Sustainable Development and the Assessment of Transport Infrastructure

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Sustainable Development and the Assessment of Transport Infrastructure

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\[ P(i|V) = \frac{\partial \ln G(e^V)}{\partial V_i} \]
Increasing attention to sustainable transport

The Future we want” (Rio +20) 2012
“132 We note that transportation and mobility are central to sustainable development....’
“ 133 We support the development of sustainable transport systems’

MDBs commitment to sustainable transport
“to provide more than $175 billion of loans and grants for transport in developing countries over the coming decade, that will be increasingly oriented towards sustainable transport”

European Unions Transport policy White Paper
• Reduce CO₂ emissions by 60% in 2050
• Break dependence on oil, Promote clean fuels
“Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs”

It contains within it two key concepts:

- the concept of 'needs', in particular the essential needs of the world's poor to which overriding priority should be given;
- the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.
Planetary Boundaries

(Source: Rockström et al 2009)
Transport and climate change (IPCC 2014)

1) **Transport accounts for about a quarter of global energy-related carbon emissions.** This contribution is rising faster than for any other energy end-use sector; direct transport carbon emissions could double by 2050.

2) **Impacts of climate change** could damage transport infrastructure such as roads, railways and ports, requiring extensive adaptation and changes to route planning in some regions.

3) **Cutting carbon emissions from transport is challenging,** given the continuing growth in demand and the slow turnover of stock and infrastructure.

4) **Many energy efficiency measures have a positive return on investment,** and could cut energy consumption by 30–50% by 2030. Some of these measures have a negative lifetime cost.

5) **Efficient, low-carbon transport systems have significant co-benefits** such as better access to mobility services for the poor, time saving, energy security, and reduced urban pollution.

Climate impacts of trade: Transport is a large part

- International transport is responsible for 33% of world-wide trade-related CO₂ emissions
- For some product groups like transport equipment, electronic equipment and machinery, the transport is responsible for over 75% of emissions
- Trade patterns are shifting, so transport will likely gain even larger shares for some product groups in the future.

(Cristea et al 2013)
# Impacts of transport – positive/negative

<table>
<thead>
<tr>
<th>Environmental</th>
<th>Social</th>
<th>Economic</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Air pollution</td>
<td>• Mobility</td>
<td>• Travel time</td>
</tr>
<tr>
<td>• Noise pollution</td>
<td>• Accessibility</td>
<td>• Costs of transport to customers/consumers</td>
</tr>
<tr>
<td>• Vibrations</td>
<td>• Accidents</td>
<td>• Transportation facility construction costs</td>
</tr>
<tr>
<td>• Light pollution</td>
<td>• Obesity</td>
<td>• Maintenance and disposal costs</td>
</tr>
<tr>
<td>• Visual intrusion</td>
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<td>• Costs relating to accidents</td>
</tr>
<tr>
<td>• Water pollution</td>
<td>• Community livability</td>
<td>• Transportation-related health costs</td>
</tr>
<tr>
<td>• Consumption of land/urban sprawl</td>
<td>• Gender imbalances</td>
<td>• Stimulation of economic growth</td>
</tr>
<tr>
<td>• Release of toxic/hazardous substances</td>
<td>• Cohesion/integration</td>
<td>• Agglomeration and labour market effects</td>
</tr>
<tr>
<td>• Solid waste</td>
<td>• Opportunity</td>
<td>• Opportunity costs</td>
</tr>
<tr>
<td>• Disruption of ecosystems and habitats</td>
<td>• Migration</td>
<td></td>
</tr>
<tr>
<td>• Hydrologic impacts</td>
<td>• Anxiety/’Rootlessness’</td>
<td></td>
</tr>
<tr>
<td>• Introduction of exotic species</td>
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</tr>
<tr>
<td>• Depletion of the ozone layer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Global climate change</td>
<td></td>
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</tr>
</tbody>
</table>

**Environmental Impacts:**
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- Noise pollution
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- Consumption of land/urban sprawl
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**Social Impacts:**
- Mobility
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- Accidents
- Obesity
- Barriers for the disadvantaged
- Community livability
- Gender imbalances
- Cohesion/integration
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**Economic Impacts:**
- Travel time
- Costs of transport to customers/consumers
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- Costs relating to accidents
- Transportation-related health costs
- Stimulation of economic growth
- Agglomeration and labour market effects
- Opportunity costs
Systems and life cycle view

