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UTILISING BAROMETRIC PRESSURE DIFFERENCES TO OPTIMISE TUNNEL VENTILATION SYSTEM DESIGN

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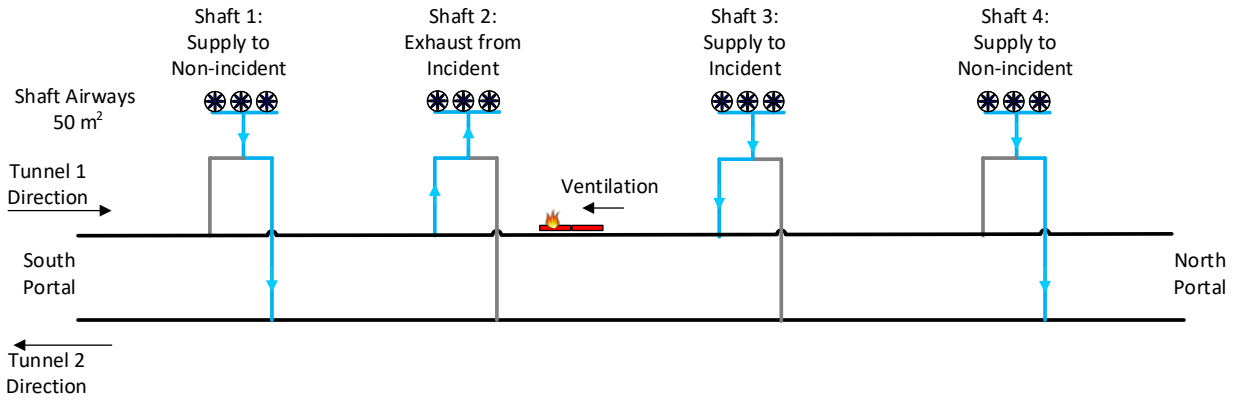
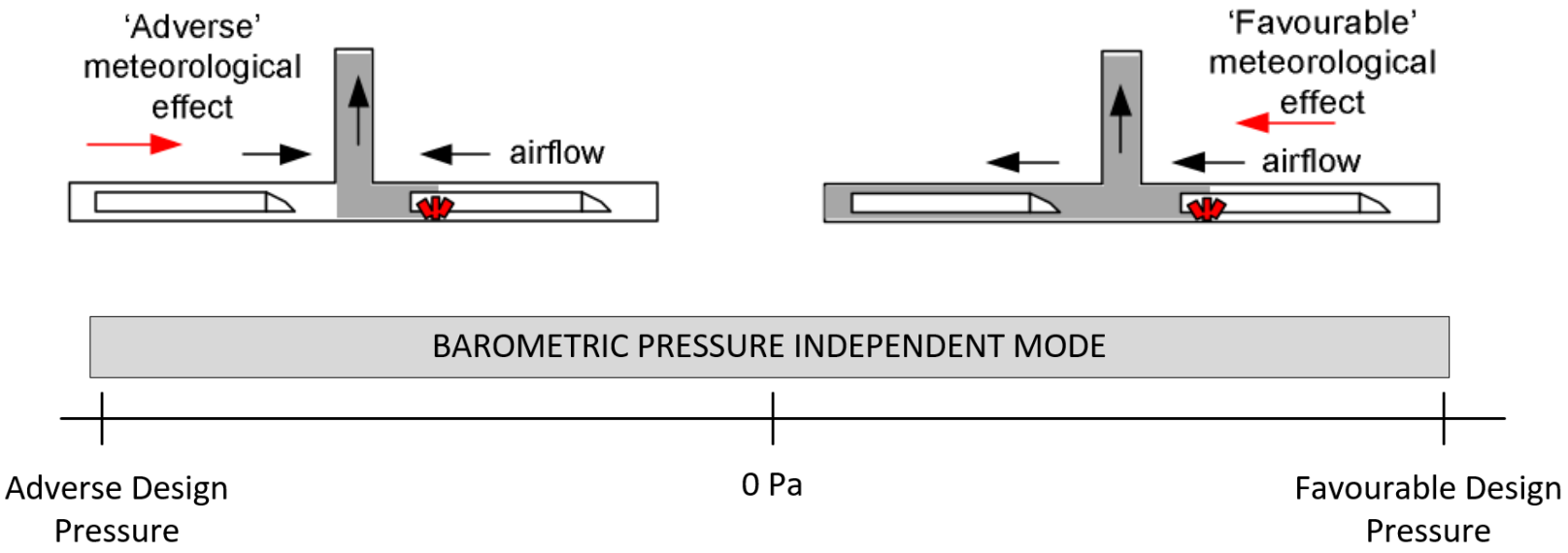
Background

