
# Rail infrastructure answer to extreme weather event : a first french study

## 1st WEATHER Workshop – Sept. 14/2010

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# Context : some very recent extreme weather events : january 24th, 2009 : hurricane Klaus reaches southwestern France

- Weeks of troubles on the transportation network
- A concern for the present : facing weather extreme episodes



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# Context : some very recent extreme weather events : february 28th, 2010 : hurricane Xynthia reaches Vendeen Coast

- One line totally stopped
- Many weeks of trouble




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# Facing weather extreme episodes

- **Ministry in charge of Ecology lauched a plan for climate change adaptation which includes infrastructure, even if nobody clearly knows the direction (according to last IPPC-gate enquiries)**

- **Closer to us, RFF has to face to the consequences of :**
  - more **rainfalls** and snowfalls resulting in damage on earthworks and structures
  - more and more serious **storms** resulting in troubles in electric and signalling systems
  - windstorms and tornados : tree falling and catenary injuries
  - **humidity** (tunnel and earthwork fragility) and flooding (risk on embankments, fundaments, seawalls and electric facilities)
  - **heatwaves** and more changes in temperature (rail dilatation, electric systems failures)
  - **dryness** : risk for structure fundaments on clay, risk of river drying (fundaments)
  - **coolwave** : rail contraction, catenaries, ice in electric systems
- **These issues have to be adressed now, and not only in a 50y time scale**

# Preparing the infrastructure

- **Difficulties to forecast the climate and probability of extreme weather events**
  - — increasing impacts and costs
  - — towards a « risk management approach »

- **Existing infrastructure :**
  - — design based on climate stability hypothesis (for example : the 100 years flooding )
  - — and on short and non significant weather data

- **New lines :**
  - — risk management approach : which level of risk is acceptable to manage both risk and cost
  - — several methods : no-regret strategy, reversible or flexible options, systematic safety margins, slow adaptation strategies

# What about resilience ?

**Concept of resilience can have several aspects**

- **Territory :**
  - social and economic approach
  - ‘‘basic and crisis’’ transportation system :
- **Network :**
  - alternative route available
  - Technical knowledge of the network
- **Economics :**
  - Repair costs VS improvement costs
  - Times losses
- **Politics :**
  - Who pay for that ? – according the public subvention to the railway infrastructure –
  - How many times do you accept to pay ?

# Basic questions (examples)

- **If the line has to be maintained (heavy maintenance) or improved, is it pertinent to include adaptation works on the basis of an expected failure term ?**
- **Can we imagine to close a route during X days when an extreme weather event occurs or to make it work under its nominal performance (without being fired) ?**
- **What are the weakest parts of our infrastructure ?**

# Methodology

- **To answer to previous questions and have a good overview, RFF passed a contract with EGIS Engineering**
- **Previously, the method has been developed for road purposes**
- **RISK = threat * vulnerability * consequences**
  - climate risk : you can't mitigate causes
  - act on vulnerability and consequences
- **Tools to be implemented on new RFF projects + most vulnerable pieces of the existing network**

# Methodology (2)

Infrastructure database

Weather data (actual or simulation)

Knowledge on previous events

2-steps System of interpretation of infrastructure vulnerability :

-1 – based on existing data

- 2 – based on expertise (field investigation + simulation calculation)

Fields :

