



TNO innovation for life

Mobility after the car era

Future of Mobility, TUE
Eindhoven, 11 November 2014

Arie Bleijenberg





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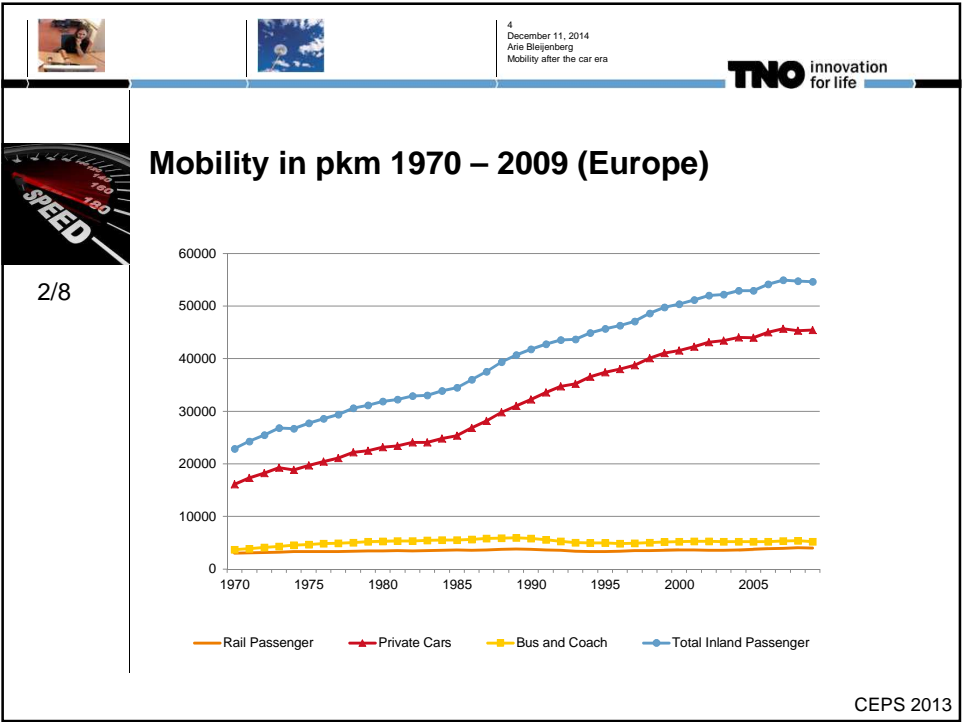
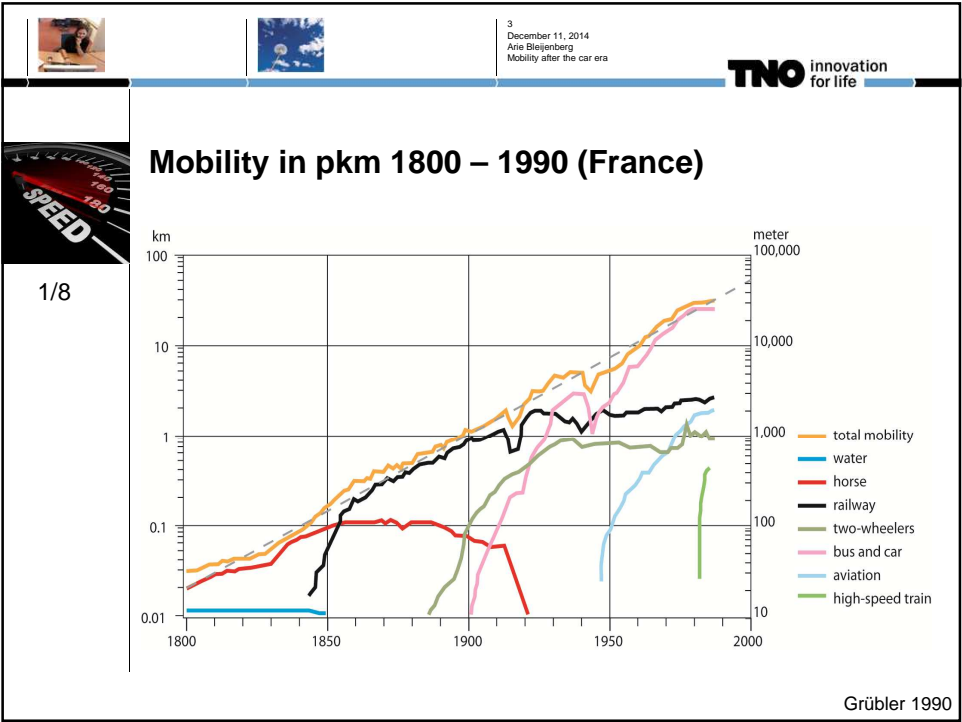
Future of Mobility

