

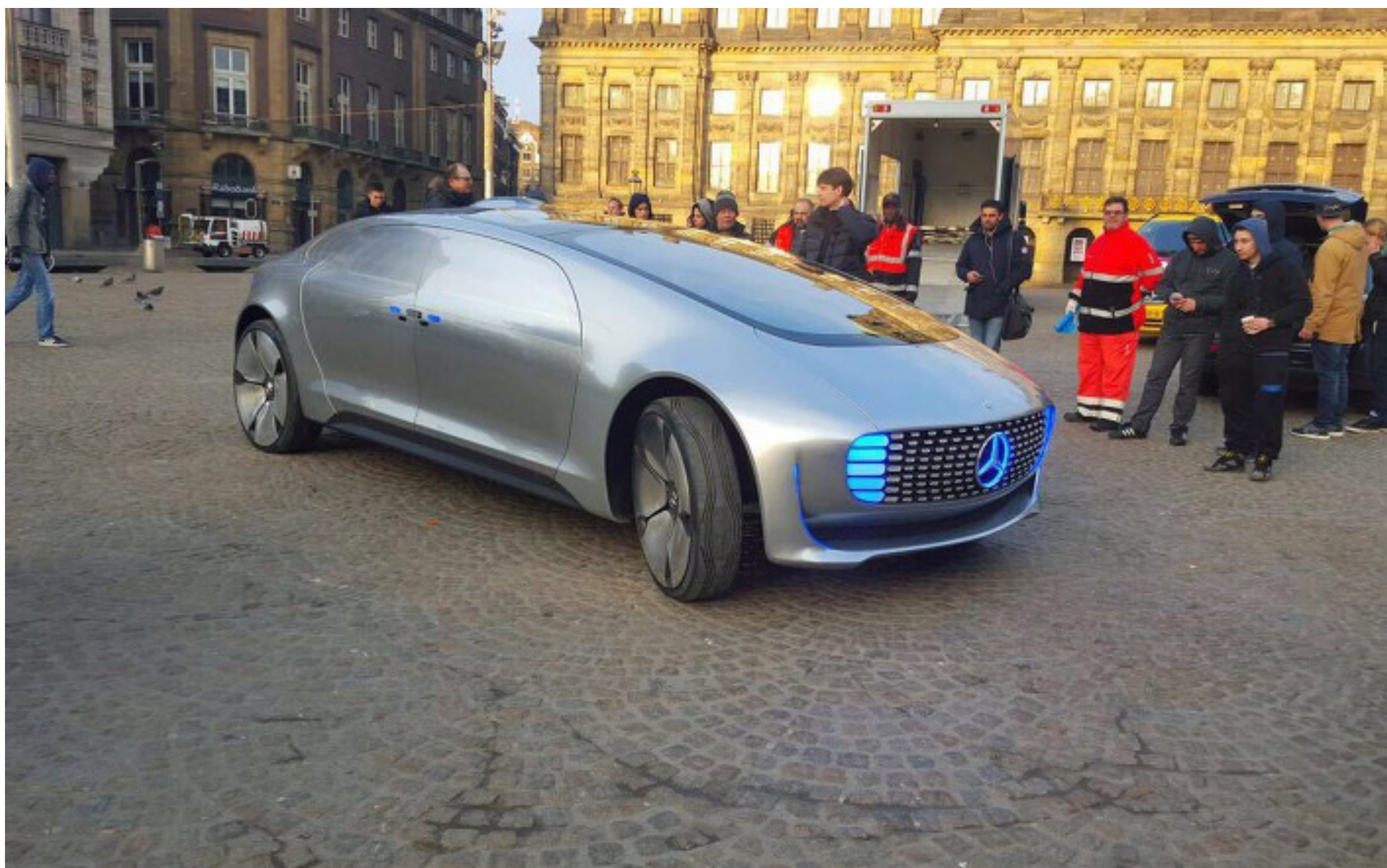
# Driver out of the loop, infrastructure in the loop

