AHB Desktop Risk Assessment of Wind Related Vehicle Incidents

For **NZ Transport Conference 2024**

Prepared by Blair Monk

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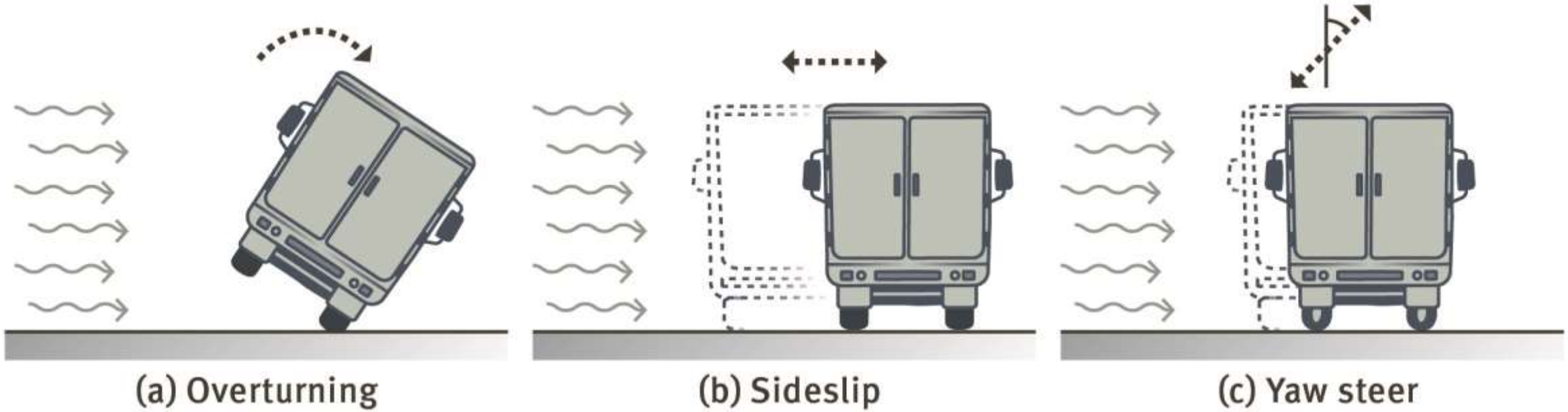
Three Failure Mechanisms



Wind comes from Perpendicular or Oblique Angles

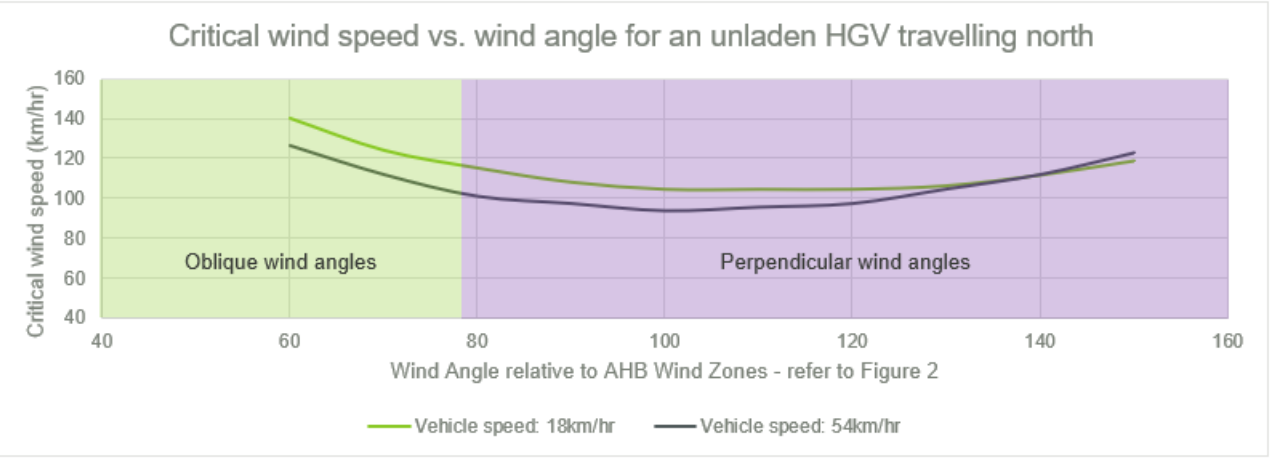


Figure 6 - Theoretical effect of wind angles on critical wind speeds for an unladen heavy goods vehicle (Hemingway & Robbins, 2019)

