BMW E46 M3 AFE Magnum Force stage 1

cold air intake system review

Review and notes

The BMW e46 3 series is an incredible work of automotive art and mechanical design. Even as the E46 is more than ten years old, it still turns heads and creates jealous looks at stop lights and parking lot conversations.

As the cars have aged though, technology and automotive design has continued to advance and improve in a number of ways. The good news is those advances can be easily integrated into our BMWs to improve their already impressive performance.

A cold air intake is a tremendously economical way of both improving stock performance and how your car sounds. This is an excellent place to upgrade your car as the return on investment is very high both in direct value and in the time to do the work and Advanced Flow Engineering (AFE) is a fantastic place to start.

The Advanced Flow Engineering cold air intake stage 1 is a substantial change from the OEM airbox design and filter. At peak it adds 11 horse power and 10 pounds of torque which is a significant increase you can both hear and feel. Adding real horsepower to a car as well designed as the BMW M3 can be a challenge, but this product actually does it.

I won't repeat all of the posted statistics as you can refer to them here, but will focus on how it feels and sounds to have this CAI installed. What matters is how the dry statistics of HP and torque gain translate into the literal and visceral sensation of driving your car. Instead of formal dyno statistics, what do your ears and your "butt-dyno" tell you?

How does the car *feel?*

Quick notes regarding installation:

The CAI stage 1 kit was installed with the Pro 5R oiled air filter and optional intake system scoop and torque booster tube. I highly recommend including both as they do what you need and provide higher air volume into the airbox. Refer to the installation guide links included below for HOW to install these products.

E46Fanatics.com review and installation guide

Testing components:
Magnum FORCE Stage-1 PRO 5R Intake System; BMW M3 (E46) 01-07 L6-3.2L 54-10461
Magnum FORCE Intake System Scoop; BMW 3-Series/ M3 (E46) 01-06 L6 54-10468
Magnum FORCE Torque Booster Tube; BMW M3 (E46) 01-07 L6-3.2L (Blk) 54-10469-B

Sound:

For the purposes of this review, a 2004 E46 M3 convertible with stock exhaust was used for testing. This test being a convertible will influence in cabin testing results the most dramatically. Coupes will see different in-cabin results which are to be as expected and all samples were taken with the top down.

Adding a cold air intake will affect the sound of your car, as it is able to draw in more air both at low speed idle but also heavy acceleration. What was important to me in reviewing the CAI, was to actually understand and measure that change. It's easy and anecdotal to say it has changed, but better to actually be able to show that change.

Anecdotal first: it *definitely* sounds different from the first restart after installation. At idle, there is a subtly deeper note in the exhaust, like a deeper harmonic.

At acceleration though is where I hear the most change: There are two new tones in the exhaust! There is a distinct new mid tone harmonic and the deeper note is now even more apparent and dramatic.

