

# Intelligent Weather Systems

## Unlocking weather effects on Traffic

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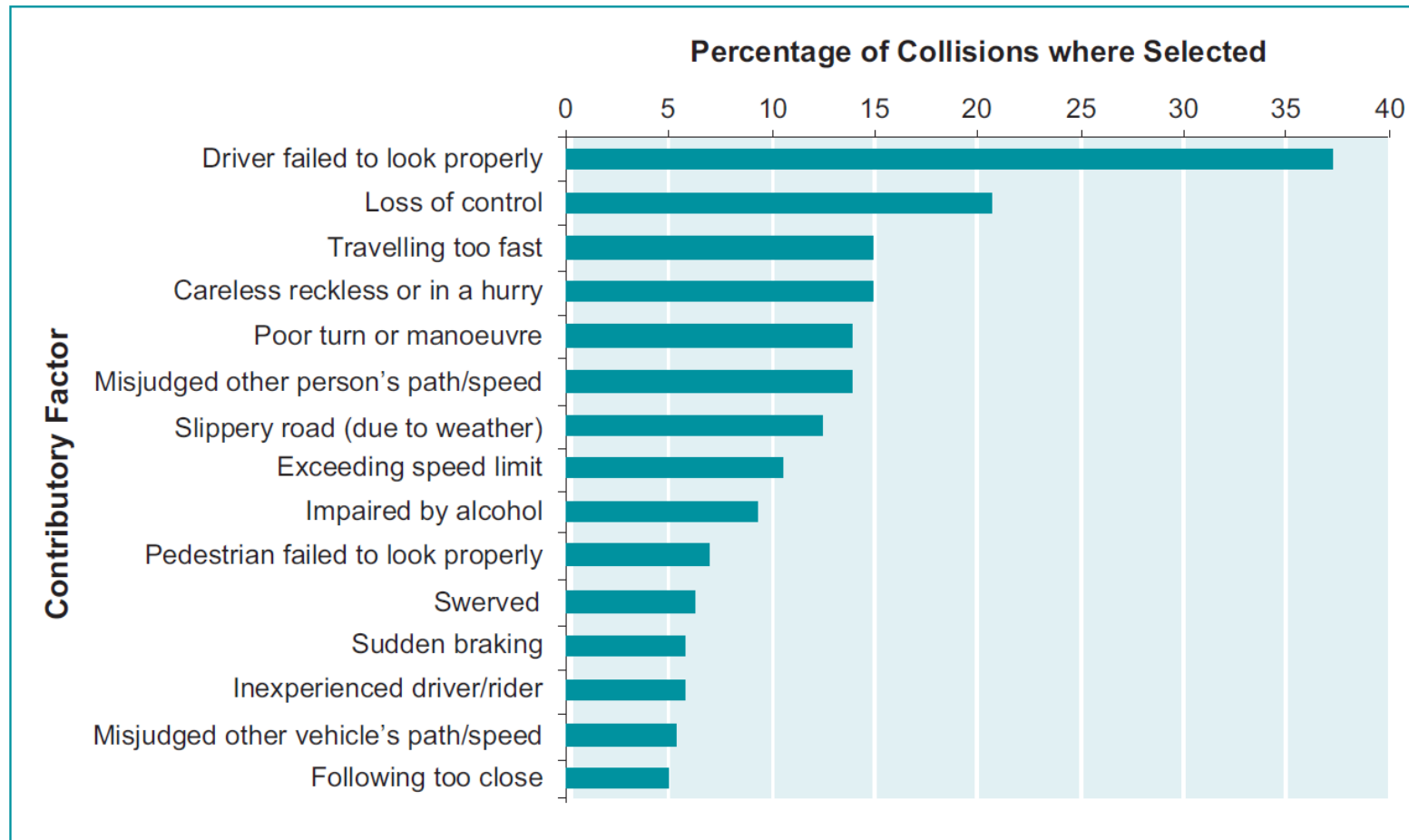
**VAISALA**

# Weather and Traffic

- Traditional aspects of weather and roads have focussed totally on safety
- Most extreme weathers cause a safety hazard of one sort or another
  
- Ice
- Snow
- Heavy rain
- **Loss of grip or friction due to weather conditions**
  
- Fog
- **Loss of reference points – driver behaviour critical**
  
- High winds
- **Physical forces overwhelming traffic**

# Typical statistic

Source: Hertfordshire Road Traffic Collision and Casualty Facts 2009



<sup>1</sup> Up to 6 contributory factors may be selected by the police per collision, the top 15 are shown. Percentages will therefore not equal 100%.

