XXIV^th World Road Congress Mexico 2011
Mexico City 2011.

Infrastructure needs for road vehicles: Will car ownership outpace road building?

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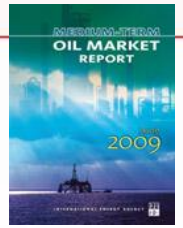
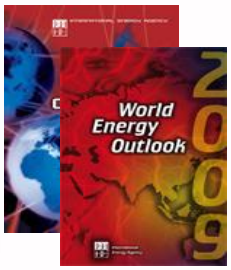
- The IEA activities in relation to transport and energy
- The role of the transport sector in reducing GHG emissions
- Latest trends in road extent worldwide
- Road-km versus Lane-km
- Vehicle sales projections by 2050
- Introducing road occupancy index
- Scenarios on road building needs

IEA, transport and liquid fuels

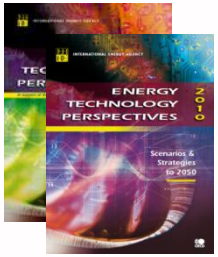
Relevant publications



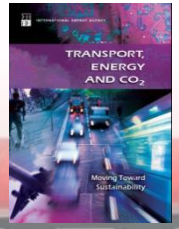
- Medium term Oil Market Report
  Horizon 2015, focus on oil
  Scenarios currently based on two different GDP growth assumptions



- World Energy Outlook (WEO)
  Horizon 2035, all energy sources
  Scenarios depicting different developments on the basis of policy actions
  One underlying assumption for GDP and population growth
  Includes a thorough analysis on the oil supply availability

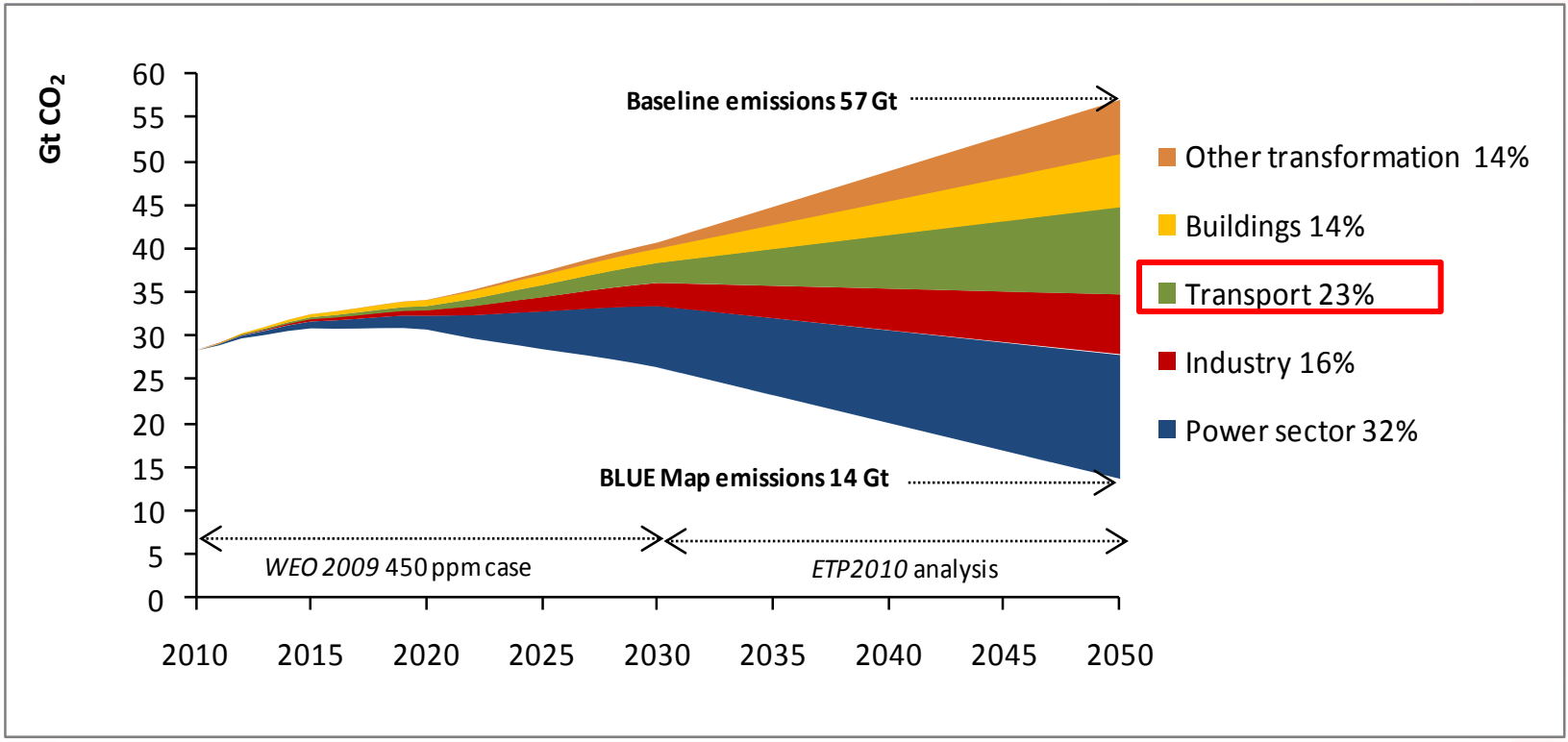


- Energy Technology Perspectives (ETP)
  Horizon 2050, all energy sources
  Scenarios that pay particular attention to the role of technology, especially on the demand side
  One underlying assumption for GDP and population growth



