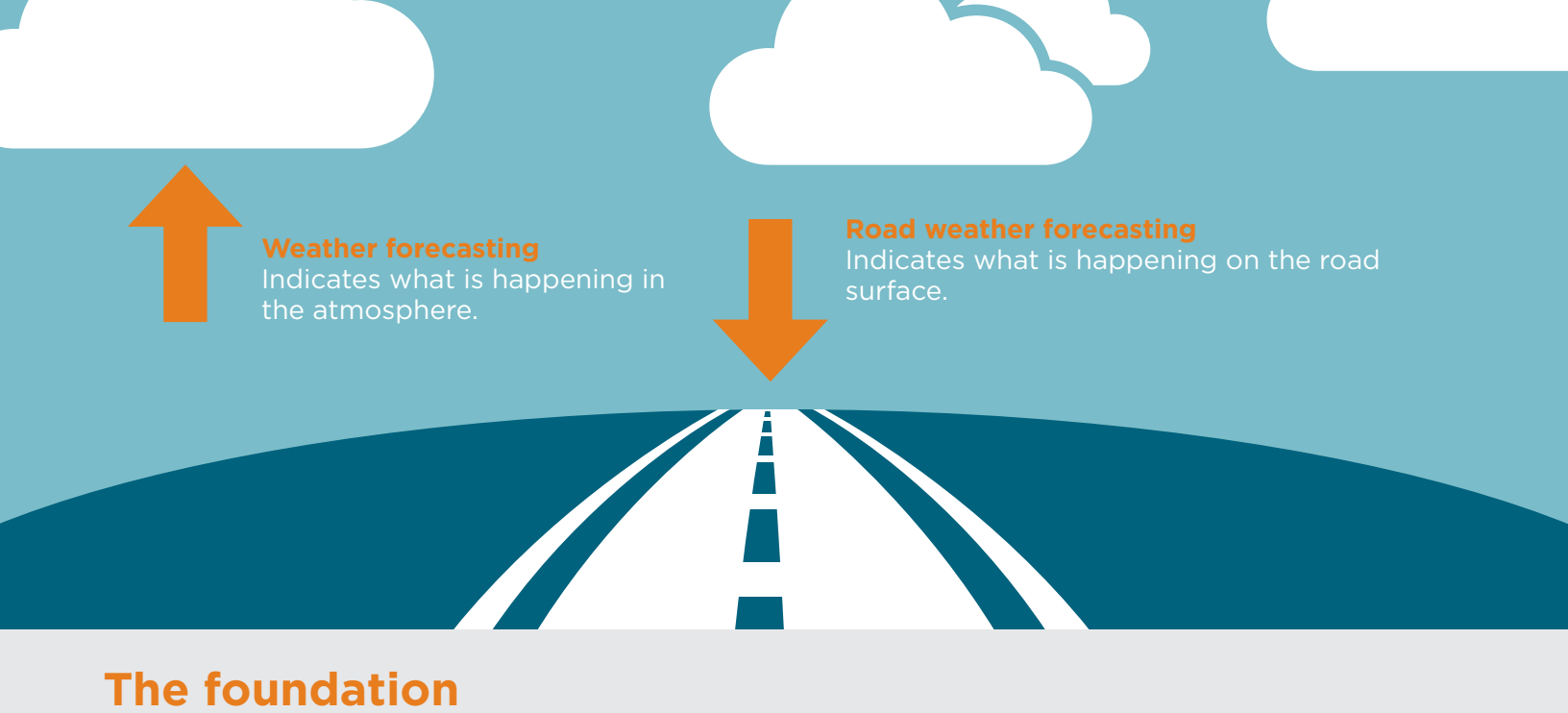


VAISALA WX HORIZON: Anatomy of a road weather forecast

Road maintenance organizations once depended on TV and radio forecasts and responding to government requests to keep the roads safe during a storm. Modern forecasting provides a wealth of data but without road conditions.

Road weather forecasting with Wx Horizon brings it all together: road conditions + weather forecast. Here's how it works.



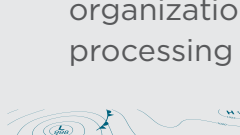
The foundation

The atmospheric weather forecast is the starting point for analyzing and predicting road weather conditions. Before you can make a forecast, you need to know the current global state of the atmosphere. This is accomplished in five steps.

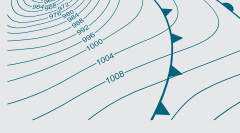
5 steps to build an atmospheric weather forecast



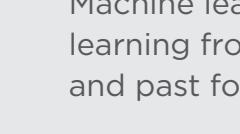
1. **Know the current atmospheric conditions around the world.** Every nation in the world participates in global cooperation for measurements.