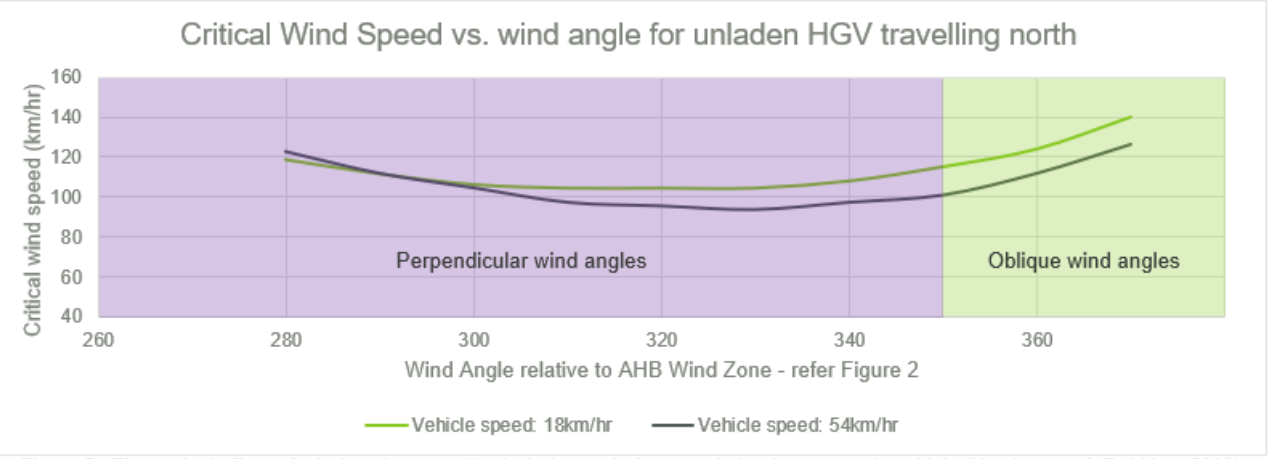
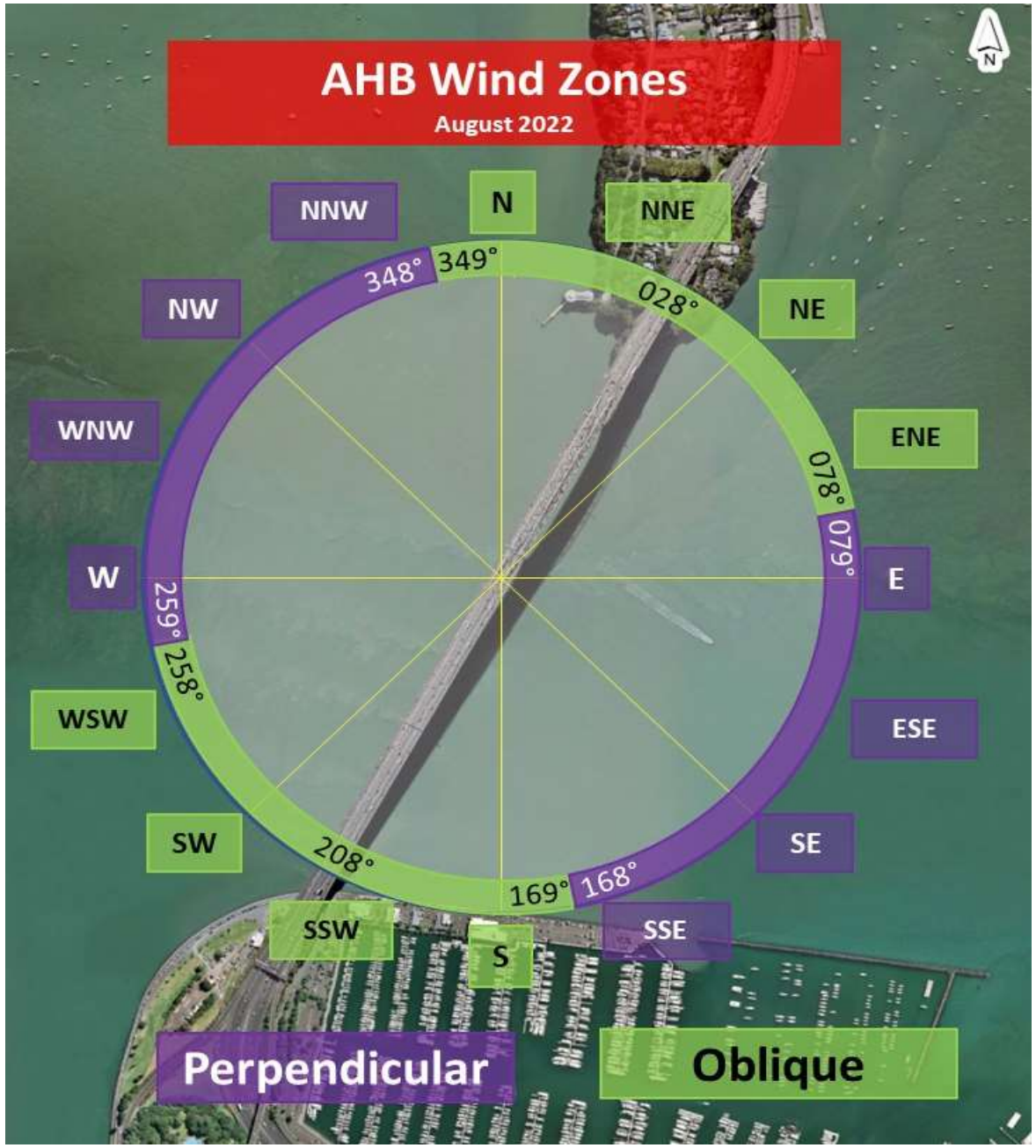


