Autonomous Driving

Impact on Highways

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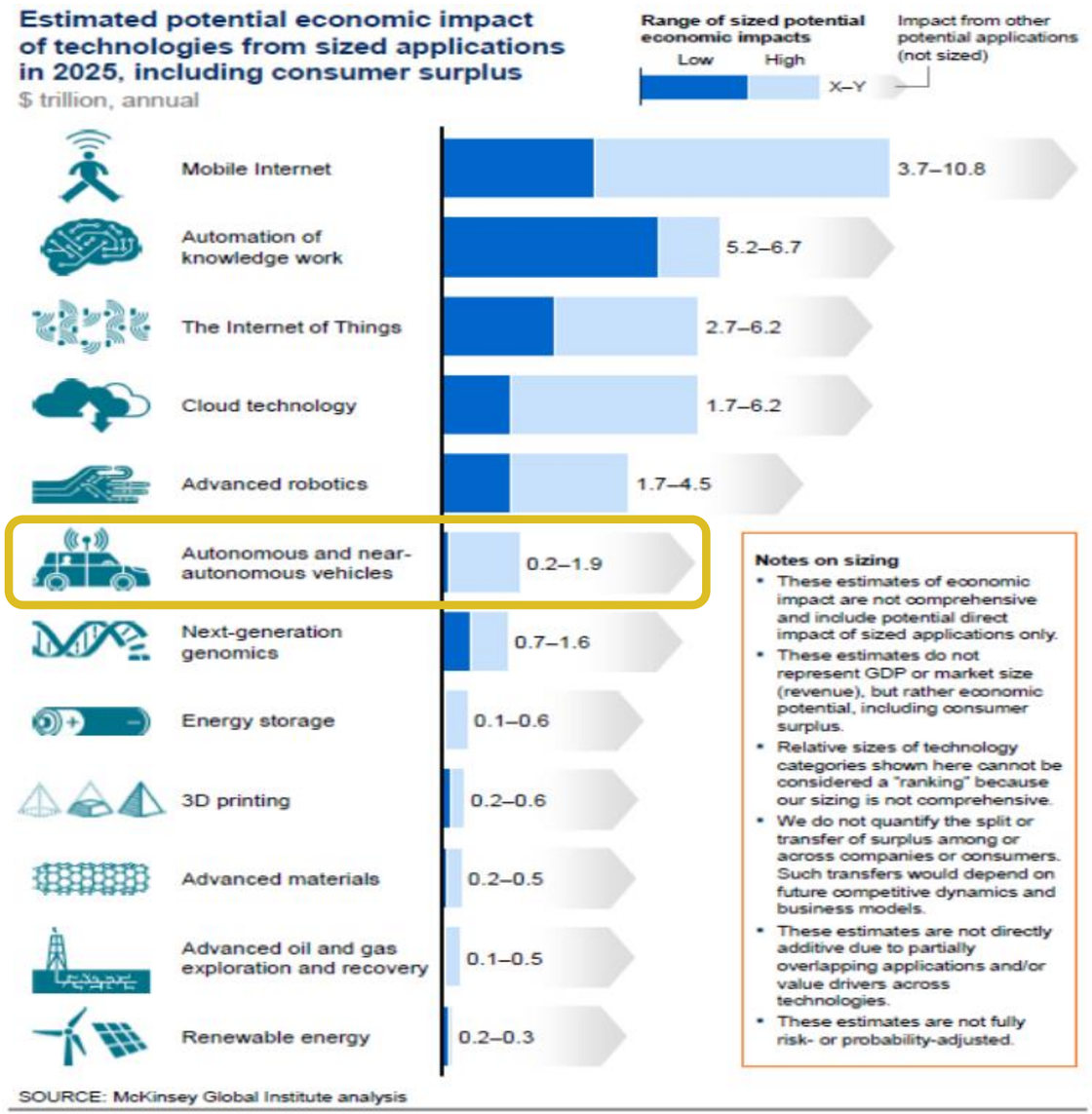
Introduction

- Technological advances will influence how we operate our highways and how we connect with our users
- McKinsey estimates that autonomous driving will be **one of the technologies with more economic impact in the future**
- The challenge is to separate the guesses and the potential from the objective evaluation of its impact in our business
- The discussion about Autonomous driving is usually **focused on technology**. However, it should analyze possible impacts in **driver behavior, travel demand and road capacity**.



