Business from technology

EWENT

Costs of Extreme Weather to the European Community

SEVENTH FRAMEWORK PROGRAMME

Exploring Extreme Weather Impacts on Transportation System Operations in Europe: Opportunities for Climate Change Adaptation and Mitigation

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Introduction

- Results presented here are based on research carried out in the EWENT (**Extreme Weather Impacts on European Networks of Transport)** project work package 4, which has focused on cost estimates of the extreme weather to the European transport network, the operators and the users
- Researchers who contributed to results presented:
  - Michael Kreuz and Thorsten Mühlhausen, DLR, Germany
  - Dr Johanna Ludvigsen, Institute of Transport Economics,Oslo Norway (TOI)
  - Hanna Askola and Heidi Auvinen, VTT

Organisation of the presentation

- Background and linkages to other work in the EWENT project
- Goals of the work package
- Cost estimates by sector
- Cost estimates at the European level
- Summary and conclusions

Background and linkages to other work in the EWENT project

Goals of the work package

- Estimation of economic costs of extreme weather impacts by selected cases from different climate zones
- Justification for valuation methods and monetary values assessed
- Overall estimate of potential economic losses in Europe due to extreme weather
- Projection of trend in Europe according to predicted changes in frequency of extreme weather phenomena in the future
- Prediction of the monetary impacts at present, 2040 and 2070

Cost estimates

- For accidents, calculated as statistical value of life for fatalities, using also unit values for severe accidents and slight injuries (definitions as applied in European transport sector analysis)
- For time costs, using the official valuations of time used in the cost-benefit calculations (usually referred to as ”time savings”) the values of time where applied to selected case studies
- For aviation, the industry provides European level official figures that were used in the calculation, which has led to more comprehensive European level estimate of time costs

Cost estimates - overview

Mode/ data availability	Road	Rail	Inland waterways	Maritime	Aviation
Accidents at European level	Yes	Yes	Yes	Yes	-
Accidents at regional (climate zone level)	Yes	No	No	No	-
Calculations provided	Yes	Partially	Partially	Partially	No
Time costs at European level	No	No	No	No	Yes
Time costs at regional (climate zone level)	Partially	Partially	No	No	Yes
Calculations provided	Partially	Partially	No	No	Yes
Freight delays at the European level	No	No	No	No	No
Time costs at regional (climate zone level)	Partially	Partially	No	No	No
Calculations provided	Partially	Partially	No	No	No

Cost estimates – road passenger transport

- Accident costs at present: 20.7 billion euro
- Accident costs at 2040: 6.5 billion euro (10 per cent of the total reduction due to changes in climate between now and 2040)
- Accident costs at 2070: 4.5 billion euro (20 per cent of the total reduction due to changes in climate between 2040 and 2070)
- Time costs at present: Not available at the European level, collected through selected case studies that are based on commuter volumes and the estimated average delays
- Road transport especially vulnerable as users have different skills and perceptions in terms of how to manage a situation
- Note: The major part of future decrease in the accident costs will be due to improvements in the technology, not due to changes in weather directly!

Cost estimates – rail passenger transport

- Accident costs: Lower as amount of users lower than in road transport, and due to the fact that trains use rail and professional operating staff
- At present: 103 million annually
- 2040:72 million
- 2070: 23 million
- Time costs: Calculations show that impacts are lower than in road transport, due to the lower volume of passengers