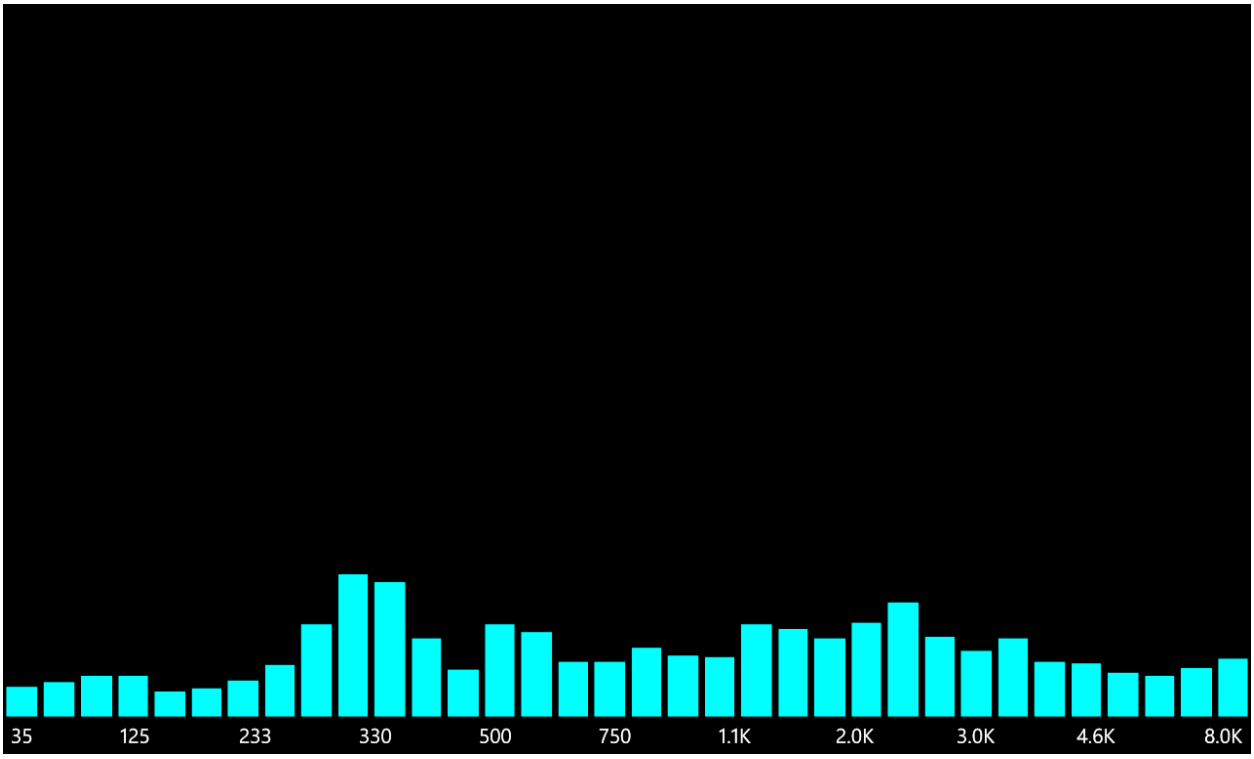
While investing in your car simply to change how it sounds, which isn't just the case with this CAI, it would be worth it for that element alone. The deeper harmonic at idle is impressive and now accelerating with enthusiasm sounds even better.

Sound alone isn't the only change, but the most easily measured so let's continue on to the results.

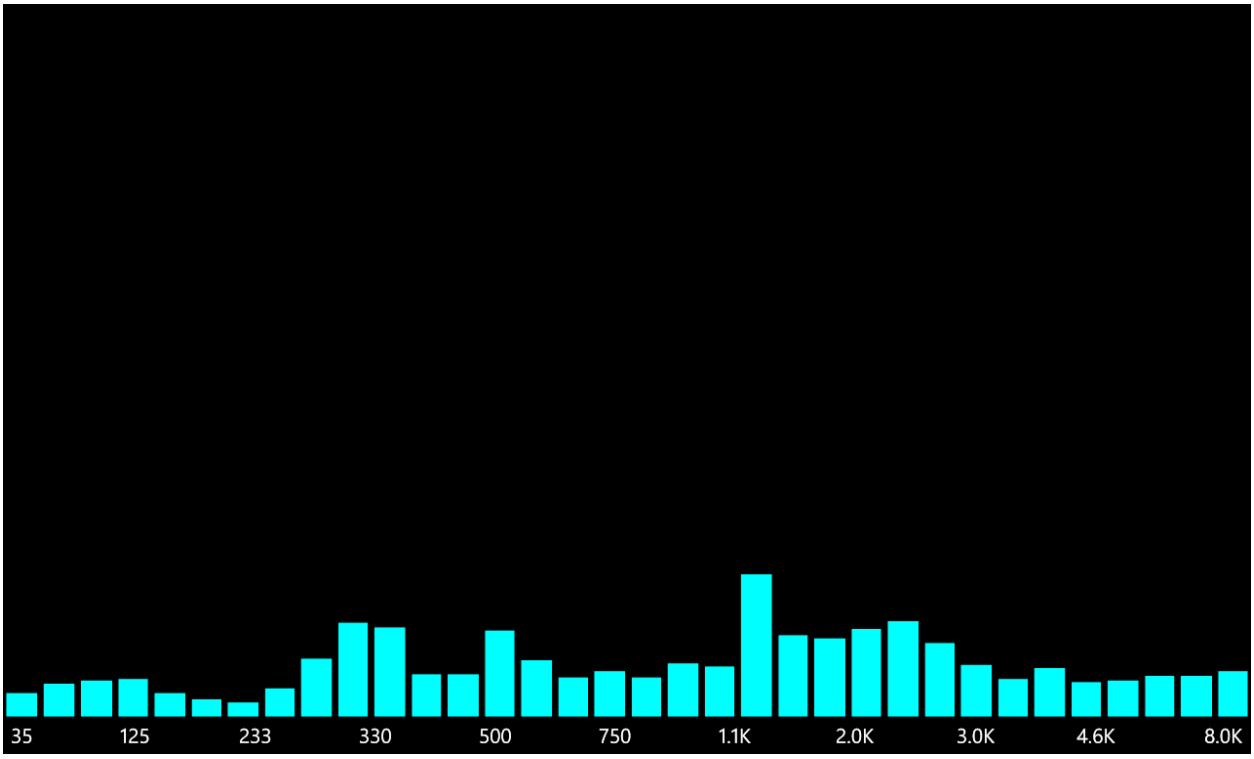
The spectrum analysis is a snapshot in time of course and can be affected by any number of variables, but still is a useful tool to see how it has changed. Samples were taken with a hand spectrum analysis tool capturing just above the airbox, sitting in cabin and centered between the exhaust pipes. Because of the difficulty in capturing representative samples during acceleration or on the road, those tests have been excluded by can be easily extrapolated from the idle testing results.

