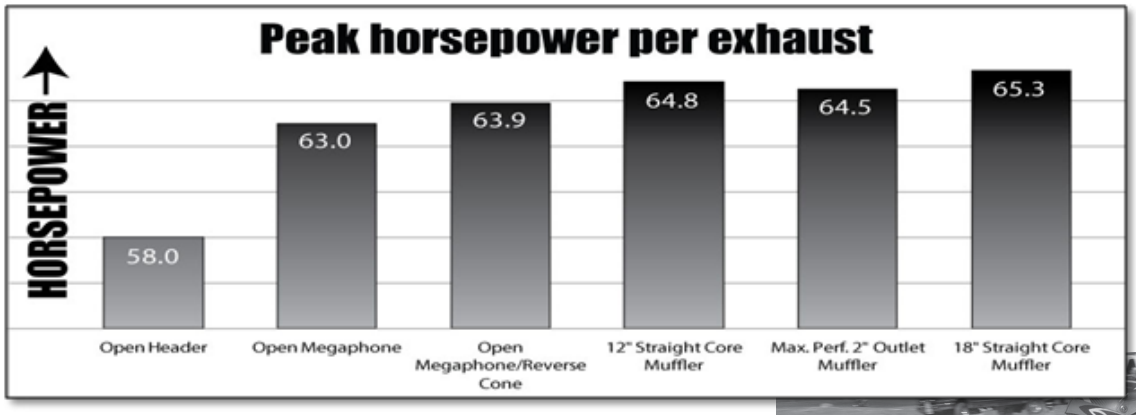
Sound vs Speed

In today's world, excessive sound is a very-real concern at every racetrack we visit, whether it be a high-dollar roadrace venue, or a farmer's field that's not far from concerned neighbors. AHRMA requires nearly every machine that goes on track to have an effective exhaust-silencing system, but it seems some folks are reluctant to comply. Many, many years ago, the credo "loud is fast" was established – but is that really the case? Can a racebike be quieter without losing horsepower? The fine folks at Cone Engineering delved into the topic for Vintage Views.



One of the statements most frequently heard in the paddock is, "My exhaust is what they ran on the bike back in the day, and if it was good enough then, it's good enough now." Sometimes this is true. Most likely though, that exhaust was the only thing available back then. Even if it was state-of-the-art at the time, that doesn't mean that it is the only (or best) option available today. Back then tolerances were looser, there weren't lithium-ion batteries, electronic ignitions, platinum spark plugs, synthetic multi-viscosity oils, hybrid compound tires, and other things that would have seemed like witchcraft 50 years ago.

The other critical factor is noise. In the 1960s, most tracks were out in the middle of nowhere and sound level just wasn't the issue it is today. Even if we love the scream of a racing machine, it doesn't mean the people in the housing tract a mile away are fond of hearing it. Just take a look at how many tracks have been pushed out of existence and you'll see that this problem isn't going away.

With all this in mind, we decided to pick up the challenge of finding out just how these different exhaust options stacked up in back-to-back testing. We believed mufflers could quiet down a racebike without making a significant negative impact on performance.

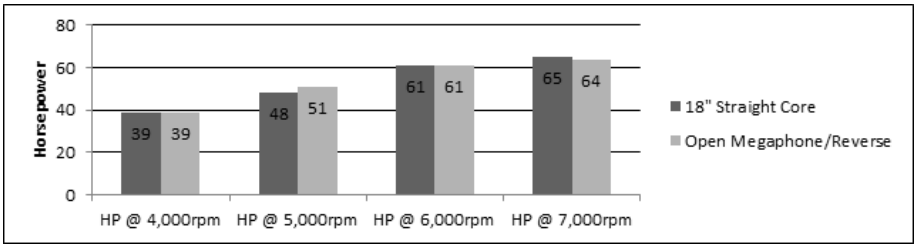
Before testing, our experience in the motorcycle and exhaust industry led us to believe that our mufflers would have better bottom-end and mid-range performance, but open exhaust styles would likely have slightly better top-end horsepower. Additionally, we thought that the differences would not be substantial, and while they would show up on a dyno, they wouldn't be practical in real-world applications.

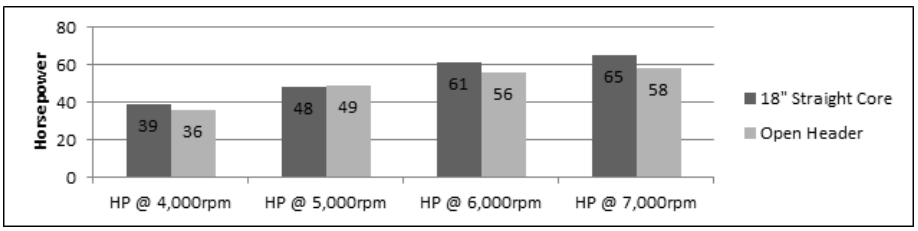
To investigate this theory we assembled several exhaust designs popular in AHRMA racing and tested them on a common platform, a 2007 Triumph Bonneville (carbureted model). We made several runs with each system to optimally tune, and then took the best run for each design. The newer Triumph was a conscious choice; we did not want to subject a vintage bike to the numerous dyno runs required to complete this testing.

