity of the road. This can give better mobility in case where traffic volume is closed to the capacity of the road.

5. Main elements with effect on the environment

The effect of traffic control measures on the environment has been studied to a lesser extent than the effect on traffic safety and mobility. However, it is necessary to pay regard to the environmental needs.

All elements shown in Fig. 5 can reduce the air pollution and noise level in residential areas, see investigation by Faure (1992).

Pedestrian streets, area-wide traffic calming reduce the local air pollution problems and noise level in urban areas. Urban play streets will lead to reduction in speed and a reduction in the proportion of heavy traffic, so it can lead to less noise level. People often feel it is easier and more pleasant to be a pedestrian or a cyclist in these streets.

The effect of speed limit on the environment is influenced by how fuel consumption, exhaust emissions and noise vary with speed. Reducing speed limits has nearly always led to lower average speeds, and also to lower environment pollution (Fig. 6).

A good supply of parking space will lead to increased car usage within an area. This may lead to increased noise and pollution. It is also possible that traffic

looking for parking places will increase when parking is controlled. This can be countered by a system showing where parking is available.

6. Conclusions

1. In this article the main traffic control elements are presented which have the major influence on traffic safety.
2. By traffic control elements influence on the number of accidents, on mobility and on the environment they are grouped into three parts.
3. If it is clear which traffic control elements reduce or do not have effects on the number of accidents, the traffic safety can be improved by introducing or eliminating them in the roads infrastructure.
4. Traffic control elements which improve or reduce the number of accidents on roads or streets commonly reduce mobility. Compromise between safety and mobility is possible, but it is not perfect.
5. Traffic control elements influence on the environment is based on reduction of pollution by noise and exhaust gases.

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