Focus: SAE Level 3, 4 Highway Automation

- Assisted driving: Supports the driver
- Partially automated driving: Permanent driver supervision
- Highly and fully automated driving: Reduced driver supervision

- Automated valet parking: 2018
- Remote park assist: 2015
- Evasive steering support: 2015
- Automatic emergency braking: since 2010
- Assisted driving: Supports the driver
- Integrated cruise assist: 2017
- Traffic jam assist: 2015
- Traffic jam pilot: >2018
- Highway pilot: 2020
- Highway assist: 2019
- Urban pilot: >2026

Highly and fully automated driving:
Reduced driver supervision

2018: Evasive steering support
2015: Remote park assist
2010: Automatic emergency braking since
2017: Integrated cruise assist
2019: Highway assist
2020: Highway pilot
>2018: Traffic jam pilot
>2026: Urban pilot
Future Interstates for Automated Driving

Key challenges for automated driving

- **Surround sensors**
  - highly robust
  - in all use cases

- **Online map data**
  - precise and up-to-date every moment

- **Localization**
  - accurate and reliable vehicle position

- **Decision making**
  - correct reasoning and decisions in all situations

- **Perception**
  - comprehensive 360° environment model

- **Motion control**
  - safe, fast and precise in all dimensions

- **Driver monitoring & HMI**
  - for partially and highly automated functions

- **Functional safety**
  - guarantees high standard at reasonable effort

- **Architecture**
  - supports safety, performance and cost targets
Future Interstates for Automated Driving

Current approach

- Perception
- Localization
- Decision Making
- Fail Operational

Validation
Future Interstates for Automated Driving
How can infrastructure help?

- Digital Signage
  - Machine readable
  - Posted periodically
  - Consistent

- Road markings
  - Clear
  - Machine readable attributes
  - Robust to weather

- Standardization
  - Within states
  - Within countries
  - Text independent symbols

- Quality gates
  - Approved for AD
  - Maintained routes
Future Interstates for Automated Driving

How can Infrastructure help? – Safe harbor

Duration to come to safe state

Standstill in current lane

Standstill in rightmost lane

Standstill in emergency lane

Deceleration & extended travel to a safe place

Driver take-over
## Future Interstates for Automated Driving
### Comparing on-board sensing with smart infrastructure

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<th>Pro</th>
<th>Con</th>
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<tbody>
<tr>
<td><strong>On board Intelligence</strong></td>
<td>- Safer option, works regardless of infrastructure variations</td>
<td>- Expensive</td>
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<td>- Fastest to market</td>
<td>- Difficult to validate</td>
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<td>- Limited to premium market segment</td>
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<td>- Each OEM takes a varied approach</td>
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<td><strong>Smart interstates</strong></td>
<td>- Can reduce costs, complexity of autonomous vehicles</td>
<td>- Even more expensive?</td>
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<td>- Increase safety</td>
<td>- Infrastructure changes take time</td>
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<td>- Can serve a wider audience of vehicles (level 1 and level 2)</td>
<td>- Challenging to achieve consistency of design between states</td>
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<td>- Collaboration on common signage between different areas could be effort-intensive</td>
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Future Interstates for Automated Driving

Summary

- Step by step to fully automated
- Allow for consumer acceptance
- OEM, Tier1 and infrastructure to work together
- A combined approach of on-board technology and automated driving customized infrastructure would speed up the process

On our way to collision-free driving
Future Interstates for Automated Driving

Thank You!