# Typical Statistic

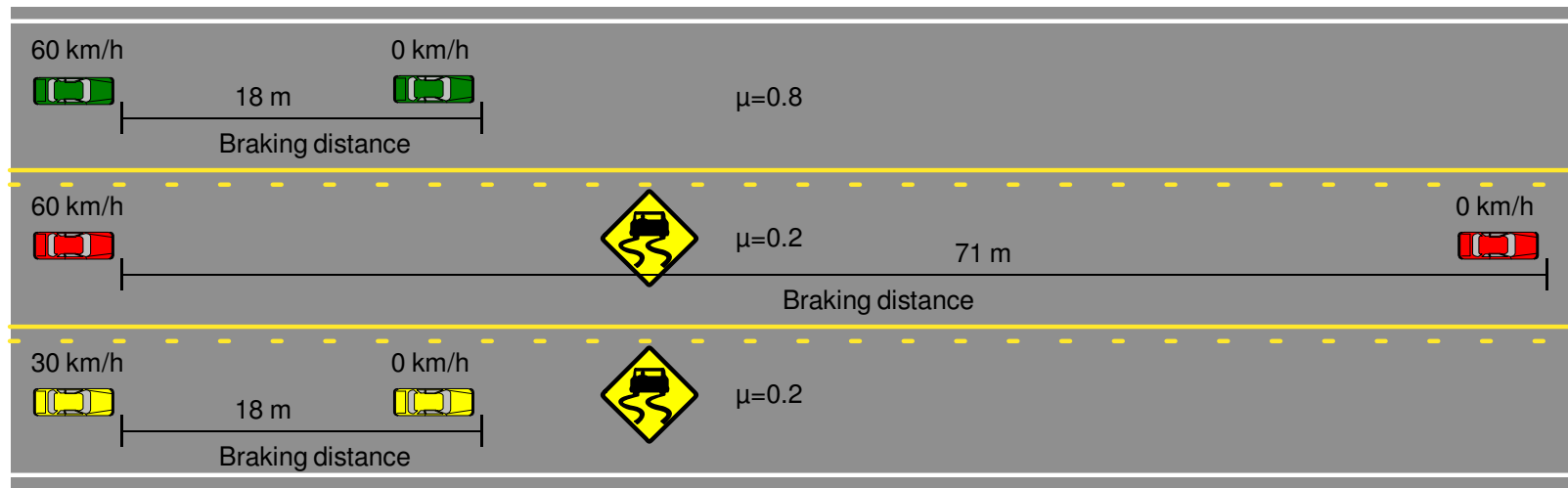
Source: Reported Road Casualties Scotland 2008

	Fatal	Serious	Minor	Total
Wet/damp/flood	122	840	4,160	5,122
Snow/frost/ice	8	70	430	508
All conditions	268	2,225	10,531	13,024

