In response to the request for comments to Docket Number NHTSA-2019-0102, the comments that follow were developed as part of the American Center for Mobility IAB Standards Committee's testing efforts. The content does not represent the opinion of any one company on the committee.

Please note that the committee has prioritized the test procedures and devoted resources to run the highest priority tests first. Therefore, we have the most extensive comments for our highest priority tests.

It would be beneficial to further extend the comment period to the end of March, allowing time to run all tests and provide additional detail on each procedure. Environmental conditions at the facility were not optimal for completing all tests within the timeline given.

NHTSA Standards – Summarized Comments (Pedestrian AEB / TJA / BSI / BSD / OTSA / APA)

- Standardize units of measure – ft or meters not both. Recommend imperial units (All test procedures)

- Standardize the number of test runs. Some tests require 7 test runs, some 3 test runs, while others do not give a required number of runs. (All test procedures)

- Lane widths are not representative of the most typical widths found in the United States. Recommend adjusting the language to reflect all common widths (All test procedures)

- Reduce visibility requirement to a distance that can be verified by the human eye at ground level. Similar specifications list 1km or 1mile. Recommend imperial units. (All test procedures)

- An accuracy of 0.1 mm (0.04") for measured GPS antenna locations is an unreasonable expectation, and far in excess of what is required by manufacturers of real-time kinematic (RTK) equipment. For example, Oxford Technical Solutions default configuration for an RT3003 requires the real location of the GPS antenna to be within 10 cm of the measured location (All test procedures).

- Eliminate requirement to use Botts dots. There are many other options for ensuring the vehicles follow the prescribed path. (P-AEB Section 3.0 Test Lane, Section 9.1.5.1 SV Approach D.2, and Section 9.2.5.1 SV Approach E.2)

- Eliminate suggested use of highly accurate coordinate measuring machine. The procedure should state what needs to be done to successfully execute the test, not how to do it. (P-AEB Section 3.0 Vehicle Width)

- Instrumentation initialization should reference the manufacturer's recommendations and be within their required calibration tolerances. Initialization procedure should not be part of the procedure. (TJA Section 5.1.2 Instrument Initialization. OTSA Section 5.1.1 Instrument

Initialization. BSI Section 5.1.1 Instrument Initialization. BSD Section 5.1.1 Instrument Initialization)

- Requiring the measurement of the brake pedal and throttle positions, and steering wheel angle and torque seem excessive and unnecessary. (TJA Section 4.6 Instrumentation Required. P-AEB Section 6.1.2 Sensor and Sensor Locations. OTA Sections 4.7.1.5 and 4.7.1.6)

- Line styles are specified, but other line styles deemed acceptable by MUTCD / AASHTO should be considered appropriate for the testing as well. (TJA Section 4.2.1 Lane Line Styles, and Figures 1, 3, 4, 5, and 6. BSI Section 4.2.1 Lane Line Styles.)

- POV for suddenly revealed stopped vehicle should be able to be any rear vehicle test target. (TJA Section 4.5.1 Surrogate Vehicles, and Section 5.3.6 Suddenly Revealed Stopped Vehicle)

- Obstruction vehicle size and color should be flexible to allow for testing various configurations. (P-AEB: Section 4.3.1 Obstruction Vehicles)

- Non – articulating mannequin is specified. Articulating mannequins should be an acceptable option. (P-AEB Section 4.3.2 Pedestrian Test Mannequin)

- Continuous monitoring of brake temp is implied, but pre and post-test measurement of brake temp should be acceptable. (P-AEB Section 6.1.2.8 SV Brake Temperature, and Section 8.2 SV Brake Warm-up and Temperature Maintenance)

- Instead of requiring the ignition to be cycled on and off, state that AEB must be in its normal operating mode. Cycling ignition can negatively impact the test equipment. (P-AEB Section 9.1.5.1 SV Approach B, and Section 9.2.5.1 SV Approach B)

- Suggest eliminating any requirements that imply a driver must operate the vehicle; “the SV driver shall modulate the throttle to maintain a constant speed until …”. (P-AEB Sections 9.1.5.1 SV Approach D.4, 9.1.5.1 SV Approach E, 9.2.5.1 SV Approach E.4, 9.1.5.1 SV Approach F. APA Section 5.4.2, 5.4.3)

- Recommended Measurements and Measurement Specifications – Table titled “Recommended” but the sensors and tolerances within are referenced as requirements in other parts of the document. Requiring the measurement of the brake pedal, throttle positions, steering wheel angle, and steering wheel torque are excessive and unnecessary. (APA Table 1, BSD Table 1, BSI Table 1, OTSA Table 1, TJA Table 1)

- LC during Automated Vehicle Level 0 or 1 Operation – Recommendation to keep figures within RTK system tolerances, for example; ±0.066 feet. BSI procedure lists; 4.99 feet and heading offset of 2.01 degrees, with no tolerances to these values. The lateral velocity has a tolerance of ± 13%, but the heading angle is specified to three significant figures. One is dependent on the

other, so one cannot be accurate to greater than 1% while the other is accurate to within 13%. (BSI Section 5.3.5.3)

