Here's how to make your exterior lights and signals (other than headlamps) work better:

Lenses and reflectors

Clean the lenses Remove the lamp assembly from the car. Cars up to '76 or so, give or take depending on model, mostly have brake/tail and park/turn lamps on which the lenses can be removed from the reflectors. With a medium-soft nylon-bristle brush, scrub the inside and outside of each lens with hot water that's sudsy with liquid dish soap. Inspect the lenses for cracking, chalking, crazing and fading. If red lenses appear pinkish or orangish when you hold them up to a strong light, instead of decidedly red, they need to be replaced. Some lenses are more prone to deterioration than others; the '66 Valiant and Barracuda lenses tend to turn to white dust and the '64 Valiant lenses tend to develop melt-divots just above the bulb. New lenses can be had for virtually all the old Mopars without too much difficulty or expense. If you need a cheap fix for faded lenses, go to a theatrical supply house and pick up a sheet of Roscolux #26. This is the material used in front of stage and movie-set lights. It's a transparent, flexible, thin plastic that's easily cut with scissors or a box knife -- use one of those tools to cut pieces of Roscolux to fit behind each faded lens.

Also clean the reflectors thoroughly, the same way (scrub with hot soapy water). Later-production cars have one-piece lens-and-reflector assemblies that can't be disassembled for cleaning and refurbishment. You can vigorously slosh hot soapy water in them and then rinse, and try to inspect the reflector. If it's dulled, your best move is to replace the assembly, though sometimes that's not possible or affordable. If you're clever you may figure out a way to disassemble it and then reassemble it satisfactorily.

Next, refurbish the reflecting surface of the reflectors. To do so, sand them as necessary, clean them with alcohol and then shoot them with "Chrome" or "Chrome Aluminum" spray paint from the hardware store. Do not use white paint, reflective tape, aluminum foil, mylar film, that high-cost paint that really does look exactly like chrome, or any other material. The plain ordinary hardware or parts store "Chrome" spray paint is virtually identical to the original material and so has the correct amount of diffusion; a mirror-shiny reflector is not what's wanted here.

Inspect the lens-to-reflector and housing-to-body gaskets. If they've deteriorated, new ones can be had from e.g. Gary Goers or DMT or other vendors.

Wiring and sockets

Inspect the sockets carefully. If the contacts have burned or corroded and/or the contact holder disc is rotten and/or the spring tension is no longer enough to hold the bulb securely, repair the socket. NAPA Echlin socket repair pigtails (wire + spring + contacts + disc, easy to install) are available as follows:

LS 6451: Single contact w/rubber weatherseal
LS 6452: Double contact w/rubber weatherseal, holder disc index tab in line with contacts

LS 6226: Single contact w/spring and backplate
LS 6228: Double contact w/spring and backplate, holder disc index tab in line with contacts
LS 6251: Double contact w/spring and backplate, holder disc index tab at 90° to contacts

Complete sockets are also available in the NAPA Echlin line in all styles originally used in old Mopars.

Check the wiring, especially the grounds. It's very helpful to run a new main ground line from the engine compartment (battery negative, alternator housing, or attachment point of engine compartment ground strap) clear to the back of the car, where it can serve as the ground attachment point for all rear lights and other electrical stuff back there. You can pick up a *lot* of intensity and make the lamps come on much faster (shorter rise time for brake lights = more advance warning for following drivers) this way.

Bulbs

Original equipment bulbs on most pre-'72 cars was as follows:

1034: dual-filament park/turn and brake tail. Clear bulb for use with red rear or amber front lens.

1034A or 1034NA: dual-filament park/turn. Amber bulb for use with clear front lens.

1141 or 1073: single-filament bulb. Reversing/backup lights (and single-function—brake-only, turn-only—lights not frequently found on old Mopars).

In the early '70s, the 1034 was replaced by the 1157, the 1073/1141 by the 1156. These 1150-series bulbs put out the same amount of light, but draw slightly more current and last quite a bit longer. When changing from 1034s to 1157s, often it was (and is) necessary to replace the turn signal flasher, because the original would flash too fast if used with 1157s. Nowtimes, it's difficult to find a flasher calibrated for 1034s.

So, what to use for upgrade bulbs? Well first, here's what NOT to use: 2057s! People sometimes assume that because it's a higher number, it's a brighter bulb. No. The difference between 1157 and 2057 is in the "minor" (dim parking or tail) filament. On the 2057, the dim filament produces 2 candlepower. On the 1157, the dim filament produces 3 candlepower. The difference doesn't sound like much, but it's very large as a percentage. Both 1157 and 2057 produce 32 candlepower from the bright (brake or turn) filament.

