Low Profile Tyres

‘Profile’ is the relationship between the width of a tyre – shoulder to shoulder – and its sidewall height – rim to tread. Profile is expressed as a percentage of height to width, so a 100 percent profile tyre like the 7.00x16 bias-ply tyre from the 1950s and 1960s has a sidewall height that’s the same as its width.

When tubed radial tyres displaced bias plies in the 1970s they introduced a 90 percent profile (7.50R16) that had almost the same rolling radius as a 7.00x16, but with half an inch more tread width.

Tubeless versions in the 1980s saw the common profile drop to 85 percent. The 235/85R16 size was the equivalent of the 7.50R16, with a 45mm wider shoulder to shoulder dimension increase.

During the late 1980s and early 1990s the 4x4 world considered the 85-profile tyre to be ‘low profile’, but passenger car tyre development was already trending much lower than that. The 4x4 tyre followed after the early-2000s Range Rover introduced 60-profile rubber.

Today, you can buy tyres to fit your 4x4 with profiles as low as 35 percent.
You can tell the profile of a 4x4 tyre by looking at the code on the sidewall: the section width (in millimetres) is followed by a forward slash and the profile figure. Most new passenger-carrying 4x4s are delivered on 65, 70 or 75 profile tyres, so sidewall codes look typically like 275/70 or 235/75. However, new luxury 4x4s are delivered on 60 or even 55 profile tyres.

Why Lower the Profile

There are several reasons why 4x4 makers are taking the low profile tyre path: more precise steering; better on-road handling; more powerful braking; quicker water dispersal; more torque capacity; and the fashionable ‘fat tyre look’.

Low profile tyres improve steering response because there is a reduced amount of flexible sidewall between the wheel and the tyre tread. If you fitted a video camera to the front mudguard of a 4x4 and steered it around a series of hard turns you’d see how sidewall flex slows down the steering action that’s imparted to the wheel.
In the case of a higher-profile tyre the wheel can be seen moving momentarily before the tyre follows it.

With a low profile tyre there’s no perceptible tyre sidewall flex and the wheel and tyre carcase move as one in response to steering inputs.
A low profile tyre can improve on-road handling, because the stiffer sidewall doesn’t roll towards the inside of the corner and so the tread area remains more stable, in contact with the road.

As the on-road performance of 4x4s continues to increase the need for more powerful brakes rises in proportion. We saw a shift in the 1990s across the entire 4x4 large wagon market from 15-inch to at least 16-inch wheels and the main driver for that move was the need to fit bigger-diameter brake discs. As power levels and braking demands climb higher the shift from 17s to 18s, 19s and even 20-inch wheels has begun.

The torque load on the tyre is at its greatest at lift-off and under heavy braking, and the torque capacity of a tyre is generally increased if its sidewalls aren't very tall. A stiffer sidewall is better able to resist the tendency for the wheel to rotate inside the tyre – look at slow-mo footage of a dragster taking off for an illustration of tyre sidewalls distorted by engine torque.

Low Profiles Off-road

Our off-bitumen test experiences in the early 2000s with 60-profile tyres weren't all good. They worked OK on gravel roads and rocky trails, but we found that they dug in easily in soft sand.

Looking back on these 2003 tests we were probably overly concerned with damaging the sidewalls if we lowered pressures too much. Alongside the 75-profile 16-inchers that were fitted to most wagons and utes of the time the 60-profile tyres didn't perform well at the slightly reduced pressures we were using on soft sand.
Typically, we'd drop the pressures on a 100 Series or a Pajero to mid-20psi levels and these wagons would float happily over the sand. The same pressures in a Range Rover's 60-profile tyres saw it digging in.

Over the last few years we've driven many more 4x4s on low-profile rubber and have had very few punctures. With our confidence levels thus raised we've become much more adventurous with low-profile tyres.

Our own Discovery 3 clocked up 45,000 kilometres on a set of Cooper Zeon XST 265/60R18 tyres. Of that mileage around half was on stony Outback roads or off-road tracks. During a trip to Geosurveys Hill, in the northern Simpson Desert, the Zeons had to handle five days of trackless mulga-scrub country.

There were no punctures and the tyres were taken off with plenty of remaining tread left.
More recently the Zeons were replaced by a set of Cooper H/T Plus tyres. They did Cape York, with side trips to the Maytown gold mine ruins on the Palmer River and Cape Melville. Once again, no punctures, just some minor stone chipping.

However, the Plenty Highway gave us two minor punctures, through the treads, that we repaired on the roadside.
To qualify these results somewhat, we travel light and current low-profile tyres (60 profile or lower) don't have the load ratings of true light truck tyres, so they're not the ideal fitments for 4x4s that are heavily loaded and required to run at highway speeds on stony roads.

Contact Patches, Profiles and Widths

In sand, a 60 or lower-profile tyre running at road pressure has the worst possible initial contact patch – wide and short – that piles up a broad mound of sand in front of it. Interestingly, it isn't the low profile sidewall that's the culprit in this situation, but the fact that the low profile tyre gets its grip across, rather than along, its contact patch.

That means the vehicle is climbing mini sand hills to make progress.

At the same time, the short contact patch doesn't allow the tyre to compact much of a chain of sand grains together, in shear, and get some grip. On hard surfaces the shape of the contact patch isn't an issue.

In contrast, a higher-profile, narrower tyre with the same contact patch area has a longer, narrower footprint on sand. The little sand hill in front of each tyre is smaller and the longer contact patch can compress more sand grains in shear, for added grip.

Lower the pressures in both tyre types and the higher profile tyre gets the benefit sooner, because its contact patch lengthens and widens at higher pressures than the low profile one.

So, in soft beach sand, low profile tyres work well with pressures somewhat lower than those we've used in higher-profile tyres. Those of us who've driven many different vehicles over many years on sand can recognise a 'sweet spot', when the vehicle is at its optimum. The equation of vehicle weight, tyre footprint and engine torque is manipulated by dropping tyre pressure to the point where progress is almost as effortless as it is on hard surfaces.

For a modern, loaded 4x4 running on soft beach sand, on 60 or lower-profile tyres that pressure is in the 16-20psi range. The same machine, running on higher profile tyres might get away with a pressure range of 20-24psi.