



Behind the Wheels Podcast Transcription Episode 6: A Balancing Act

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You're listening to Behind the Wheels with Doug Mason, Dave Walters, and Mike Yagley. This is a show where we talk about heavy truck and medium duty axle ends. Doug, Dave, and Mike bring close to 100 years of experience and expertise in the transportation business.

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MIKE YAGLEY

Welcome to another episode of, Behind the Wheels. I'm Mike Yagley.

DOUG MASON

I'm Doug Mason.

DAVE WALTERS

And I'm Dave Walters.

MIKE YAGLEY

Today, we're going to be tackling wheel balancing. It's a lot of interest in the industry on this. Let's start out with some simple definitions. Doug, what is balance?

DOUG MASON

Well, let's try to make it as simple as possible. Balance is probably very easy, but people get confused between balance and run-out, because they both can create some of the same issues. So I'll try to just give a simple explanation of both of those just as we start here. A balanced perspective, if you think about a wheel and say it's perfectly round, but if there's more mass or something heavier on one side, obviously it'll tilt that way. So you're going to have an uneven mass distribution, and what that does is it creates a centrifugal force when it rotates and that's what leads to the vibration. So that's really what they call an imbalance, you just have a more mass on one side than the other of a disc, if you want to think of it that way, and you have to accommodate for that, so that you won't have that centrifugal force creating a vibration.

DOUG MASON

Whereas when you talk about a run-out, you really have two types of run-out that occur. You have a radial run-out and a lateral run-out, and try to give a little bit of explanation of that as well. I wish we could say our whole crowd really knew what records were, because that would be a really good way of doing it, but instead we'll just say you have a-

MIKE YAGLEY

They're not as old as us.



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DOUG MASON

Right. If you have a disc that is perfectly centered and you spin it, obviously you can put your finger right next to it and you would never touch it because it's perfectly centered. You can have a radial run-out of a type where instead of that disc being perfectly round, it is undulated. So, although it's still in the same plane, if you were standing next to it, you'd get hit by it every once in a while, right? Because you'd have a high spot and a low spot, so to speak.

DAVE WALTERS

Hopefully for those who have seen record players, if you take the record and shift it over to one side and you have the whole offset a little bit, it's not going to make a perfect circle. It's going to have that an undulating bray, an offset sort of thing, where it's going to be high in one section and low in another.

DOUG MASON

Okay. That would be type two radial run-out, that's when you have an offset center.

DAVE WALTERS

Right.

DOUG MASON

Type one radial run-out is when the actual outer diameter itself is not perfectly circular. So you have a high spot in a low spot, although it's perfectly centered, you still have, I don't know if you want to call it, potato chipping around the edge, maybe, as a way to think of it. So those are two types of run-out that you can have. That's the type one and a type two, and you can imagine that with a wheel, you're going to have both. You're not going to be perfectly centered on the axis of the axle, and the circumference is not going to be perfectly round either. So that's where you get those two types of radial run-out, and that'll give you a high spot and a low spot as you're going down the road, so to speak.

DOUG MASON

A lateral run-out is almost easier to envision. A lateral run-out is if you have a flat disc, a perfectly flat disc, and you spin it, it stays perfectly flat and you don't see anything wobbling. It's really what we're talking about, is a wobble type effect. And so you can have, again, both types, you can have type one, where the disc itself is like a potato chip. So it wobbles up and down, no matter what, or you could have it tilted. And if it's stilted, obviously then you're going to have a high spot and a low spot as well, from a lateral run-out perspective. And that's more, if you're going down the road, you'll see a wobble, right? And you're going to wobble in and out, in and out, in and out as it's turning, and a radial run-out, you're going to be going up and down, up and down, up and down. Maybe that's the best way to determine.

MIKE YAGLEY

So Dave, when you have run-out problems and you have balance problems, are there things that customers, a fleet, can look for, just in the way the vehicle rides the wheel where's is there something folks can be looking for to try and figure out what is what?

DAVE WALTERS

Yeah. The rule of thumb in the field is, run-out is typically a ride at issue. So if a driver comes back and says, he's hopping a lot of times, it's more of a ride issue. Balance really gets into tire wear. If the tire is not wearing evenly, it's most of the time balance. Run-out can do it, but run-out's more of a driver saying, "I got a hop," or "I got a shimmy," or, you know what I mean? "I got a shake," or something like that. So that's how they do it in the field. They really go to run-out is typically ride issues, and when they get into tire wear issues, they'll to start looking for balance.

