

Engine, Foot and Terrain Braking

What is Engine braking?

Engine braking is when you're driving down a road and take your foot off the accelerator.

The engine will naturally start slowing down to 800rpm (0.8 in the picture).

If your clutch is up and you are in gear, then you have joined the engine to the car and so a by-product of the engine slowing is that it also slows the car to a degree. This is quite a subtle brake but very important and useful.

You should be aware that the more revs you have, the more engine braking you have. You will lose speed quicker between 6000rpm and 4000rpm than you will between 3000rpm and 1000rpm for instance.

When you get to 800rpm, the car will pull you along the road so you have no engine braking at all; get below 800rpm and the car will try to accelerate you back up to 800rpm.



What is Foot braking?

This is a no brainer, the more you push the brake pedal, the quicker the car stops.

What is Terrain braking?

This could also be known as World Braking I suppose; it's how the world around us affects the car.

Going uphill will slow down quicker than on a flat; you might even pick up speed going downhill.

Driving on gravel will slow you quicker than concrete, ice will not be as effective as concrete.

Head wind will slow you more than a tail wind.

The Situation

Assuming that you are driving a manual car, when we want to drive off we want our feet on the clutch and accelerator.

We want this so that we can raise our revs just prior to pulling away to lessen the chances of stalling the car as we bring the clutch up a bit.

The clutch basically moves revs from the engine into the gearbox to give us motion. If we don't raise the revs, the bite on the clutch could drop the engine revs below minimum speed and stall us; the fix for this is to raise the revs away from idle prior to using the clutch.



The Problem

The world is not flat and so there's a very good chance that you will be on a hill when you get to a junction.

If you approach an up-hill junction on a brake pedal and stop, when you take your foot off the brake to drive off, you are very likely to roll backwards into whomever is walking behind the car – this is bad!

You will have to perform a hill start at this point which means putting the handbrake on, getting your feet on the correct pedals, getting a bite and raising revs before slowly lowering the handbrake to move off.

Now, I do hill starts all day long and there's nothing wrong with them, they're very useful!

However, if I drive in such a manner that I force myself into a hill start at every junction, then I am incorporating delays that just don't need to be there. Wouldn't it be better to 'arrive ready to drive' and if there's a hole in the traffic, just drive into it? Of course it would be!

So therefore, if I can get my feet on the clutch and accelerator prior to arriving at the junction then I'm in a good position to just flow out into traffic.

I want you to think of the brake pedal as a pedal we use to top up the deficiencies in the other two brakes: engine and terrain.

In theory, given enough road, you could take your foot off the accelerator, the car would slow, clutch down around 1000rpm (to avoid being pulled along the road) and the car would roll to a stop in due course.

You would need a lot of road for this, so what we do is speed up the slowing process by supplying additional braking half way through. I still want to let terrain braking do the last little bit if I can though because I want my right foot on the accelerator when I get to the junction.

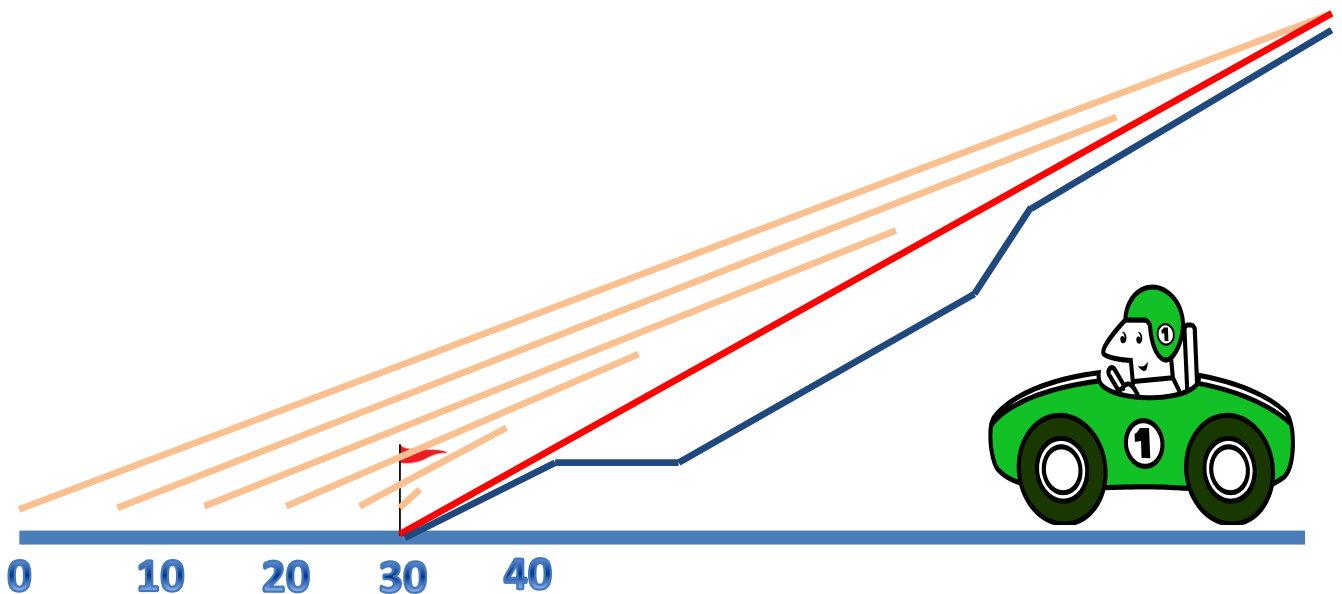
Now, most learners think that you brake for the place you want to get to (see red line in diagram on next page), you don't. If you apply brakes to stop at a place and half way through braking you suddenly go up hill (blue line on the diagram over), you'll end up stopping too soon, then you'll have to drive along a bit more and that will confuse everyone behind you.