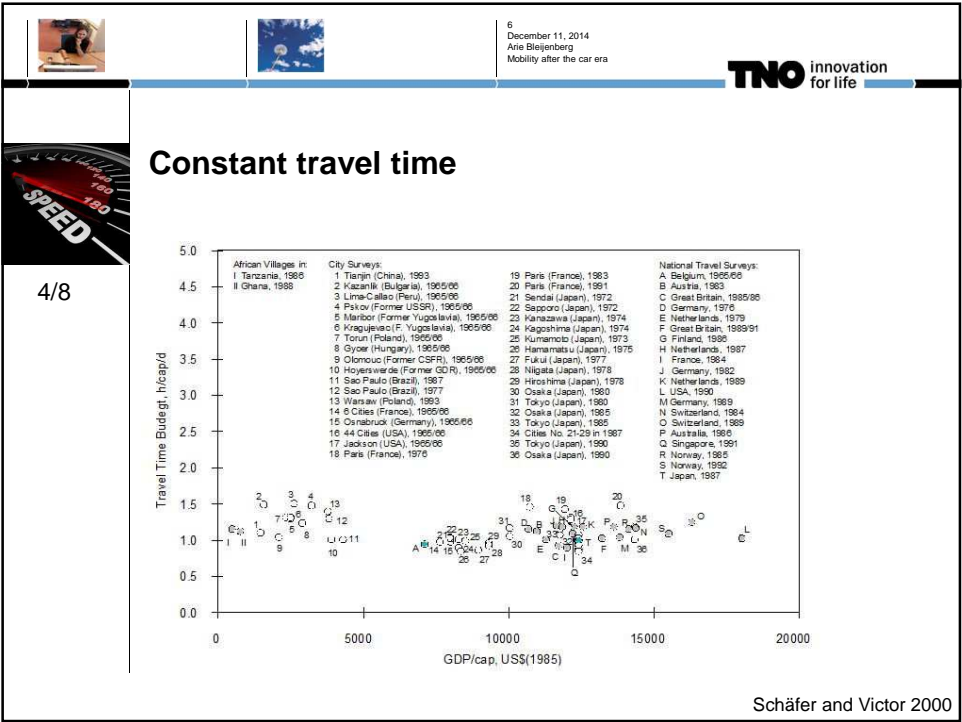
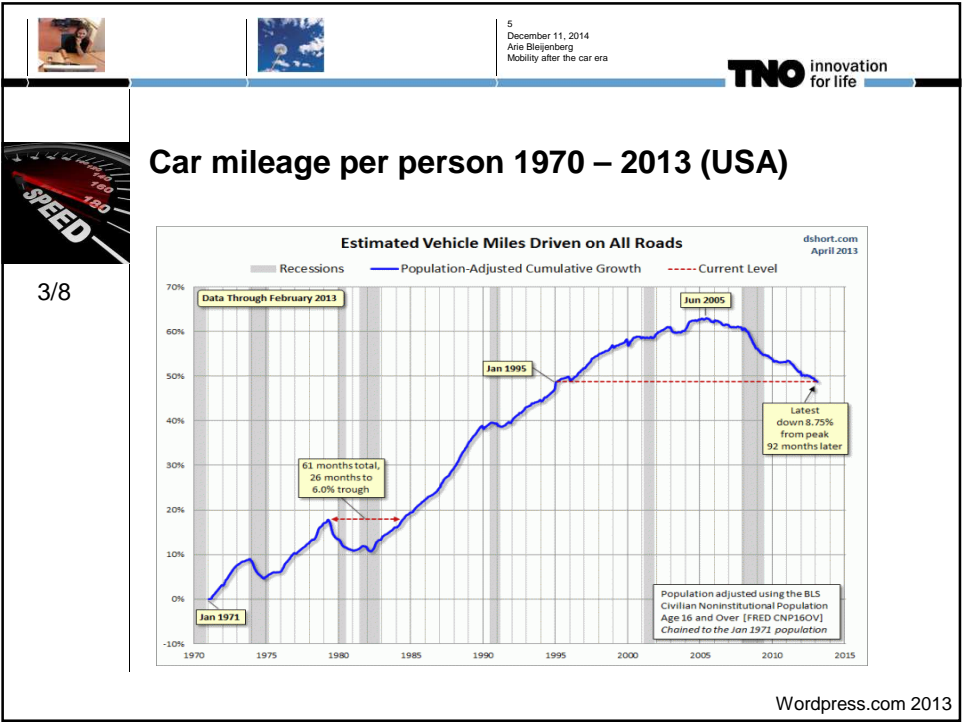
Approach: driving forces, long term, facts & figures



| | slides |
|------------------------|--------|
| › Speed | 8 |
| › Urbanization | 7 |
| › Mobility in 2050 | 1 |
| › Freight transport | 5 |
| › Sustainable mobility | 6 |
| › Transport technology | 2 |
| › Conclusions | 1 |











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Explaining growth in passenger travel


Mobility [pkm/day]

- ▬ Population [P]
- ✕ Average travel speed [km/h]
- ✕ Travel time ~ 1,1 [h/day]