Even we were surprised by what we found. Across the board, our mufflers (that all use a perforated internal core) made more power, and most importantly, made the power more quickly. In addition, they were also quieter! The chart below shows how each system compared in terms of total horsepower.

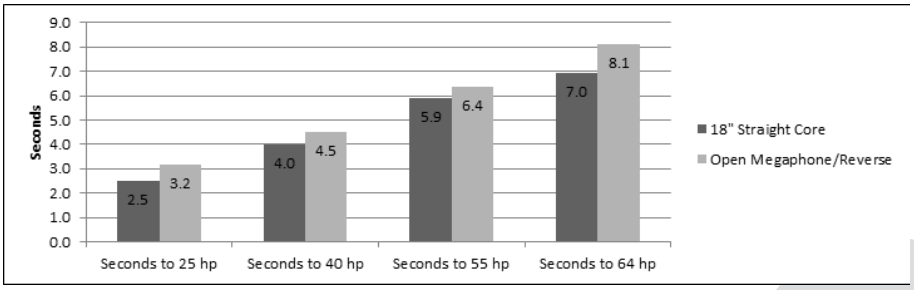
To look deeper into the results, let's compare three popular exhaust options. Two designs are quite similar externally and very popular in vintage racing. Both are megaphones with a reverse cone. Both are 18" overall length, but one is hollow inside, while our muffler utilizes an internal perforated core. The third option (also very popular) is a simple, open, straight-tube header.

From this chart, we can see there wasn't any decrease in power from using a muffler, except for a very slight variance at 5000rpm. Most striking, however, was that the muffler didn't lose the top-end performance we had expected. In fact it held its own, and actually pulled more horsepower than the other designs at higher RPM. The next chart showed us an even more surprising result!

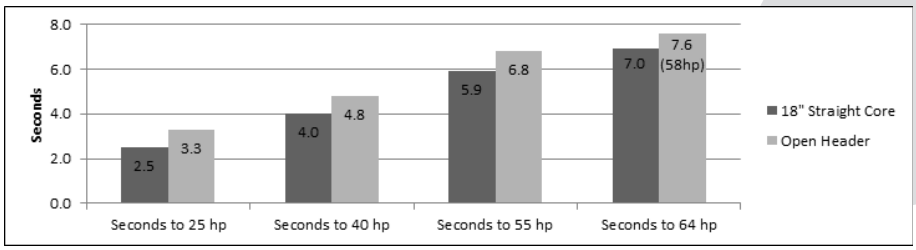




Glancing at these charts it might appear that the open megaphone/reverse and open header outperformed the 18" straight core muffler, but keep in mind that these bars represent time.

