

**Board Report**

---

**File #:** 2023-0160, **File Type:** Motion / Motion Response**Agenda Number:** 25.

---

**EXECUTIVE MANAGEMENT COMMITTEE  
OPERATIONS, SAFETY AND CUSTOMER EXPERIENCE COMMITTEE  
JUNE 15, 2023****SUBJECT: BUS SENSOR TECHNOLOGY****ACTION: RECEIVE AND FILE****RECOMMENDATION**

RECEIVE AND FILE status report on Bus Sensor Technology.

**ISSUE**

At its February 23, 2023 meeting, the Board approved Item 14, Bus Sensor Technology Motion (Attachment A), by Directors Hahn, Horvath, Mitchell, Solis, and Krekorian. The motion directed the Chief Executive Officer to report back in June 2023 with recommendations on safety features such as Pedestrian Detection technology and the feasibility of (1) incorporating them into new bus procurements, (2) installing them into our existing bus fleets, in order to reduce pedestrian collisions and to ensure that bus operators are alerted in the event of a pedestrian-involved collision, and (3) exploring other emerging collision avoidance technologies, pursuant to Metro's Street Safety Data Sharing and Collaboration Policy and Action Plan.

**BACKGROUND**

Metro is in the process of concluding two separate passenger collision avoidance studies. In 2017 Metro partnered with New Flyer (NF), and the Center for Transportation and the Environment (CTE) on a Federal Transit Administration (FTA) grant funded study. The study evaluates commercially available collision avoidance systems on 40-foot transit buses operating in revenue service within downtown Los Angeles. The study was recently concluded, and the final report is anticipated in July 2023. Metro is also currently conducting an internal study with BYD to evaluate the effectiveness of MirrorEye electronic rear/side view monitors.

**DISCUSSION****Mobileye Study with NF and CTE:**

The intent of the FTA grant funded study with NF and CTE was to identify five (5) commercial collision avoidance options and choose two (2) to install and test on Metro's transit buses. It is also important to note that this study was led by the FTA, and analysis led by CTE. Metro's role was to

provide the vehicles and facilitate the study as a participant. After initial vetting, it was determined that of the five options initially considered there was only one that was viable. Accordingly, the team moved forward in September 2019 to test Mobileye Shield + ADAS (Advanced Driver Assistance System) on 50 of Metro's 40' NF buses. Specifically, the features listed below, offered on Mobileye Shield + ADAS, were tested. (Please see Attachment B):

1. Lane Departure Warning with Display
2. Forward Collision Warning with Display
3. Pedestrian Detection/Pedestrian Warning with Left and Right Displays
4. Pedestrian Blindspot Monitoring

APAS (Advanced Pedestrian Alert System) integrates with Mobileye Shield + and provides an exterior audio alert to pedestrians when a bus is approaching.

Numerous technical challenges arose during the system interface and installation process, compounded by the circumstances brought about by the COVID-19 pandemic. These challenges led to delays in engineering support as Mobileye's engineering team was based in Israel. Additionally, the initial data collection was hindered by a high number of false positive and false negative alerts, hampering progress. Consequently, the system had to remain in stealth mode, collecting data without displaying warnings to operators until the project team could ensure its safety for activation.

By May 2021, the installation of Mobileye systems on all 50 buses was completed, with the system operating in stealth mode. In December 2021, 40 buses transitioned to active mode, enabling continued data collection until its conclusion in June 2022. However, the preliminary findings of the study yielded inconclusive results, lacking sufficient evidence to demonstrate safety improvements compared to transit buses without active systems.

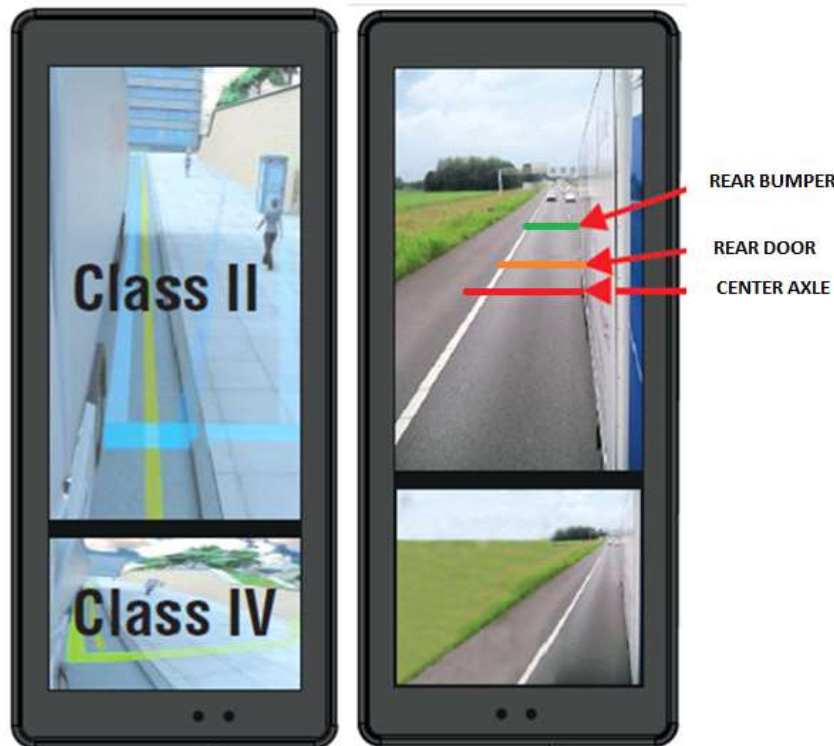
Differentiating performance between the modified and non-modified buses proved challenging, as the observed differences were minor and difficult to attribute solely to the technology. Factors such as operating conditions, environmental variables, limited reliable data collection due to the use of GPS-speed data, assessing operator response, and the limited number of buses and mileage contributed to this difficulty. The project's data gathering and analysis section was not adequately detailed, limiting its ability to provide comprehensive insights.

