Plenary Session III – Responding to the Global Agenda – Policies and Technical Aspects

Wednesday, 16 May 2007

Disaster Risk Management Surveyors Contributions

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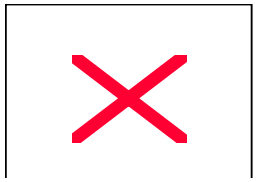
1. Background



Tsunami in Southeast Asia, December 26, 2004

Tornado in Greensburg, Kansas 7.5.2007

www.smh.com.au

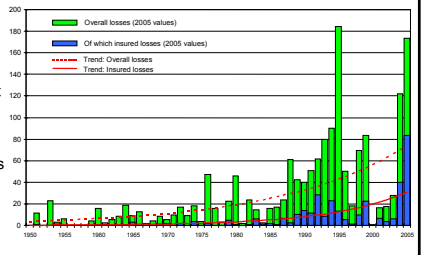
www.brownsvilleherald.com/

Economic and insured losses with trends

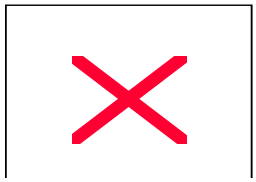
The number of natural and human-made disasters is on the rise worldwide

The serious impact on the global environment show that there is an urgent need for more and better urban development strategies for disaster risk assessment and risk reduction

Great natural catastrophes 1950 – 2005
Overall losses and insured losses

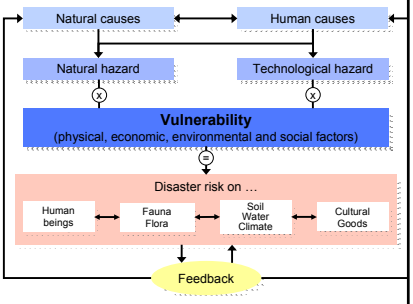


2. Disaster Risk Management and its Components



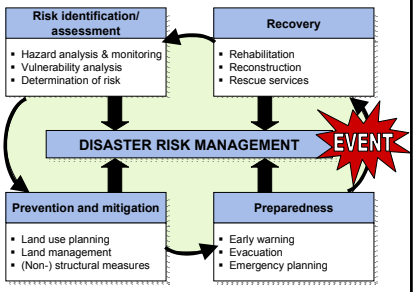
Disaster risk as the product of hazard and vulnerability

The risk of disaster is expressed by a compound function of natural hazard and the number of people, characterized by their varying degrees of vulnerability to the specific hazard, who occupy the space and time of exposure to the hazard event (Wisner et al 2004)

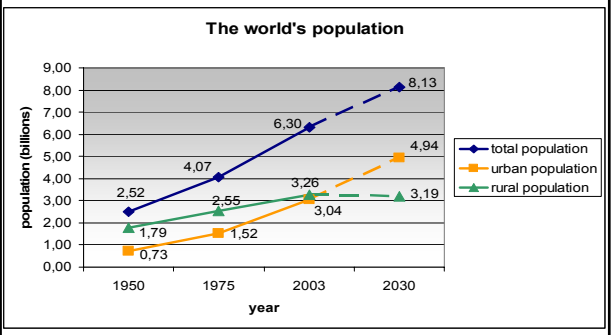


Key elements of disaster risk mangement

Disaster risk management includes measures *before*, *during* and *after* a disaster.



Current Trends in Urbanization



Data Source: World Urbanization Prospects: The 2003 Revision

Urban Agglomerations (Year 2015)

Spatial distribution of the world's megacities 2015

Definition Megacity

A **megacity** is usually defined as a recognized *metropolitan area with a total population in excess of **10 million people*** and a minimum level for population density at least 2.000 persons/km^2 and only include cities with a single dominant centre, whereby polycentric agglomerations are excluded.

Megacities Task Force (http://www.megacities.uni-koeln.de/)

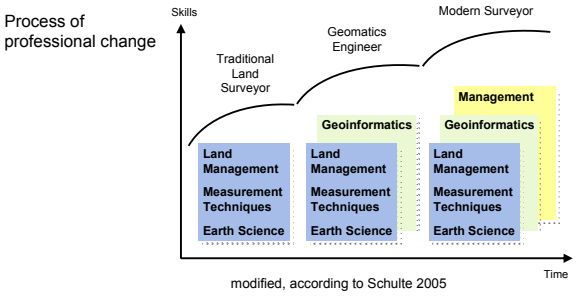
Effects and Impacts of Urbanization

Megacities…

- show the **highest density** of inhabitants, industrial assets and production, social and technical infrastructure.
- are characterised by **highest dynamic** in the fields of spatial and demographic growth, change of land use and consumption of land.
- show **social-cultural conflicts** because of the different backgrounds of the immigrants and a **great number of urban poor.**
- run **highest risk** in the cases of natural and human-caused disasters.