IJDS congress June 15th  
2017

Chris de Veer

Chris de Veer, Province Noord-  
Holland

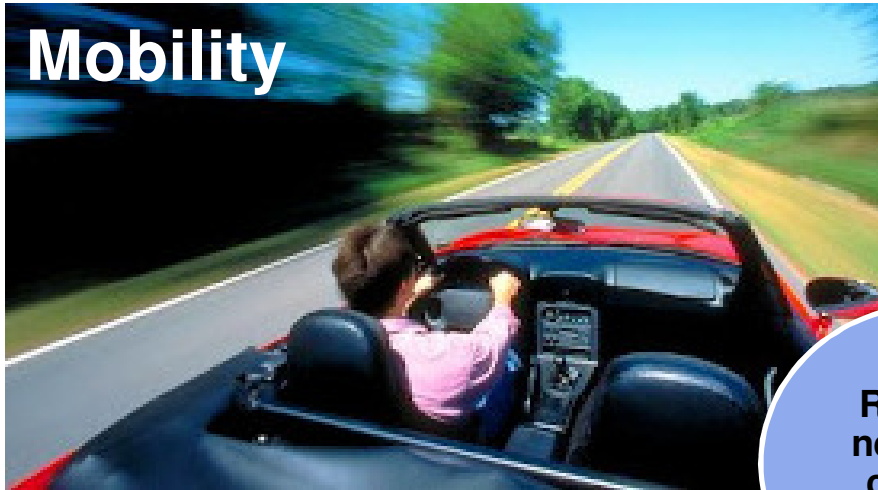






# Concerns road operator

**Mobility**



**Accessibility**



Reduce  
negative  
consequences

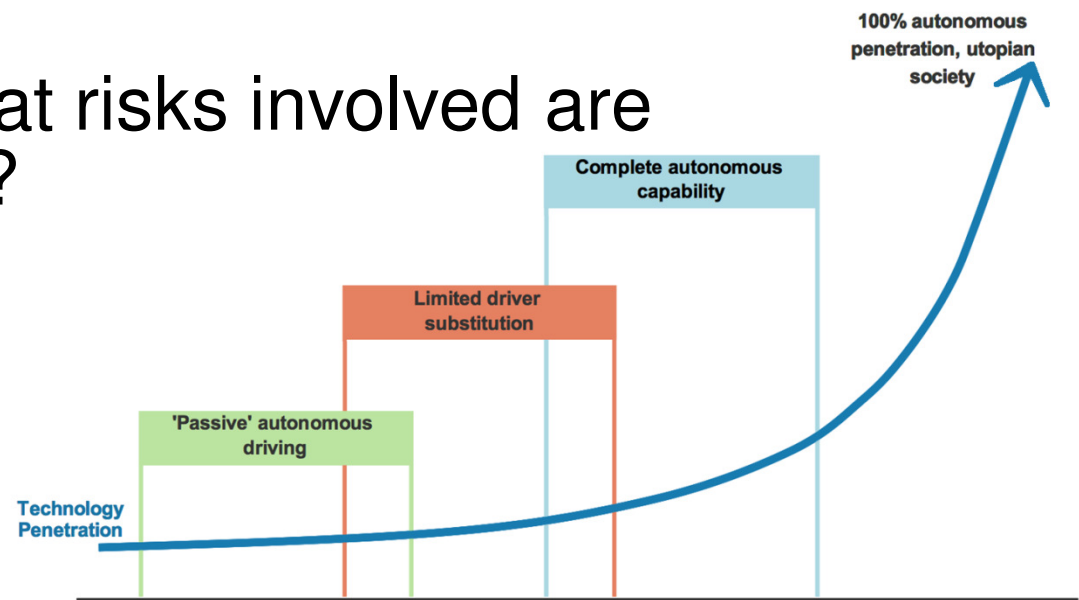
**Environment**



**Safety**



1. The impact or potential benefits of automated driving are much bigger when we reach higher levels (and higher penetration)
2. These benefits go beyond the transportation domain
3. Does this mean that risks involved are increasing as well?



# Effects AV on societal goals

Stedelijke doelen		Concrete doelen <sup>1</sup>	Impact			
			1	2	3a	3b
1	Bereikbare stad	Meer ruimte creëren voornamelijk voor voetgangers en fietsers				+/-
		Betere doorstroming op belangrijke routes				++
		Betere verbindingen in en naar de stad			++	++
2	(Verkeers) veilige stad	Voorkomen van enkelzijdige fietsongevallen				
		Voorkomen van ongevallen waar een motorvoertuig bij is betrokken		+	++	++
		Voorkomen van overige ongevallen + algemene veiligheid				
3	Aantrekkelijk stad	Verbeteren van de kwaliteit van de openbare ruimte		-	-	+/-
		Imago van Amsterdam				
4	Duurzame stad	Verminderen van energieverbruik en verhogen van productie van duurzame energie				
		Stimuleren van de circulaire economie (beweging van 'bezit' naar 'gebruik' en het 'delen')				+
5	Economisch sterke stad	Verhogen van de welvaart van de bewoners		+	++	++
		Versterken van de concurrentiepositie van Amsterdam en bedrijven				
6	Stedelijke gebiedsontw.	Meer woon- en werkruimte in Amsterdam (bijv. verdichting en verandering van functies)				
7	Gezonde stad	Verbeteren van de gezondheid van Amsterdammers (met name bewegen)				
		Verbeteren van de luchtkwaliteit in Amsterdam				
8	Sociale stad	Meer mensen zijn (duurzaam) aan het werk				
		Meer mensen functioneren zo zelfstandig mogelijk, zo nodig met ondersteuning				
		Minder mensen ervaren financiële belemmeringen om mee te doen in de stad				

