Pole side impact

Cost / Benefit study, French data

Cyril Chauvel

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Objectives

• Evaluate the cost / benefit of vehicle technical evolution

• Regarding side impact
  – Injury changes in barrier side impact
  – Injury changes in pole side impact
**Data base used**

- BAAC data base (ONISR)
  - French National data 2009
  - Police forces data collection
  - M1 and N1 passenger vehicles
  - Fatalities and serious injuries distribution

<table>
<thead>
<tr>
<th></th>
<th>Fatalities: pole side impacts</th>
<th>Fatalities: barrier side impacts</th>
<th>Fatalities: all side impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M1 vehicles</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONISR year 2009</td>
<td>167</td>
<td>307</td>
<td>474</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Serious injuries: pole side impacts</th>
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<tr>
<td>ONISR year 2009</td>
<td>312</td>
<td>1301</td>
<td>1613</td>
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<tbody>
<tr>
<td><strong>N1 vehicles</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONISR année 2009</td>
<td>11</td>
<td>14</td>
<td>25</td>
</tr>
</tbody>
</table>

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<tr>
<td>ONISR année 2009</td>
<td>6</td>
<td>95</td>
<td>101</td>
</tr>
</tbody>
</table>
French Fleet

- M1 French fleet (year 2009)
  - 30.85 Millions
- N1 French fleet (year 2009)
  - 5.75 Millions
- Ratio (fatalities + severe injuries) vs fleet

<table>
<thead>
<tr>
<th>Gravity (Fatalities + severe injuries) per million vehicle</th>
<th>Pole side impacts</th>
<th>Barrier side impacts</th>
<th>All side impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>16</td>
<td>52</td>
<td>68</td>
</tr>
<tr>
<td>N1</td>
<td>3</td>
<td>19</td>
<td>22</td>
</tr>
</tbody>
</table>
French fleet renewal

• Takes about 14 years in France to renew completely M1 and N1 car fleet

• Used to calculate cost / benefit evolution (progressive increase of new M1 and N1 designed cars into the fleet)
French social cost

- Positive effect on Fatalities and Serious injuries reduction
  - For year 2009 in France
    - 1.2 M€ per Fatality
    - 0.132 M€ per Serious injured people

- Negative effect of weight increase on fuel consumption and CO2 emissions
  - EEVC WG13 and WG21 Subgroup, Report: Analysis to estimate likely benefits and costs for the EU of modifying Regulation 95
  - Not taken into account for the cost/benefit calculation
Technical evolutions

Technical requirement

No pole side impact requirement

ECE 95 and EuroNCAP 13 points (2008 protocol)

FMVSS 214 (PSI 75°, 32kph)
Technical cost and additional weight for M1 and N1 vehicles

- Upgrade of vehicle to meet proposed regulatory option requirements -> Pole test Baseline (Euro NCAP 13 points)
  - Additional cost
    - Source EEVC studies: 290€ to 348€ / vehicle
  - Additional weight: 13 to 20kg
- Upgrade of vehicle to pole side impact 75° / 32 kph
  - Additional cost
    - Source NHTSA 2004 studies: 84€ to 223€ / vehicle
    - Source France: 50€ to 60€ / vehicle
  - Additional weight: 7 to 15kg
- Total cost used for calculation: 340€ to 408€ / vehicle
- Total weight: 20 to 35kg
Potential reduction of Fatalities and Serious injuries

• Benefit evaluation of
  – New side impact safety systems on cars: Curtain Airbags
  – Structural changes: car stiffness, side body and doors

• Gain with new side impact safety systems and car stiffness -> 34% potentiel efficiency (source: LAB studies)
**Potential reduction of Fatalities and Serious Injuries**

- Benefit evaluation regarding pole side impact implied by the new requirements on pole side impact (32kph – 75°) of
  - Modified restraint system: optimised airbags,…
  - Structural changes: increased reinforcement,…

- Regarding the figure moving from 29kph to 32kph pole side impact will bring a maximum of 20% potential efficiency on fatalities and serious injuries.

