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Climate change adaptation and mitigation policies and approaches

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TC A1

Preserving the Environment
Préservation de l'environnement
Conservación del medio ambiente

A1.1 National policies and strategies for reducing the impacts of the road transport system on climate change and policies and strategies for the adaptation of transport systems to climate change

Acknowledgement

The contributors to the preparation of this report are:

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Methodologies

- SURVEY to PIARC nations leading to 19 answers mostly from developped countries (Canada, Canada-Quebec, France, Germany,Japan, New Zeland, Norway, Pakistan, Scotland, Sweden, Switzerland)
- 7 working sessions (Paris, Glasgow, Washington, Timisoara, Lisboa, Bonn, New Delhi)
- Hours of team and personal work
- Major reference: OECD report, 'The Economics of Climate Change Mitigation: How to Build the Necessary Global Action in a Cost-Effective Manner'.

Foreword

- The purpose of this report is to examine different countries' plans, policies and initiatives for mitigating against the impacts of roads and road transport on the climate and adapting road transport systems to climate change.

- It seeks to provide an overview of existing policies and initiatives supported by illustrative examples.

- This report does not comprehensively address country approaches to reduce greenhouse gases (GHGs) or adapt to climate change. Such an undertaking would require massive financial and staff resources and is beyond the current scope.

Foreword

- Examples are provided by country to illustrate the range of measures that countries are employing to address climate change.
- Many are examples of best practices from which all countries may learn.
- The order of presentation is meant to reflect any importance or priority intended by the authors of this report.

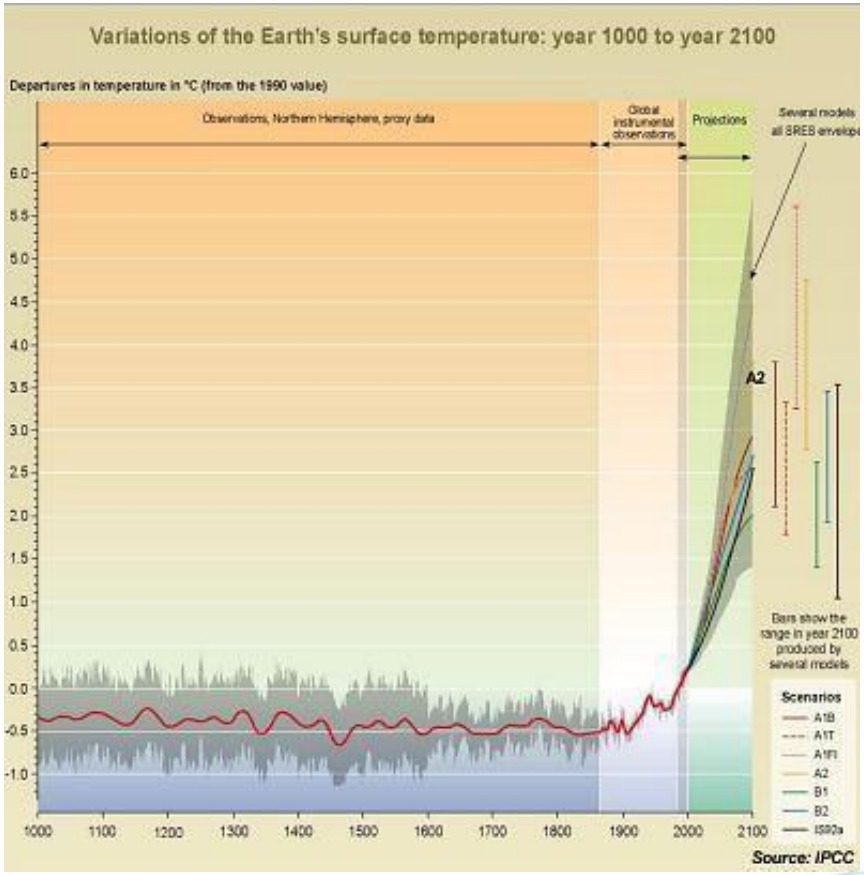
Structure of the report

1. REPORT OVERVIEW
2. OVERARCHING POLICIES AND MEASURES
3. FISCAL DEMAND MANAGEMENT MEASURES
4. BEHAVIOURAL DEMAND MANAGEMENT MEASURES
5. VEHICLE TECHNOLOGIES TO REDUCE GHG EMISSIONS
6. ROAD INFRASTRUCTURE MITIGATION MEASURES
7. ADAPTATION MEASURES
8. ANALYSIS
9. CONCLUSIONS
10. BILIOGRAPHY

GLOBAL WARMING

IPCC
INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE
WMO UNEP

The average global temperature has risen 0.74 degrees Celsius since 1900, and the IPCC estimates that it will further rise 1.1 to 6.4 degrees Celsius by the end of the 21st century.