Figure 7 - Theoretical effect of wind angles on critical wind speeds for an unladen heavy goods vehicle (Hemingway & Robbins, 2019)



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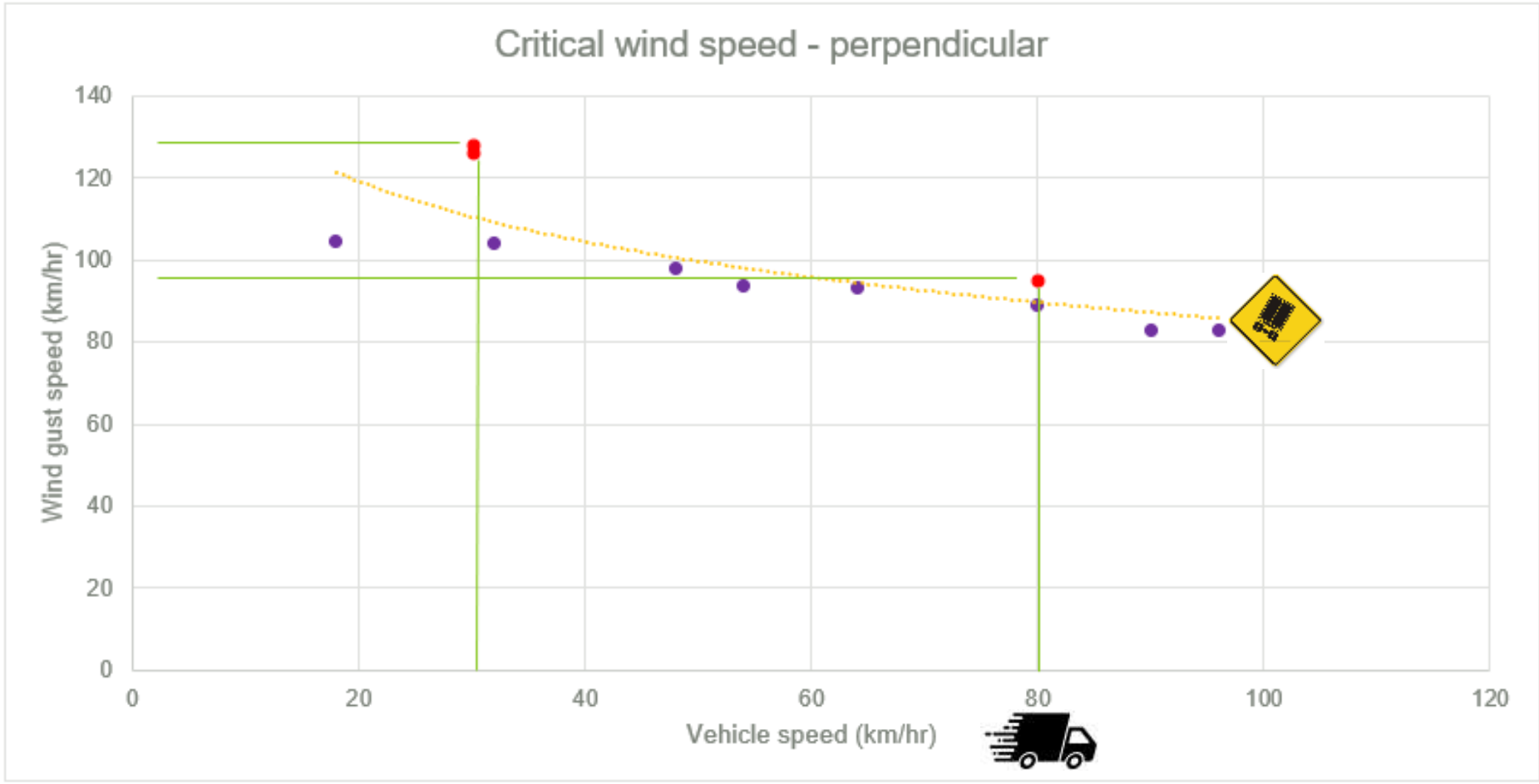
The Critical Wind Speed is when the Risk of a wind related incident may occur, it is related to the speed of the wind vs the speed of the vulnerable high sided vehicle.