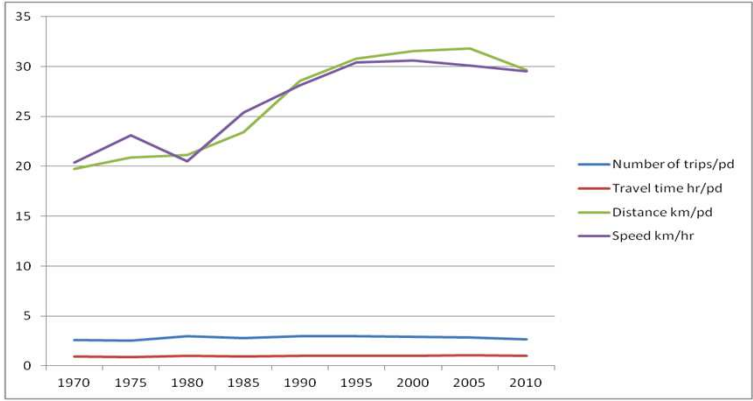
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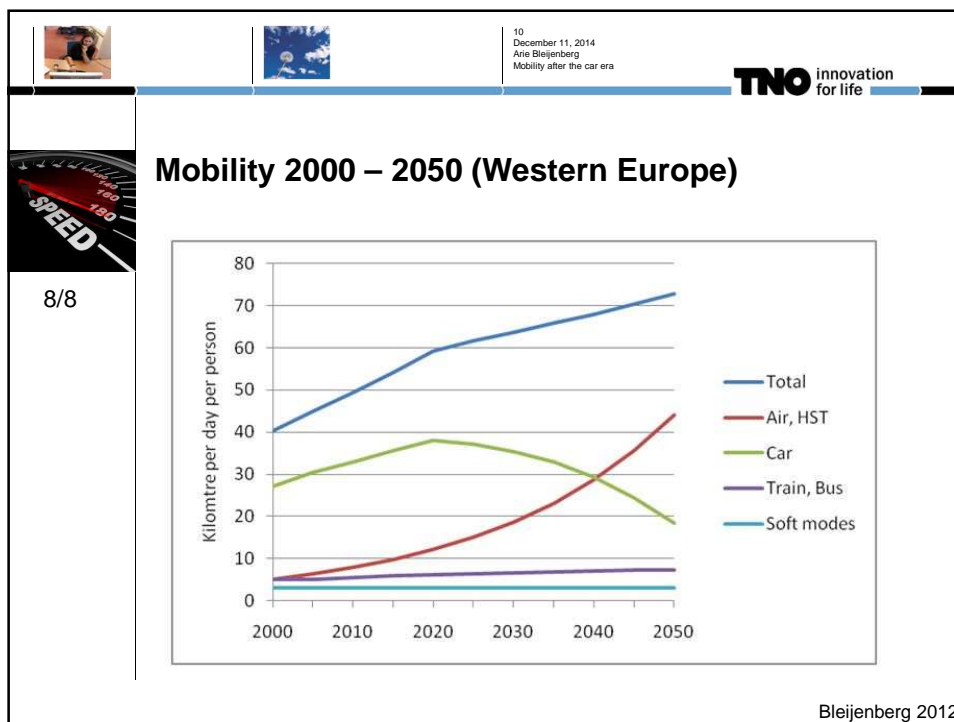
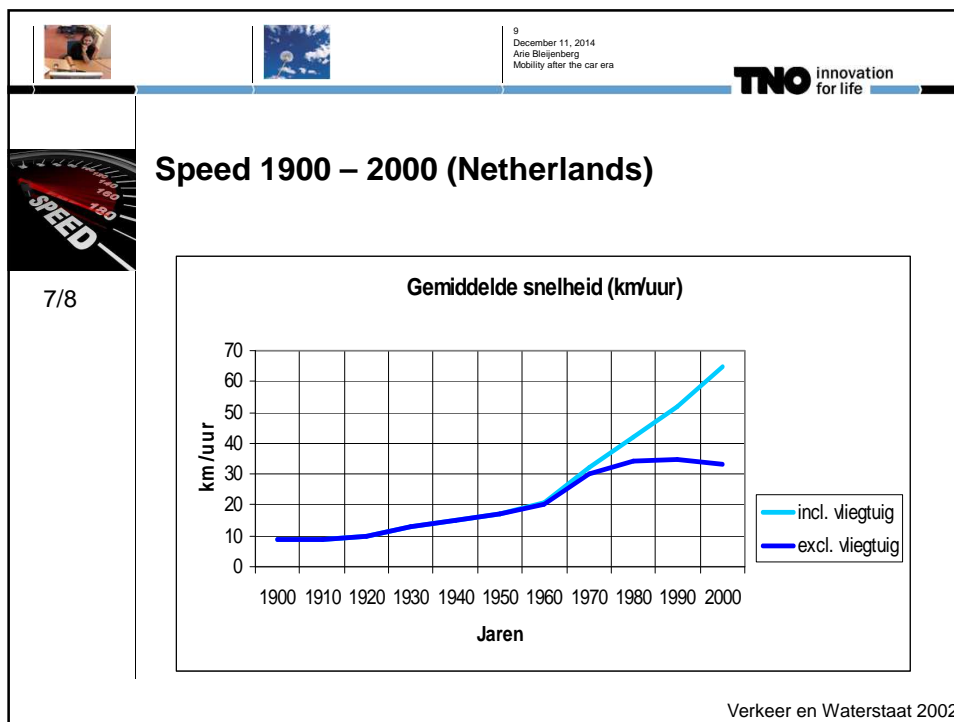
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Constant travel time 1970 – 2010 (UK)



| Year | Number of trips/pd | Travel time hr/pd | Distance km/pd | Speed km/hr |
|------|--------------------|-------------------|----------------|-------------|
| 1970 | 2.5 | 1.0 | 20 | 20 |
| 1975 | 2.5 | 1.0 | 21 | 23 |
| 1980 | 2.5 | 1.0 | 21 | 21 |
| 1985 | 2.5 | 1.0 | 24 | 26 |
| 1990 | 2.5 | 1.0 | 28 | 28 |
| 1995 | 2.5 | 1.0 | 31 | 31 |
| 2000 | 2.5 | 1.0 | 32 | 31 |
| 2005 | 2.5 | 1.0 | 32 | 30 |
| 2010 | 2.5 | 1.0 | 30 | 30 |

Department for Transport






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Accessibility counts: economic and social