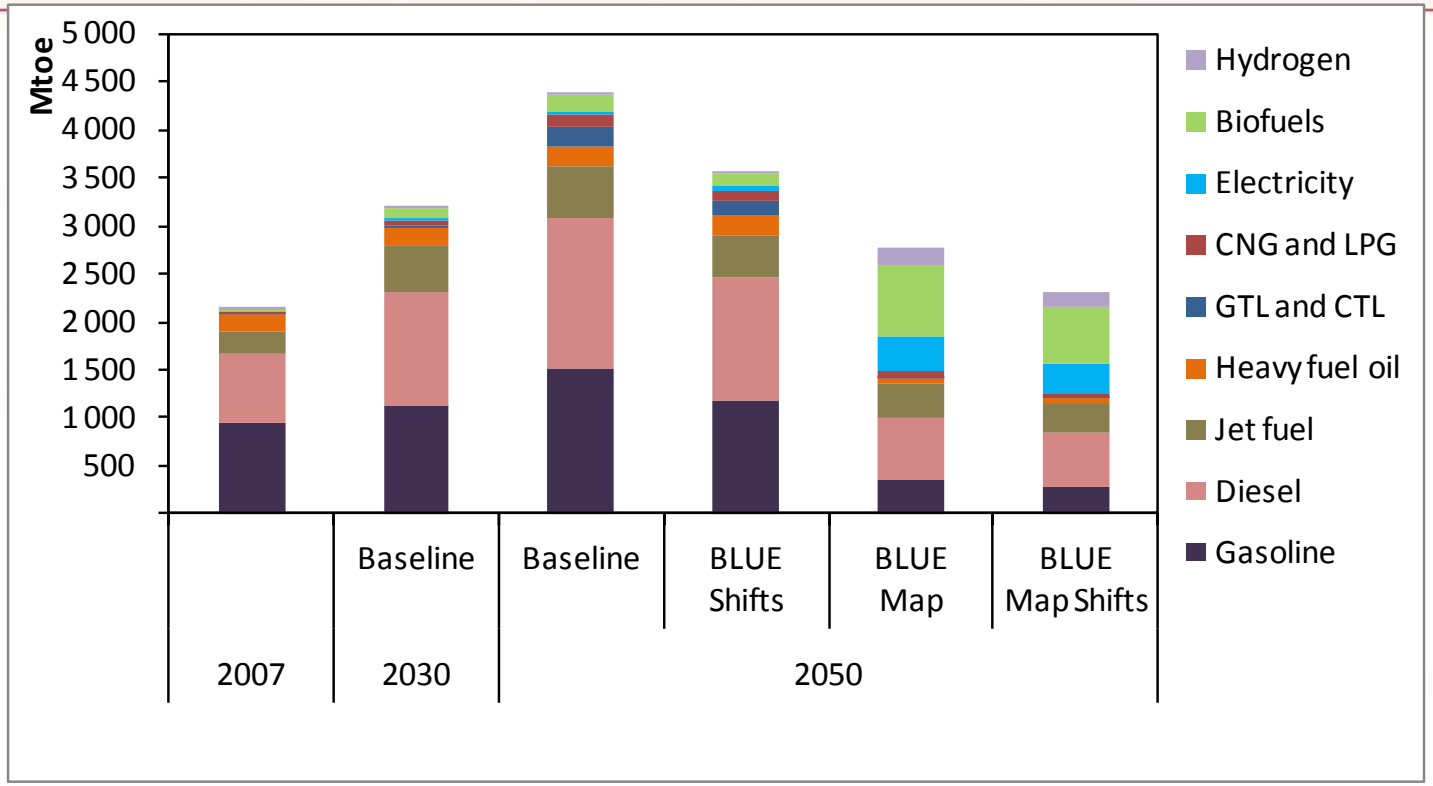
- ■Transport, energy and CO_2 (Transport book)
  Moving towards sustainability
  (ETP Transport book, 2009)
  Horizon 2050, all energy sources
  Builds and expands the work done on ETP

World energy-related CO_2 emissions abatement by sector



In the BLUE Map scenario, transport accounts for 23% of reductions. Additional savings accrue in "transformation", since less high-CO2 fuels (such as coal-to-liquids) are produced for transport use.

Transport Energy Use by ETP Scenario

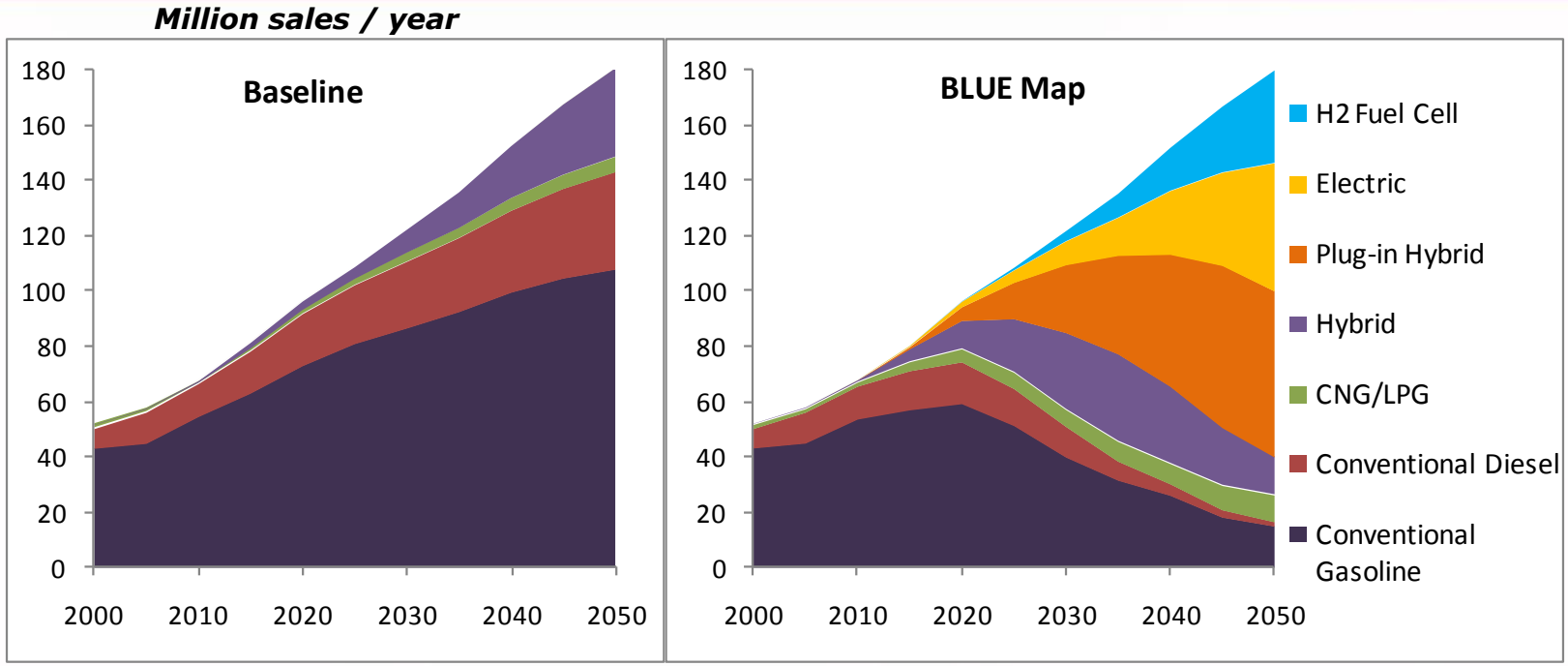


- *Global transport energy use in Baseline doubles by 2050*
- *BLUE Shifts achieves a 20% reduction in 2050; BLUE Map achieves 40%, BLUE Map/Shifts achieves nearly 50%*
- *Nearly 50% of energy is low-CO_2 renewable in 2050*

Key Transport steps to achieve BLUE outcomes

- BLUE Map – *technology* solutions
  - 50% reduction in conventional new PLDV (car, SUV) fuel intensity by 2050
  - 30-50% reduction in energy intensity for bus/truck/rail/ships/aircraft by 2050
  - Strong uptake of advanced technology vehicles and Fuels
    - Plug-in Hybrids [PHEVs], starting in 2010-2015
    - Battery electric vehicles [BEVs], starting in 2010-2015
    - Fuel cell vehicles [FCVs], starting in 2025
    - Advanced, low-GHG Biofuels reach 12% of transport fuel use by 2030, 25% by 2050
- BLUE Shifts – *travel* solutions
  - 25% lower level of car and air travel in 2050 compared to Baseline
  - Up to 2x travel by rail, bus (such as Bus Rapid Transit systems)
  - Lower travel demand due to better land use planning, road pricing, telematic substitution

