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FUTURE HIGHWAY DESIGN WITH AUTONOMOUS DRIVING

What will be the role of the ‘driver’ in highway design?

15 June 2017

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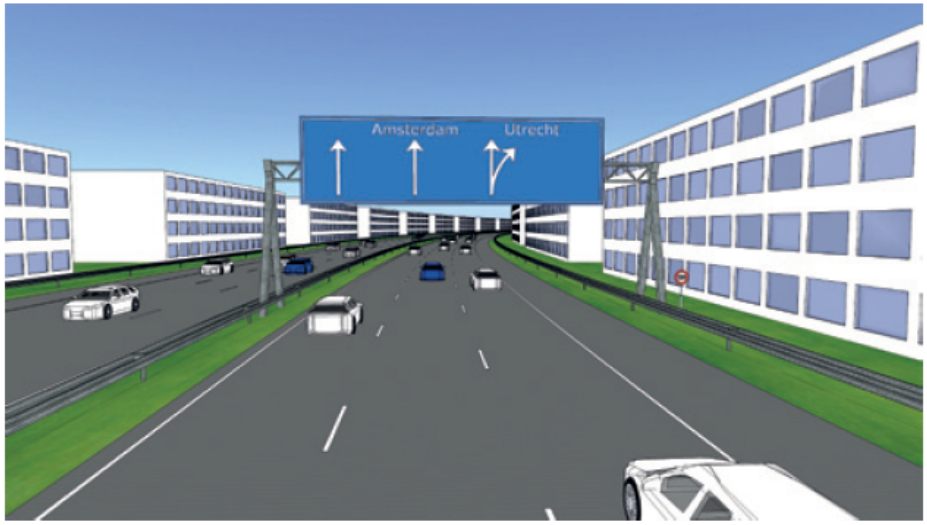

