



Vehicle
Certification
Agency

ACPE test procedure

Initial results of UK investigations

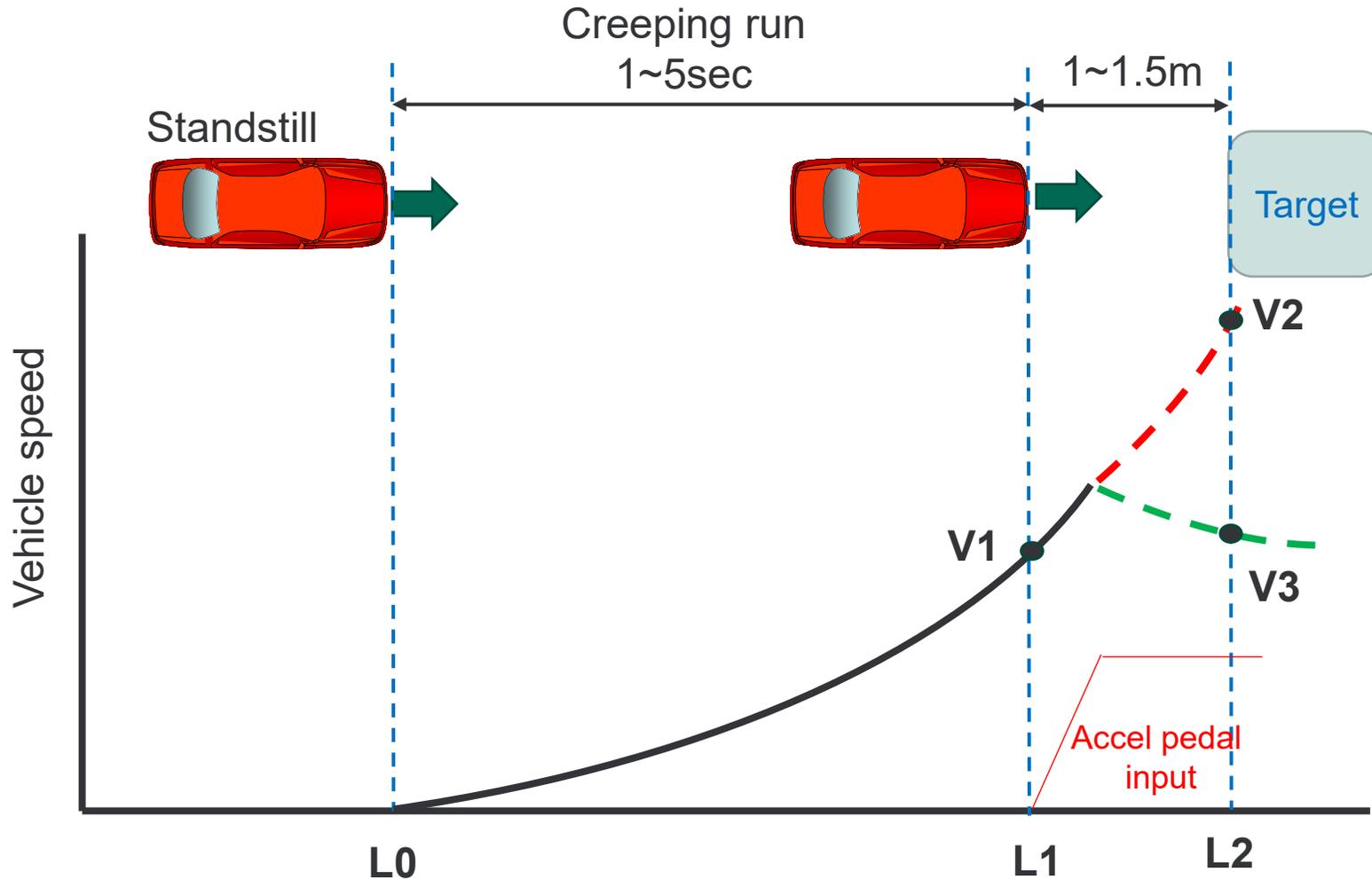


Background

- ▶ ACPE should work effectively for vehicle designs which ‘creep’ when releasing the brake pedal, as well as those which remain stationary.
- ▶ At the 4th meeting of the ACPE Task Force, a test procedure was suggested by the UK, intended to be more representative of a real-world scenario in comparison with the procedure outlined in the earlier drafts.
- ▶ The proposed procedure introduces a short delay between releasing the brake pedal and applying the accelerator pedal, to represent the ‘moving off’ condition (allowing ‘creeping’ vehicles to begin motion).
- ▶ The delay suggested by the UK was between 1 and 5 seconds, although these values are not fixed.