3. The Need of the Surveying Profession in Dealing with Disasters

The change of geodetic activities from traditional tasks to new methods

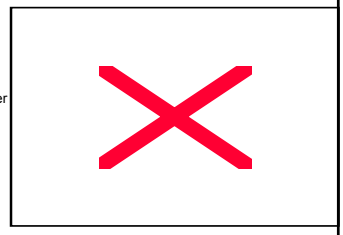


modified, according to Schulte 2005

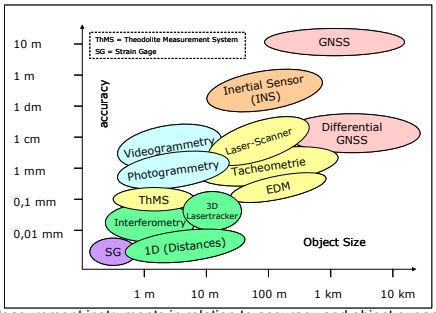
The need to surveying methods and applications for disaster risk management

Tasks of a surveyor:

1. **Acquisition of disaster-relevant data** by using different data sources such as airborne and satellite data; radar and (multi-spectral) images: geodetic engineering
2. **Hazard assessment** and design of **monitoring** and/or **early warning systems** as part of **Geographic Information Systems (GIS)** and other computer-based information systems
3. Development and implementation of **preventive measures of land use planning and land management** to reduce disaster damage
4. **Cadastral reconstruction** using **Global Positioning Systems (GPS/GLONASS)** and/or **Tacheometry** in the post-disaster phase



Geodetic Engineering and Satellite-Based Positioning



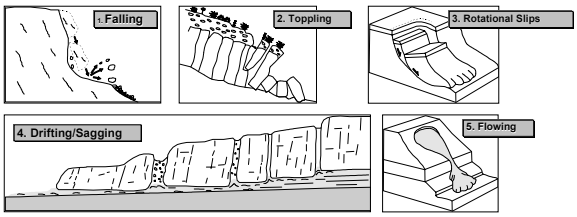
Measurement instruments in relation to accuracy and object expansion
(Source: Foppe et al. 2004)

Geodetic Engineering and Satellite-Based Positioning

- design, develop and implement measurement systems on the basis of the dynamic object model using e.g. methods of sensitivity analysis
- process, evaluate and adjust the geodetic measurements, including models and analysis of time-dependent measurements as well as deformation analysis
- develop and implement algorithms for data fusion, partly in cooperation with other disciplines that also deliver measurement data (e.g. geotechnical measurements)
- model, describe, measure and propagate the quality of geodetic data
- manage and visualise measurements and results as well as
- coming to decisions within the disaster risk management process in an interdisciplinary team

Good Practice-Examples

Monitoring of slopes with respect to landslides

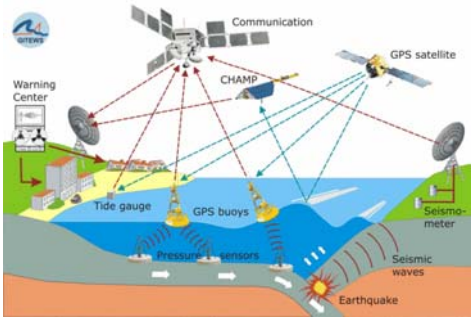


Classification of landslides according to UNESCO Working Group for World Landslide Inventory (Source: Foppe & Schwieger, 2000)

Land slide

Good Practice-Examples

Tsunami Warning System



Indian Ocean Tsunami Warning System (Source: GFZ 2006)

Photogrammetry and Remote Sensing

Aerial photogrammetric data acquisition techniques

- give very accurate data about the damaged area
- good tool for coordinating rescue operations
- LIDAR (= Light Detection And Ranging) data gaining method
  - weather and day light independent method
  - provides data very fast and detects the damaged parts automatically

Earth observation satellites

- providing data for a wide range of applications in disaster risk management
- Pre-disaster uses
  - risk analysis and mapping
  - disaster warning
  - disaster assessment
- Remotely sensed data provide a historical database
  - Hazard maps can be compiled
  - Combination with geographic information systems in order to carry out risk analysis and assessment

Photogrammetry and Remote Sensing

High *Resolution* QuickBird image of the devastated area – Tsunami in Southeast Asia, December 26, 2004 (Source: Prof. Altan)

GIS and Geoinformatics

Special Tasks of GIS:

- Use of spatial data and object related data from various sources
- Integration of mobile action force information in near real-time
- Providing adequately processed intersected data including decision support signals for control centers and field staff
- Information retrieval and intersection support
- Decision process support
- Scenario projection of retrieved intersected information
- Database of existing databases and cadastres
- Connection of existing disaster management systems via open standard interface
- Logging of activities for the purpose of documentation

