Zelfrijdende auto’s: zijn we er al?

Bart van Arem
A first drive with fully automated vehicle...
<table>
<thead>
<tr>
<th>SAE level</th>
<th>Name</th>
<th>Narrative Definition</th>
<th>Execution of Steering and Acceleration/Deceleration</th>
<th>Monitoring of Driving Environment</th>
<th>Fallback Performance of Dynamic Driving Task</th>
<th>System Capability (Driving Modes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No Automation</td>
<td>the full-time performance by the human driver of all aspects of the dynamic driving task, even when enhanced by warning or intervention systems</td>
<td>Human driver</td>
<td>Human driver</td>
<td>Human driver</td>
<td>n/a</td>
</tr>
<tr>
<td>1</td>
<td>Driver Assistance</td>
<td>the driving mode-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the human driver perform all remaining aspects of the dynamic driving task</td>
<td>Human driver and system</td>
<td>Human driver</td>
<td>Human driver</td>
<td>Some driving modes</td>
</tr>
<tr>
<td>2</td>
<td>Partial Automation</td>
<td>the driving mode-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the human driver perform all remaining aspects of the dynamic driving task</td>
<td>System</td>
<td>Human driver</td>
<td>Human driver</td>
<td>Some driving modes</td>
</tr>
<tr>
<td>3</td>
<td>Conditional Automation</td>
<td>the driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task with the expectation that the human driver will respond appropriately to a request to intervene</td>
<td>System</td>
<td>System</td>
<td>Human driver</td>
<td>Some driving modes</td>
</tr>
<tr>
<td>4</td>
<td>High Automation</td>
<td>the driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task, even if a human driver does not respond appropriately to a request to intervene</td>
<td>System</td>
<td>System</td>
<td>System</td>
<td>Some driving modes</td>
</tr>
<tr>
<td>5</td>
<td>Full Automation</td>
<td>the full-time performance by an automated driving system of all aspects of the dynamic driving task under all roadway and environmental conditions that can be managed by a human driver</td>
<td>System</td>
<td>System</td>
<td>System</td>
<td>All driving modes</td>
</tr>
</tbody>
</table>

(All driving modes)
Automated driving

Driver assistance/
Partial automation

Driver needs to be able
to intervene at all times

Automated parking,
autocruise

High automation

Vehicle in control in
special conditions

Taxibots, platooning,
automated highways

Comfort, efficiency, safety,
costs

Mode choice, location choice,
urban and transport planning

## Personal Estimates of Market Introductions *(based on technological feasibility)*

<table>
<thead>
<tr>
<th></th>
<th>Level 1 (ACC)</th>
<th>Level 2 (ACC+LKA)</th>
<th>Level 3 Conditional Automation</th>
<th>Level 4 High Automation</th>
<th>Level 5 Full Automation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Everywhere</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Some urban streets</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Campus or pedestrian zone</td>
<td></td>
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<tr>
<td>Limited-access highway</td>
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<tr>
<td>Fully Segregated Guideway</td>
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</tr>
</tbody>
</table>

**Color Key:**
- **Now**: Green
- **~2020s**: Light Green
- **~2025s**: Yellow
- **~2030s**: Orange
- **~2075**: Red

*Courtesy Steve Shladover*
En zijn de files verleden tijd?

- Solve traffic jams by increased outflow
- Prevent traffic jams by better stability
- Better distribution of traffic over network

Less congestion delay

- Decreased throughput by larger headways
- Decreased stability by lack of anticipation

Increased risk of congestion

Non connected
Large penetration
Spatial implications

Functional
- Geometric redesign of roads and junctions
- Increasing sprawl residential and employment locations
- Concentration activities by better accessibility
- Redesign of urban, commercial, touristic areas
- No on street parking
- Combinations with car sharing, electric driving

Spatial
.. and what about ethics?

... so much more than robot-dilemmas

- Responsibility
- Values
- Triple helix
- Equity, fairness
- Collaborative design
- Privacy
- Security
- Testing
- Sustainability
- Mixed traffic
- Authority transitions
- Laws and regulations
- ...
De auto wordt sleeds slimmer!

Technologie beter, goedkoper
Draagvlak groot
Nieuwe regelgeving
Veel testen

Computer doet alles zelf op speciale wegen
Bestuurder let op

.. maar is nog (lang) niet slim genoeg!
Wij moeten ook nog leren:

- Slimme auto of simpel verkeer?
- Acceptatie en gebruik?
- Hype en realisme?
- Wie betaalt?
- Wanneer is de slimme auto verantwoordelijk?
- Marketing of wetenschap?
- ICT of automotive?
- Gevolgen mobiliteit en ruimte?
- ...

Never stop learning because life never stops teaching.
Aan de slag, ook in onze regio!

STAD: Spatial and Transport Impacts of Automated Driving