Source: ***Disruptive Technologies: Advances that will transform life, business, and the global economy***
McKinsey Global Institute, May 2013

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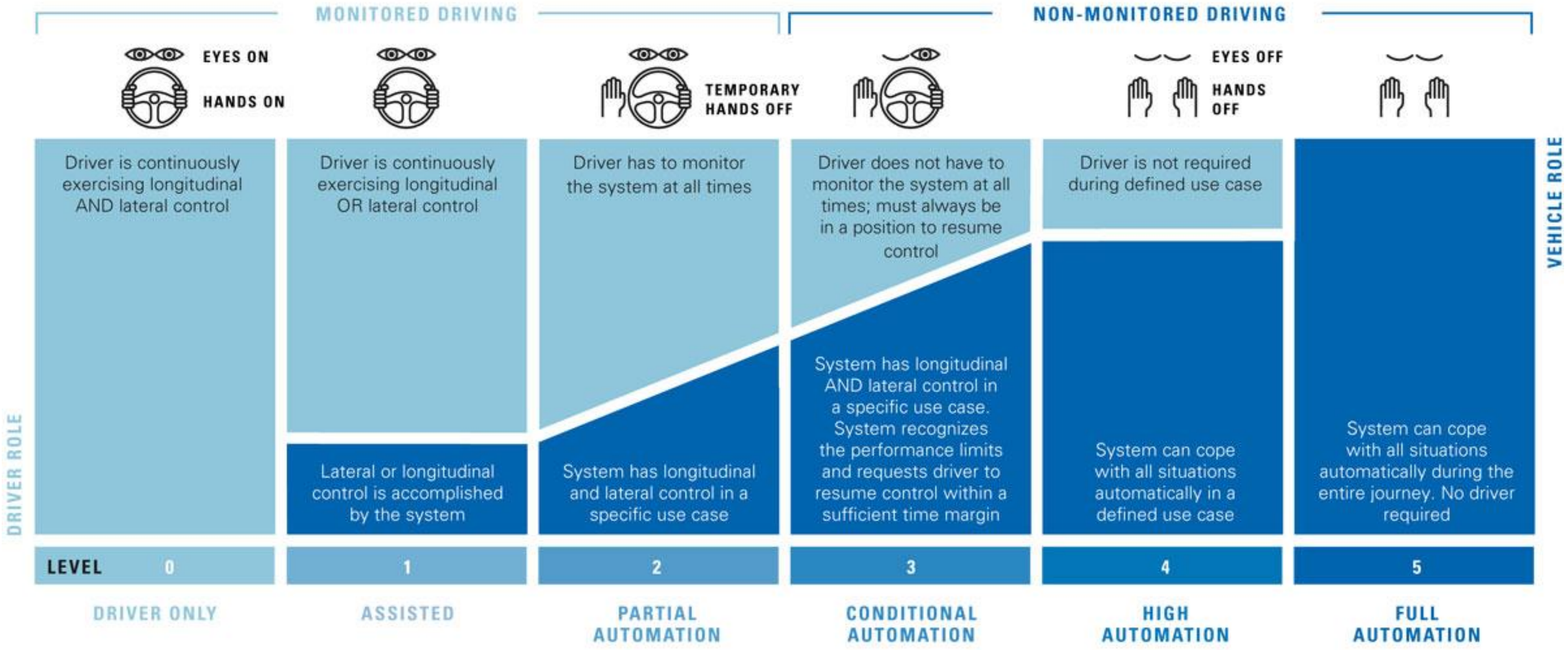
Technological Concepts

