

# AUTONOMOUS CARS

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**DET ER SNART  
FREMTID!**

**FORDELE**

**BEHOV**



# DEFINITIONS AND BACKGROUND



- Links til NHTSA's definitioner på autonom kørsel:
  - Short format: <http://www.greencarcongress.com/2013/05/nhtsa-20130531.html>
  - Details: [http://www.nhtsa.gov/staticfiles/rulemaking/pdf/Automated\\_Vehicles\\_Policy.pdf](http://www.nhtsa.gov/staticfiles/rulemaking/pdf/Automated_Vehicles_Policy.pdf)



- Andre relevante links:
  - Ny OECD rapport om hvordan autonomous driving kommer til at påvirke infrastrukturen:
    - *"[...] shared fleet of self-driving vehicles could completely obviate the need for traditional public transport"*
    - *Looks at car fleet size, travel volume, parking, peak hours vs. average, and more. 33 pages.*
  - [http://www.internationaltransportforum.org/Pub/pdf/15CPB\\_Self-drivingcars.pdf?utm\\_campaign=cmp\\_417691&utm\\_medium=email&utm\\_source=getanewsletter](http://www.internationaltransportforum.org/Pub/pdf/15CPB_Self-drivingcars.pdf?utm_campaign=cmp_417691&utm_medium=email&utm_source=getanewsletter)
  - Futuristic view on robocars: <http://www.templetons.com/brad/robocars/>

# AUTOMATED DRIVING LEVEL DEFINITIONS



NHTSA: "The major distinction between level 2 and level 3 is that at level 3, the vehicle is designed so that the driver is not expected to constantly monitor the roadway while driving."

Note: (a) and (b) in L4 not part of NHTSA definition.

Liability crossing

NHTSA	0	1	2	3	4 (a)	4 (b)
"Popular" definition	No automated functions	Automation of one primary control function (brake, steering, throttle)	Automation of two or more primary control functions.	Limited self-driving: in some situations. Car has fail-safe mode.	Full self-driving or human driving	Full self-driving only (no human driving)
Role of the Driver	Full control and attention	Full control and attention	<b>Always ready to take over instantly.</b> (but may be only monitoring the car in some well defined scenarios).	<b>Ready to take over with comfortable notice.</b> No attention needed in well defined scenarios.	Control driving <i>if</i> desired	Control not possible
Driver controls speed	Yes	Sometimes not	Sometimes not	When planned	If desired	No
Driver steers	Yes	Yes	Sometimes not	When planned	If desired	No
Driver with license present	Yes	Yes	Yes	Yes	Yes	No
Examples	May use driver assist warning systems Lane Departure Warning	Adaptive Cruise Control or Lane Keeping Aid	Queue assist: (ACC and LKA)	Drive Me (Volvo)	Google Car	

Transition from L3 to L2 **initiated by system.**  
If driver does not respond (or accept), system has to have a safe fallback solution.

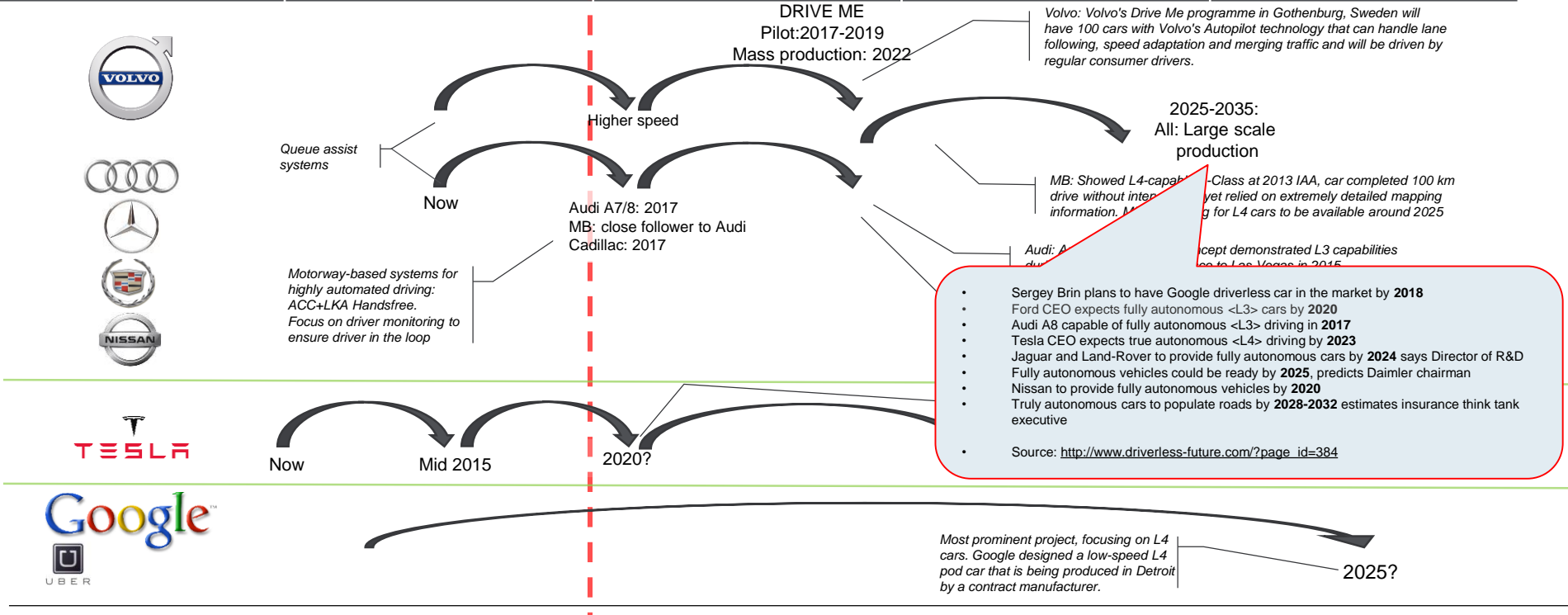


Transition from L2 to L3 **initiated by driver.**  
System accepts transition if required conditions are met.

