Behind the Wheels Podcast Transcription
Season 2 Episode 5
Transit Wheels: The Wheels on the bus go... aluminum

ANNOUNCER
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.

Join us once a month to learn new things about axle ends. Sponsored by Alcoa® Wheels, the global leader in aluminum wheel innovation.

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
Well, today we're going to be talking a little bit about transit wheels, the transit market. Anybody who goes around, just look around at the buses that are cruising there next to you as you drive down the road, especially the coaches. You'll see an awful lot of aluminum wheels on those buses, and it wasn't always that way. Aluminum wheels, just like every market, started out on... The transit market started out with steel.

MIKE YAGLEY
And what we're going to talk about today is we're going to start off with just the history, what was it about aluminum wheels that really worked for that transit market, and then we're going to be getting into where we think that transit market's going to be going. And we have a lot of experience here. Dave Walters, I think we talk about Dave's capabilities, and he's been around that transit market for 30 plus years. And then Doug's got all the expertise from... He's a metallurgist, so Dr. Doug. We'll get his input too. So, I'm really looking forward to the discussion.

MIKE YAGLEY
Let's get started. Dave, why don't we start out with a little bit of the history of the transit market and your experiences with the transit market.

DAVE WALTERS
I stated earlier that I had to do a presentation one time at the transit market, and they had some issues. And when we first went into the transit market, a person like myself was saying, "Well, what's your issues?" And the first one that they said is they've been on bias tires forever. And then all of a sudden, they're going into radials and the brake... We're going from non-asbestos brake lining, and so heat became a real issue. And what's unique mostly to transit is they actually lease their tires. So, they lease the tires, and they pay per mile, so many cents per mile as tire wear. So, because they lease tires, it's a giant issue to them. So, we started to do heat studies and the major tire companies were with us on every one of these and found out aluminum wheels could get rid of a lot of their brake heat between the steel and aluminum and that could last the tire.

DAVE WALTERS
So, we kind of went through the first hurdle because of just plain Jane, the aluminum wheels better at dissipating heat. And the buses, the only thing we can antiquate buses with is transit. They're a waste industry type of stopping because these guys are stopping every corner to pick up people, doing a lot of stopping compared to most vehicles. And so, we really had antiquated to the waste industry. So, believe it or not, that was one of the first big hurdles was that.

MIKE YAGLEY
If I could just make a quick comment on that just for our listeners, at least the way I think of heat dissipation with an aluminum wheel versus steel, what happens is aluminum... If you get aluminum and you get it hot, that heat will transfer all the way through the aluminum pretty quickly. The heat can go all the way from the hub all the way up into the rim. And so, what ends up happening is you have all the surface area of the wheel that is exposed to the air and that helps get rid of that heat, but now with a steel wheel, the heat doesn't transfer through the wheel quite as effectively.

MIKE YAGLEY
So, it sort of stays more localized and you only have a limited amount of air that's really on that surface. And so, what ends up happening is it holds onto that heat a little bit longer, and that holding onto the heat is what Dave is talking about. When the steel wheel is holding onto the heat and that heat goes... It gets transferred by conduction, by the touching of the tire into the wheel rather than by convection, which is the air going over the wheel.

MIKE YAGLEY
The aluminum wheel is just a little bit more efficient at getting rid of that heat, where the steel is going to hold onto it a little bit, and that's at least a very simple way of looking at it. And if, Dave or Doug, you have any other comments, I'd love to hear your thoughts on that, why that is.

DOUG MASON
No, I think you covered it pretty well there. I think Dave, maybe a comment is too, is that the heat damages relate to the bead area of the tire from that transmission of the heat through the wheel to the tire, correct?

DAVE WALTERS
Yes. And it's radiating from the brake drum at that time, from the brake drum into the wheel, into the tire. And as aluminum can dissipate heat at a better rate than the steel, people are looking at this and you're leasing tires, firm beads at one time was pretty regular there, especially with the new onslaught lot of radials. So, as the markets change, things really changed and this kind of leads me into the second thing was, when they got into radials, they never seen rim flange wear ever with the bias buyers. And all of a sudden, they started to see rim flange wear.

DAVE WALTERS
Well, they really became quite alarmed by that. So, we really put a push to develop Dura-Flange and a coating that we can put on the edge of the wheel that will eliminate rim flange wear. And as people would say, it's great when you get to deal with a customer every day and you go back and say here's their issues. And as we come up with new products to solve those issues, that was gigantic, was saying, "Hey, we got a product now that basically will help you not have rim flange wear," and the transit industry has eaten that up. So, I mean, that's another big thing.

MIKE YAGLEY
And now you say the rim flange wear issue on Coach primarily or is that also in the city bus?

DAVE WALTERS
It's on both city bus and the Coach. And again, radial tires flex. The way radials get their higher mileage from bias tires is they flex, and they flex quite a bit. So, the sidewalls flex on that part of the aluminum wheel and if you're in grime and dirt and sometimes the overload of transit buses, they're like, "Well, they don't overload." Well, when you have rush hour in a major city at one time, there's a lot of overloading of transit buses, believe it or not.

