



FEM Product Group Cranes and Lifting Equipment

**International Tower Crane
Conference 2012**

by ***Francesco Valente, TEREX***
Berlin, 11th October 2012



Beyond EN14439

Site specific Wind to be observed

Information on local site effects created by buildings and affecting the behaviour of the nearby tower crane



Wind related effects on crane behavior

- **Extraordinary Storm** → Overload → structural failure
- **No Weather Vaning** → Overload → structural failure
- **Site Effects** due to Buildings
 - disturbed wind field + accelerated wind + inhomogeneous wind direction + turbulences
 - incorrect behaviour / rotation / oscillations / etc.



Wind related effects on crane behaviour

- Normal behaviour of tower cranes standing in strong wind



- Spinning due to wind field behind building → Luffer:

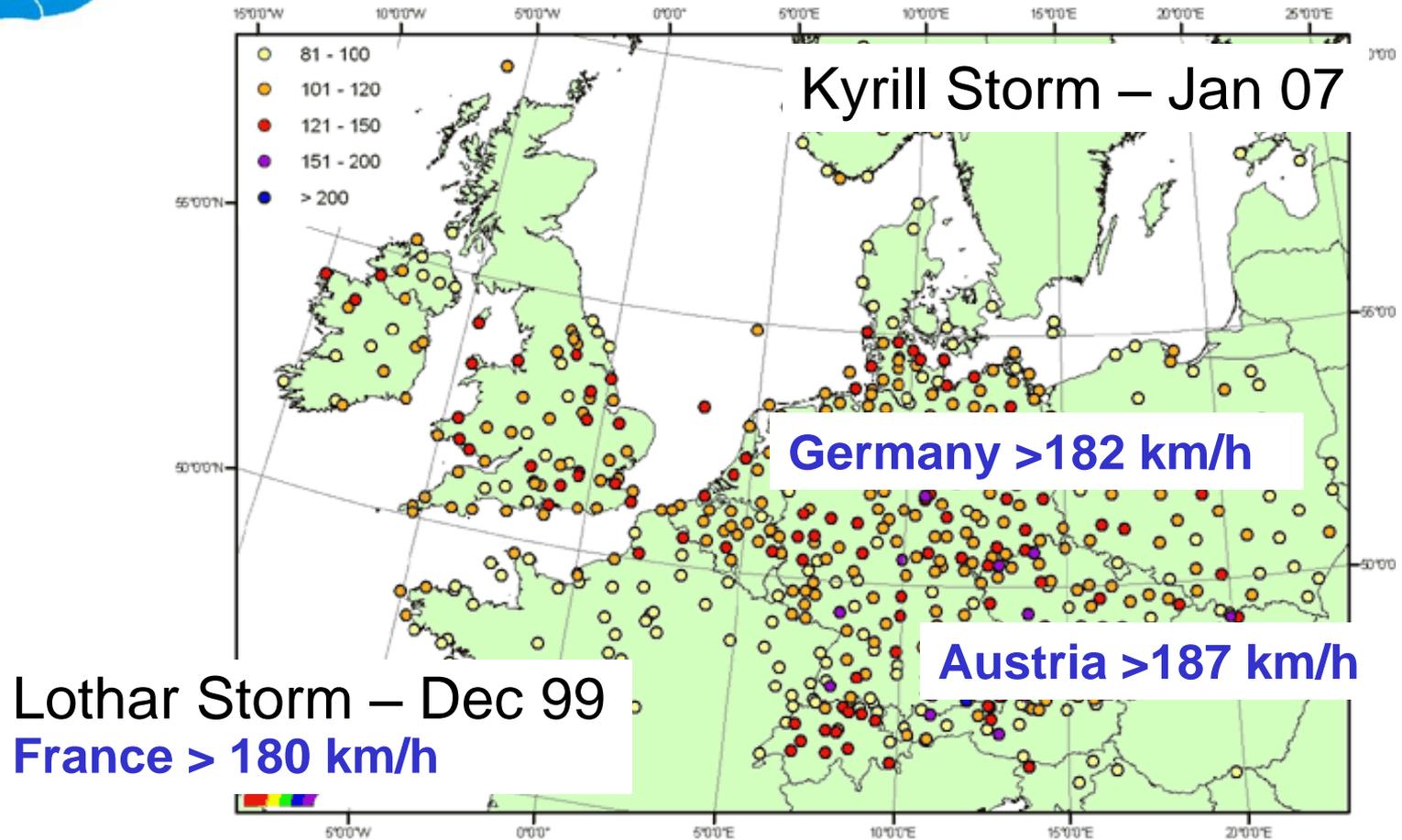


- Spinning due to wind field behind building → Hammerhead:





Wind related crane behavior



Source: ZAMG



Development in product standard EN14439

MANUFACTURER

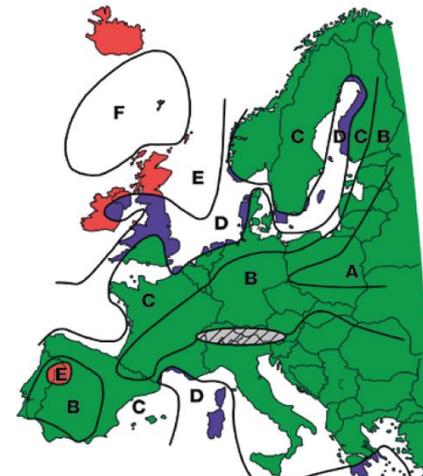
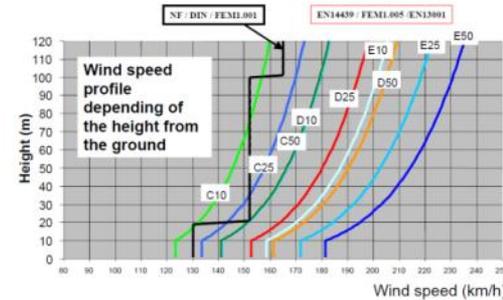
Wind Force Calculation

MANUFACTURER

Anemometer (crane height > 30m)

USERS

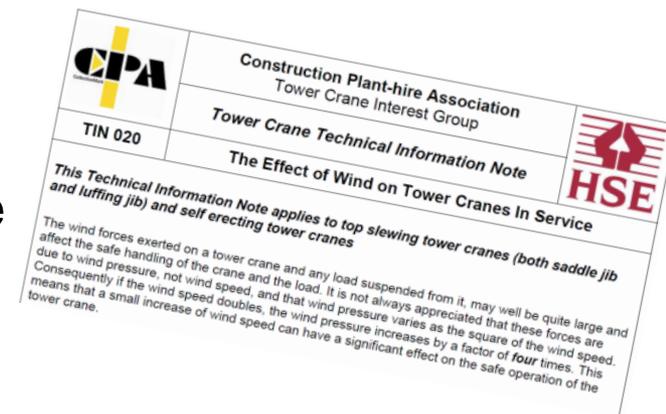
Wind zones





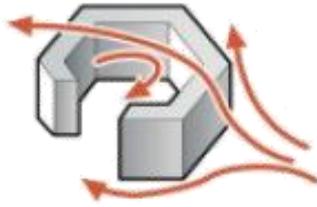
Recommendations to Tower crane users and inspectors

- **Observation:** Local wind site effects are often not taken into account by users and inspection bodies
- **UK (2009) – CPA/HSE**
(User Association + Health & Safety Executive issued a Technical Note including hint on site Effects
- **France (2004) – CNAMTS**
(Health insurance for employees) → New recommendation for tower crane users – „*Preventing wind induced tower crane tip over*“





