Adaptation of the transport sector to climate change

ToPDAd-Meeting
Graz, 11.03.15 – 13.03.15
Impact of climate change on transport

Key Observations

1. Climate change and resulting weather extremes have an impact on the transport sector today *(But it is not always identified as such)*

2. Monitoring of the current information is a key necessity for establishing long term adaptation strategies *(Currently: no or limited logging of ‘climate related events’)*

3. Infrastructure that is built now, should be adapted to conditions which are ‘future-proof’ *(Currently: focus on ‘short term’ disturbances)*

4. Rule of thumb here is the **lifetime of infrastructures**
   
   - Road signs / Traffic lights / Signaling equipment: 1-10 years
   - Cars / trucks: 4 - 15 years
   - Roadways / Highways: 10 – 30 years
   - Trains / carriages: ~30 years
   - Railways: 20 – 40 years
   - Ships: 30-50 years
   - (Air) ports: >50 years
   - Bridges: >>50 years
   - Canals / inland waterway infrastructure: >100 years

5. **Better data and tools are needed!**

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- Case 1: Tourism -> **Demand side** adaptation: may change prospects for passenger demand by air transport
- Case 3: Prospects for arctic navigation -> **Supply side** adaptation: Use of the North Sea Route as an alternative for the ‘Suez’ route for maritime traffic
- Case 4: Urban downpour (case study Zurich) -> **Demand & Supply** side adaptation: Reduced capacity due to extreme rainfall (& snow) + Impact of travel information (rerouting & rescheduling)
- Case 6: Flooding (case study London) -> **Demand & Supply** side: Impact of flooding on the whole urban system (including transport)
Key conclusions (1)

Impact of travel information

- The additional travel costs generated by extreme events for a medium sized city like Zurich tend to be rather modest.
- We find that the cost ranges from around 6 million euros (high occurrence) to 64 million euros (low occurrence) per day.
- The impact of passenger information in case of extreme events, using integrated weather route information at travelers can reduce aggregate disruption costs mentioned above with about one third.
- The largest impact on the cost is experienced when travelers are able to reschedule their activity patterns (60-70% of the adaptation effect).
- On-route information can be beneficial, but full informedness of travelers is not always beneficial (benefits are largest when about 50-60% of the travellers is informed).
- This means that, given the relatively low implementation cost of these options, they are cost-effective ways to increase the resiliency of the transport sector.
Impact of on-route travel information
Key conclusions (2)

Impact of investments in physical infrastructure

• From the flooding impact assessment for London we conclude that extreme precipitation and flooding may have a serious impact on larger cities, especially when semi-permanent damages to the transport network are possible.

• Physical adaptation measures in that case become a cost-effective way to adapt (decreasing the risk of flooding by about 40% in the case of London).

• The additional benefit of – usually expensive – physical measures on top of the supposedly less costly prioritized recovery approach is however appreciably smaller, than in case of physical measures only.
Key conclusions (3)

The optimal timing of investments in adaptation

- Transport infrastructures with long lifetimes should be the first to consider the impact of climate change adaptation. Railways, ports and airports are the most critical with respect to their long-term exposure. Tracks and bridges can endure up to 100 years. Rolling stock is at risk as well, with lifetimes up to 40 years.
- The long life time of these infrastructures makes that they should be designed for conditions that have a low occurrence today, but are more common by 2050 and 2100.
- Reactive adaptation leads to a higher exposure to extreme weather events in the future than under optimal investment options.
- The risk for maladaptation of infrastructure should be considered when uncertainty on future events is very high or when adaptation of infrastructure can lead to increased vulnerability for other events.
Key conclusions (4)

Resilience of maritime trade flows: the North Sea Route (NSR)

• The NSR provides an opportunity for maritime trade, however this can only be realised when various factors are sufficiently conducive.

• In the first place the pace of ice cover retreat is uncertain even for given RCP scenarios. Due to decadal variations a series of years with reasonable access for (Polar class) container ships may be followed by a sequence of years with limited access, despite the long term trend of improving access.

• We find that under reasonable conditions a transit of container vessels using a combined Suez – NSR trade route is possible on regular basis. However the trade potential remains rather limited at a maximum of 2.5 million TEU’s or around 800-900 transits per year.

• We also find that there is a non-negligible degree of competition between the Siberian railway line and the NSR for certain transport flows.

• Costs on the NSR (/tkm) need to be at least half of the costs on the TSR and not more than double of the ones on the Suez (South) route to be competitive.
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