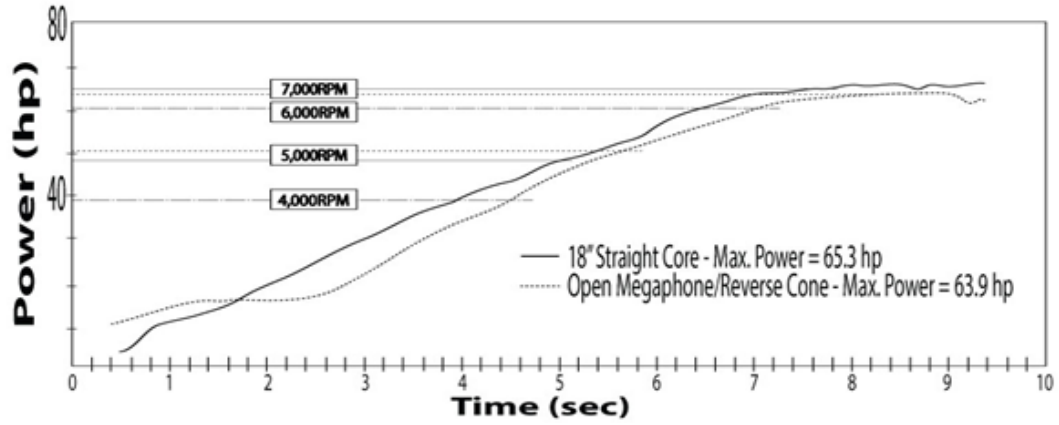


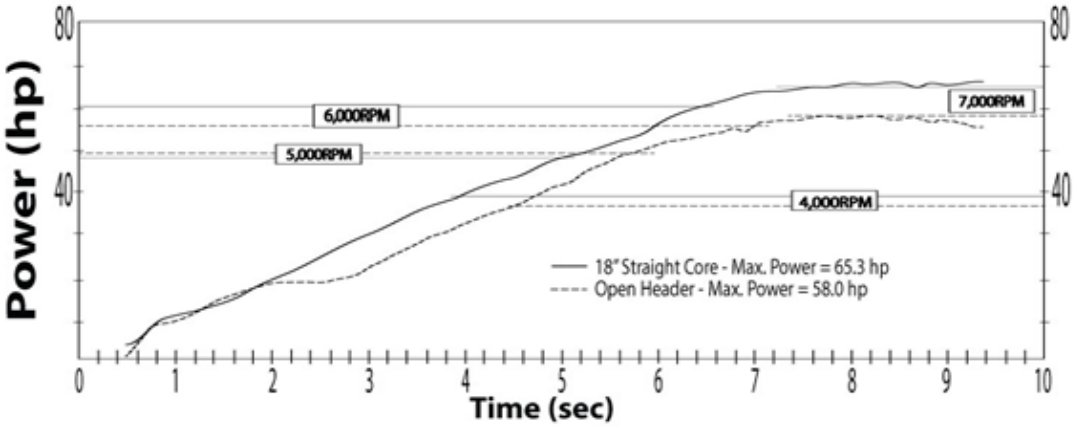
Like a race, the first to the finish is the winner. These results show that not only did our muffler get to a higher overall power, but it did so significantly more quickly. Note that in the second graph not only is there a time differential, but the open header never reaches the same total horsepower as the muffler does.



These differences are even more obvious when we look at a graphs of the dyno results for power and time of horsepower of each exhaust.

Sound vs *Speed*





For those used to looking at normal Horsepower/Torque dyno graphs, these can seem a little unusual. In a standard dyno run, we normally see RPM plotted across the bottom of the chart and performance numbers up the left side. Instead, here you have time across the bottom instead of RPM. In many situations, the time it takes to achieve maximum horsepower could be as crucial as the absolute power itself and is often overlooked. The horizontal lines on this graph show the horsepower achieved at levels of RPM.

Other than these two comparisons, the rest of the exhaust designs produced total horsepower that were similar. But now we should take a look at another issue we talked about – sound level.

Because our exhausts are not designed for a specific motorcycle, we typically don't state an absolute decibel level. However, in order to complete our analysis, such testing was necessary. In conducting the research for this article, we found that there is substantial impact based on terrain, air density, air temperature, and design elements of the exhaust header. Wall thickness, header wrap, mild steel or stainless steel, and the direction the exhaust points also come into play. The results of our very unscientific tests are presented below. The numbers should not be considered absolute measurements, but rather a relative comparison to evaluate one style of exhaust with another. Recorded performance is not necessarily indicative of future results.

dB SOUND LEVEL AT 2 FEET FROM EXHAUST

2007 Triumph Bonneville

EXHAUST STYLE	IDLE	4500 RPM	Full Throttle
Open Header	96	108	117
Open Megaphone	101	119	123
Open Megaphone/Reverse Cone	99	114	120
12" Straight Core Muffler	93	107	113
Max Perf 2" Outlet	94	110	115
18" Straight Core Muffler	94	107	113

dB SOUND LEVEL AT 50 FEET FROM EXHAUST

2007 Triumph Bonneville

EXHAUST STYLE	IDLE	4500 RPM	Full Throttle
Open Header	77	94	104
Open Megaphone	85	103	109
Open Megaphone/Reverse Cone	83	96	109
12" Straight Core Muffler	74	91	98
Max Perf 2" Outlet	78	94	98
18" Straight Core Muffler	77	87	99

The results were pretty much as expected. In each test, mufflers utilizing an internal core were substantially quieter than those without. Additionally, those with a core presented a different exhaust tone, lacking the typical high-pitched crackling of an open exhaust and therefore sounded much less "harsh". We felt they sounded even quieter than the absolute dB levels indicated.

So what further stumbling blocks are left? The only one we could think of was cost – cutting off a stock muffler and running just the header will always be the least expensive option. But is it the truly best? Hopefully this article showed that it's certainly not the best option if you are trying to maximize performance and minimize noise. The important thing to always remember about cost is perspective. In many cases, an exhaust that will last you several race seasons is often less than you will spend on tires for just a few races.

Ultimately, the choice is up to the individual. Noise levels will continue to be an issue as long we have to race in proximity to those that don't share our common passion for performance and speed. We've tried to present to you the most common options in race exhaust and show how they compare in terms of performance and sound level. We believe the data we collected thoroughly "busted the myth" that only loud exhausts make power.

Cone Engineering has been producing fabricated exhaust components for manufacturing companies since 1970. In 2007, they began offering the same components to both professional and amateur fabricators to simplify and expedite their builds. In 2010, Cone released a line of motorcycle mufflers that – while not a "bolt-on" solution – eliminated the need for fabricators to design, engineer and manufacture specialized internal muffler components. In 2014, Cone Engineering became a sponsor of AHRMA's CB160 exhibition roadrace class. ▲