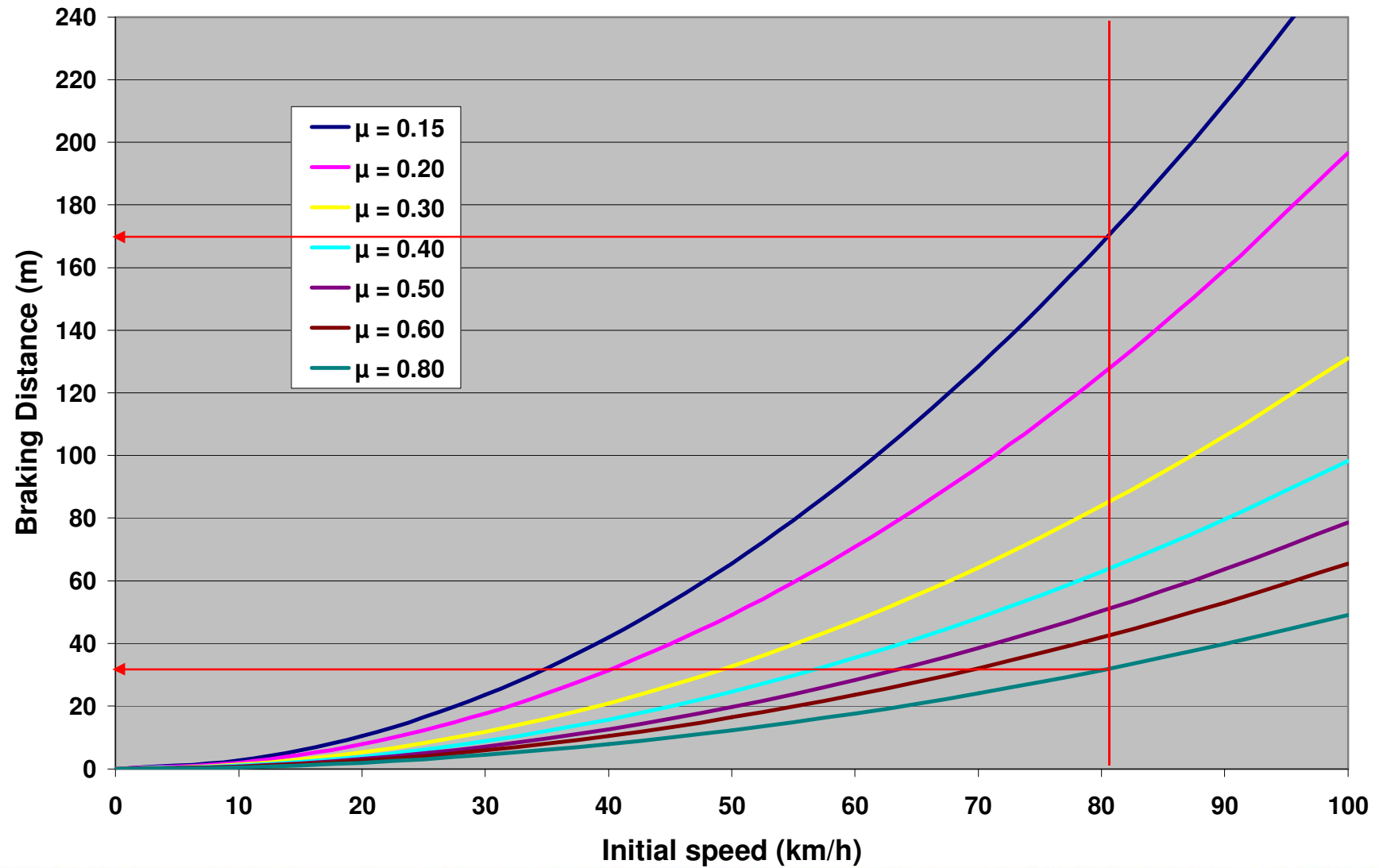
	Fatal	Serious	Minor	Total
Wet/damp/flood	46%	38%	40%	39%
Snow/frost/ice	3%	3%	4%	4%

# Friction vs. Braking distance

- The easiest way to understand what friction means in road environment is to compare it to the braking distance



# Braking Distance vs. Initial Speed and Friction



# Worlds first remote surface state sensor – DSC111

- Non-invasive remote surface sensing
- Individually identifies the presence of:
  - Water
  - Ice
  - Slush
  - Snow or frost
- Unique measurement of grip
- Can also provide visibility measurement (option)



# Combination of Grip and Traffic flow

- Loss of grip to around 0.6
- Combined with unmodified driver behaviour
- Very high risk of accident (Scotland 40%)
  
- Focus should be on driver behaviour
- Link from DSC111 to VMS gives automatic protection for known accident locations
- Data quality paramount to avoid false alarms
- Vaisala Data Centre has over 1200 data checks to ensure messages are based on actual weather



