Effects of automated highway speed enforcement: average versus instantaneous speed control

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Speed kills...
...but people like speed!

**Speed**

- Higher speeds are associated with higher risks (Aarts & van Schagen, 2006)
- Road users are well aware of this (SARTRE 3, 2004)
- Yet road users continue to drive too fast (ETSC, 2011)
**Solutions?**

- ‘Safe’ speed limits
- Public awareness
- Road design
- Vehicle technology
- Enforcement

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**Enforcement**

- Manual/automated
- Visible / non-visible
- Point control vs. section control
Speed enforcement effective?

- Fixed speed cameras reduce speeds (Retting et al., 2008; Liu et al., 2011)
- Fixed speed cameras reduce crashes (Elvik et al., 2009):
  - All crashes: -16%
  - Fatal crashes: -39%
- Section control: high compliance rates + crash reductions (Soole et al., 2013)
- But:
  - Effects local or also at a larger distance?
  - Section control better than point control?

Objectives of the study

Speed cameras on motorways
Effect on speed?
Effect on crashes?

Section speed control on motorways
Effect on speed?
Effect on crashes?

→ Speed cameras vs. section control
Effects of fixed cameras on speed behaviour

- Before-after study with control for trend
- Research locations
  - 2 locations with speed cameras
  - Motorways, $V_{\text{max}} = 120 \text{ km/h}$
  - Measurements at 5 points
- Only free flow moments

Speed effect: V-profile

- Clear speed decreases at camera location
- No substantial effects up- or downstream $\rightarrow$ no spill-over effects
- Considerable speed differences at short distances $\rightarrow$ "kangaroo-effect"
Effect of section control on speed behaviour

-2.3 km
-1.7 km
+2.3 km
+0.6 km
-6.4 km
+6.4 km

Direction of
Ghent on section
Direction of
Brussels on section

- • Before-after study with control for trend
  • Research locations
    - 2 segments with section control
    - Motorways, $V_{\text{max}} = 120$ km/h
    - Measurements at 5 points
  • Only free flow moments

- More homogenous speed reductions
- Indications for spillover effects
Safety effects of speed cameras

Results:
- Crash data 2003-2011
- 27 camera sites
- Empirical Bayes before- and after study
  - Correction for regression to the mean by means of CPM (Van Hout et al., 2013)
  - Comparison group: crashes on motorways > 20 km

<table>
<thead>
<tr>
<th>Distance (m)</th>
<th>Speed camera effects</th>
<th>CPM (Van Hout et al., 2013)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1200 to +200</td>
<td>+53% 1.53 [1.39, 1.69]</td>
<td>+42% 1.42 [0.98, 2.05]</td>
</tr>
<tr>
<td>+200 to +5000</td>
<td>+27% 1.27 [1.19, 1.36]</td>
<td>-20% 0.80 [0.71, 0.90]</td>
</tr>
</tbody>
</table>

- -1200 m up to +200 m: ambiguous results
- +200 to +5000 m: ambiguous results
- Separate analysis: side crashes and rear-end crashes increase, single-vehicle crashes decrease

Safety effects of section control

Results:
- Before after analysis with comparison group
- 2 enforced segments: (7.4 km each)
- Before period: Jan 2007 - Sep 2012
- After period: Apr 2013 - Dec 2013

<table>
<thead>
<tr>
<th>Section</th>
<th>PDO (property damage only)-crashes</th>
<th>Injury crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>+2km</td>
<td>+31% 0.98 [0.72, 1.33]</td>
<td>-35% 0.65 [0.45, 1.02]</td>
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<tr>
<td>+5km</td>
<td>-18% 0.83 [0.64, 1.07]</td>
<td>-31% 0.69 [0.40, 1.18]</td>
</tr>
</tbody>
</table>

- Consistent effects, but not significant => preliminary!
- Crash decreases, in particular injury crashes
- Indication of some spillover effects
Conclusions

- Fixed speed cameras at motorways
  - V-profile of speeds
  - Ambiguous till adverse effects on crashes
- Section control
  - Homogenous speed reductions
  - Indications for spillover effects
  - (Preliminary) favourable effects on crashes

Thank you. Questions?

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Publications