Though they are spendy, the best bulb you can use in place of 1157 is a 3496. You can get them from your local Honda dealer. Part number is 34906-SL0-A01. It draws the same amount of current as 1157, but is much more efficient. It produces 43 candlepower on the bright (brake or turn) filament, and 3.5 candlepower on the dim (tail or parking) filament. It also has a nickel-plated base that is much more corrosion resistant than the plain brass base of an 1157, so it's less likely to stick in the socket.

The best replacement for 1156, 1141 and 1073 in all applications *except* reversing/backup lights is a 3497. You can get P3497 bulbs from your local Honda dealer, too. Part number is 34903-SF1-A01.

3497 produces 45 candlepower. (Yes, the 6 and the 7 in P3496 and P3497 are reversed from the 6 and the 7 in 1156 and 1157 relative to how many filaments the bulb has. This is not a typo.) The 3496 and 3497 bulbs have a life span about double that of an 1157. It is worth your time, money, and trouble to get the 3496 and 3497 from a Honda dealer rather than a parts store...the parts store items are of much poorer quality and don't last as long.

The best bulb for use in backup/reverse lights is a 796. It is a 35W halogen bulb that produces 62 candlepower, or about double the light of an 1156 and about triple the light of an 1141. The extra wattage is minor (35W vs. 28W, the wires and lenses will not notice or care) and the filament is in the right place. Neither of these compliments can be said of those 50W halogen backup bulbs you see in the parts stores! 50W is wayy too much current draw (100% overload!) for the stock wiring and switch, they produce way too much heat for safety near plastic lenses, and the filament's in the wrong place so the reflector doesn't work correctly with them. The P796s work great, and you finally get to see where you're going when backing at night.

Amber bulbs are a special case. The amber coating "steals" some of the light, so the output is lower. The bright filament inside an 1157A or 1157NA produces 32 candlepower, but what comes through the amber coating is 24 candlepower. Unfortunately, there's no amber equivalent of 3496 for use in park/turn lights that have clear lenses. The next best thing is 2357A or 2357NA, which draws the same current as an 1157 and produces 30 candlepower despite the amber coating. 2357NA (or 2357A), as well as their non-amber 2357 counterparts, are considerably less expensive than P3496, but they lack P3496's anti-corrosion nickel-plated base, and they also lack P3496's Krypton gas fill, so they tend to blacken sooner than other bulbs if used in "bright" mode for prolonged periods (e.g. using a 2357 in brake lamp service). The 2357NA or 2357A works fine in front park/turn service because turn signal service is short and intermittent, which limits bulb blackening and makes overall bulb life acceptable.

Be careful when buying any of these bulbs. A lot of the major parts outlets are switching from name-brand bulbs worth buying to 3rd-world crapola not worth its blister pack. Only one company makes quality 3496s and 3497s, for example, that is Stanley. GE and Sylvania used to supply Stanley-made 3400-series bulbs, but both marketers went to Chinese lookalikes, and then to even cruddier Chinese ones that don't even look right. That's why to buy those particular ones at the Honda store.

The '68-'71 sidemarker lamps can be made about 60% brighter with 3886x bulbs, which also fit directly in place of the 1895s and 57s used in instrument cluster lights that take the metal bayonet-base bulbs.

1972-up sidemarker lights (and a lot of the '66-up instrument cluster lights) take an all-glass wedge-base bulb, which can be upgraded with 2886x bulbs - about 75% brighter than a 194, 60% brighter than a 168.

If your car has the little turn signal indicators mounted on top of the fenders, and one or both of them no longer flash, you can either spend $3.40 *apiece* at Year One for a replacement bulb with a plain brass base, or you can spend $10.60 and get a 10-pack of 'em with corrosionproof nickel-plated bases.

Flashing front sidemarkers

Another cool and useful (and legal) upgrade is to make the front amber sidemarker lights on '70-up cars do double-duty as turn signal blinkers so pedestrians, cyclists and drivers in the next lane or cross street can see you signalling. If they aren't already wired this way, it's usually simple to make the change, see here. This *can* be done on '68 cars, but it's tougher because the early sidemarkers use only one wire and get their ground via body sheetmetal. This can be worked around, but it's more effort.