- End-of-Test Instructions – The trial should be considered complete at the end of the validity period. No instructions should be provided to the driver after the end of the validity period. (BSI Sections 5.3.5.6, 5.3.6.5, 5.3.7.6. BSD Sections 5.3.1.2, 5.3.2.2. OTSA Sections 5.3.6.4, 5.3.7.4, 5.3.8.4, 5.3.9.4, 5.3.10.4)

- SV and Test Object Positions – This section specifies that the positions of PV2 and PV3 shall be measured and recorded during the data interval. PV2 and PV3 are not expected to move in any way, so this should be rewritten to specify the position relative to the SV or, to say that the distance between the SV and PV2 and PV3 shall be measured instead. To measure these vehicles relative locations, there are two main options. The first is to include an RTK unit in both PV2 and PV3 and have their shapes properly defined as polygons in the RTK software for measuring relative distances. The second possibility only works since the vehicles are parked and will not require any RTK units outside the SV. This second possibility is to define a polygon in a fixed point in space on the SV RTK, and to ensure that PV2 and PV3 are precisely located in the real-world space represented by the polygons in the software. Option 1 requires more hardware to be tied up in parked vehicles, while Option 2 requires more effort and time to ensure the physical and virtual vehicle positions are aligned. Since PV5 will be moving, it will always require its own RTK unit. It should be made clear that option 2 is acceptable. (APA Section 4.6.1.2)

- Test Choreography – This states that "The left side of the SV shall not deviate more than 5.35 ± 0.8 ft (1.63 ± 0.25 m) from the inboard edge of the lane line immediately to its left". Several large SUVs were found to have vehicle widths of 80 – 82 inches without mirrors. If the lane is 12 feet from inboard edge to inboard edge, this could lead to a larger passenger vehicle driving with its right wheels on or beyond the right-side lane lines in the first stage of this test. Need confirmation that this is acceptable. (OTSA Section 5.3.6.2)

- OTSA Scenario 1 Test Specifications – Table 3 here is likely meant to be a continuation of Table 2. Other than their first columns indicating Automation Condition, the first half of Table 2 is identical to the second half of Table 2, and also identical to the entirety of Table 3. These three can be combined into a single table for no turn signal, manual lane deviation. Additionally, for the SV Path Deviation, the lateral velocity has a tolerance of ± 18%, but the heading angle is specified to three significant figures. One is dependent on the other, so one cannot be accurate to greater than 1% while the other is accurate to within 18%. (OTSA Section 5.3.6.2, Tables 2 & 3)

- Test Choreography – This states that "The initial distance between the left side of the SV and the inboard edge of the lane line immediately to its left differs, and changes as a function of SV speed." According to Table 3, this distance is 6.23 ± 0.8 ft (1.90 ± 0.25 m) for the slowest speed test. The lead vehicle for this test is specified to be between 70 and 76 inches wide. If the lane

is 12 feet from inboard edge to inboard edge, this would lead to a 70 inch wide vehicle driving with its right wheels on or potentially past the right side lane lines in the first stage of this test. For the larger passenger vehicles mentioned above, their right-side wheels would be past the right side lane line when at the nominal offset. Need confirmation that this is acceptable. (OTSA Section 5.3.7.2)

- OTSA Scenario 2 Test Specifications – This Table 3 is on page 24, there is already a Table 3 on page 18, mentioned above. Other than their first columns indicating Automation Condition, the first third of the table is identical to the middle third of the table, and also identical to the last third of the table. These three parts can be combined into a smaller table for active turn signal, manual lane deviation. Additionally, for the SV Path Deviation, the lateral velocity has a tolerance of ± 13%, but the heading angle is specified to three significant figures. One is dependent on the other, so one cannot be accurate to greater than 1% while the other is accurate to within 13%. (OTSA Table 3)

- OTSA Scenario 4 Test Specifications – Other than their first columns indicating Automation Condition, the first third of the table is identical to the middle third of the table, and also identical to the last third of the table. These three parts can be combined into a smaller table for active turn signal, manual lane deviation. Additionally, for the SV Path Deviation, the lateral velocity has a tolerance of ± 13%, but the heading angle is specified to three significant figures. One is dependent on the other, so one cannot be accurate to greater than 1% while the other is accurate only to within 13%. (OTSA Table 5)

- Automated Parking Execution – The first paragraph states that “The parking phase of the maneuver shall be taken to begin at the instant the SB driver fully releases the brake pedal”. This also should be redefined to exclude any driver action. It is unclear what would be an appropriate replacement. Current sensor scheme only measures force applied to brake pedal, which would not indicate whether the vehicle itself is applying the brakes. It is probably easiest to redefine the beginning of the phase once the vehicle exceeds a certain speed threshold. The longitudinal speed is already being recorded throughout the test, and the test procedure is written such that the SV will come to a stop in Stage 1. (APA Section 5.4.3 Stage 3)

- Principal Other Vehicle Specifications – POV specified as a high production midsize car, not GVT. Minimum dimensions are still larger than GVT. GVT not specified because procedure calls for speeds in excess of the current GVT’s capabilities. However, recommend allowing GVT as an option for running this test, to accommodate future GVT developments (BSD Section 4.5)

- Automation Condition - It is not clear what automation condition is supposed to be tested. The test procedure lists manual, conventional cruise, adaptive cruise, and adaptive cruise with lane centering as control options. Recommend that the Manufacturer’s ODD is considered to identify the appropriate automation condition. (BSI, OTSA)