Dear lady at head office (Customer Experience Genius),

I have done some measurements on the effectiveness of the brake pedal and here are the results.

The brake pedal sits 160mm from the floor when measured perpendicular to the front face of the pedal itself.

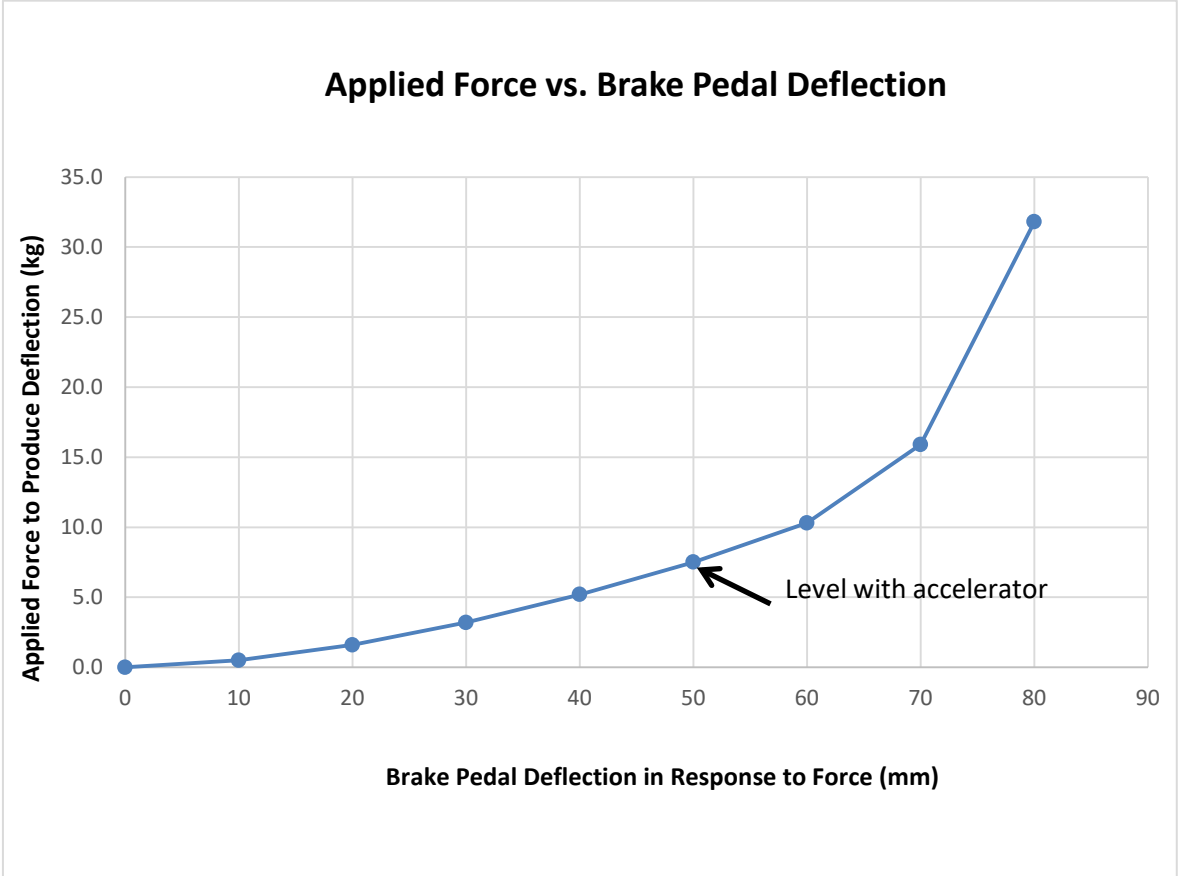
As the pedal is pressed it rotates through an arc. The measurements in the table below are distances along that arc from the starting base height of 160mm.

The total distance through which the pedal can be moved is 80mm. After this point the brake fluid cannot be further compressed by the driver.