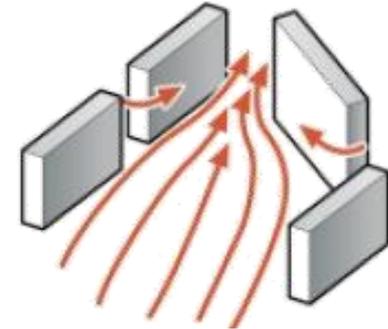
Site effects



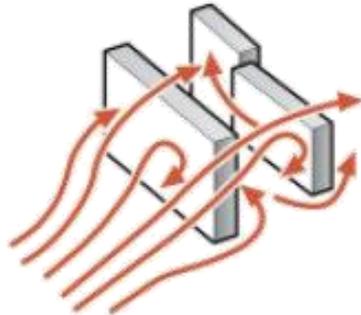
„mesh - effect“



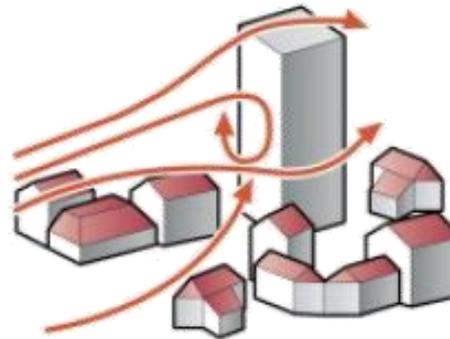
„Corner - effect“



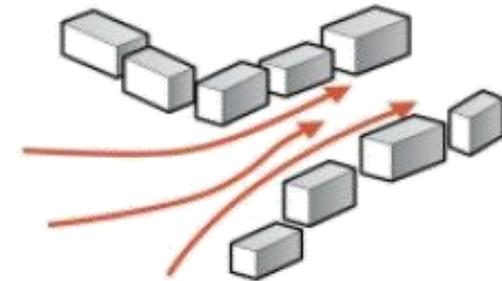
„Venturi - effect“



Connection between
different pressure zones



Effect due to high rise building in
urban area with small buildings

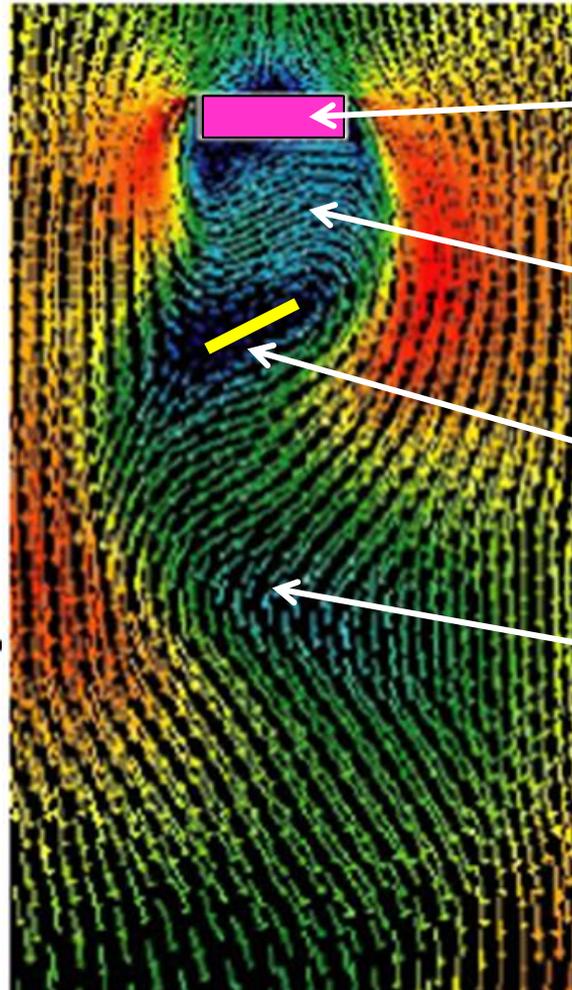
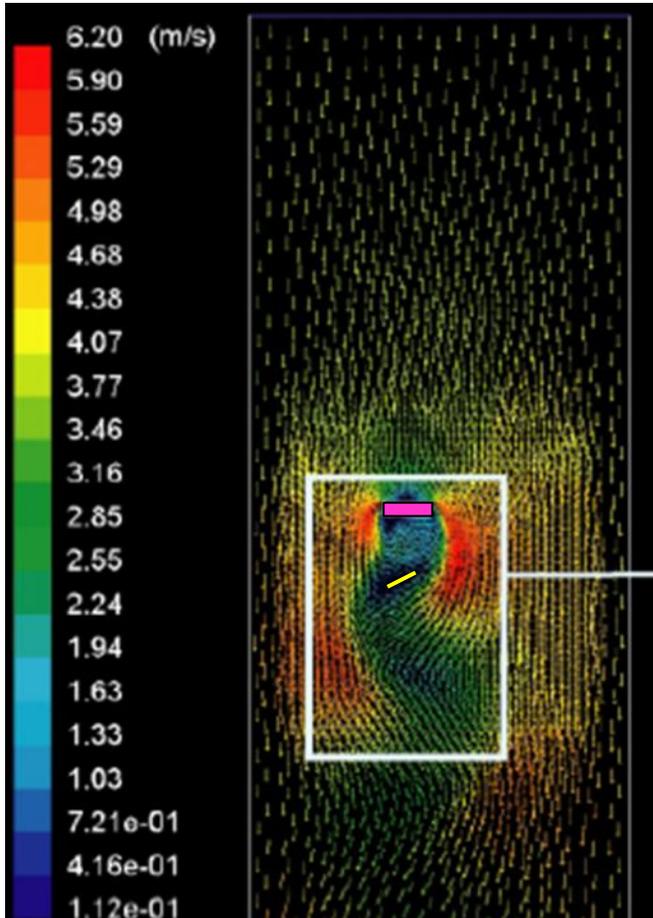


„Channel - effect“

Source: CNAMTS – France (Recommendation R406)