Recap - UK suggestion for test procedure



- L0 : Brake release
- V1 : Speed just before pedal input
- V2 : Speed without ACPE control at L2 distance
- V3 : Speed with ACPE control at L2 distance

Evaluation Criteria based on difference between V1 and V3



Potential issues raised

- ▶ ACPE should stay outside of AEBS operation regime (above 10 km/h), therefore accelerator control application should happen well under 10 km/h
- ▶ The distance the vehicle travels while creeping will vary, so the exact required time between brake release and accelerator application is unknown (in order to apply the accelerator at the required distance from the target)
 - ▶ A human driver (or robot) might not be able to reliably apply the accelerator at the required position
- ▶ There may be a delay between accelerator application and vehicle speed increase (e.g. due to transmission slip or gear change). Therefore, the vehicle may collide with the target without any speed increase, even in the absence of ACPE
 - ▶ This could appear to pass the test without any intervention of ACPE

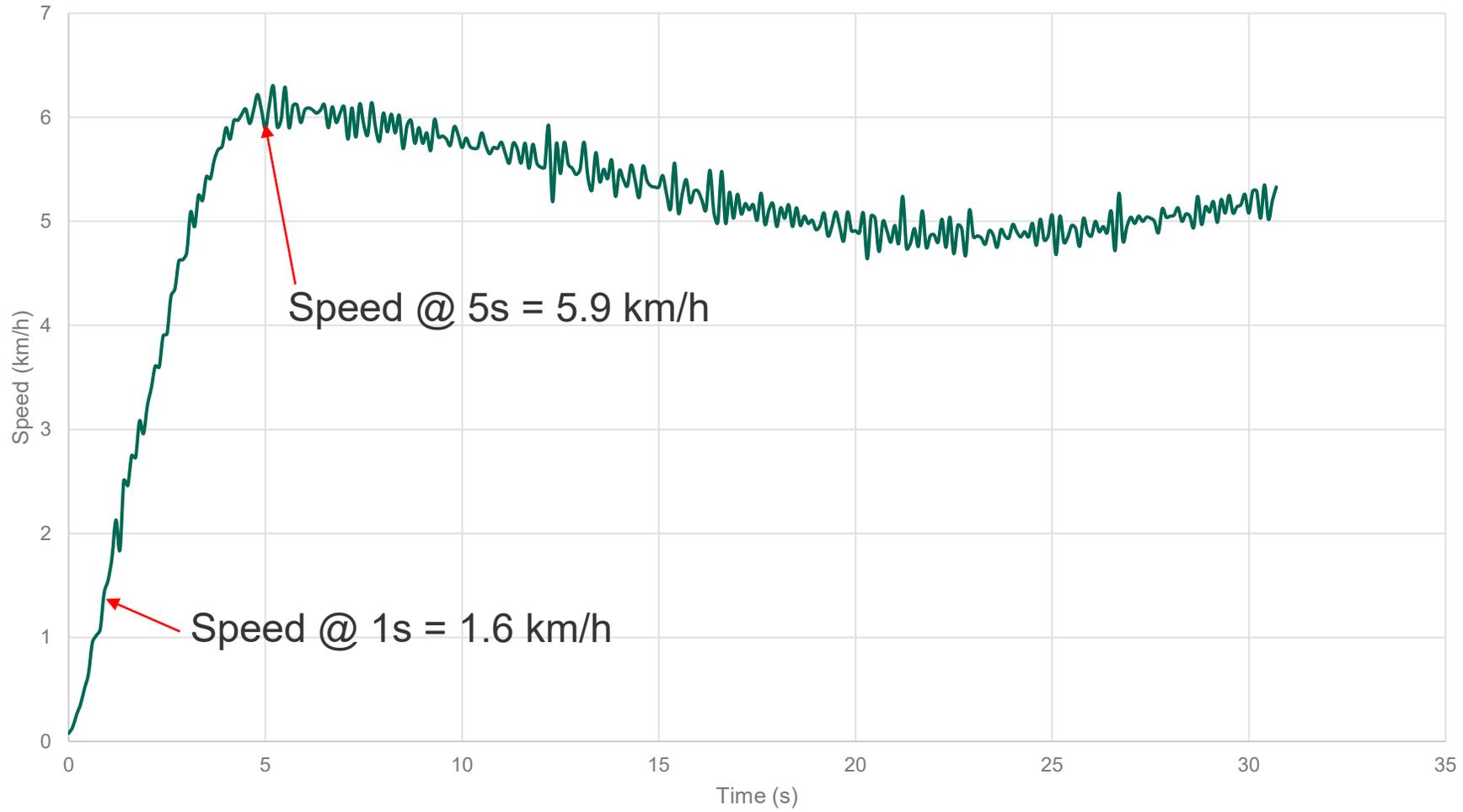


Research testing

- ▶ On behalf of the UK, VCA have performed trials to provide information to the ACPE IWG to help answer the following questions:
 - ▶ What is a typical acceleration profile (speed against time) of a creeping vehicle when the brake pedal is released?
 - ▶ What is a typical acceleration profile (speed against time) when the accelerator is rapidly applied to 'wide open throttle' (WOT)?
 - ▶ What does test data from the proposed procedure look like?
 - ▶ How reliably can a driver apply the accelerator within the suggested 1-1.5m tolerance?
- ▶ The tests of creep acceleration profile have been performed with two vehicles:
 - ▶ Battery Electric Vehicle (BEV)
 - ▶ Diesel ICE vehicle with automatic transmission
- ▶ The tests of WOT acceleration profile and application point accuracy have currently been performed only with the BEV.

