THE WEATHER PROJECT - OVERVIEW AND FIRST RESULTS

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WEATHER core objective

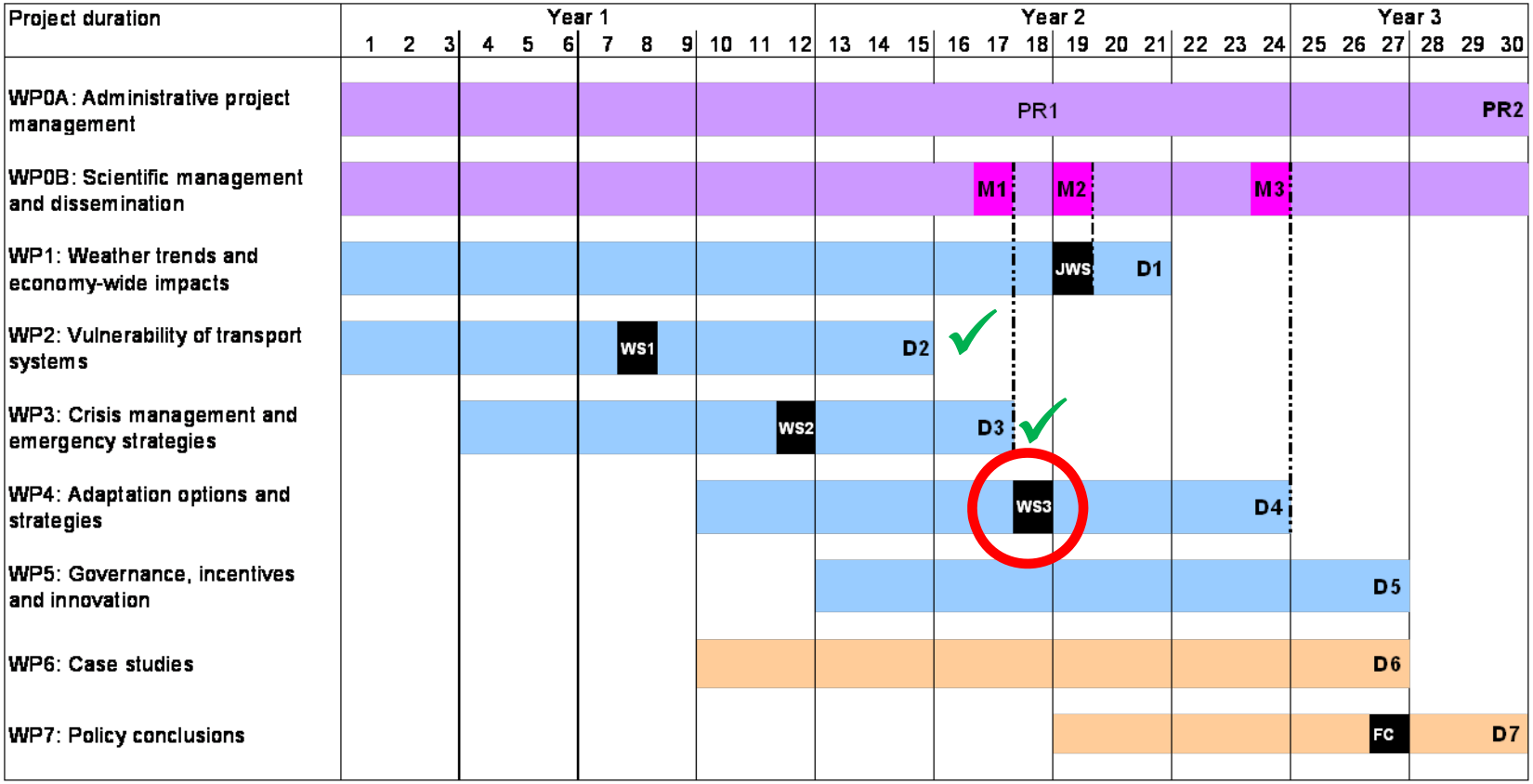
Determine the physical impacts and the economic costs of extreme weather events on transport systems and identify the costs and benefits of suitable adaptation and emergency management strategies.