3rd centre brake light

This is actually a really good safety device, though there was no shortage of grumbling when it was first introduced in 1986 in North America. It lets drivers behind you see you apply the brake earlier, and lets the drivers behind *them* see you do it, too. This is especially valuable for cars that have small/dim brake lights...'71-'73 Darts, among others. See the Allpar article. From the '80s through the mid '90s, the market was flooded with cruddy retrofit kits that were of very poor quality, looked ugly and had failure-prone logic modules that allowed easy (but failure prone) hookup to cars like ours, which have the brake lamp and turn signal function combined in one lamp. Most of us probably remember seeing an older American car with one of these junk retrofits...they never worked right. They'd blink with the left or right signals, or they'd be on when the brakes were off and off when the brakes were on, etc. Yuck. A *good* center brake light works well and doesn't really detract from the appearance of the car, but proper installation requires running one new wire from the brake lamp switch to the back of the car. This isn't very hard, all it involves is the wire itself, a piggyback terminal and removal of the left sill plates (which exposes the channel through which all the front-to-rear wiring runs).

If you install a center brake light, do NOT put any kind of a blinker or flasher device on it! These are out there on the aftermarket, but they are not a smart idea and they're also illegal. In North America, a flashing red light on the rear of the car means "turn signal" or "hazard flasher", so making the center brake light flash can only confuse the meaning of your rear signals as you try to convey them to other drivers.

Daytime running lights

Opinions run high in the car enthusiast community. Fact is, DRLs are not the bloody safety menace the anti-DRL types claim they are, but neither are they the next seatbelt or disc brake. The potential safety benefit from optimised DRLs is small, but it is real. If you drive an old car in a country where newer cars all have DRLs -- Canada, for example -- you're much harder to see in traffic without them. Most arguments against DRLs are legitimate, solid beefs about the problems caused by particular *kinds* of DRLs, not the concept itself.

Headlamp-based DRLs, both high and low beam, are very common in North America. They make a lot of problems: too much glare, too much fuel to run, they eat up expensive headlight bulbs, and they make the turn signals harder to see in daytime. And just turn on your headlamps during the day, either manually or automatically, isn't a good solution either. It increases fuel and bulb consumption, and because the taillamps are on it reduces the visual contrast between "not braking" and "Braking" conditions as your car is viewed from the rear.

Parking lamps are not DRLs; they're not anywhere near bright enough and the light isn't distributed through the right range of angles. And there's the brake/tail light issue, too.

For retrofit purposes, the best implementation is the full-time operation of the front directional signals (except, of course, when they are operating as signals). Chrysler has used this kind of DRL on some vehicles over the last twenty years, and you can enable it on any car with an easily-installed module -- see the Allpar article.

LED retrofits

LED signalling lamps (brake, tail, turn...) are appearing on cars, and are
widely used on buses and trucks, but are really cannot safely be retrofitted by replacing the bulb with an LED device. The signalling lamps of your car rely on a point source of light (glowing filament), collecting that light with a parabolic reflector and dispersing it with optics in the lens. An LED is a