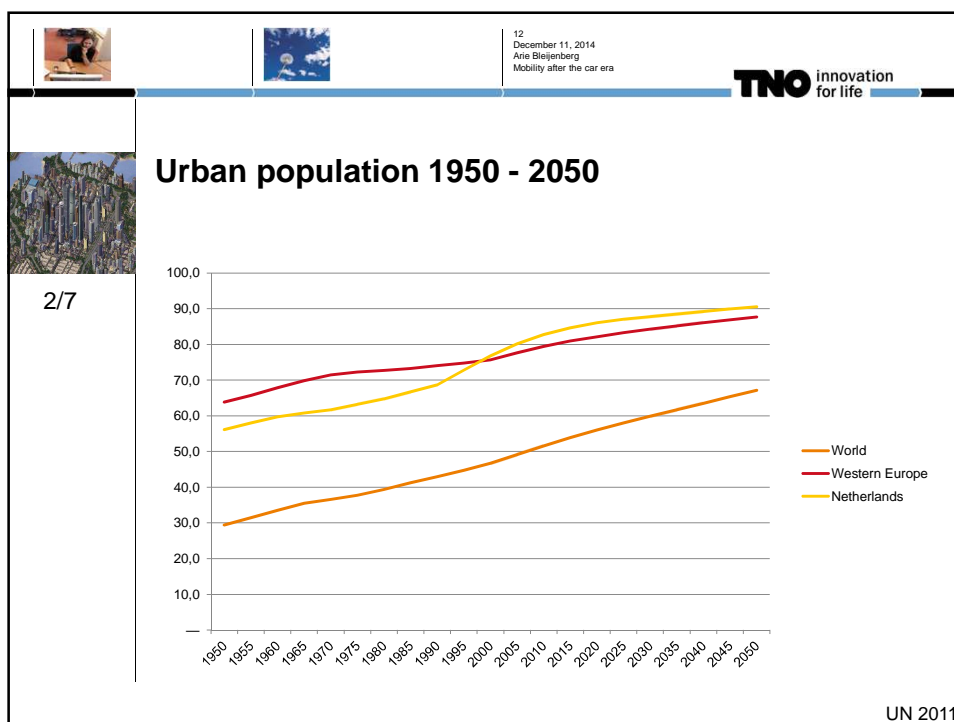
Accessibility



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Speed

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Distance







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Urbanisation and economy







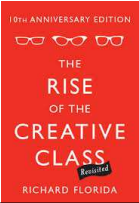
Sharing

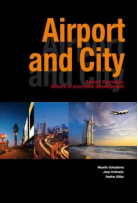
Matching

Learning


Duranton and Puga 2004
















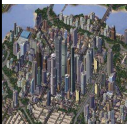
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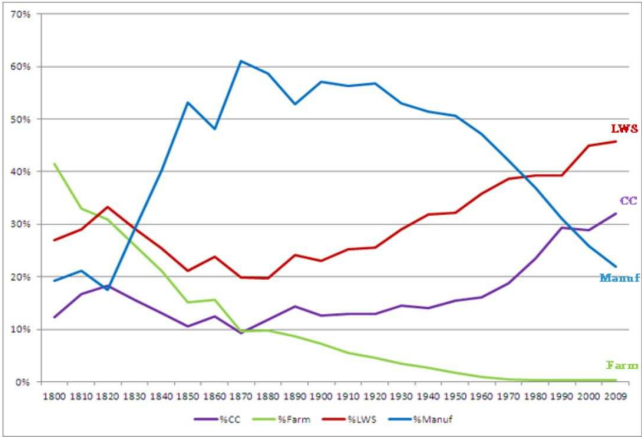
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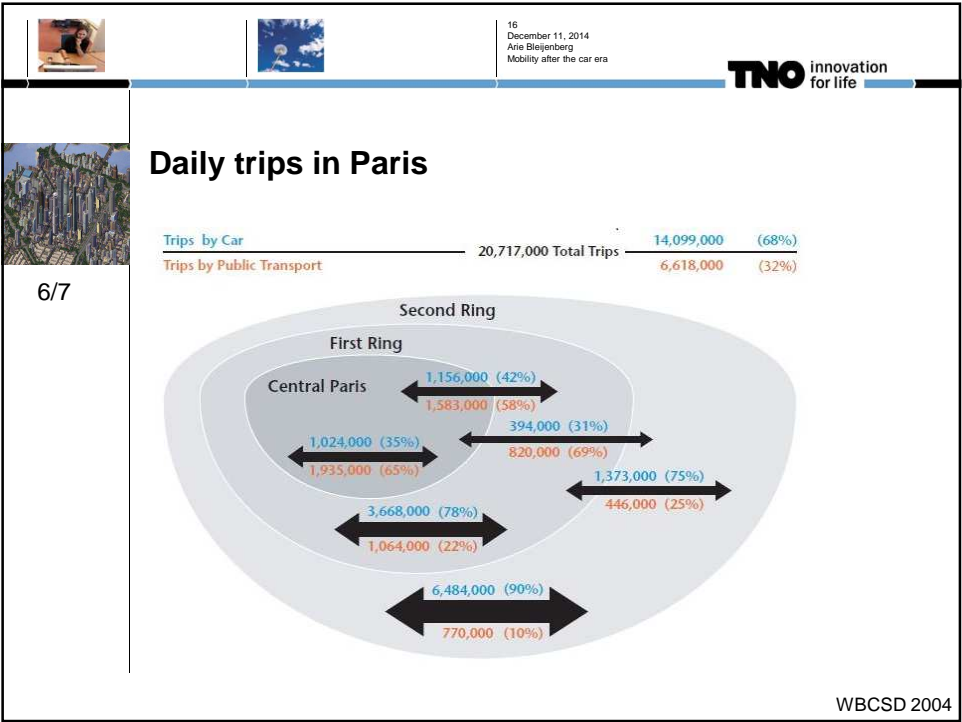
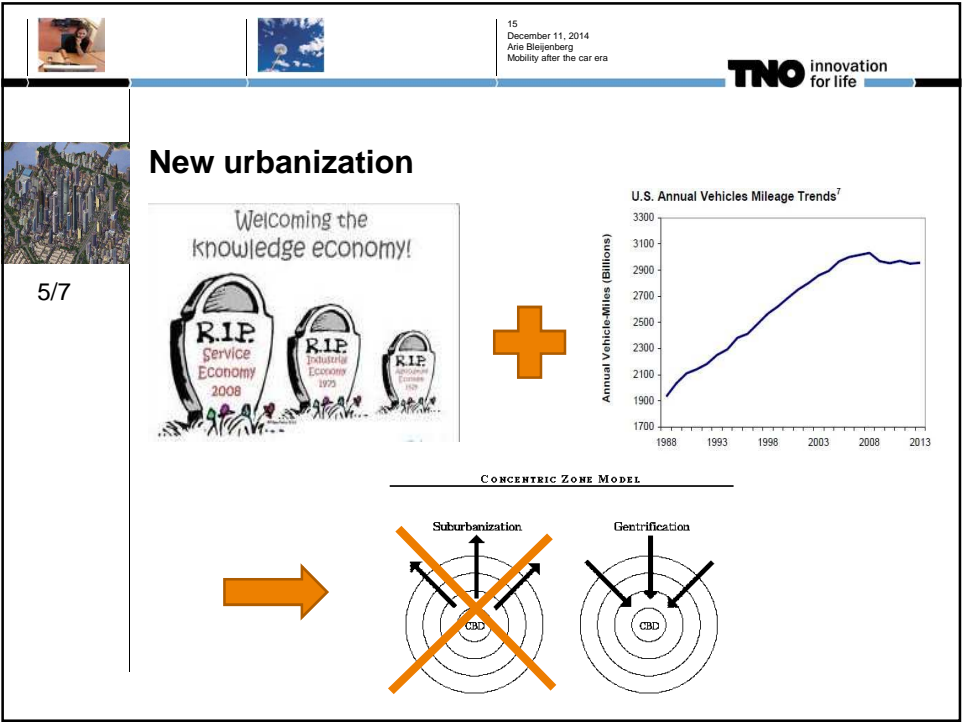
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Rise of the knowledge and creative economy




Florida 2014


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Urbanization determines mobility (Netherlands)


| | Most urban | Least urban |
|--|-------------|-------------|
| Average trip distance | 10 km | 12 km |
| Average commuting distance | 17 km | 20 km |
| Distance to hospital, station, theatre | 2 – 3 km | 9 km |
| Average speed | 24 km/h | 33 km/h |
| Average speed car | 39 km/h | 45 km/h |
| Average travel time ppd | 1,1 h | 1,0 h |
| Car trips | 36% | 55% |
| Public transport trips | 10% | 2% |
| Walking and cycling | 53% | 40% |
| Total kilometres ppd | 26 km | 32 km |
| Car kilometres ppd | 16 km - 40% | 26 km |