Duration: November 2009 – April 2012

Funding: 7th framework program of the European Commission, DG-RESEARCH

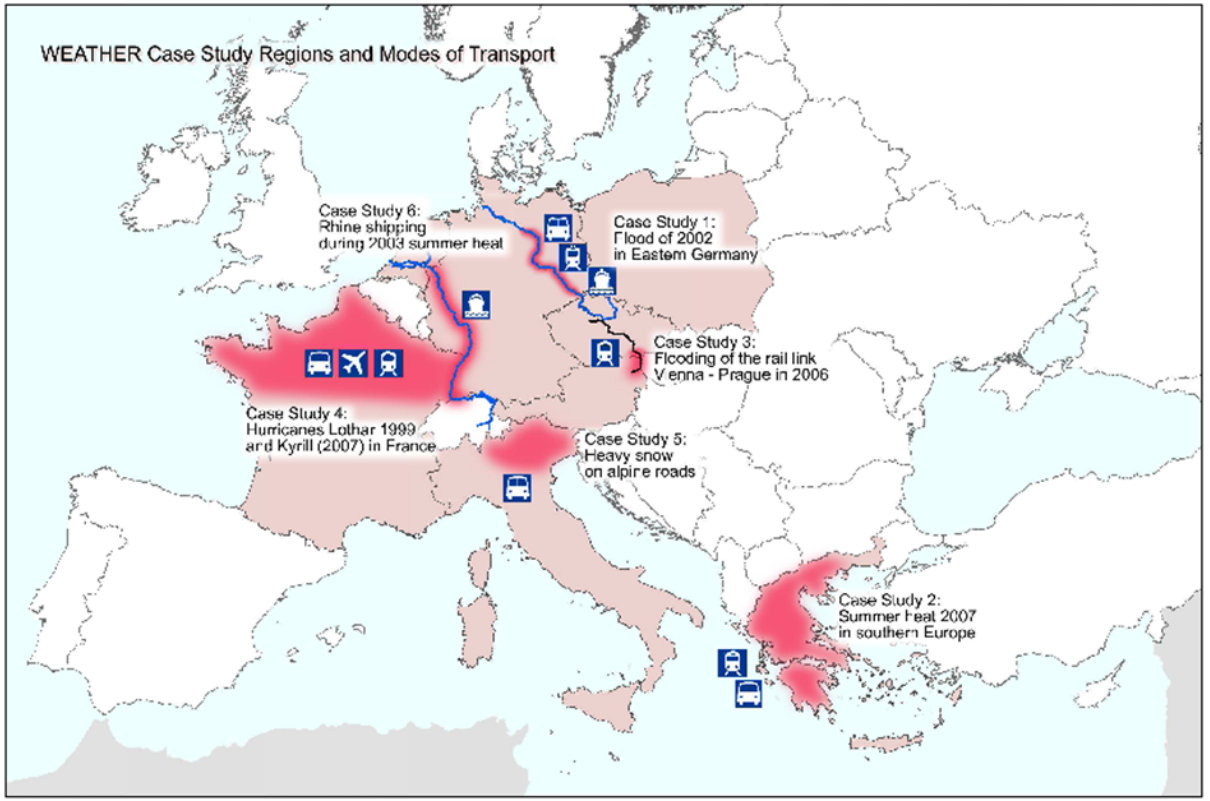
Participant organisation name	Country
Fraunhofer Society, Institute for Systems and Innovation Research (ISI) and Institute for Transportation and Infrastructure Systems (IVI)	
Centre for Research and Technology Hellas, Helenic Institute for Transportation (**CERTH-HIT)**	
Société de Mathématiques Appliquées et de Sciences Humaines - International research Center on Environment and Development (**SMASH-CIRED)**	
Center for Disaster Management and Risk Reduction (CEDIM), **Karlsruhe Institute of Technology**	
Institute of Studies for the Integration of Systems (**ISIS)**	
Herry Consult GhmH	
Agenzia regionale per la Prevenzione e l'Ambiente dell'Emilia Romagna (**ARPA-ER)**	
NEA Transport research and training	

