Low cost solutions to improve safety at level crossings in Hungary

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II. Statistics data (number of level crossings and forms of protection)
III. Regulation
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VI. Interventions on level crossing safety (low cost solutions)
VII. Results of interventions
I. Survey on level crossings

Survey is conducted by Institute for Transport Sciences Non-Profit Ltd. (Hungary)

The project has 5 main chapters as follows:

1. Overview on the amendment of national technical regulation of level crossings,
2. Preparation of literature study of international experiences on level crossings design and regulation,
3. Technical evaluation and preparation of proposals for further development of level crossings,
4. Preparation of new methodologies to define hazard ranking,
5. Preparation of proposals to upgrading legislations and technical standards on level crossings.
II. Statistics data

- **7718 km** of railway network
- Area of the country: **93000 km²**

Two main operators:

- Hungarian State Railways Company
- Győr-Sopron-Ebenfurt Railway Co.  
  *(Raab–Oedenburg–Ebenfurter Eisenbahn AG)*
Number of level crossings

- **5838** level crossings in 2010 (1 level crossing/1.3 km of railway)

- **3196** open level crossings without barriers or flashing signals
- **1476** open level crossings with flashing signals
- **918** level crossings with half-barrier and flashing signals
- **248** level crossings with full-barrier
III. Regulation

Establishment of level crossing is allowed where $V_{\text{train}} \leq 160 \, \text{km/h}$

<table>
<thead>
<tr>
<th>Legislative act</th>
<th>Standards, technical specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decree no. 20/1984. (XII. 21.) – about road traffic</td>
<td>e-ÚT 03.06.11 – technical specification about establishment of level crossings</td>
</tr>
<tr>
<td>regulation and placement of road signs</td>
<td></td>
</tr>
</tbody>
</table>

- Other regulations which affects level crossings indirectly
IV. Safety problems

\[
\frac{\text{Number of injuries}}{\text{Number of accidents with only material damage}} = \text{on road: ~20\%, at level crossing: ~100\%}
\]

- Risk of grounding of long low vehicles.
- Insufficient clear sight triangle
- Remove contradictions between regulations
V. Typical accidents

Causes of level crossings accidents (2000-2009)
(data based on 589 accidents)

- Did not stop at the flash signal or barrier: 56%
- Failures of pedestrians - pass through red light: 11%
- Did not comply the obligation of stop - other: 5%
- Priority was not granted - other: 4%
- Failures of pedestrians - other: 4%
- Priority was not granted despite the road signs: 4%
- Careless driving: 4%
- Did not stop at the signal of the police man or...: 3%
- Inappropriate speed for the road conditions: 2%
- Failures of pedestrians - crossing in forbidden place: 2%
V. Typical accidents

Collisions at level crossing depending on the participation form in the road traffic
Collisions of rail and road vehicles at level crossings depending on the type of protection (1990-2013)
V. Typical accidents

Severity of accidents (2006-2012)
VI. Interventions on level crossing safety

Safety improvements:

- Reconstruction of unfavorable longitudinal section of level crossing to prevent suspension of low chassis vehicles,
- Barrier program,
- Modernization of train detection system,
- Establishing event-driven cameras,
- Installation of vehicle diagnostic and monitoring systems (to minimize the subjectivity of the diagnostic results to decrease the risk of accidents),
- Level crossing campaigns.
VI. Interventions on level crossing safety

Annual number of interventions to improve safety on the railway network (1999-2013)

- Hazard ranking of level crossings
VI. Interventions on level crossing safety
VII. Results of interventions

Result of installation of barriers (1999-2013)

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of accidents before</th>
<th>Number of accidents after</th>
<th>Number of analysed crossings</th>
<th>Number of analysed years</th>
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<tbody>
<tr>
<td>1999</td>
<td>17</td>
<td>10</td>
<td>7</td>
<td>13</td>
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<tr>
<td>2000</td>
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<td>72</td>
<td>22</td>
<td>48</td>
<td>12</td>
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<tr>
<td>2002</td>
<td>22</td>
<td>7</td>
<td>36</td>
<td>11</td>
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<tr>
<td>2003</td>
<td>67</td>
<td>22</td>
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<td>19</td>
<td>9</td>
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<td>6</td>
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</table>
VII. Results of interventions

![Bar chart showing the installation of LED technology and the number of accidents before and after installation over the years 2003 to 2013.](chart.png)

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Analysed Crossings</th>
<th>Number of Accidents Before</th>
<th>Number of Accidents After</th>
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</thead>
<tbody>
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<tr>
<td>2011</td>
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</table>

The chart indicates a decrease in the number of accidents after the installation of LED technology.
Pictures of typical level crossings in Hungary
Level crossing without protection

Level crossing with flashing signal
Level crossing with flashing signal

Level crossing with flashing signal
Level crossing with full-barrier

Level crossing with half-barrier and flashing signal
Level crossing
For vehicles: with half-barrier and flashing signal
For pedestrian: flashing signal
Level crossing with half-barrier and flashing signal

Level crossing with half-barrier and flashing signal for all of users
Level crossing
For vehicles: with half-barrier and flashing signal
For pedestrian: flashing signal
What does not exist can not go out of order and cause problem.

...the most effective way to avoid accidents on level crossing is to not establish them, but we can not avoid them in any case. If we already have them, we must work to have it safety.