Critical perpendicular wind speeds of high-sided vehicles from literature (● purple dots) (Baker & Soper, 2018) (Hemingway & Robbins, 2019) and from previous incidents on the AHB and Manukau Harbour Crossing (● red dots). Line of best fit = derived perpendicular critical wind speeds used for this assessment (..... yellow line).

The number of high sided vehicles on the AHB is not related to the weather

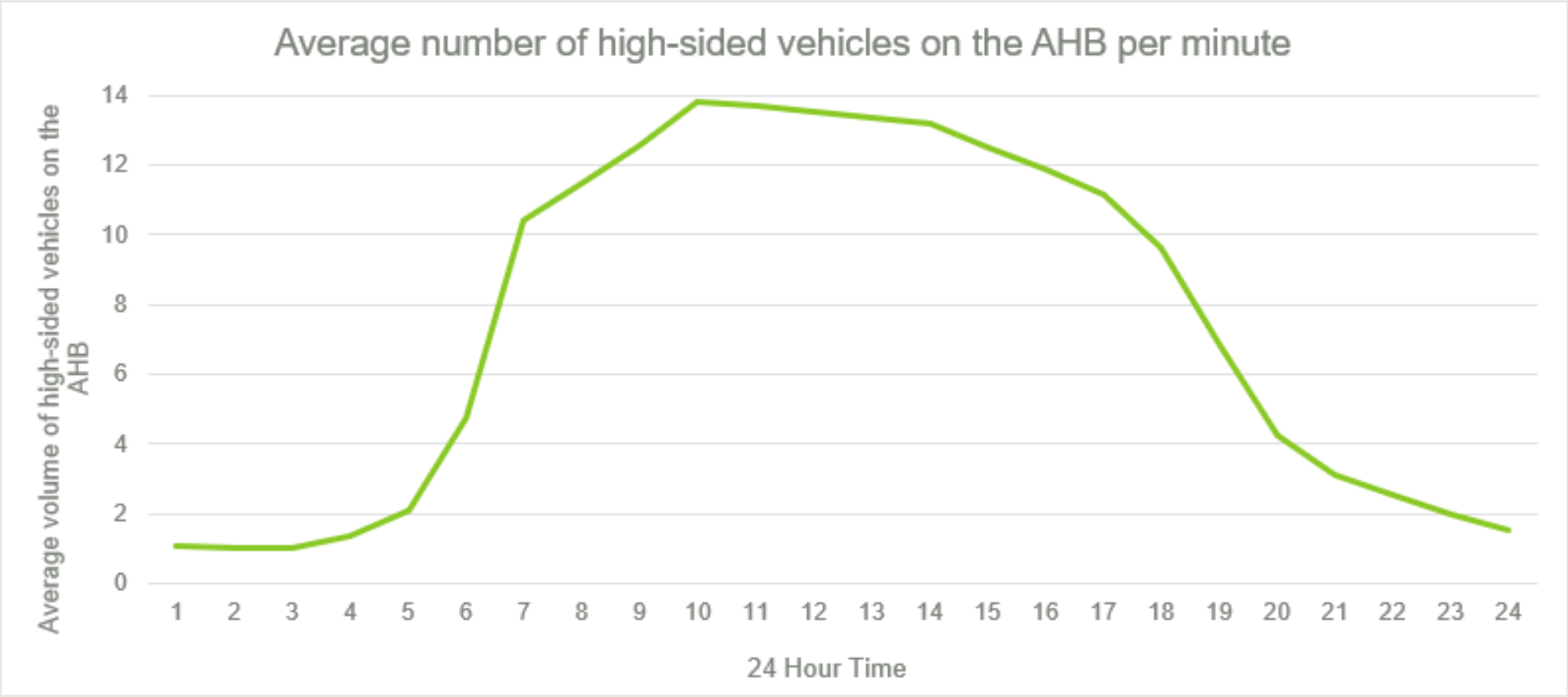


Figure 14 - Average number of high-sided vehicles on the AHB in any given minute across a 24-hour period

Hypothetical Scenarios Considered:

Scenario A: No restrictions to vehicles travelling over the AHB during a Wind Event

Scenario B: Lane restrictions as per Waka Kotahi AHB High Winds Operations Manual

Scenario C: Lane restrictions in AHB High Winds Operations Manual + Enforced speed limits

Scenario D: Lane restrictions in AHB High Winds Operations Manual + Enforced speed limits + Enforced detours

Table 2 - AHB High Winds Operations Manual – Copy of Restrictions Summary

Restriction Stage	MetService Alert	Wind Gust (perpendicular)	Wind Gust (oblique)	Action (on forecast)	Action (on observation)