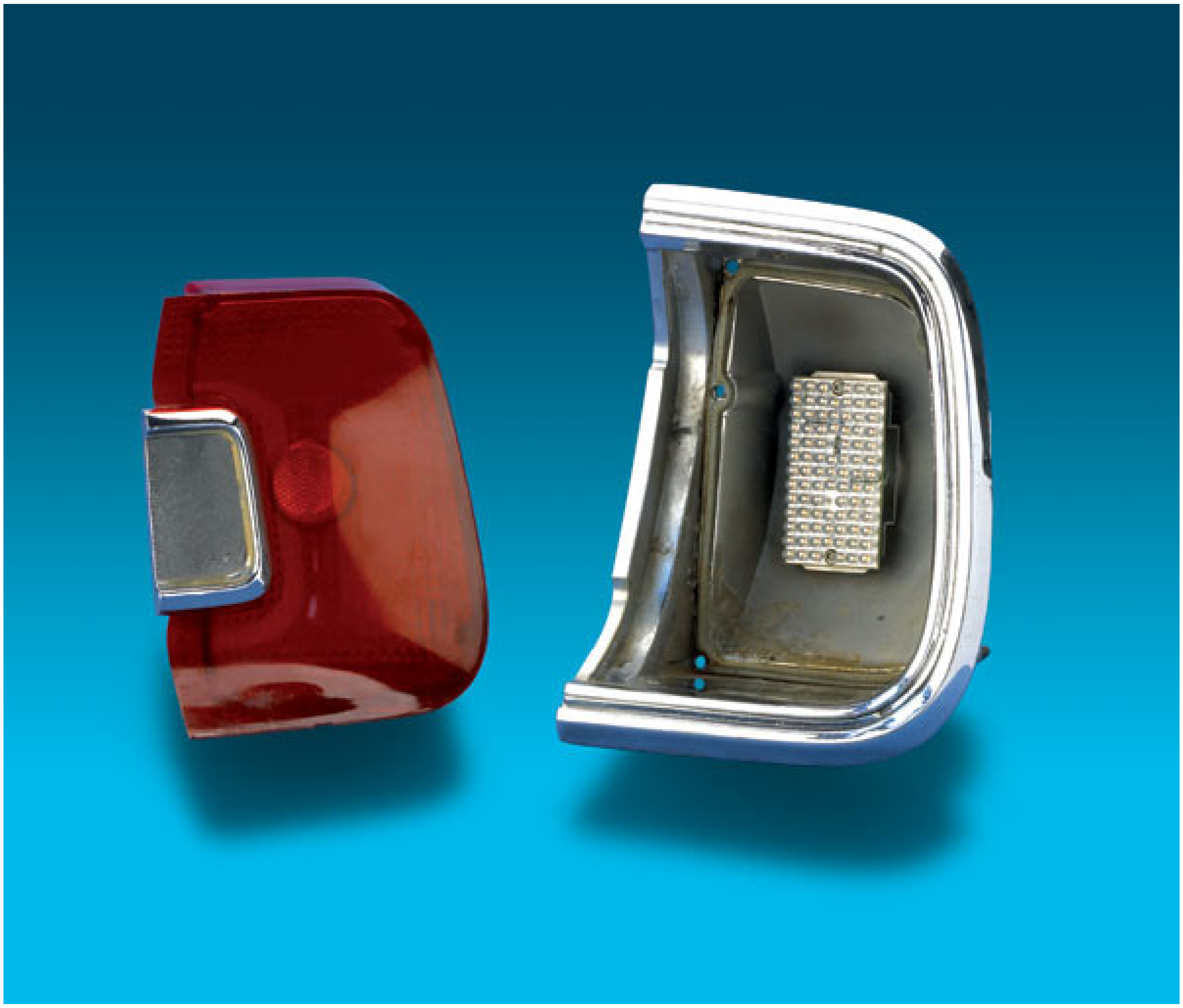
vastly different kind of light source. Unlike a glowing filament, it does not produce light in an even sphere. Instead, it projects a very narrow beam of light in ONE direction. That's why these so-called "LED retrofits"
are unsafe; there's no way you can get enough light through a wide enough angle (horizontally and vertically) to create a safe and legally-compliant lamp. Pulling up behind a car equipped with these "LED bulbs" is really obvious; there's a tiny spot of light right in the middle of the lens, and the rest of it is dark. This applies even to the clever $50 units with some of the LEDs pointing sideways.

There are other considerations, too -- it is tricky to get the right ratio of bright-to-dim intensities both on axis (straight behind the lamp) and also through the entire vertical and horizontal beam spread. Look at the optics of the Cadillac DeVille that has LED tail/brake lamps, or the high-end Mercedes S-class that has LED brake lamps. You'll see some very fancy optics used to coordinate the light from a lot of LEDs to get everything right in terms of brightness in both dim and bright mode, uniformity of brightness throughout the visibility angles required by law, ratio of intensity between "bright" and "dim" mode, etc. These kinds of optics are not something that can be kludged in the garage, let alone achieved with these "LED bulbs". Leave 'em on the shelf for the kids with Honda Civics to get tickets with.

Bulb-type brake (etc.) lamps really **need** to use bulbs. The model-specific LED "retrofits" are certainly less godawful than the so-called "LED bulbs" (1" wafer of LEDs on a bulb base), but they still mostly aren't a good idea. The performance of all exterior signalling functions (brake, tail, front and rear turn, parking, back-up, sidemarker, etc.) is regulated in great detail. It's not just a question of how bright they have to be!

There are specifications for minimum and maximum intensity, for each different function, through a large range of horizontal and vertical angles. That's to make sure that not only can the guy directly behind you see and recognise your brake lamps as brake lamps when he's sitting at about the same height as you, but so can the guy in the next lane over to the left, sitting down low in his Corvette...and so can the guy in the next lane over to the right, sitting way up high in his semi truck...and so can the guy on the on-ramp in his SUV. There are also specifications for the minimum intensity ratio, again through a large range of H and V angles, between functions that share a lit compartment (brake/tail, for instance, or park/turn). That's so that your taillamps can't be mistaken for brake lamps, or your brake lamps for taillamps. There are specifications for minimum projected active illuminated surface area, to make sure that the lamps, when lit, are "big" enough to do a reliable job of grabbing attention and quickly and accurately conveying the intended message.

