



# 964 Track Preparation

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As the price of 964s has come down over the past year or two, we are seeing more of them at driver education events at the track. The purpose of this article is to survey the current state of 964 track preparation, with a specific focus on improvements geared to that difficult category of dual-purpose usage, which includes both daily driving and track usage. While sharing some common points, preparation specifically for racing is outside our scope (although maybe not too far). An important note is that, beyond local PCA driver education requirements, your 964 can be driven on the track, as-is. As your track driving skills and speeds increase, you might consider the suggestions that follow. There are two underlying themes in the discussion: safety first, and lightweight is

good. The 1989-1994 964 included notable changes to the 911 line, including four-wheel drive (derived from the 959 program), a 3.6-liter engine, coil springs instead of torsion bars, ABS brakes, airbags, power steering, a retractable rear spoiler; and a new heating and air conditioning system that worked. Significant work was done on the body aerodynamics, and the 3.6 M64 engine was the first Porsche engine that was produced as a single engine for all worldwide markets, with 247 hp (SAE net). In addition to the worldwide availability of the Carrera 2 and Carrera 4, the 964 line also included the limited edition, high performance European Carrera RS and the Carrera Cup racing cars, both of which provide a source of higher performance parts which can all be used.

## *Improvements geared to that difficult category of dual-purpose usage including both daily driving and track time.*

In addition, there are performance parts available through non-Porsche aftermarket sources. References 1 and 2 detail 964 specifications for rear-wheel-drive models including 964 Cup cars.

Your first activity should be to check with the PCA region you plan to drive with to review the driver education technical requirements and rules. These are usually posted on their web site.

Looking at the interior; to keep from chewing up the foam padding under the front carpets (carpets are removed at the track), consider either a textured aluminum sheet or, like the factory thin plywood, cut in the shape of the floor and secured. Note there's a big bunch of wires running down the middle of the driver and passengers foot well, so the foam isn't typically removed unless the wires are repositioned, or spacers are used between the floor and the plywood.

While typically not required to start (unless you have a cabriolet), a roll bar or roll cage is a prudent investment as your experience and speed increases.

(Note that a harness bar which is only for shoulder harnesses to go over provides no rollover protection.)

Many people start with a roll bar and progress to a roll cage. There are several roll bar solutions, including bolt-in roll bars that don't require welding for installation. One popular cage requires welding of feet that the roll cage can bolt to. Others bolt directly to the floor and of course there is the weld only variety. My preference is for a sill-mounted roll cage, as the sills are an inherently strong part of the 911 body. Besides the safety aspects of a roll cage, an additional benefit is that it also stiffens the chassis. PCA Club Racing specifications provide some good guidelines on roll bars and roll cages (Reference 4, Appendix A). Be sure to check for any local requirements, too.

You'll soon find you're fighting the stock seat and seat belt to stay in place. In which case a harness and seat with shoulder cutouts for the harness might be next on your list. Upgrade seats usually have more significant side bolsters, weigh less than stock seats and often have a cloth seating surface, which grips

the driver better and breathes better than leather: Seats fit everyone differently so be sure and sit in whatever you plan on buying and, to maximize seat safety make sure the seat tracks have locking lugs on each sliding rail. Harnesses used are five or six strap versions, with either latch or cam locking mechanisms. Some PCA regions don't allow harnesses with stock seats, as the shoulder straps can slide up on the seat. If you don't have a roll bar or cage, you'll need to get a harness bar to route the shoulder straps over on their way to connect at the base of the rear seats (typically; an eye bolt replaces each rear seat belt). With a roll cage, roll bar or harness bar; they allow the harness straps to leave your shoulders at close to 90 degrees (and no more than 40 degrees below horizontal), to minimize chances of spinal compression injury in an accident.

While on restraints, helmet restraints are starting to trickle down to the non-professional track level - three varieties that work to restrain forward head movements are HANS, ISAAC and Simpson's Head and Neck Restraint.



*Textured aluminum sheet protects factory foam padding. Floor mats sit on top for daily drive.*

We haven't said anything about the engine yet and, outside of racing, there's not much that's usually done. Typically you find one of the two mufflers replaced with a bypass pipe (reduces weight around 15-18 pounds, increases exhaust sound, adds maybe a few horsepower), cut holes in the plastic air box cover or a cone-style air filter installed (increases intake sound and influences exhaust tone). Sometimes people try a different DME (Digital Motor Electronics) chip, which may add a small amount of power or



Ruf front valance (left) and Porsche Tequipment front splitter (right)

inadvisably allows higher revs before the fuel cut off. Another upgrade is the Carrera RS clutch and RS lightweight flywheel (15.4 pounds lighter than stock). Because the 964's idle is controlled via software, some 964s with a lightweight flywheel can experience stalling issues. Reference 3 covers the broader set of engine and transmission options in more detail.