# DIFFERENT STRATEGIES AND HEADINGS



Automation level	2: Automation of two or more primary control functions	3: Limited self-driving in some situations	4: Full self-driving or human driving	4: Full self-driving only (no human driving)
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# FORUDSÆTNINGER

## Infrastruktur

- Kameralæsbare striber !!!!
- Læsbare og ens skilte (internationalt)
- Bløde sving
- Andre maskinlæsbare sribetyper

## Teknologier i køretøjet

- Bedre kameraer og software
- HD kort
- High precision GPS
- Fremdrift – El & Hybrid
- C2C
- C2I

## Teknologier udenfor køretøjet

- C2I
- Transport & traffic control centers
- Big Data

## Deleøkonomi

- Bred acceptans af delebil-ideen
- Bred acceptans af fællestransport

## Lovgivning & regler

- Accept af L3 og L4
- Ansvarsplacering
- Fælles internationale regler
- Regler for "death algorithms"

## Incentamenter for brugeren

- Tidsbesparelser (separate vognbaner)
- Økonomi (afgifter)

# POTENTIELLE EFFEKTER

## Lavere pladsbehov?

- Meget mindre behov for p-pladser
- I starten øget distance mellem kørende biler. Ved C2C meget lavere.
- Bredde på kørebaner

## Mindre trængsel?

- Mere plads på vejene
- Hurtigere fremkomst (intelligent styring & bedre plads)

## Lavere forurening

- Lavere km/l (AD biler kører mere økonomisk + bedre planlægning)
- Samlet antal kørte km kan stige (til gengæld nul busser; OECD)
- Samlet transportbehov kan stige (folk uden kørekort kan nu køre selv)
- Elektrificering tager over (fordi range anxiety kan adresseres)
- Gn-snit størrelse på biler reduceres (size-on-demand)

## Færre Uheld

- Vil formentligt falde drastisk på "AD-only" veje.
- Usikkert i mix-zoner.
- Færre alvorlige uheld

## Lavere anlægsudgifter til infrastruktur

- Lavere pladsbehov => færre veje
- Bedre kontrol af peak-load => lavere udgifter på f.eks. broer
- Kontrol af hvor tunge køretøjer kører => ikke alle veje skal kunne klare det

## Beskæftigelse

- Chaufførbranchen kommer under kraftigt pres
- Lavere transportpriser

## Godstransport


- Langdistancetransport => AD lastbiler

# HVORDAN KUNNE DANMARK FÅ EN SPECIEL GEVINST?



- Vi bør **ikke** satse på at drive den teknologiske udvikling på AD:
  - Når bilfabrikker udvikler og tester AD teknologi skal bilerne "hjem" til udviklingscenteret hver dag => geografisk nærhed er en nødvendighed.
- Det er helt nyt territorie på globalt plan
  - Der er behov for forskning i hvad AD betyder for et samfund i praksis.
- Kunne DK forske i det og derved *samtidig* høste de positive fordele før andre lande, dvs:
  - De generelle fordele ved AD (forrige side)
  - Potentielt stort overlap til green-tech
    - hybrid/elektriske biler
    - DK har ret avanceret infrastruktur på el-siden
  - Forskning i samfundsmæssige konsekvenser
- *Hvorfor ville Automotive Industrien vælge Danmark:*
  - Trafik-kultur er relativt god (udokumenteret påstand 😊)
  - Lille land => hurtig penetration, hvis det understøttes af myndighederne
  - Generelt høj penetration af high-tech
  - Automotive Industri er også interesseret i link til både green tech og anden infrastruktur
  - Datalovgivning er væsentligt mere lempelig i DK end mange andre lande. Relevant i forbindelse med Big Data
  - Tæt på store spillere i Tyskland og Sverige

*Authors' personal opinion.  
Not official VOLVO policy.*



**THANK YOU  
ANY QUESTIONS?**

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# NEEDS TO LEVERAGE BENEFITS OF AD



	2: Automation of two or more primary control functions	3: Limited self-driving in some situations	4: Full self-driving or human driving
Infrastructure	Camera-readable line markers, all-weather conditions, preferably on both lane sides. Good signs. Not too tight corners.	← +: e.g. magnetic stripes to increase accuracy	
Technologies	Available today + better cameras / software	Improved accuracy: • HD Maps • High precision GPS See beyond own sensors: C2C, C2I	Transport & traffic control center (both for traffic lights and for vehicles)
Legislation		Clarified liability. Rules to allow L3 (driver out of loop) Internationally aligned traffic rules	Rules to allow L4 vehicles
Desirability for the user	Incentivize L2 technology via tax	Incentivize L3 technology via tax & time (e.g. allow emergency lane for L3)	←
Potential societal benefits	Less accidents Less pollution (smoother driving)	← + Road space efficiency (width & length) + Less pollution	← + Shared Autonomy: more efficient transportation (public/private/mix) + More efficient goods transport + Less pollution + reduced need for parking spaces + Max load controllable => cheaper/lighter infrastructure (e.g. bridges, roads)