CBS 2014





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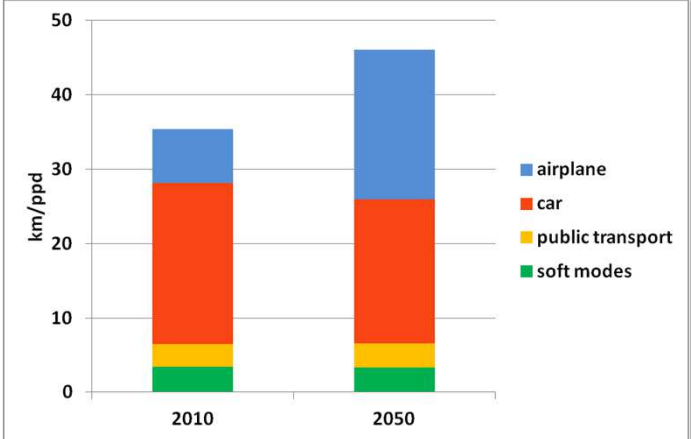




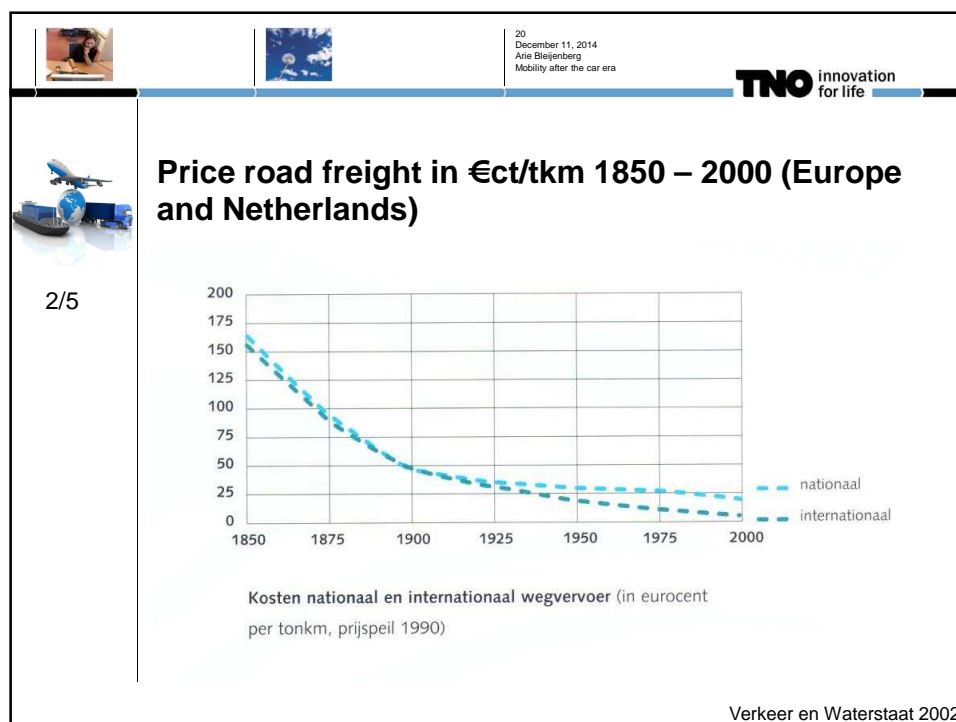
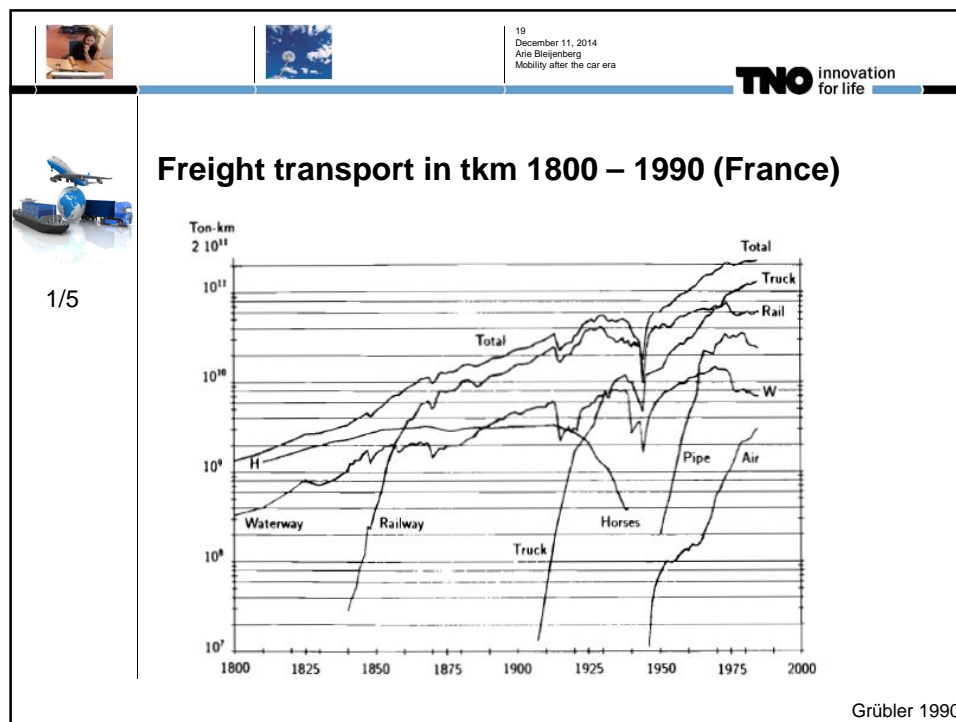
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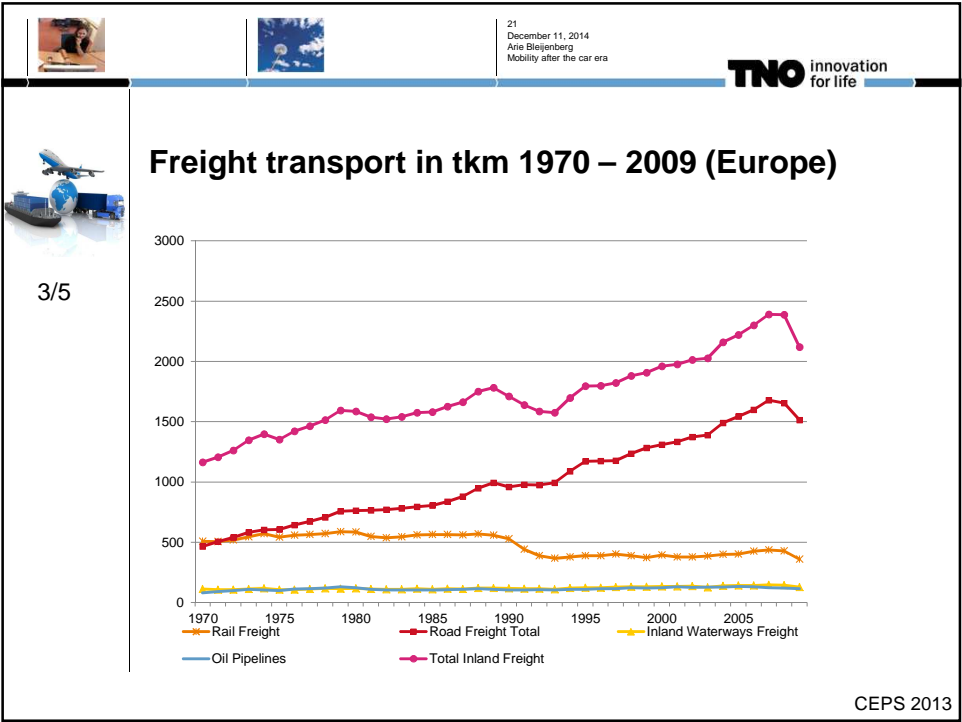