DOUG MASON

Obviously when you're diagnosing and you see that you have a tire wear issue and you want to take a look at "Well, am I in balance or not?" There's a few different ways that can be taken a look at. You can look at it from a static perspective, the people do a static balance. And that's really, if you think about it, you really only have a single plane of balance. You take a plate, or the wheel, if you want to say, and it's balanced on a single point. If there's more mass to one side than the other, obviously it's going to dip, and you need to place mass on the other side to make it obviously balance out. And that would be a static balance.

DOUG MASON

That gets you somewhere, but you really need to move more toward a dynamic or even an on-vehicle spin balancing. The good thing about the dynamic balancers, and Dave and I were just talking about this a minute ago, the machines that are out there now, you really don't even need to know how they work. You put them on there, you hit the button and it says, "Put this much weight on this flange, and this much weight on this flange." And that's because when you do dynamic balancing, it's not just a single plane or plate that it's trying to balance. When it's spinning, it's actually balancing both planes, the inboard and outboard flange, if you want to think about it that way, and then that allows you to have a much more uniform balance because you're able to put the balance weights exactly where they needed, and the amount that's needed, for each individual flange.

MIKE YAGLEY

So when you're talking about balance, there is a difference between a steel and aluminum wheel. Dave, you want to tackle that one?

DAVE WALTERS

When you look at the two, a steel wheel versus an aluminum wheel, aluminum wheel is basically a forged aluminum wheel, that's the state which is what you're going to see in most of your class six, seven, eights. The forged aluminum wheel's going to have very little balance issues compared to a steel wheel. So in the field, people understand that. Our wheel's close to zero as you can, and really what, it's odd, but where we put the valve stem in, we tell them to put the dots there. A valve stem basically is going to be the heavy point of our wheel because the valve stem's a couple of ounces. So we're really true.

DAVE WALTERS

So I got a real funny story. I was over in Japan one time at a major OEM, and he's saying, "We have to use more wheel weights on your wheels, what's up?" And I'm like, "Yeah, you're going to have to use more real weights on our wheel, because if the tire is 10 ounces out and our wheel's zero, you got to put 10 ounces on it. If the steel wheels five ounces out and you got a tire out 10, if you mismatch it, you can get to five. So you're going to use a lot more wheel weights with aluminum wheels." And he didn't seem to [crosstalk 00:07:44]-

MIKE YAGLEY

Just to compensate for the tires?

DAVE WALTERS

Because of the tires. The tires is where most of the balance issue is. When we write all these TMC things, we understand that the tires is where most of the balance issue is, and the wheels are pretty true, but when you're mismatching them, you're really mismatching the high and the low spot to try to get them. That's why these dots are so important to a lot of fleets, because they just want to match up the dot against the valve stem, put them on and say, "There, we're done. It's over, we did the best we can." These guys want a, time's money, maintenance cost, so just put it on the dot and that's as good as it gets, so away we go.

MIKE YAGLEY

So you want to talk about on-vehicle balancing and off-vehicle balancing, Dave?

DAVE WALTERS

Oh, that has been the talk, mostly to only ever balance the steers. When you do it on the vehicle, you jack up the truck, you take a machine, you spin the tire wheel, but now also you're including the hub, the brake drum, you've got disc brakes or whatever, you're including whole axle end. And then they balance it that way. It's a really a decision on, "Do I want to spend the cost of the machine, and every time I do this, I'm jacking up the truck, it takes more time to do it this way." But the people who say, "Hey, I pay more money for steer axle tires. I'm trying to get every ounce of mileage I can out of them, this is the way to do it." It's a great debate in the industry, and again, every fleet has their own idea. You can definitely get the whole wheel end balanced that way.

DOUG MASON

Yeah. And I think was just stepped back just for a second. We keep talking about balancing. We're really talking about balance weights at this point, right? When we're talking about doing a static, or a dynamic, or even an on-vehicle balance, it's to know where to put the wheel weight, that's going to be basically either a stick-on weight that adheres to the wheel, or a clip or a knock-on weight as they call it, that will attach to the flange, the amount of weight that's needed. Right?

MIKE YAGLEY

Right. And that gets us into one of the things that Dave said just a moment ago, that really caught my attention, is that most fleets aren't balancing. He mentioned they'll line up the dots and then off they go, they don't bother putting more weights on. They just want to have it as close as they can without having that extra effort. Other folks that are balancing on the vehicle, they're trying to really dial it in perfectly, and so there's this whole, call it a range, of solutions out there. Dave, you want to talk a little bit about from a fleet standpoint? What drives that one way or the other?