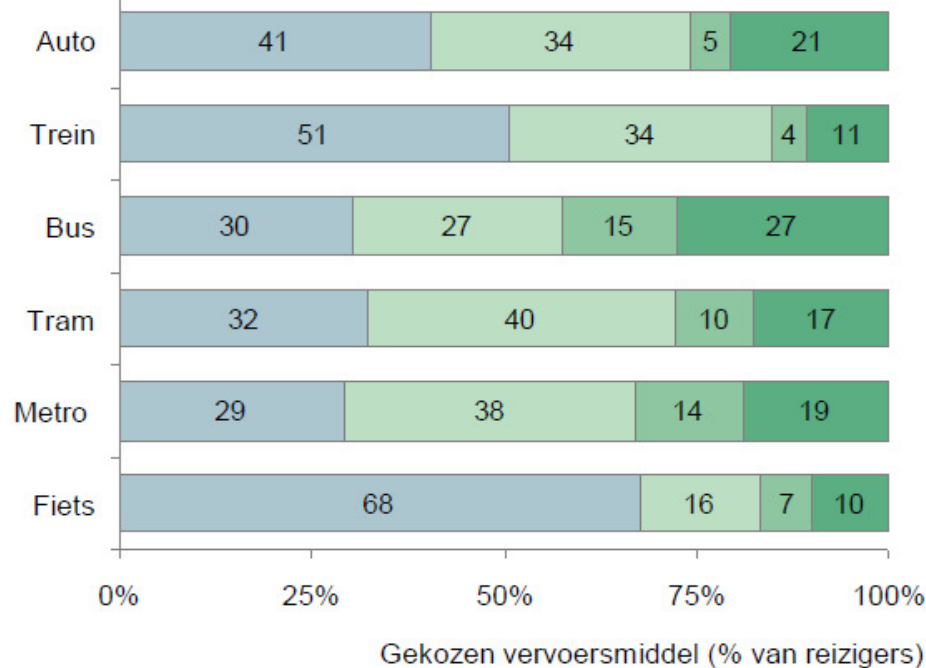
Source: Impactstudy of selfdriving vehicles in Amsterdam by BCG

# Willingness to adapt to automation

Survey on 500 inhabitants of Amsterdam

*If Automated Driving would be available, what option would you choose during rush hour?*

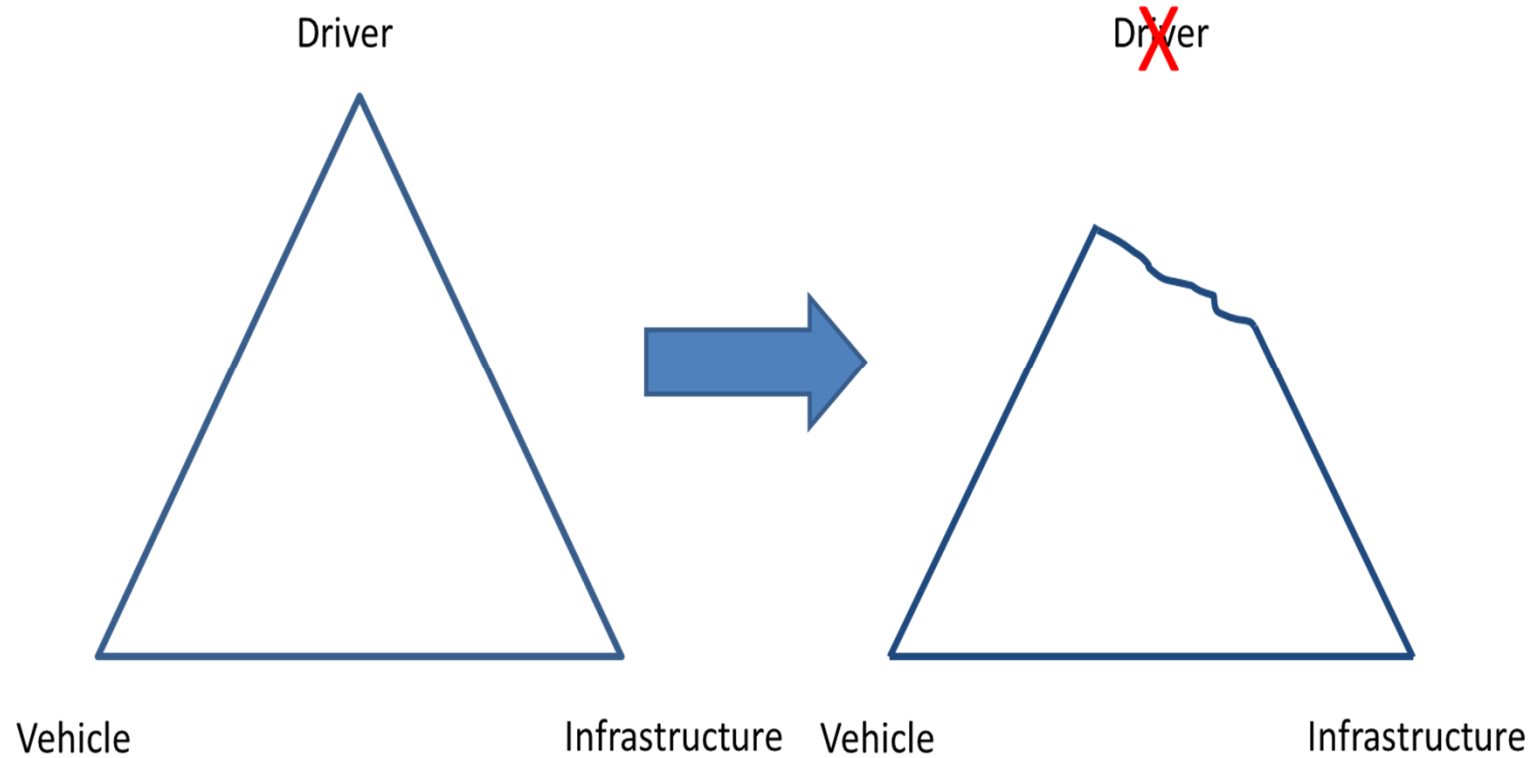
Huidige vervoers-  
middel in de spits<sup>1</sup>:



→ About 50% would change to automated driving



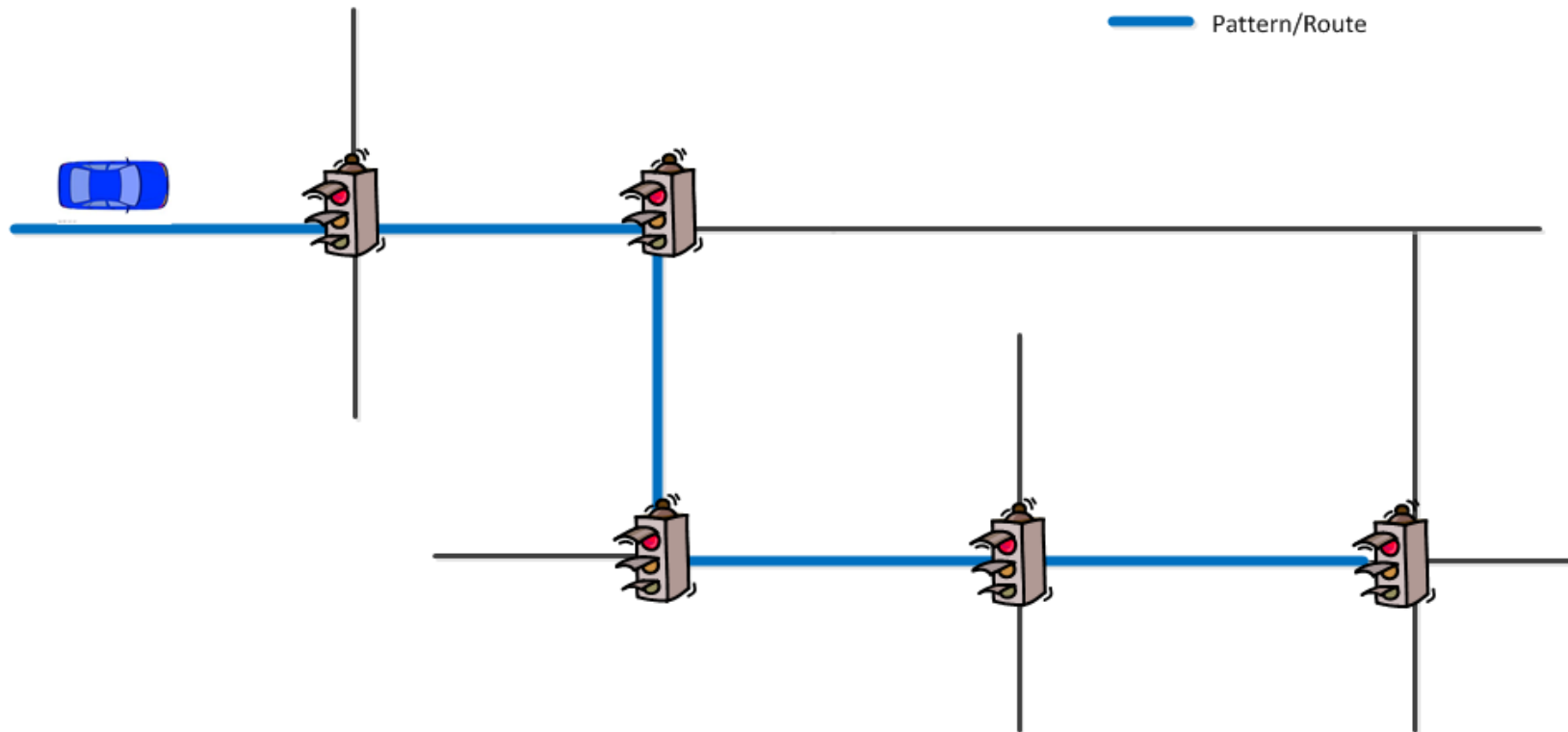




# Elements to focus on

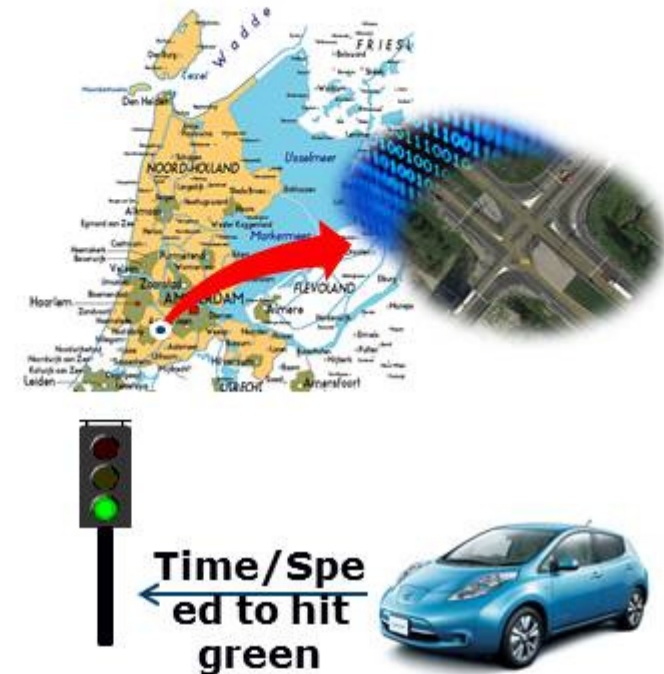
1. Vehicle technology
2. Driver/ passenger acquirements
3. Infrastructure and road side units
4. Digital infrastructure
5. Redundancy
6. Business models
7. Other impacts

# Route patterns for automated driving



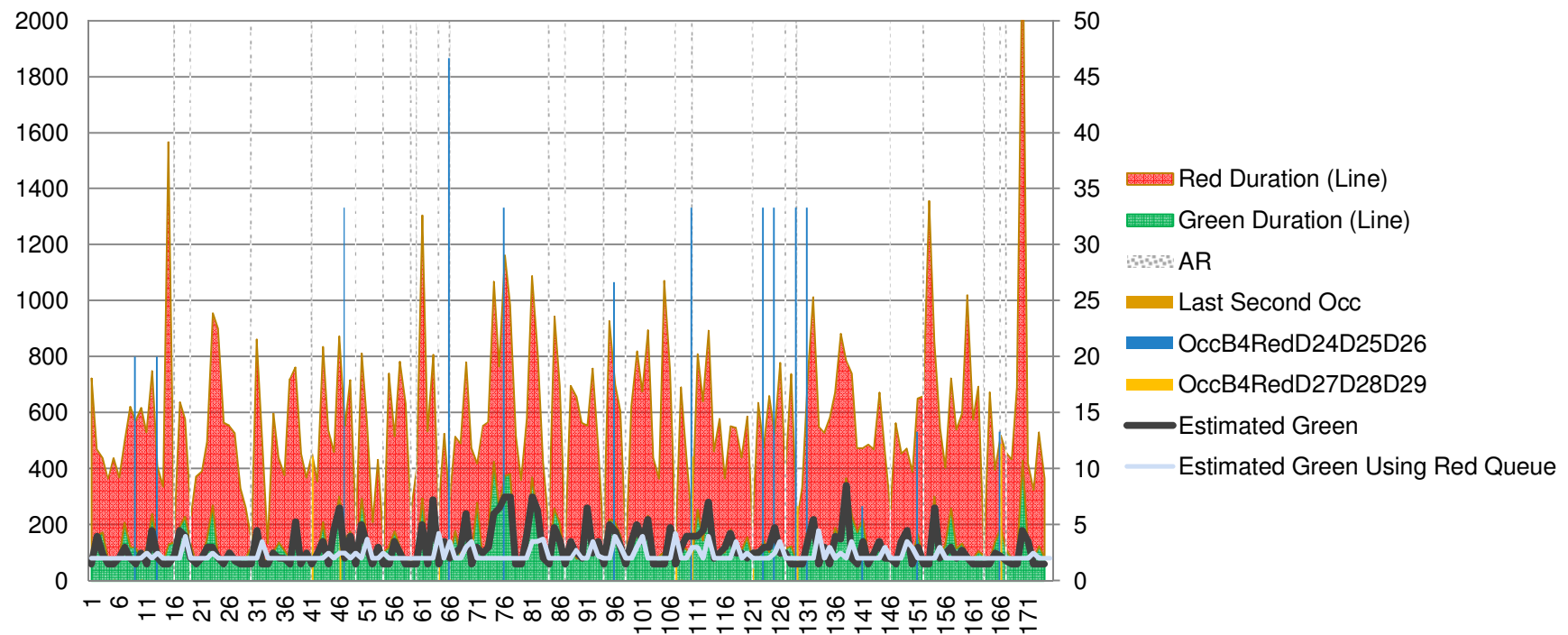
# Traffic Signal Timing Prediction Project: A Step-by-Step Approach

- **Overall Objective:** Develop and test a traffic signal timing prediction model for short-term and long-term predictions
- **First Step (Simplified Problem):** Check if we can estimate the green signal duration using existing detector and/or signal data (not a real-time prediction)
- **Outcome:** Identify features that have significant correlation with signal timing to build the prediction model