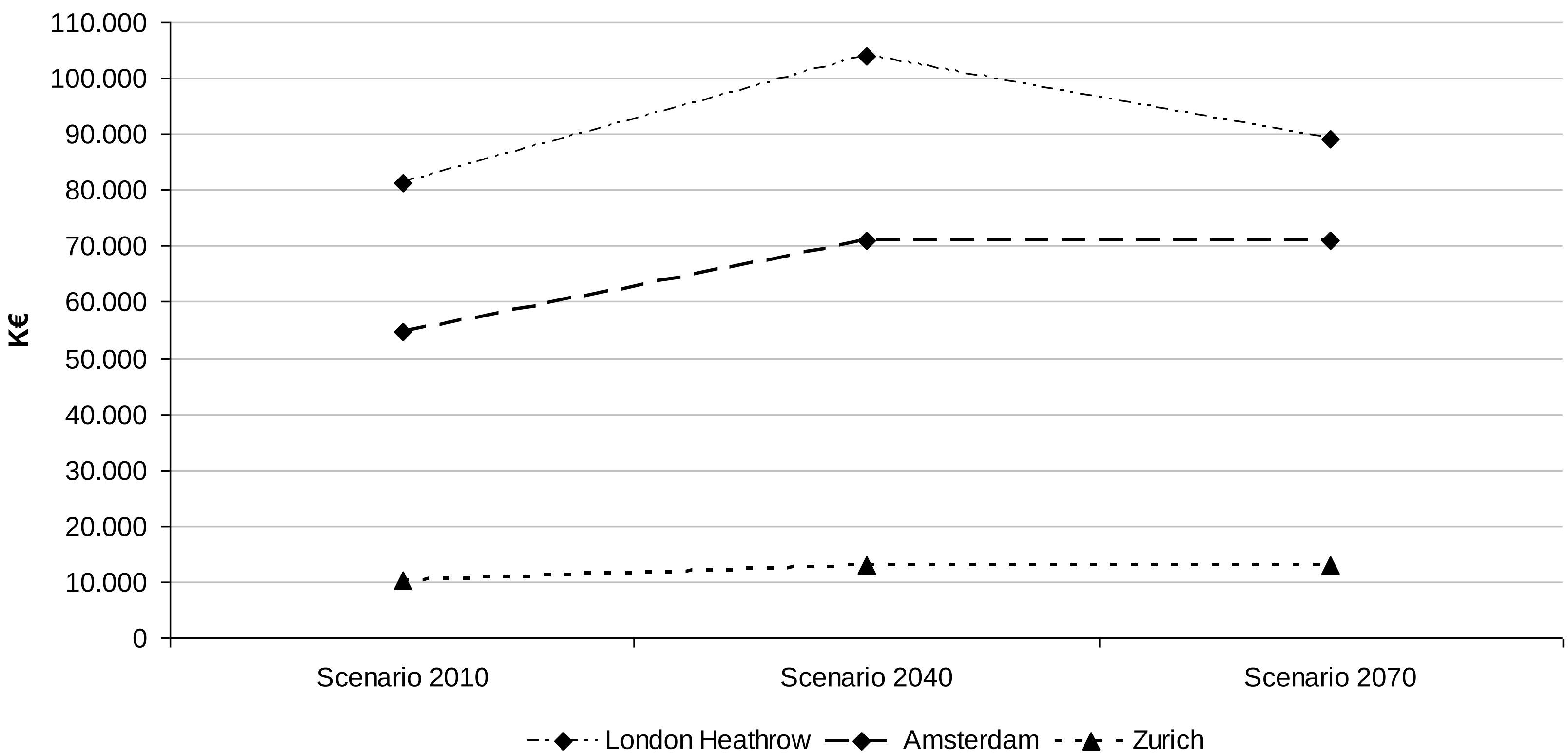
Cost estimates – waterborne transport

- Accident costs: Less than 100 million annually, inland waterways and maritime transport combined
- Will decreaser further by 2040 and 2070
- No time costs calculated (due to the nature of the waterborne transport, most volumes of passengers are leisure travellers, so also the value of time lost would have been lower than in other transport modes)

