

# EWENT

## Extreme weather impacts on European networks of transport

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Knowledge for Tomorrow



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# Outline

- Introduction and background
- Methodology
- Qualitative results
- Determination of social and operators costs in case of extreme weather
- Summary and outlook



# Extreme weather – an aviation perspective

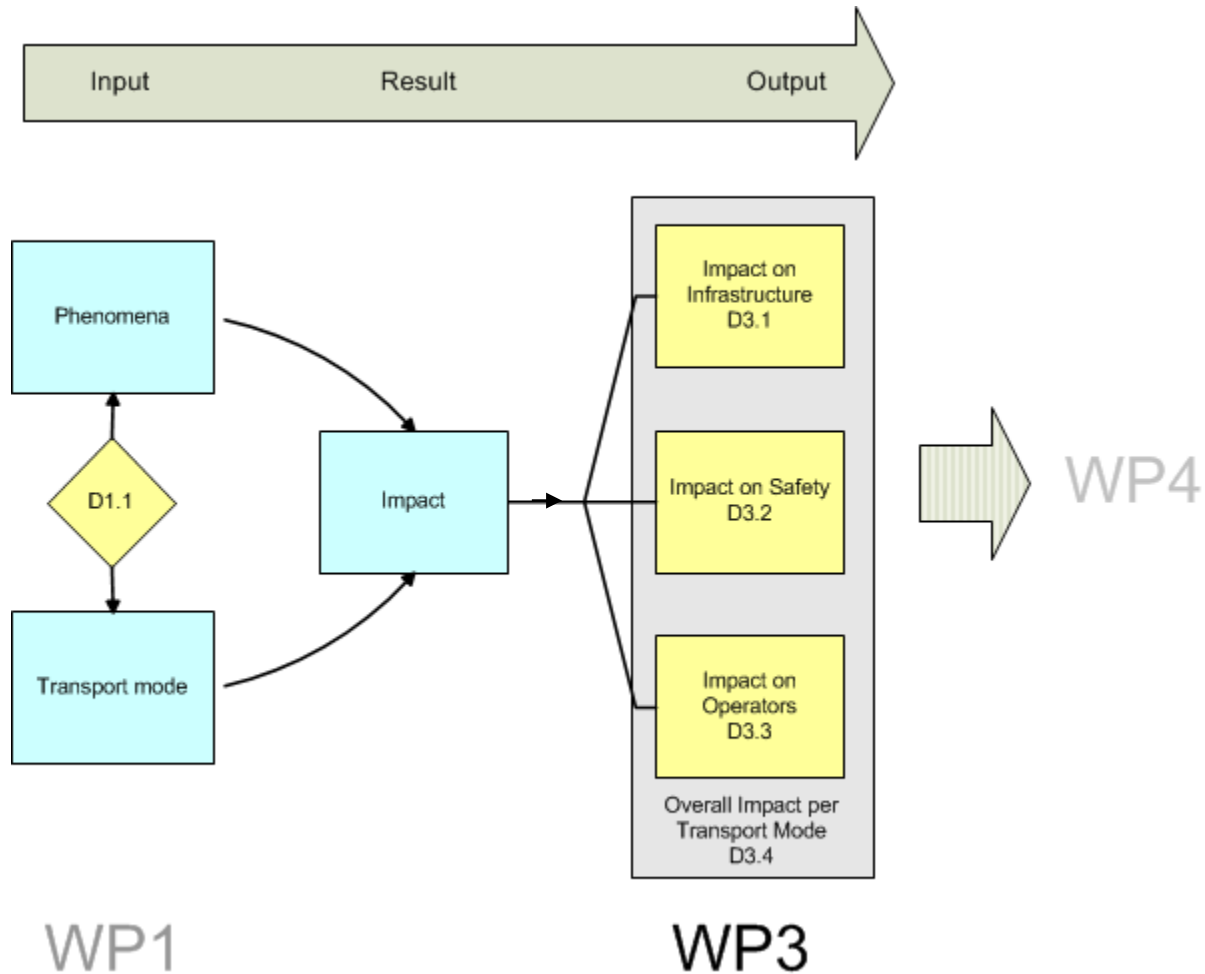


## Work packages of greatest relevance

- WP1: Overview about the impacts of extreme weather phenomena on the European network on transport
- WP2: Probability today for these weather condition in each of the regions  
Probability in future for these weather condition
- WP3: Quantitative impact of the consequence, i.e. how many movements are cancelled and/or how many average delay minutes are generated?
- WP4: Determine the cost of the movement cancellation and/or delay and multiply these results with the probabilities from WP2