Risks for transportation system

Coastal flooding

Permafrost melting

Risks for transportation system

Pakistan Flood 2010

Katrina hurricane 2005

EXTREME WEATHER

2. OVERARCHING POLICIES AND MEASURES

- Recognition of need to reduce GHG is a fact

- 3 levels of implementation among nations
  - Comprehensive approaches with legal binding limits
  - Expression of clear intent to reduce emissions
  - General recognition of environmental effect

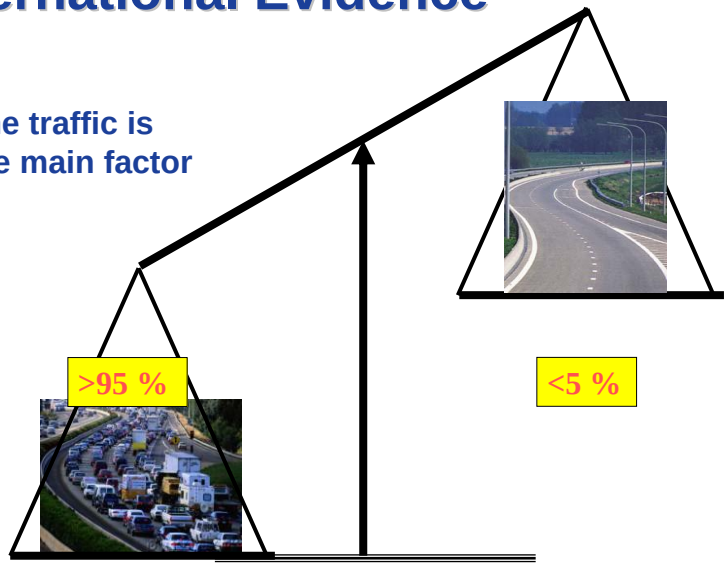
References from: Canada, France, Germany, Italy, Japan, Norway, Pakistan, Scotland, Sweden, Switzerland, United Kingdom, United States of America

2. OVERARCHING POLICIES AND MEASURES

- Many, if not all, transport agencies across the globe are taking measures that could reduce greenhouse gases
- Some nations have very clear and comprehensive targets and measures to reduce transport emissions as part of their overall national plans.
- Others are taking action for congestion relief, efficiency, mobility or revenue enhancement purposes that will nonetheless have a positive effect on emission reduction.
- When it comes to adaptation to the climate changes, most countries are taking action.

MITIGATION

International Evidence



- More than 95 % of CO2 emissions from road transport come from the vehicles.

3. FISCAL DEMAND MANAGEMENT MEASURES

3.1 Management Measures Related to Traffic Demand

implemented as a tool to control traffic demand, manage congestion to limit new construction of infrastructure.

However, by their impact on demand, now they are used as a tool for mitigating CO2 emissions as a consequence of the reduction of fuel consumption.

More and more the association with CO2 emissions reduction is pushed forward as an integrated part of the measure.

LESS VEHICLE = LESS FUEL = LESS CO2

3. FISCAL DEMAND MANAGEMENT MEASURES

3.1 Management Measures Related to Traffic Demand

Road Pricing and Congestion Charges

Charges related to distance for heavy trucks, access charges in cities center, toll rates variable with hours

Experiences in: Austria, China, Germany, Italy, Malta, Netherlands, Norway, Singapore, Sweden, Switzerland, United Kingdom, United States of America

3. FISCAL DEMAND MANAGEMENT MEASURES

3.1 Management Measures Related to Traffic Demand

Parking Charges

Parking pricing can be used to address several issues including congestion reduction and equalising parking demand, as well as serving as a revenue-raising tool.

Workplace Parking Levy

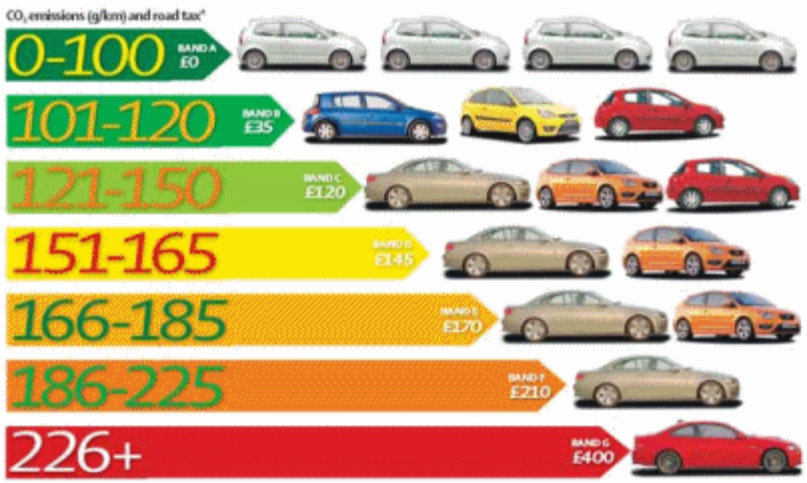
The WPL is a charge made for each parking space provided by an employer and used by its employees and regular business visitors.

3. FISCAL DEMAND MANAGEMENT MEASURES

3.2 Management Measures to Decrease Pollution from Vehicles

Green Taxation Systems Based on Emission Standards

encouraging the purchase of low emission vehicle and penalizing the ownership of old and new high emission vehicles.



Ouch! Road tax!