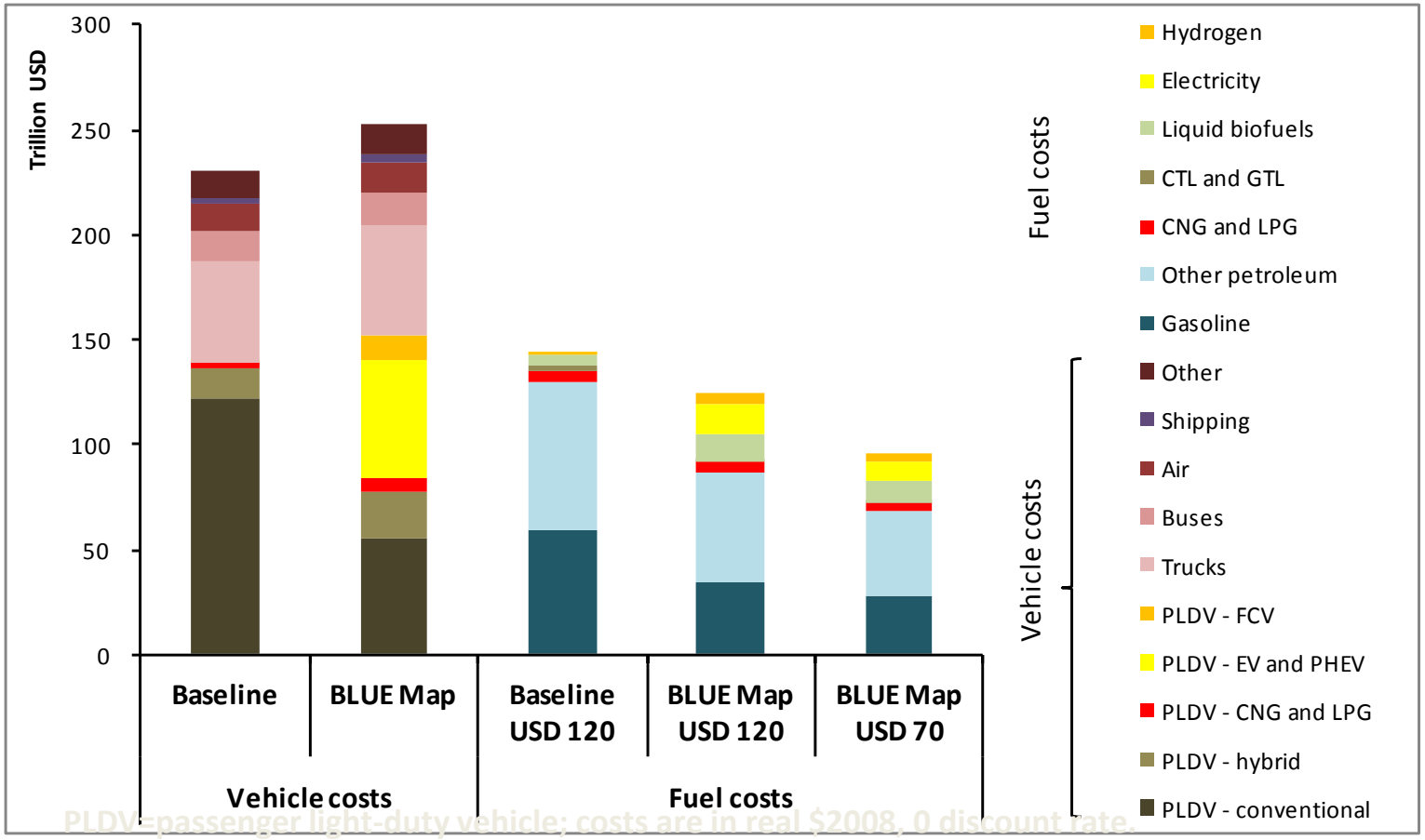
Passenger LDV sales by technology type and scenario: BLUE Map will be VERY challenging



In the ETP Baseline, sales are mainly conventional vehicles through 2050; hybrids reach about 20% of sales

In BLUE Map, strong penetration of hybrids by 2015, PHEVs and EVs by 2020, FCVs after 2025. By 2050, plug-in vehicles account for more than two-thirds of all sales.

Global Vehicle and Fuel Costs, 2010-2050 by Scenario (ETP 2010)

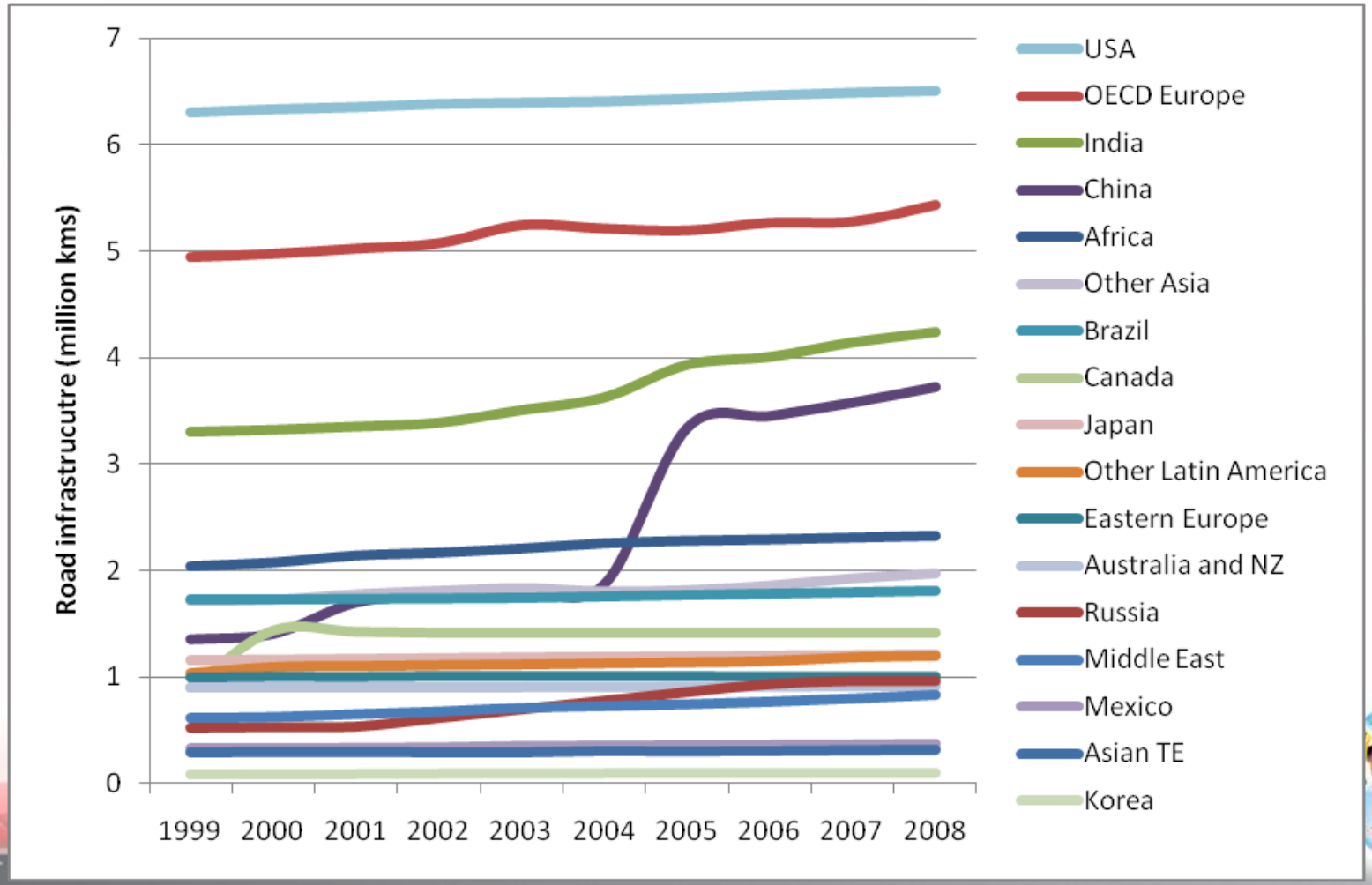


PLDV=passenger light-duty vehicle; costs are in real $2008, 0 discount rate.