By the time the project team recognized the necessity of an external data collection methodology to independently evaluate system effectiveness, insufficient budget remained to procure or utilize the required tools, such as wheel speed sensors on each bus. It was initially believed that the existing systems installed on Metro buses would suffice. The final report is expected to be available in July 2023.

MirrorEye study with BYD:

In addition to the Mobileye evaluation, Metro is also conducting a study on MirrorEye electronic rear/side view monitors. The California Highway Patrol (CHP) authorized Metro to test the MirrorEye on the G Line (Orange) buses for a period of five years. Metro and BYD are currently evaluating the effectiveness of MirrorEye electronic rear/side view monitors to provide legally required fields of view. Although the system was initially installed to mimic the rear-view mirrors, it enables useful features such as night vision and marking lanes. The system currently being studied does not provide alerts to

the operator but allows bus network integration, potentially enabling sensor automated functions. The evaluation is presently being conducted on five (5) 60-foot BYD buses and five (5) 40-foot BYD buses. This study is expected to conclude with published results by the Summer of 2024. (See **Figure 2**).



**Figure 2**

Staff Response to Board Motion Items:

In response to item (1) *incorporating them [Pedestrian Detection safety technology] into new bus procurements*, staff has included language in the Technical Specification for new bus procurements to include vehicle safety technologies such as: pedestrian detection, lane departure warning, and the capability to integrate Advance Driver Assistance from levels 0 to 5 as defined in SAE J3016\_021806. A supplemental graphic from SAE International of J3016 is provided in Attachment C, but in summary:

- 0 - provides warnings and momentary assistance. Automatic emergency braking, blind spot warning, lane departure warning
- 1 - Provides steering OR brake/acceleration support, lane centering OR adaptive cruise control
- 2 - Provides steering AND brake/acceleration support, lane centering AND adaptive cruise control at the same time
- 3- Driver is not actively operating the vehicle unless instructed to by features. Technology will drive the vehicle under limited conditions. Example is full driving during a traffic jam

- 4 - Automated features will not require you to take over driving. Examples is a local driverless taxi. Vehicle pedals/steering may or may not be installed
- 5- Vehicle can operate autonomously under all conditions

In response to item (2) *installing them into our existing bus fleets, in order to reduce pedestrian collisions and to ensure that bus operators are alerted in the event of a pedestrian-involved collision*, staff is not recommending the retrofit of Mobileye on the existing system as the operational/system benefits are inconclusive, but will continue to assess technologies for the existing bus fleet as they mature and benefits are demonstrated.

In response to item (3) *exploring other emerging collision avoidance technologies* staff will continue to explore new technologies as they emerge and merit additional evaluation.

### **EQUITY PLATFORM**

The technology is intended to improve traffic safety and reduce disproportionate harm for vulnerable road users. As noted in the Street Safety Policy, traffic violence kills and injures "Black, Latino, Native Hawaiian and other Pacific islander and unhoused residents as well as people walking and cycling at greater rates than other people."

There is great overlap between the project's service areas and areas that Metro defines as Equity Focus Communities. The improvements are targeted to benefit communities with some of the greatest mobility needs in Los Angeles County. The Project's service corridors are composed of 88 percent in Low-Income Communities as identified by AB 1550 (Figure 3 - Attachment D), 73 percent disadvantaged Communities as identified by SB 535 (Figure 4 - Attachment D), and 61% Equity Focus Communities as defined by Metro's EFC definition (Figure 5- Attachment D). The investment brings benefits to the community beyond the transit riders themselves: zero emissions, quieter exterior and interior noise not only attracts riders but provides a benefit to the community as well.

### **IMPLEMENTATION OF STRATEGIC PLAN GOALS**

These recommendations support Goal #2, Deliver outstanding trip experiences for all users of the transportation system, Goal #3, Enhance communities and lives through mobility and access to opportunity, and Goal #5, Provide responsive, accountable, and trustworthy governance within the Metro organization.

### **NEXT STEPS**

Staff will include language in the Technical Specifications for new bus procurements to include Pedestrian Detection safety technology.

Staff will continue to monitor the development of emerging Pedestrian Detection safety technologies and will pilot promising solutions to enhance safety on our bus network.

### **ATTACHMENTS**

Attachment A - Motion # 2023-0102 by Directors Hahn, Horvath, Mitchell, Solis and Krekorian

Attachment B "Mobileye Shield V4 W/ Apas" Operator Reference-

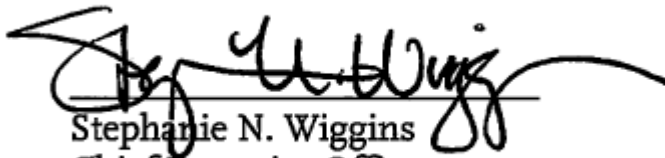
Attachment C - SAE J3016 Levels of Driving Automation

Attachment D - Equity Platform Figures 3 - 5

Prepared by: David Faulk, Deputy Executive Officer, Vehicle Engineering &  
Acquisitions, (213) 922-3293

Jesus Montes, Senior Executive Officer, Vehicle Engineering & Acquisition, (213) 418-  
3277

Reviewed by: Conan Cheung, Chief Operations Officer, (213) 418-3034



Stephanie N. Wiggins  
Chief Executive Officer