3. FISCAL DEMAND MANAGEMENT MEASURES

3.2 Management Measures to Decrease Pollution from Vehicles

Incentives for Low Emission Vehicles

subsidies to car buyers to increase the use of low emission vehicles.

Examples from :

Austria, Belgium, Canada (Ontario, Quebec), Cyprus, Czech Republic, Denmark, Germany, Greece, Ireland, Italy, Japan, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and the United States of America.

3. FISCAL DEMAND MANAGEMENT MEASURES

3.2 Management Measures to Decrease Pollution from Vehicles

Other incentives

Governments can give economic contributions to communities that implement measures that reduce the amount of transport and change the modal split, for example public transport measures, cycle lanes and walkways, road pricing, parking policies and space planning

3. FISCAL DEMAND MANAGEMENT MEASURES

3.3 The special case of tax on fuel

widely used tool for its ability to address all types of demand side components such as activity, mode share, energy intensity, and fuel choice

Some weakness:

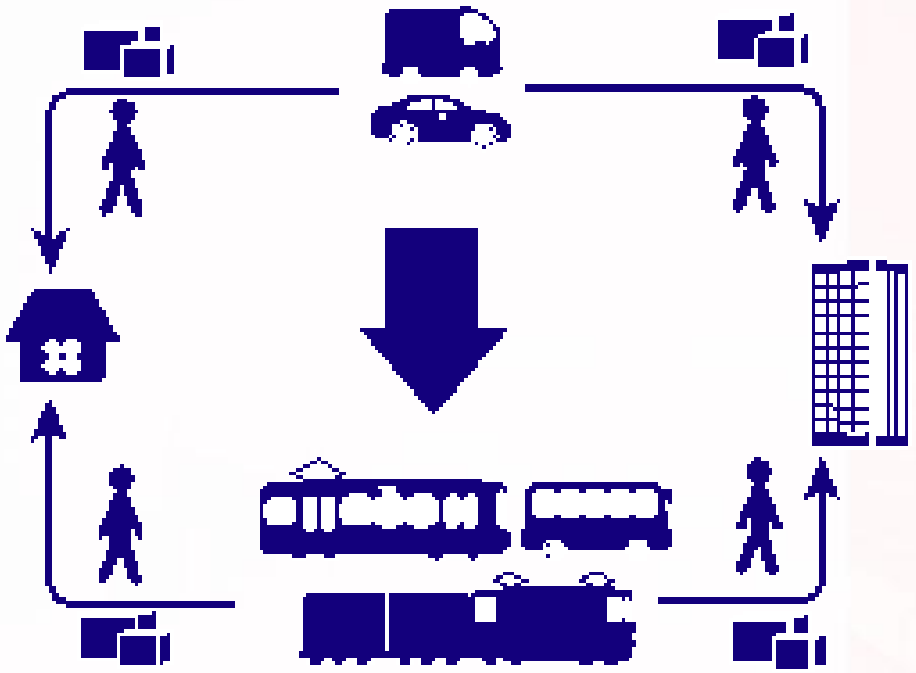
- Inertia to the change to lower fuel vehicles
- Political aspects to increasing taxation
- Consumers decision not in line with price

Climate Cure 2020 Norway studies:

100 % increase in fuel price induces only 10 % decrease in consumption.

4 BEHAVIOURAL DEMAND MANAGEMENT MEASURES

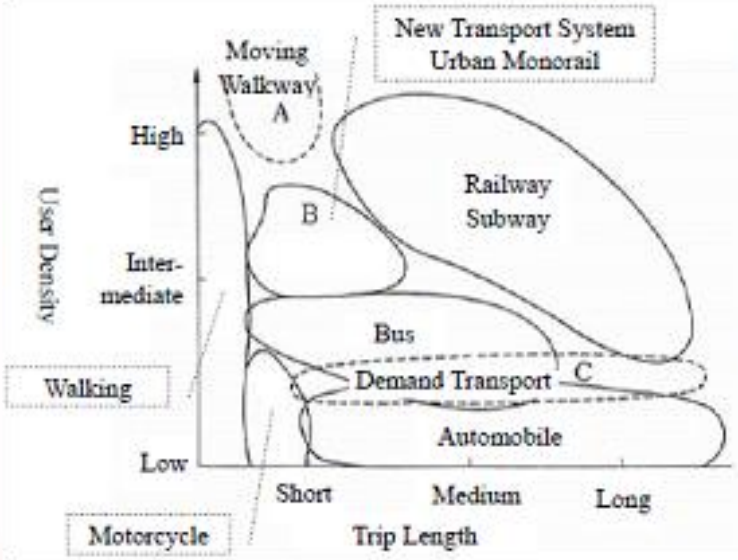
Behavioural measures focus on efforts to reduce future demand for single-occupant automobile travel by promoting alternative forms of travel (transit, cycling, walking, etc.), ridesharing and car sharing, improved land use and transport planning, and shift to higher efficiency modes in the transport of freight;



4 BEHAVIOURAL DEMAND MANAGEMENT MEASURES

4.1 Increased Use of Less Energy Intensive Modes

Expand and Improve Public Transport Services



A. Area with relatively short trip length and high user density, located between commercial district and transportation node, or in airports. Continuous transportation system or individual express shipping can be applied.