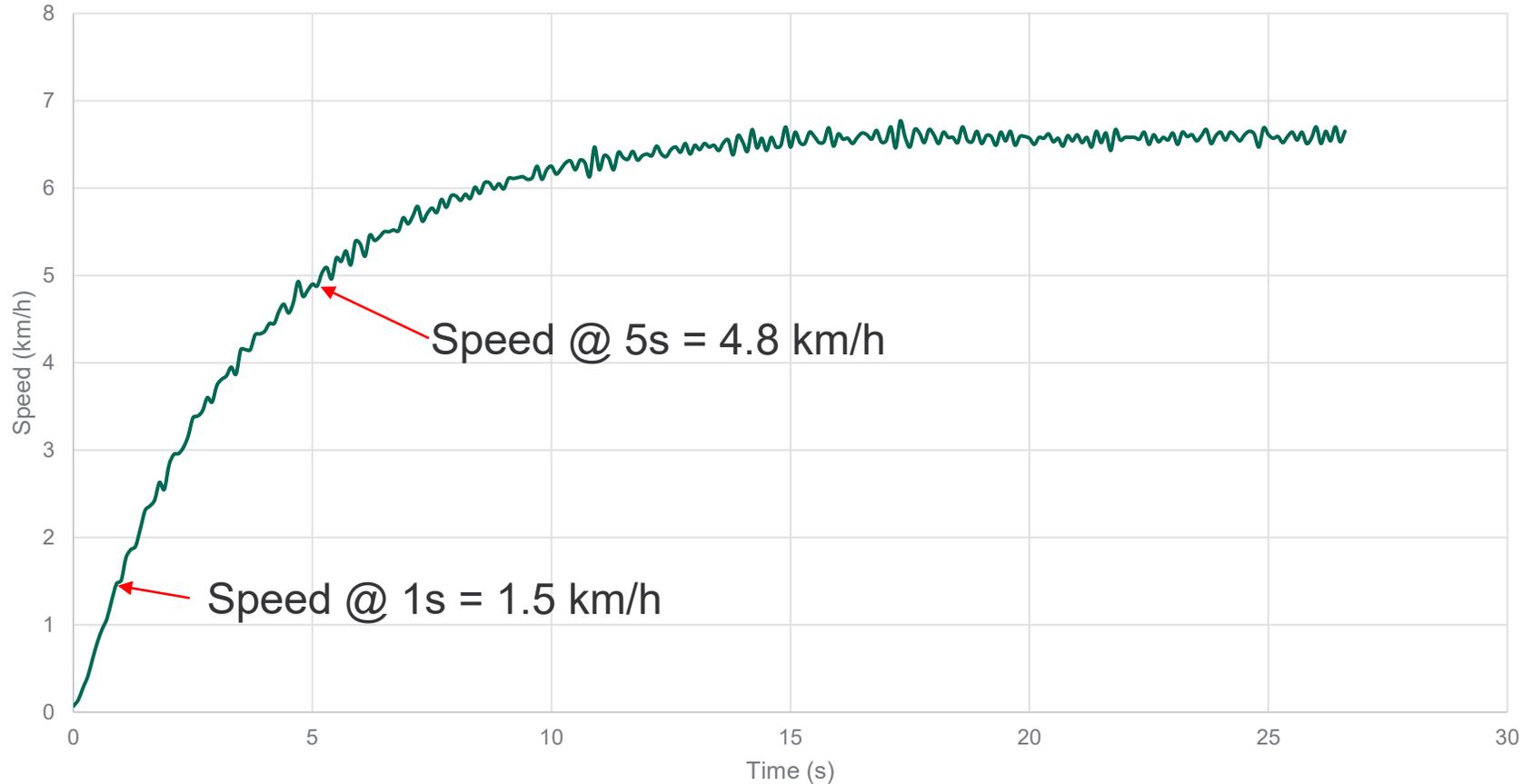


Results of creeping acceleration tests – Diesel AT



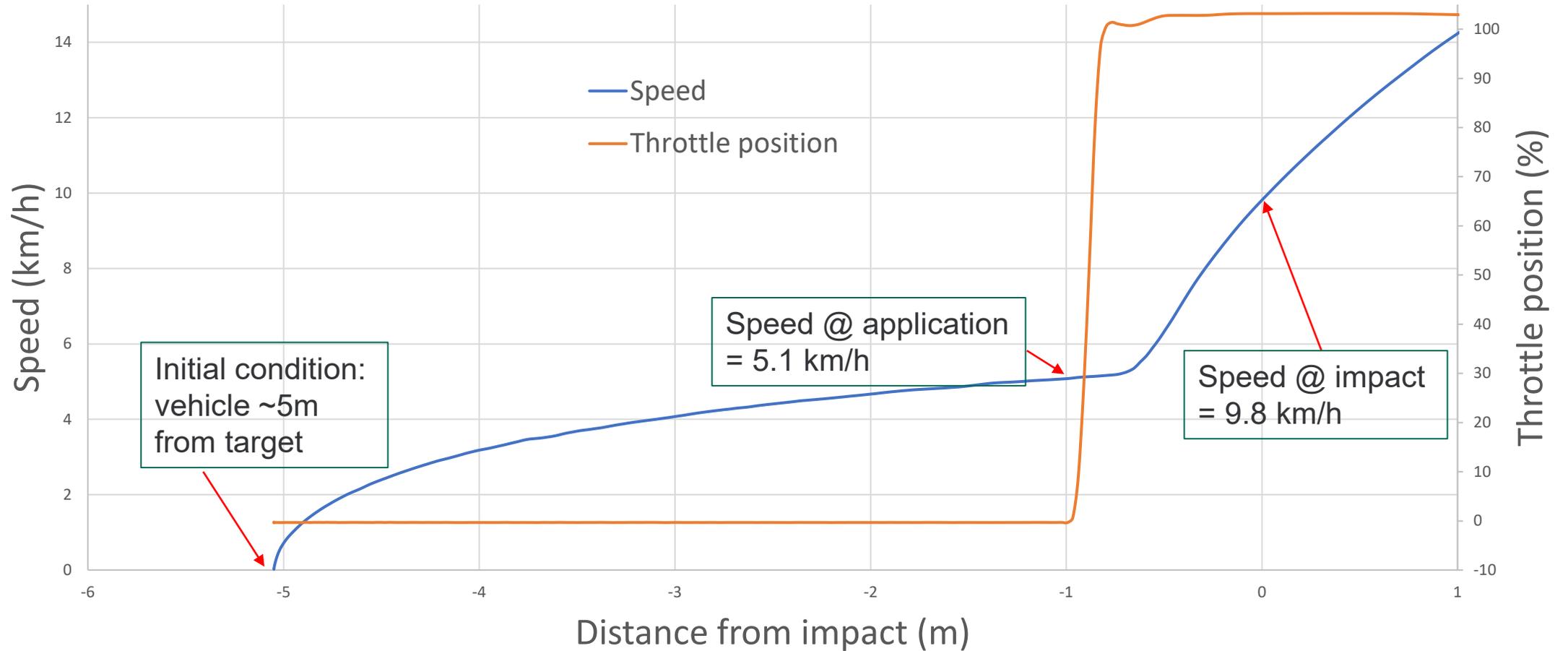


Results of creeping acceleration tests - BEV





Results of WOT acceleration tests - BEV





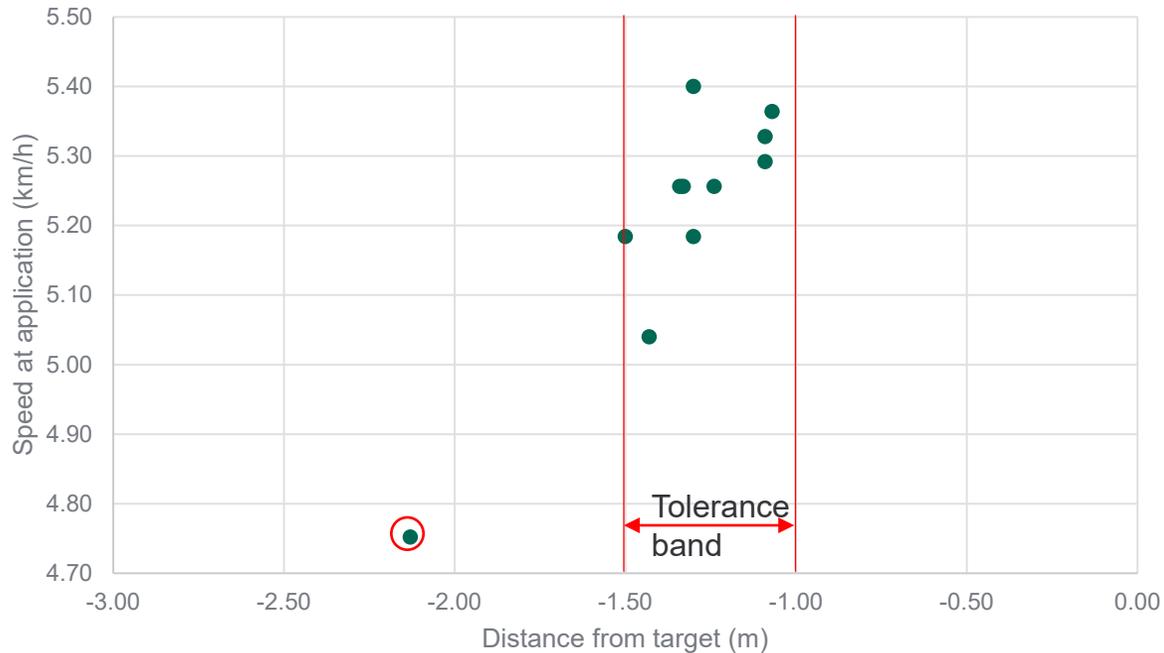
Application position results, 20m creep - BEV

| Test Run | Creep Start Position (m) | Distance from L2 at accel application (m) | Speed at accel application (km/h) | Speed at 1m from Accel Point (km/h) | Speed at 1.5m from Accel Point (km/h) |