DAVE WALTERS

It's really about tire life. When you talk to fleets, they'll tell you that their number one cost is fuel, and then tires is number two. If you look at a fleet, anything to do with added fuel mileage and that is gigantic. So fuel is by far number one, the tires is number two. So here's your number two maintenance item on your vehicles. How are you going to get maximum tire life? And that's really where they're at. And every fleet has a different scenario. A lot of them basically use the warranty. So they buy a truck, they trade it off, they get a five year, 500,000 mile warranty on the truck, and they want to trade that truck off in three to four years so they don't have to do any of the heavy maintenance. So they think of it different than a guy that's saying, "I'm going to keep this truck for a long time."

DAVE WALTERS

Again, the world is so different, so you don't have cookie cutters out there. You got, everybody has a different thought process. So it's really tire life. So they're looking at tire like that's the number one thing the fleets want to do is tire life, casing life, because a lot of them are going to retread, they get two or three retreads out of the casing, and again, that all goes back to tire life.

MIKE YAGLEY

The fleet perception is another big part of it. Doug, you want to cover that one?

DOUG MASON

I was just going to make some other comments here, the differences in why you would or wouldn't balance. I think, Dave, you and I talked about this before as well. If you're maybe an over the road fleet and you are very sensitive, and you have a very good maintenance program, etc., etc., TMC has done studies that showed if you balance the whole truck, you can get another two to two and a half percent fuel efficiency improvement, which as you've said is one of the main drivers, obviously, for fleet costs. So there are certain fleets that are going to see that, have the ability to do it and gain a benefit from it. But if you're running a garbage truck or something like that, what's the use in really balancing at that point. Right? So there's that, maybe, another evaluation of the ends of the spectrum, on who's looking to balance and why.

MIKE YAGLEY

One of the things that I think about are motor homes. Basically you have just regular folk driving lots of miles on a motor home, and they're going to feel every vibration, every shimmy, that's on that vehicle, and they want to have the harmonics just dialed in. So one of the things that they can do is add a little bit of weight. If you have a harmonic problem, where you're getting a little bit of sound, in engineering, we would call it a modal stress. It's where basically your axle end starts acting like a bell, and it starts getting a harmonic in there and you can hear it in the vehicle. And one of the things you can do is add a little bit of weight there to that axle and maybe balanced weights might do it for you. You might have to go to just a heavier wheel. That's one thing you can look at, is having a little bit more weight on that axle end to get those harmonics taken care of.

DOUG MASON

Bit of a funny story on that, well, I think it's a funny story. I was in the automotive field for 15 plus years, and working with some high-end car manufacturers. And we're always talking about making the lightest wheel possible and they're like, "No, we don't want the lightest wheel possible, we want the quietest wheel possible," for the vehicles they were building and, like you said, to get out of some of the modal issues, which really are not balance concerns. Those get into the run-outs and the harmonics that we were talking about earlier, but they would make their wheels heavier and heavier, so that they would not have to run into any harmonic issues. You don't see that, you don't need that on a commercial vehicle, or a class three and above, but in situations like you said, with a motor home, somebody who's very sensitive driving down the road, it may come into play.

MIKE YAGLEY

Dave, you want to talk a little bit about what fleets do out there, what you're seeing in the field, when it comes to balance?

DAVE WALTERS

Again, I'm just generalizing, but most fleets will say, "If it's within 10 ounces of balance, we're good to go." So they put the tire wheel, they run around on their balancer, if it's within 10, "Hey, we're good to go." It's so weird when you watch them, because they know what tire life is, and they understand that. And you say, "Okay, this is what they do now." At TMC, we put maxes on everything. So we put a max of 14 ounces on the steers, and we put a max of 18 ounces on the drives. And again, that's just a guideline, but you see fleets, when they get the tire wheel assembly, if it's below 10, they're good to go. They're like, "Hey, we're not going to mess around with weighting this and doing all this." Again, I think everything is, time is money, in that business, and the more you understand what they're trying to do, it's practical. They're trying to get that tire wheels as, "Hey, that's pretty good. Let's go." As long as the driver doesn't complain, everybody's happy.

MIKE YAGLEY

So we're going to talk about the different kinds of balancing they have. There's external balancing and there's internal balancing. Let's start with external balancing. Doug, you want to talk a little bit about that?