Fuel cost savings mostly or fully offset the costs of advanced technology vehicles in BLUE Map

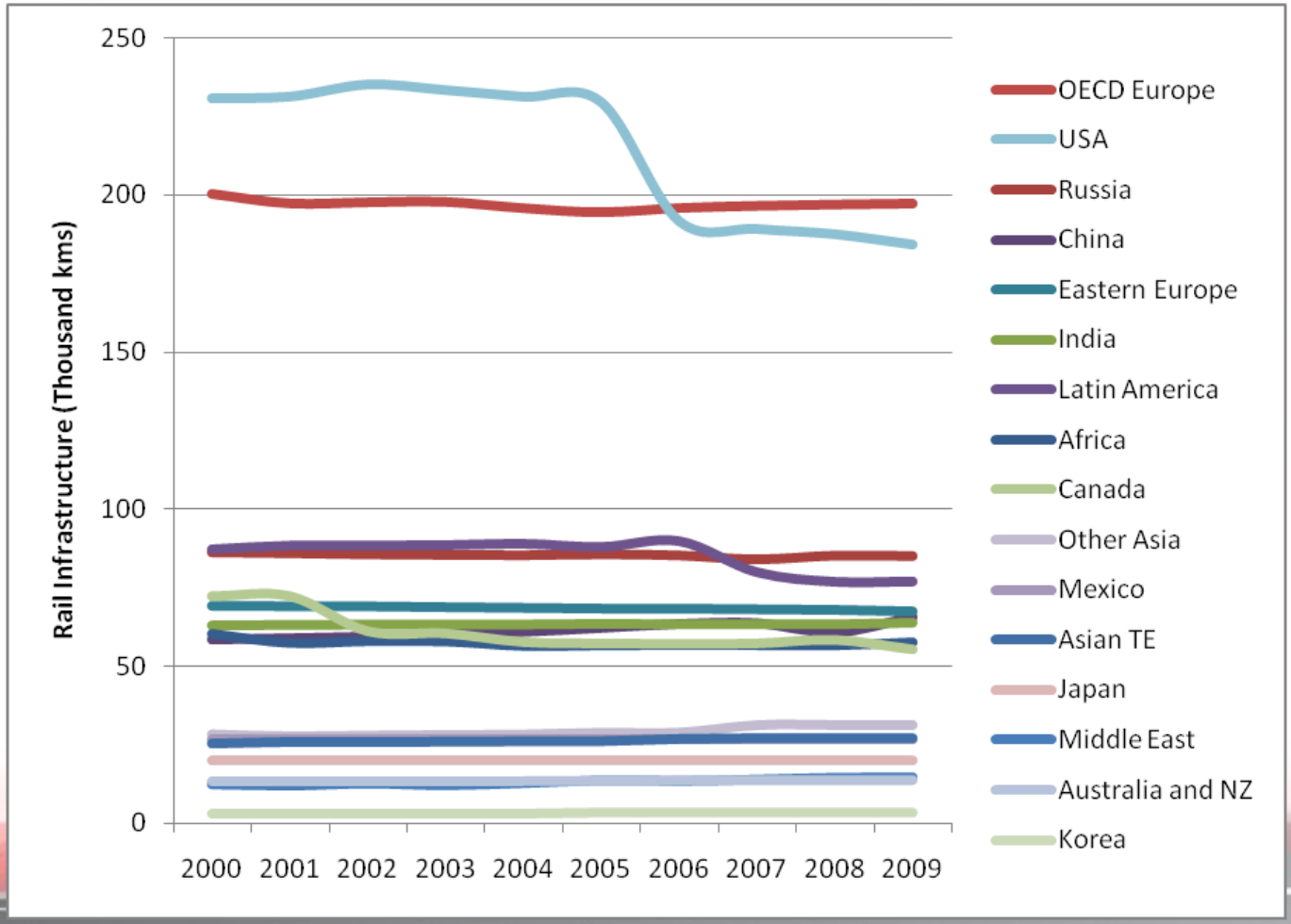
Extending the analysis to vehicle infrastructure

- Gathering data on infrastructure per mode - Road
- China, India, Russia have the highest growth

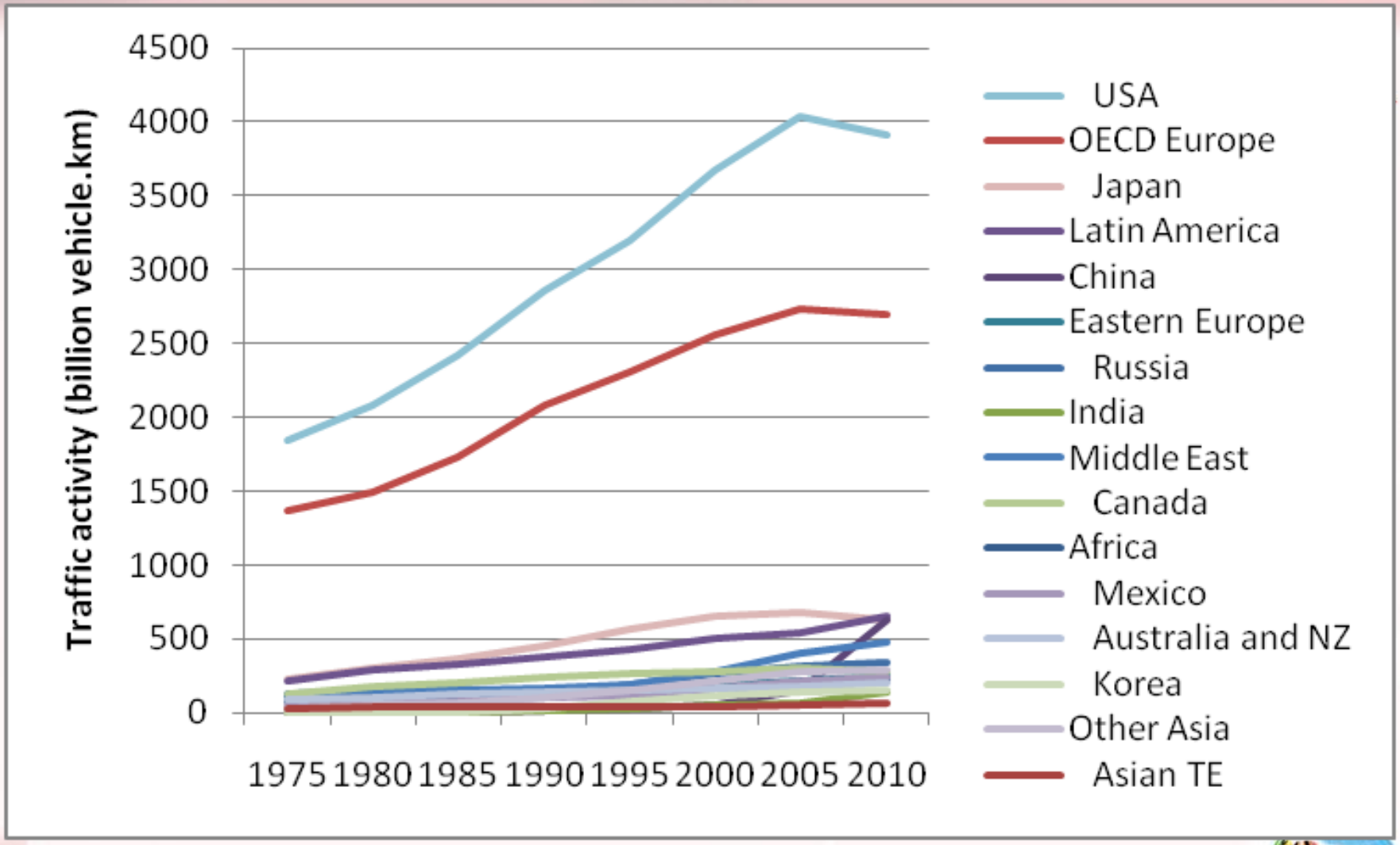


Extending the analysis to vehicle infrastructure

- Gathering data on infrastructure per mode - Rail
- Some countries decreases the rail track kilometres