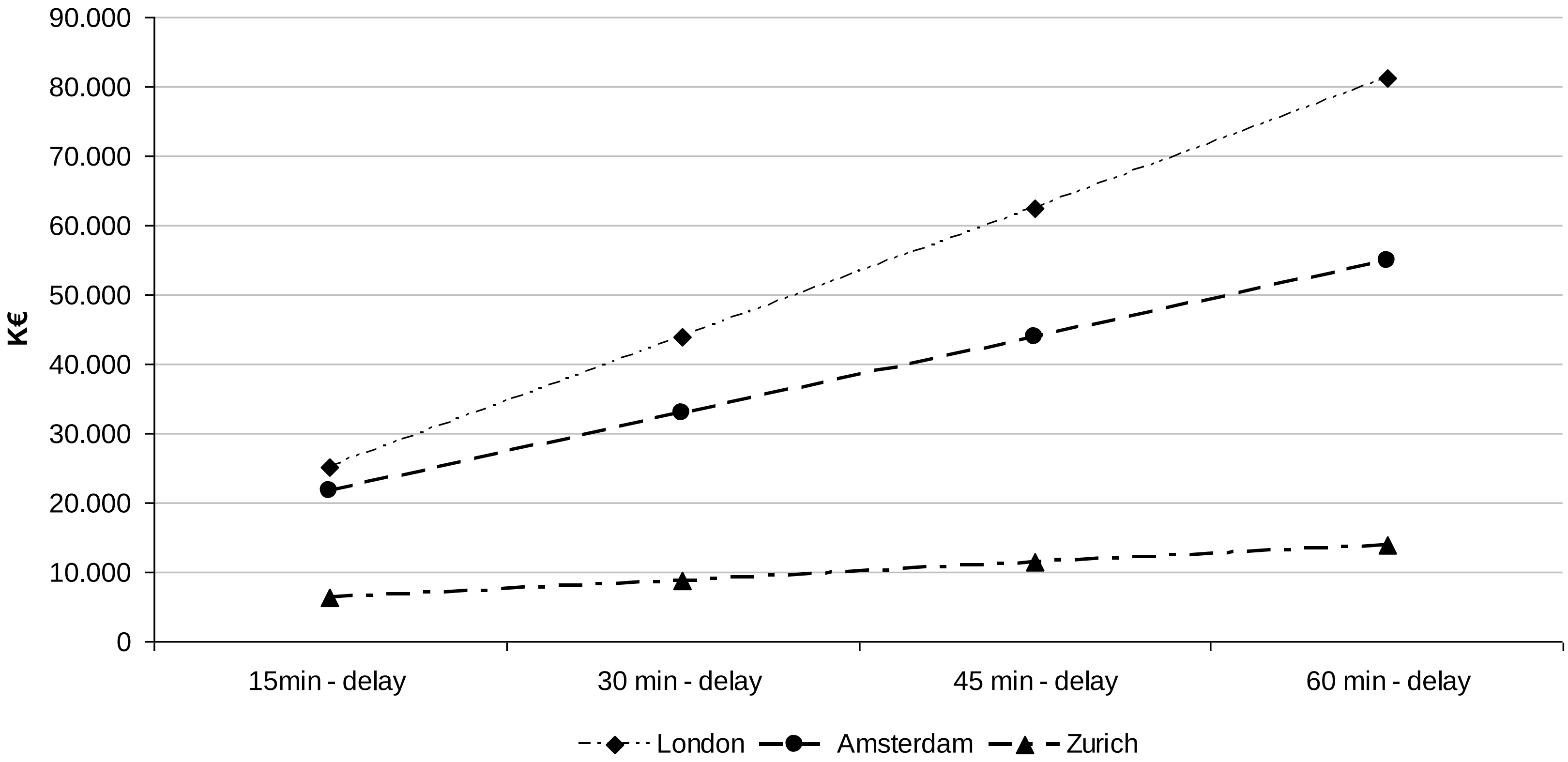
Cost estimates - aviation

- No accident costs calculated, as there is a neglible number of accidents in aviation
- At European level significant: One day of airspace closure (as in the case of volcanic ash from Island) costs several billions of euros
- This is a result of two factors: operator costs and passengers travel time losses
- According to 2040 and 2070 estimates depending on the climate zones a diversified picture emerges about the changes in costs
- Detailed examples of selected airports presented in next slides