B. Area with insufficient demand for railway, though bus is not feasible. New transport system can be applied.

C. Area with low user density and private cars are widely used, and the introduction of fixed facilities is difficult. On-demand bus (paratransit) can be applied.

Source: "Urban Transport Planning (2nd Edition)", Yoji Shintani (2003)

4 BEHAVIOURAL DEMAND MANAGEMENT MEASURES

4.1 Increased Use of Less Energy Intensive Modes

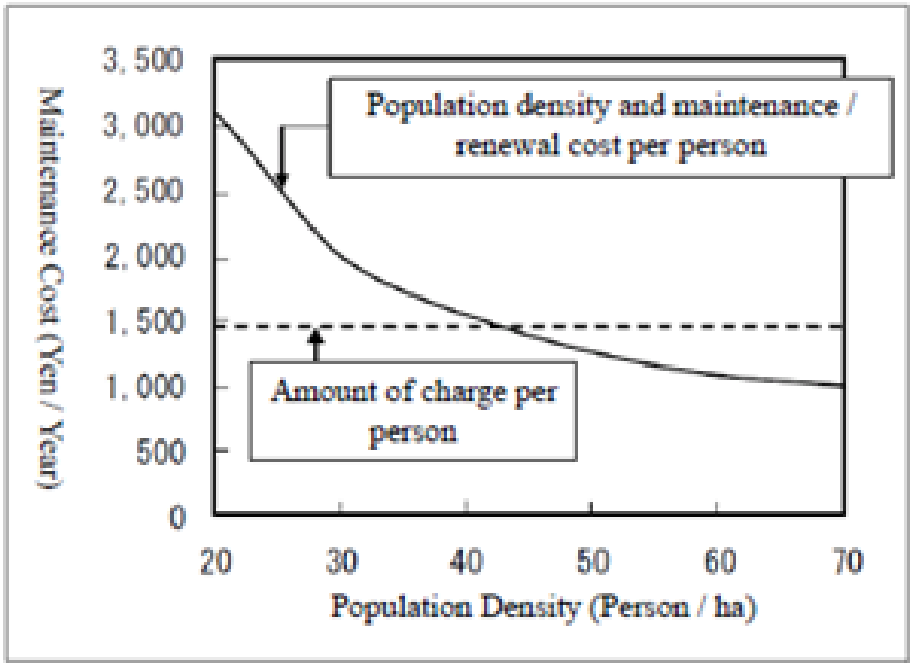
Improve Cycling and Pedestrian Networks

Ridesharing

Car Sharing

4 BEHAVIOURAL DEMAND MANAGEMENT MEASURES

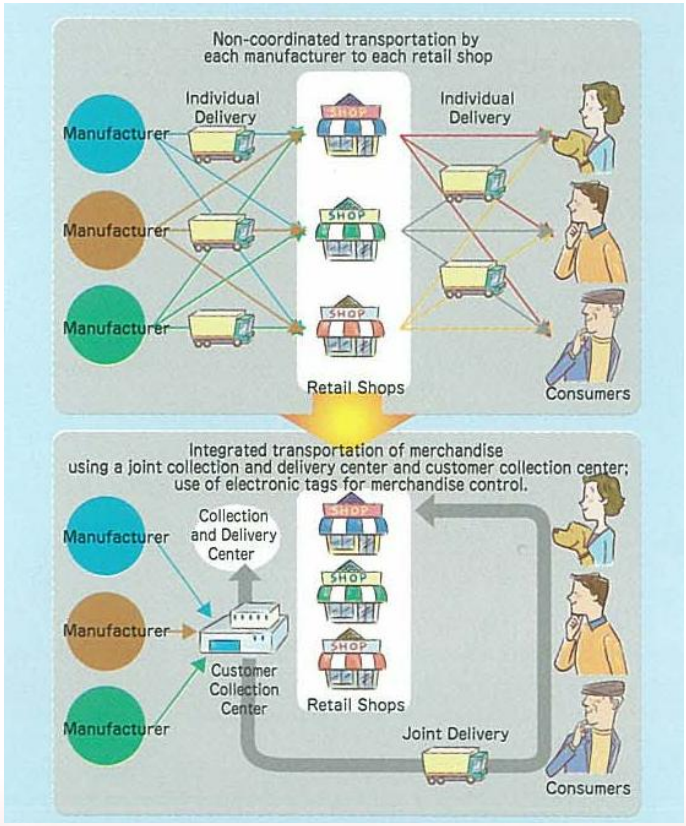
4.2 Land Use and Transport Planning - Promoting Compact Urban Design



- *Maintenance of urban facilities here includes snow removal, street cleanup, maintenance of block parks, and maintenance of sewerage pipes.*
- Source: Report of the Research on the Creation of Compact City (Digest Version), Toyama City, March 2004

4 BEHAVIOURAL DEMAND MANAGEMENT MEASURES

4.3 Improvement of Freight Transport Efficiency



Japan experience

Operational optimization helps to reduce GHG emissions for the case of HGVs.