The scale is in hertz through 8 kilohertz and the most common audible levels.

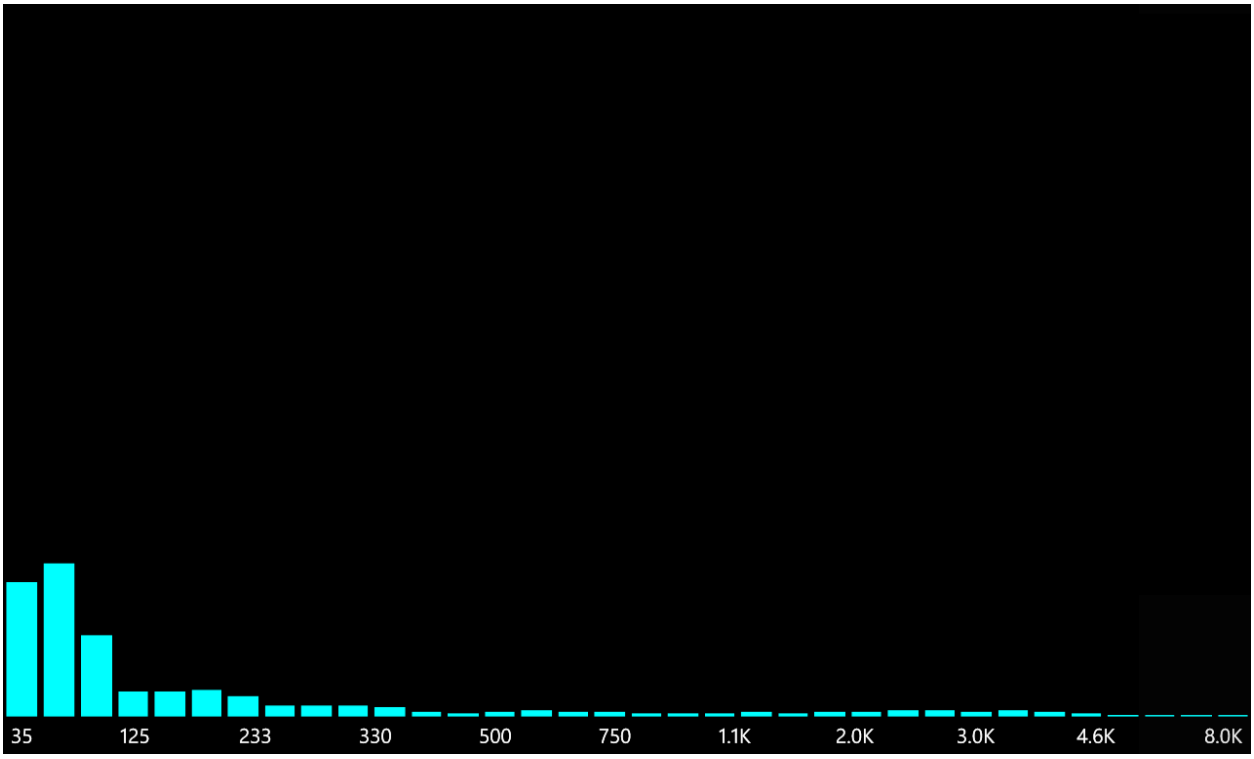
OEM sample taken at the airbox at idle.