Mobility in 2010 – 2050 (Western Europe)



| Mode | 2010 (km/ppd) | 2050 (km/ppd) |
|------------------|---------------|---------------|
| airplane | ~7 | ~20 |
| car | ~21 | ~19 |
| public transport | ~3 | ~3 |
| soft modes | ~3 | ~3 |
| Total | ~35 | ~46 |








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Explaining growth in freight transport

| | Impact | Change |
|-----------------------------------|--------|--------|
| Economic value (GDP) | + | - |
| Physical economy (weight, volume) | ++ | -- |
| Liberalisation, globalisation | +++ | -- |
| Reduction transport costs | +++ | -- |
| Range of consumer goods | ++ | - |
| Comparative advantages | ++ | - |
| Freight transport growth | | -- |

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Logistics sprawl and city logistics

Atlanta, Georgia Metropolitan Area by Zip Code
NAICS: 483100 Warehousing and Storage

1998
Total Number of Warehousing Establishments: 122
Average Distance from Downtown: 17.8 Miles

2008
Total Number of Warehousing Establishments: 451
Average Distance from Downtown: 20.6 Miles

Legend:
Number of Warehousing Establishments:
1-2
3-4
5-6
7-8
9-10
11-12
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813-814

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CO₂ emissions transport: trend and target (EU)

GHG emissions (million tonnes)

1200
1000
800
600
400
200
0

1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050

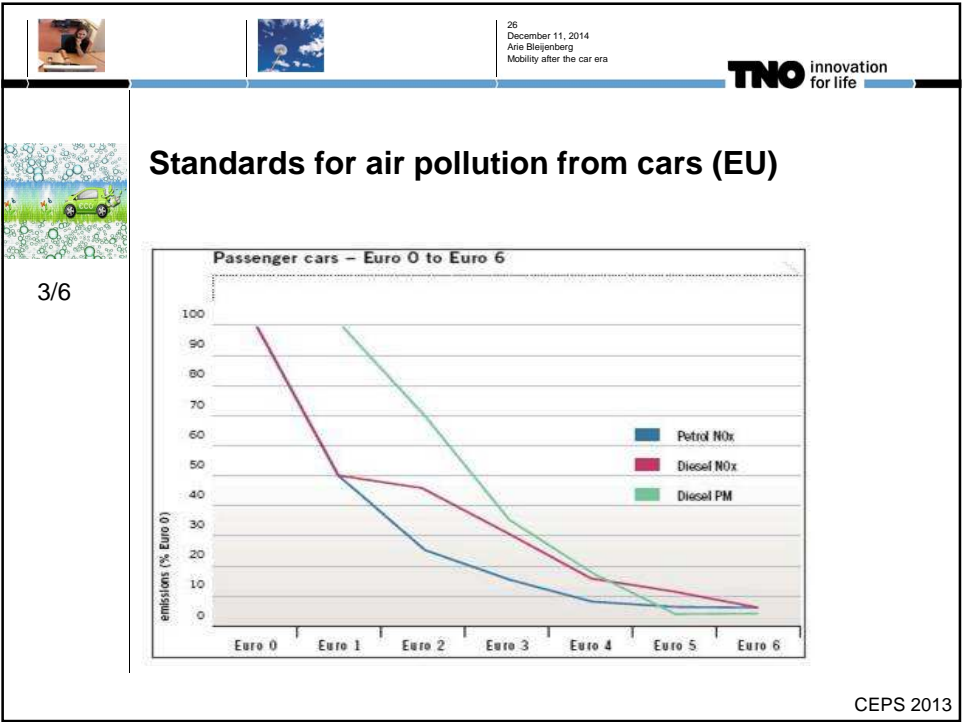
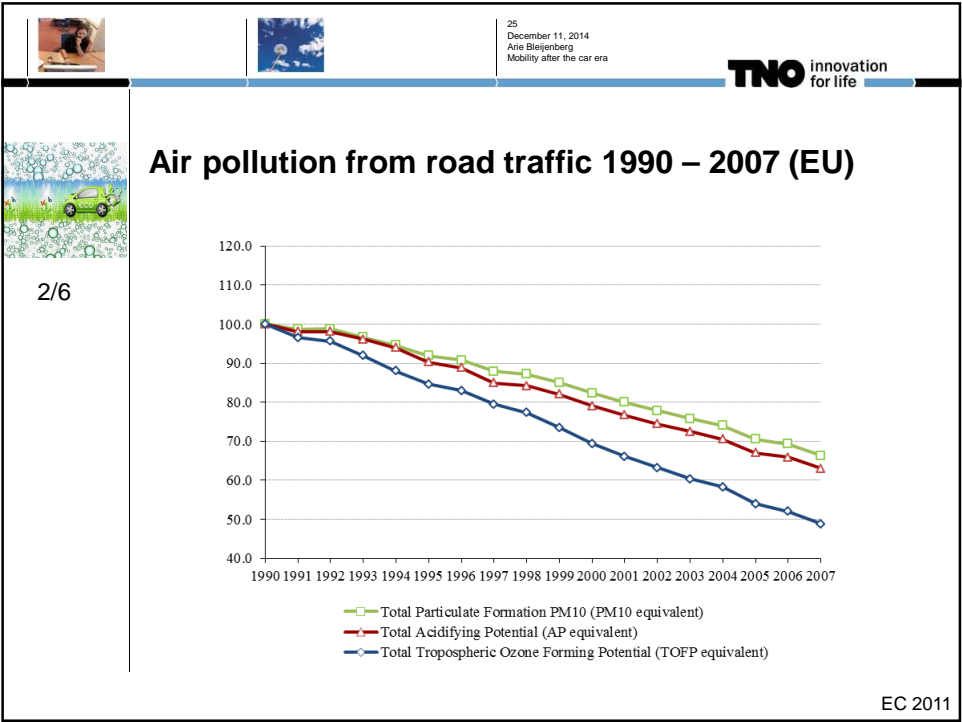
— Transport including international aviation — International maritime transport