Joint collection and delivery system is operated by several logistics companies.

This system is intended to improve the truck transport efficiency as well as to reduce the CO_2 emissions through the "Truck Transport Efficiency, Joint Collection and Delivery System."

5. VEHICLE TECHNOLOGIES to reduce GHG emissions

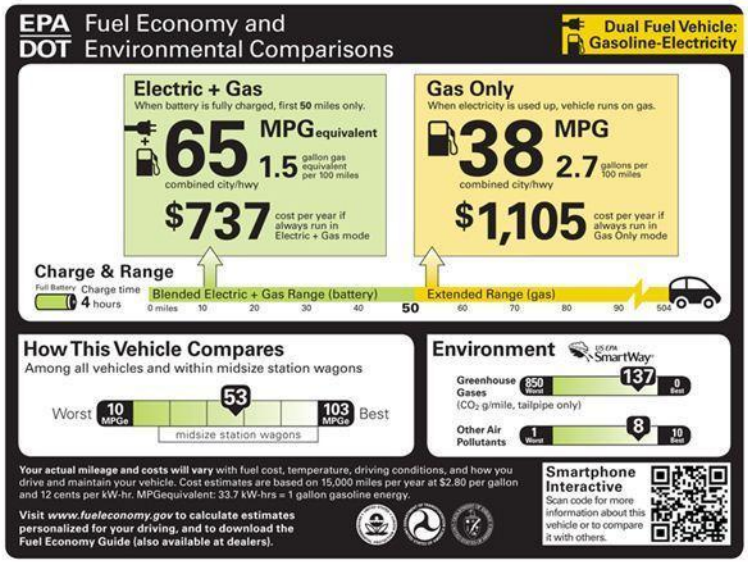
- Vehicle technology measures seek to require or promote higher efficiency or lower carbon alternative fuels in passenger or freight vehicles

5. VEHICLE TECHNOLOGIES to reduce GHG emissions

5.1 Fuel Efficiency Potential of Current Internal Combustion Engine Light-duty Vehicles

- The world vehicle fleet is currently dominated by internal combustion engines (ICE's)

- A number of technologies enable smaller engines to retain the same performance characteristics as larger, more fuel consuming engines.



5. VEHICLE TECHNOLOGIES to reduce GHG emissions

5.2 Improvement of Heavy-Goods Vehicle Fuel Efficiency

- International Energy Agency estimates that future HGV efficiency may improve by 20 % by 2050 under business-as-usual trends.

- This may be increased to 33 % with additional technology, fuel switching and more aggressive operational changes but the potential falls short of the 50 % improvement foreseen for LDVs.

5. VEHICLE TECHNOLOGIES to reduce GHG emissions

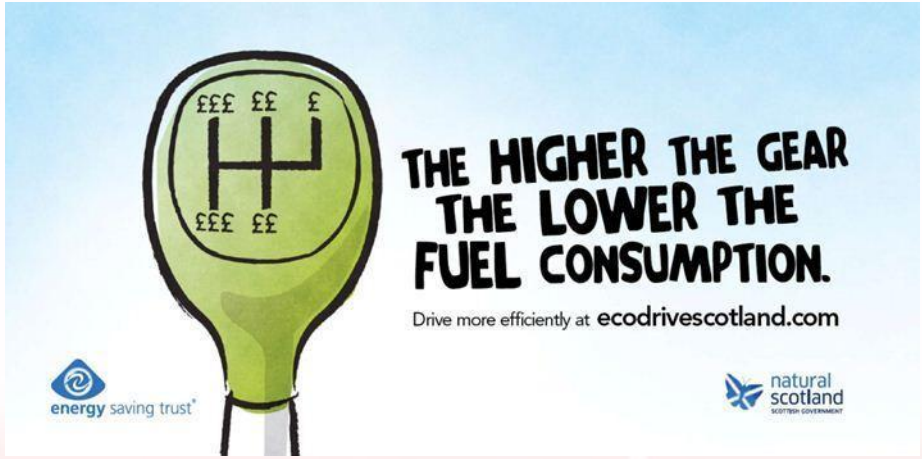
5.3 Electric Cars, Hybrids and Other New Technologies

- Plug-in hybrids and electric cars are major options for decarbonising road transport, particularly over the medium to long term.
- It can be said that GHG reduction benefit is considerable when electricity supplied to the grid is relatively low carbon.
- However, the produced electricity is based on traditional coal with no carbon capture as is the case today, the GHG benefits of powering vehicles are less and sometimes lower than advanced ICEs.

5. VEHICLE TECHNOLOGIES to reduce GHG emissions

5.4 National Motoring Package

- targeted eco-driving messages and training
- through in-car technology such as fuel economy meters, gear shift indicators, tyre pressure indicators, Intelligent Speed Adaption (ISA) and “green” satellite-navigation systems.



5. VEHICLE TECHNOLOGIES to reduce GHG emissions

5.5 Biofuels and lower carbon fuels

- The GHG emissions associated with different fuels depend on the way in which those fuels are produced. To compare the GHG impacts of fuels it is necessary to take into account all the emissions generated from their production, transport and storage, as well as the emissions associated with their use in vehicles on the basis of a full life-cycle analysis.

