

Case Study

Arc Infrastructure – Automated Heat Detection Software



Heat Speed Restriction Forecast

Region		Central																							
Forecast Date		2021-03-29																							
Line Number	Heat Speed Sub Segment	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
1	Avon Yard-Southern Cross	22.4	21.9	21.5	21.3	21.4	21.3	21.7	23.4	27.7	31.2	34.1	36.4	38.1	39.2	40.2	40.3	40.0	39.0	35.9	32.1	30.0	28.9	28.0	27.3
4	Toodyay West-Bolgart	18.6	17.6	17.4	17.5	16.7	17.1	17.0	18.5	22.9	27.7	31.6	34.5	37.0	38.9	40.3	39.9	39.2	36.6	33.7	29.3	26.5	24.5	23.1	22.3
	Bolgart-Miling	22.0	21.4	21.2	20.7	20.5	20.2	21.1	25.3	29.8	33.4	35.9	38.0	39.3	40.2	40.2	40.0	39.0	35.6	31.5	28.5	26.6	25.3	24.1	
31	Avon Yard-Beverley	20.1	19.4	18.6	18.2	17.9	18.0	17.8	18.7	22.9	26.8	31.4	34.8	37.1	38.7	40.4	40.3	40.3	39.2	36.2	32.0	29.1	26.9	25.8	24.6
	Beverley-Narrogin	20.1	19.6	18.5	18.0	17.6	17.1	16.7	18.8	23.4	27.4	31.4	34.8	37.1	38.6	40.4	40.3	40.3	39.5	36.3	32.0	29.1	27.1	25.8	25.1
	Narrogin-Wagin	19.1	18.2	17.3	16.7	16.1	15.9	15.6	17.2	21.7	25.8	29.4	32.1	34.4	36.1	37.3	37.9	37.8	37.3	34.5	31.1	29.0	27.4	25.7	24.6
34	Avon Yard-Goomalling	20.7	19.9	19.6	19.1	19.0	19.1	19.2	20.1	23.8	27.7	31.5	34.5	36.6	38.8	39.9	40.3	39.8	38.7	35.5	31.8	29.1	27.2	26.0	25.1
	Goomalling-Wongan Hills	21.2	20.8	20.5	20.9	20.9	21.0	20.3	21.8	25.6	29.6	33.4	36.1	37.7	39.0	40.1	40.4	40.0	39.5	36.0	31.8	29.1	27.2	26.0	25.1
	Wongan Hills-McIver	24.1	23.7	23.4	23.0	22.2	21.7	21.3	22.5	26.9	31.1	34.2	36.8	38.4	39.3	40.1	40.2	39.9	39.0	36.0	31.8	29.5	27.2	26.2	25.0
35	Goomalling-Amery	22.0	21.5	21.5	21.3	20.9	20.8	20.7	21.9	25.5	29.3	32.7	35.4	37.4	38.7	39.6	40.1	39.4	38.7	35.5	31.8	29.1	27.6	26.8	26.0
	Amery-Wyalkatchem	22.4	21.9	21.8	22.3	21.8	21.5	20.8	22.4	26.0	30.3	33.3	35.7	37.5	38.7	39.5	39.6	39.4	38.6	35.2	31.3	28.8	27.9	26.8	26.2
36	Amery-Kalannie	24.4	24.1	24.3	23.8	23.5	23.4	23.1	24.2	27.9	31.7	34.6	36.7	38.2	39.1	39.9	39.8	39.4	38.8	36.3	32.1	29.9	28.9	27.6	26.5
37	Burakin-Beacon	25.4	25.1	25.2	25.2	25.2	25.1	24.9	26.5	29.8	33.1	35.7	37.5	38.7	39.5	40.0	40.0	39.8	39.2	36.7	32.7	30.9	29.5	28.9	27.4
38	Wyalkatchem-Mukinbudin	24.2	23.9	23.8	24.0	23.6	23.5	23.0	24.7	27.9	31.4	34.5	36.6	38.3	39.2	39.8	39.8	39.5	39.2	36.3	32.4	30.9	29.5	28.9	27.3
61	Wagin-Lake Grace	20.0	19.2	17.9	17.4	17.4	16.7	16.7	18.5	22.8	27.2	30.5	33.6	35.7	37.4	38.7	38.8	38.4	37.6	35.0	31.6	29.7	27.9	27.0	26.2
	Lake Grace-Newdegate	19.2	18.3	17.5	16.8	16.4	15.7	15.7	19.1	24.2	28.5	32.3	35.0	36.8	38.2	39.1	39.1	38.7	37.5	34.0	30.6	29.3	27.9	27.0	26.2
	Lake Grace-Karlgarin	21.2	20.3	18.7	18.0	17.5	17.5	17.2	20.2	24.2	28.9	32.7	35.4	37.0	38.3	39.6	39.3	38.7	37.5	34.4	31.4	30.0	28.7	28.0	26.2
62	Karlgarin-Hyden	19.5	18.3	17.9	17.3	17.1	17.0	17.2	20.2	24.2	28.9	32.8	35.6	37.3	38.7	39.7	39.7	39.3	37.9	33.8	30.9	29.5	28.2	27.5	26.0