- There are 5 commonly accepted levels in Automated Driving



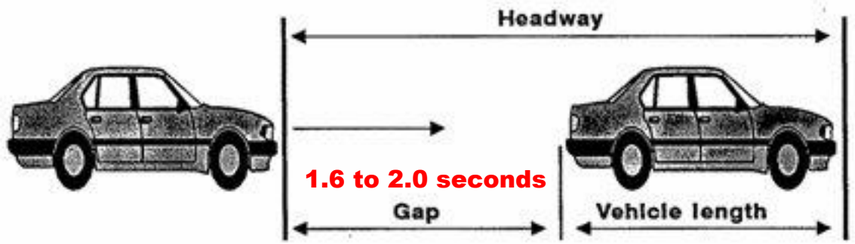
Impacts in Highways Business

Positive Factors

- **Private Vehicle Demand Increase**
  - Increase of the market of potential "drivers" (elderly people, handicapped individuals, teenagers, etc.)
  - Reduced travel time cost of opportunity, it can be used for other activities (work, leisure) and it will allow:
    - Live and work at greater distances (more urban sprawl)
    - Longer or more frequent leisure trips
  - Reduction of other costs due to more efficient fuel use and increase in road safety
  - Use of car for longer trips instead of using a plane or train

Negative Factors

- **Increase of Road capacity**
  - Level 4-5 "driverless" cars could maintain smaller safety distances which would result in almost doubling the capacity of the road if 100% of the vehicles were autonomous



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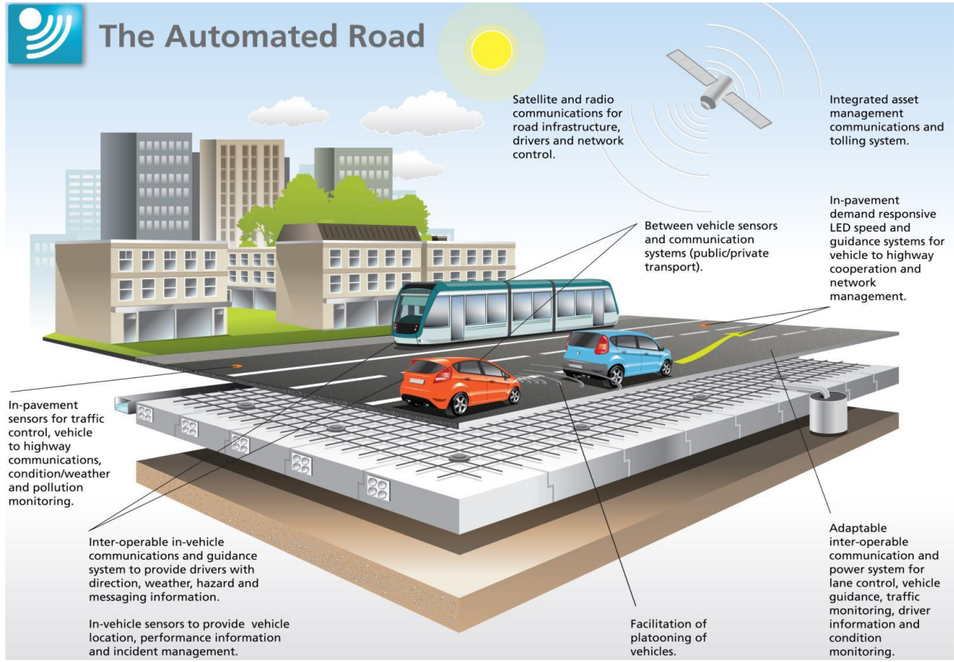
Opportunities