DOUG MASON

We've mentioned it a little bit already. That's what I was saying about stick-on weights, or clip-on weights. When we're talking about doing the actual balancing, obviously you need to add weight somewhere to counteract the out-of-balance situation. So most of the time it'll be done externally, with clip-on weights, specifically here in North America, the wheels are designed with a TAL, we'll call it a balanced weight flange, which accepts the TAL balanced weight. That is fairly standard in North America. Those are typically coded, and then when I say the TAL, that's for an aluminum wheel, you'd have a I7 flange for a steel wheel, which would take the appropriate weight for that as well. And for the aluminum wheel, you want to have it coated, so you don't create a corrosion issue. You can go with uncoated for the steel wheel, because they're painted, and to apply them, those again, they're knocked on, we'll call it. So it has teeth on it, you stick it on the flange, you whack it, and those teeth basically hold it in place.

DOUG MASON

Another way of doing it, where some people don't want to damage their wheels, specifically on aluminum wheels, they don't want to, maybe you can see the balance weight. You can use stick-on weights, and those can be applied onto the rim more easily, and it's just an adhesive. And in that situation, you really want to clean that area well, you want to make sure that it's a dry, clean surface, just like you would for any, putting a tape on anything, you want to make sure you've got the best surface possible for the adhesion to stay, and for it to stick long term.

DOUG MASON

And so those would be two ways that it's done, from an on the wheel perspective. And then there are also what they call, balance rings, that are out there. And they're a separate component that can be, typically it would go between the duals. They do have them for steers as well. And they would go onto the bolt circle, just as you would a regular wheel, it would be part of the whole stack-up of the wheel, on top of the hub, and you would bolt that all together. And that's the one thing you got to be careful of with those is, again, you have an extra surface now, that has come between the wheel and the hub. And the more surfaces you have, the more opportunity you have for torque loss and miss-mounting opportunities. So you got to be careful of that as well. And Dave, you probably have some input on those in the field, too.

DAVE WALTERS

On clip-on weights, ever since radial tires, which it's really odd that, again, we're a little more older than most people because some of the younger listeners would say, "What do you mean? What was before?" There used to be a bias tire, believe it or not. And they didn't flex, very solid. Ever since the onslaught of radials, because they flex so great. Technically, to put a clip-on balance weight on correctly, you run it through the spin balancer, you see where the weight needs to go, you actually have to reduce the air pressure in the tire by 50%, beat on the weight, air it back up and run it again. As we keep saying, time is money. Most people don't do it. The correct way. A lot of clip-on balance weights are falling off in the field. And that is true.

DAVE WALTERS

So a lot of fleets don't want to use clip-on weights because technically, to get them on and to stay on, they have to reduce that air pressure in that tire and let that radial come back up, so you can actually beat them on, and get them to stay on, and then believe it or not, when you air back up, the radial is actually going to help you keep that clip-on weight in the spot. So there's one thing about that.

DAVE WALTERS

Stick on weights, we talked about, the big thing about stick on weights is getting a clean surface. Everybody says, "Well, where do I put them?" Well, you put them closest to the edge, to the two edges, or towards the disc. Sometimes you might have brake drum clearance issues, because the brake drum might be as close, or you might have a rotor or something in the disc brake. So you really have to make sure when you're putting a stick-on weight, is it going to interfere with the brake drum or is it going to interfere with the rotor? And that will take them off really quick.

DAVE WALTERS

So, these are some of the things to look for. That's why, again, those two types, balancing rings, where I see them most is on motor homes. It goes on before you put the wheel on. So you put the brake drum on, or you got the disc brake, you put the balancing rings, you put the wheel on, and basically the balls in the balancing rings, they go around and around and it's like the harmonics, it's smoothing out the ride and some people love them and other peoples don't see any difference. So that's my opinion on those.

MIKE YAGLEY

Well, why don't you keep on going, Dave, and talk to us a little bit about the internal balancing technologies that are out there.

DAVE WALTERS

Oh boy, these are subjects that most-

MIKE YAGLEY

Yeah, I knew you had opinions on this, so I'll tee that up for you.

DAVE WALTERS

Internal balancing, and again, what I'm going to state, this is my opinion and my personal opinion. There's powders, or we call them granules, and then there's liquid internal balancers. And I have been to fleets that say they're the greatest things in the world, and I've been to fleets that say, "Boy, this is really terrible." So again, it's on their own experience. I'll tell you what maintenance issues that you need to look for on the powders and granules. You need a filter valve stem, because if you check the air pressure, these powders or granules try to come up and come out of the tire, just like air does. So you have to have a filter valve stem.