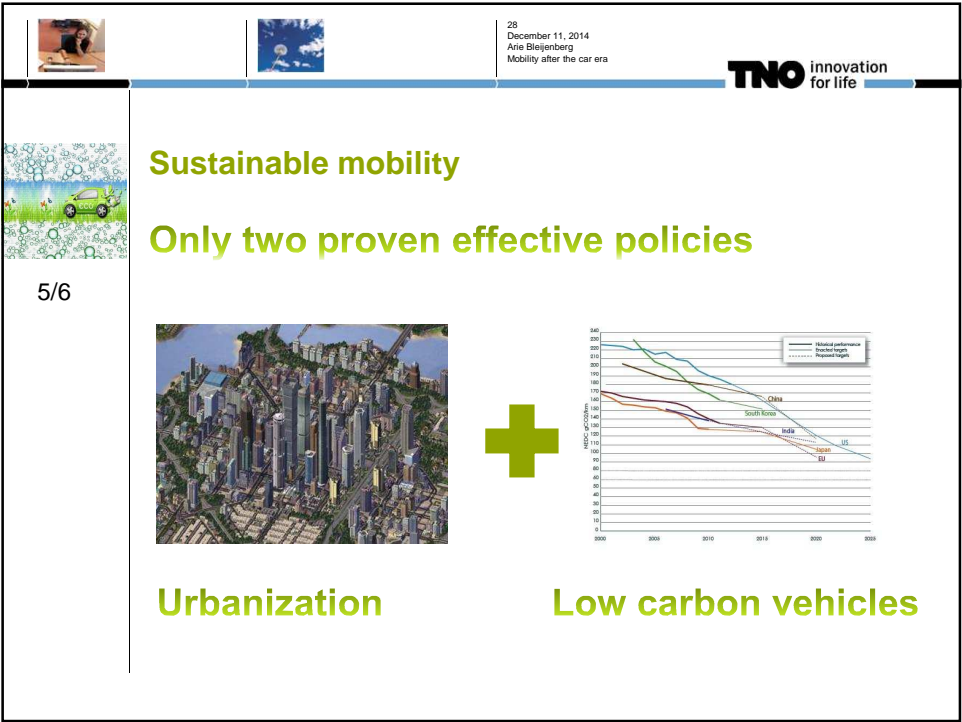
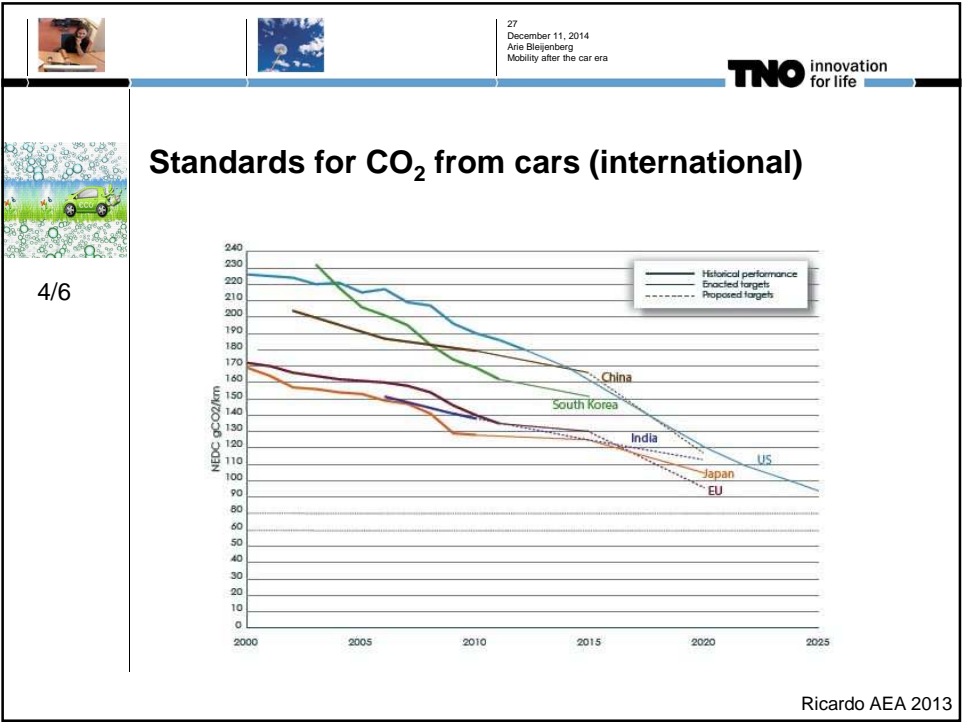
2030 target: 20 % transport GHG reduction compared to 2008

