

## **APPENDIX C**

### **J-Turn Maneuver Tests - Logic Tree Diagrams**

## J-Turn Maneuver Test Criteria

The following criteria is used to evaluate the results of J-Turn maneuver tests;

Criterion 1 – Lane Keeping (S5.3.1, S5.3.2.2 & S5.3.3.3) – the wheels of the test vehicle must remain within the lane between the start and end gates during the test run.

Criterion 2 – Engine Torque Reduction (S5.3.2) - The ESC system must reduce the driver requested engine torque by at least 10% for a minimum continuous duration of 0.5 seconds during the time period from 1.5 seconds after the vehicle crosses the start gate to when it crosses the end.

Criterion 3 – Vehicle Speed at 3.0 s (S5.3.3.1) – The vehicle speed measured at 3.0 seconds after the vehicle crosses the start gate must not exceed 29 mph.

Criterion 4 – Vehicle Speed at 4.0 s (S5.3.3.2) – The vehicle speed measured at 4.0 seconds after the vehicle crosses the start gate must not exceed 28 mph.

Criterion 5 – ESC system service brake activation (S5.3.3.4) - The ESC system applies service brake pressure at any wheel for a continuous duration of at least 0.5 second of at least 34 kPa (5 psi) for air-braked systems and at least 172 kPa (25 psi) for hydraulic-braked systems.

### Computing Test Run Speeds

**Criterion 5 is met** – If during the J-Turn Maneuver test run, the ESC system applies service brake pressure to slow the test vehicle in accordance with Criterion 5 above, compute the entrance speed as 0.5s average of raw speed data prior to ESC system service brake application.

**Criterion 5 is not met** – If during the J-Turn maneuver test run, the ESC system does not apply service brake pressure to slow the vehicle in accordance with Criterion 5 above, compute the entrance speed as 0.5s average of raw speed data prior to the instant when the vehicle's traverse centerline of the front axle (i.e., center of the front tires) crosses the start gate and round to the nearest 1 mph. For consecutive test runs in which Criterion 5 is not met, compute each test run entrance speed as indicated above and use the minimum entrance speed to calculate the incremental 1 mph increase for the next set of consecutive test runs.

## Determine the Preliminary Reference Speed

Determine the Preliminary Reference Speed by driving the test vehicle through a series of test runs on the J-Turn maneuver test course as follows;

1. The First Test Run entrance speed is  $20 \pm 1$  mph
2. Enter the Start Gate at the entrance speed and steer through the maneuver by modulating the accelerator pedal to maintain speed.
3. Conduct a test run
4. Determine if Criteria 1 and 5 were met.
  - 4.1 If both Criteria were met, the test is completed. Compute and record the entrance speed as the Preliminary Reference Speed (PRS).
  - 4.2 If Criterion 1 was met but Criterion 5 was not met, increase the entrance speed 1 mph and conduct another test run.
  - 4.3 If Criterion 1 was not met, conduct an additional test run at the same entrance speed.
    - 4.3.1 If Criterion 1 was not met during the additional test run, conduct 4 additional consecutive test runs at the same entrance speed
      - 4.3.1.1 If Criterion 1 was not met during at least 2 of the 4 additional consecutive test runs: **STOP – all testing is terminated – Indication of test failure and possible non-compliance**
      - 4.3.1.2 If both Criteria were met during at least 1 of 4 consecutive test runs, the test is completed. Compute and record the entrance speed(s) and record the minimum entrance speed as the Preliminary Reference Speed (PRS).
      - 4.3.1.3 If Criterion 1 was met but Criterion 5 was not met, increase the entrance speed 1 mph and conduct another test run

## Determine the Reference Speed

Determine the Reference Speed by driving the test vehicle through a series of test runs on the J-Turn maneuver test course as follows;

1. The entrance speed is equal to the Preliminary Reference Speed ( $\pm 1$  mph)
2. Conduct 4 consecutive test runs
3. Enter the Start Gate at the entrance speed and steer through the maneuver by modulating the accelerator pedal to maintain speed.
4. Determine if Criteria 1 and 5 are met during at least 2 of the 4 test runs.
  - 4.1 If both Criteria were met, the test is completed. Compute the entrance speeds and record the minimum entrance speed as the Reference Speed.
  - 4.2 If Criteria 1 was met but Criterion 5 was not met, increase the entrance speed 1 mph and conduct 4 additional consecutive test runs (Go to Step 2).
  - 4.3 If Criterion 1 was not met, **STOP – all testing is terminated – Indication of test failure and possible non-compliance**