Schedule of tasks and events



Case studies, regions and modes

1. **Flood of 2002 in eastern Germany**
2. **Summer heat 2007 in southern Europe**
3. **Flooding of the rail link Vienna - Prague in 2006**
4. **Hurricanes Lothar 1999 and Kyrill (2007) in France**
5. **Heavy snow on Alpine roads in northern Italy**
6. **Rhine shipping during 2003 summer heat**



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Deliverables

Del. no.[1]	Deliverable name	WP no.	Lead partner	Nature[2]	Dissemi-nation level	Delivery date	Status
D1	Review of climatology and scenario results for Europe and its downscaling	1	SMASH-CIRED	R	PU	07/11	In preparation
D2	The vulnerability of transport systems	2	ISIS	R	PU	01/11	Formally accepted
D3	Innovative emergency management and policy guidelines	3	CERTH-HIT	R	PU	03/11	Submitted
PR1	Progress report period 1	0A	Fraunhofer	R	CO	04/11	In preparation
D4	Options for adaptation in transportation systems	4	Fraunhofer-ISI	R	PU	10/11	In preparation
D5	The role of governance and incentives	5	KIT-IIP	R	PU	01/12	'Work started
D6	Case study synthesis report	6	NEA	R	PU	01/12	'Work started
D7	Final report for publication	7	Fraunhofer-ISI	R	PU	04/12	'
PR2	Progress report period 2	0A	Fraunhofer	R	CO	04/12	

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Deliverable 2
"The Vulnerability Assessment" in brief

Analytical steps

- Transport sector observations
- Insurance and general statistics
- Media reports

→

- Infrastructure damage costs
- Vehicle damage costs
- User time costs
- Infrastructure operating costs
- Fleet & service operating costs
- User health costs

→

House numbers of average annual costs

Dimensions:

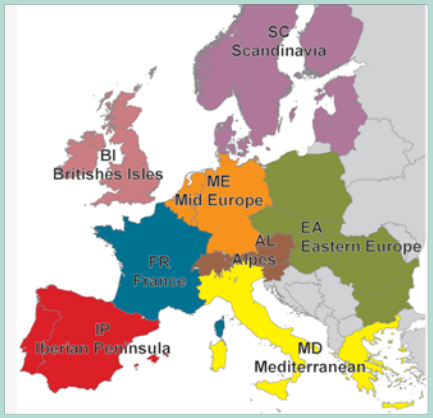
Transport modes:
- Road,
- UPT
- Rail,
- CT
- IWW,
- Maritime
- Aviation

✖

Weather categories
- Rain, hail,
- Floods, l
- andslides
- Cold, snow, ice
- Heat, drought
- Wildfires
- Storms,

✖

Climate zones



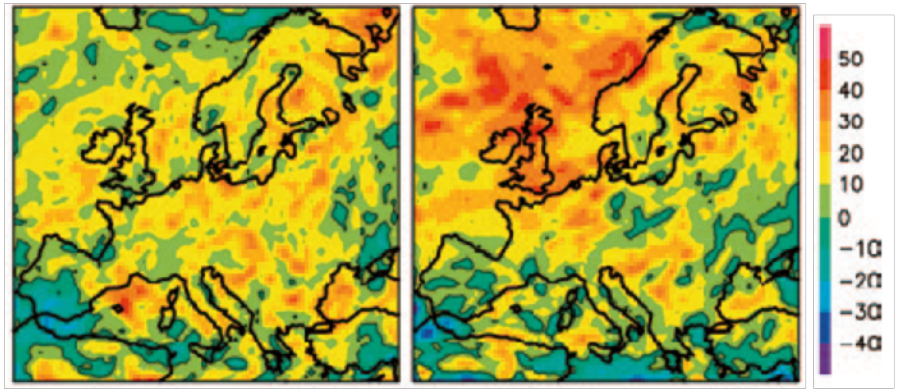
Climate scenarios

- Different models with partly wide bandwidths
- Focus on IPCC and related publications → detailed scenarios in D1

