EMASS Subproject HIGHRISE



Darmstadt University of Technology

Institute of Concrete Structures and Materials

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Institute of Concrete Structures

Introduction

Research activities of the Institute of Concrete Structures:

- sustainability of structures
- masonry structures
- concrete construction
- reliability of structures:

\Rightarrow wind loads on high-rise buildings



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Full scale wind measurements on high-rise buildings

 permanent wind measuring device at antenna Commerzbank 275m since 1997

• Permanent wind measuring at climbing cranes during construction at different altitudes

Main Tower200m1997-1998Gallileo130m2001-2002

German Weather Services
 Frankfurt Airport 10m











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Full scale wind measurements - results

- Wind climatology: 50-year return period 22,1m/s instead of 24,3m/s (EC 1) gales source for strong winds, main wind direction South-west
- Mean wind profile (mixed profile)









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Full scale acceleration measurements





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Full scale acceleration measurements

Natural frequencies:

20% above the calculated by FEM decrease slightly with rising accelerations respectively wind velocity

- Damping ratio: values are very low, scatter is high
- Max. Acceleration: measured: threshold of perception of motion: disturbing

2-3 milli-g 5 milli-g 15 milli-g

⇒ far below threshold of perception



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Future research activities

- Improved wind load assumption could be developed, which allows a reduction up to 20 % opposite to current regulation
- \Rightarrow Confirmation by further measurements \Rightarrow Increase the scope of application
- Beneath ULS the SLS becomes more important due to
 the progress in materials and construction techniques
- ⇒ Realistic information of frequent wind loads and dynamic properties in the SLS



Future research activities

Wind loads on high-rise structures

- State of the Art Report Wind loads, comfort criteria
- Full scale wind measurements
- Implementation of monitoring systems on the structure
- Parallel experimental and numerical work wind tunnel tests - CFD simulations - finite element calculations



Future research activities Monitoring system of façades

Requirements:

Mobile, non-destructive, quick, high resolution and inexpensive

- Principles:
 Investigation of dynamic properties, system identification, damage detection
- First steps: state of the art report, classification of different types and materials (glass, natural stone etc.) tests could start under laboratory conditions in full scale to detect various kinds of failure coordination of the façade construction with these kinds of failure (predictability of failure)



Requirements of expertise Capable partners needed in following fields of activity:

- Wind engineering, full-scale measurements, wind-tunnel tests, CFD-simulations
- Laser scanning techniques
- system identification, damage detection
- Façade manufacturer
- Construction companies
- Authorities
- Building owners

\Rightarrow You are invited



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Thanks for your kind attention!





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