# REQUIREMENTS FOR WIND TURBINES IN HARBOUR AREAS

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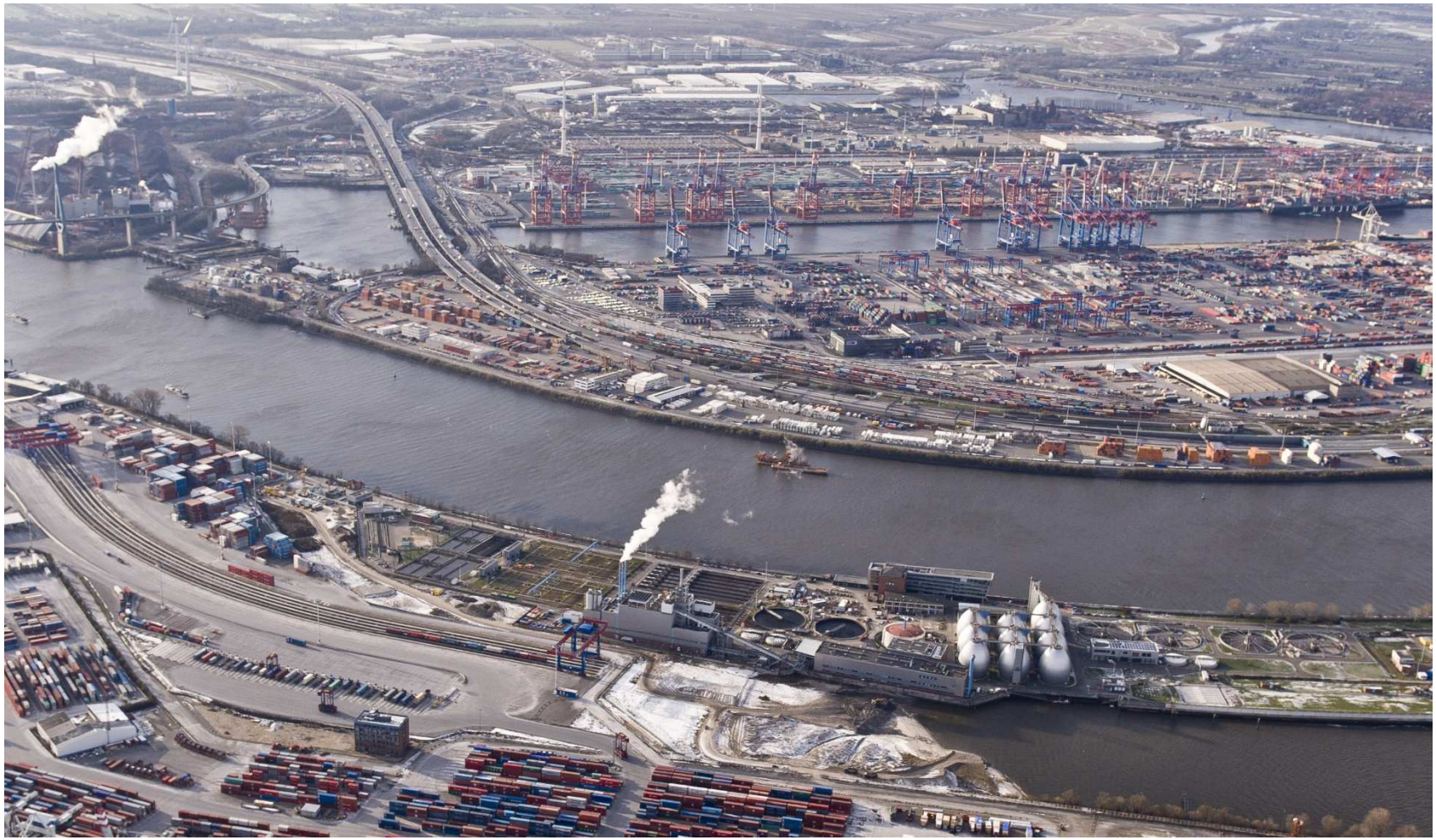
Sundsvall, February 2014