1 Reduce Speed	No Specific Alert Required	55+ km/h	70+ km/h	▪ Swap to storm flags (regardless of direction)	▪ 70 km/h advisory speed ▪ Messaging: – Wind Gusts – High Sided Vehicles | Motorcyclists Take Extra Care
2 Detour Vulnerable	No Specific Alert Required	65+ km/h	80+ km/h	▪ Remove all flags (regardless of direction)	▪ 50 km/h advisory speed ▪ Messaging: – Strong Wind Gusts – High Sided Vehicles | Motorcycles Detour via SH16/18
3 Close Lanes	AMBER	75+ km/h	90+ km/h	▪ DE assess intel and circulate op briefing ▪ Lane closure resources standby ▪ Shift MLB into 4/4 ▪ Media release if high confidence of network impact ▪ Remove all personnel from structure	▪ 30 km/h advisory speed ▪ Alternating leeward lanes closed ▪ Messaging: – Severe Wind Gusts – Obey Speed Signs – High Sided Vehicles | Motorcyclists Detour via SH16/18
4 Full Closure	RED	90+ km/h	105+ km/h	▪ MetService Briefing ▪ DE assess intel and circulate op briefing ▪ Full resources standby if long duration expected ▪ Media release & customer preconditioning	▪ AHB Fully Closed (either at inner or outer cordons based on event type & MetService advice - at discretion of DE) ▪ Messaging: – Harbour Bridge Closed – Remain In Vehicle OR Detour via SH16/18 (depending on closure type)