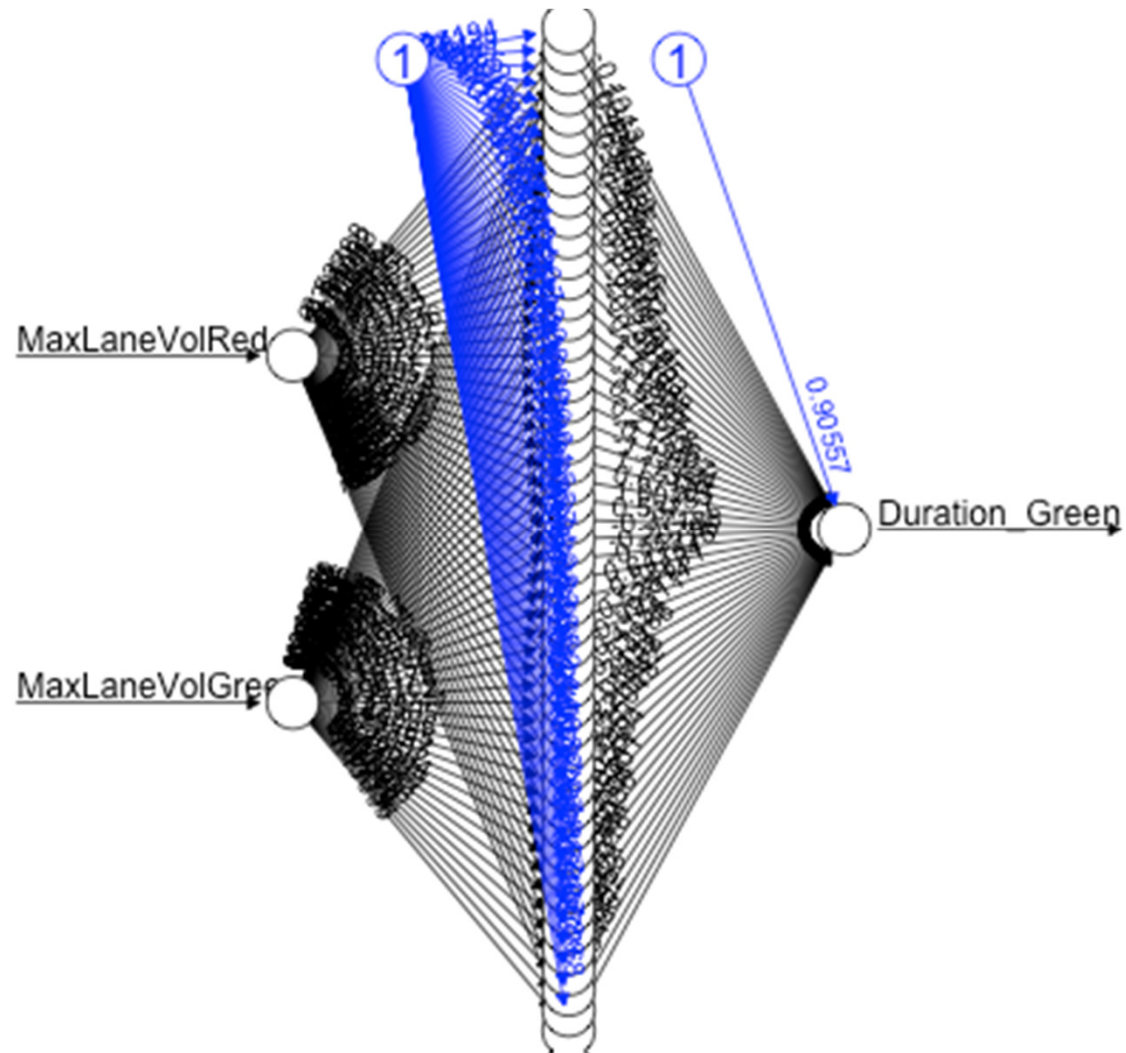


# Analyse

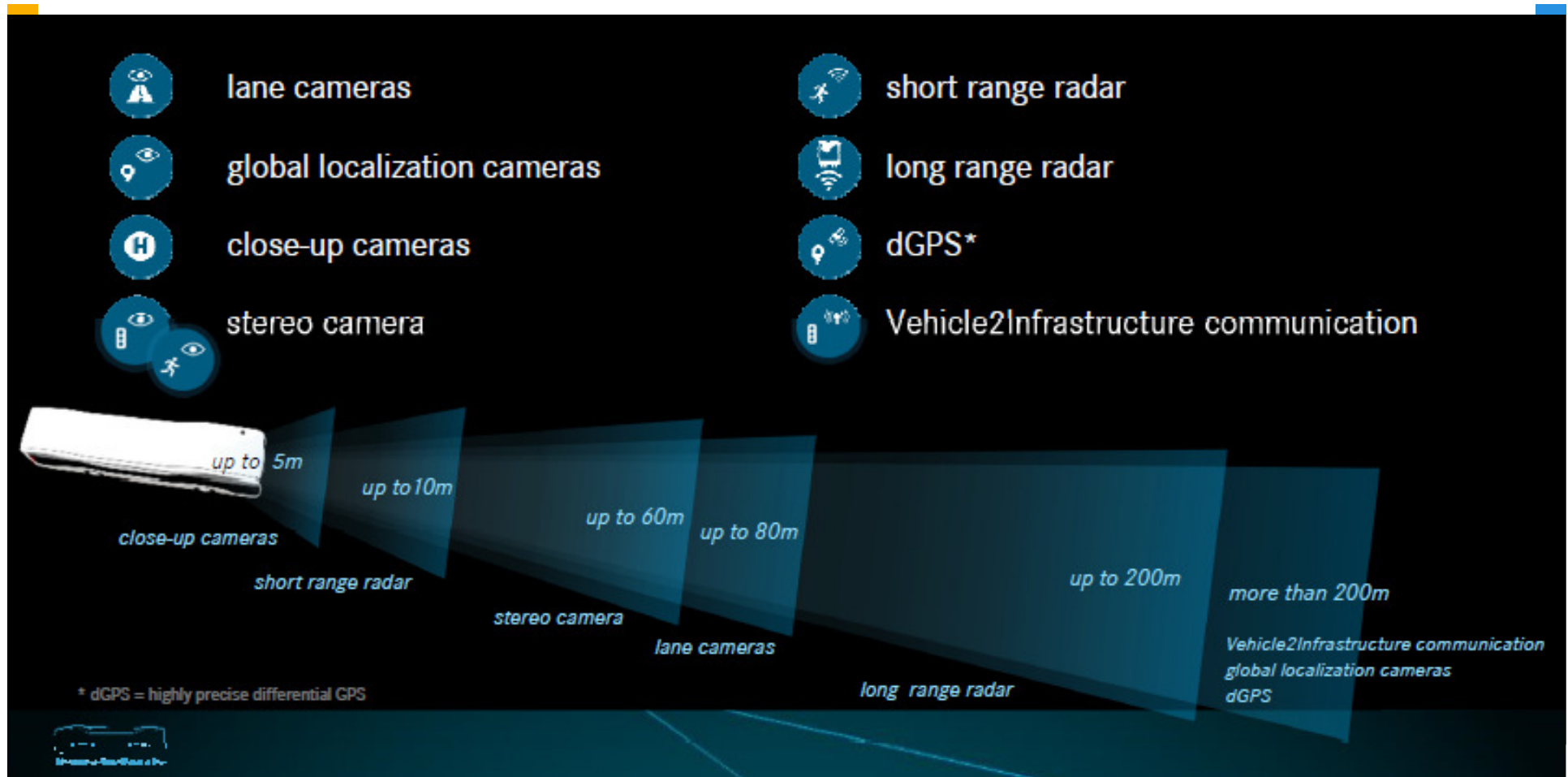
## Traffic Signal Durations

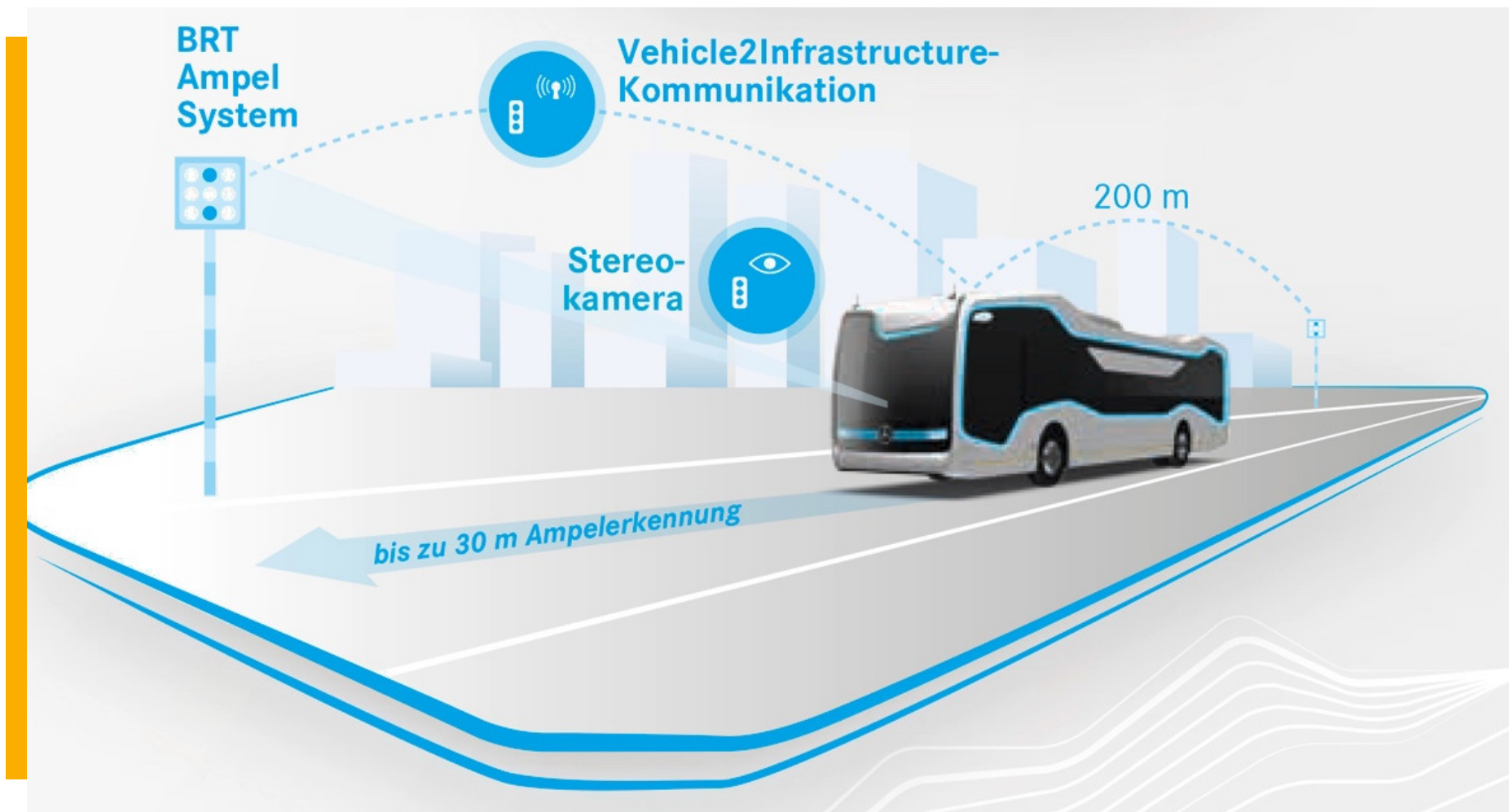


# Neural networks



# Testen van technologie



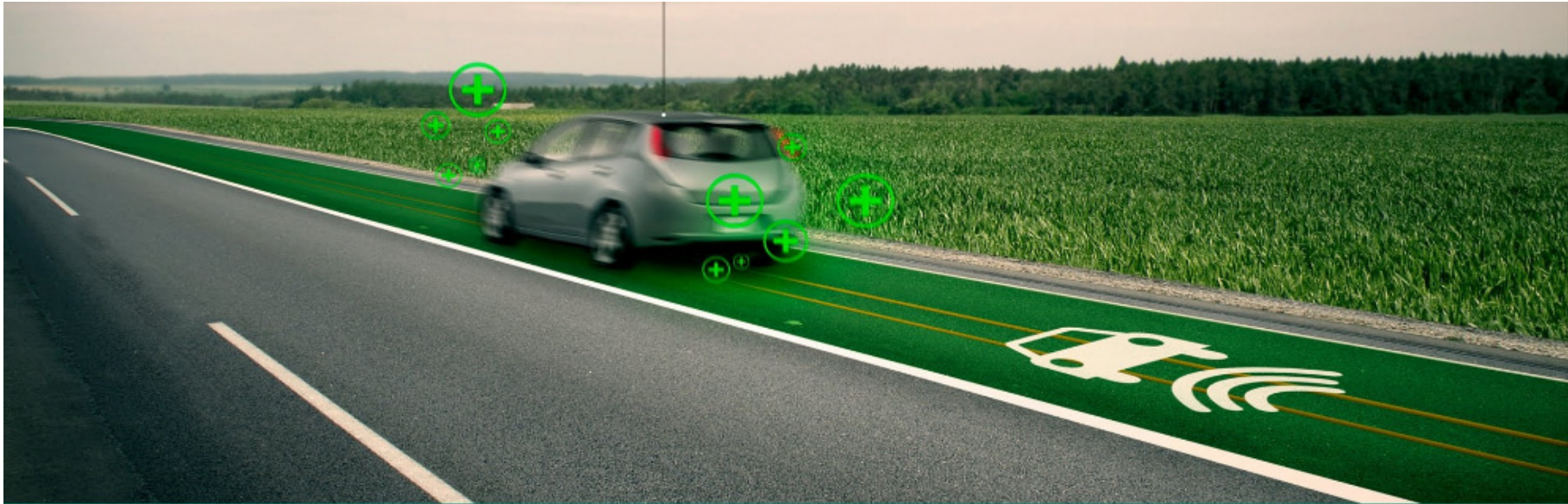






**MAKING ROAD**

# Smart Roads



**FUTURISTIC  
SMART ROADS**

# What might change?

[illegible]

# Lines and signs

- Improve quality marking
  - RadarReflecting lines
  - Communicating lines
- Traffic signs
  - Digitalized



# Levels of infrastructure preparedness for automation

Level	Name	Adaptive road profile	Digital infrastructure	Road side units	System capability (driving modes)
<b>Human driver monitors the driving environment</b>					
0	No Automation	Not needed	Etc.	Etc.	n/a
1	Driver Assistance	Not needed			Some driving modes
2	Partial Automation	Not needed			Some driving modes
<b>Automated driving system monitors the driving environment</b>					
3	Conditional Automation	Separate lanes			Some driving modes
4	High Automation	Separate lanes			Some driving modes
5	Full Automation	Totally adaptive			All driving modes

# Preliminary conclusions

- For the time being: a separate (digital) I to V infrastructure is needed e.g. secure short range communication with traffic lights and a mobility centre to monitor automated vehicles and to guide them when necessary.
- Redundancy: we will regard dual systems for accurate information on location, distance with respect to other road users, road markings and road signage.
- Tests have to show which minimum redundancy is needed and how secure the systems should be.

# Thank you for your attention



*“Does your car have any idea why  
my car pulled it over?”*