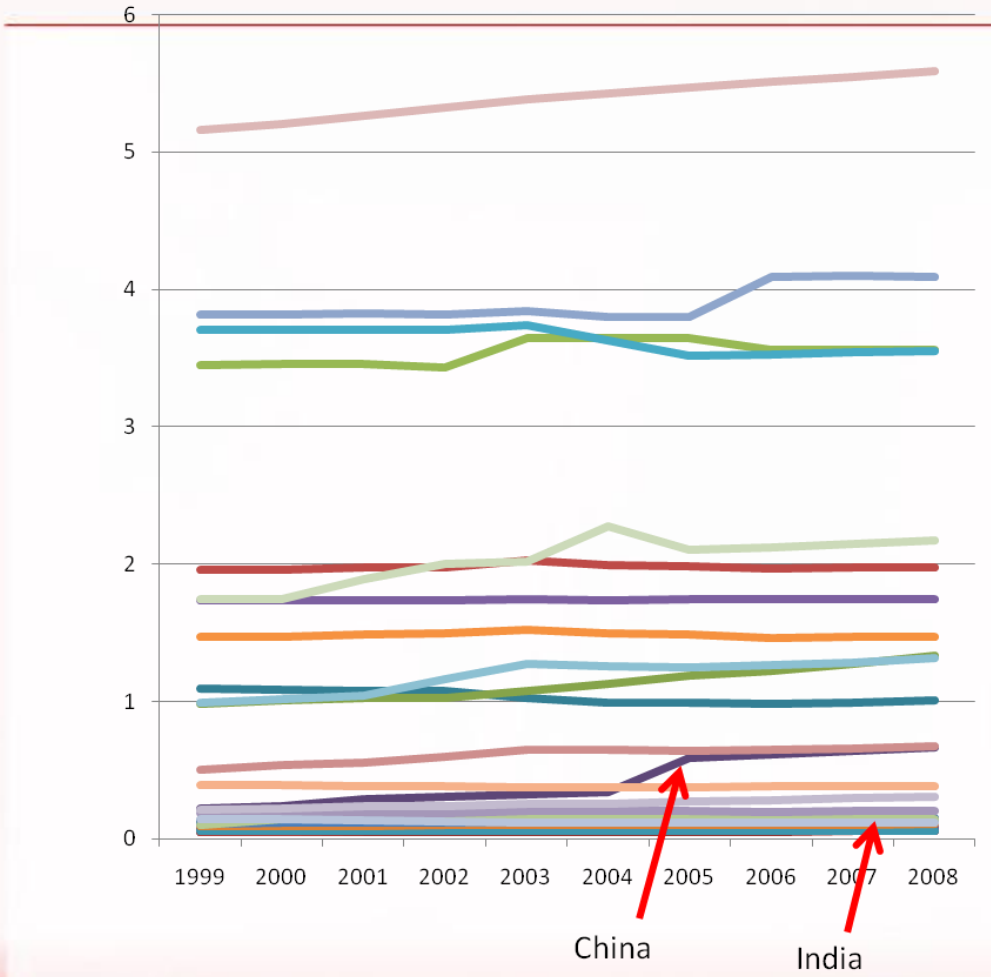


Linked with traffic activity



Sustained growth of traffic from the mid 70s in all countries, at different rates

Historic Roadway Densities (Paved Lane-Km per Km^2)

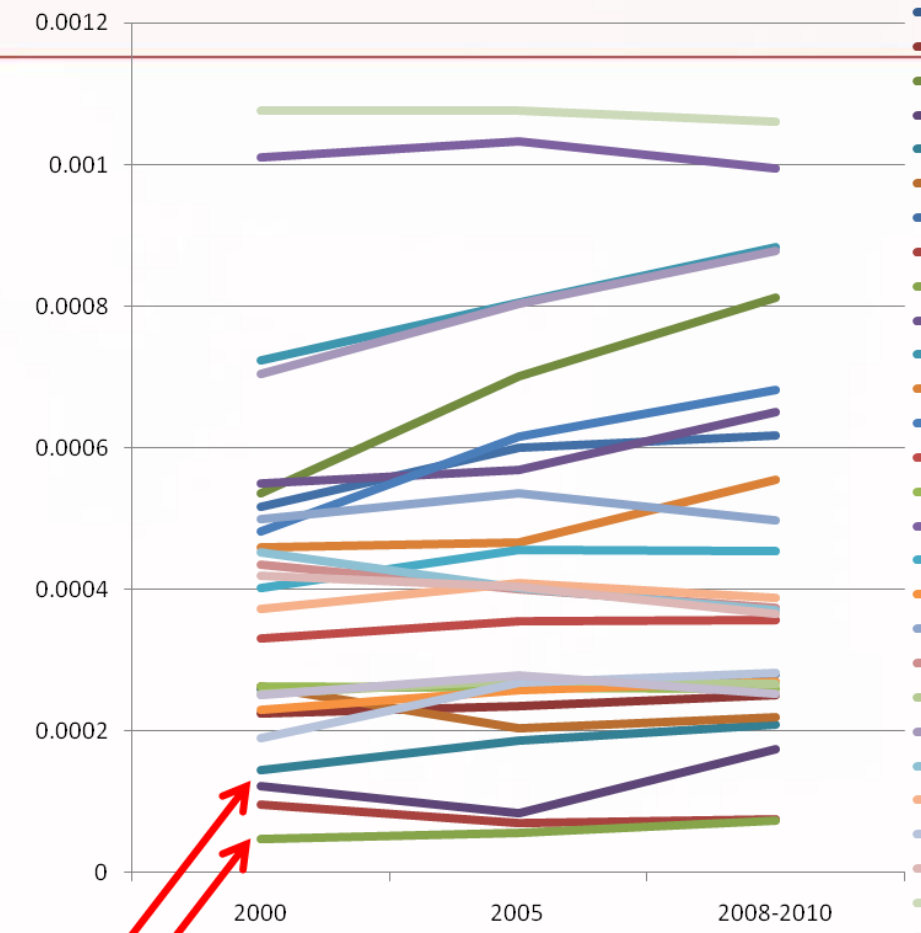


- Africa
- Other Africa
- South Africa
- China
- Eastern Europe
- FSU
- Asian TE
- Russia
- India
- Latin America
- Brazil
- Other Latin America
- Middle East
- OECD Europe
- France
- Germany
- Italy
- Other OECD Europe
- UK
- OECD North America
- Canada
- Mexico
- USA
- OECD Pacific
- Australia and NZ
- Japan
- Korea
- Other Asia