Summary of Risk Profile for each Scenario

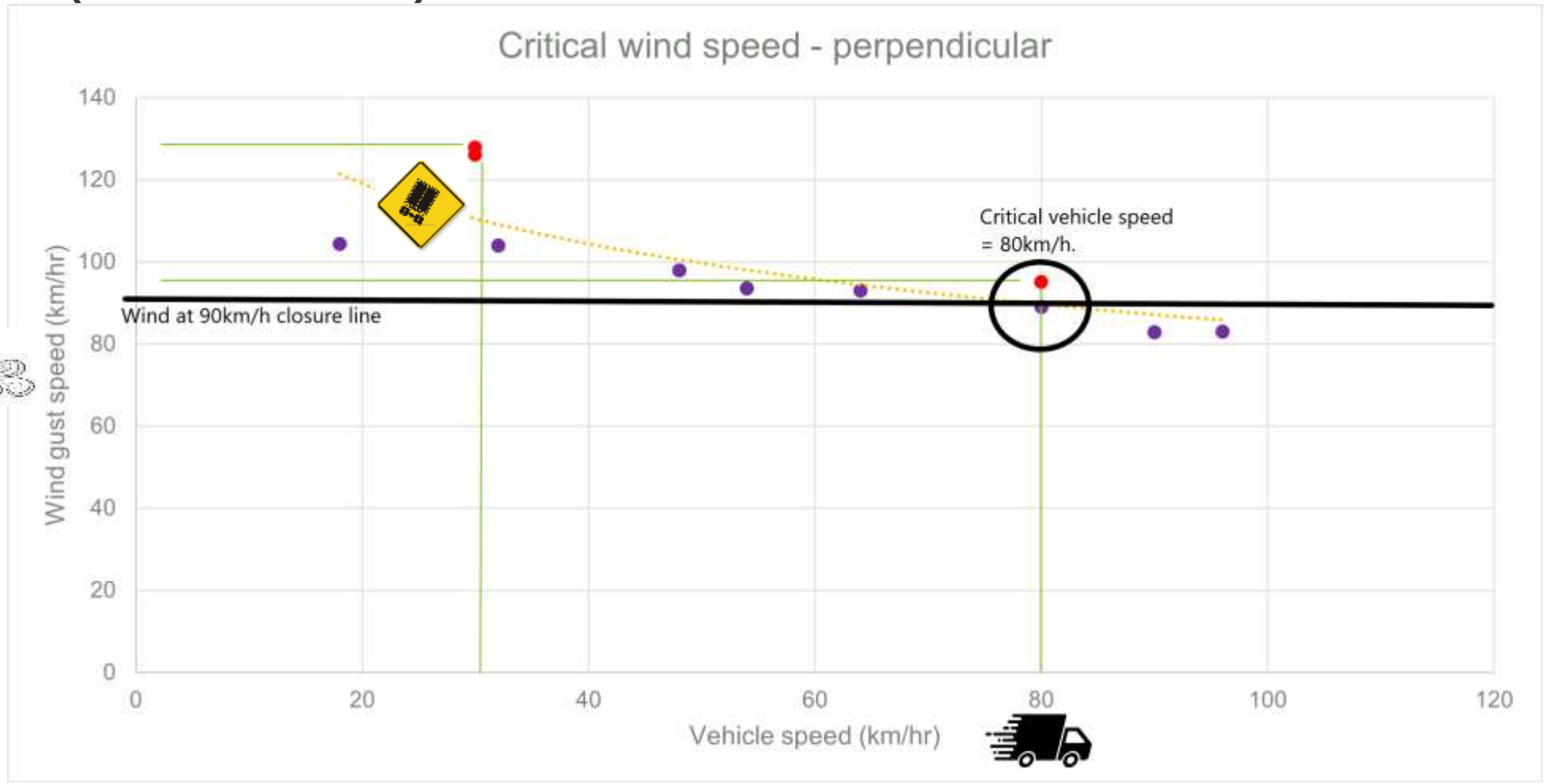
Table 10 - High-level risk profile of wind related vehicle incidents on AHB under the four hypothetical scenarios

	Scenario A	Scenario B	Scenario C	Scenario D
Potential wind related vehicle incident return period	Approximately 20 times in 1 year	Approximately 1 in 1 year	Approximately 1 in 10 years	Approximately 1 in 50 years
Consequence of an incident	- Medium to long duration high congestion and travel time costs. - Potential bridge damage. - Potential deaths and/or serious injuries.	- Medium to long duration high congestion and travel time costs. - Potential bridge damage. - Potential deaths and/or serious injuries.	- Medium to long duration high congestion and travel time costs. - Potential bridge damage. - Potential deaths and/or serious injuries.	- Medium to long duration high congestion and travel time costs. - Potential bridge damage. - Potential deaths and/or serious injuries.
Consequence of bridge closures	NA	- Short duration high congestion and travel time costs - Avoided trips.	- Short duration high congestion and travel time costs - Avoided trips.	- Short duration high congestion and travel time costs - Avoided trips.
Consequence of reduced speeds	NA	NA	- Short duration minor travel time costs.	- Short duration minor travel time costs.
Consequence of high-sided vehicle detours	NA	NA	NA	- Short duration medium travel time costs for commercial vehicles and buses.