River hydraulics

Wastewater management

Way

Way installations

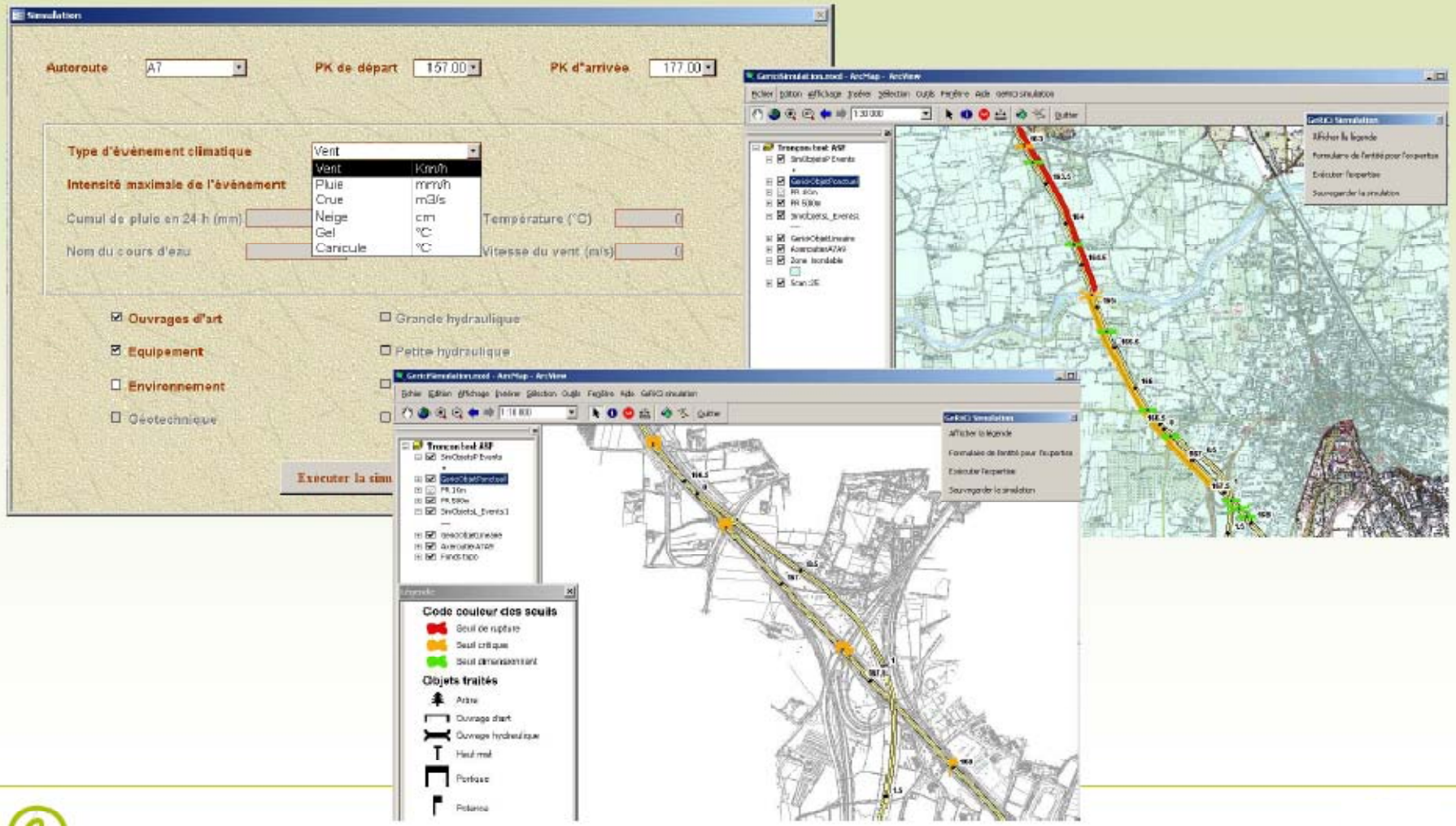
Superstructures

Environment

Soil and geotechnics

Geo-located overview of the consequences of an extreme weather episode on infrastructure elements

# Risk management on infrastructure : expected outcome



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# Current testing

- **A study is now in progress in the Aquitaine area – Bordeaux -**
- **We are assessing the 3 main lines of this region**
- **Five extreme events are tested (rainfall, heatwave, coolwave, hurrican and flooding)**
- **Results are expected for the 2nd quarter of 2011**
  - where are the weakest points ? → bridges
  - what are the mains risks ? → probably rainfall and flooding
  - how many does it cost to improve / to fix ? → for one line, first ideas say at least 100 M€
- **Similar studies should be conducted for all coastal regions – depend of first results and budget allocation -**

# Thank you for your attention !

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