# WIND TURBINES IN THE HARBOUR



# WHAT HAS TO BE CONSIDERED ?

- BImSchG
- Technical constrution regulations that claim ice detection systems – DiBT “Liste der technischen Baubestimmungen“
- The HSE themes must be thoroughly considered
- Condition monitoring
- Ice throw must be avoided
- Ice fall cannot be avoided

Pict.: augustin-windenergie.de

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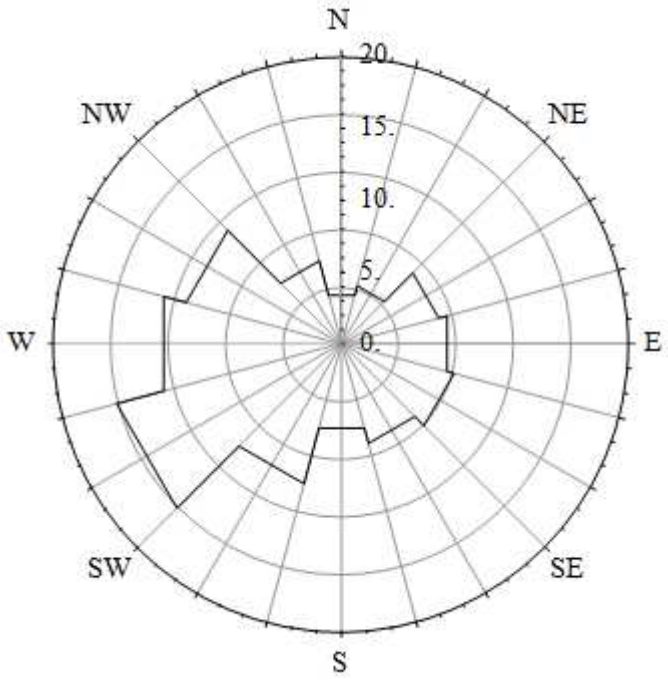
# ICE FALL CANNOT BE AVOIDED !

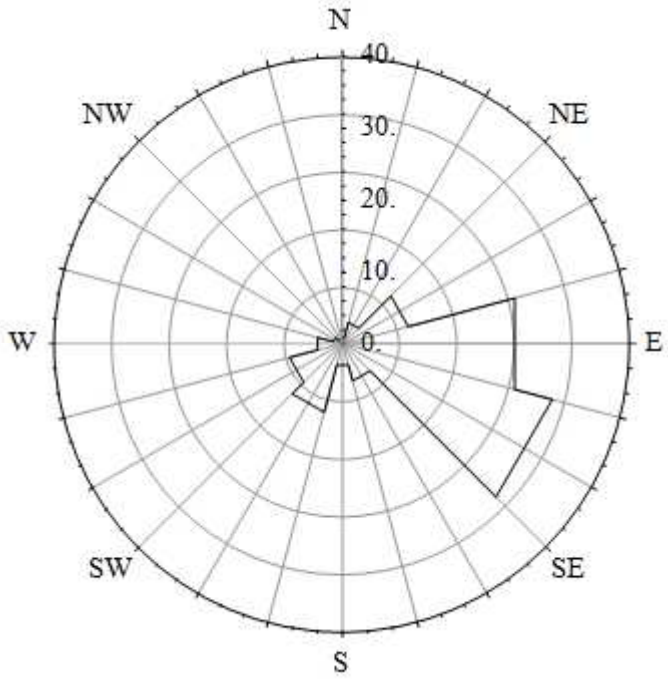
# BEST AVAILABLE DATA ?