6. ROAD INFRASTRUCTURE MITIGATION MEASURES

- Road Infrastructure measures attempt to improve the efficiency of passenger and freight movements through a wide variety of measures :
  - better planning and road design,
  - lower emission methods for road construction and maintenance
  - efforts to improve traffic flow through improved operations of the roadways

6. ROAD INFRASTRUCTURE MITIGATION MEASURES

6.1 TRANSPORT PLANNING

- The desired outcome of effective transport planning is a system that fully considers sustainable transport options and the whole life carbon impacts of potential transport interventions.

6. ROAD INFRASTRUCTURE MITIGATION MEASURES

6.1 TRANSPORT PLANNING

- The use of regional materials can reduce transport efforts and the use of defined construction materials can support the replacement of deconstructed materials in the construction of the restored road.

- Intelligent line design also can help to reduce the efforts for example for wintertime maintenance, if the road will be lead under the predominant snow border. The cut of green should be used in place f.e. in a biogas plant.

6. ROAD INFRASTRUCTURE MITIGATION MEASURES

6.1 TRANSPORT PLANNING

- The use of certain road construction materials and the adequate sub-constructions can elongate the cycles for the rehabilitation measures and help to reduce congestions effected by construction work.

- Roads need a lot of facilities to operate them like lights, signs or pumps. All these facilities should use fossil free energy sources.

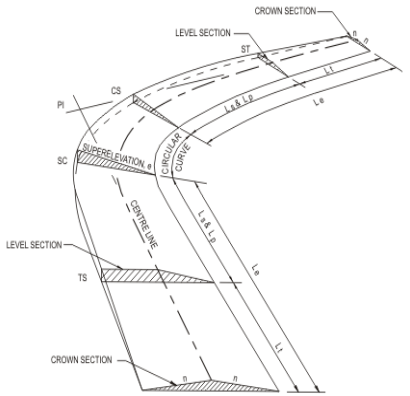
- Facilities like noise walls can be used for photovoltaic, white surfaces can help to reduce solar heating by reflecting the sunrays and roads can be used as storage for energy.

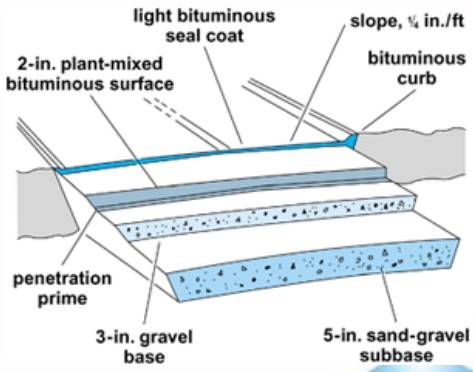
6. ROAD INFRASTRUCTURE MITIGATION MEASURES

6.2 PROJECT DESIGN

- For geometric design, gradient, curvature, type of crossing, capacity etc are fixed by standards. However some considerations such as larger median to avoid concrete safety barrier can be considered as a more friendly solution.

- For structural design, the choice of the type of road structure between rigid, flexible of mixed pavement and the use of recycled material also may have a big impact on the total count of carbon emissions due to the construction itself.





6. ROAD INFRASTRUCTURE MITIGATION MEASURES

6.3 CONSTRUCTION AND MAINTENANCE

- Opportunities exist at the construction and maintenance phases to use innovative products and processes to optimize approaches to sustainability.
- Considerable research has already gone into issues such as the processing of local construction materials, the recycling of waste materials, reducing transport requirements, the use of hybrid construction materials and new techniques such as the “crack and seat” re-use of concrete road bases.

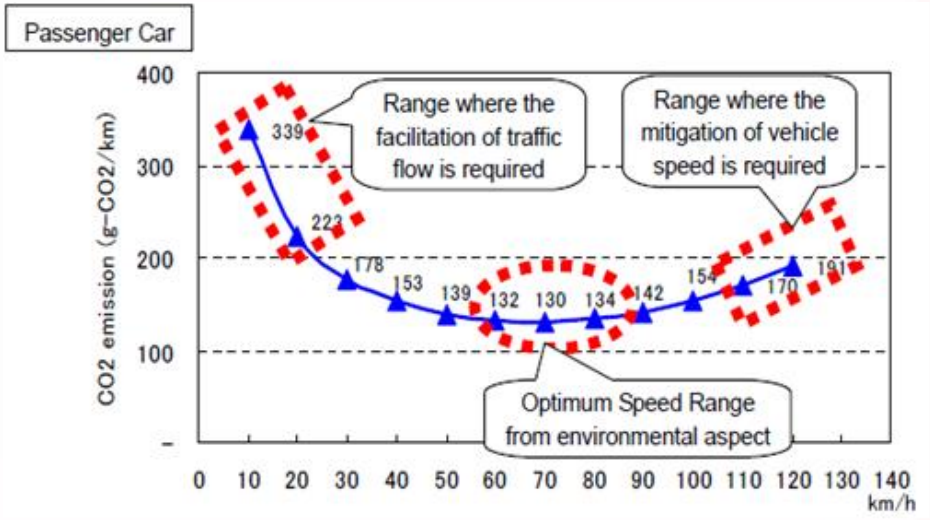
References from: Canada, France, Japan, New Zeland, Norway, Scotland, United States of America

6. ROAD INFRASTRUCTURE MITIGATION MEASURES

6.4 OPERATIONS

- Road traffic operation has a vital role from a viewpoint of reducing CO2 emissions in the road sector.