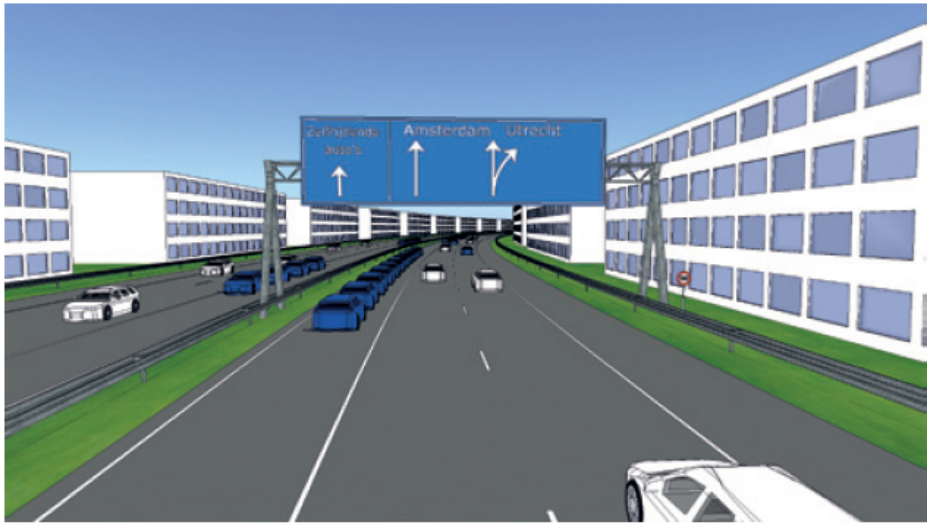

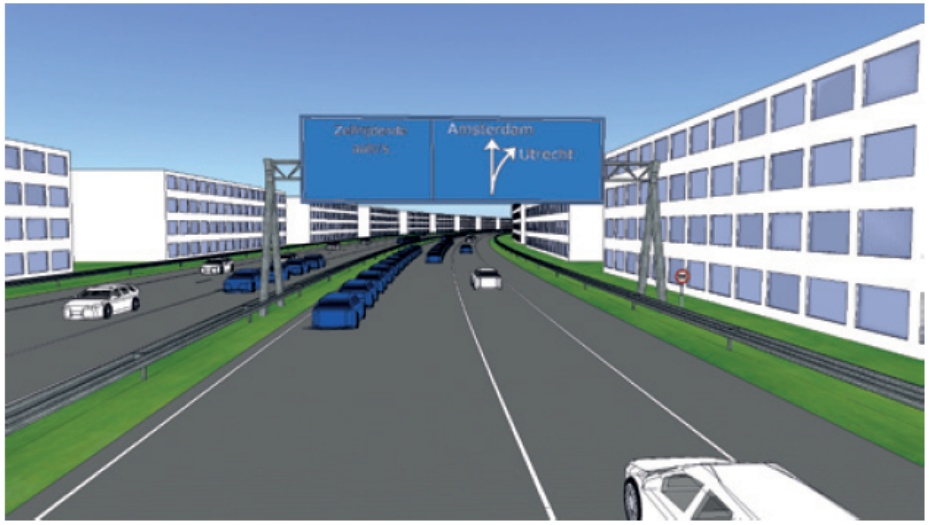

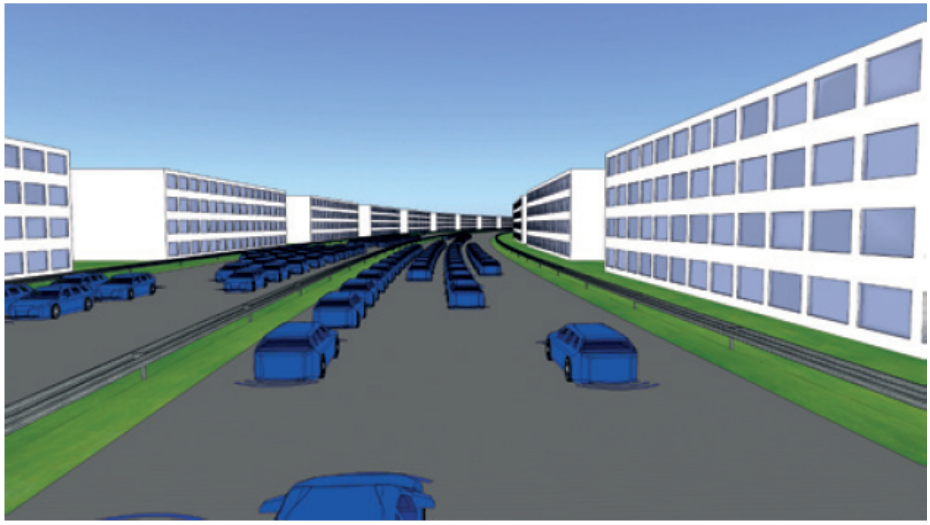

Introduction

- Level 4 AV's within next 10 year (Shladover, 2016)

- Exploratory study commisioned by Rijkswaterstaat
  - what will level 4 highways and intersections look like?
  - How will the transition phase look like?

- Collaboration of Arcadis, Witteveen+Bos and TU Delft

Method

- Our scope:
  - Level 4 as defined by SAE
  - 100% penetration of level 4 or higher

- Parameters in ROA2014
  - Which to be altered, removed or added?

			DDT			
Level	Name	Narrative definition	Sustained lateral and longitudinal vehicle motion control	OEDR	DDT fallback	ODD
4	High Driving Automation	The sustained and ODD-specific performance by an ADS of the entire DDT and *DDT fallback* without any expectation that a *user* will respond to a *request to intervene.*	system	system	system	limited

Brainstorm sessions

- Two brainstorm sessions with our experts
- Original focus was on technical capabilities of AV's
- Quickly we found that occupants will become normative for certain parameters

Human-normative parameters

- Example: speed or curve radii, what is comfortable?
  - Comfort can be calculated, but what about other factors such as feeling safe and giving up control?

Driver, road design and AV

Transition from level II to level IV: The **driver turns into a passenger**, and this may have consequences for the road design

- Lane width *(lateral distance to other vehicles and roadside objects)*;

- Curve radii (of arches), transversal sloping and minimal radius of horizontal curves (*being able to look ahead and driver experience*);

- Curve and transversal slope transitions (*being able to look ahead and driver experience*);

- Absence of a median (*as being a barrier (and extra distance) with oncoming traffic*);

- Lateral distance to shoulder/objects (*fear of hitting objects, how forgiving is the road design when a mistake is made?*).

