Adaptation of the transport sector to climate change

ToPDAd-Meeting
Graz, 11.03.15 – 13.03.15

TRANSPORT & MOBILITY LEUVEN

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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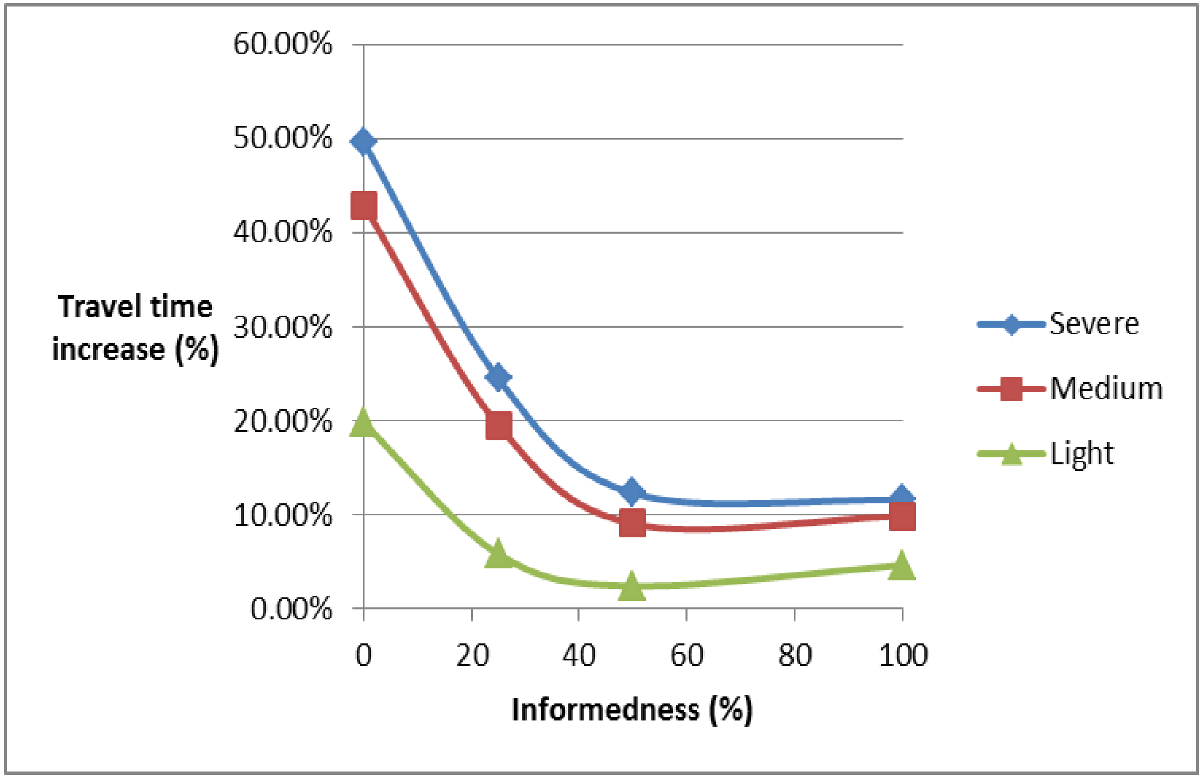
- Case 1: Tourism -> **Demand side** adaptation: may change prospects for passenger demand by air transport
- Case 3: Prospects for arctic navigation -> **Supply side** adaptation: Use of the North Sea Route as an alternative for the ‘Suez’ route for maritime traffic
- Case 4: Urban downpour (case study 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)