Site effects



Building

Turbulences

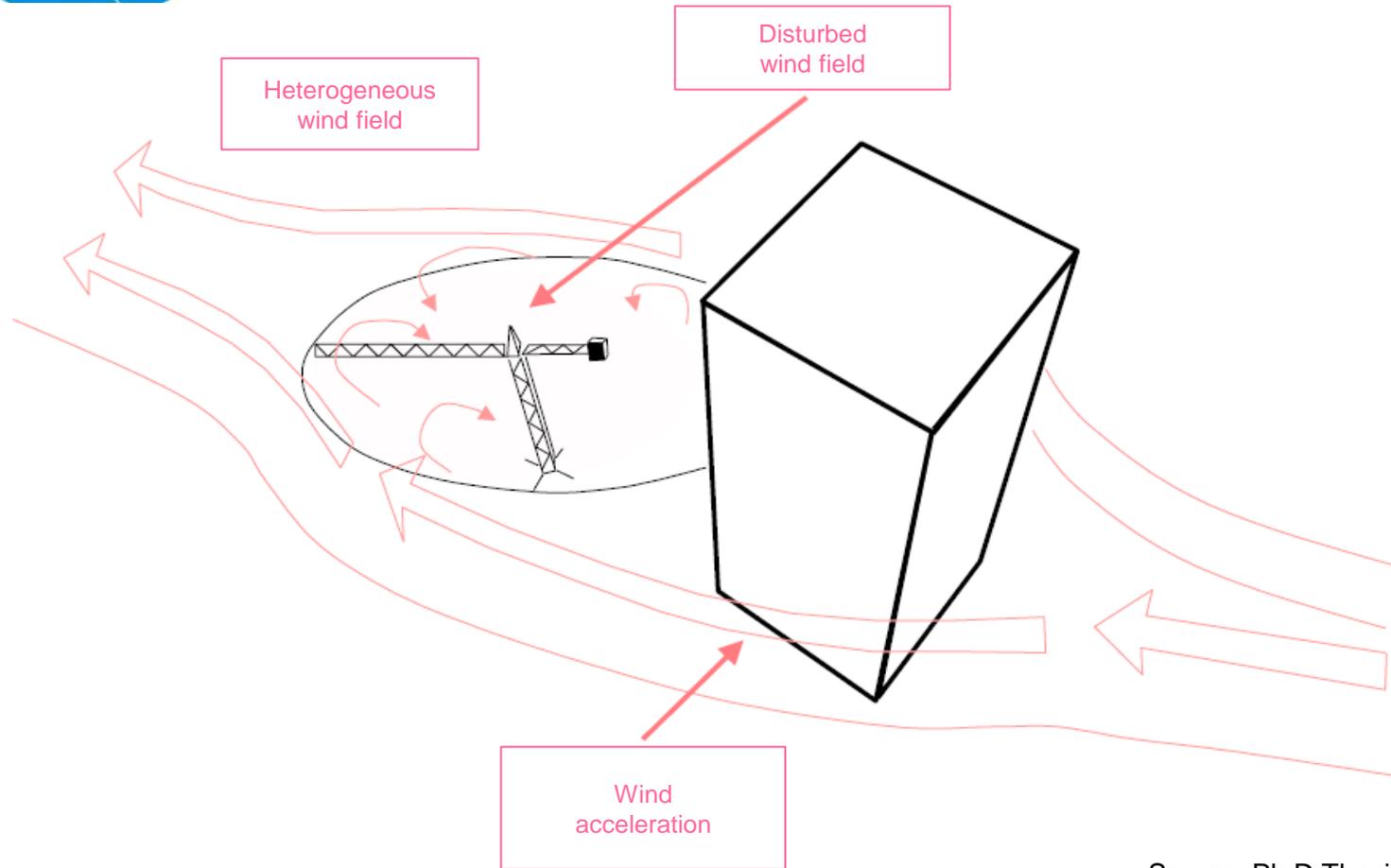
Tower Crane

Slipstream

Source: Ph D Thesis / D. Voisin



Site effects



