

# Risk and Safety in Engineering

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# Research and Teaching

- **Aims and objectives**
- **Research focus**
- **Theoretical and methodical building stones**
- **Teaching activities**
- **The group on Risk and Safety**
- **Services and clients**

# Aims and Objectives

- **What do we actually do?**

**We provide risk informed decision support for the**

- **Safe**
- **Efficient**
- **Sustainable**

**development and maintenance of**

- **Infrastructure**
- **Production facilities**
- **Housing**

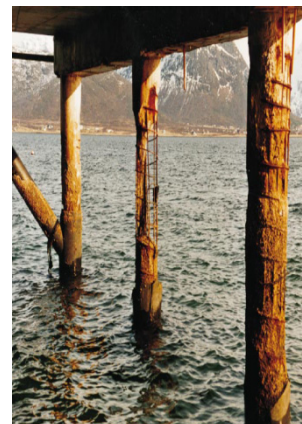


## Research Focus

- **What is the focus of our research?**

**We develop models for**

**- hazards (natural, technical, anthropological)**



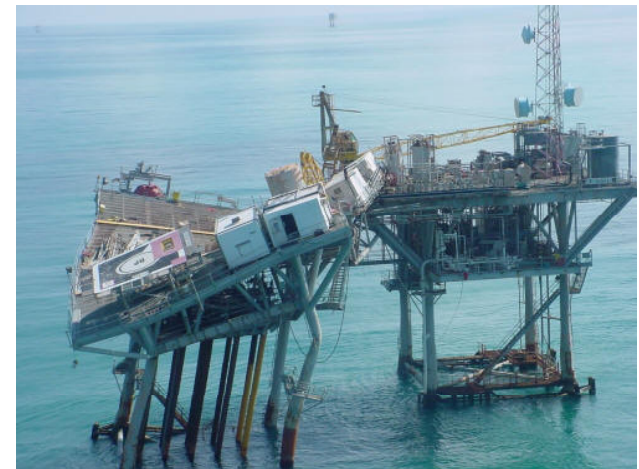


## Research Focus

- **What is the focus of our research?**

**We develop models for**

**- vulnerabilities (infrastructure, buildings, industry)**

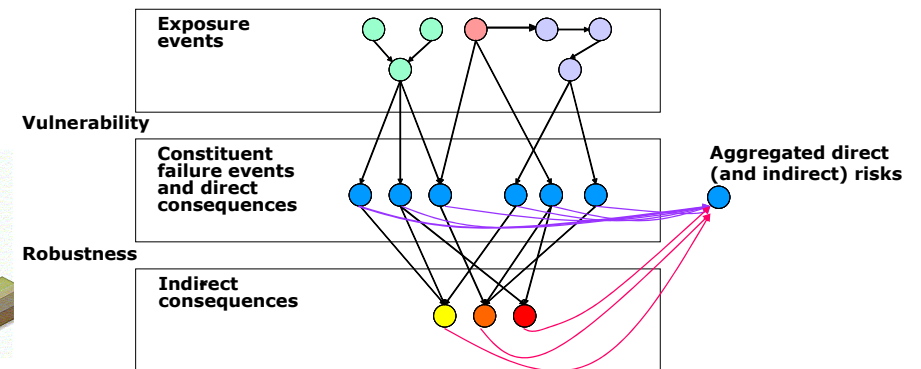
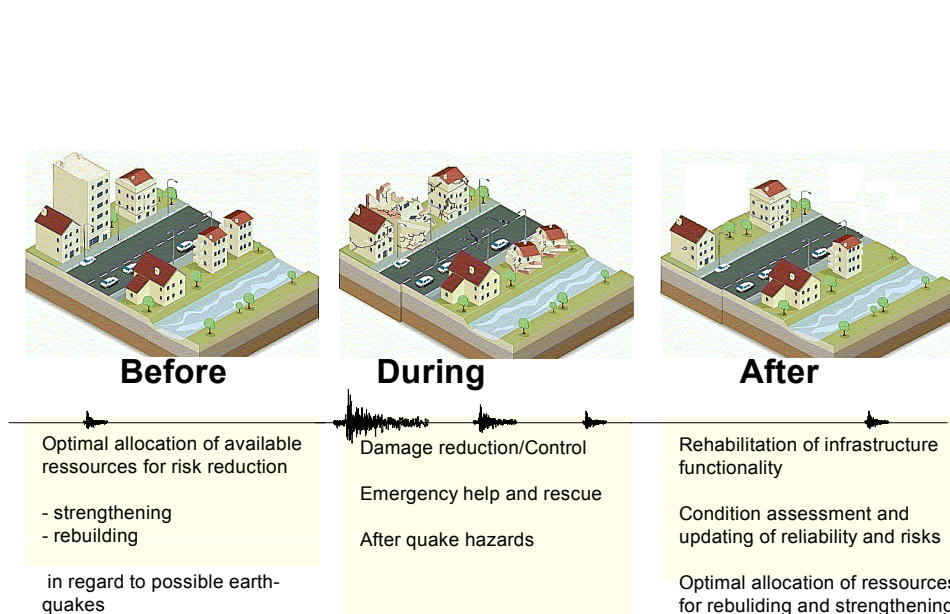