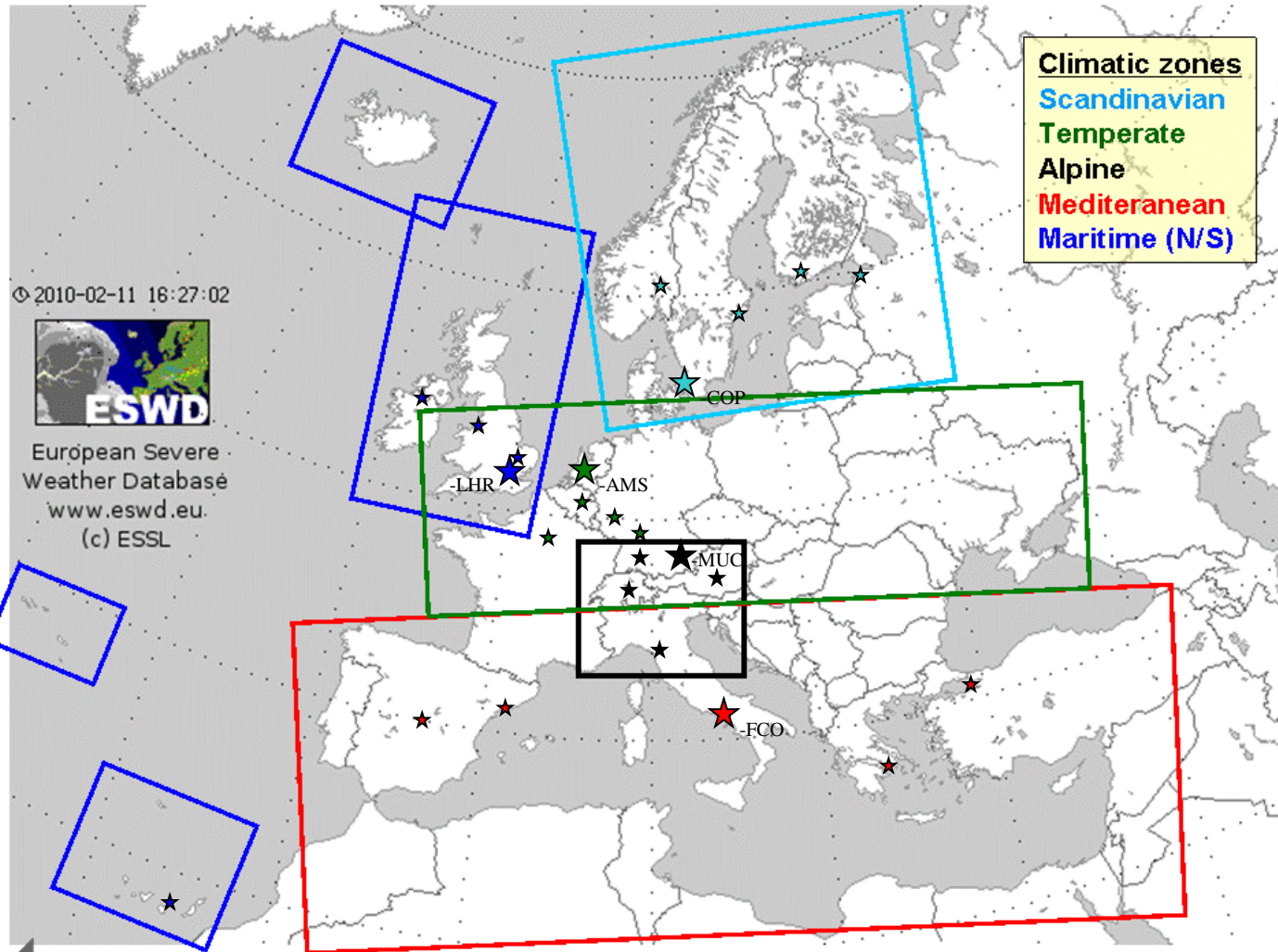


## WP3 Methodology

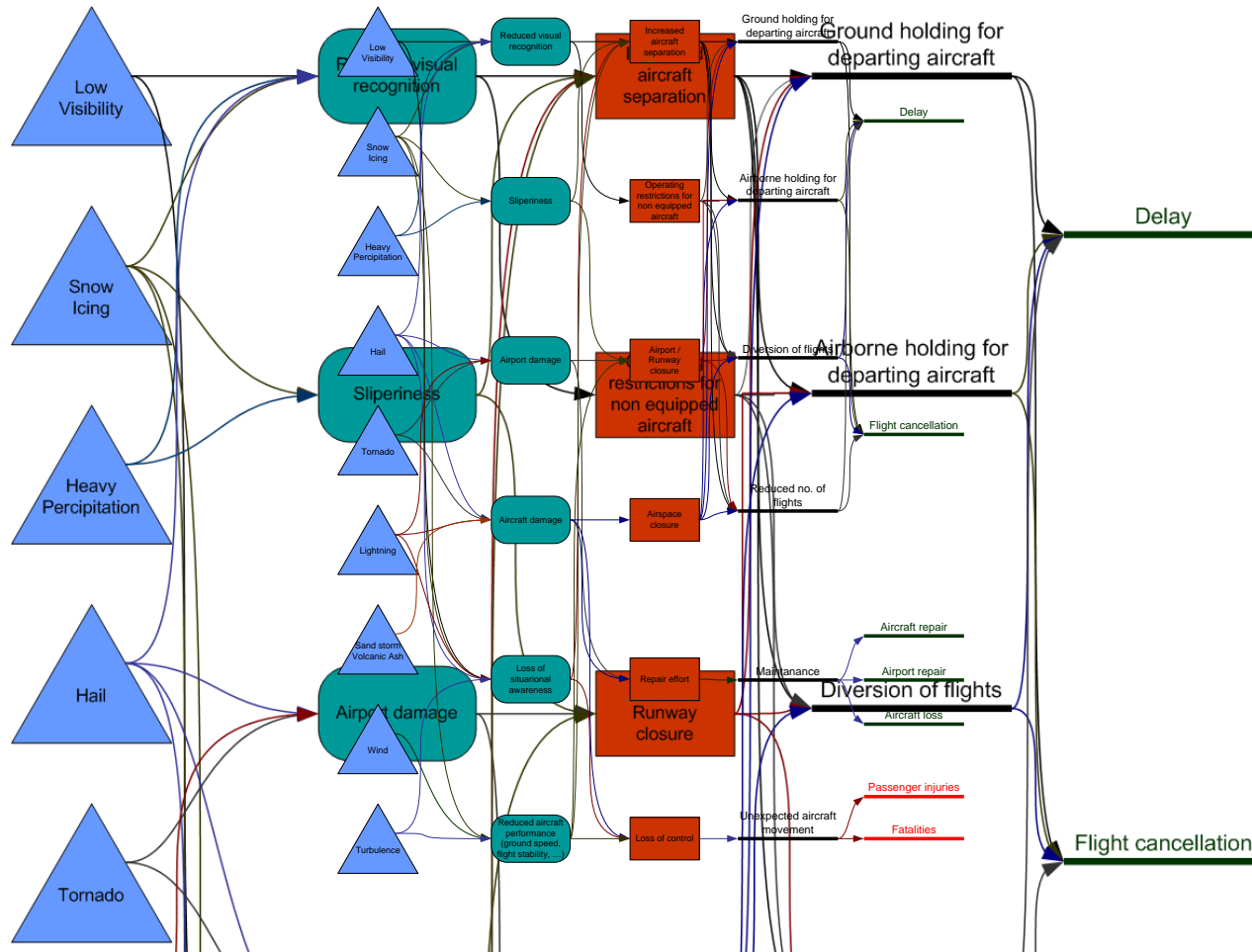




# Selected hub airports – practical approach



# Qualitative results – causal diagram



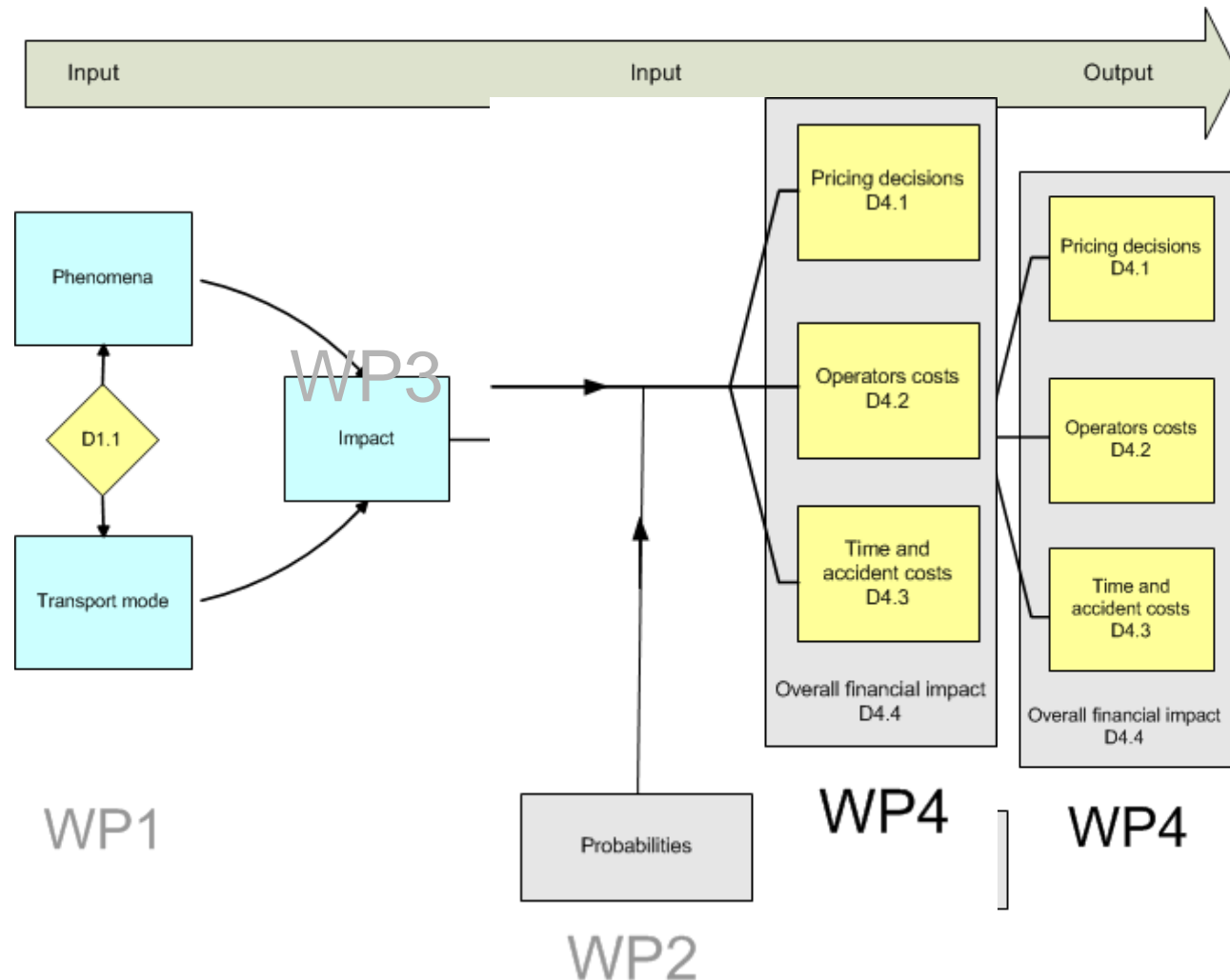
## Examples from Causal diagram

- **Decreasing Fog / Bad vision** → Reduction of higher separation  
→ Increase in capacity → Delay reduction
- **Increasing Wind / Thunderstorms** → Runway / Airport closure  
→ Decrease in capacity → Delay / Cancellation
- **Higher temperature** → Less de-icing → Faster turnaround  
→ Increase in capacity → Delay reduction