	Applied Paved Lane-Km Density Limits
Africa	1
Other Africa	1
South Africa	1
China	**2**
Eastern Europe	2
FSU	1
Asian TE	1
Russia	1
India	**3**
Latin America	1
Brazil	1
Other Latin America	1
Middle East	1
OECD Europe	3
France	5
Germany	3
Italy	5
Other OECD Europe	2
UK	5
OECD North America	2
Canada	1
Mexico	1
USA	2
OECD Pacific	1
Australia and NZ	1
Japan	5.7
Korea	4
Other Asia	2

China and India have a lot of room for road growth

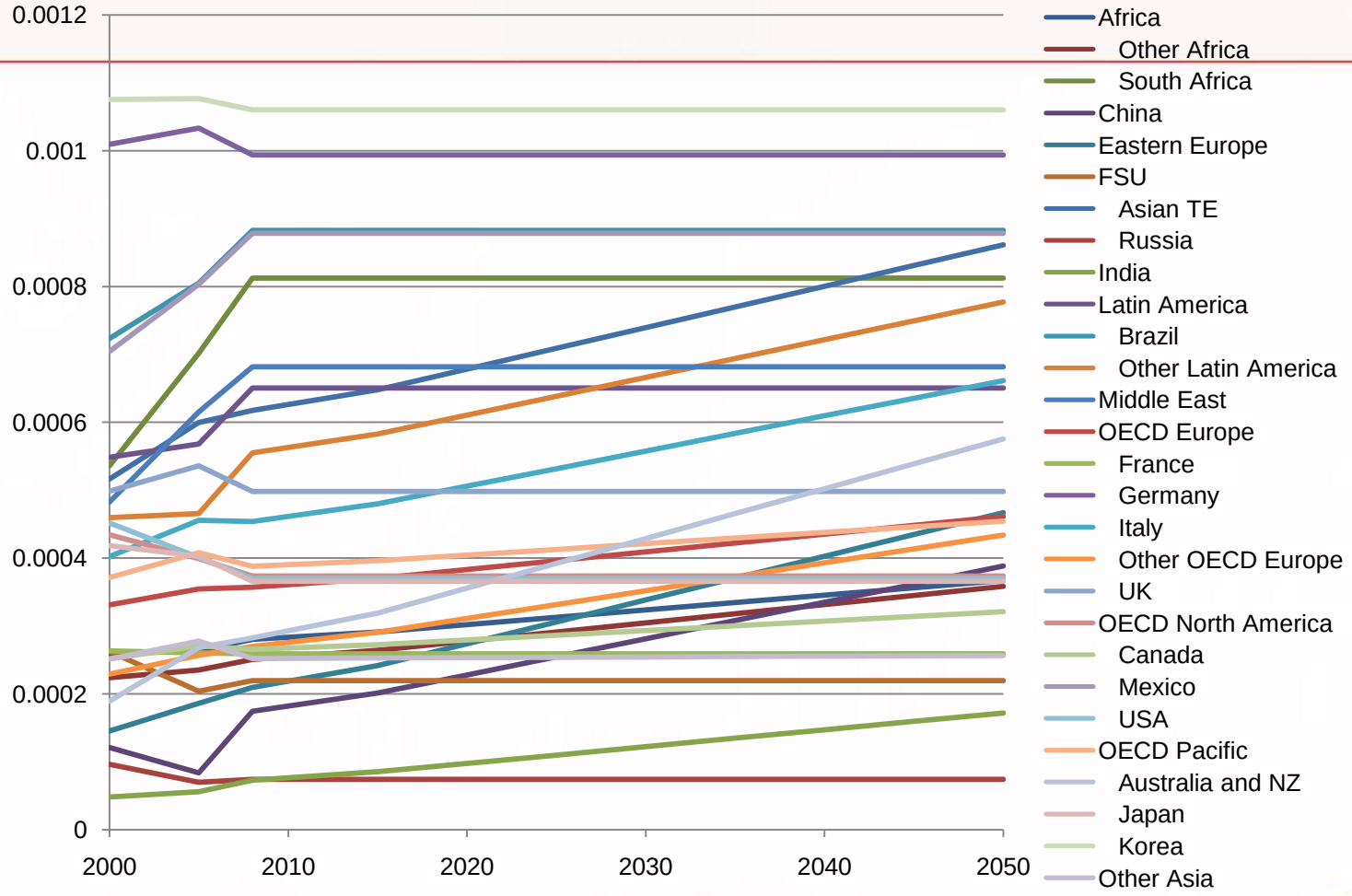
Historic Ratio: Vehicle Km to Paved Lane-Km (Road Occupancy Factor)



	Average Ratio
Africa	0.00026767
Other Africa	0.00023648
South Africa	0.0006832
China	0.00012635
Eastern Europe	0.00018021
FSU	0.00022863
Asian TE	0.00057786
Russia	8.0124E-05
India	5.8694E-05
Latin America	0.00058911
Brazil	0.00080377
Other Latin America	0.00049352
Middle East	0.00059309
OECD Europe	0.00034772
France	0.00026087
Germany	0.00101229
Italy	0.00043729
Other OECD Europe	0.00025216
UK	0.0005108
OECD North America	0.00040247
Canada	0.0002626
Mexico	0.00079536
USA	0.00040748
OECD Pacific	0.00038922
Australia and NZ	0.00024666
Japan	0.00039557
Korea	0.00107109
Other Asia	0.00026037
World Annual Average	0.00031287