One racing item we rarely if ever see on non-racing 964s is an emergency battery cutoff. A friend recently had an electrical fire break out as he was coming off the track. Thankfully there were fire extinguishers on hand to put it out. Given the money that we invest in our Porsches, perhaps this is something more of us should consider. A fairly non-invasive approach is discussed in the PCA Club Racing Rules in Appendix C (Reference 4). There is a wiring diagram in the factory manual for the Carrera RS battery cutoff and a battery cutoff installation article in *Up-Fixin* (Reference 5).

Like engines, there's not much typically done with the 964 body. The rear engine undertray is usually removed to promote better engine cooling and saves around 15 pounds. Also in back, the stock 964 extendible rear spoiler can be replaced by a Carrera-style fixed rear spoiler (also used on the RS America) to gain greater lift reduction.

STOCK SPRING RATES (lb/in)		
	Front	Rear
1989-91 C2/C4	158	189
1992-94 C2/C4	169	189
1991-94 Option M030 1993-94 RS America 1991-92 Turbo 3.3	169	263*
1992 Carrera RS (European) 1992 Carrera Cup USA Carrera Cup Racing Car	247* 200-600	440* 240-800
Note *Progressive spring working rate		

Table 1

While the factory RS America wing weighs 9.5 pounds more than the stock extendible wing, many use an aftermarket fiberglass version

which saves weight. The 964, especially with fixed wing, can get a bit light in the front end at high speed, so some add a valance extension or front splitters.

The suspension is an area that sees upgrades, typically in several stages. Usually the first upgrade involves the installation of progressive springs and, typically, Bilstein struts/shocks, available from Porsche as the Carrera RS suspension, or from other companies in various combinations. Progressive springs are great when starting out at the track, as they reinforce the need to be smooth in your steering transitions, they allow lowering the body by one to two inches, they stiffen the response to weight transfer in cornering and braking, and are street-usage friendly. And although it may seem obvious, remember when you lower your suspension that your road clearance is also reduced. Porsche stock spring rates are shown in Table 1. Aftermarket progressive spring rates are usually in the 200-350 lb/in range.

Adjustable sway bars are also part of the suspension improvement program, and can be sourced from the Porsche Carrera RS parts bin and from other companies. One popular combination is the adjustable Carrera RS front 24mm bar in combination with the 1990 C2 rear 21mm bar (which is not adjustable). Note that the RS 24mm front sway bar may require some careful fitment in C2s, to clear the brake vacuum booster. To really tune your suspension, you'll need an adjustable rear sway bar; and a larger sway bar in back helps to tame the inherent 964 understeer.

When sourcing suspension parts if you have a 1989 or 1990 964, be aware that Porsche modified the rear suspension (mounting, shock length, other parts) in model year 1991 (which started in late 1990), so be sure the parts you get will fit your model. Some people add a shock tower brace between the two front towers, to help keep them from moving under hard cornering or braking.

After making a suspension change it's a good idea to align and corner balance your suspension. The Carrera RS alignment specs should be your starting point for dual use purposes.



*Scoop replaces foglamp to route air to inner fender for additional brake cooling.*

For comparison, stock front camber is 0 degrees +/- 10 minutes, while the Carrera RS calls for minus one degree +/- 10 minutes, and many use minus two to minus two and a half degrees of negative camber. Your choice of track tire may also influence your alignment settings. Unfortunately there's no free lunch with negative camber and track needs are opposite street needs. Not enough negative camber and you'll wear the outside of your tires on the track and won't get the best grip and performance. Too much negative camber will cause quicker inside tire wear, especially on the street. So keep an eye on the tires and remount the tires on the opposite wheel to even out tire wear:

As your experience, speed and transitions progress, you may find that progressive springs are no longer the best choice for you. This is because when turning into a corner, the car has to move through the progressive portion of the spring before it can take its ultimate set for the turn, which in turn can affect your transitions in a corner: The next stage involves another suspension upgrade, this time to linear springs, or linear with helper springs, in the 550-750 lb/in range. along with re-valved shocks (springs and shocks should always support each other). Your upgrade may also include monoball upper shock mounts which, unlike the stock mounts, have no rubber in them. This combination can be surprisingly streetable, although stiffer and more controlled than a progressive spring setup.

For those who want more, you can replace the front A-arm and rear swing arm rubber bushings with monoball bushings (if you do the rear, replace the spring plate as well). This enhances turn in and brings better predictability to the rear by eliminating the Weissach axle effect. The Weissach axle, introduced on the 928, allows the rear toe to change under hard cornering, to reduce oversteer caused in a rubberbushed swing axle.

In lieu of replacing bushings with monoballs, another more expensive option is to install the Carrera RS A-arms in front, which have harder rubber bushings. and the Carrera RS rear swing arms in back, which have thicker washers to limit the Weissach axle effect.

A word of caution: As you tighten up the suspension and chassis, while there are rewards on the track, your 964 also becomes less forgiving of any driver indiscretion out towards the performance edge (yours or your 964's).