Source: Ph D Thesis / D. Voisin



Site effects

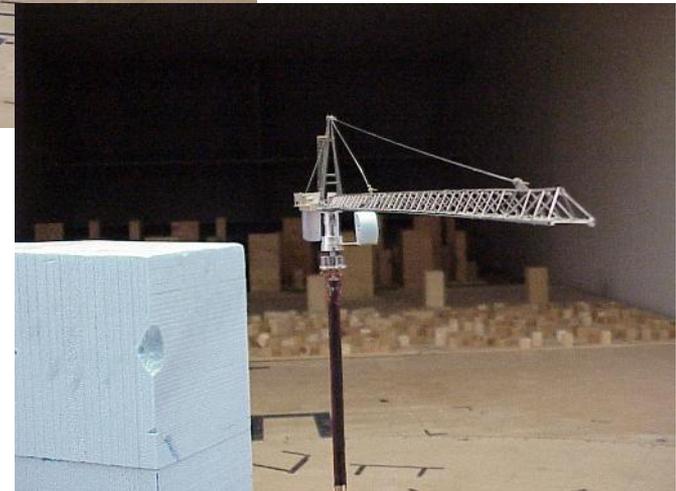
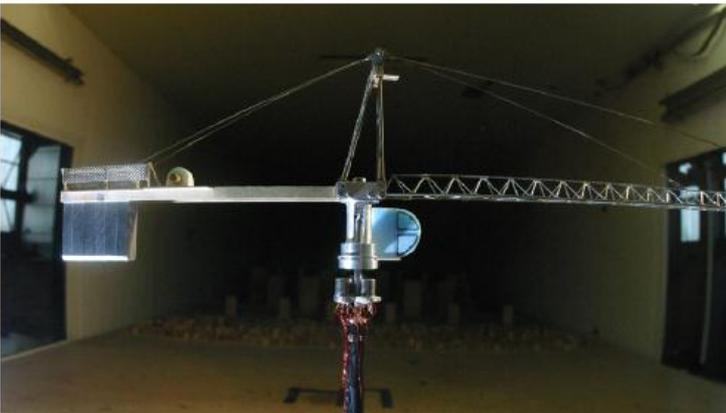
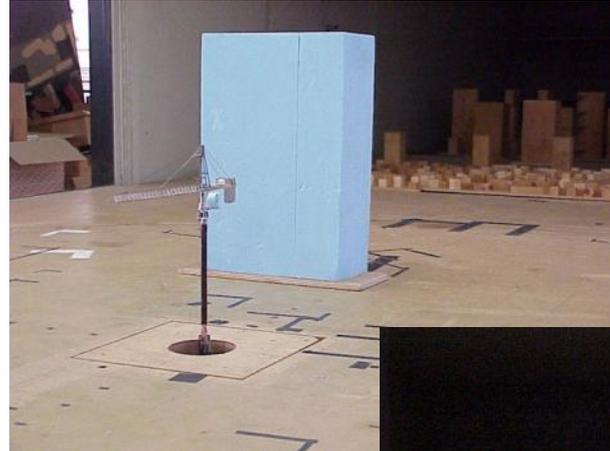


