



Technical Torque #24

See and be seen; Part 2. – The Development of Headlights - Russell Walsh

In part 1 of this series, we talked about visibility and the progression from having no front windscreen to the digital technology we have today to provide for safer vision all around the vehicle. In part 2 we will talk about what has developed to light up the pathway ahead, headlights.

As motor driven transport replaced the horse and cart it soon became obvious an improvement in the ability to project light ahead was needed. Although candles and kerosine lamps would indicate to oncoming traffic your presence on the road they had little forward light projection, simply this style of lamp was no longer suitable as a result few people ventured out in their vehicle at night.

In the late 1880s the first forward facing lights, headlights, found their way onto motor vehicles, these early lights, often powered by acetylene, were generated by the chemical reaction of water dripping onto calcium chloride in a container mounted on the vehicle. When lit the acetylene produced a bright flame and behind the flame was a mirror to project the light forward, this light however was not focused. A problem with this type of arrangement was that in wintry weather the water froze, and the lamp did not work. Also, storage of the volatile gas produced an ongoing risk to safety. Despite this, and the availability of rudimentary electric lighting for vehicles, acetylene gas powered lights were the common headlights fitted. This style light could illuminate the way ahead up to 150 metres.



Circa 1908 Albion mail truck with early headlights.

Electric headlights were available in these early days but were expensive. The electrical current required was provided by an engine driven dynamo, this meant that the speed of the engine tended to dictate the brilliance of the headlights, the engine had to be turning over to produce the electrical power required. The bulbs for these were based on the original design of an incandescent bulb by Thomas Edison. Although these designs were refined over the years the principle of a heated filament producing light remained for many years.

Incandescent lighting became common place and evolved through 7 inch and 5¾ inch semi sealed and sealed beam arrangements, these became standard light fittings for many years with frontal vehicle design tailored to fit around these.



Examples of vehicles fitted with 7 inch and 5¾ inch headlights.

Semi-sealed headlights had a replaceable bulb and fitted into an aperture in the rear of the assembly that included a guide to maintain the correct alignment of the bulb. In the sealed beam arrangement, the headlight assembly was the bulb, the filament was enclosed in a sealed glass housing.

Although these headlights did the job their service life was not great as the bulb filament was subject to vibration and would break.

During the 1970s square and oblong assemblies started to appear to give designers some flexibility in frontal styling.



Retrieved from: A Brief History of Sealed Beam Headlamps in the U.S.

Halogen lighting

Developments in Europe during the 1960's led to the use of halogen as the gas encasing the bulb filament. This greatly improved the service life of headlight bulbs and provided brighter light giving drivers much enhanced forward vision.

A further improvement on halogen lighting came with High-Intensity Discharge lights (HID). In these, xenon gas replaced the halogen gas further increasing the brightness of the lamp and again improving the view of the road ahead for drivers.

HID lamps also improved light serviceability, a service life up to three times the life of halogen bulbs has been stated, while using less electrical energy than halogen bulbs.



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Plastic headlights

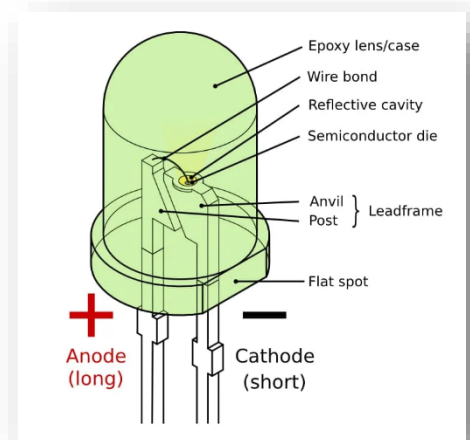
During this time plastic was used in many applications to replace glass. Produced at a cheaper cost, the use of plastic had many advantages including allowing vehicle designers to mould the headlight assemblies into different shapes thus facilitating different frontal design. Plastic lights however have their disadvantages including fogging up of the lens reducing headlight effectiveness.

Light Emitting Diodes (LED)

The biggest breakthrough in headlight design and efficiency in recent years has come with the use of Light Emitting Diodes (LEDs) in the late 1970s. An LED is an electrical semiconductor that can produce light when an electrical current is passed through it. Different coloured lens cases can be used to produce different coloured light outputs.

Originally used in daytime running lights LEDs were soon adapted for use in main headlights. Their inherent characteristics of low cost, less energy consumption, long life, and ability to be used in shaped clusters have enable LED headlights to be adapted to suit modern truck design especially when it comes to reducing frontal aerodynamic drag.

It is expected that LEDs will be the lighting source for some years to come.



A simple LED. Retrieved from Wikipedia



Example of shaped headlights. Retrieved from Volvo NZ website

Looking into the future

Testing of forward-facing cameras that detect on coming light sources and environmental conditions and adjust headlight beam accordingly are already well advanced and in use in some high-end vehicles.

Headlights connected to GPS that can adjust the headlights according to the upcoming road conditions are in test.

Laser beam headlights have been tried with disappointing results so far, but they still may prove to be the next breakthrough in headlight technology.