## WP 4 Methodology



# Operators Costs – calculation method

$$\frac{\emptyset M_{jets}}{day} \times weather(scenario)_{days} \times Canc.prop \cdot M_{jets} \times Canc.costs_{M_{jets}}$$

- This approach is used for the calculation of:
  - where
    - 2010 and 2040 scenario
    - Medium and heavy jets
- $\frac{\emptyset M_{jets}}{day}$  = average amount of medium jets per day
- $weather(scenario)_{days}$  = amount of extreme weather days in the respective scenario
- **Average values of 5 up to 30 % cancellation (medium jets only)**
  - $Canc.prop \cdot M_{jets}$  = percentage of cancelled medium jets
  - **Assumption: Medium jets are prior to be cancelled due to economic reasons**
  - $Canc.costs_{M_{jets}}$  = cancellation costs per medium jet
- Worst case scenario: Airport closure (100 % cancellation)



## Operators costs – data used

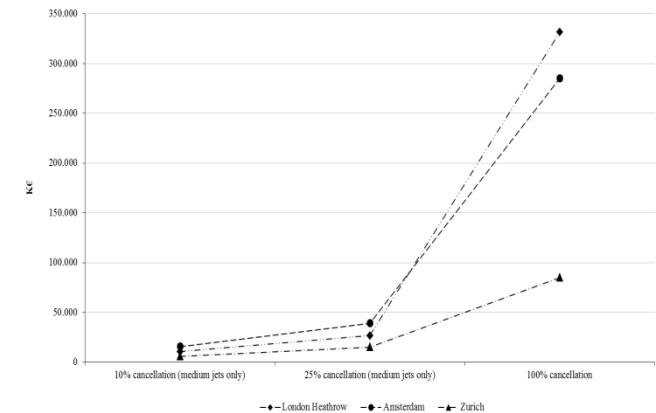
	London Heathrow	Amsterdam	Zurich
Number of departures/year (in 2009)	239.280	220.656	131.499
Percentage of heavy jets	31 %	15 %	8 %
Percentage of medium jets	69 %	85 %	92 %
Cancellation costs heavy jets (€)	78.900 €	78.900 €	78.900 €
Cancellation costs medium jets (€)	16.900 €	16.900 €	16.900 €
Most significant weather phenomena (scenario 2010/scenario 2040) (days)	Cold temperatures (7/7)	Wind gusts (9/8)	Cold temperatures (5/4)

Sources: EUROCONTROL, Flightstats



## Operators Costs – results scenario 2010

- Operators costs in London Heathrow and Amsterdam are a multiple of Zurich
- Slightly higher costs in Amsterdam compared to London Heathrow in case of 10% and 25% cancellation
- Vice versa situation in case of 100 % cancellation
  - Higher percentage of heavy jets in London compared to Amsterdam (Ø 31% vs. Ø 15%)