When you use a bulb in a bulb-type lamp, the entire reflector is illuminated when the bulb comes on. Now, leaving aside the photometric requirements (intensity through various angles, bright/dim ratio), take a look at these two Hi-Tech "conversions" and think about that last requirement I mentioned (active illuminated area):



H'mmm...now, without some very fancy measuring and calculating, I can't determine if these LED "conversions" will reduce the active illuminated area below the legal minimum, but it will certainly reduce it. Safety...?

As far as intensities and intensity ratios, the only way to test this is with a goniophotometer, which is just as specialised a piece of equipment as the name suggests. It's a machine that measures the amounts of light being emitted by a device, over a range of angles relative to the axis of the device. It produces a plot of the intensity that looks like this (this one's for a low beam headlamp), and from that plot and the raw data, it can be determined whether the device meets all the requirements. Snapping a picture or filming a video of taillights and saying "Gee, wow, lookit how bright they are!" just plain doesn't cut it. Neither the human eye nor a camera is an appropriate or valid measuring device for assessing the safety performance of vehicle lighting devices.

There is an additional issue with LEDs that is not at all addressed with these "conversions": Heat. Everyone knows LEDs produce hardly any heat, right? Wrong! LEDs are commonly considered to be low-heat devices due to the public's familiarity with small, low-output LEDs used for electronic control panels and other applications requiring only modest amounts of light. However, LEDs actually produce a significant amount of heat per unit of light output. Rather than being emitted together with the light

as is the case with conventional light bulbs, an LED's heat is produced at the rear of the emitters. The difficulty is that LEDs' light output is extremely variable depending on temperature, with many types producing at 30° C (85° F) only **60%** of the rated light output they produce at an emitter junction temperature 16° C (60° F). Take one hot day...add one traffic jam with extended brake light "on" time...and it is extremely likely that these LED "retrofits"' output will drop to such a degree that the lamp assembly will no longer produce minimally adequate safety performance.
The opposite case is also true: Many types of LEDs produce at -12° C (10° F) up to **160%** of their 16° C (60° F) rated output. Take one cold night, add LED "retrofits"...and the lamps will not perform safely.

All of these factors can be managed, otherwise we wouldn't see LEDs showing up as original equipment on some cars (and the almost complete adoption of LEDs in the standard-size lighting devices used by heavy trucks and buses). Thing is, all of those devices are engineered and tested from the start *as* LED devices. They are not bulb-type devices with LEDs "retrofitted" into them. They contain intricate control circuitry that compensates for output change with temperature, and advanced heat sinks that minimize heat buildup behind the emitters (with resultant output drop). They contain optics specifically designed to collect and distribute the light from LED emitters, which bulb-type lamps do not. All of that engineering and testing is missing from these LED "retrofit" kits.

It is possible that some of Hi-Tech's "retrofits" may result in safe, legally-compliant lamps. But none of the relevant information is present on their website, and their response to my inquiries was not confidence inspiring ("They're bright enough. They're really bright. Don't worry about it.") In order to know for sure, each retrofit kit would have to be tested in the lamp for which it is marketed. My experience in such matters tells me there would be a large number of failures.

That said, some of our cars' lights lend themselves more easily to a good LED retrofit job than others. The reason why so many more trucks and buses than cars use LEDs is because all trucks and buses use standard-format signalling lights. With just four size formats of complete self-contained LED lamp assemblies, virtually the entire on-road North American fleet of trucks and buses can be serviced. The formats are roughly: 7" round (used on buses and ambulances), 4" round (used on the majority of semi tractor-trailers), 3" x 5" rectangular (used on semi tractor-trailers) and 2" x 6½" (used on semi tractor-trailers). If your car happens to have lamps of about this size, with some creativity it's probably possible to remove the bulb, socket and reflector assembly and install a truck-type LED module behind the lens. Round-taillamp cars like '61-'62 Lancers, '60 Darts, '63-'64 Darts and A100 vans come to mind here.

If you decide to try and retrofit LEDs in this manner, be sure to observe and stick to the intended function of the LED lamp you buy. Marker and clearance lights will fit where brake/tail ("S/T/T, Stop Tail Turn") lights won't, but marker/clearance/side turn lights do not produce anywhere near enough light for use as brake or front/rear turn lights.

Headlamps are discussed here amongst other threads.