## Engine Torque Reduction Test

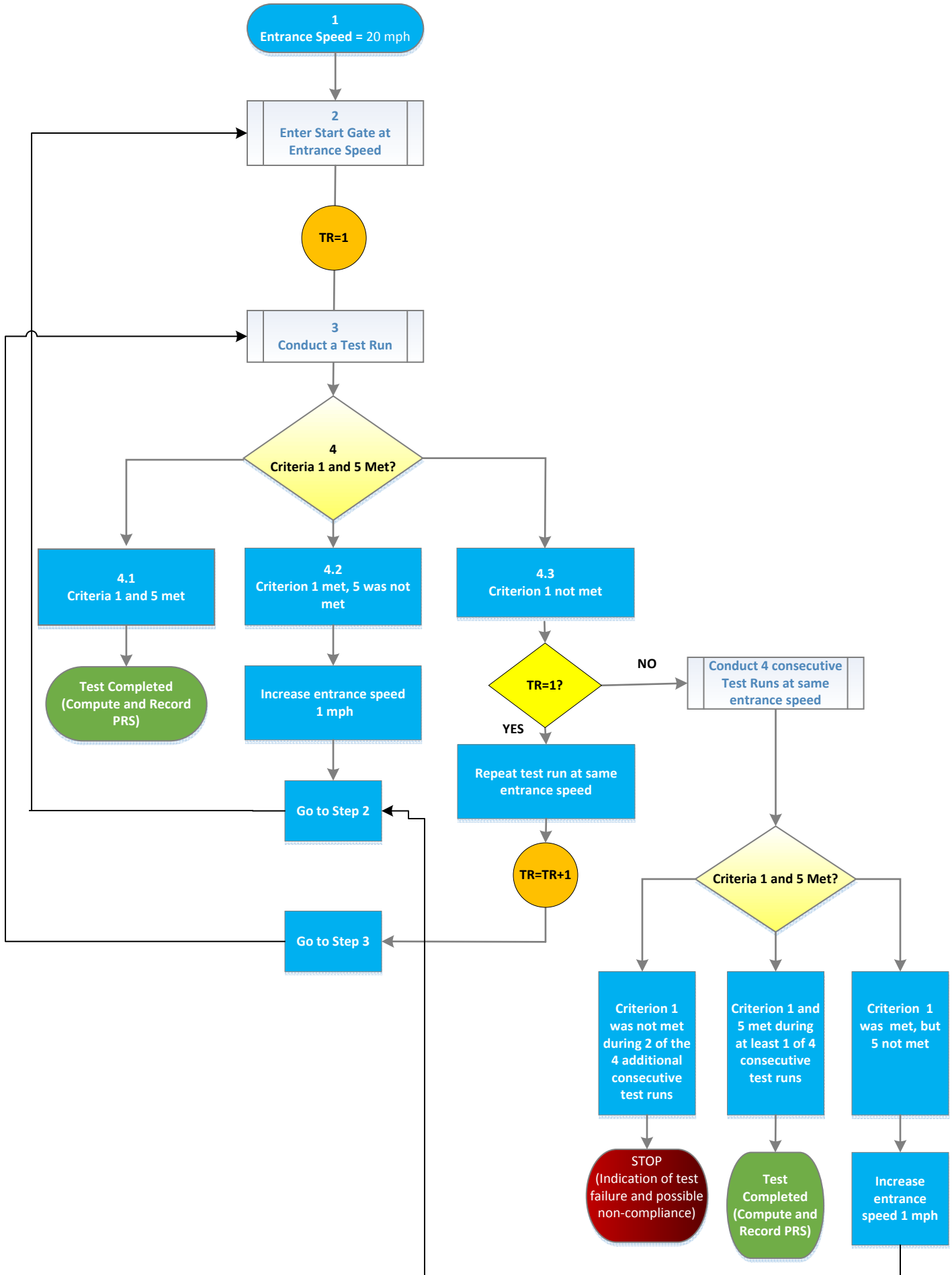
Conduct four consecutive test runs as follows;