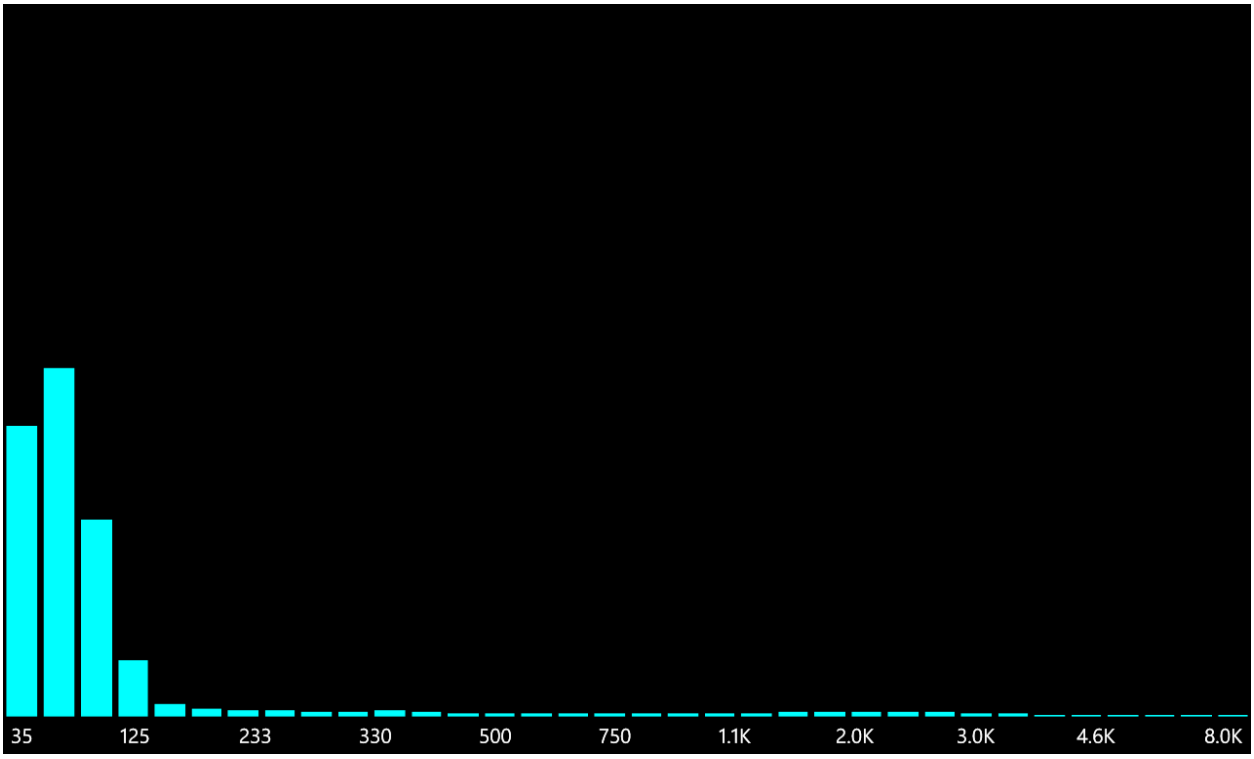
AFE Stage 1 sample taken at the airbox at idle.