DAVE WALTERS

If you use too much lubrication, when you mount the tire and that lube balls this stuff up, you're going to have a real thumping issue, because it bonds this stuff up and then it goes, "Thump, thump, thump." The other thing about these powders and granules stuff is, they put a bag of it in, the bag melts away, disintegrates, so it's always in the tire and wheel. So when you're taking it off, you better understand that you have powder or granule, because most people reuse them.

DAVE WALTERS

Liquids, hoo boy. First thing, if I was a operator, is check to see if that liquid is going to do something to your wheel. There are ones that I've seen in the field that will eat right through aluminum. There are ones that will take off every bit of paint on that steel wheel. So try to understand what they're doing, and as a liquid sealant, or as a liquid balancer, they basically go around, kind of what the powders and the granules do. Again, some fleets love them, some don't, but try to understand, and again, understanding the liquids, that stuff's going into the valve stem. So when you check air, that stuff could basically clog your valve stem and do that. So again, they tell you use a filtered stem. So these are the things that I know in the field.

MIKE YAGLEY

Doug, do you want to talk a little bit about the regulations that we see coming down the pipe?

DOUG MASON

For lead weights? Yeah, it's already happened in the pass car, light truck industry, that they've outlawed lead in balance weights, and so the stick-on, or even knock-on weights, they've had to go to different materials. Steel weights are used a fair bit now, in pass car light truck. And so it is something that I believe is going to be coming to the commercial vehicle. They're trying to get rid of lead everywhere they can. So that would probably be the main thing to be aware of. Obviously when you go from the lead, which has such beautiful density for what we're doing, and go to any other material, you end up having a much larger weight, and so that obviously changes the look, it changes how you have to adhere it and the strength you need to hold it in place, it's going over a larger distance.

DOUG MASON

Then that's one of the other, I guess, issues that you run into with balance weights, is you need multiple sizes for multiple wheel sizes, as well, so that they'll fit properly. I guess there's another to your point, Dave, one of the headaches of balancing, if you choose to balance, but that would be the main thing with regulations, is the lead weights having to move to a steel or other material.

DAVE WALTERS

And a lot of the ones I see in the commercial ones are liquid, and the liquid ones, as Doug pointed out, they're much larger than the old stick-ons and clip-on lead ones. So that's the biggest issue. You got something a lot bigger when you go into a liquid balance weight.

MIKE YAGLEY

Right. Yeah. There's all sorts of things you hear out there. People trying to cheat the system, and using all sorts of crazy stuff to do that balancing. They don't want to spend the money for the powders, they think that they can come up with some sort of solution on their own. Dave, you've probably seen more of that than any of us. What are some of your favorites?

DAVE WALTERS

Top of my list would be golf balls. When those guys say, "Well, I put golf balls in there," and that's what, if you realize what a golf ball's doing inside that tire wheel, bouncing around, it's hilarious because that's one of our jokes and, and I'll mention them by name, because I have to, but Bridgestone makes golf balls and tires. If it's a Bridgestone golf ball, I guess it's okay, right? Because Bridgestone guys don't like when we always say, "Well, as long as it's a Bridgestone golf ball, they're made to do that," but that's a wives' tale, and people will tell you, "Oh, it works." Well, I'm telling you, you're going to damage your tire and wheel more than what you ever think, and casing life in that tire is so important. Just try to understand what that ball bouncing around, hitting the wheel tire, bouncing in there. So golf balls was number one.

DAVE WALTERS

The second one that I've seen and heard of is marbles. They take marbles and they throw it in there because they're cheaper than this other stuff. And they're like, "Oh, it works great." Well, again-

MIKE YAGLEY

Cheaper than golf balls.

DAVE WALTERS

It's cheaper than golf balls. It's cheaper. And it's cheaper than some of the powders and granules. And you're like, little things hitting everything. You know what I mean? That's not what you want. And then the other one that I love was antifreeze. They would put antifreeze in there because it doesn't freeze, it's like a liquid, but antifreeze and tires hate each other. So you're basically ruining your tires. But I got to say there's a lot of people will try anything, but when you're talking the cost of a tire and commercial trucks, I would not recommend using any of these three things that I've just brought up.

MIKE YAGLEY

As always. And we can't say it enough, follow the manufacturer's recommendations. As engineers, as experts in the field, I can promise you, we've put a lot of thought, and the guidance that we give you isn't just made up. This is a lot of thought, trying to get the most performance for you. And yes, we are concerned about your costs too, but we're not trying to get you to buy stuff. We're trying to take care of you when we put that guidance out there. Well, I think that about does it, hey, thank you again for joining us on this episode of, Behind the Wheels, we'll be back next time.

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