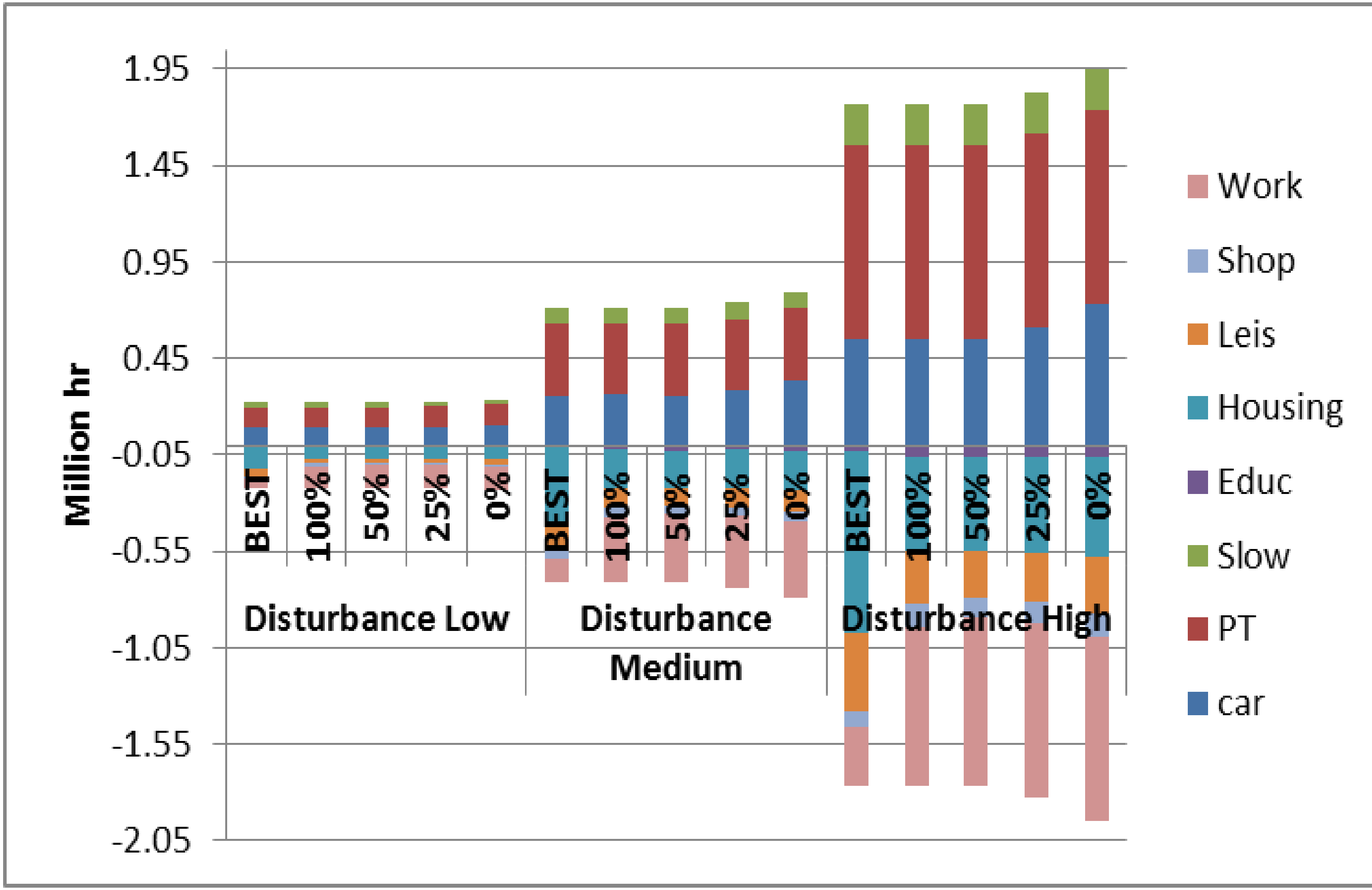
Key conclusions (1)

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




Million hr
1.95
1.45
0.95
0.45
-0.05
-0.55
-1.05
-1.55
-2.05
BEST
100%
50%
25%
0%
Disturbance Low
Disturbance Medium
Disturbance High
Work
Shop
Leis
Housing
Educ
Slow
PT
car

Key conclusions (2)

Impact of investments in physical infrastructure

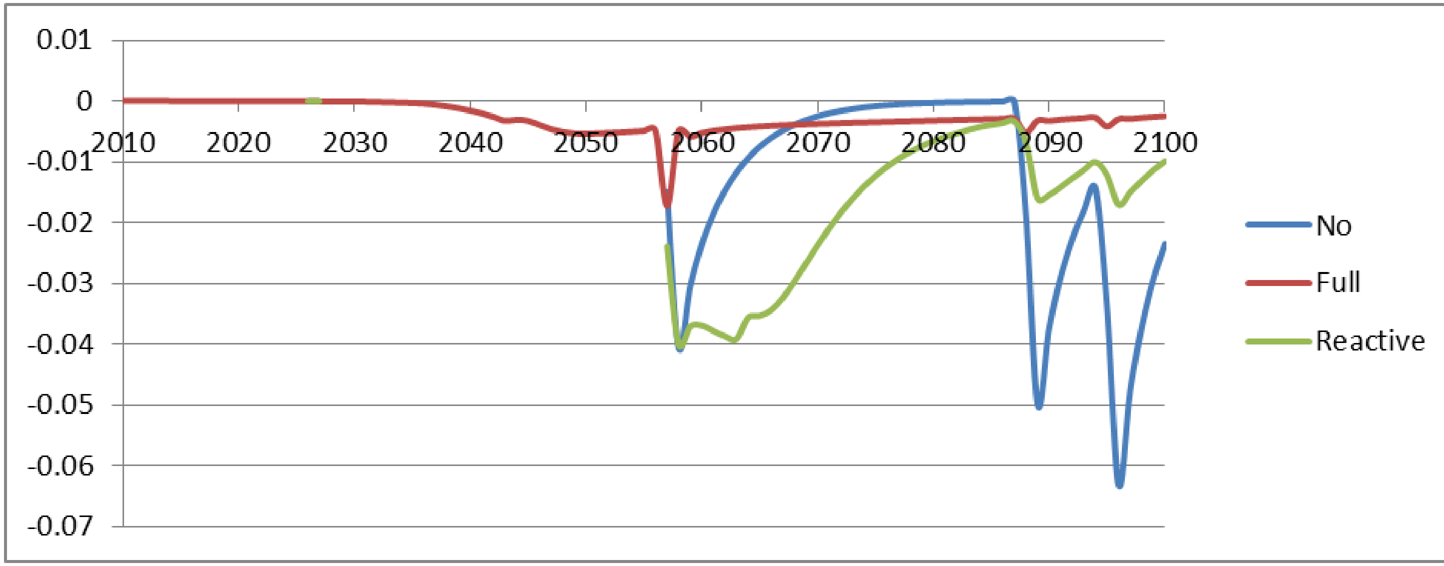
- From the flooding impact assessment for London we conclude that extreme precipitation and flooding may have a serious impact on larger cities, especially when semi-permanent damages to the transport network are possible.
- Physical adaptation measures in that case become a cost-effective way to adapt (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)