You want to let engine and terrain braking do the work and then top up with foot brake when it looks like you're going to overshoot your stopping point. At the last moment you get off the brake pedal if terrain can do the last little bit for you.



$$E_{\text{engine}} + F_{\text{foot}} + T_{\text{terrain}} = \text{Total}$$

5		2	7	7	23
4		-3	1	8	22
3		1	4	12	18
2		3	5	17	13
1	1	1	3	20	10
0	2	1	3	23	7
0	1	1	2	25	5
0	3	1	4	29	1
0	0	1	1	30	0



You need to supply 30 lots of braking to stop at the flag; supply too little and you'll overshoot, supply too much and you'll stop early.

1. Foot off the pedals, you initially get 5 engine and 2 terrain totalling 7 braking; you are projected to stop at 7.
2. As you slow, your revs drop and so the amount of engine braking you get reduces.
3. Now you get 4 engine and this time we go down hill so you get 3 terrain accelerating totalling 1 braking so you are projected to stop at 8.
4. Then you get 3 engine and 1 terrain, projected to finish at 12.



5. Then you get 2 and 3 projected to finish at 17 but you're getting close to your finishing point and it looks like you're going to overshoot, you'd better start thinking about adding a bit of foot brake.
6. 1,1 and 1 gives an extra 3 so now you're projected to finish at 20.
7. You've now got so slow that you have to push the clutch down to avoid stalling the engine, you have now lost engine braking. Now it's just foot and terrain braking so you need to supply the brake pedal to top up the braking where it's lacking.
8. You can see that you might need to increase or decrease the pressure on the pedal to vary the amount of braking.
9. When you are a few car lengths away from your finishing point, slip the car into 1st gear and get ready to hold the car still using the clutch.
10. Finally, at the last moment, remove your foot from the brake pedal and let the car roll to a stop by way of terrain braking.

You should now catch the car with the clutch pedal. The clutch bite will stop the car rolling backwards; the hill will stop the car rolling forwards. If you have good clutch control they will cancel each other out and you can hold the car still on the hill.

Crucially, your right foot is over the accelerator so if you can go, you just raise your revs, slightly bigger bite and you're away!!!

Remember that if you are pointing downhill, you will need to still use the brake pedal. This is not a problem, because when you take your foot off the pedal, the car will roll forwards and this is what we want anyway.

Just a word of caution, having a bite for a long period of time generates a lot of friction in the clutch plates. This in turn generates a lot of heat and you can smell burning sometimes, keep burning the clutch and you could shatter the flywheel and basically lose your gearbox – not good; very expensive to fix.

However, there's a big benefit of using the clutch for short periods of time before you try to set fire to your car because your driving style will be so much smoother and fluid.

Summary:

1. We use the brake pedal to top up deficiencies in the engine and terrain braking.
2. Always 'aim short, 1st gear, creep'.
3. If 'a pause becomes a await' i.e you're going to be held up for a while, by all means put the handbrake on and wait with the clutch down (to avoid burning the clutch). We are trying to avoid driving in a manner that forces us to do a hill start every time; there's nothing wrong with doing a hill start when you actually need one.