- Operational data from nearby turbines
- Observations from the operational personnel
- „Alpine Test Site Guetsch“, Cattin, R.
- Climatic data
- Icing incidents from Secured climatic data from weather stations
  - Airports
  - Remote sensing

# GENERAL CLIMATIC DATA VS. OBSERVED ICING CONDITIONS WIND DIRECTION

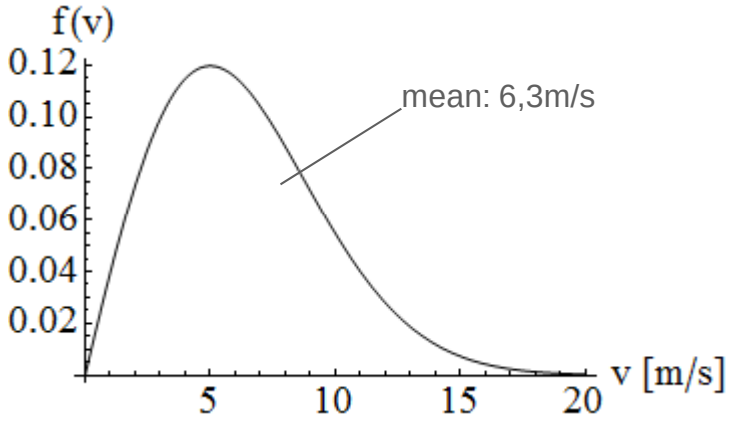



**general climatic data**

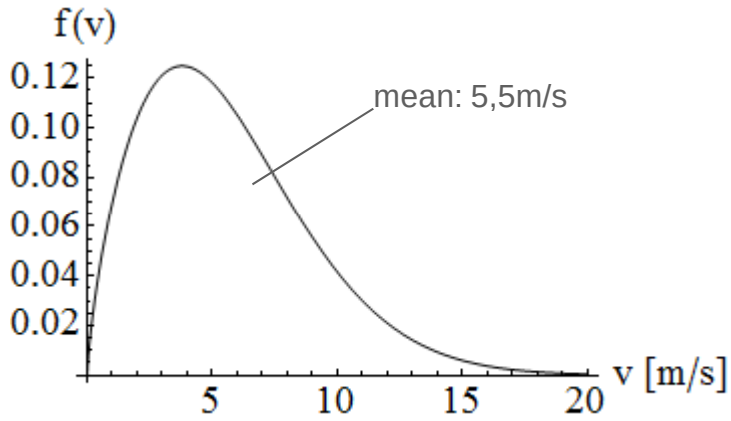