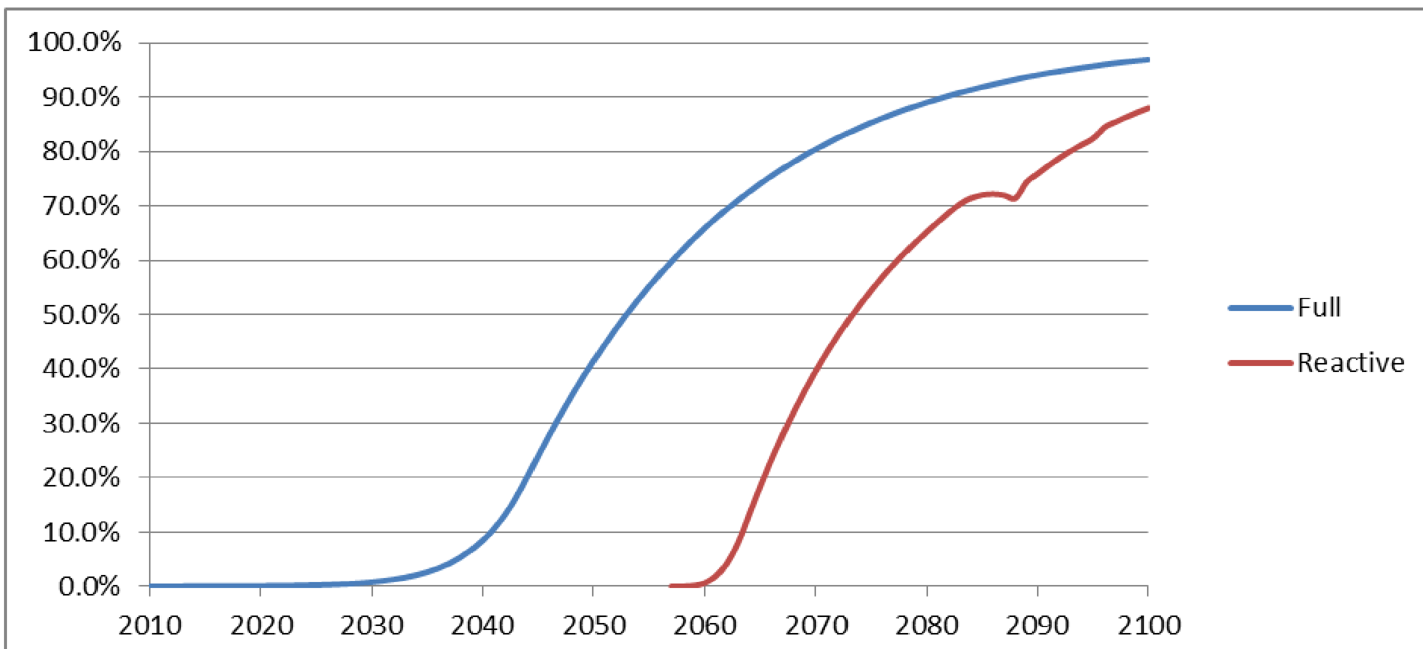
The optimal timing of investments in adaptation

- 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

% Deviation of GDP from reference case



Share of adapted capital stock in total capital stock



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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