

# Morris Minor Gear Ratios

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The Morris Minor was meant to be used around town and on secondary roads. Consequently, to get acceptable acceleration with the small motor, it is configured with very low gearing (numerically high). This creates somewhat of a dilemma for those of us in today's world where it is difficult to get places without spending at least some time on the freeways, causing that poor little motor to buzz along at uncomfortably high RPMs.

I originally bought my Traveller in California, and drove it home to the Seattle area along coastal secondary roads in order to keep from backing folks up. According to my calculations, with the stock tires (5.20-14) and gearing (4.55:1), the motor was spinning along at over 4,000 RPM while doing 60 MPH. Not what you want to do if you want a long lived-motor, so I limited myself to about 50-55 MPH.

I thought that some of you might be interested in examining alternatives for reducing the RPM.

## Tire/Wheel Changes

The easiest way to reduce RPMs is to change tire sizes. The stock tires have a diameter of 22.3". It's easy to figure out the diameter of other tires. Here's the formula:

$$\text{Overall Diameter} = \text{wheel diameter} + \text{tire width (in inches)} * \text{tire aspect ratio} * 2$$

So, a 165-70R13 tire has 13" diameter, the tire width is 165 mm (divide by 25.4 to convert to inches), and an aspect ratio of 70%. When plugged into the formula, the diameter of the tire is:

$$\text{Overall Diameter of 165-70R13 tire} = 13 + 165/25.4 * .70 * 2 = 22.1"$$

As a result, if you change from the original small 14" tire size to a commonly-sized 13" radial such as the 165-70R13, you will increase the RPMs by about 1%, but larger 13" tire sizes can reduce your RPM. Because of the unusual 4"x4 bolt pattern, we know that replacement wheels for our Morris Minor are a lot easier to find in 13" rather than 14" diameters. By the way, if you work the formula backwards, the factory Morris Minor tires, by modern measurement standards would be about 135-80/14.

The change in RPM is directly proportional to the ratio of tire diameters. So, for example, if the tire has a 10% larger diameter, the RPMs will decrease by 10%.

## Differential Changes

The stock Morris motors may not have adequate power if you reduce the RPMs considerably, but with slightly larger motors (or warmed up original motors), one can also change the center-section of the differential to another gear ratio. The most popular is the 3.9:1 which is used in all the 1275 Sprites and Midgets (same cars that make good disk-brake donors). From my experience, changing the differential center section is pretty much a bolt-in other than drilling/tapping a filler/level plug into the Morris differential housing.

Other alternatives would be the 4.2:1 gear-set used in early (pre-1275) Sprite/Midgets and later Morris Minors (after '63), and the 3.7:1 used in Sprite/Midgets built after August 1976. The latter is fairly hard to come by because of low production volumes of these cars.

### Comparing the Changes

Using these calculations, here are the RPMs at 60 MPH with various size tires and gear ratios.

<b>RPM at 60 MPH – 4<sup>th</sup> gear</b>				
<b>Tire Size</b>	<b>RPM - 4.55:1 gearing (stock)</b>	<b>RPM - 4.2:1 gearing</b>	<b>RPM - 3.9:1 gearing</b>	<b>RPM - 3.7:1 gearing</b>
5.20x14 (stock)	4,115	3,798	3,527	3,346
165-70R13	4,153	3,833	3,560	3,377
175-70R13	4,052	3,740	3,473	3,295
185-70R13	3,956	3,652	3,391	3,217
165-70R14	3,973	3,667	3,405	3,230
175-70R14	3,881	3,582	3,327	3,156
185-70R14	3,792	3,500	3,250	3,084
195-70R14	3,708	3,423	3,178	3,015
195-75R14	3,596	3,319	3,082	2,924

This and a similar chart below are both based on the RPM at 60 MPH so that you can more easily compare the two. To change to a different speed, for example 70 MPH, just multiply each number by 1.17 (which is 70/60).

### Transmission Changes

One of the popular modifications to Morris Minors is to install a Datsun 210 5-speed transmission. This gives one the advantage of having synchromesh in first gear, and an overdrive 5<sup>th</sup> gear. Kits for this conversion are available from places such as Rivergate ([www.Rivergate5Speed.com](http://www.Rivergate5Speed.com)). The overdrive ratio is 0.821:1, giving you an 18% reduction in RPM, while still having similar ratios in the lower gears. Here's a comparison of the ratios between the two gearboxes.

<b>Transmission</b>		
<b>Gear</b>	<b>Morris Gearbox</b>	<b>Datsun 210 Gearbox</b>
1 <sup>st</sup>	3.628:1 (non-synchro)	3.513:1 (synchro)
2 <sup>nd</sup>	2.374:1	2.170:1
3 <sup>rd</sup>	1.412:1	1.320:1
4 <sup>th</sup>	1:1	1:1
5 <sup>th</sup>	N/A	0.821:1

Here's a table similar to the one above, but now with using overdrive 5<sup>th</sup> gear with the Datsun transmission.

<b>RPM at 60 MPH – Overdrive 5<sup>th</sup> gear</b>				
<b>Tire Size</b>	<b>RPM - 4.55:1 gearing (stock)</b>	<b>RPM - 4.2:1 gearing</b>	<b>RPM - 3.9:1 gearing</b>	<b>RPM - 3.7:1 gearing</b>
5.20x14 (stock)	3,378	3,118	2,895	2,747
165-70R13	3,410	3,147	2,922	2,772
175-70R13	3,327	3,071	2,851	2,705
185-70R13	3,248	2,998	2,784	2,641
165-70R14	3262	3,011	2,796	2,652
175-70R14	3,186	2,491	2,731	2,591
185-70R14	3,113	2,874	2,668	2,532
195-70R14	3,044	2,810	2,609	2,476
195-75R14	2,952	2,725	2,531	2,401

### **Summary**

Hopefully this is of help to you in figuring out changes that you might make to your Morris Minor. On my Traveller, I have installed a 1500cc Datsun 210 engine (with SU carbs), along with the mating Datsun 210 5-speed gearbox, 3.9:1 rear-end gears, and 185-70/14 tires. I like the lowered RPMs (2,668 at 60 MPH), and the car would easily pull 3.7:1 gears if I were to make that change. With the present combination, not only is it more relaxed during cruising, it gets significantly better fuel mileage than when stock.