**icing conditions**

# GENERAL CLIMATIC DATA VS. OBSERVED ICING CONDITIONS WIND SPEED

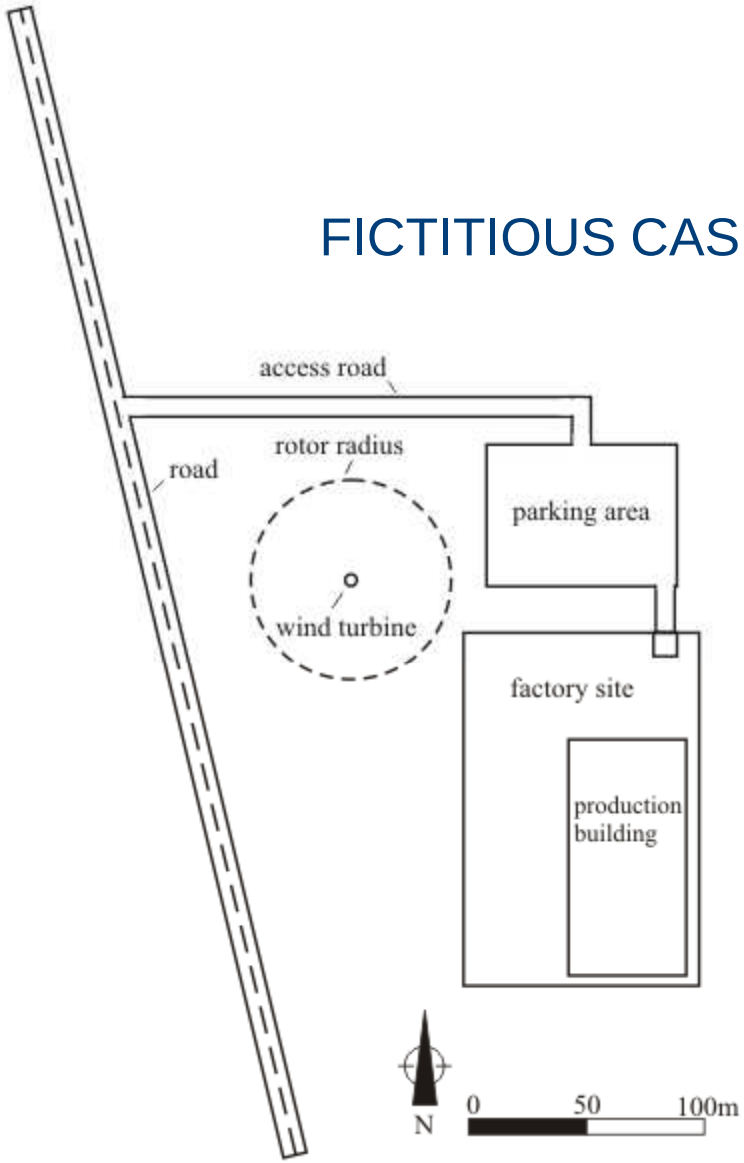



**general climatic data**




**icing conditions**

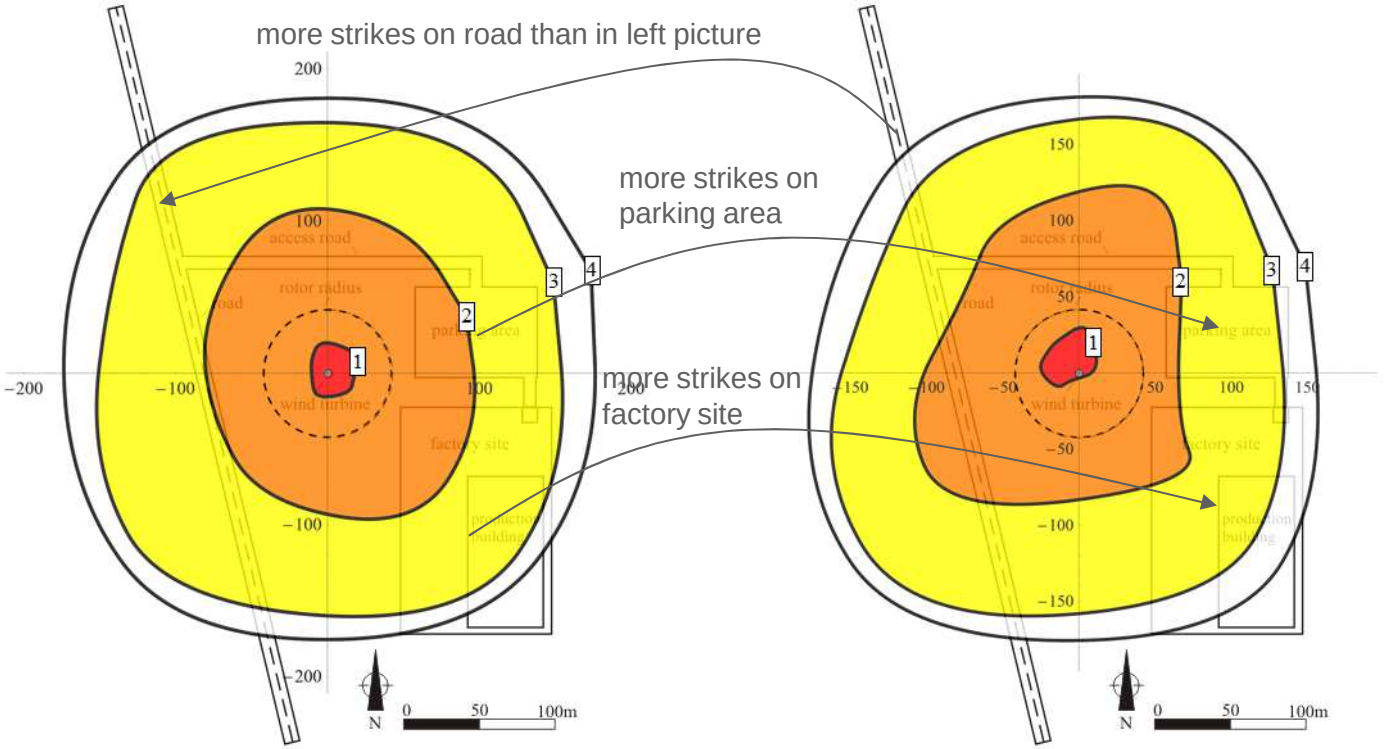
# FICTITIOUS CASE STUDY




| | |
|---|---|
| hub height | 100m |
| rotor diameter | 84m |
| rotational speed | 16 U/min |
| distance to road | 74m |
| distance to access road | 68m |
| distance to parking area | 57m |
| distance to factory site | 50m |