Note: Information generated based on BoM file from 4:57AM 2021-03-28



Overview

As part of an ongoing program to reduce train derailments to zero, Arc Infrastructure was looking to better understand how predicted and actual temperatures can be translated to heat speed restrictions. Both in terms of severity of the restriction to apply and where to apply to it, and to convert manual imposing of heat speed restrictions to an automated process by tracking weather forecast data and applying or updating restrictions as required.

The goal was to demonstrate if automated information gathered from BoM and DPIRD can improve Heat Speed Restriction (HSR) accuracy, particularly when removing it, and enable more rigorous and uniform process.

Interfuzer were engaged to test this hypothesis through a proof of concept that could go on to form a production ready solution should the theory prove viable.

The Client

Arc Infrastructure manages and operates 5,500 kilometres of rail network across the southern half of Western Australia.

As the only freight rail network in the southern half of Western Australia, our network is vital to providing access to the eastern states of Australia and overseas markets through the region's six government-owned ports.

- Analysis of forecast temperature proved the predictability of HSR successfully
- Realtime processing of actual temperature data alerted the field staff if the track was under or over protected



interfuzer.

The Challenge

The challenge was to understand and identify Weather Station coverage of the rail track based on the longitude and latitude. And then produce an algorithm to predict effective schedules to apply based on the forecast temperature, and to alert field staff based on thresholds for the heat speed segments.

The Approach

The project went through an extensive temperature modelling and relationship mapping exercise to understand the relationships between Weather Stations and Track Segment (also known as Heat Speed Segments).

The team then correlated every weather station with Heat Speed Segments, which enabled the establishment of an algorithm to calculate the forecast temperature for each heat speed segment on the network based on distances from nearby Weather Stations. Also, the team established the alerting mechanism based on the variance of actual temperature on the day within a threshold.

Once this was established the project team were able to build a Heat Speed restriction prediction engine that could suggest heat speed restrictions to be applied, monitor actual temperature, predict at-risk heat speed segments and generate alarms for over or under protection of segments.

The Results

For field staff the manual work of checking rail temperatures has been replaced with an automated solution which continually:

- Monitors incoming forecast temperatures and suggests heat speed restrictions which field staff can then accept and apply or cancel.
- Monitors the actual temperatures and can generate quarterly heat speed segment alerts based on the threshold logic for the track sections that are at risk of derailment due to overheating.

Improving the safety of trains on the Arc Infrastructure network.

The Solution

- Custom developed software solution using the Microsoft stack that integrates to publically available weather forecasts and actuals to continually receive temperatures information across the Arc Infrastructure Network
- Prediction engine to convert raw weather information into likely heat events across the Arc Rail Network
- Integration to the existing Heat Speed Restriction Application to trigger creation, or lifting, of heat speed restrictions.

"Interfuze provided the solutions for this essential tool to ensure the Regions are fully covered through every aspect of Heat Speed Restrictions. They were able to take on board and listen to the regional requirements and provide real time results. This new concept marks a new and improved delivery of Network Heat Speed Restrictions."

Lee Ilic

It has been a pleasure working with Interfuze."

Contract Specialist
Works Delivery
Arc Infrastructure

interfuze.

interfuze.

Think we can help solve your problem?

Reach out to Interfuze on

08 6270 2488 or hello@interfuze.com.au

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