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16. Abstract

The cost and weight impact of LED headlamps was investigated by comparing an LED headlamp assembly to a halogen headlamp assembly for a 2020 MY Kia Forte. Both headlamp assemblies contained daytime running lamps and side position marker lamps, so the key difference was in the light source for the low and high beams of the headlight itself. The halogen headlamp had separate high and low beam bulbs and the LED headlamp had a single LED lamp for both high and low beams as can be seen in Figure 1. LEDs are controlled with a current driver circuit to regulate the electrical current flow through the diode. LEDs are also compact and can be mounted directly to a heat sink, unlike a halogen bulb, so thermal management systems for LEDs is more complex as well. The added complexity behind an LED headlight drives up the cost.

Detailed teardown analysis was performed on the two headlamps to reveal manufacturing costs for every step and component in both headlamp assemblies. It was estimated that the manufacturing cost for an LED headlamp assembly was $57.44, a $20.13 delta over the comparable halogen headlamp assembly which was estimated to cost $37.31 to manufacture. Manufacturing costs were then translated into the cost impact for the end user by adding overhead costs and profit margin for the headlamp supplier and the vehicle manufacturer to yield a $76.08 price increase and a $49.44 price increase for the LED and the halogen headlamps, respectively, an LED headlamp, then, incrementally costs $26.64 more than a halogen headlamp. For the Kia Forte vehicle purchaser, the final price increase was estimated at $53.28 for two LED over halogen headlamps as shown in Table 1.

17. Key Words LED, Headlamps, halogen, light, high, low, beam, bulbs,	**18. Distribution Statement** This report is free of charge from the NHTSA Web site at www.nhtsa.dot.gov		
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