ANALYSIS OF ROAD ACCIDENTS ON PEDESTRIAN CROSINGS CAUSED BY SPEEDING

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INTRODUCTION

Driving speed is a crucial parameter of road safety. Consequences of accidents significantly aggravate with increasing speed.

Within crashes of vehicles with pedestrians the vehicle speed is a very important factor. The accidents with high speed are always catastrophic for pedestrians. The sort of injuries or fatalities of pedestrians depends on the vehicle speed (and a shape of the vehicle front). Accident statistics show that 50 km/h is the limiting speed when a pedestrian can still survive crashing with a vehicle. If a vehicle drives in 30 km/h speed while crashing with a pedestrian, there is a high probability that the pedestrian will survive the crash or will suffer only a light injury.

STATISTICS OF ACCIDENTS WITH PEDESTRIANS

There was an increase by 63% in accidents on pedestrian crossings in 2001, when the new traffic code gave more priorities to pedestrians on pedestrian crossings, comparing to 1999 in the Czech Republic. 57 pedestrians were killed and 387 seriously injured on pedestrian crossings in 2001.

Figure 1

Fatality accidents of pedestrians within 24 hours

All killed pedestrians

Fatal injuries on pedestrian crossings

From that on pedestrian crossing

All killed personal

1999 2000 2001
In 2001 there was also a decrease in 85percentile speed in urban areas, but it is necessary to mention that difference between 85percentile-speed and maximal speed is still increasing.

The disproportion of traffic flow results very often in conflict situations – isolated speeding vehicles endanger all other road users.

**Figure 2**

![Average speeds of personal cars on selected two - lines urban roads](image)

**Figure 3**

![Average speeds of personal cars on selected four - lines urban roads](image)
ANALYSIS OF ROAD ACCIDENTS ON PEDESTRIAN CROSSINGS IN 2001

The analysis of road accidents with pedestrians on pedestrian crossings in the Czech Republic in 2001 was focused on two main parts. The first part was summarising and determining the most problematic districts and possibly deriving dependencies between the frequency of accidents and the size of place, traffic density, eventually on other factors. The second part was analysing in details accidents at selected problematic localities in towns or districts with the aim to find the most serious causes of increasing number of accidents with pedestrians on pedestrian crossings. To give an overview the following text shows the sequence of the most problematic districts in 2001.

The most problematic districts in 2001

*Figure 4: The sequence of districts upon consequences of accidents with pedestrians on pedestrian crossings in 2001 in dependence on numbers of inhabitants per fatality or serious injury.*