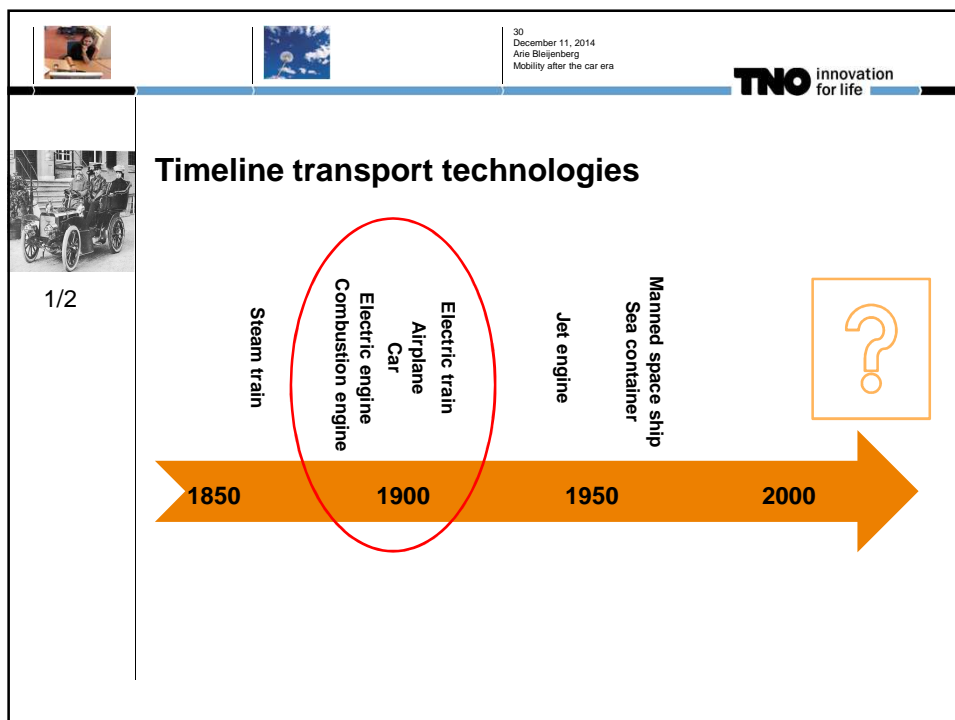
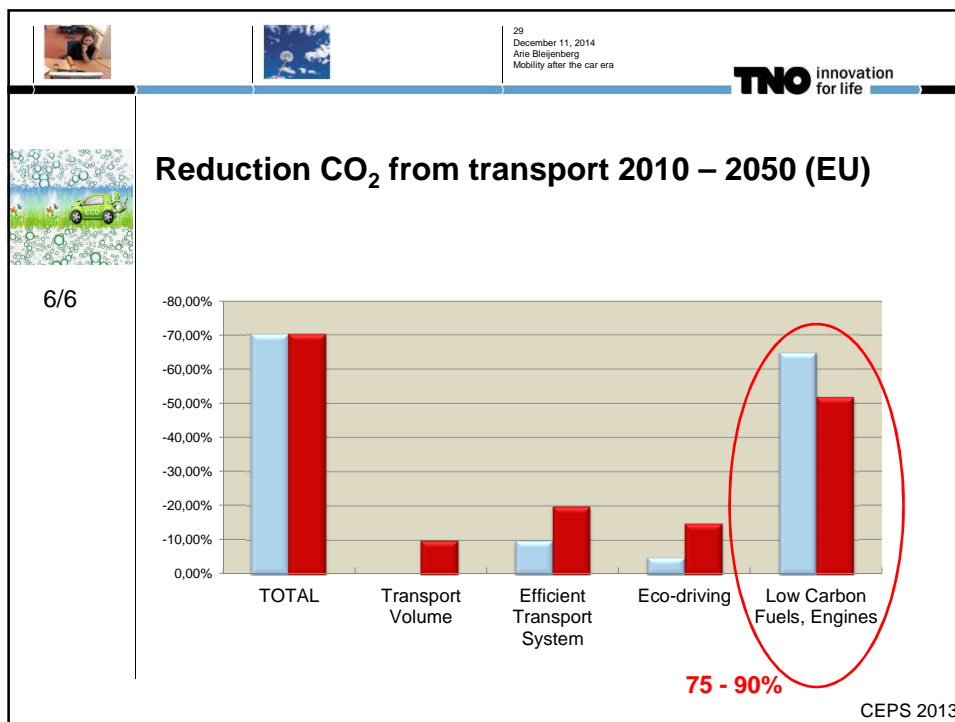
2050 target: 60 % transport GHG reduction compared to 1990



2050 target: 40 % maritime GHG reduction compared to 2005

| Year | Transport including international aviation | International maritime transport |
|------|--|----------------------------------|
| 1990 | 850 | 100 |
| 1995 | 950 | 100 |
| 2000 | 1050 | 120 |
| 2005 | 1150 | 150 |
| 2010 | 1100 | 150 |
| 2015 | 1050 | 150 |
| 2020 | 1000 | 150 |
| 2025 | 950 | 150 |
| 2030 | 900 | 150 |
| 2035 | 850 | 150 |
| 2040 | 800 | 150 |
| 2045 | 750 | 150 |
| 2050 | 700 | 150 |









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New transport technologies?




Urban travel:
Beat the underground!

Long distance travel:
Beat the airplane!





Or beat the car in door-to-door speed!
And the truck in generalised costs!





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Developments and challenges

- › Aviation becomes dominant transport mode for passenger travel
- › Clean technology for cars, trucks, ships and airplanes
- › New urbanization: knowledge economy and end car growth
- › Urbanization requires improved mass transit, elevators, cycling and walking; car, van and truck continue to play their part.

Uncertainties and challenges

- › Faster urban transport than the underground?
- › Faster long distance travel than aviation?
- › Faster or cheaper than car and truck on medium distances?
- › Impact ICT on travel behaviour?
- › Space ship as future travel mode?



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Thank you for your attention!

**Questions?
Discourse?**

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