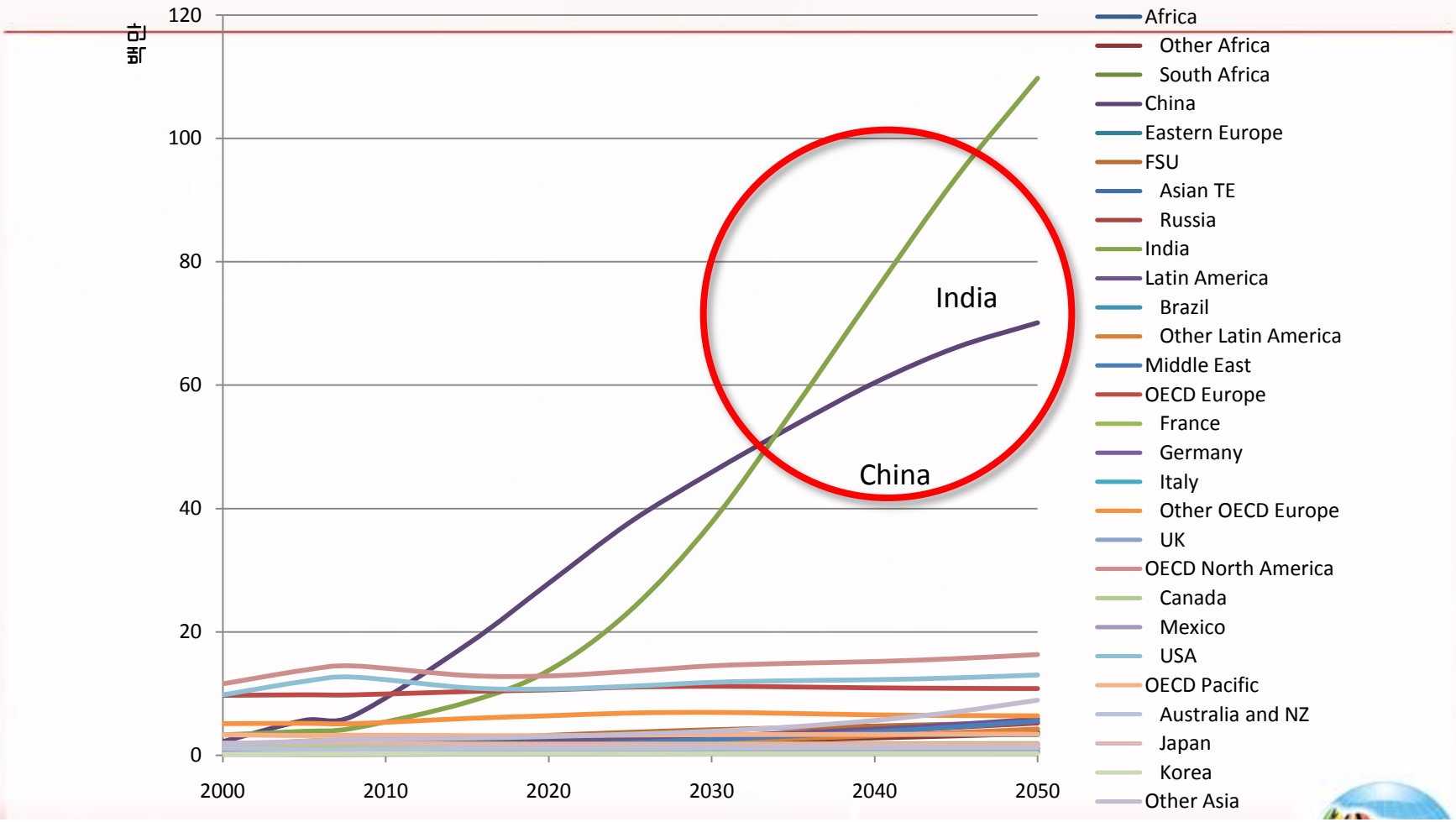
China and India seems to have anticipated the car sales booming

Applied Converging Vkm to Paved Lane-Km (Congestion) Limits



Convergence towards a common congestion hard to figure out

Paved Lane-Km Projections (vkm * ave paved lane-km/vkm), No Limits Applied



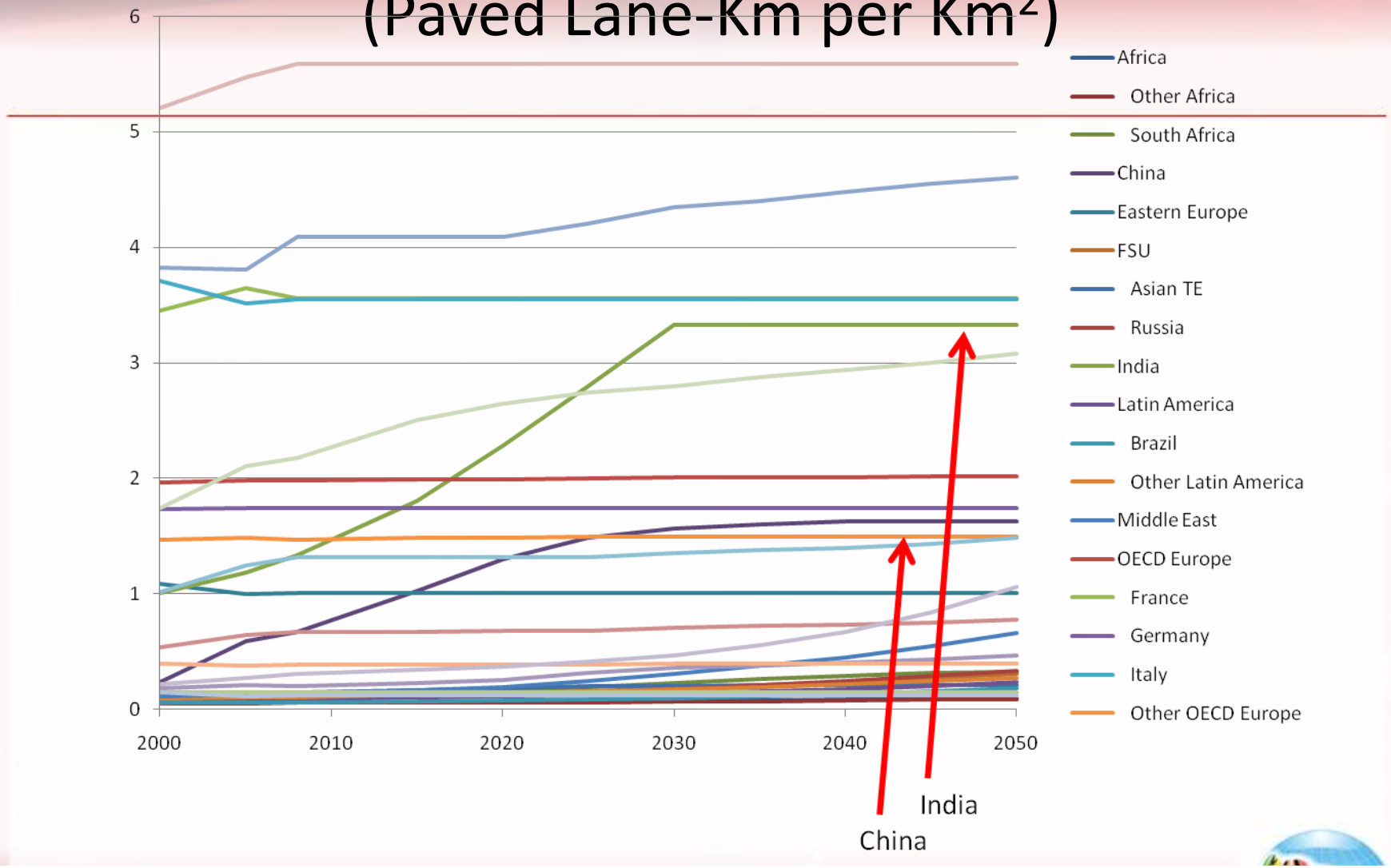
China and India would be desperate for road building, in a business as usual scenario

Scenarios on road building needs

- China and India are on track for intense road building programmes to match vehicle stock growth
  - the road building rate is difficult to reach
- Two extra constraints taken into account:
  - Road density saturation levels
  - Maximum road building past rates

