Investigation of truck weights and dimensions using WIM Data

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Context and objectives

<table>
<thead>
<tr>
<th>Tire manufacturer’s stakes</th>
<th>Infrastructure’s stakes</th>
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<td>• Design the right tire for end users</td>
<td>• Assess HCV’s impact on infrastructure</td>
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<td>• Size → Volume / Load capacity</td>
<td>• Implement a fair road charging and tolling</td>
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<td>• Rolling resistance → fuel consumption</td>
<td>• Ensure a fair competition between transport companies and modes</td>
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<td>• Design the right tire for safety</td>
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<td>• Load capacity → safety</td>
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<td>• Drivability → safety, truck stability</td>
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WIM data analysis to understand the trucks’ loading habits …
… to anticipate its evolution then the impact on road and tire needs
WIM stations in France

- 29 stations on the road network: 30 millions trucks weighted / year
- Sample of 1 year on 3 stations, ≈ 3 millions trucks
  - Axle load and spacing
  - Front/rear overhang
  - Speed
  - License plate in case of infringement
- Loading depends on the truck configuration:
  - Truck classification
Truck classification

- Classification by axle spacing, load and overhang criteria based on regulation and OEM specifications. Example for tractor 4x2 and semi trailer:
  - $d_{01} < 1.75m$
  - $3m < d_{12} < 4.4m$
  - $d_{23} > 4m$
  - $d_{34} < 1.8m$ & $d_{45} < 1.8m$
Classification Output

- 3 main classes:
  - Tractor 4x2 + semitrailer with tridem
  - Tractor 4x2 + semitrailer with tandem
  - Rigid 4x2

- High proportion of semi-trailer with tandem axle
  - because of lifted axles
  - app. 1 tridem on 8 has its first axle lifted
Axle load distribution rather well comply with legal limits and tire capacity.

Nevertheless, a very limited amount of vehicle use the full tire load capacity.
Axle load distribution (Rigid truck + trailer)

- Axle loads comply with legal limits and tire capacity
- The trailers’ tires are by far oversized
A significant proportion of trucks are fully loaded with a payload above 20 t, while a majority of the truck are not fully loaded.

When the payload increases, the center of gravity (CoG) moves to the back while the load scattering is reduced.

Above 25 t payload, the CoG is at the middle of the semi-trailer.
Load patterns of rigid truck + semitrailer

- The payload of these trucks is far below the maximum of 26 t, because the volume or surface limit is reached before the load limit.
- When the payload increases, the CoG moves to the back while the scattering is reduced.
- The CoG longitudinal location stabilizes above 20 t payload → the volume or surface is fully occupied.
Conclusion

– **WIM data** → reliable patterns of truck and tire loading, by truck configuration, i.e. transport business.

– **Better understanding of trucks loading and use**

– **Perspectives of new and more optimized approach of tire design:**
  - product segments based on real use to optimize fleet operations and truck safety performance
  - further investigations on HCVs use could interest many transport stakeholders in Europe
Thanks for your attention

Acknowledgements

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