|----------|-----------------------------|--|--------------------------------------|--|--|
| 1 | 20 | 1.35 | 6.88 | 10.22 | 12.64 |
| 2 | 20 | 1.29 | 6.98 | 10.55 | 12.82 |
| 3 | 20 | 1.03 | 6.95 | 10.55 | 12.82 |
| 4 | 20 | 1.18 | 6.88 | 10.33 | 12.74 |
| 5 | 20 | 1.31 | 6.95 | 9.76 | 12.38 |



Application position results, 4.5m creep - BEV

Application position



| Test Run | Creep Start Position (m) | Distance from L2 at accel application (m) | Speed at accel application (km/h) |
|----------|--------------------------|---|-----------------------------------|
| 1 | 4.5 | 1.30 | 5.40 |
| 2 | 4.5 | 1.30 | 5.18 |
| 3 | 4.5 | 1.43 | 5.04 |
| 4 | 4.5 | 1.34 | 5.26 |
| 5 | 4.5 | 1.33 | 5.26 |
| 6 | 4.5 | 1.50 | 5.18 |
| 7 | 4.5 | 2.13 | 4.75 |
| 8 | 4.5 | 1.07 | 5.36 |
| 9 | 4.5 | 1.09 | 5.29 |
| 10 | 4.5 | 1.24 | 5.26 |
| 11 | 4.5 | 1.09 | 5.33 |