* Scenarios A & B assume drivers continue at 80km/h

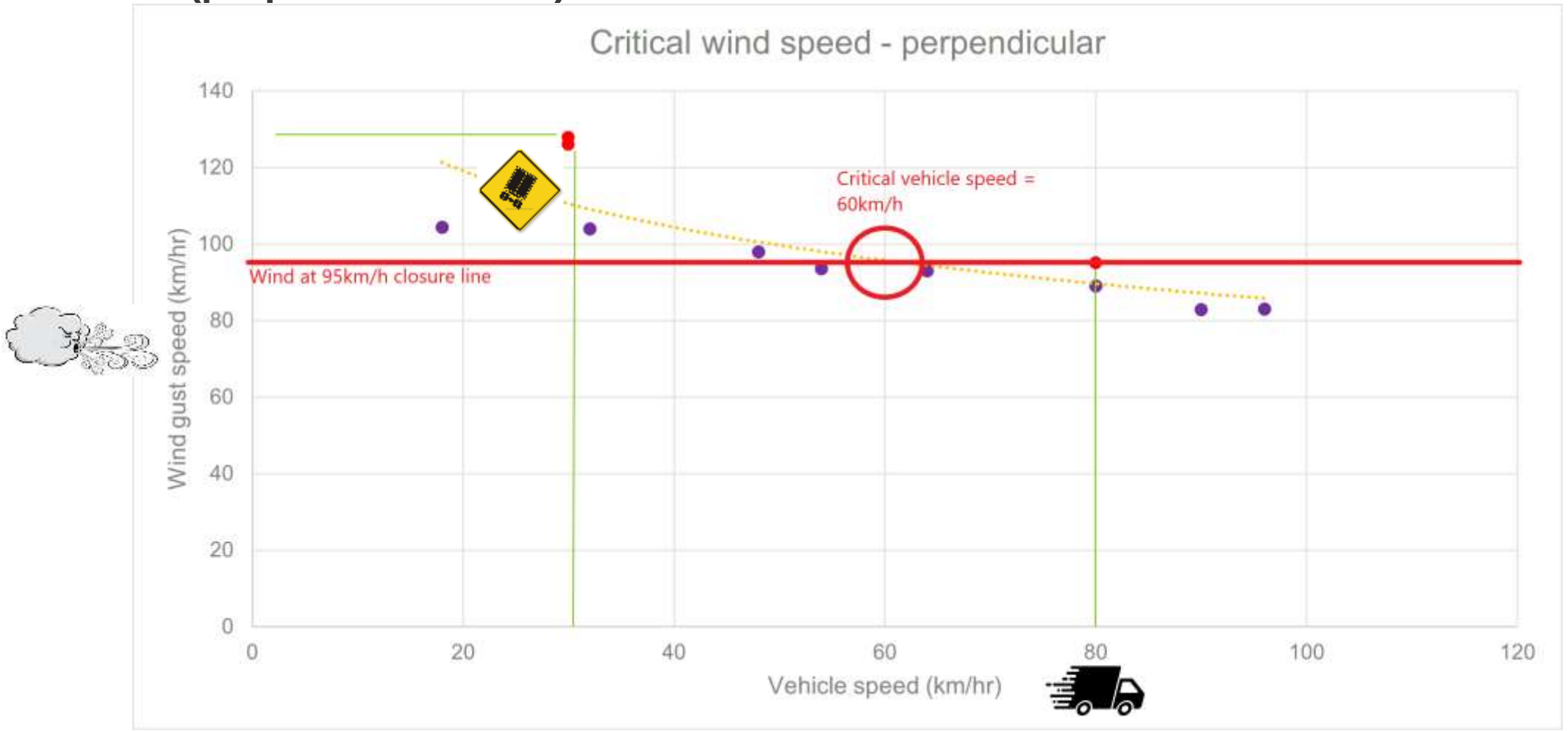
Risk of changing the closure speed from 90km/h (current situation)

Harbour bridge **closed** at critical wind speed for vehicle doing legal speed limit (80km/h)

