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| **16. Abstract**Ricardo has analyzed the cost and weight of Automatic Emergency Braking (AEB) systems, exclusive of forward collision warning hardware, which use radar and/or camera sensors. AEB systems can avoid or mitigate forward collisions by either assisting the driver if enough braking force is not being applied (called Dynamic Braking Support, DBS) or automatically applying the brakes if a forward collision is imminent (Crash Imminent Braking, CIB.) The Toyota Camry AEB system is part of Toyota Safety SenseTM P which has a Pre-Collision System (PCS) and uses a combination of radar and camera with sensor fusion. The incremental manufacturing costs and weights for the Toyota Camry camera system, including wiring, was $50.68 and the radar system was $69.68 for a total system cost of $120.36. The Toyota Camry system weighed 883g. The total manufacturing cost was split into $113.44 for variable and $6.92 for fixed costs. The end-user cost increase for the Camry AEB system was $156.18, or a 38% markup over the variable manufacturing cost basis. The Subaru Outback, equipped with EyeSight®, uses a stereo camera system only for AEB. The system has a unique stereo camera module that is capable of detecting distance and speed of objects in front of the vehicle without the need for a radar sensor. The incremental cost of the Subaru camera module was $136.80 and other hardware, including incremental wiring, camera cover and mounting plate, and PCS braking switch, was $23.06 for a total system cost of $159.86. The weight of the Subaru Outback AEB system was 2478g but more than half of that total was for incremental wiring; the stereo camera module itself weighed 785g. The total manufacturing cost was split into $147.25 for variable and $9.65 for fixed costs. The end-user cost increase for the Outback AEB system was $207.21, or a 41% markup over the variable manufacturing cost basis. Both the Toyota Camry and Subaru Outback AEB systems relied upon a processor that was shared with and present on the vehicle before the AEB systems were added and therefore was not included in the incremental analysis. |
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