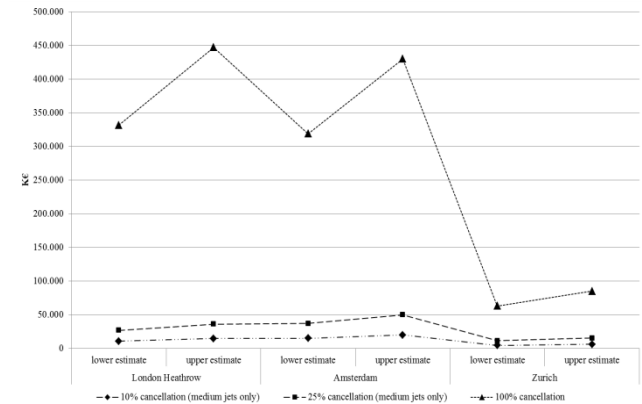


Source: <http://vielflieger-blog.de/files/2010/05/landeahn-parkplatz.jpg>



# Operators Costs – results scenario 2040

- Sensitivity analysis concerning the annually rate of increase
  - Lower estimate: Same amount of flights as in 2010 scenario
  - Upper estimate: Annually increase of 1 % assumed
  - only one parameter has been changed to minimize the uncertainty and variability of the results
- Results show a similar distribution of values as in 2010 scenario



Source: <http://vielflieger-blog.de/files/2010/05/landebahn-parkplatz.jpg>



## Social costs – calculation method

$$\frac{\emptyset Paxe}{M_{jets} \times day} \times prop_B \times VOT(scenario)_B \times time_{factor} \times weather(scenario)_{days}$$

where

- This approach is used for the calculation of:

$\frac{\emptyset Paxe}{M_{jets} \times day}$  = average passengers in medium jets per day

$prop_B$  = proportion of business travellers

$VOT(scenario)_B$  = value of time for business travellers in the respective scenario

$time_{factor}$  = time factor for sensitivity analyses

$weather(scenario)_{days}$  = amount of extreme weather days in the respective scenario