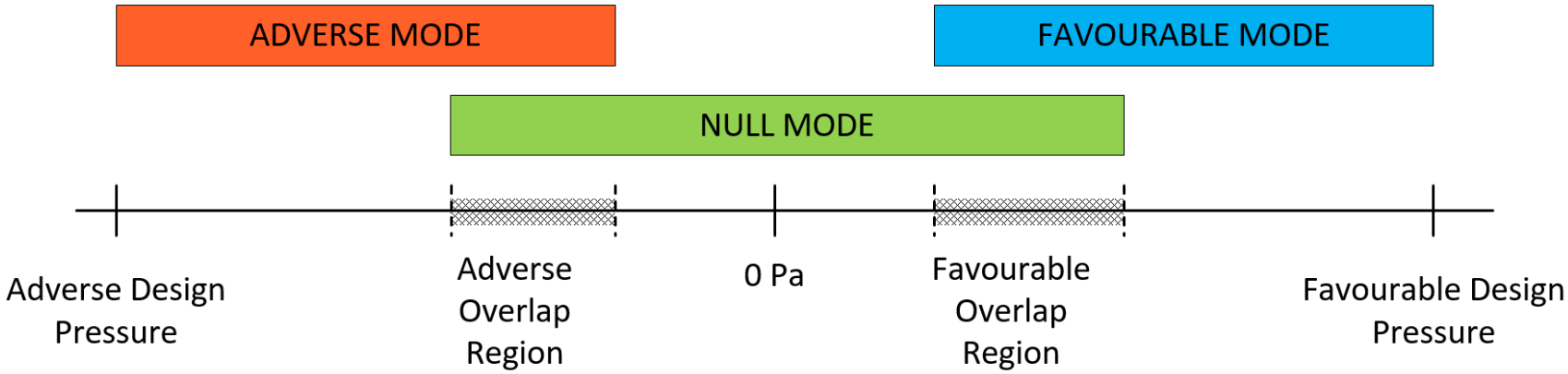


- Tunnel ventilation systems tend to try and create enough flow to push smoke one way to allow people to evacuate the other way. Pressure differences across the tunnel portals affect the system.
- Short Tunnels: 20 to 30 Pa Pressure
- Long Tunnels: Over 100 Pa Pressure