The forces required for deflection were measured using a calibrated force gauge and the engine was idling in park.

The brake pedal is equipped with a spring that holds the pedal against its upper stop and assists in returning the pedal to its upper (rest) position when the driver's foot is removed from the pedal.

Pedal Height above floor (mm)	Pedal deflection (mm)	Force to produce deflection (kg)
160	0	0.0
	10	0.5
	20	1.6
	30	3.2
	40	5.2
	50	7.5
	60	10.3
	70	15.9
	80	31.8



As can be seen from the graph of the results table the pressure felt by the drivers right foot when pressing the brake pedal gradually increases until shortly after the brake pedal reaches the height of the accelerator pedal. At this point the resistance rapidly increases as the system reaches its compressibility limits.

In real terms to the driver, the brake pedal is spongy, there is no noticeable effective resistance from the brake pedal until a deflection of approximately 40mm is achieved. When driving, this is when the brakes seem to begin to have an effect, albeit a small one. When the brake pedal deflection reaches a deflection of approximately 60mm the brakes are quite effective.

The problem with this is that the brake pedal has to move through 50% of its available movement before the brakes really start to do anything.

In a brake system the brake pedal operates the master cylinder via a pushrod. The pushrod doesn't fill the exact distance between the pedal and master cylinder. There is usually a small gap of 1 to 2mm. In real life this usually translates to approximately 10mm at the pedal face. That is to say, when you press the brake pedal it should move approximately 10mm before it begins to operate the hydraulic system via the master cylinder. As you press the brake pedal further the master cylinder pushes more fluid into the brake system thus increasing the pressure and consequently the braking force.

I have measured the pedal free play at the brake pedal and it is 6mm. This seems to be in line with what would be expected. Thus the Yeti's brake pedal initially travels through approximately 8% of its available travel, the pushrod begins actuating the master cylinder and then braking action should begin.

Although I don't have measurements from before the brake change I know from my experience driving the Yeti that this probably wasn't too far off the mark as I used to gently tap the pedal if I wanted to disengage the cruise control without actually initiating any braking action. Additionally, I didn't have to push the brake pedal very far to achieve effective braking. It is a difference that you immediately notice when you drive the car before and after.

As far as I am aware in the Yeti ABS the master cylinder forces additional fluid under pressure into the wheel cylinders via the ABS module. The ABS module shouldn't really come into play and operate valves to relieve pressure to a wheel unless it locks up. The master cylinder wasn't changed or removed and therefore the pedal / master cylinder (via the pushrod) relationship should be unchanged. Thus pedal free play should be the same.

To my mind this leaves only 2 options (assuming a serviceable ABS module without any sticky valves or internal leaks) was installed. These are:

> Air in the system. Brake systems use fluid and it can't be compressed. If there is any air in the system then the brake system will have to compress any air first before effective braking can be achieved. This is normally typified by a spongy brake pedal and excessive brake pedal movement to achieve braking. In extreme cases where there is too much air the brake system will be unable to compress the air and the pedal will go to the floor without effective braking being established.

The second option is that during the bleed process a seal in the master cylinder has become partially displaced or damaged and, as a result, some of the fluid in the master cylinder is bleeding back past the seal into the reservoir instead of being sent to the brakes. I believe that this scenario is unlikely as it would cause the brake pedal to gradually sink to the floor if it was held down. This does not occur.

So could you please have your ”experts” provide data in relation to the design effectiveness of the braking system to attempt to determine why the brakes are worse now than before maintenance was conducted on the system. I am sure that brake system effectiveness would had been addressed in the Yeti design approval data.

Alternatively if you like I can pressurize the system via the brake pedal ad crack each of the bleed nipples on the callipers to check for the presence of air in the system as it is typically forced to the end point. After this I could repeat the above measurements to check for any differences. I am happy to video the experience and could even live stream it to Youtube for everyone to see; if you want.

Kind regards

Kev Manning