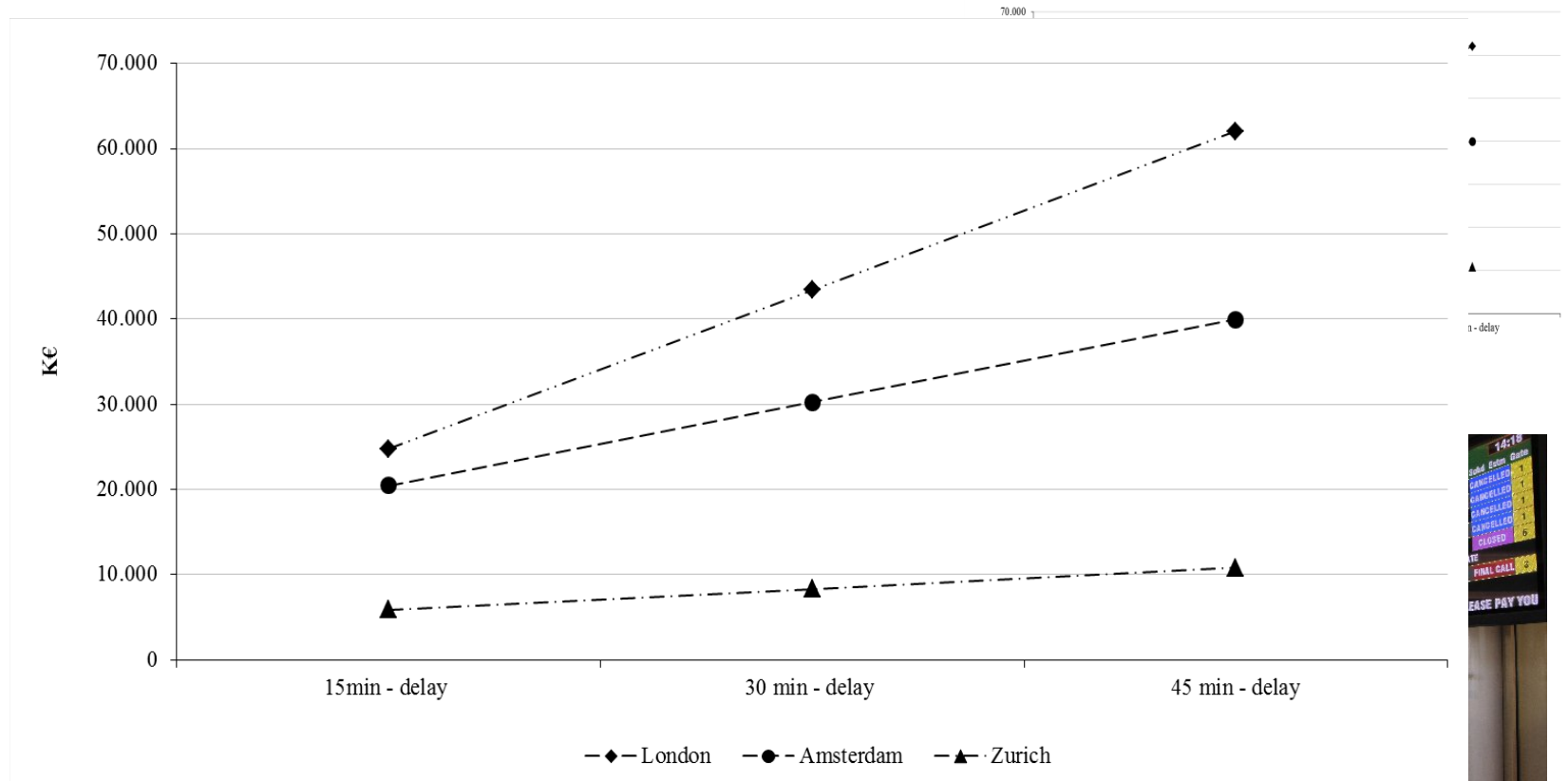
## Social costs – data used

	London Heathrow	Amsterdam	Zurich
Number of departures/year (in 2009)	239.280	220.656	131.499
Percentage of heavy jets	31 %	15 %	8 %
Percentage of medium jets	69 %	85 %	92 %
Value of time business travellers (scenario 2010/scenario 2040)	47/63 €	47/63 €	47/63 €
Value of time leisure travellers (scenario 2010/scenario 2040)	23/26 €	23/26 €	23/26 €
Seat load factor (heavy/medium jets)	83/70 %	83/70 %	83/70 %
Average seat capacity (heavy/medium jets)	300/120	300/120	300/120