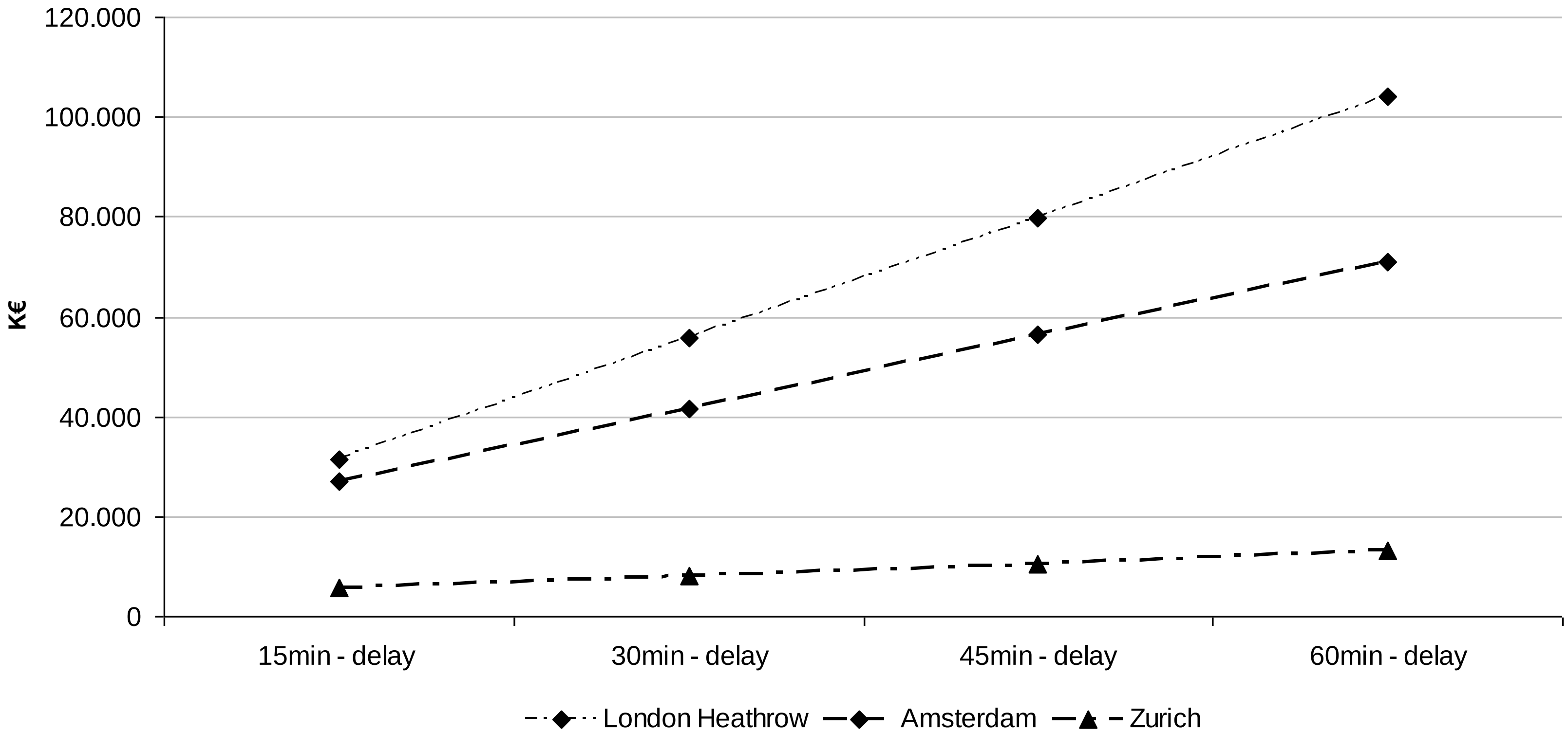
Cost estimates - aviation



Cost estimates – aviation sensitivity analysis for 2010



Cost estimates – aviation sensitivity analysis for 2040



Cost estimates – freight transport

Six Empirical Studies of Bad Weather Impacts on Freight Transport , Logistics and Infrastructure Providers

1. Two surveys of business practitioners on bad weather impacts on road and rail freight transport, and infrastructure systems in England, Poland, Sweden, Switzerland, Finland, Austria and Norway, and preparedness quality
2. Modeling of impacts of two natural disasters on HGV traffic breakdowns and cost increases for road hauliers, logistics providers and shippers
3. Calculations of delayed cargo tonnages per freight train in Finland during 2008-2010 and values of time lost
4. Calculation of proportion of weather-induced delays in all delays of freight trains in Finland over 2008-2010
5. Modeling of co-variation between the odds for duration of freight train delays and aggregate weather indicators (mean monthly temperatures, precipitation averages and minimum and maximum temperatures) depicting weather conditions over Finnish rail network during 2008-2010.