- This is mainly based on the road traffic flow smoothness, namely the relationship between the automobile driving speed and the CO2 emissions caused by fuel consumption



Relationship between CO_2 Emission and Average Vehicle Speed

6. ROAD INFRASTRUCTURE MITIGATION MEASURES

6.4 OPERATIONS

1- Securing Smoothness of Road Traffic Flow

1. **Removal of bottlenecks**
2. **Completion of missing road links (Japan)**
3. **Utilizing emergency lanes and hard shoulders (France, Germany, Scotland)**
4. **Synchronized control of traffic lights (Germany, USA)**
5. **Electronic Toll Collection (Canada, Germany, Japan)**
6. **Promotion of expressway use (Japan, Pakistan)**
7. **Provision of traffic information (Canada, Japan, New Zeland, Scotland, USA)**
8. **Emerging Technologies - Global Positioning System**
9. **Active Traffic Management (UK, USA)**

6. ROAD INFRASTRUCTURE MITIGATION MEASURES

6.4 OPERATIONS

2- Speed Limits Enforcement

- According to a study result on impacts of the speed limiters installation on CO2 emissions announced in 2007 in Japan, the installation of speed limiters on heavy trucks makes not only their speed but also the whole traffic flow slower on expressways and thus reduces the CO2 emissions from the whole vehicles travelling on the expressways

6. ROAD INFRASTRUCTURE MITIGATION MEASURES

6.4 OPERATIONS

3- Ecodriving

- Betterment of driving behaviour, commonly grouped under the title “eco-driving,” also contributes to the improvement of fuel efficiency of automobiles and reduction of CO2 emissions.

- Better maintenance of vehicle engines and accessories has an important impact on CO_2 emissions

6. ROAD INFRASTRUCTURE MITIGATION MEASURES

6.4 OPERATIONS

4- Energy Consumption for Roadside Operation

- Lighting, signalization, roadside messaging, and maintenance of rights-of-way in the median or alongside roadways all require energy and contribute to road transport greenhouse gas emissions. Through use of new technologies, these emissions can be reduced.

6. ROAD INFRASTRUCTURE MITIGATION MEASURES

6.5 MEASUREMENTS AND MONITORING

- Two approaches

1. GHG emissions assess thru fossil fuel consumption within the transportation sector on the basis vehicle-kilometers travelled, fuel consumption efficiency of the vehicle and GHG emissions factors for various types of fuels.
2. The carbon footprint referring to the fact that the GHG emissions created when manufacturing and maintaining the vehicle during it life but excluding the final recycling are added to fuel consumption related to its operations

National examples: Canada, France, Italy, Japan, New Zeland, Norway, Scotland, Sweden

7. ADAPTATION

- As climate effects worsen, there will be a growing need for transport agencies to adapt their infrastructure and services.

- Design standards of road facilities need to be modified to adapt to changes in external forces and conditions caused by the climate change.

- Country experiences vary in their approaches to adaptation. All countries surveyed indicated a growing awareness of the need to begin the process of adaptation on an ongoing basis.

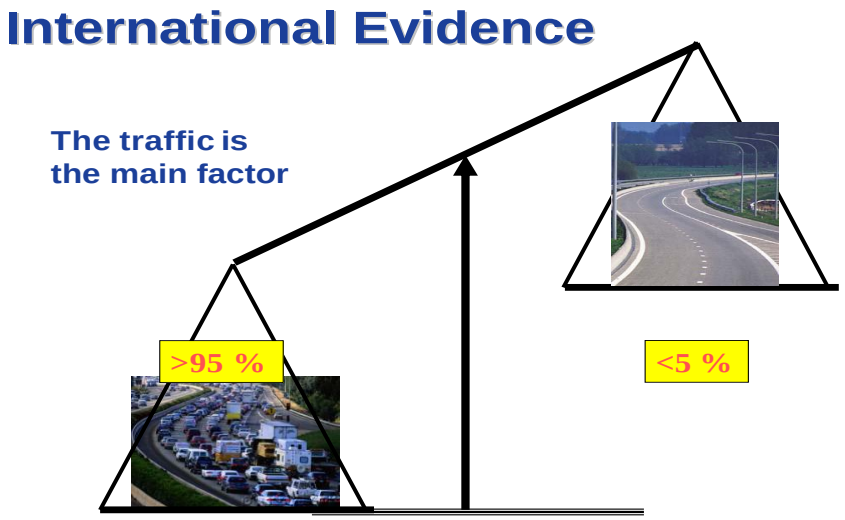
7. ADAPTATION

- during the four years of this report's development, the science has advanced considerably and more is being accomplished every day
- The UN Development Program has developed several resources to assist developing countries in planning for adaptation, including a monitoring and evaluation framework for adaptation, policy frameworks on stakeholder engagements and assessing vulnerabilities, hot spot analyses, and country portfolios for risk and adaptation opportunities.