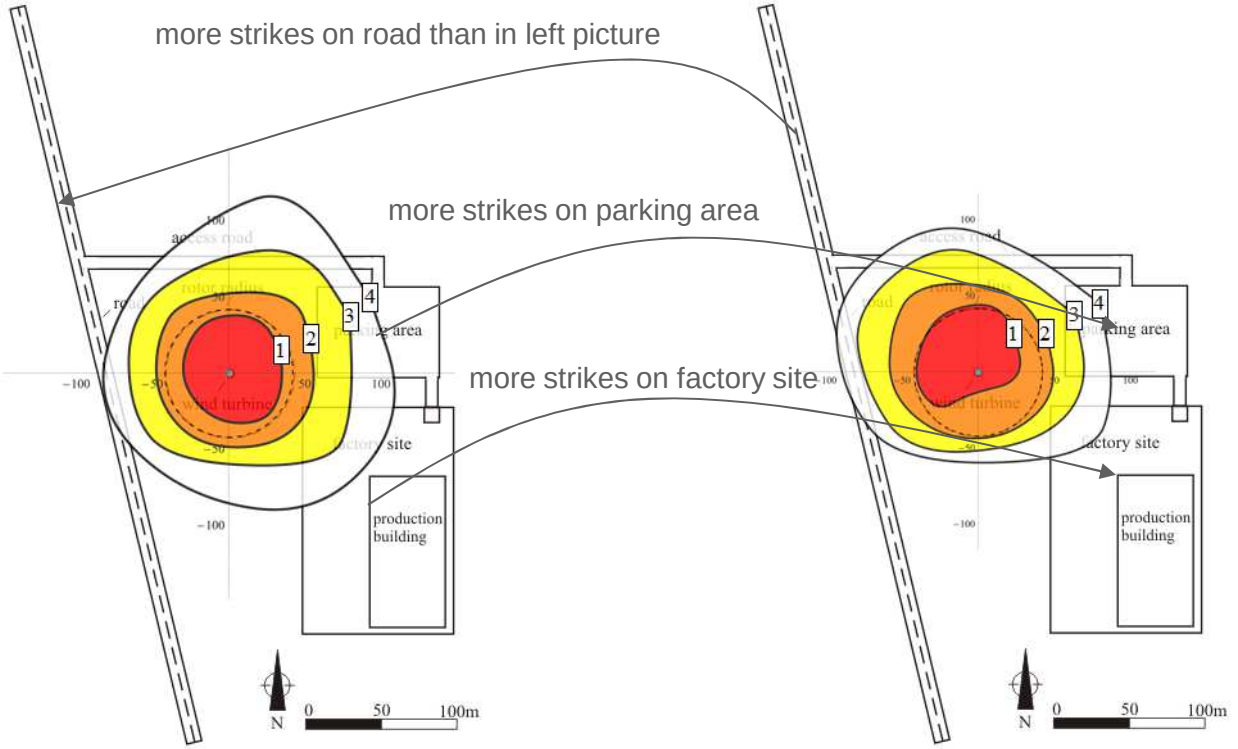
relevant parameters

# RESULTS ICE THROW




**general climatic data** **icing conditions**

# RESULTS ICE FALL

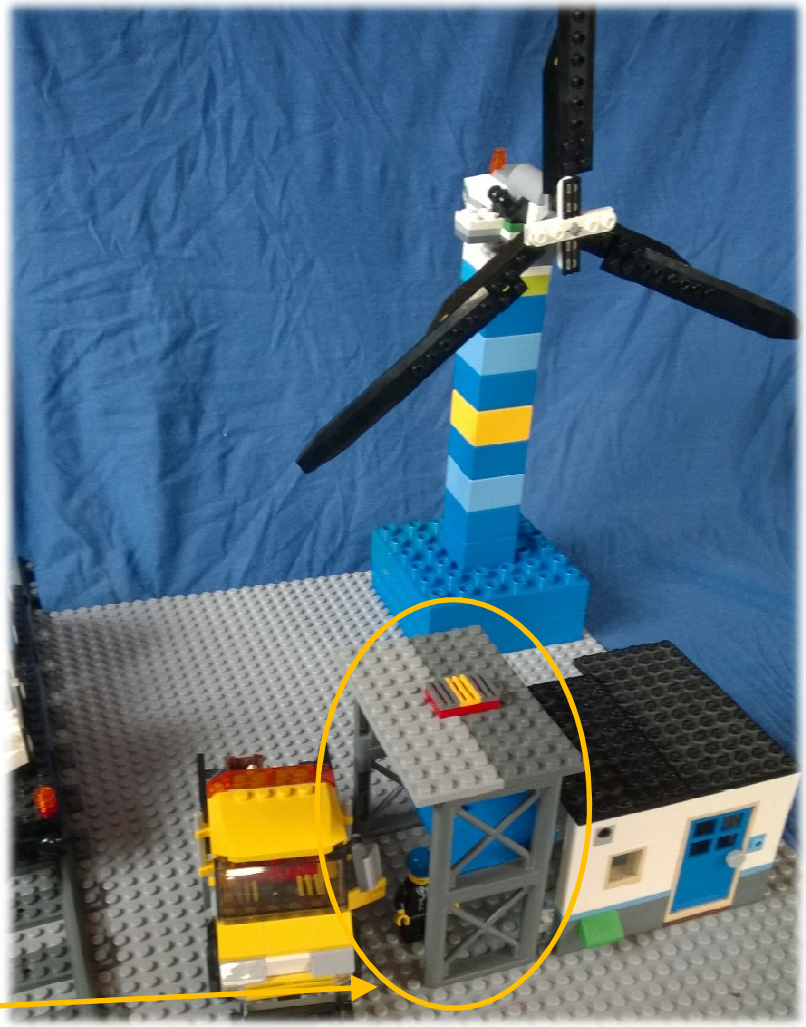



**general climatic data** **icing conditions**

# METHODS FOR RISK REDUCTION ON WIND TURBINE

- Icing conditions detection system
- Ice detection system (Blade - CMS)
  - inform about icing (SCADA, 3rd party)
  - avoid ice throw (stop and park)
  - manual start / autostart
- Parking Position
  - reduce the risk of ice fall through optimized parking position
- Blade heating
  - can only partly protect against the icing
  - accelerated / controlled de-icing

# METHODS FOR RISK REDUCTION

Protective roof or net

# METHODS FOR RISK REDUCTION ON WIND TURBINE

- Mark the potential hazardous area
  - signs and signals
- Instructions on personnel and visiting persons
- Hazardous area
  - can the area be avoided for several hours ?
  - moving only with vehicles
  - working only inside the buildings or under roofs or nets

# THANK YOU

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