Source: POTAIN

Source: GBF / TEREX



Site effects



Source: POTAIN



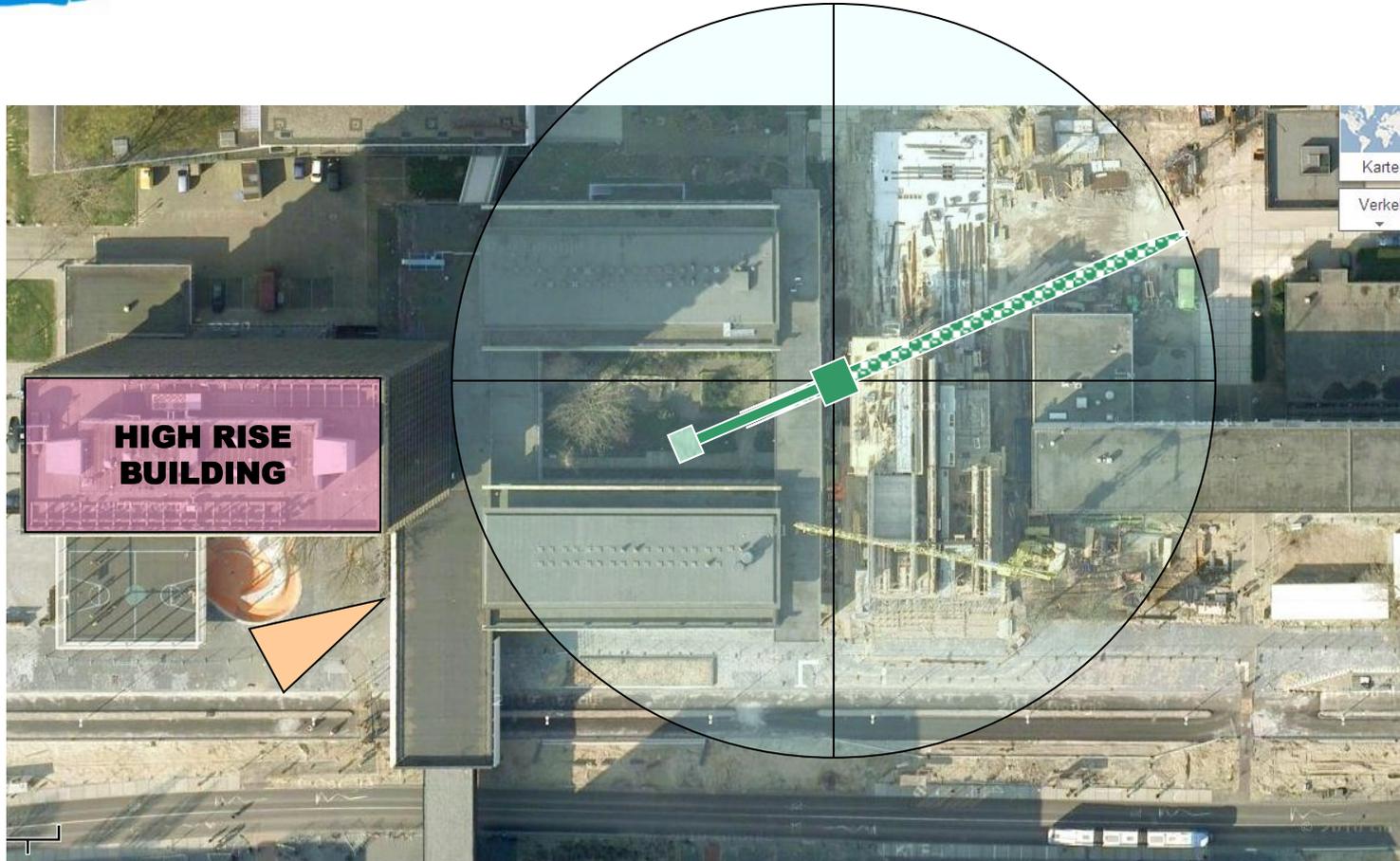
Site effects

- Crane jib 50m
- Crane height 65m
- Building height 75m



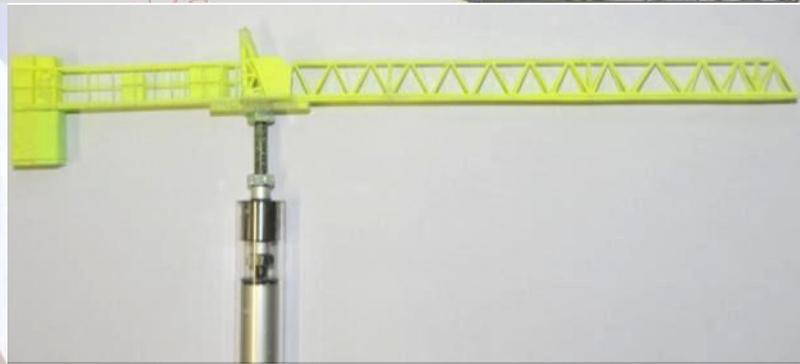
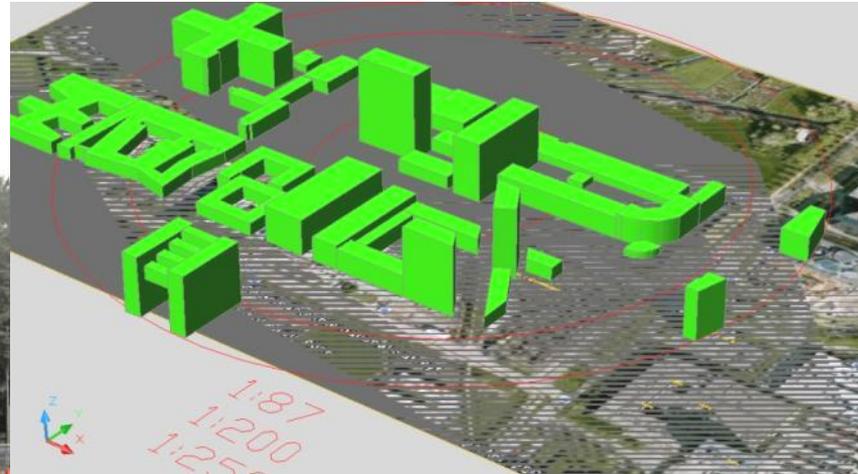