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Districts</th>
<th>Kill</th>
<th>Serious injury</th>
<th>Number inhabitant</th>
<th>Number inhabitant per fatal or serious injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Praha 1 - 10</td>
<td>15</td>
<td>110</td>
<td>1 160 118</td>
<td>9 280</td>
</tr>
<tr>
<td>2</td>
<td>Trutnov</td>
<td>3</td>
<td>7</td>
<td>120 486</td>
<td>12 049</td>
</tr>
<tr>
<td>3</td>
<td>Kladno</td>
<td>1</td>
<td>11</td>
<td>149 988</td>
<td>12 499</td>
</tr>
<tr>
<td>4</td>
<td>Prachatice</td>
<td>1</td>
<td>3</td>
<td>51 380</td>
<td>12 845</td>
</tr>
<tr>
<td>5</td>
<td>Ostrava</td>
<td>4</td>
<td>19</td>
<td>315 442</td>
<td>13 715</td>
</tr>
<tr>
<td>6</td>
<td>Liberec</td>
<td>1</td>
<td>10</td>
<td>158 351</td>
<td>14 394</td>
</tr>
<tr>
<td>7</td>
<td>Karviná</td>
<td>1</td>
<td>7</td>
<td>141 613</td>
<td>17 702</td>
</tr>
<tr>
<td>8</td>
<td>Brno město</td>
<td>2</td>
<td>19</td>
<td>373 272</td>
<td>17 775</td>
</tr>
<tr>
<td>9</td>
<td>Pardubice</td>
<td>1</td>
<td>8</td>
<td>160 770</td>
<td>17 863</td>
</tr>
<tr>
<td>10</td>
<td>Jihlava</td>
<td>1</td>
<td>5</td>
<td>108 261</td>
<td>18 044</td>
</tr>
<tr>
<td>11</td>
<td>Zlín</td>
<td>1</td>
<td>9</td>
<td>195 020</td>
<td>19 502</td>
</tr>
<tr>
<td>12</td>
<td>České Budějovice</td>
<td>3</td>
<td>6</td>
<td>178 140</td>
<td>19 793</td>
</tr>
<tr>
<td>13</td>
<td>Chomutov</td>
<td>1</td>
<td>5</td>
<td>124 826</td>
<td>20 804</td>
</tr>
<tr>
<td>14</td>
<td>Cheb</td>
<td>1</td>
<td>3</td>
<td>88 770</td>
<td>22 193</td>
</tr>
<tr>
<td>15</td>
<td>Přerov</td>
<td>2</td>
<td>4</td>
<td>133 703</td>
<td>33 426</td>
</tr>
<tr>
<td>16</td>
<td>Opava</td>
<td>3</td>
<td>5</td>
<td>181 168</td>
<td>22 646</td>
</tr>
<tr>
<td>17</td>
<td>Ústí n. Orlicí</td>
<td>1</td>
<td>5</td>
<td>138 892</td>
<td>23 149</td>
</tr>
<tr>
<td>18</td>
<td>Znojmo</td>
<td>2</td>
<td>3</td>
<td>141 023</td>
<td>28 205</td>
</tr>
<tr>
<td>19</td>
<td>Děčín</td>
<td>1</td>
<td>3</td>
<td>133 703</td>
<td>33 426</td>
</tr>
<tr>
<td>20</td>
<td>Olomouc</td>
<td>1</td>
<td>3</td>
<td>224 535</td>
<td>56 134</td>
</tr>
</tbody>
</table>

In spite of the leading position of Prague, the table shows that fatal and serious consequences of accidents with pedestrians are proportional neither with the size of towns, nor traffic density. The fact can be partly caused by a lower quality infrastructure inherited from the past and as well by insufficient work of people responsible for these issues at the municipal level. Nevertheless the high number of accidents and their consequences are often caused by behaviour of road users.
ANALYSIS OF SELECTED TRAFFIC ACCIDENTS ON PEDESTRIAN CROSSINGS IN CZECH URBAN AREAS IN 2001

To be analysed in details 52 records of accidents with pedestrians on pedestrian crossings in 2001 resulting in fatal or serious injuries were selected. 21 of these accidents occurred in Prague (Prague 1 – Prague 10), 12 of the selected accidents happened in Ceske Budejovice, 8 ones in Prostejov, 6 ones in Brno and 5 ones in the Vyskov district.

The most frequent found circumstances of the analysed accidents:

- insufficient lighting (high occurrence of serious accidents within decreased visibility – 34,6% of analysed records)
- pedestrians crossing at the red light (15,4% of analysed records)
- vehicle in one lane stops for giving priority to a pedestrian, vehicle in parallel lane does not respect the crossing pedestrian (13,5 % of analysed records)
- high speed on 4-lane roads with non-separated directions (9,6% of analysed records)
- disrespected of the speed limit
- driver turning at the junction menaces a pedestrian crossing the road which the driver is turning on (5,8 % of analysed records)
- sudden running of pedestrians (especially children) onto the road (3,9 % of analysed records)
- driving of vehicles at the red light (1,9% of analysed records)

However, it is necessary to state that it was sometimes impossible to find out the mentioned circumstances of accidents in the analysed records because of different level of particularities; e.g. it is possible to presume that the real share of accidents caused by speeding would be even higher.

The most frequent types of accidents on pedestrian crossings influenced by speeding are:

- conflicts with pedestrians while driving straight on crossroads
  pedestrian crossing from the left side in front of crossroads (from the view of driver)
  from the right side in front of crossroads
  from the left side behind crossroads
  from the right side behind crossroads
- conflicts with pedestrians on straight sections of roads (both from the left and right side)
COMMON FEATURES OF ACCIDENTS ON PEDESTRIAN CROSSINGS WITH FATALITIES OF PEDESTRIANS IN BRNO AND CESKE BUDEJOVICE

The following towns can serve as an example of the detailed analysis of accidents on pedestrian crossings resulting in fatalities of pedestrians and as an example of searching for their common features.