Example **heavy Precipitation**:

- Likely increase in winter / dryer summers
- high uncertainty

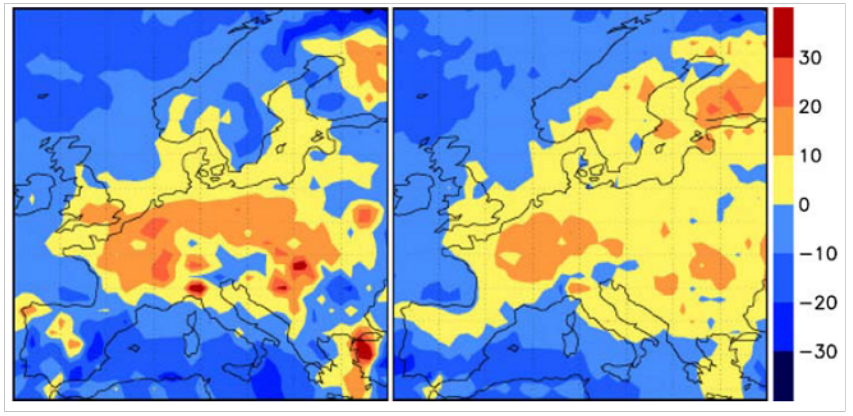
Figure: comparison of models



Example **storms**:

- Associated with strong winter cyclones
- Positive trends for north-south wind gusts

Figure: comparison of models



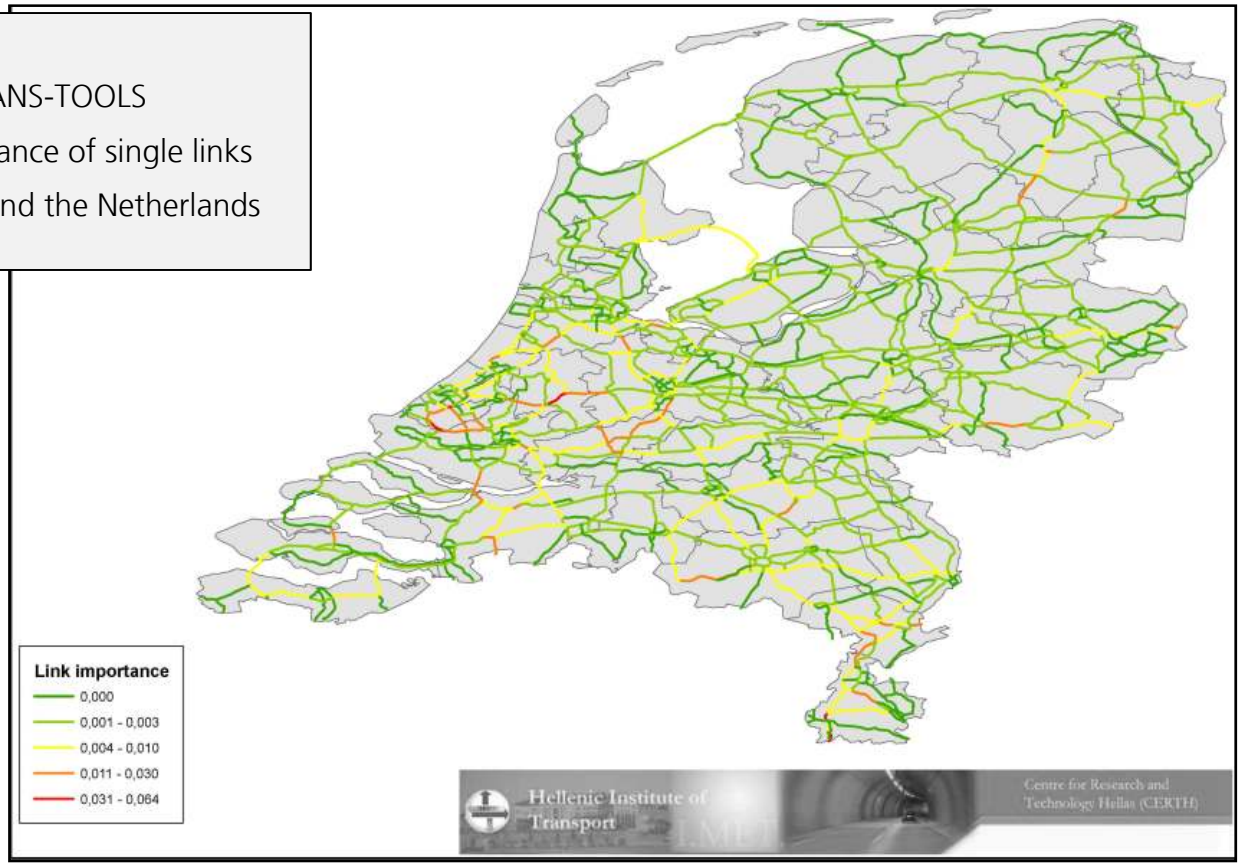
Network criticality assessment: were does the cut of road networks hurt most?