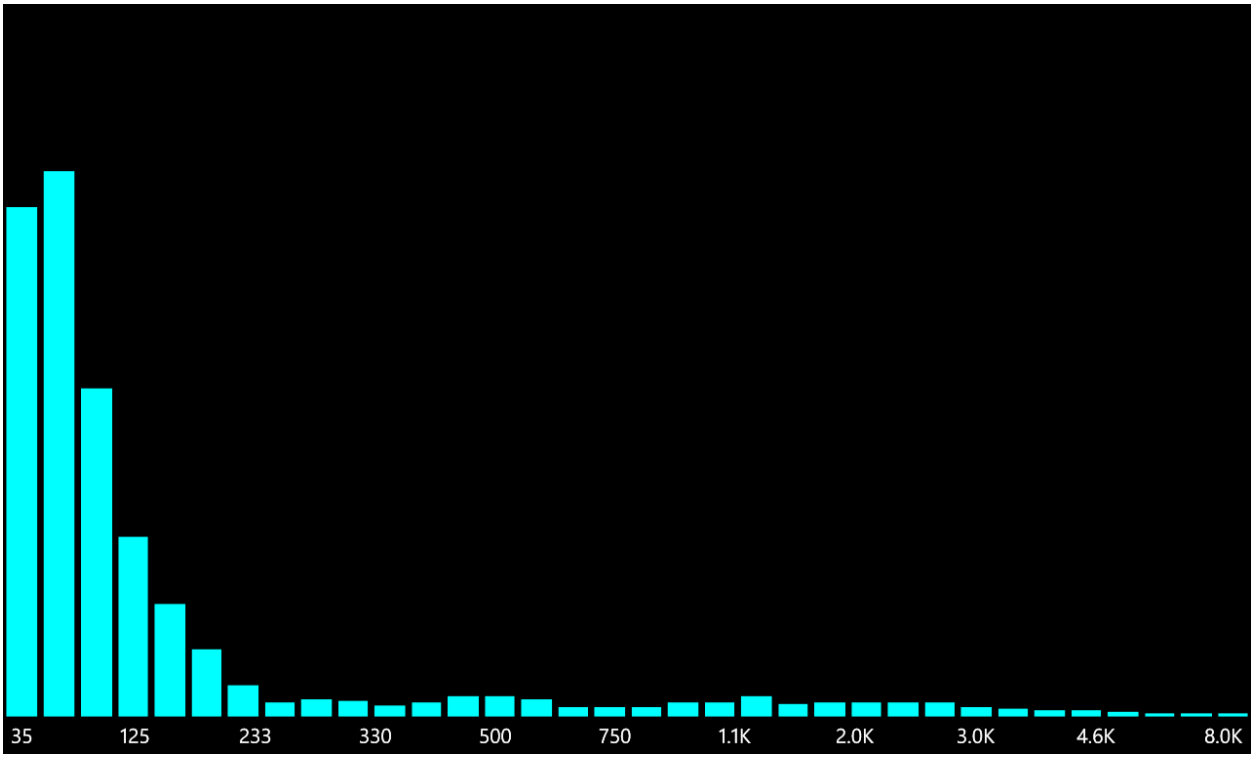
OEM sample taken in cabin at idle



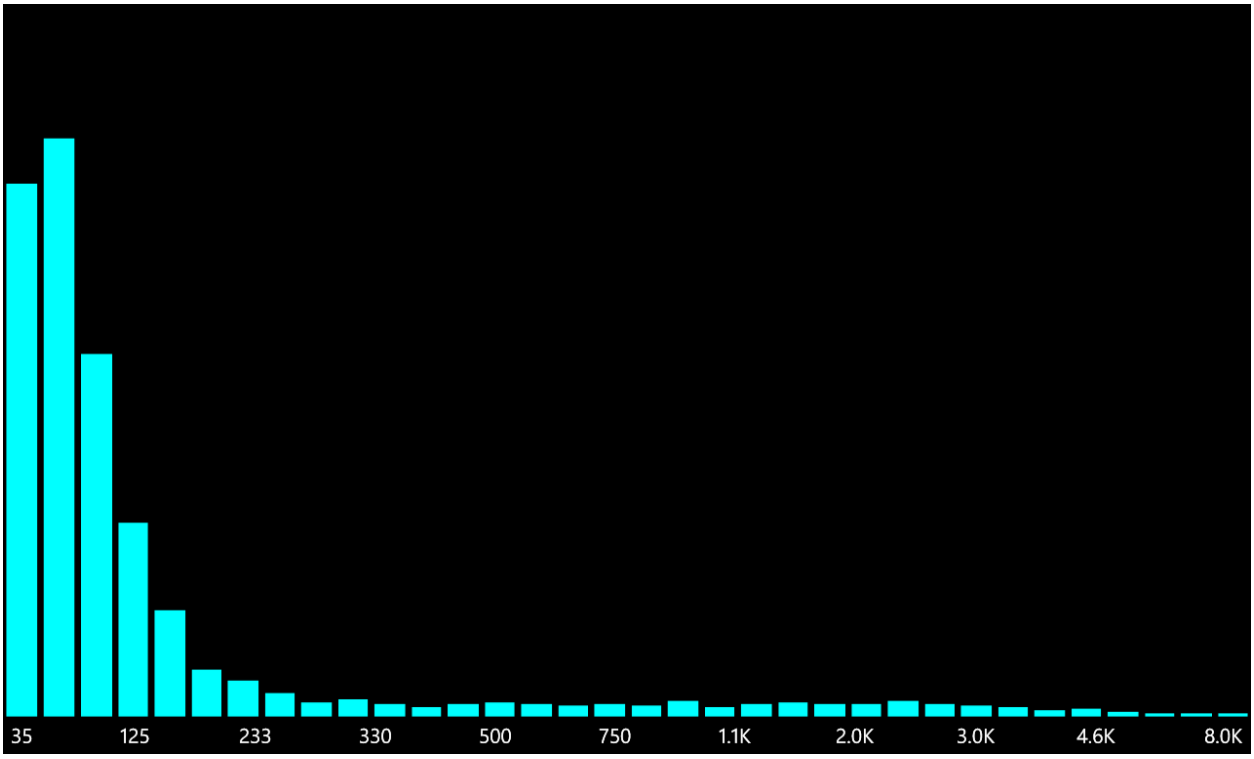
AFE stage 1 sample taken in cabin at idle