GIS and Geoinformatics

Types of GIS:

- Spatial information portals and data warehouses
- Modeling and simulation systems
- Monitoring and early warning systems
- Planning support systems

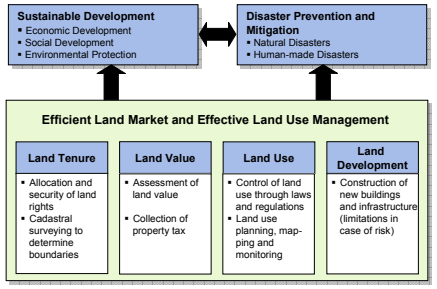
Emergency route service, special routing system adapted to the needs of emergency aid

Spatial Planning and Land Management

spatial planning and land management have to mitigate disasters and reduce vulnerability and risks by

•avoiding human settlements in hazard prone areas and

•controlling the density of population and expansion



Sustainable land use management as a tool for risk reduction (modified, according to Enemark 2004, p.8)

Spatial Planning and Land Management

The surveyor as a land manager

- develops effective land use concepts that are necessary for a sustainable urban and rural development
- coordinates and directs the complex procedures of land consolidation, land registration and land reallocation
- creates sustainable infrastructural, economic and ecological conditions for developing urban and rural areas and solving land use conflicts

New Orleans: Reconstruction or Relocation?

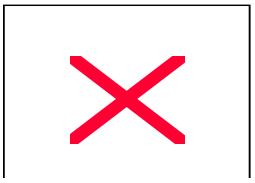
- coordinates public-private agreements in order to use land in a economic, ecological and social way
- undertakes damage assessment of the destroyed or harmed buildings and public facilities in the aftermath of a disaster

Land Management and Land Use Planning

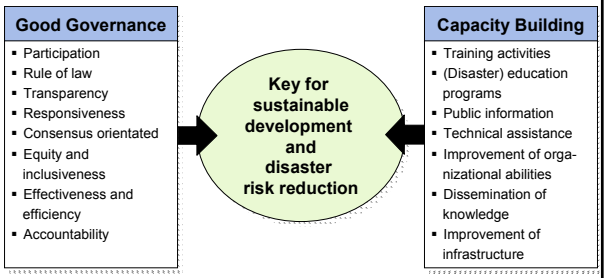
Tools and strategies of land use and land development used for disaster risk:

- Risk reduction and mitigation by integration of regional and urban planning with land management as a process
- Identification an assessment of disaster-prone areas as well as alternative sites that are more suitable for development
- Controlling the type of land use and land development in such areas
- Retrofitting and building of settlements and homes adapted to disaster conditions
- Relocation of population in areas with degree of vulnerability
- Strengthen public awareness by participation
- Reduction of vulnerability by embedding a decentralized development settlement
- Engineering measures and construction of hazard-resistant and/or protective structures and infrastructure

4. Institutional and Organizational Challenges of Disaster Risk Management



Governance and capacity building for risk reduction

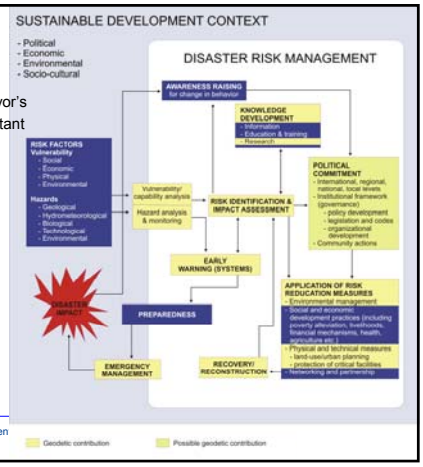


Conclusions

- **Risk analysis and assessment:**
  analysis using geospatial data; detecting and quantifying land cover and land use change for hazard analysis and monitoring
- **Knowledge development:**
  research in disaster reduction and control, e.g. sea level changes, gravity field
- **(Precautionary) disaster risk reduction measures:**
  Land management; development of land use concepts; deformation measurements; engineering and monitoring of structural measures
- **Early warning:**
  technologies and techniques for early warning systems; software development; cartographic visualization; disaster modeling
- **Emergency management:**
  use of virtual 3D-models for an easier location in case of a disaster
- **Recovery / Reconstruction:**
  documentation of damages (by laser scanning, tachometry); damage assessment; cadastral reconstruction

Conclusions

The **whole scope** of surveyor's abilities can make an important contribution to improve the disaster risk management procedure!



Source: UN/ISDR 2004, p.15
(modified and supplemented)