Sources: EURONCONTROL, Flightstats



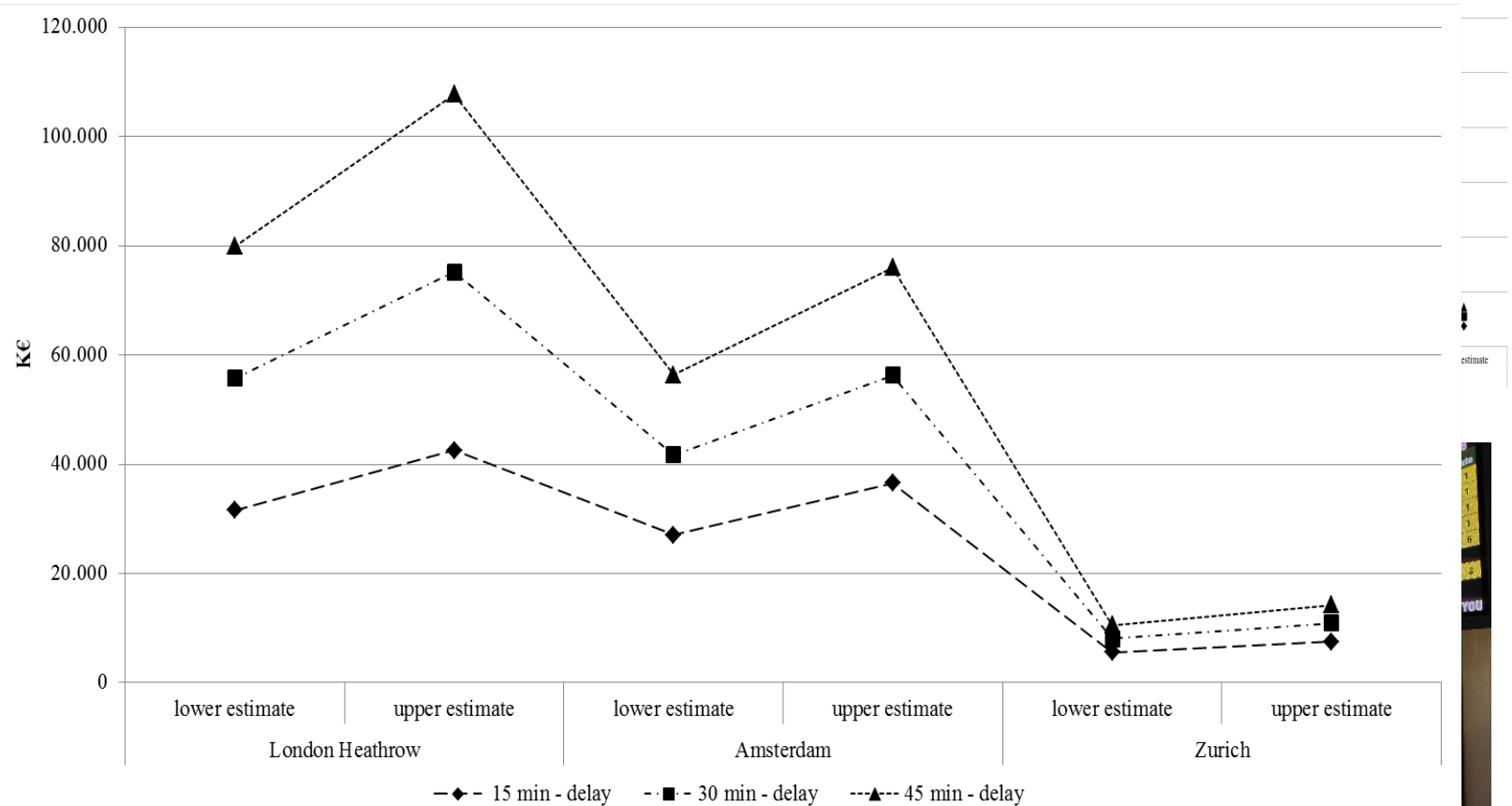
## Social Costs – results scenario 2010



Source: [http://www.odt.co.nz/files/story/2012/03/passengers\\_and\\_visitors\\_gather\\_at\\_queenstown\\_airpo\\_4f65bd34d9.JPG](http://www.odt.co.nz/files/story/2012/03/passengers_and_visitors_gather_at_queenstown_airpo_4f65bd34d9.JPG)



# Social Costs – results scenario 2040



Source: [http://www.odt.co.nz/files/story/2012/03/passengers\\_and\\_visitors\\_gather\\_at\\_queenstown\\_airpo\\_4f65bd34d9.JPG](http://www.odt.co.nz/files/story/2012/03/passengers_and_visitors_gather_at_queenstown_airpo_4f65bd34d9.JPG)



## Summary and outlook

- We received great interest in the results from the European Investment Bank (EIB)
  - Results from the EWENT project will be integrated in risk management tools dealing with credit allowances
- Output from this project will be the basis of a project “MOWE-IT” (management of weather events in transport systems)
  - Goal: Mitigation of the impacts of extreme weather on the European network of transport





Thank you for your attention!!!

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