# How friction information can be used to maintain roads

- **Level of Service**
  - Operators receive real time friction data and use this to adjust their treatment of the road
- **Storm Management**
  - Friction data are collated to a central location and used to deploy assets to locations where friction levels are unacceptable
- **Application of materials**
  - real time friction values are used to adjust the application of materials directly from the truck
- **Operator Safety**
  - Real time friction values provide in-cab warnings to alert operators to presence of black ice
- **Early warning for Ice formation**
  - Patrol vehicles use friction to locate ice formation and call out trucks for de-icing
- **Litigation**
  - Archived friction values provide significant benefit when agencies are sued for accidents
- **Quality control**
  - Friction is used as an independent quality check of roadway conditions. Especially helpful when maintenance services are contracted out.
- **FAST trigger**
  - As an efficient trigger for Fixed Automated Spray Technologies

# Weather isn't just about accidents

## US Federal Highways Literature Review

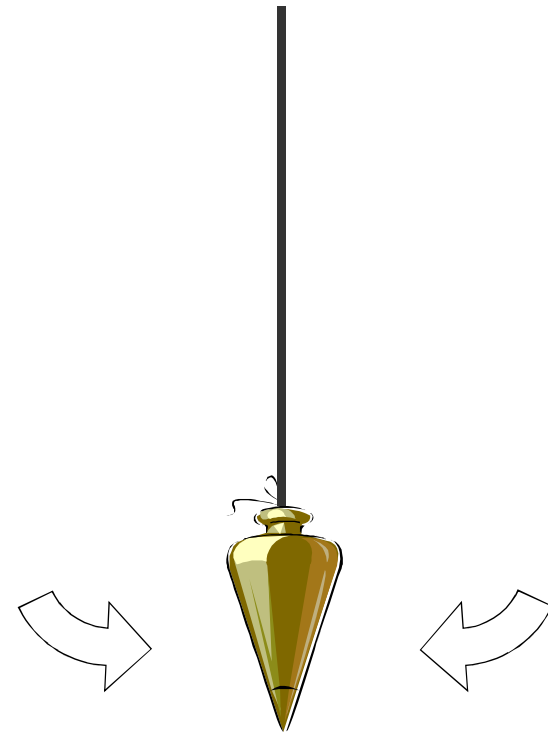
- Traffic Volume reductions
  - Snowfall <25mm up to maximum of 35% reduction observed
- Traffic speed reductions

Factor	Speed Reduction (mph)
Wet	5.9
Snow	10.2
Wind > 24 km/h	7.3 (variation of speed drop is high)
Visibility < 0.28 km	0.48 per 33 ft below critical

Source: Kyte, et al., 2001.

# Driver response is all about thresholds being passed

- As a race we like the Status Quo
- We will return to resting as soon as we can
- However pass a certain threshold and we will change behaviour
- The retail industry know this well and play on it every day by exploiting opportunities as weather passes various thresholds



# Retail Thresholds

- One hot meals company discovered that hot meal sales declined by £70,000 a day each time the temperature rose by one degree over 20 °C
  - 20 C is the threshold most watched
- Soft Drinks are documented to see sales uplifts from 20C-24C much more than is seen when temperatures rise from 10C-14C
- Forecasts for the weekend showing sunny weather in summer will mean BBQ stock at major supermarkets is moved to near front door.
- Growers for major retailers are given warning of good weather so they can speed up or slow down growth so shelves never empty when we all want salad
- Sales of ladies razors jump by several hundred percent on the first weekend of hot weather at the end of spring – one week later the sales of men's razors then also show a smaller but noticeable jump!