DAVE WALTERS
So, they got rim flange wear. And when we came up with the Dura-Flange, and they were a big push into our Dura-Bright wheels too, because they didn't want to clean wheels. They run these buses through a bus wash every day and they wanted just to run the bus through a bus wash and the wheels look great. So, Dura-Bright was a big thing.

DAVE WALTERS
So, I remember the first time I was out in Fresno, California, and the guy says, "Well, I want to buy Dura-Bright Dura-Flange." And at that time, you could get one or the other. And I said, "Well, you can only get one or the other." And he's like, "I want them both." And I remember coming back and saying, "This guy wants both. Can we make a DD?" And now if you look at our sales, most of the transit wheels are Dura-Bright Dura-Flange. It's amazing when you watch an industry grow with Alcoa wheels over the year. But again, we listened to our customer, we went and fixed their problems, and then the last thing that they wanted was a 10-year warranty because they keep their buses for 12 to 14 years and they'd like a 10-year warranty. We did a lot of studies, and mileage is not an issue on a transit bus. So, we basically went to a 10-year warranty on bus wheels, which really helped us capture the market.

MIKE YAGLEY
When it comes to that mileage comment that you made. From an engineering perspective, what causes wheels to crack in the field... Tires, for example, talk a lot about maintaining air pressure. And when we talk about it, the problems with maintenance, we talk about torque. But from an engineering standpoint, when we're designing the wheels, what we're taking into account, there are really two things. Number one, we're looking at the load. And then number two, we're looking at how many cycles, how many miles are you going to put on with that load. And so, what Dave is saying, when he says this whole thing with the 10-year warranty, we did do a deep dive into that. And because the mileage is low and even the loading... You have these short bursts of loading, and you don't have a consistent loading of overload, what you end up with is a very unique market that we can offer something like a 10-year warranty, because it really has those two things working for it.

MIKE YAGLEY
It has, for the most part, typically pretty low loads. And then the second thing is relatively low mileage. And so, we can do something unique to satisfy the needs of that market. That is really, from an engineering standpoint, not a problem. Now, across the board, of course we can't do that, but with this little market niche, we could pull that off. So, that's great that that worked for them.

DOUG MASON
You used the word "Unique" there, Mike, for this market. And there are a number of things within the market that are unique to this market, especially in North America. Most of us are used to a standard 10 on 285, 75 bolt circle is primarily what's used throughout the market in every truck. But when you get into the bus market, it's a 10 on 335 is the primary bolt pattern. That's one unique thing about it. And then there's also another unique feature is the… In general, sleeve nuts are used, which is not common in North America, other than in the bus market.

DOUG MASON
Dave, do you have some of the history behind why it's a 10 on 335? And then I think I have an idea of why it's sleeve nuts, but maybe you could give us a bit of history on that as well.

DAVE WALTERS
One of the acts of handicap acts came out. One of the big things that these transits had to do was figure out how to get wheelchairs onto their buses. They went to basically a design they called a low floor. So, it had to have different axles, different wheels. And a lot of times, the axles had to be to where they could lower the bus down to the curb so the wheelchairs could come in and get onto the bus. So, a lot of things change because of the regulations and the buses have to be equipped to haul all sorts of passengers. So, these low floor buses came and that really changed the market because the axles had to be different. They had to have where they could lower the air to get the lifts on.

DAVE WALTERS
So, it has really changed the market, Doug, and that's why when they went into a lot of this, some of the thought was if they put sleeve nuts on… This is a long time ago when steel wheels were still prevalent. If we use sleeve nuts, we wouldn't have to change all these studs out when we're switching to aluminum wheels, and this is a great fix for us to do that because the heat studies are showing that we need to do that. Not many industries retrofit like these guys did at one time. I mean, I spent quite a bit of my career going and helping them retrofit into aluminum wheels, which was very unique in our market. Again, I guess the key word is "Unique" when we talk about the transit bus market.

DOUG MASON
And so just to say a little more about the sleeve nuts, I don't know if all of our listeners, hopefully customers, are aware of really what a sleeve nut is. And how that works is, on a standard truck with a bolt hole of 26 millimeters and a stud diameter of 22-millimeter diameter, you just have a nut that sits on top of the wheel, obviously bolts it and holds it straight to the wheel. You can imagine if you go from a steel wheel, which may have a thickness of maybe 12 to 15 millimeters, and you go to one of these bus wheels that's more like 25 millimeters in hub thickness, all of a sudden, a lot of area of that stud is eaten up. I think that's what you were referring to, Dave, and they didn't want to change those studs.

DOUG MASON
And so one way around that is to increase the thread engagement by making a sleeve that will go down inside of the bolt hole to hold the nut in place. And to do that, there's a larger diameter hole, typically 32 millimeters. And then we have a sleeve that is threaded attached to the nut base that we would typically see from the surface. And you then have enough thread engagement to hold that all in place.