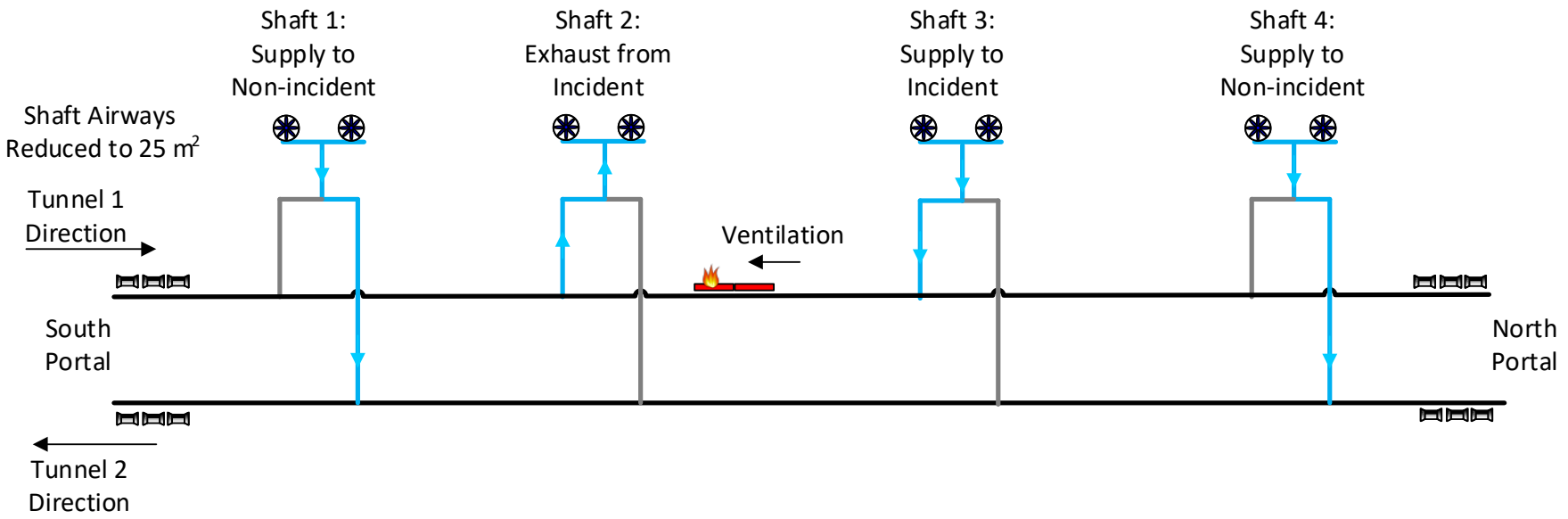
Standard Approach to Barometric Pressure