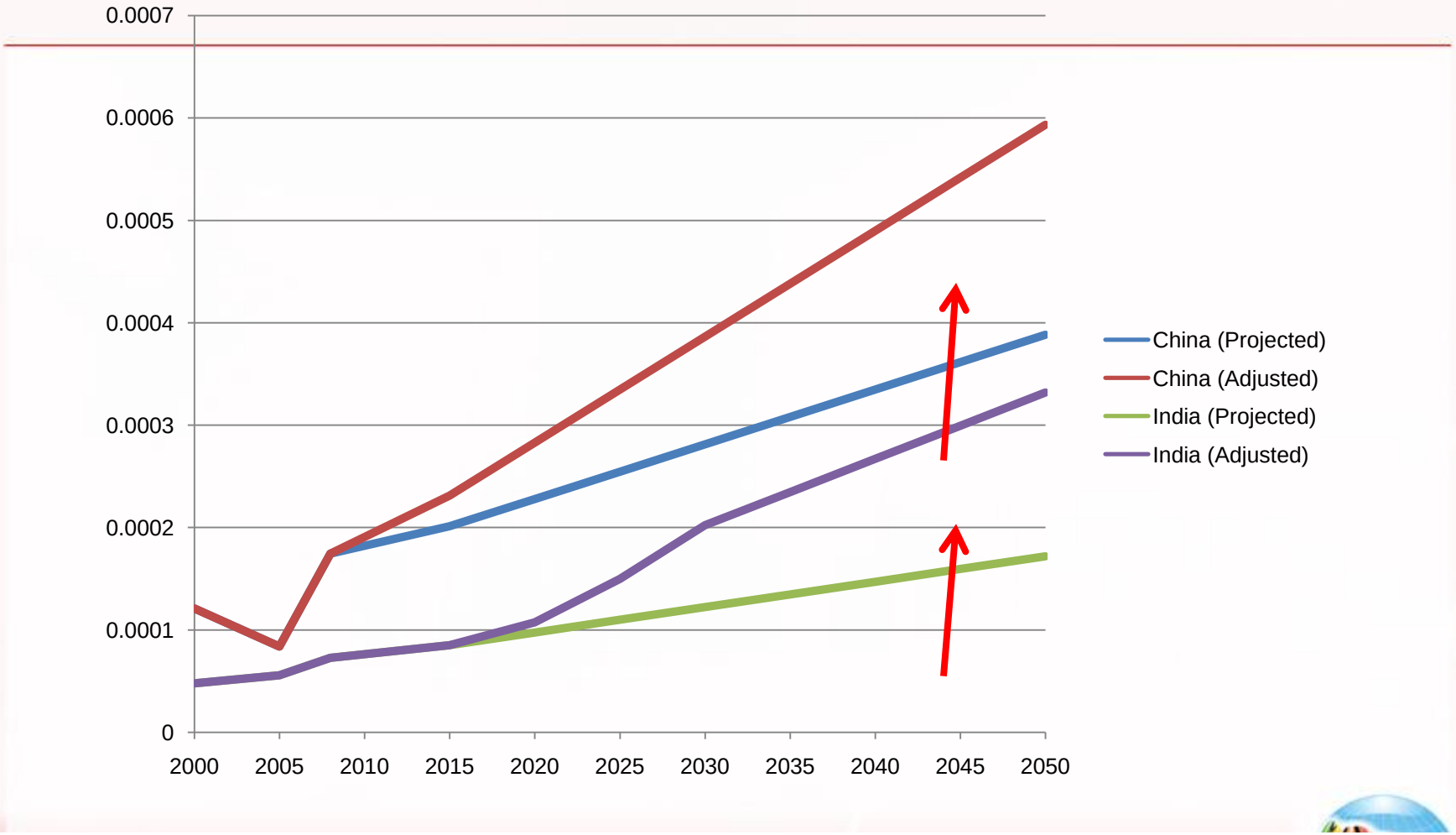
=> Congestion levels are likely to increase in those countries

Resulting Roadway Density (Paved Lane-Km per Km^2)



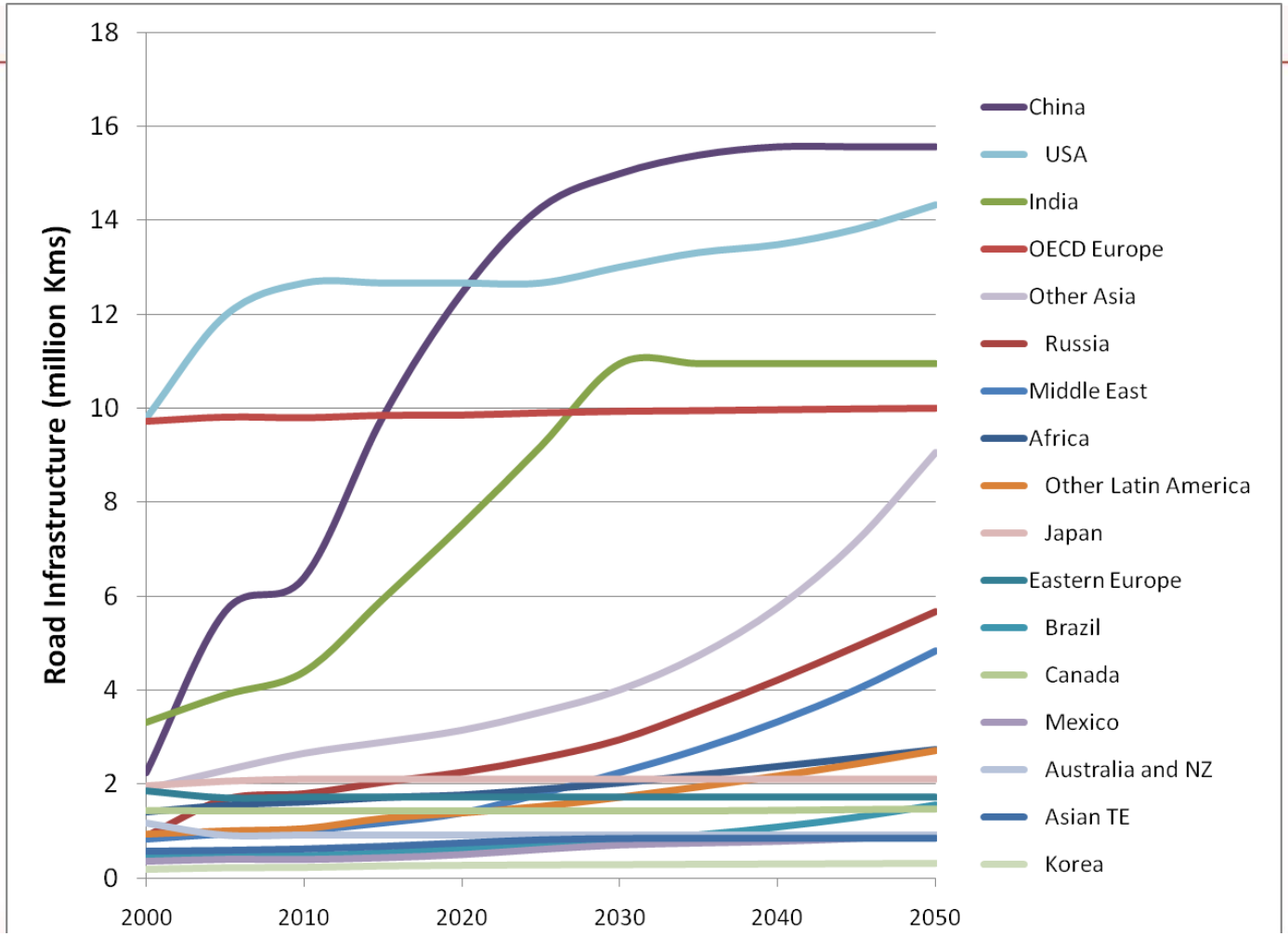
Applying road density limits how much road can be built

China and India Converging Vkm to Paved Lane-Km (Congestion) Limits,



Congestion likely to increase to dangerous levels once the limits are applied to China and India

Paved Lane-Km Projections: Density and Congestion Limits Applied



More realistic picture of the future; strong growth still expected in the decades to come for China and India

Conclusions

- In a future where car ownership follows OECD countries trends, road infrastructure needs will boom in the coming decades
- Given some limits, road occupancy is likely to increase at a national level, possibly leading to increased congestion
- China and India are keys to road infrastructure development until 2050

- Next step is to cost that out !