# No Doubt that similar thresholds exist in Traffic!

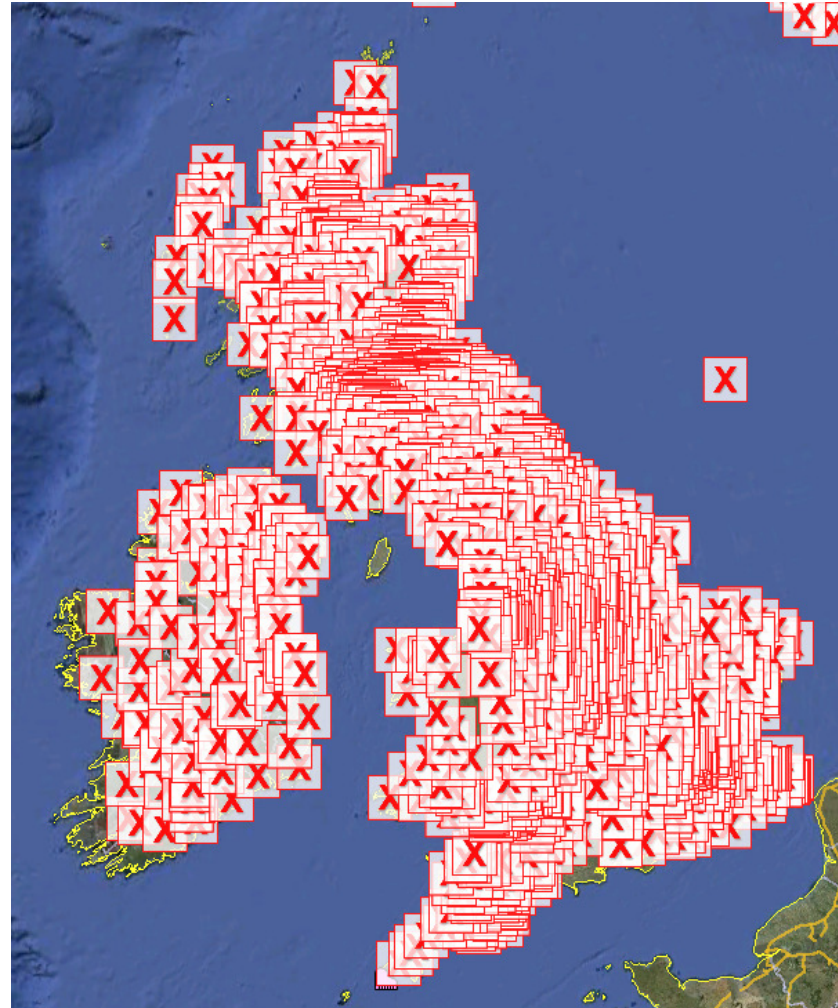
- How much rain needs to fall before you slow down?
- How bad does the visibility need to be before you switch on your fog lamps?
- What level of wind causes traffic to start to wander across lanes, hence causing unexpected braking?
  
- The key is we all react as individuals, it's just we all do it at the same time!
- More research is needed, but need not be expensive
- Road Weather stations are all over the UK

