

Urban Infrastructures: Criticality, Vulnerability, and Protection

Veranstalter: Research Training Group KRI-TIS, Technische Universität Darmstadt

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More than 70 scientists from different disciplines and countries came together for the international conference. The focus was on networked critical infrastructures in cities as socio-technical systems that require special protection strategies due to their vulnerability. Five multidisciplinary panels on governance, spatiality, temporality, safety and security, and ICT solutions elucidated urban critical infrastructures protection. The keynote lectures highlighted and deepened the aspects relevant to this context.

Despite the diversity of the contributions, one aspect has always been prominent: the enormous complexity of urban critical infrastructures. Regardless of the task – governing and planning cities, creating security concepts and making cities more resilient – the complexity of the critical infrastructures systems must always be considered. At the conference, civil engineers, computer scientists, urban and spatial planners, architects, sociologists, political scientists, historians, and philosophers as well as practitioners from public administration and operators of critical infrastructures made interesting suggestions on how to deal with the uncertainties involved. It also became clear that current challenges require approaches that cannot be found in a single discipline alone.

Cities are the major sites and physical nodes in the infrastructurally mediated flows of water, energy, waste, communication, people, goods and services. Networked infrastructures have become increasingly critical for urban life. Their smooth operation is a prerequisite for social well-being, economic prosperity and political stability in our cities. However, their smooth functioning is not a given. Due to their complexity, interconnectedness

and strong interdependency, these systems are highly vulnerable. The failure of a subsystem or system components can cause serious cascading malfunctions within and across the system boundaries. Obviously, there is a need for protecting critical infrastructures, considering their specific characteristics as socio-technical systems and their embeddedness in urban space. Besides engineering, the social sciences and the humanities provide important perspectives in assessing the challenges and requirements of critical infrastructure protection. Such protection strategies have to take into account the criticality, vulnerability, and resilience of critical infrastructures in their interrelatedness with and embeddedness in urban space. Above all, the high complexity of urban critical infrastructures must be taken into account.

In his keynote lecture, historian PER HÖGSELIUS (Stockholm) introduced the fundamental category of complexity. He pointed out that complexity represents a challenge to both, infrastructure providers and social and historical scientists researching infrastructures. He underlined the ever-growing social desire for security and showed that growing complexity in infrastructures often motivates attempts to get them under control, which again ends up in complexification so that critical infrastructures cannot really be controlled. Högselius presented some recent attempts to get along with complexity in a smart way, which are all based on accepting complexity.

The panel *Governance* was opened with the presentation by ANDREAS HUCK (Darmstadt). He critically assessed recent calls for cross-boundary stakeholder collaboration and flexible and adaptive forms of governance as generally accepted principles for urban resilience governance and risk management. MARK DE BRUIJNE's (Delft) presentation focused on the massive challenges of Dutch infrastructure managers in urban infrastructure renewal. EVA STOCK (Bonn) addressed in her talk the local governance challenge to integrate the risk management of critical infrastructure operators and emergency management organisations despite their different institutional interests, expertise and practices.

In his keynote lecture, JON COAFFEE (Coventry / New York) places emphasis on the shift from protective-based risk management towards adaptive-based resilience and its relevance for critical infrastructures. The aim of this new thinking is to advance risk management through new mechanisms of coping with and adapting to multiple risks, which are only partially known. Coaffee provided a critical assessment of how resilience shapes the ways infrastructure providers deal with complex risk and the tensions elicited in the paradigm transition from risk management towards resilience. He also highlighted the implications for organisational governance in seeking more integrated ways of assessing risk across multiple systems, networks and scales in order to futureproof our cities.

The panel *Spatiality* began with the joint presentation of IVONNE ELSNER and MARCEL MÜLLER (Darmstadt), who discussed how disruptions of critical infrastructures illustrate the decisive role these networked systems play in our everyday perception of space. PRANJALI DESPANDE-AGASHE (Pune) then introduced Pune as an Indian city that seeks to implement India's National Urban Transport Policy to achieve its sustainable transport goal of reducing dependency on private motorised vehicles from fifty to ten percent by 2031. TIMOTHY MOSS (Berlin) explored the relationship between urban politics and infrastructure throughout Berlin's turbulent history since 1920, focusing on how energy and water infrastructures proved resilient, vulnerable – or even conducive – to shifts in political rule.

UWE LÜBKEN (München) opened the panel *Temporality* by addressing the interplay between flooding and the use of rivers as integrated into infrastructure systems (water provision, energy production, navigation) in the era of industrialisation. Subsequently, three PhD researchers presented case studies: STEPHANIE EIFERT (Darmstadt) made a case for the importance of the so-called clock time for the highly regulated rhythms of river transportation and market access in medieval Frankfurt and Mainz. BENEDIKT VIANDEN (Darmstadt) talked about the German protestant Templar colonists in the Holy Land at the

turn of the 20th century. NADJA THIESSEN (Darmstadt) focused on flood control on the river Rhine in the 20th century and raised the problems of an industrialised and international cross-linked environment. SUSANNE KRINGS (Bonn) addressed the interplay between highly politicised national policies and concepts of critical infrastructure protection on the one hand, and civil society protection legislation on the other hand.