2. **Collect measurements into global weather prediction centers.** Global weather models are only computed by a few organizations around the world with exceptional computer processing power.



3. **Use high-resolution models to refine the global weather models.** Most governments run a local model for their own regions. Vaisala also runs local models where more data is needed.



4. **Refine raw data.** Machine learning techniques improve forecasts by learning from past forecast errors, past measurements, and past forecasts.



5. **Run a nowcast model to improve the initial forecast.** Nowcasting models use the latest weather station, radar, and satellite data to improve short-range forecasts.

The modelling

The road weather model is a physical model of the main processes affecting the road surface.

3 parts to the road weather model

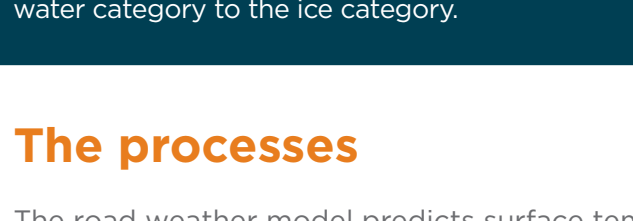
Energy balance model

Predicts the surface temperature. Example: When black asphalt gets warmer under sunlight, the model calculates the rise in temperature.



Material balance model

Tracks and categorizes the amount and state of water and chemicals on the road surface. Example: When the weather forecast says it is raining, the model adds water to the water category. If the surface temperature then drops below freezing, the model moves material from the water category to the ice category.



Forecast site information

Processes environmental site factors. Example: Identifying bridges, capturing traffic profiles, determining the impact of shading on the forecast location.

The processes

The road weather model predicts surface temperature and surface condition by taking multiple factors into account, including the following.

Road surface temperature – Impacted by heating and cooling



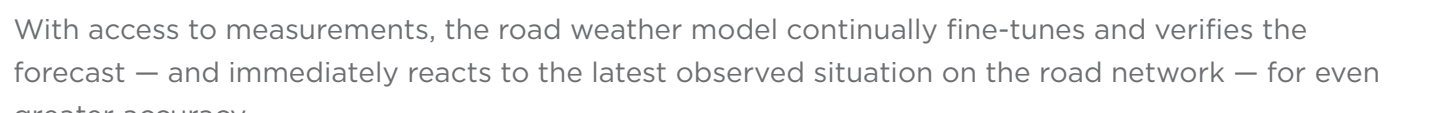
Solar radiation

Traffic heating/turbulence

Radiative cooling

Deicing

Adding and removing material: water, snow, ice, and chemicals



Rain

Snow

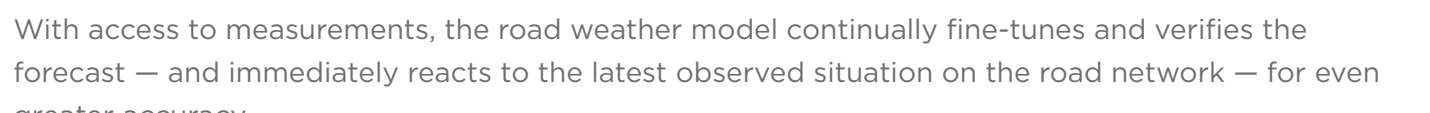
Condensation or frost

Evaporation or sublimation

Treatment and snow removal

Traffic spray

Road weather condition – Interpretation based on road surface temperature + the amount of water, snow, and ice



Dry

Moist

Wet

Slush

Snow

Frost

Ice

Black ice

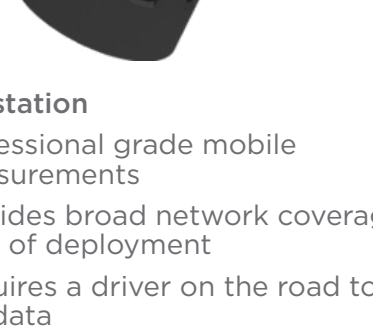
Observations drive forecast improvement

With access to measurements, the road weather model continually fine-tunes and verifies the forecast – and immediately reacts to the latest observed situation on the road network – for even greater accuracy.