# Research Focus

- What is the focus of our research?

We develop theory and methodology for

**- risk informed decision making**



$$p_N(n) = \int_{\theta} \binom{k}{n} (p_F(F|\theta))^n (1-p_F(F|\theta))^{k-n} f_{\theta}(\theta) d\theta$$

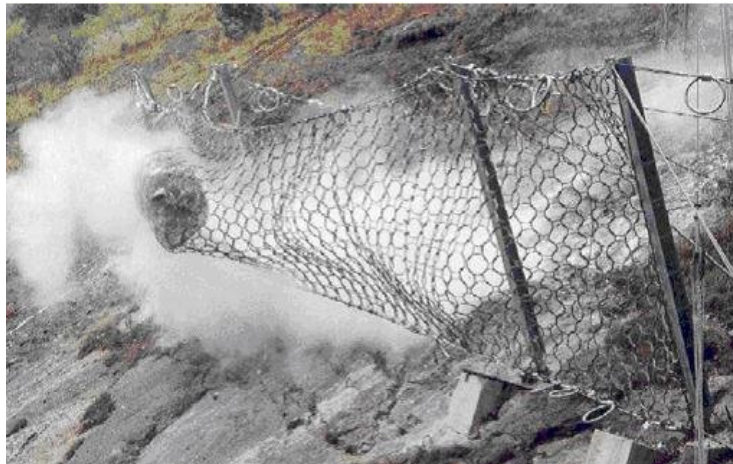
## Research Focus

- **What is the focus of our research?**

**We develop theory and methodology for**

**- risk informed decision making**

**How to protect against hazards?**



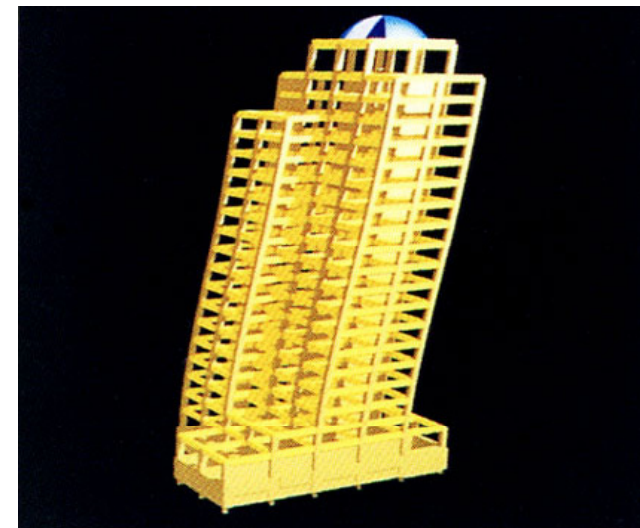
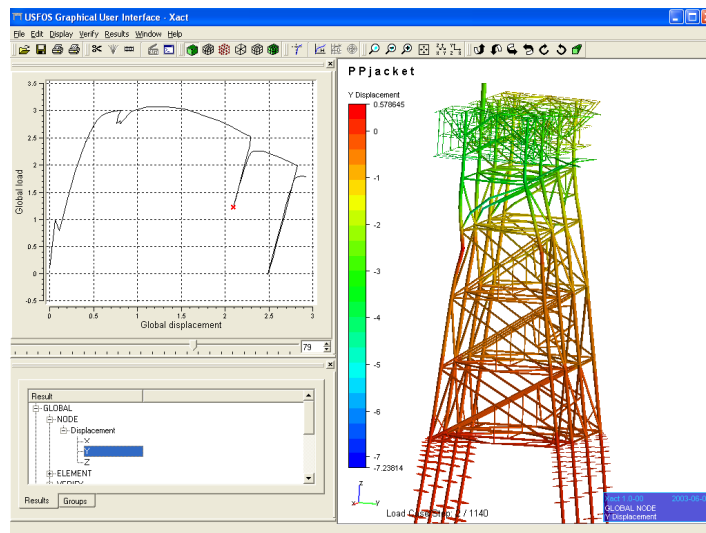
## Research Focus