# leverage of existing infrastructure

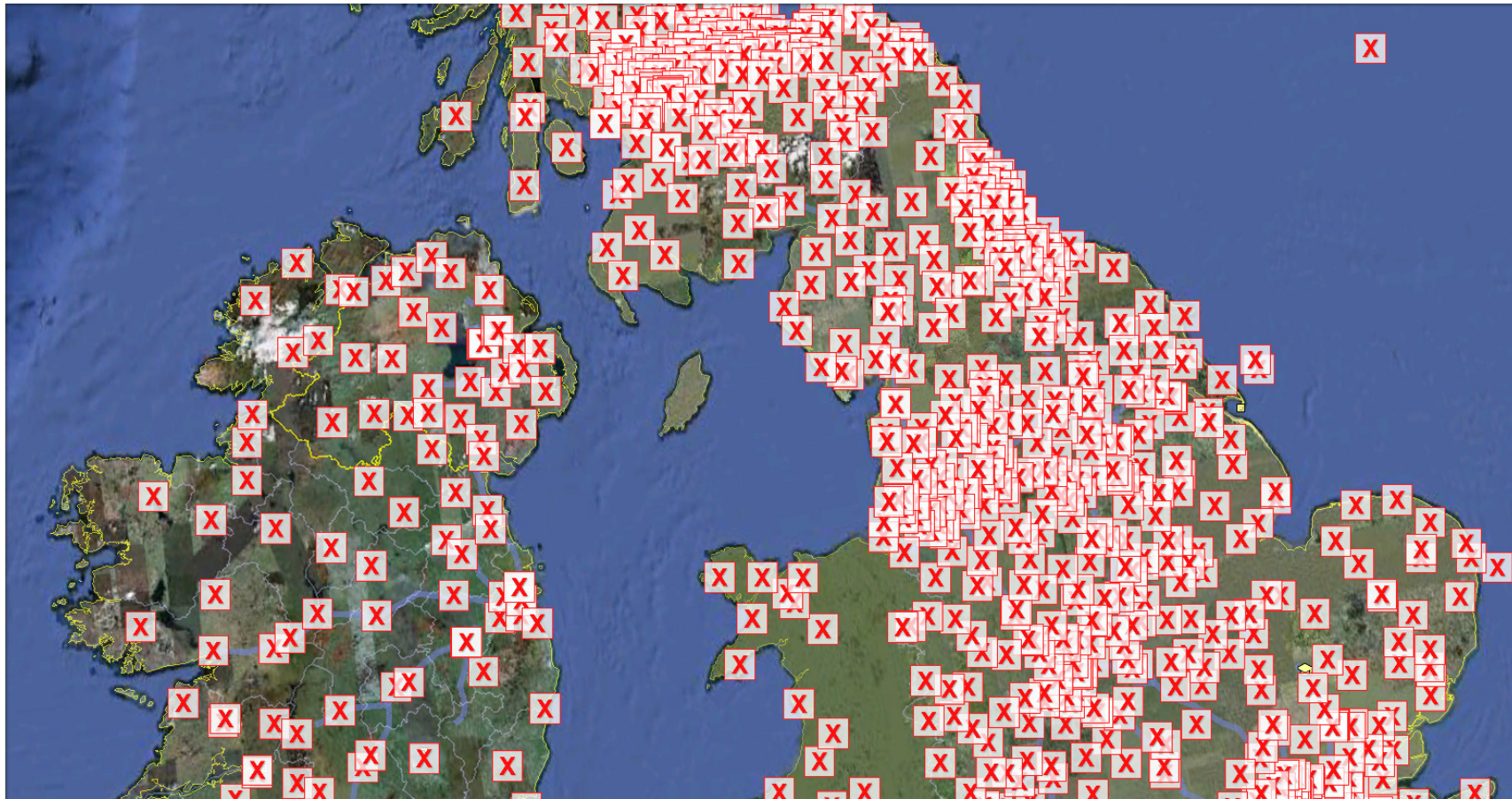
## Weather related driver information

- High wind gusts
  - High sided Vehicles
  - Caravans
- Poor Visibility
  - Slow down all traffic
- Ice forming (poor Grip)
  - Motorbikes beware
  - Emergency Services H&S
- Heavy Snow
  - Avoid travelling
  - EPO rest centre advice
- Heavy rain
  - Slow down all traffic
  - Roads slippery
  - Danger flooding liable