A second set of wheels with DOT "R" rated tires is another popular addition for the track. Wheels range from lightweight three-piece wheels from vendors like BBS, Fikse, HRE and others, to one-piece wheels from Porsche and others. Keep in mind that some wheels are quite heavy in an area where lighter makes for a more responsive suspension. For track usage, generally stick with either a major brand or Porsche wheels, as they have to stand up to the rigors of track usage (although I have seen more than one set of Porsche's Cup II wheels with cracked spokes). On 964s prior to 1992, you should install the 10mm steering stops (part number 964.347.325.02) for 17-inch wheel usage, and may experience some tire rubbing. Porsche never approved 18-inch wheels for the non-Turbo 964s, although some do run them. For tires, the stickier DOT R rated tires are usually seen on the track, which are also legal for street usage, Hoosier, Kumho, Michelin, Toyo and Yokohama are some of the popular DOT R brands. Note that R compound tires aren't all season road tires, so exercise caution if it's cold or wet. (Some, like the Toyo RA1 and Yokohama A032R can be all right in the rain, while others can be downright scary). A discussion on tire sizes could generate another article, however; in general, on 17-inch rims, 225s work in front and either 255s or 275s in back. Wheel offset can affect fitment and with wider tires in back, watch for rubbing at several points: on the inside wheel wells, on the righthand rear metal oil line, and on the rear trailing arms.

With brakes, first ensure your brake system is in good health, i.e., recent brake fluid change. no sticking brake pistons, rotors are within spec.: factory air scoops are in place, rubber brake lines are less than ten years old, etc. In order to minimize the chances of boiling brake fluid (which creates air bubbles resulting in a soft brake pedal) you'll want to use a high temperature brake fluid (I like ATE Typ 200) and bleed the brakes more often than Porsche's recommended two year interval.

Some bleed their brakes before each track event. A brake pad upgrade will help provide better braking at the higher rotor temperatures experienced at the track. Some popular brands (compounds within brand) are Hawk (HP+, Blue), Pagid (Orange, Black), Performance Friction (Z-rated, 97) and Porterfield (R4-S, R4), amongst others. It's best to ensure your brake pads are properly broken in before getting to the track, so follow the manufacturer's or distributor's recommendations. Off the track, some people swap their track pads for street pads, as track pads are expensive, tend to squeal, and don't have the best stopping power when cold. As you progress, you may find that brake cooling is an issue. Due to the four-wheel-drive hub and ABS design, there's not a lot of room to get cooling air to the rotors; however an easy first step is to remove the backing plates on each wheel. Another option is to remove the front fog lamps and install a kit which has a scoop and hose to route air to the wheel well, aimed towards the brakes. In order to help the rotors last longer under track conditions, some people use cryogenically processed rotors.

Porsche 964 brakes, as used on the street, are quite good. However for the heat intensive track environment, improvements can make the brakes usable for longer periods of time. While the various brake upgrade combinations could generate another article. They generally fall into three areas: rear calipers for 1990-91 C2s, S4s and Big Reds.

If you have a 1990-91 C2, you can replace the dual piston rear calipers with the quad piston callipers (which use larger brake pads) from the 1992-94 C2s and all C4s). With this upgrade, changing the 45 bar bias valve to the 1992 and later 55 bar bias valve (part number 964.355.305.10) will send more brake pedal pressure to the rear calipers, resulting in more balanced braking.

The 928 S4 caliper has also been used on the 964 Carrera RS, 968 with option M030, and 993 C2 amongst others. The 928 S4/993 C2/968 M030 calipers use a thicker 203mm x 32mm front rotor (928 S4 or 968 M030 rotors fit a 964 in front) and, with a small spacer, you can use 16-inch wheels. The Carrera RS uses the larger 322mm x 32mm front rotor. The

993/Carrera RS rear calipers uses the 964 stock size 299mm x 24mm rotor; however, with larger caliper pistons. While you can upgrade just the fronts, upgrading the rears at the same time will provide better braking balance and is recommended.

Big Reds, from the 993 Twin Turbo, have the larger 322mm x 32mm (front) and 322mm x 28mm (rear) rotors with larger brake pads and require 17 inch wheels for wheel/caliper clearance.

After moving to larger calipers, some people notice a slightly lower brake pedal. This can be addressed by installing the larger 993 master cylinder which requires specially fabricated 10mm to 6mm brake line adapters.

Other upgrades available are the Carrera RS shifter which shortens the shift throw by 10mm and repositions the shifter knob 28mm higher and 10mm closer to the driver. Some replace the hydraulic engine mounts with the Carrera RS rubber engine mounts. While you might not install one, a limited slip differential isn't a bad option to have. If you're serious about driving on the track, a non-sunroof coupe gives you more headroom, is a tad lighter and contributes to a stiffer chassis.

In summary; we've described some modifications you can make to a 964 to enhance its safety and performance on the track, while still maintaining some civility for the daily drive. If you think you may want to start PCA Club Racing or some other racing series, read and reread the rules so you'll understand the implications of upgrades you make.

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References:

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3. Joel Reiser, "Late Model 911 Performance Enhancement" *PORSCHE PANARAMA August 1999* p. 36
4. 2004 PCA Club Racing Rules, available at <http://www.pca.org>.
5. Tom Tauscher. "911 Kill Switch Installation" *Up-Fixing der Porsche Vol. 10*, p. 121.