ECONOMY

RAIL TRANSPORT

ROAD TRANSPORT

SEA TRANSPORT

INFRA-STRUCTURE

VEHICLES

ENERGY

Design

Recycling

Construction

Operations

Maintenance

Main-tenance

Use

Consumption

Distri-bution

Explo ration

Production

Recycling

Extraction

IMPACT ON SUSTAINABILITY
Sustainability aspects for Transport corridors

‘Corridor’ concept
Not just basic infrastructure facilities, also:
• transport technologies (including ICT applications, energy systems etc.);
• logistics solutions (including business models); and
• transport policies and regulatory procedures

SuperGreen research project
• to support the development of sustainable transport networks by fulfilling requirements covering environmental, technical, economical, social and spatial planning aspects
# SuperGreen: KPIs for corridors

## Table 4. Benchmarking results (all corridors)

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Mode</th>
<th>Cost (€/tkm)</th>
<th>Av. speed (km/h)</th>
<th>Reliability (%)</th>
<th>Frequency (no/year)</th>
<th>CO₂ (g/tkm)</th>
<th>SOx (g/tkm)</th>
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<tbody>
<tr>
<td>Brenner</td>
<td>Intermodal</td>
<td>0.03-0.09</td>
<td>9-41</td>
<td>95-99</td>
<td>26-624</td>
<td>10.62-42.11</td>
<td>0.02-0.14</td>
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<tr>
<td></td>
<td>Road</td>
<td>0.05-0.07</td>
<td>19-40</td>
<td>50-99</td>
<td>104-2.600</td>
<td>46.51-71.86</td>
<td>0.05-0.08</td>
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<td>Rail</td>
<td>0.05-0.80</td>
<td>44-98</td>
<td>50-100</td>
<td>208-572</td>
<td>9.49-17.61</td>
<td>0.04-0.09</td>
</tr>
<tr>
<td></td>
<td>SSS</td>
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<td>23</td>
<td>100</td>
<td>52</td>
<td>16.99</td>
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<tr>
<td>Cloverleaf</td>
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<td>40-60</td>
<td>80-90</td>
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<tr>
<td></td>
<td>Rail</td>
<td>0.05-0.09</td>
<td>45-65</td>
<td>90-98</td>
<td>156-364</td>
<td>13.14-18.46</td>
<td>0.01-0.02</td>
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<tr>
<td>Nureyev</td>
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<td>0.10-0.18</td>
<td>13-42</td>
<td>80-90</td>
<td>156-360</td>
<td>13.43-33.36</td>
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<td>SSS</td>
<td>0.05-0.06</td>
<td>15-28</td>
<td>90-99</td>
<td>52-360</td>
<td>5.65-15.60</td>
<td>0.07-0.14</td>
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<td>Strauss</td>
<td>IWT</td>
<td>0.02-0.44</td>
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<td>-</td>
<td>-</td>
<td>9.86-22.80</td>
<td>0.01-0.03</td>
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<tr>
<td>Mare Nostrum</td>
<td>SSS</td>
<td>0.003-0.20</td>
<td>17</td>
<td>90-95</td>
<td>52-416</td>
<td>6.44-27.26</td>
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<tr>
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<td>DSS</td>
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<td>-</td>
<td>15.22</td>
<td>0.22</td>
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<tr>
<td>Silk Way</td>
<td>Rail</td>
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<td>DSS</td>
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<td>20-23</td>
<td>-</td>
<td>-</td>
<td>12.50</td>
<td>-</td>
</tr>
</tbody>
</table>
SuperGreen: Sustainable measures for European corridors

- Improvement of green supply chain design and management;
- Harmonisation of policies and regulations;
- Development and harmonisation of transport infrastructure and technology;
- Harmonisation and development of ICT solutions and transport documents;
- Ensuring supply of good quality labour

Necessary technologies of greening freight corridors:
- alternative clean fuels,
- energy efficiency improvements,
- smart telematic applications
Conclusion: Some options to promote Sustainable Transport Systems (1)

1) General policy level

- Consider planetary boundaries and sustainable development goals
- Integrated transport policy across modes
- Internalization of external costs (and reducing subsidies)
- International fuel consumption standards for trucks
- Providing education in sustainable transport solutions
- Including sustainability impacts in monitoring and benchmarking systems
Conclusion: Some options to promote Sustainable Transport Systems (2)

2) Design and construction of infrastructure corridors

- Ensure effective and inclusive environmental assessment procedures
- Adopt a life cycle perspective (life cycle cost and impacts)
- Build in climate resilience
- Prepare for alternatives to diesel and petrol for road transport
Conclusion: Some options to promote Sustainable Transport Systems (3)

3) Management and operation of mobility

- **Avoid** unnecessary transport, by using planning and ICT
- **Shift** transport to least polluting modes via pricing and investment
- **Improve** the energy and environmental performance of mobility technology through regulations, incentives and logistics
Final remarks

• “What you do in life echoes in eternity”

• A Sustainable Silk Road?