- If technology evolves towards **I2V (Infrastructure to Vehicle)**
  - Equip our highways with technology to be used by the first autonomous vehicles, making them more attractive.
    - It is easier to apply this technology to our roads (dedicated lanes, newly built, with communication infrastructure, etc.) than to other roads of the network
    - It will be easier for a private company that provides a paid service to do this investment than to the public sector, normally with less funds available



- The period of **shared usage of the road between autonomous and traditional vehicles** (50 years) will impact negatively in the capacity of the alternative roads and will be positive for toll highways during most of their concessional period.
  - Autonomous vehicles are programmed to follow the rules. They keep bigger safety distances and travel at slower speeds in the presence of traditional vehicles (Human vs. Machine Factor)

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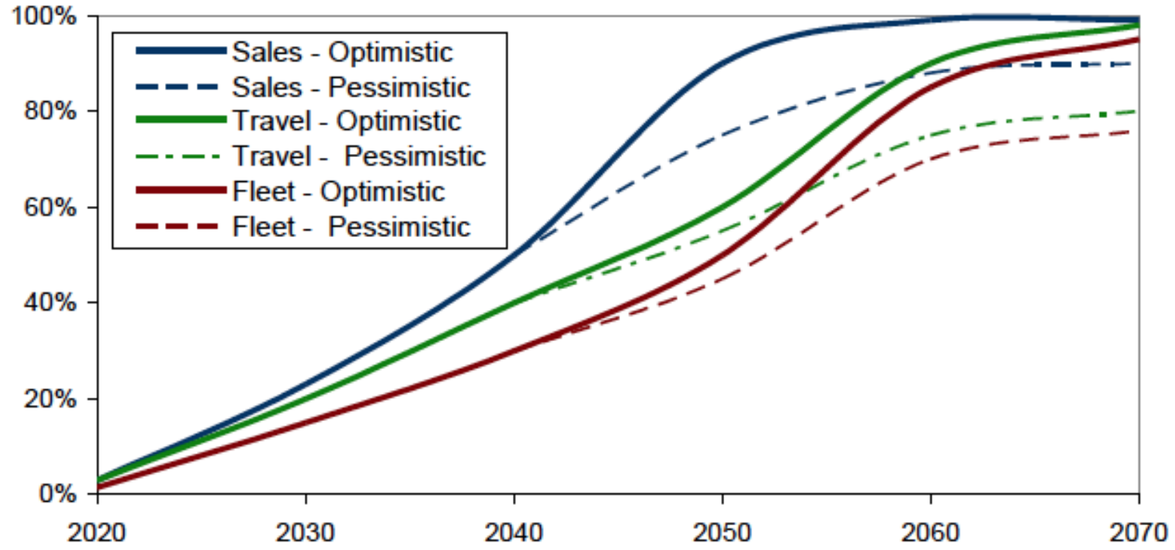
Timeline

- Vehicles with a certain level of automatisms are common nowadays
- Driverless Autonomous Vehicles for certain uses (public and goods transport in dedicated lanes, valet parking, etc.) are estimated to be available in 2025
- Experts say that a high penetration of level 5 autonomous vehicles are several decades away
- Relevant aspects to consider:
  - Technological Aspects
  - Safety elements and shared use with traditional vehicles
  - Development of legislation
  - Legal treatment of the responsibilities in case of an accident
  - Insurance

Figure 1 **Autonomous Vehicle Sales, Fleet and Travel Projections**



If autonomous vehicle implementation follows the patterns of other vehicle technologies it will take one to three decades to dominate vehicle sales, plus one or two more decades to dominate vehicle travel, and even at market saturation it is possible that a significant portion of vehicles and vehicle travel will continue to be self-driven, indicated by the dashed lines.

Source: Autonomous Vehicle Implementation Predictions Victoria Transport Policy Institute, 24 August 2015

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Conclusion

The impact of autonomous driving in Highway Business is a balance of positive (demand increase) and negative factors (road capacity increase), that are difficult to estimate nowadays and that will materialize in the long term

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