OEM sample taken at exhaust at idle



AFE Stage 1 sample taken at exhaust at idle



Conclusion:

You can see changes throughout the spectrum results, with the most dramatic in the in-cabin and at exhaust charts.

In cabin, the deeper drone notes are substantially higher and lower bands are compressed which is what you can clearly hear and feel. Exhaust tones are also higher in the lowest bands and show similar compression. I suspect the spike 1.1k results in cabin at idle is the expanded mid-tone note you hear during moderate to hard acceleration.

The car sounds more aggressive, throaty and muscular sitting even at idle.

In short, if the results were just this alone it would be worth it.

Performance

As a reminder, testing is in a 2004 M3 convertible with a six speed manual transmission, in excellent mechanical condition. Also the "sport" button is always on in all tests. (Side note, as it should be on anyway)

The dyno statistics for this kit show 11 horsepower, 10lbs of torque and 70% increase in outflow from the OEM stock airbox and filter. Those stats are available here.

I believe it.

Now that the stage 1 kit has been installed I have noticed a number of distinct changes in the M3 in regards to performance.

First, it is just *quicker.* 11hp is 3% addition to the stated 333hp of the E46 M3, but it just feels *quicker* than the stats would indicate. It is more responsive and quicker to spool up out of first gear and quicker getting to speed with enthusiastic acceleration. The felt and perceived improvements are greater than what the simple statistics will show. The "butt-dyno" definitely registers a distinct change with this addition to the car.

Next, fuel efficiency and gas mileage: my particular M3 gets 21.6-21.8mph like clockwork with quality (Chevron, Texaco, Shell) 90+ octane gas at all times. Side note, NEVER short your car on your fuel choices. Is literally $2-3 dollars per fill up worth fouled fuel lines, injectors and filter, or even worse results? You have a high performance car and treat it as such.

While my sample set with the CAI S1 is relatively small, I immediately saw and have maintained a 2mpg bump in statistics. The car is currently running at 23.6mpg which is a 10% gain, which is not an insignificant amount. The true test will be long term analysis, but for now this shows trending to actually be a value proposition for fuel consumption, not just performance and sound.

Lastly, the impacts of performance and drivability: This last observation is subtle but important. The M3 6spd manual can be at times a little harsh through the first two gears. You increase through power bands quickly, making clean and crisp shifting even more necessary. In numerous testing sets of enthusiastic acceleration and day to day driving, the M3 with the CAI S1 installed feels easier to drive. The shift boundaries especially through the first two gears feel smoother and easier, as the engine torque and power curve have shifted. Not only does it feel like I can shift later, but the transition through gears and blending into the next gear is an easier boundary.

The observation is very anecdotal and I do what to highlight that. It also likely can be car specific consideration condition, maintenance, transmission history and a dozen other variables. That said, the change is very noticeable in the full spectrum of daily driving and I believe is worth acknowledgement. I didn't expect the CAI to make shifting easier, but it just *does*.

Conclusion

You can read hundreds of opinions regarding possible improvements to the E46 M3, and in almost every case the amount of money and effort is really significant. You have to spend thousands of dollars to gain single digit percentage performance over what came stock, simply because it was beautifully engineered from the start.

My conclusion is that the AFE CAI S1 system is the glorious exception to those opinions: Installation is simple and can be done by anyone. Audible and perceivable performance gains are obvious and apparent. The kit is no small investment but can pay for itself over time as you improve gas mileage and recondition the air filter every year instead of replace it.

The sound is there.

The performance is there.

The cost savings over time are there.

In short: DO IT and you will thank yourself for it every single time you fire up the deep basso rumble of your M3.