**Brno**

3 pedestrians were killed on pedestrian crossings in Brno - city in 2001. Brno is at the 7th position among Czech districts regarding consequences of accidents on pedestrian crossings in dependence on number of inhabitants per fatality or serious injury.

**Ceske Budejovice**

In Ceské Budejovice as well, 3 pedestrians were killed on pedestrian crossings in 2001. Ceske Budejovice is at the 12th position within the mentioned statistics.

6 fatal accidents were then analysed in total. The particular accident localities had the following common features:

*Figure 5*

<table>
<thead>
<tr>
<th>Common features</th>
<th>Number of accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Night time</td>
<td>3</td>
</tr>
<tr>
<td>Decreased visibility</td>
<td>6</td>
</tr>
<tr>
<td>Lighting of the road</td>
<td>4</td>
</tr>
<tr>
<td>Road with 4 and more lanes</td>
<td>5</td>
</tr>
<tr>
<td>Lane width of 3,5 m and more</td>
<td>3</td>
</tr>
<tr>
<td>Speeding of vehicles over 50 km / h</td>
<td>4</td>
</tr>
<tr>
<td>Crossing pedestrian from the left side</td>
<td>5</td>
</tr>
</tbody>
</table>

By the findings all the accident spots had a decreased visibility within the accident (even with a functional lighting of the road), road with 4 and more lanes, speeding and in majority of the cases a pedestrian crossed the road from left.

Through the common features it is possible to figure the fact that wide design dimensions of unchannellised roads offer more space for vehicles which gives them the opportunity for speeding. High speed in combination with decreased visibility increase delaying and the ridden distance, as under decreased visibility a driver notices the dangerous situation with a delay and the high speed will reduce the time when he still can react adequately, therefore also a pedestrian crossing the road from left is menaced.
Figure 6: Brno (Plotní – Zeleznicí street)

Figure 7: České Budějovice (Pražská street)
TRAFFIC ENGINEERING MEASURES

To increase the safety of pedestrians on pedestrian crossings, the following traffic engineering measures and their combinations can be implemented:

A) General traffic engineering measures
   - Central islands
   - Lighting of the road: Lighting of pedestrian crossings should have a high intensity, eventually it should be painted with a colour different from the colour of previous and following stretches of the road.
   - Physical separation of the carriageway from other road surfaces (e.g. parking, stop lane)
   - Installation of traffic lights: suitable to be provided also upon demand
   - Special provision for pedestrian crossings

B) Recommended measures for 2-lane roads
   - Planted surfaces at pavements
   - The surface will arise e.g. by pulling the pavement surface through an interrupted parking lane.
   - Traffic refuges at stops
   - Surfaces interrupting a vehicle lane between a public transport stop and a pavement
   - Local narrowing of vehicle lanes
   - Humps (raised areas)

C) Measures for 4-lane roads
   On road stretches with 2 and more lanes it is not recommended to install pedestrian crossings without a special provision which does not apply for pedestrian crossings at junctions.

D) Definition of the particular height of speed limit for a given urban stretch
   While defining the speed limit many circumstances must be considered, like e.g.:
   ♦ traffic volume
   ♦ demand for crossing
   ♦ frequency of pedestrians and cyclists
   ♦ characteristics of surrounding area
   In the Czech Republic, the basic speed limit for defining the highest allowed speed on a given road stretch usually is 50 km/h. According to the mentioned characteristics it is possible to deflect from the basic speed limit downwards, eventually upwards. E.g. on
sensitive stretches (in city centres where an increased flow of pedestrians is concentrated) it can be suitable for a limited length to reduce the speed limit below the basic speed limit, usually 30 km / h. Respecting of the reduced speed limit must be supported by appropriate construction measures. On less sensitive stretches in outskirts with prevailing industrial utilisation it is possible to increase the basic speed limit to 60, eventually to 70 km / h.

A adapting the individual speed limit according to the character of a given locality is better accepted by road users than a unified speed limit.

CONCLUSION

Through implementation of adequate traffic engineering measures it is possible to eliminate the increased number of pedestrian accidents, including the accidents caused by speeding.

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