Site effects





Site effects

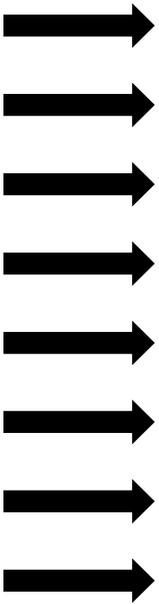


Source: GBF / TEREX

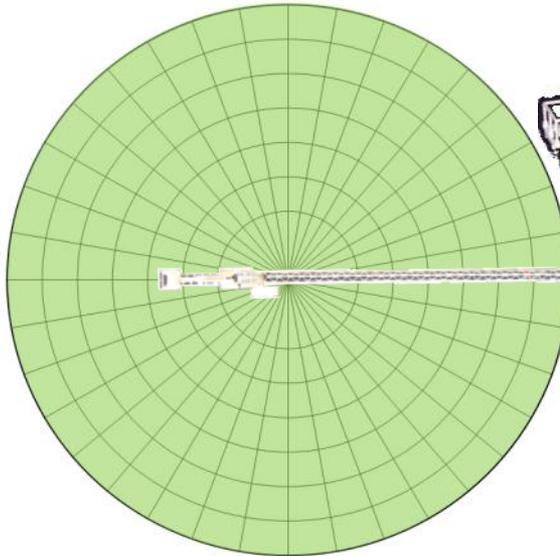


Site effects

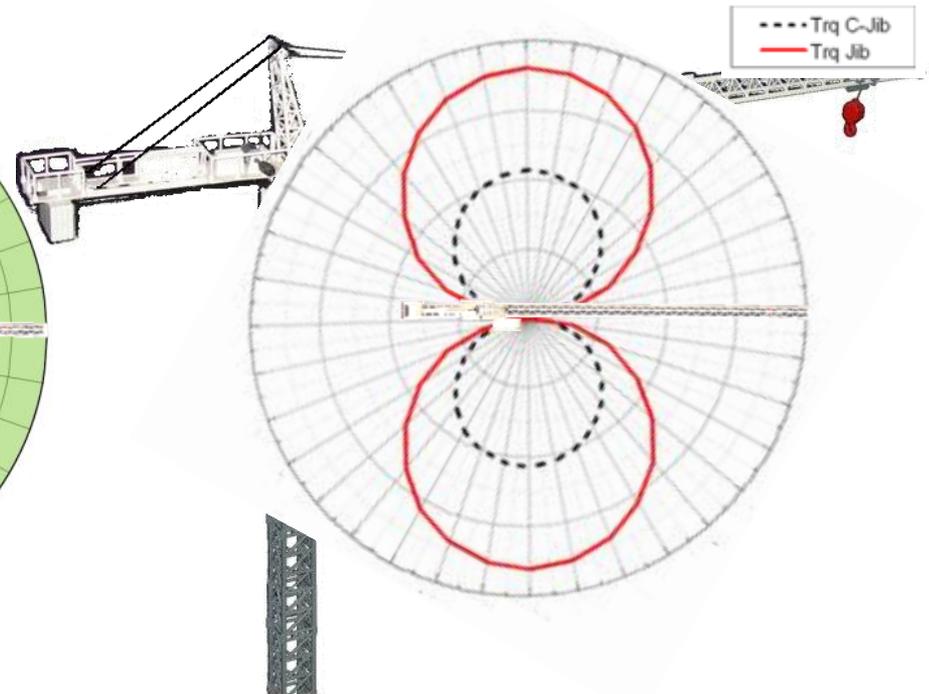
Wind



Windfield



Torque Upper Crane

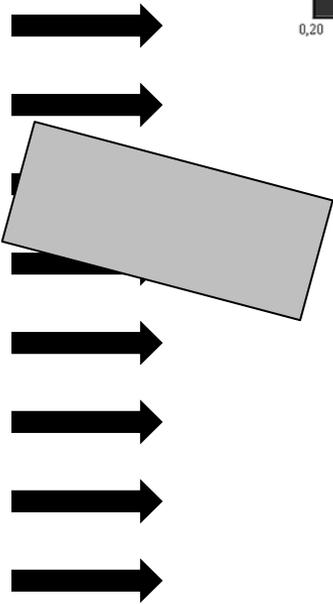


Source: GBF / TEREX

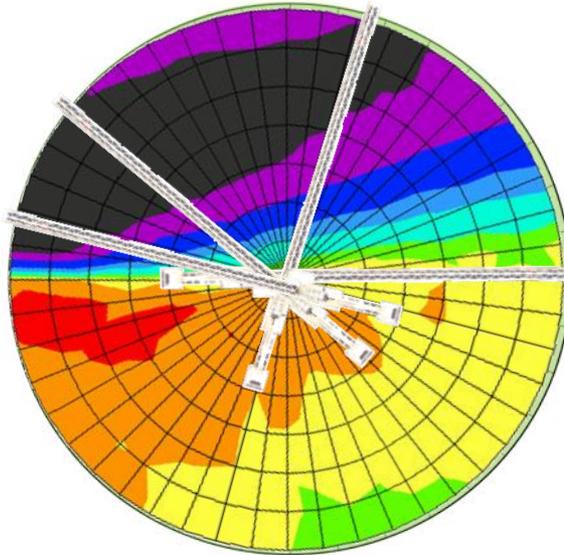


Site effects

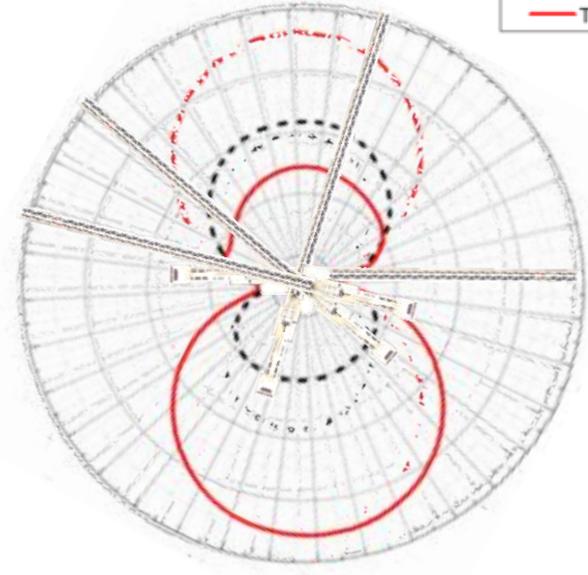
Wind



Windfield



Torque Upper Crane



Source: GBF / TEREX



Site effects

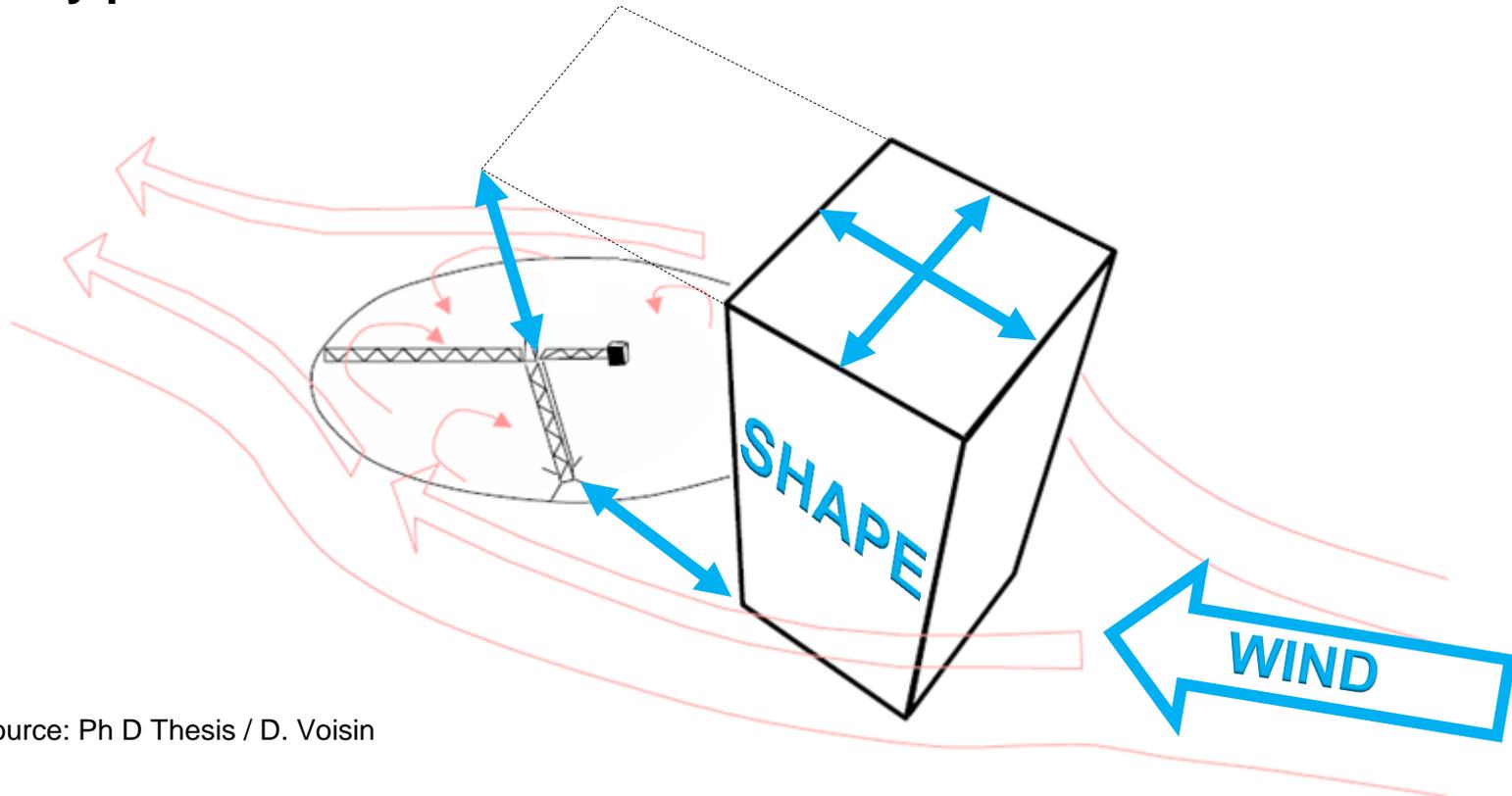


Source: GBF / TEREX



Site effects

Key parameters:



Source: Ph D Thesis / D. Voisin



FEM Message

- **Product standard** cannot cover site specific wind effects
- **Assessment of job site specific wind effects = responsibility user**
- **Local site effects are not included** in the information received from weather station and shall be evaluated separately
- **Local site effects can lead to an unintended behaviour or even an accident** although the average reported wind speed is not exceeding the permissible value
- We need **consistent guidance** and requirements to users in **Europe and elsewhere**



Thank you



Sources and Literature References:

CNAMTS – R406

CPA – TIN 020

Ph D Thesis Mr D. Voisin

GBF Institut

ZAMG

<http://www.ameli.fr>

<http://www.cpa.uk.net>

<http://vdimitri.free.fr>

Gesellschaft für Bemessungsforschung mbH / Aachen - Germany

Zentralanstalt für Meteorologie und Geodynamik - Austria