Main features

- Transport models VISUM and TRANS-TOOLS
- Algorithm indentifying the importance of single links
- Application to Greece, Germany and the Netherlands

General findings

- Most critical access roads to big agglomeration areas
- Partly high relevance of inter-urban links in sparsely populated boarder areas.
- Similar results for densely populated NL and for rural German and Greek areas.
- Approach applicable to other modes, too



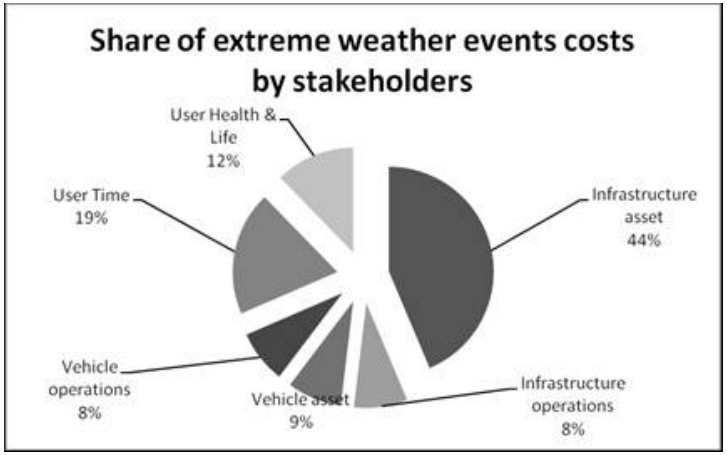
The results: which impacts are most costly and what is the biggest cost driver?

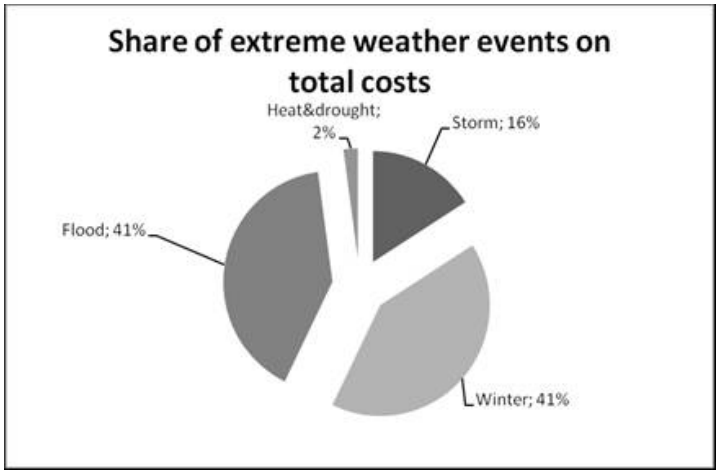
Focus of modal studies is extremely different:

- EU-wide generalisation of costs from a sample of countries (road, CT and aviation)
- Concentration of a set of relevant core countries (maritime and IWW)
- detailed assessment of selected events and cases (rail)
- reporting of some selected observations (urban and intermodal passenger transport)

Results:

- Total annual costs: €2.2 billion,
- Most costly extreme: rain and floods.
- Biggest stakeholders affected: Infra assets and users' costs (delays and accidents)





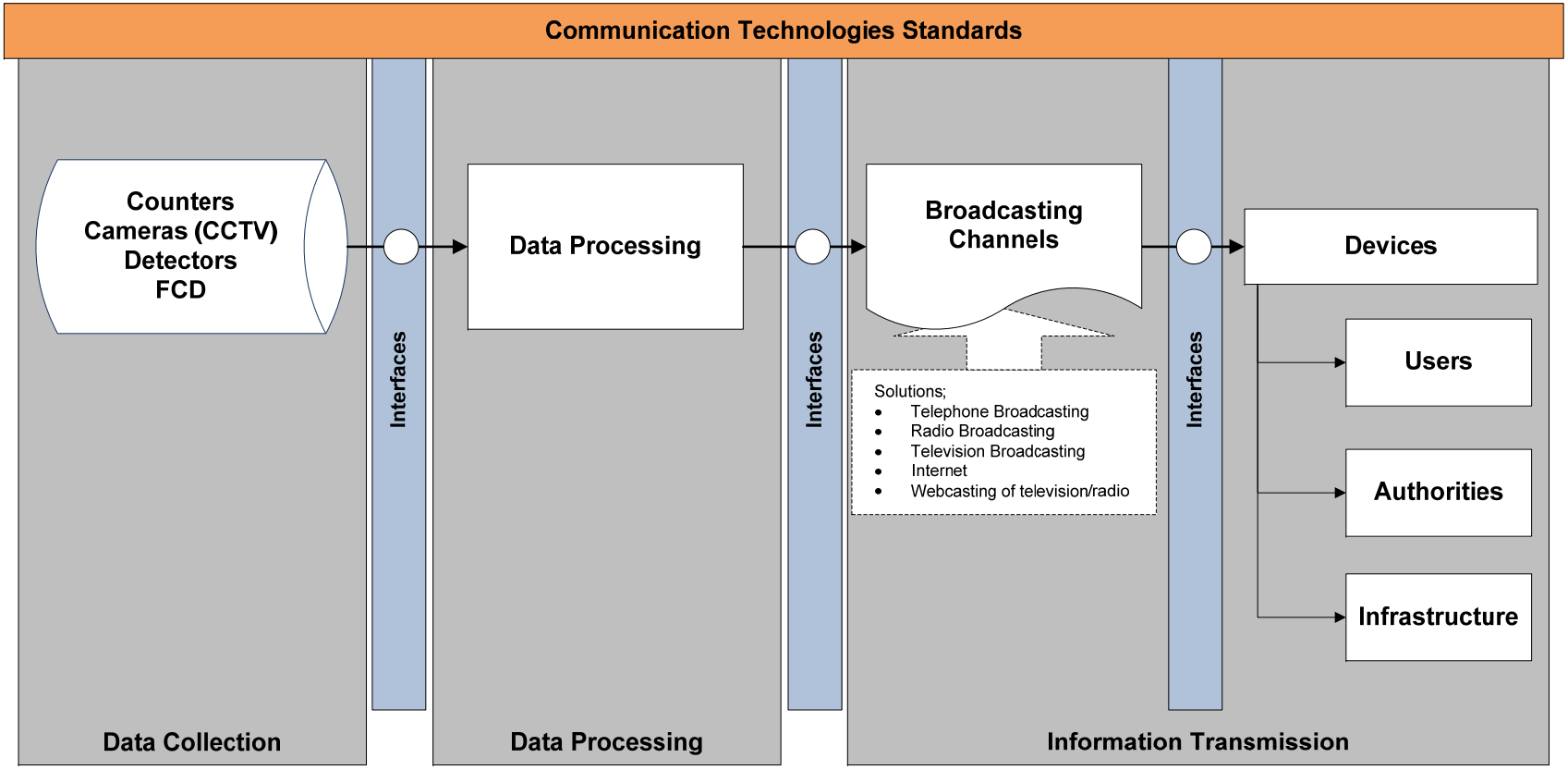
Deliverable 3: Innovative EM and policy guidelines