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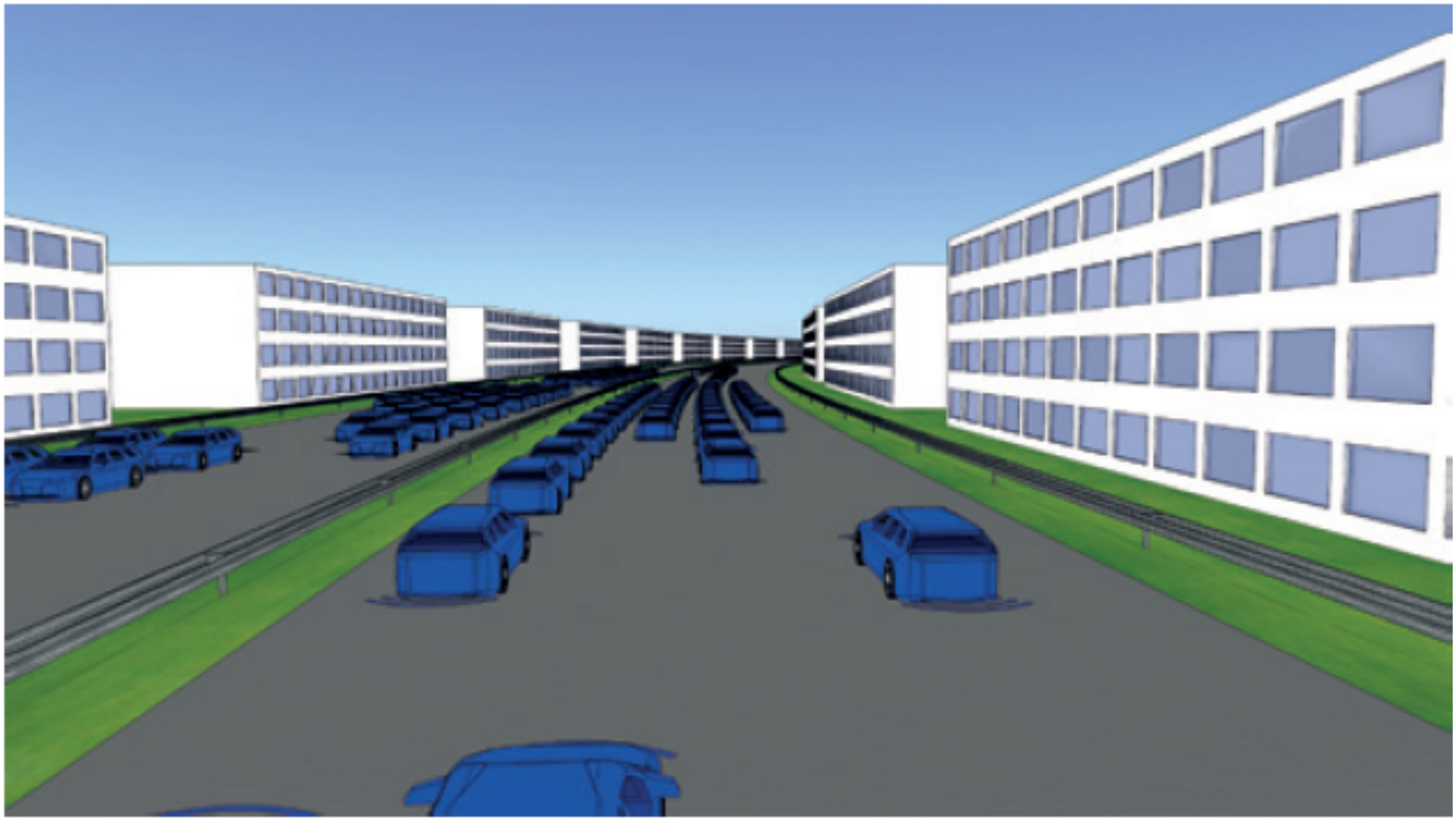
Smaller lane width *(lateral distance to other vehicles and roadside objects)*