- **What is the focus of our research?**

**We develop theory and methodology for**

**- risk informed decision making**

**How to reduce vulnerability?**





## Research Focus

- **What is the focus of our research?**

**We develop theory and methodology for**

**- risk informed decision making**

**How to reduce losses?**



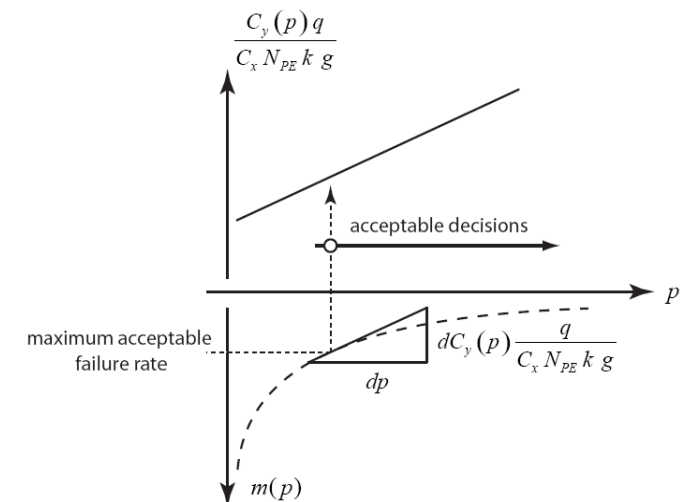
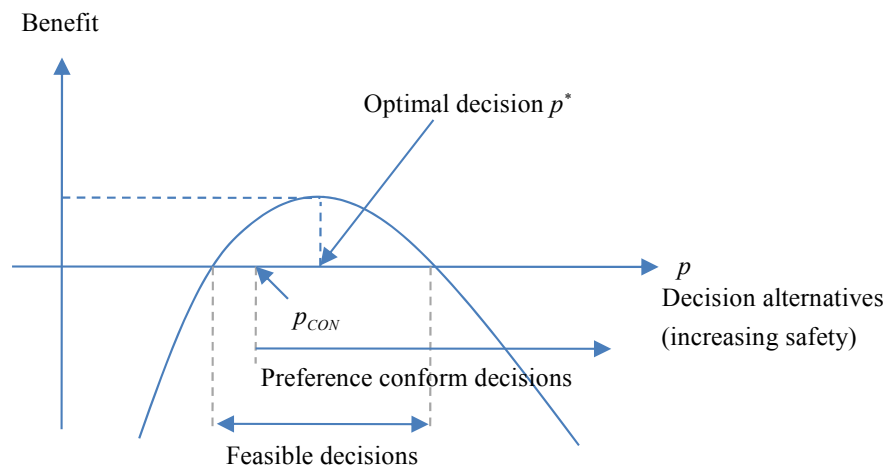
## Research Focus