Fixed road weather station

- Reference grade, continuous data
- Can be used to calibrate other data sources



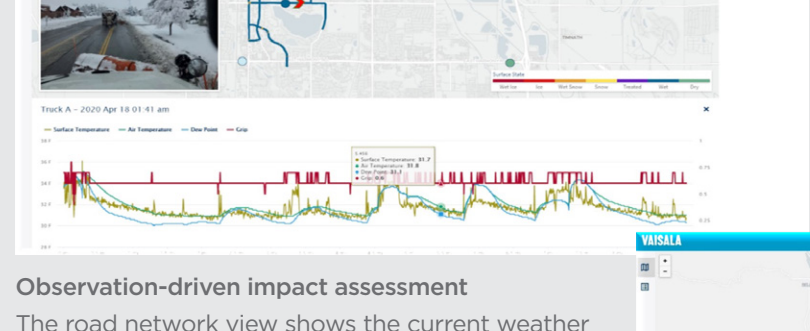
Mobile station

- Professional grade mobile measurements
- Provides broad network coverage and ease of deployment
- Requires a driver on the road to collect the data

The delivery

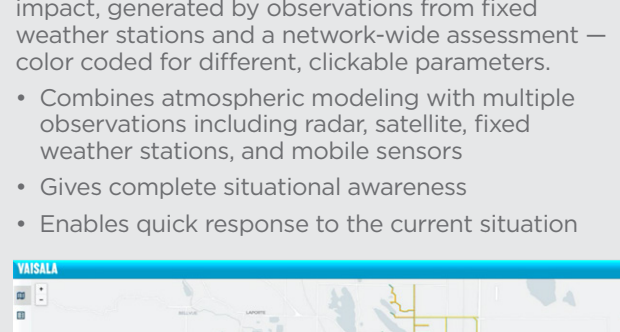
The combination of observations and forecasting gives a clear and accurate view of current and near-future road weather conditions. This insight helps simplify road maintenance decision making for greater speed, accuracy, and proactive maintenance.

3 ways to get the big picture



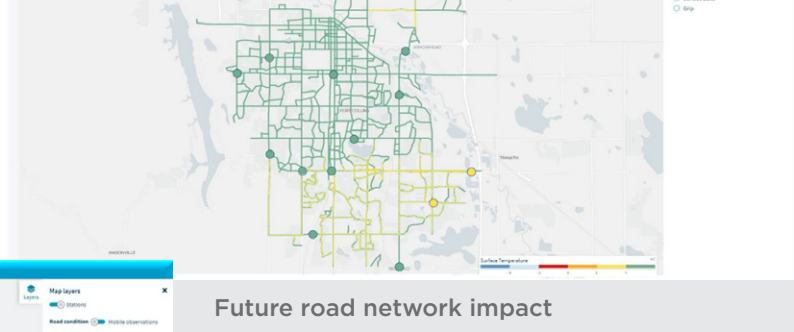
Mobile data visualization
Wx Horizon can incorporate and display data from any mobile device. This view is equipped with a Vaisala MD30 sensor to read multiple parameters.

- The color-coded map shows data from the mobile sensor and fixed weather station
- Road segments are clickable to show an image
- Individual drives or multiple vehicles can be selected



Observation-driven impact assessment
The road network view shows the current weather impact, generated by observations from fixed weather stations and a network-wide assessment – color coded for different, clickable parameters.

- Combines atmospheric modeling with multiple observations including radar, satellite, fixed weather stations, and mobile sensors
- Gives complete situational awareness
- Enables quick response to the current situation



Future road network impact
Real-time data is vital, but to plan for a storm the decision maker needs to be able to see how an event will impact the road network. This example displays current conditions and:

- A time slider to show how, when, and where the weather will impact the network over the next 24 hours
- RWIS stations and data plus the network-wide assessment
- Forecast information on a wide assessment map or radar

The network will change colors based on impact at future time intervals. You can select any area on the network and see on a graph how that part will behave in the future.

Vaisala Wx Horizon



Combines data from fixed and mobile Vaisala sensors and other suppliers

Uses a secure, cloud-hosted environment

Provides road weather condition forecasts using our proprietary road weather model

Leverages Vaisala industry-leading sensors and world-class forecasting capabilities

Benefits

- Maintain safer roads
- Simplify and save time
- Improve sustainable operations
- Drive efficient treatment practices
- Improve your mobile integration
- Provide consistent level of service

Vaisala is here to help

From sensors to systems and digital services, Vaisala gives road stakeholders unrivaled road network visibility and decision support – so everyone can keep moving toward better, more insightful ways of operating. We are recognized experts in transportation, and we continue to channel our curiosity into new ways of making roadways safer and more efficient than ever – as reflected in our guiding principles:



Move ahead



Mobility and beyond



The innovators



See, understand, decide