Driver experience

	Level II	Level IV
Smaller lane width	😐	☺

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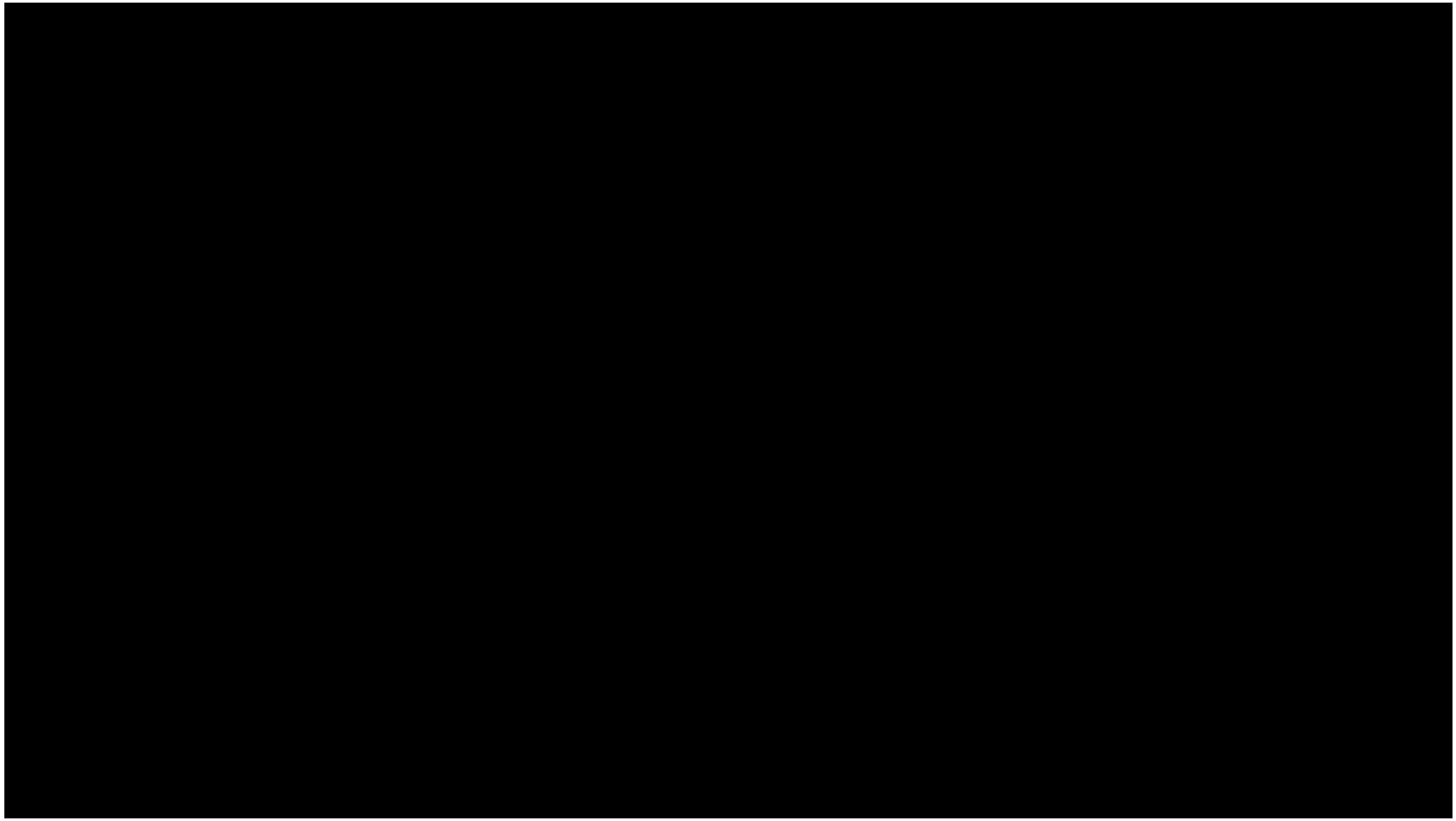
Smaller curve radii (of arches), transversal sloping and minimal radius of horizontal curves (*being able to look ahead and driver experience*)

Driver experience

	Level II	Level IV
Curve radii, transversal sloping and minimal radius of horizontal curves	☹	☹

Curve and transversal slope transitions (*being able to look ahead and driver experience*)



Driver experience

	Level II	Level IV
Curve and transversal slope transitions	😐	😐

Absence of a median (*as being a barrier (and extra distance) with oncoming traffic*)