![Risk curves](image)
M1 Results
M1 Potential reduction of Fatalities and Serious injuries

- After 14 years French fleet renewal
  - Severe injury benefits: 4 150 involved people
  - Fatality benefits: 1 326 involved people
  - Social benefit: 2 139 M€
  - Technical cost: between 10 489 M€ and 12 587 M€
**M1 Cost/Benefit calculation**

<table>
<thead>
<tr>
<th>Cost / benefit ratio</th>
<th>Balanced cost / benefit ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mini</td>
<td>Maxi</td>
</tr>
<tr>
<td>4.9</td>
<td>5.9</td>
</tr>
</tbody>
</table>

- After 14 years French fleet renewal
  - Cost / benefit ratio: **between 4.9 and 5.9 (>1 not good)**
- Technical cost balance: **69 Euros per vehicle**
N1 Results
**N1 Potential reduction of Fatalities and Serious injuries**

<table>
<thead>
<tr>
<th>Total</th>
<th>Severe injuries</th>
<th>Fatalities</th>
<th>Gain (M€)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>241</td>
<td>73</td>
<td>119</td>
</tr>
</tbody>
</table>

- **Severe injury benefits**: 241 involved people
- **Fatality benefits**: 73 involved people
- **Societal benefit**: 119 M€
- **Technical cost**: between 1,955 M€ and 2,346 M€

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### Technical cost per vehicle (euros) vs. French fleet

<table>
<thead>
<tr>
<th>Technical cost per vehicle (euros)</th>
<th>French fleet</th>
<th>Technical cost for all the French fleet (MEuros)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal cost</td>
<td>Maximum cost</td>
<td>Million vehicles</td>
</tr>
<tr>
<td>340</td>
<td>408</td>
<td>5.75</td>
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</tbody>
</table>

- **After 14 years French fleet renewal**
  - Severe injury benefits: 241 involved people
  - Fatality benefits: 73 involved people
  - Societal benefit: 119 M€
  - Technical cost: between 1,955 M€ and 2,346 M€
N1 Cost/Benefit calculation

- After 14 years French fleet renewal
  - Cost / benefit ratio: between 16.4 and 19.6 (>1 not good)
- Technical cost balance: 21 Euros per vehicle
Potential reduction of Fatalities and Serious injuries with vehicle ESC equipped

• Benefit evaluation of ESC (regulation)
  – Pole side impact avoidance -> 34% potentiel efficiency (source: EEVC)

• Benefit evaluation regarding pole side impact implied by the new requirements on pole side impact (32kph – 75°)
  – -> 20% potential efficiency
M1 (with ESC) Results
### M1 Potential reduction of Fatalities and Serious injuries

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<tr>
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<tr>
<td></td>
<td>4007</td>
<td>1249</td>
<td>2028</td>
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- **After 14 years French fleet renewal**
  - Severe injury benefits: 4 007 involved people
  - Fatality benefits: 1 249 involved people
  - Social benefit: 2 028 M€
  - Technical cost: between 10 489 M€ and 12 587 M€

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M1 Cost/Benefit calculation

- After 14 years French fleet renewal
  - Cost / benefit ratio: between 5.2 and 6.2 (>1 not good)
- Technical cost balance: 66 Euros per vehicle
N1 (with ESC) Results
**N1 Potential reduction of Fatalities and Serious injuries**

<table>
<thead>
<tr>
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<th>Severe injuries</th>
<th>Fatalities</th>
<th>Gain (M€)</th>
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<td>238</td>
<td>68</td>
<td>113</td>
<td></td>
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- **After 14 years French fleet renewal**
  - Severe injury benefits: 238 involved people
  - Fatality benefits: 68 involved people
  - Social benefit: 113 M€
  - Technical cost: between 1,955 M€ and 2,346 M€
N1 Cost/Benefit calculation

- After 14 years French fleet renewal
  - Cost / benefit ratio: between 17.3 and 20.8 (>1 not good)
- Technical cost balance: 20 Euros per vehicle
## Synthesis

### Not ESC equiped

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### ESC equiped

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<tr>
<td>M1 vehicles - ESC equiped</td>
<td>5.2</td>
<td>6.2</td>
</tr>
<tr>
<td>N1 vehicles - ESC equiped</td>
<td>17.3</td>
<td>20.8</td>
</tr>
</tbody>
</table>
Conclusion

- Results give a technical extra cost per vehicle 4 to 6 time higher than fatalities and serious injuries benefits for M1 and 16 to 20 time higher for N1.

- Human benefit versus technical cost balance is about 66 Euros per M1 vehicle and 20 Euros per N1 vehicle.

- Not economically interesting to push such a test as regulation.

- Nevertheless, the decrease of fatalities and serious injuries is not unimportant.
Questions?

Thank you for your attention