Achieving efficient Emergency Transport Management

<table>
<tr><th>Extreme weather event</th><th>Impact to transport network</th><th colspan="2">Emergency strategies</th><th>Actions</th><th>Implementation tools</th><th>Strategic Emergency Management</th></tr>
<tr><td>Before the event</td><td>Surpass predefined vulnerability thresholds</td><td colspan="2">Activation of alarming systems</td><td>Provide real time information to authorities</td><td>Weather and traffic sensors, RWIS</td><td rowspan="3">Technological issues</td></tr>
<tr><td rowspan="4">During and after the event</td><td>Overload of transport network</td><td rowspan="2">Network management</td><td rowspan="2">Traffic management, control, provision of information</td><td rowspan="3">Provide real time information for alternative solutions /paths</td><td rowspan="3">ITS, GPS, GIS, VMS, Car2X, ATIS, DTA models</td></tr>
<tr><td rowspan="2">Overload + infrastructure failures</td></tr>
<tr><td>Network restoration</td><td>Infrastructure repair</td><td rowspan="3">Building efficient and innovative mechanisms and structures, information flow</td><td rowspan="3">Standards for cooperation and coordination between authorities</td><td rowspan="3">Organizational issues</td></tr>
<tr><td>Assign Emergency (transport) actions</td><td>Set up and execute EM plans</td><td>Evacuation, first aid, search and rescue etc</td></tr>
</table>

Deliverable 3: Innovative EM and policy guidelines

Classifying technologies with application in ETM



Deliverable 3: Innovative EM and policy guidelines

Policy guidelines for technological aspects

POLICY ISSUES Technological aspects	Supporting Actions / Strategies	Cost	Implications
Determination of technological equipment needed for traffic management and control	Review and benchmarking of available technological ITS solutions	Implementation and maintainance	Improvement of traffic management, automation of services, integration of services
Explore technological developments for organisational purposes	Examine opportunities for resolving organisational barriers with the use of technology (robots, agents)	Unregistered	Easy and quick solution of organisational issues concerning responsibility sharing, cooperation etc

Deliverable 3: Innovative EM and policy guidelines

Policy guidelines for organizational aspects

POLICY ISSUES Organizational aspects	Supporting Actions / Strategies	Cost	Implications
Assessment of hazard and vulnerability of transport systems (infrastructure and processes) to extreme weather events	Risk analysis of transport systems regarding extreme weather events	None	More effective allocation of personnel and equipment
Responsibility sharing in relation to the existing resources and needs	Organization and conduction of common exercises, negotiation techniques between authorities, role games/simulation, group dynamics	Insignificant	More effective emergency planning to extreme weather events and efficient response
Promotion of cooperation between local authorities	Sign of agreements, establish communication networks and a platform to exchange best practices in weather-related emergency transport management	Insignificant	More effective inter-modal coordination and wide-spread knowledge about best practices, integration of weather data in ETM
Enhancement of communication between the different types of authorities (weather, traffic, civil protection etc)	Common EU standards on e.g. the format and content (message standards) of weather information and traffic warnings	None	More easier and consistent inter-modal, trans-sectoral, and trans-regional communication and information

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