# Existing road weather network



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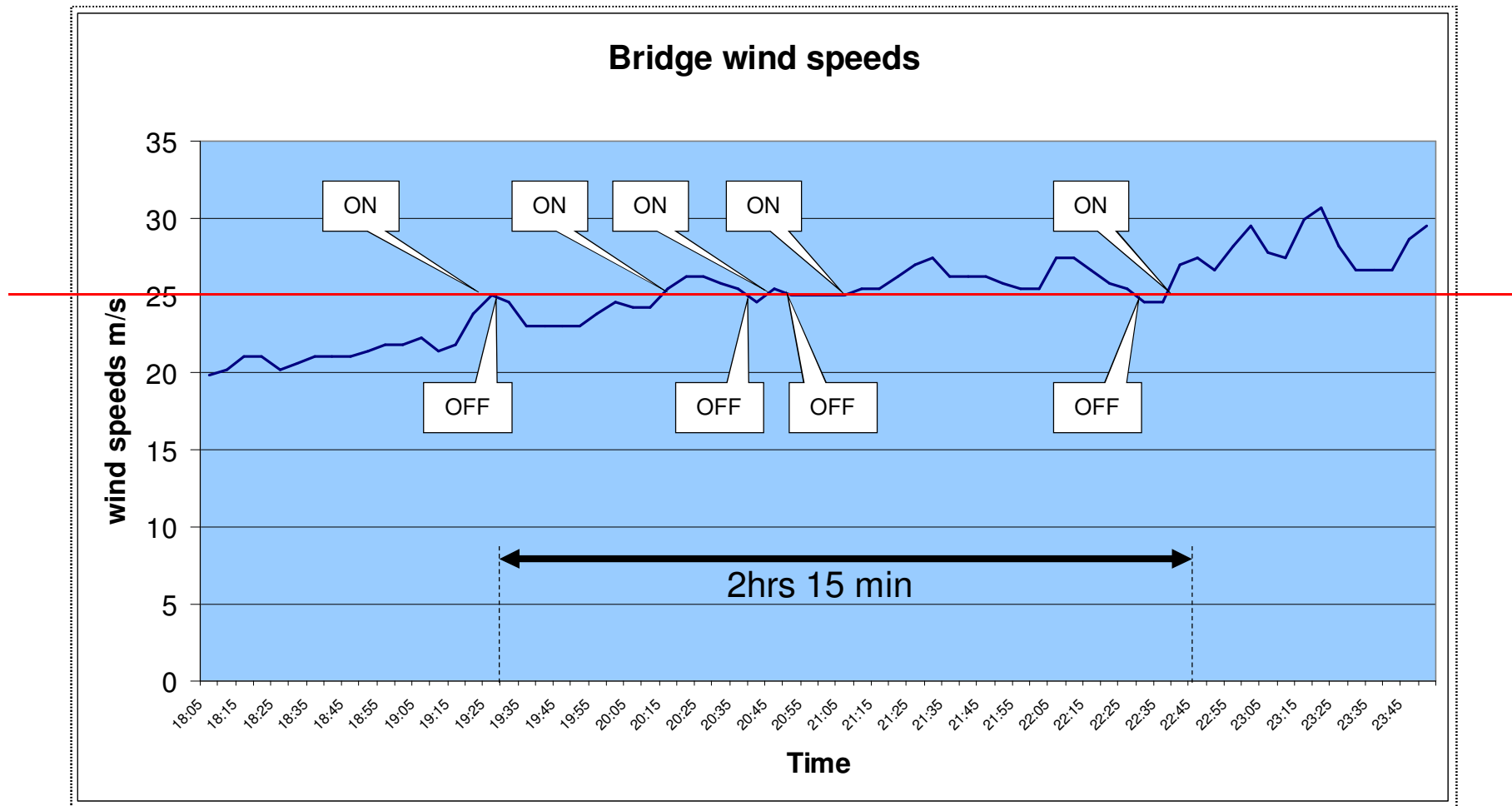
# Vaisala Data Centre

- Collect data on behalf of local Authority winter maintenance teams across the UK
- Also collect data from Private contractors
- Perform full Quality control in real time
- Full archiving facility
- Ready to export data for use in wider Traffic Management

# What does the UTMC community need?

- Vaisala have provided data in a bespoke fashion (e.g. Devon) for inclusion in Traffic Management systems
- However we would like to work with the community to provide standard feeds that can be used by all
- Question: is raw data actually that valuable?
- Should we put our knowledge and expertise and create value added data...
- Intelligent Weather!

# Wind Warning threshold set at 25 m/s



# Summary

- Weather has a vital part to play in managing highways
- Weather has a clear effect on traveller safety
- Ice and Snow well understood
- Rain causes more accidents than any other weather
- Grip is at the heart of the issue
- Reduced grip with unmodified behaviour should be the next focus for highway management in terms of safety
- Sensors now can deliver effective information
- Combine this with growing understanding of thresholds linked to UTMC/VMS could prove to be a major step forward
- Vaisala could provide Intelligent weather
- Benefiting the travelling public by using what's already there!
- More for less!

**Thank you!**