1. The entrance speed is equal to the Reference Speed ( $\pm 1$  mph).
2. Conduct 4 consecutive test runs
3. Enter the Start Gate at the entrance speed and steer through the maneuver while fully depressing the accelerator pedal from the time when the vehicle crosses the start gate until the vehicle reaches the end gate.
4. Determine if Criteria 1 and 2 were met during at least 2 of 4 consecutive test runs.
  - 4.1 If both Criteria were met, the engine torque reduction requirement is met (i.e., PASS) and the test is completed.
  - 4.2 If both Criteria are NOT met - **STOP – all testing is terminated – Indication of test failure and possible non-compliance.**

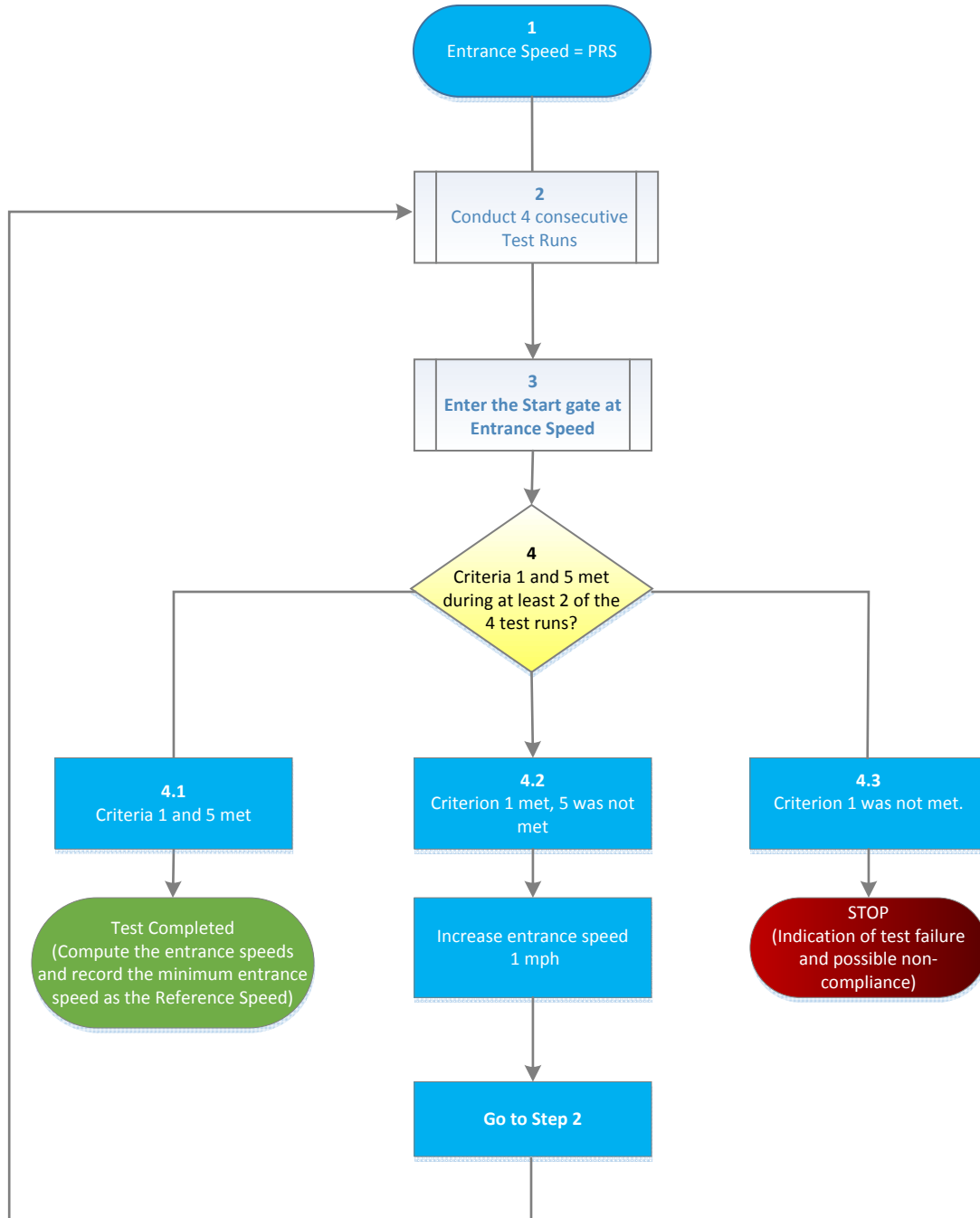
## Roll Stability Control Test

1. The Entrance Speed is 30 mph
2. Conduct 3 consecutive test runs
3. Enter the Start Gate at the entrance speed ( $\pm 1$  mph) and steer through the maneuver while fully depressing the accelerator pedal. Release the accelerator pedal if the ESC system (i.e., service brake applications and/or engine torque reduction) slows the vehicle by more than 3.0 mph below test speed.
