Global Auto & Truck Markets

Autonomous Driving and the Future of Travel

October 31, 2017

Today’s Agenda

• Introduction – why now?
• Availability – when will self-driving cars arrive?
• Adoption – how quickly will this proliferate?
• Implications – what might this mean for future cities and living?
Introduction

- **Why now?**
- U.S. traffic fatalities have increased two-consecutive years
- Technology in development today has the potential to virtually eliminate traffic accidents

Source: NHTSA, Mobileye

Introduction

- **Why now?**
- Even the intermediate step of offering active safety and highly automated driving offers immense societal benefits

Source: IIHS

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Availability

- When will this arrive?
- Automakers have a clear product development roadmap of offering higher levels of autonomy
- Until this year, safety systems required constant human monitoring of the driving environment
- The all-new Audi A8 is the first vehicle where human involvement is not a constant requirement (depending on the specific driving task)

Availability

- SAE defines five levels of automated driving

  - Full automation: no human controls
    - Available: 2025+
  - High automation: the driver is just a passenger (in a given environment)
    - Available: 2021
  - Conditional automation: driver responds when requested
    - Available: today

Source: SAE

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Adoption

- The “core” hardware for automated driving is available…but costly
  - Tier 1 suppliers estimate $5,000+ of system cost to the OEM to achieve Level 4 capability in 2020

Adoption

- Significant strides to reduce costs already being achieved
  - Driver assist has already achieved optimal price for mass adoption in most regions of the world

Source: Baird Research, Company reports
Adoption

- Technology adoption follows an S-Curve
  - Without regulation, technologies proliferate over 4-5 design cycles or 20-25 years
  - With mandates, adoption can be much quicker (~10 years)
  - Assuming “normal” adoption curves, Level 4/5 vehicles proliferate by 2040-2050

Source: Baird Research, Ward’s Automotive

Implications

- **Baird’s view**: people will continue to own cars, whether driven or autonomous
- **Autonomous shared mobility disrupts**… shared mobility

Source: DOT, KBB, Baird estimates

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Implications

• Typical vehicle use case (i.e., commuting) prevents greater reductions in fleet density
  – Vehicles are utilized at the same time each day

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<tr>
<td>Driving Alone</td>
<td>83.514</td>
<td>91.323</td>
<td>105.046</td>
<td>109.962</td>
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<td>Carpool</td>
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<td>Total Automobiles Engaged in Commuting</td>
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<td>119.898</td>
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Source: US Census Bureau, FHWA

• Greatest changes to travel likely to come in high density areas…
  the very environment Level 4 vehicles are first being deployed

Source: Alphabet, IEEE
Implications

- **Case Study**: “Go Boston 2030”
- Commute (one-way): 29 minutes
- Primary transport: Driving alone (39%)
  Public transit (34%)
  Walk/bike (20%)
  Carpool (6%)
- Trips ending in Boston: 395,300
- Accidents: 200+ per year

Source: City of Boston, Central Transportation Planning Staff

Benefits

- **Productivity** (1.2B hrs of driving saved)
- **Traffic efficiency** (30% reduction in time)
- **Traffic density** (10-30% fewer vehicles)
- **CO2 Emissions** (down ~70%)
- **Parking** (40-50% fewer spaces)
- **Safety** (90% fewer accidents)

Source: BCG
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