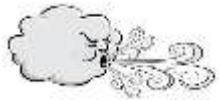


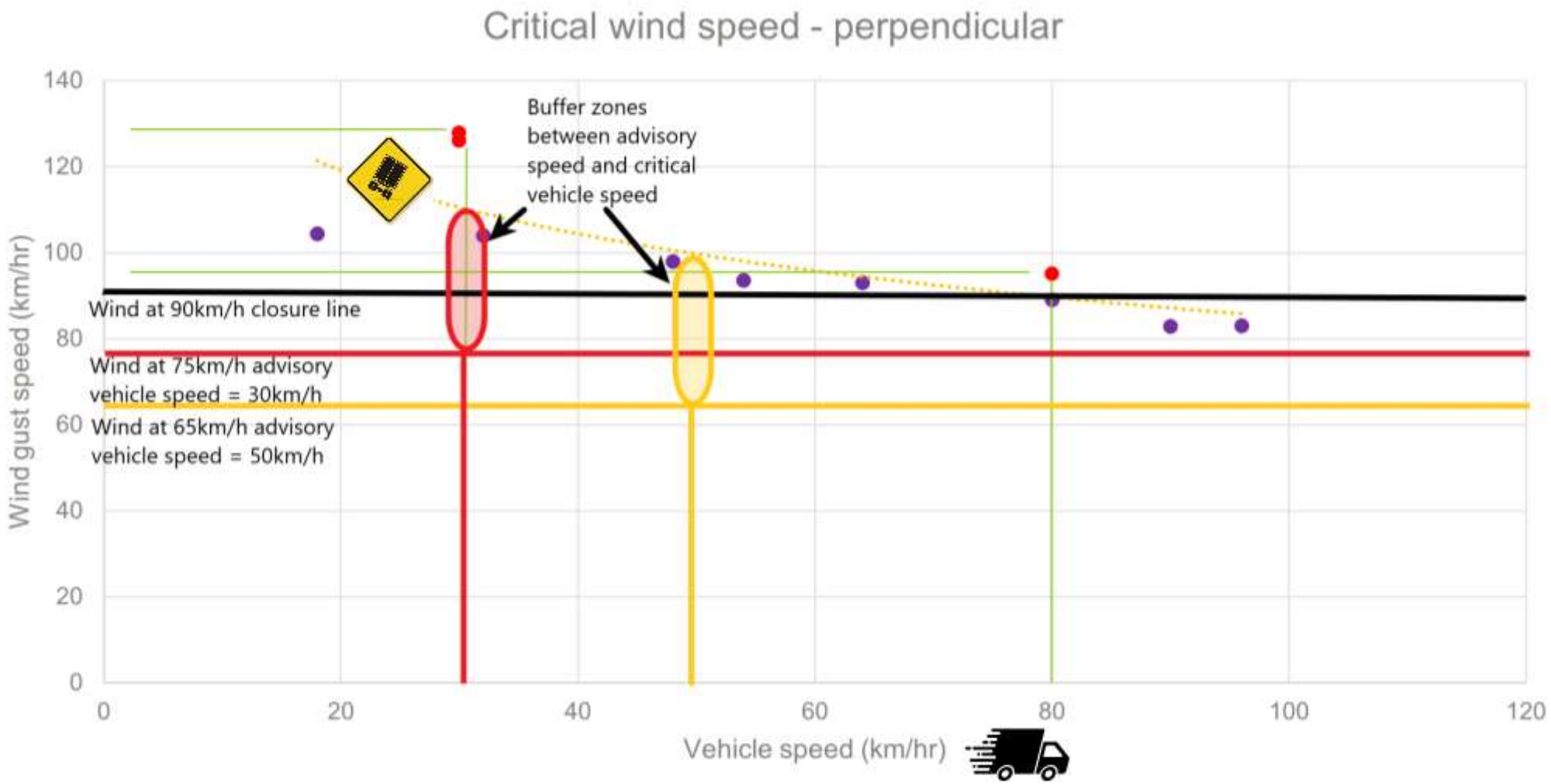
Risk of changing the closure speed to 95km/h (proposed situation)

Harbour bridge **open** at critical wind speed for vehicle doing 60km/h when legal speed limit is 80km/h!



We have a safety buffer zone with the current recommended speeds





Conclusions

Closing the AHB at wind speeds of 90km/h is adequate.

There is an opportunity to improve safety on the AHB by making the advisory speeds regulatory. This would lock in the current advisory safety buffers.

Questions or Comments?

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