4. Determine if Criteria Nos. 1, 3, 4 & 5 were met during at least 1 of the 3 test runs.
  - 4.1 If No, increase entrance speed 1 mph.
    - 4.1.1 Does the increased speed exceed the Max Test Speed
      - 4.1.1.1 **Yes - STOP – all testing is terminated – Indication of test failure and possible non-compliance.**
      - 4.1.1.2 **NO** - Go to step 2.
    - 4.2 If Yes, conduct 5 additional consecutive test runs at same speed.
      - 4.2.1 For each of the 5 test runs, determine if Criteria Nos. 1, 3, 4 and 5 were met.
        - 4.2.1.1 If Yes, the Roll Stability Control requirement is met (i.e.,PASS) and the test is complete.
        - 4.2.1.2 If No, increase the entrance speed 1 mph.
          - 4.2.1.2.1 Does the increased speed exceed the Max Test Speed
            - 4.2.1.2.1.1 **Yes - STOP – all testing is terminated – Indication of test failure and possible non-compliance.**
            - 4.2.1.2.1.2 **NO** - Go to step 2.

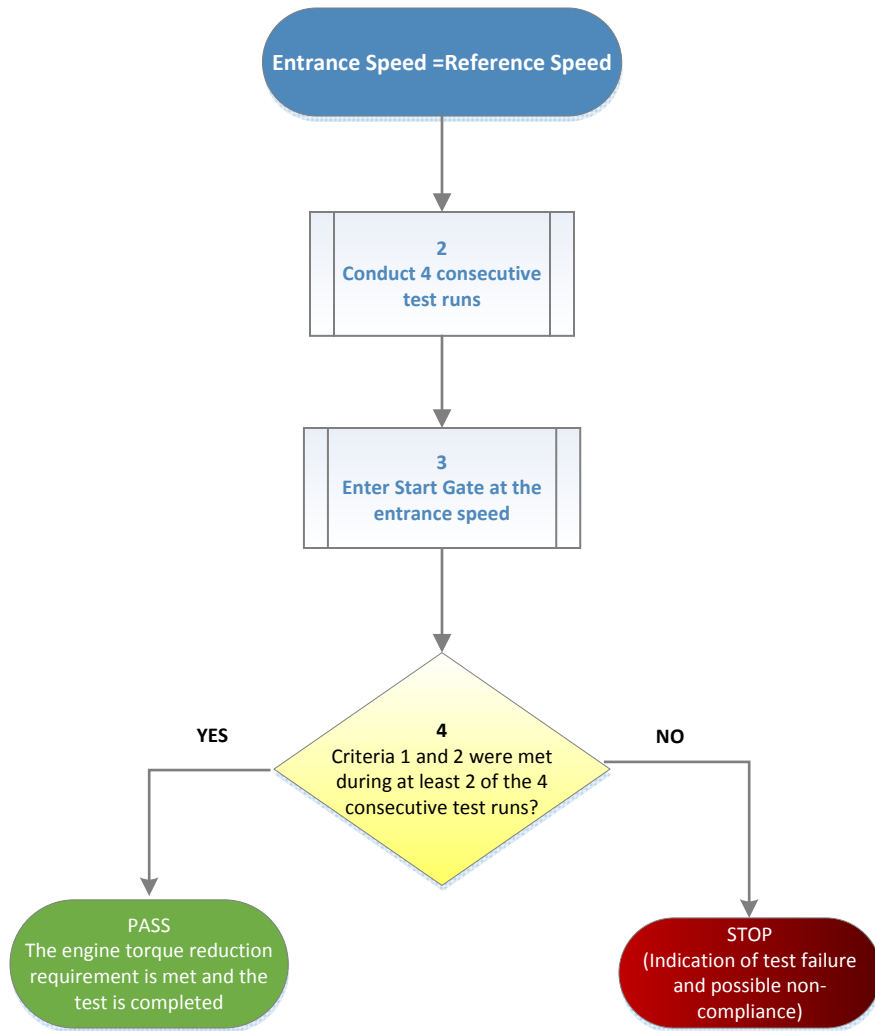
# Determine the Preliminary Reference Speed (PRS)



## Determine the Reference Speed



# Engine Torque Reduction Test





# Roll Stability Control Test