CHRISTOPH LAMERS (Münster) illustrated in his keynote the structure of the fire brigade and thus one of the critical aspects of this infrastructure: people. He then explained the structures of the German fire brigade and Technisches Hilfswerk (governmental disaster relief organisation) in order to demonstrate their capabilities and limitations. He repeatedly referred to the spatial and temporal relationships that are important for this infrastructure and made clear that the emergency service infrastructure is also a vulnerable infrastructure due to its complex interdependencies. He made his point by describing the cascading effects in case of „power failure“ and „epidemic“. Further, Lamers addressed the vulnerabilities and the solutions already available or currently in research. For the future, he stated, it is important to develop integrative approaches to create resilience in emergency services and to overcome the „valley of death“ between research and practice.

The panel *Safety and Security* was opened by THOMAS KÖSTLER (Lübeck) who gave an insights report of the power supply failure on May 16th, 2018 in the city of Lübeck. Three PhD researchers – ANNA-KATHARINA BRAUNER, ARTURO CRE-SPO, and MARCUS DOMBOIS (Darmstadt) – presented a framework for the involvement of different stakeholders (especially passengers) in the creation of disruption programmes in commuter railway. The panel concluded with SYLVIA BACH (Wuppertal) who introduced some of the results of the EU project „SmartResilience“ using the example of the Heidelberg smart city Bahnstadt district.

In the panel *ICT Solutions*, FLORIAN STEINKE (Darmstadt) questioned the often held belief that the move to a more varied energy production due to the transition toward renewable energy also comes with a decen-

tralised control of the electrical grid. Then ANTONIO JORBA (Darmstadt) described the advantages of LoRaWAN, short for Long Range Wide Area Network. LoRaWAN is a citywide, low-power communication network that has been deployed in the Digitalstadt Darmstadt. The final talk by LARS ALMON and JISKA CLASSEN (Darmstadt) illustrated the use of smartphones and Internet of Things (IoT) devices without cellular connection in cases of an emergency.

A more detailed report can be found on the website of the Research Training Group KRITIS.

Conference Overview:

Keynote:

Per Högselius (KTH Royal Institute of Technology Stockholm): The Dialectics of Complexification

Panel: Governance

Chair: Jochen Monstadt (Universiteit Utrecht)

Andreas Huck (TU Darmstadt): Governing Urban Infrastructure Resilience: Institutional Barriers and Opportunities

Mark de Bruijne (Technische Universiteit Delft): Challenges in (Urban) Infrastructure Renewal: How To Design to Manage Infrastructure Interdependencies? (Dutch)

Eva Stock (Bundesamt für Bevölkerungsschutz und Katastrophenhilfe = Federal Office of Civil Protection and Disaster Assistance, Bonn): Critical Infrastructure Protection: Integrated Risk Management as an Approach to Address Governance Complexities and Cooperation in Civil Protection in Germany

Keynote:

Jon Coaffee (University of Warwick, Coventry / New York University): Futureproofing City Infrastructures: Transitioning from Risk Towards Resilience

Panel: Spatiality

Chair: Sybille Frank (TU Darmstadt)

Ivonne Elsner and Marcel Müller (TU Darmstadt): The Impact of Infrastructure Disruptions on Our Everyday Perception of Space

Pranjali Deshpande (Institute for Transportation and Development Policy, India): Towards

a Sustainable City: Case of Pune

Timothy Moss (Humboldt-Universität zu Berlin): Vulnerable City, Resilient Infrastructures? Contested Spatialities of Sociotechnical Networks in Berlin's Turbulent Modern History

Panel: Temporality

Chair: Jens Ivo Engels (TU Darmstadt)

Uwe Lübken (Ludwig-Maximilians-Universität München): When Rivers Don't Behave: Natural Rhythms and Infrastructural Failure(s)

Stephanie Eifert, Nadja Thiessen and Benedikt Vianden (TU Darmstadt): Time to Be in Time

Susanne Krings (Bundesamt für Bevölkerungsschutz und Katastrophenhilfe = Federal Office of Civil Protection and Disaster Assistance, Bonn): Legislating Contingency and Managing Criticality

Keynote:

Christoph Lamers (Institut der Feuerwehr NRW = State Fire Service Institute North Rhine Westphalia, Münster): Fire Service and Technical Relief – a Structure in Space and Time

Panel: Safety and Security

Chair: Uwe Rüppel (TU Darmstadt)

Thomas Köstler (Fire Department Lübeck): Power Failure in Lübeck Including Failure of the TETRA Digital Radio – Measures for Police and Non-police Emergency Response

Anna-Katharina Brauner, Arturo Crespo and Marcus Dombois (TU Darmstadt): User-based Contingency Planning for Railway Disruptions Using Network Analysis

Sylvia Bach (Universität Wuppertal): Towards a Smart Critical Infrastructure! – Big Data Offers New Chances for Resilience

Panel: ICT Solutions

Chair: Matthias Hollick (TU Darmstadt)

Florian Steinke (TU Darmstadt): Is Resilience the Real Driver for Decentral Intelligence in Energy?

Antonio Jorba (COUNT+CARE GmbH, Dig-

italstadt Darmstadt GmbH): LoRaWAN: The
Wireless „Nervous System“ for Digital Cities

Jiska Classen and Lars Almon (TU Darm-
stadt):

Bricked or Useful Tool: the Role of Everyday
Electronic Devices in Crises

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