MIKE YAGLEY
I'm going to have to stop you for a second here, Doug, just to sort of do all the translations for everybody. Because when Doug says the 26-millimeter bolt hole, that's the one-inch diameter bolt hole that you typically see, roughly about an inch diameter bolt hole that we typically see on our wheels. And then the 32 millimeter is roughly about a little less than maybe an inch and a half. And so, what he's talking about is you have that bolt hole gets a little bit bigger and it gives you that chance to put the sleeve down into it. I was talking to somebody this week and I was talking in millimeters… Engineers like to talk in millimeters, and I was talking to them, and they said that they had no idea what I was saying. They made me put it all into inches.

DAVE WALTERS
Thanks for translating. Appreciate it, Mike. And just one other comment on that. It's quite interesting that although sleeve nuts have been in the US market for a very long time, there has not been a specification-related government here in the North American market, and that has led to a few issues that I've run into, and Dave, maybe you've run into them too, where we've had people enter the market and they bring in a sleeve that does not work, a sleeve mount that doesn't work and they don't understand why. And so, what we've done with SAE, and we've talked about these different committees and organizations that kind of help govern what's going on on the wheel end.

DAVE WALTERS
One of them is SAE. They have a truck and bus committee, the number of the suppliers obviously sit on and bring expertise to, and just over the last year and a half have introduced into the SAJ-694 for anyone who was interested in looking, a sleeve nut specifications so that those who are using sleeve nuts in North America, and those who are designing with them as well, will have a clearer understanding of how they should be used in a proper and a safe scenario, because there are a number of things that can occur when you go to a sleeve nut in terms of the amount of thread engagement that you need to make sure that you're holding your torque properly and also so that you don't bottom out the sleeve if it's too long for the wheel hub that's being used. Number of issues there. But that's another unique thing about the bus market is sleeve nuts are primarily used.

MIKE YAGLEY
One of the things that Doug also mentioned was the 10 on 335 bolt circle. And I know we've talked a little bit about bolt circles on the podcast before, but just to go over that once more, if you drew a line that went from bolt hole to bolt hole to bolt hole all the way around and made a circle out of that, and you measured the diameter of that circle, that's the 335 millimeters, which is about a little bit more than 13 inches. In North America, what we use is a 10 on 285, 75-millimeter bolt circle, which is really almost exactly... It is exactly 10 bolt hole on 11 and a quarter inches. So, what they've done, this is a European fitment. That axle that Dave was talking about, that low floor axle that the bus guys used, that was shipped over from Europe.

MIKE YAGLEY
So, that was a technology that was easily available in Europe. And so, what they did was they brought it over here, but the trade-off for that is we had to introduce some European, we'll say, roughly a little bit more than 13 inch bolt hole diameter, bolt circle wheels into the market. That is a very unique thing with the transit bus market.

MIKE YAGLEY
So, now that we've talked a little bit about the history, we've talked about what makes the transit bus market unique, let's talk a little bit about where we see it going. Doug, you want to cover that? Where do you think the transit bus market is going?

DOUG MASON
I think a lot of people will see this already. We've gone green. We've gone green, and electric buses to be used within the city limits is a huge way to reduce a carbon footprint for a city. There's a number of cities, especially in Europe and some in North America where they're making basically a carbon free zone, if you want to call it that, where you can't really have a typical ice engine running. There's no diesels, there's no anything, and they want just zero emission. And so, the bus market has really jumped into this. If you look on any bus website, the first thing you're going to see is all electric or partially electric, and what that does is that drives further the space requirements they need. Dave was mentioning one of the requirements in the past where they had to make the ability for wheelchairs and dropping down and how that made the axles totally change. Well, now you got to put a battery pack under there and that's impacting the wheel end.

DOUG MASON
We're seeing that there's a little extra room that's needed, we're getting requests and we've already started making wheels that have different offsets. And so, the change to electric is going to drive what's going on in the wheel end. Eventually, maybe they'll have wheel and motors there as well. I don't know how that will eventually play out. I know there's those companies who are playing with things like that, but there's tons of electric buses on the market and that's going to drive the axles and the wheel ends to accommodate the next change. So, that's one of the changes that's coming forward, Mike.

MIKE YAGLEY
That's a big one. I really appreciate the discussion. This is a good one. We've talked a little bit about how the aluminum wheels were able to dissipate the heat a little bit better than steel. The market needed that rim flange wear solution. We did the Dura-Flange Alcoa Wheels, developed Dura-Flange. That solved that for them. And then they wanted to have an in and out and just easy cleaning, and that got us to Dura-Bright. I think that pretty much covers it. Any final words, Dave, or Doug?

DOUG MASON
Maybe just one little one. We've talked primarily about the larger vehicles. Now, I'll say that when we talk about transit, you can go down to smaller vehicles, even down to a Sprinter 3500 or a 4500 from four chassis vans, that type of thing, and aluminum wheels are making inroads there as well for some different issues. Maybe we can address that at a different time, but the transit industry runs from the buses that take you to the airport all the way up to the Coaches that we've been talking about, and each segment is unique on its own. Very interesting stuff.

MIKE YAGLEY
Very good.

MIKE YAGLEY
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