National examples: Canada, France, Japan, New Zeland, Norway,Pakistan, Scotland, Switzerland, Sweden, USA

8. ANALYSIS

- many measures are being employed by transport agencies across the globe, but a critical question is**, "how effective are these measures at reducing GHG emissions?"**



8. ANALYSIS

System Efficiency | **Combined 3-6% GHG ↓**

	2030 GHG Reduction	Key Assumptions
Highway bottleneck relief	<0.1-0.3%	Improve top 100-200 bottlenecks by 2030
Reduced speed limits	1.1-1.8%	55mph national speed limit
Truck idling reduction	0.1-0.2%	26-100% of sleeper cabs with one board idle reduction tech
Freight rail and marine operations	0.1-0.5%	Reduce rail chokepoints, shore-side power for ships, reduce VMT in intermodal terminal, limited modal diversion
Air traffic operations	0.3-0.7%	Airport efficiency, direct routing, reduced separation, continuous descents
Construction materials	0.7-0.8%**	Recycled material in cement, low temp asphalt
Other	0.3%	Truck size and weight, freight urban consolidation centers, transportation agency energy efficient buildings, alt fuel fleet and construction vehicles
Combined Strategies	3-6%	Includes strategies not shown

Mike Savonis Federal Highway Administration (FHWA) US Department of Transportation

8. ANALYSIS

Travel Activity | Combined 5-17% GHG ↓

	2030 Reduction	Key Assumptions
Pay as you drive insurance	1.1-3.5%	Require states to allow (low) Require companies to offer (high)
Congestion pricing	0.4–1.6%	LOS D on all roads (avg 65c/mi for 29% of urban and 7% of rural VMT)
Public transportation	0.2-0.9%	2.4-4.6% annual increase in service
Non-motorized travel	0.2-0.6%	Comprehensive urban bike/ped improvements 2010-2025
Land use	1.2-3.9%	60-90% of new urban growth in approx. >5 units/acre
Parking management	0.2%	Downtown workers pay for parking ($5/day avg. for those not already paying)
Commuter / worksite trip reduction	0.1-0.6%	Widespread employer outreach and alternative mode support
Telework / compressed work week	0.5-0.7%	Doubling of current levels
Individualized marketing	0.3-0.4%	Reaches 10% of population
Eco-driving	0.8-4.3%	10-50% of drivers reached, half implement
Combined Strategies	5-17%	Does not include interactive effects. Includes induced demand.
VMT fee (not included above)	1.1-3.5%	2 to 5 cents per mile

8. CONCLUSIONS

- Climate effects have important ramifications for transport agencies as well as society as a whole.
- Many nations are already making concerted attempts to reduce greenhouse gases,
- In line with the growing national identification of the need to reduce greenhouse gas emissions, there is an emerging recognition that climate change is an important, even critical, issue for transport agencies.
- All nations surveyed have employed some or all of these types of measures that have reduced greenhouse gas emissions compared to what they would have been if such measures were not taken.

8. CONCLUSIONS

MITIGATION:

- Vehicle technological improvements have shown the greatest potential for long term reductions but even these are not currently sufficient to achieve the kinds of reductions necessary to limit climate change to what are now considered acceptable levels

- Newer, more aggressive vehicle technologies, like electric hybrids, currently cost considerably more limiting their introduction into the marketplace

8. CONCLUSIONS

MITIGATION:

- Other measures that are being undertaken or considered by transport agencies face similar or greater limits on their effectiveness. Fiscal measures can raise costs to consumers which are politically unpopular.

- Fostering alternative modes of transport, such as transit services, cycling and ridesharing, are usually accomplished through capital investment and new programs in distinct locations

- Land use measures which can reduce the need for surface transport services, are very long term

8. CONCLUSIONS

MITIGATION:

- Road infrastructure measures are also very limited in their ability to significantly reduce emissions. Construction and maintenance emissions are just a small part of the total

- These limitations listed should not be construed to mean that they are not worthwhile or should not be implemented.

8. CONCLUSIONS

MITIGATION:

- Many measures will be necessary to significantly reduce greenhouse gases from transport because of these limitations, and complementary combinations of measures that both provide low carbon means of transport and reduce the attractiveness of automobiles using existing technologies will be necessary to both meet travel demand and limit emissions.

8. CONCLUSIONS

ADAPTATION

- As climate effects worsen, there will be a growing need for transport agencies to adapt their infrastructure and services.
- Country experiences vary in their approaches to adaptation. All countries surveyed indicated a growing awareness of the need to begin the process of adaptation on an ongoing basis.
- Countries vary in their development and use of risk assessment tools and vulnerability analyses.
- The need to assess future climate effects and develop cost-effective adaptation measures is already clear.

- Thanks for your attention
- Merci pour votre attention
- Gracias por su atencion