Modified Approach to Barometric Pressure



Emergency Ventilation Strategy – Modified Approach

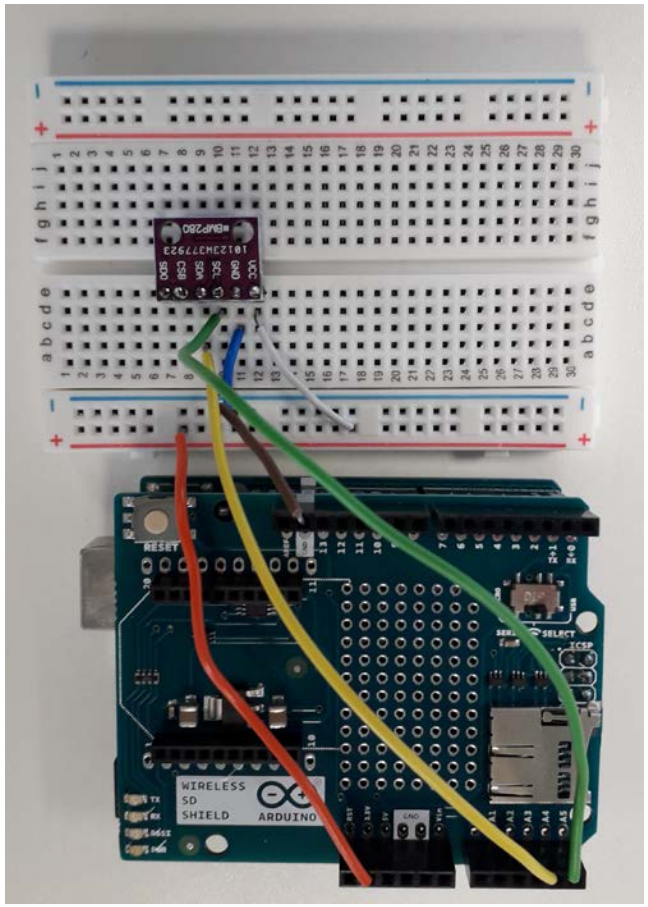


Stability of Barometric Pressure Reading

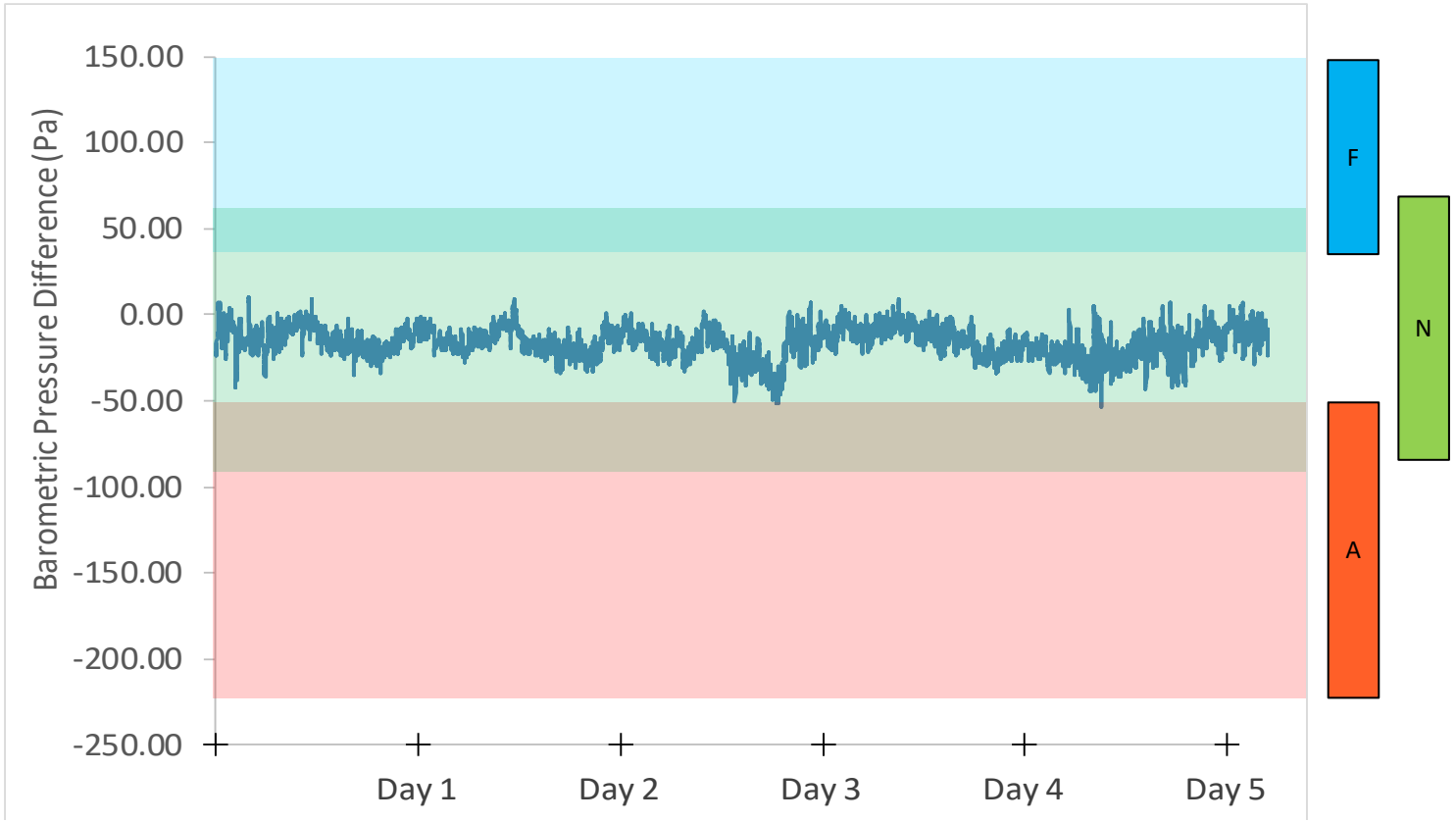
- Challenge:
  - Designing a stable and reliable ventilation system
- Key Questions:
  - How often does the pressure change outside?
  - How often should we react to the changes in outside pressure?
- Experiment:
  - Use pressure sensors to record barometric data to simulate actual tunnel emergency ventilation system