Bad Weather Impacts on Road and Rail Freight Transport in England Poland, Sweden, Switzerland, Austria, Finland and Norway

- Breakdown of rail and road transport operations
- Shutdown of road and rail infrastructure
- Increased use of human resources for ad hoc damage containment
- After-shock contagion from infrastructure to transport operations, from transport to logistics, from logistics to manufacturing and wholesale/retailing, with stock-outs and/or production breakdowns as end outcomes
- Loss of customer trust, market share and damage of business prospects
- Fleet damage, supply disruptions and statutory penalties imposed additional costs and revenue losses on operators

Bad Weather Impacts on Road and Rail Freight Transport in England, Poland, Sweden, Switzerland, Austria, Finland, and Norway

- Despite negative impacts, low willingness to improve organizational /channel robustness through physical preparedness and disaster risk management skills
- Poor understanding of weather-hazard probability combined with intra-organizational differences in risk definition and pursuit of lean operations models lead to risk underestimation
- High uncertainty as to weather hazards will materialize and cause financial losses hinders resource commitment to development of disaster risk management skills and preparedness programs
- Inadequate managerial/operational preparedness at infrastructure and transport providers to withstand harsh weather in 2010 and 2011

Monetary Consequences of Natural Disasters on HGV Traffic Breakdowns

- Monetization of HGV detour and traffic re-assignment costs caused by blockage of two primary carriageways varied with types of adaptations chosen
- The highest additional costs were incurred when HGVs continued on the same route and drove over detour
- Much lower additional costs were incurred when cargo was transferred to cheaper rail and/or ferry transport
- The lowest additional costs were incurred when cargo was reassigned and consignments consolidated decreasing shipment numbers

Bad Weather Impacts on Rail Freight Transport in Finland 2008-2010

- Higher tonnage of goods delayed per train due to bad weather disruptions leads to higher value of time lost
- Cargo volumes and values of time lost increased during autumn and winter, when weather became harsher
- 60 % of all freight train delays over 2008-2010 were attributed to bad-weather and/or weather-induced technical damages
- Combined effect of temperatures below 7 centigrade and 10-20 cm change in snow depth from the month before explained 65% of variation in the log odds for freight train delays
- Change in number of days with 10-20 cm snow depth explained 65% variation in train arrival lateness contributing to 626 minutes or 10 ½ delay hours
- Change in number of days with snow falls over 5 mm accounted for 77% of variation in arrival lateness implying that each additional day with this snow fall could contribute to 19 ½ delay hours
- A combination if increase in mean number of days with 5 mm snowfalls and temperature below 20 centigrade explained 80% of variation in train arrival tardiness contributing to additional 193 minutes or 3’ 15’’ in delay duration.

Bad Weather Impacts on Road and Rail Freight Transport in England Poland, Sweden, Switzerland, Austria, Finland and Norway

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Cost estimates at the European level

- Combined values of the costs at European level look as follows:
- The ”bad boys” are road transport due to high accident costs and aviation due to high time loss and operator costs
- Future reduction in overall costs anticipated, the scenarios ascribe this to changes in technology, not to transport system better coping with anticipated climate change or weather-induced problems
- Fact is that annually the losses at European level across all transport modes are tens of billions of euros

Summary and conclusions – passenger transport

- Cost estimates presented represent the first attempt to monetize impacts at the European Union level (27 countries, 500+ million inhabitants
- Data availability was an issue. As analytical methods are available, data scarcity stopped us from more thorough calculations
- In the beginning no clear picture of the annual costs at European level (millions or billions of euro?)
- Weather has a major impact on transport system in terms of costs to users, operators and service providers, particulary in the road and rail transport and aviation
- If current trends of accident and time cost changes are complemented with additional investments to increase preparedness against extreme weather major further reductions in costs can be attained, which also translates directly into fewer lives lost due to accidents

Conclusions – freight transport

- Although weather-induced disruptions pose considerable threats to supply reliability and competitiveness of environmentally friendly rail freight transport in Europe, still statistical assessment of causal links between harsh weather and transport operations requires much better data quality
- To effectively combat weather-induced disruptions, a better understanding of interactions between transport operations and weather conditions is needed
  To devise effective preparedness and damage containment programs, tight collaboration between meteo-professionals, transportation managers and behavioral scientists is recommended
- More research is needed to enhance understanding of utility of concomitant preparedness programs and disaster risk management skills at transportation, logistics and manufacturing companies

For additional information

- Publication of the results out during the spring 2012 (TOI publication series)
- More information available from Marko Nokkala, marko.nokkala@vtt.fi

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