Driver experience

	Level II	Level IV
Absence of a median	☹	😐☺

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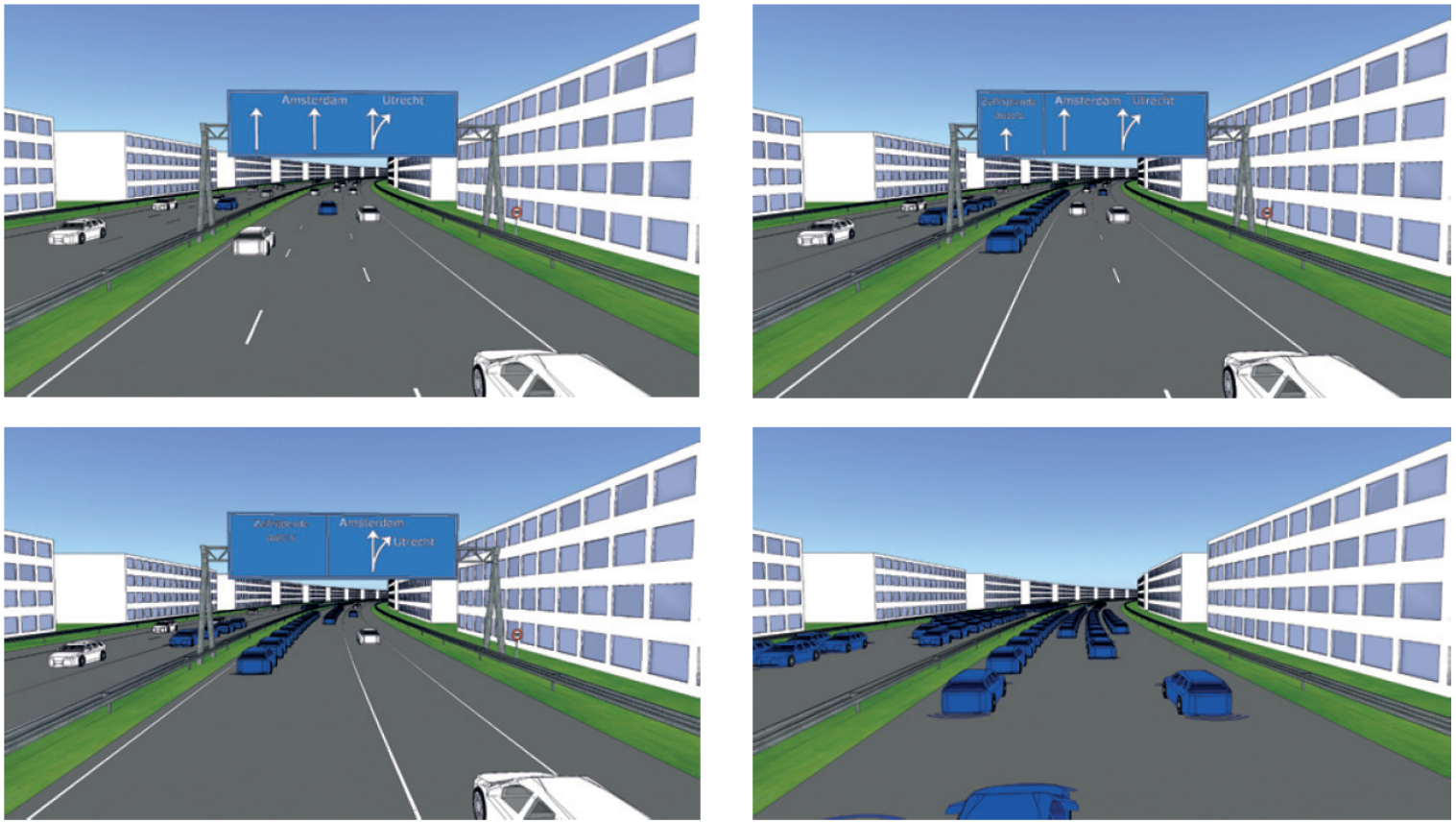
Small lateral distance to shoulder/objects (*fear of hitting objects, how forgiving is the road design when a mistake is made?*)

Driver experience

	Level II	Level IV
Small lateral distance to shoulder/objects	☹	😐☺

Conclusion

	Level II	Level IV
Smaller lane width	😐	☺
Curve radii, transversal sloping and minimal radius of horizontal curves	☹	☹
Curve and transversal slope transitions	😐	😐
Absence of a median	☹	😐☺
Small lateral distance to shoulder/objects	☹	😐☺



Any questions?