Experimental Setup

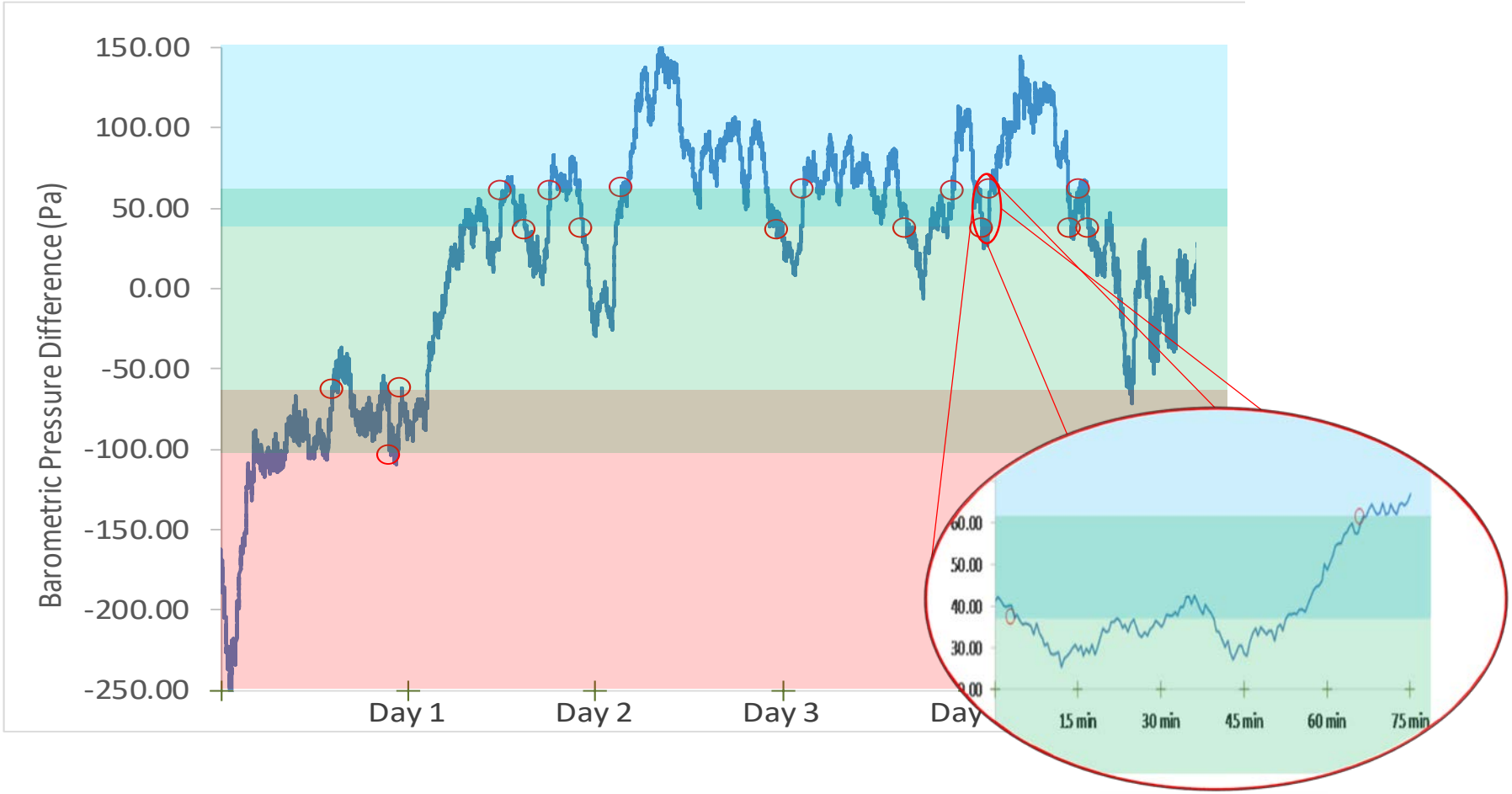
- Two Sets of Data
  - Data Set 1: 8.5 km
  - Data Set 2: 55 km
- Pressure recorded over 5 days
- Data used to simulate ventilation system



8.5 km Results



55 km Results



Experiment Conclusion

- Mode change dependent upon:
  - Initial operating point
  - Change of pressure with time
- Potential for 1 mode change however two changes during emergency very unlikely
- 15 minute sampling frequency is reasonable

Conclusion

- Presented new approach to designing barometric pressure dependent emergency ventilation modes.
- Demonstrated the stability of the barometric pressure difference across the tunnel. Indicating that the modified approach is feasible.

Thank you