- **What is the focus of our research?**

**We develop theory and methodology for**

**- safeguarding human lives**

**How much shall society invest into life safety?  
How to regulate life safety risks?**



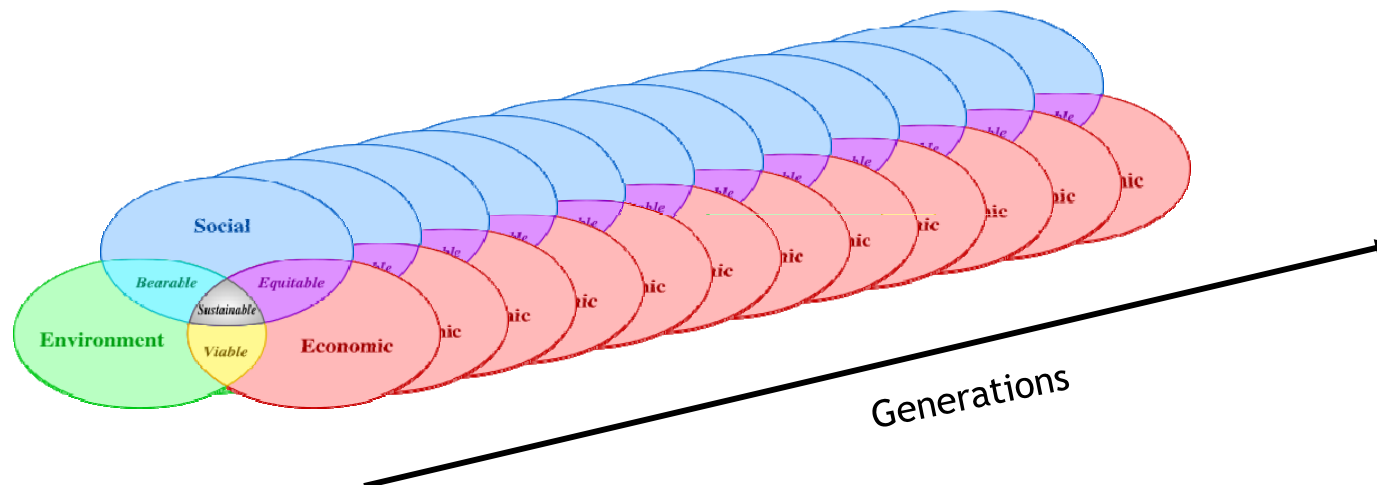
## Research Fields

- **What is the focus of our research?**

**We develop theory and methodology for**

**- sustainable decision making**

**How to account for the preferences/capacity of future generations?**



# Theoretical and methodical building stones

- **What theories and methods are mainly applied?**
  - **Statistics and probability theory**
  - **Operations research**
  - **Stochastic fields**
  - **Extreme value analysis**
  - **Systems and portfolio theory**
  - **Hierarchical Bayesian modeling**
  - **Probabilistic nets**
  - **Probabilistic mechanics**
  - **Utility theory**
  - **Consequence analysis**
  - **Risk assessment**
  - **Bayesian decision analysis**



## Teaching Activities

- **What lectures do we offer?**

### **Undergraduate course on:**

- **Statistics and Probability Theory**

### **Graduate courses on:**

- **Risk and Safety in Engineering**
- **Finite Element Analysis (linear/non-linear systems)**
- **Probabilistics in Engineering**

### **Continuing education:**

- **CAS course on: Risk and Safety of Technical Systems**
- **MAS course on: Natural Hazards Management**

## The group on Risk and Safety

- **15 researchers working on issues of risk and reliability, e.g.:**
  - **Industrial risk management**
  - **Bayesian decision theory**
  - **Extreme value theory**
  - **Complex systems reliability analysis**
  - **Probabilistic mechanics**
  - **Natural hazards risk management, earthquakes, hurricanes, rockfall, avalanches, floods, etc.**
  - **Decision making for sustainable developments**
  - **Portfolio risk modeling for the building insurance industry**
  - **Risk criteria and safety management**

## Services and Clients

- **What services do we provide and for whom?**

### Public authorities and professional associations

#### **Best practices development**

- **Pre-normative work**
- **Guidelines**
- **Model codes**
- **Code calibration**

### Insurance industry, production industry and public authorities

#### **Loss estimation and risk informed decision making**

- **Risk based design**
- **Risk based maintenance**
- **Risk and safety management**