TIRE MANAGEMENT

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The subject of my presentation this afternoon is tire management. The first thing to establish are some goals or objectives of tire management.

I feel that we can reach two primary objectives by proper tire management. We can reduce overall tire costs in terms of cost per mile traveled or annual tire cost, and we can reduce downtime. Downtime costs are sometimes difficult to pin down, but they can be very high. Downtime causes the loss of vehicle and operator as well as the expense of a repairman and a service truck.

The first step in tire management is tire selection. This involves the proper selection of tire size, construction, tread pattern and compounds for use in a particular vocation.

The first area to look at in tire selection is the tire construction. Here the questions are whether to go radial or bias and whether to go tubeless or tubetype.

The tire industry has gone through a revolutionary change in the past 15 years. All tire lines, passenger, light truck, truck, farm and earthmover have changed, or are changing, from bias to radial construction.

For the truck tire user, this means a change to an all steel radial construction with a single steel ply running radially from bead to bead and a circumferential belt package of 3 to 4 steel belts encircling the tire under the tread.

The steel belts that run under the tread of the tire perform several important functions that make the radial tire a superior product to its bias predecessor. First, they prevent the tread from squirming in the footprint area. This slows tire wear and improves tire traction. The belts also present a relatively cut and puncture-resistant tread area to the road and, finally, the stiff belt area forces the tire flexing up into the thin sidewall area where less energy is absorbed so the rolling resistance decreases and fuel economy improves.

Modern tire dealer magazine surveyed its readers to find what benefits they felt radial tires gave them. The answers were:

- Fuel economy
- Improved treadlife
- Retreadability
- Road hazard resistance

Fuel economy improvement is naturally dependent upon driving mode with the largest benefits coming in long haul continuous service. However, even local and short haul users benefit from radials.

The modern tire dealer survey showed that, while treadwear improvement with radials was substantial for line haul fleets, it was even more impressive for local service vehicles.

A summary of the radial tire benefits for medium trucks shows:

. Greater Fuel economy	3-8%
. Longer original tread mileage	Up to 60%
. Reduced down time	Road delays reduced 40%
. Improved retreadability	Longer carcass life (Usually 1 additional retread per carcass)

If we look at the total industry usage of medium radial truck tires in 1987, and by medium truck tires we mean all sizes of 19.5", 22.5", and 24.5" tubeless and 20" and 22" tubetype, we see that original equipment usage is now at 72% and replacement usage is now at 62% of total medium tire sales.

During the transition from bias to radial tires, there has been a simultaneous change from tubetype to tubeless tires.

Tubeless truck tires have been around for 25 years or more, but the change from tubetype to tubeless was very slow until the introduction of radial tires.

When fleets and smaller users decided to change to radials, they usually decided to go tubeless at the same time. There is a tubeless equivalent tire size for each tubetype medium truck tire size.

One of the reasons for changing to tubeless tires is to get away from multi-piece rims and the inherent safety problems involved with maintaining inventories of, and correctly using, matching rim bases, side rings and lock rings.

The tubeless rim, with its one-piece construction, is simpler to use and maintain. When combined with a tubeless tire, it forms an airtight package that also offers the advantage of producing a slow leak rather than a blowout when cut or punctured.

Tubeless tire and wheel assemblies are compatible with tubetype assemblies. There is no need to replace wheels when converting to tubeless tires.

The tubeless package of one-piece rim with bolted in valve and tubeless tire replaces a 2 or 3-piece rim assembly plus tire, tube and flap. This eliminates pinched tube failures, foreign material leaks, flap push through and all of the other tube and flap problems.

The current lineup of equivalent tire sizes, which shows tubetype, tubeless and low profile tubeless radial truck tires, show that these latest tire sizes are being introduced in tubeless only.

1987 industry sales figures on medium radial truck tires show that 92% of the tires delivered to original equipment were tubeless while 79% of the radial tires delivered to the replacement market were tubeless.

A summary of the reasons why you should take a serious look at equipping all of your vehicles with tubeless radial truck tires shows that you can expect the following benefits:

- Greater fuel economy
- Reduced downtime
- Longer original treadlife
- Improved retreadability

The next area is tire selection by vocation. We promote the use of specific tires for specific jobs with different tires available for line-haul, metro or city service and special service. By special service we mean applications that involve both on-highway and off-highway usage.

I will only touch lightly on line-haul tire usage because most of you are not concerned with this type of service.

For line-haul service we frequently recommend different tire designs for steer, drive and trail positions. On steer positions, we further subdivide our recommendations based on expected operating loads with separate tire designs for lightly-loaded (10,000 lbs. or less) or heavily loaded (10,500 lbs. to 12,000 lbs.) applications. Drive position tire recommendations vary depending on whether tractors are single-screw, where high traction/lower nonskid tires are used, or tandem drive, where high mileage/high nonskid tires are used.

For trailer positions use we offer a choice of premium carcass/low nonskid tires that resist irregular wear and can be retreaded for use on either drives or trails or a "trailer only" tire for use where a minimum-cost tire is desired for limited mileage trailers, such as those use in intermodal operations (piggy back trailers).

Generally speaking, line-haul usage is going toward low profile radial tires, while most metro and all special service usage remains on conventional sizes.

The industry usage figures for 1987 show that 42% of the medium truck tires supplied to original equipment were low profile, while 23% of the replacement market was low profile.

If we look at the types of vehicles that I think are of most interest to you, they can be divided into vehicles that traverse city, county and state highways on short trips and vehicles that are used both on and off-highway.

In the first group are city delivery vehicles, school busses, etc. These vehicles can have box type bodies or stake bodies or even light dump bodies.

For these vehicles, the recommended tubeless radial design for the front axle is a premium rib design with good lateral traction, long wear, good puncture resistance and good retreadability.

For the drive axle, the recommended tire is a traction design offering good mud and snow traction along with long, even wear and good retreadability.

In the category of trucks requiring special service tires are refuse trucks, dump trucks, logging trucks, etc.

We further subdivide this group into vehicles that spend most of their time on the highway with some amount of time on gravel or unimproved surfaces and vehicles that are primarily in off-highway operations with only a small amount of highway service.

For this first group, we recommend that the steer tire be an aggressive rib design with a tread compound that is more resistant to chipping, chunking and cutting than the on-highway rib design.

For a drive tire, we recommend an aggressive traction design with a chip, chunk and cut-resistant compound that is capable of long highway hauls as well as having an open traction pattern for off-road operation.

For the truck that will be spending most of its service life off-road, we recommend a different set of steer and drive tires.

The steer tire is more aggressive and deeper in nonskid than the one used primarily on highway. The compounding is for maximum chip-chunk resistance. Some of the ability to run long distances at high speed and to give maximum wear on paved surface is sacrificed to obtain these goals.

The companion drive tire has maximum nonskid depth with a high traction design aimed at providing traction under the worst underfoot conditions. All of these tires have carcasses suitable for multiple retreads.

The other component of good tire management, after a tire of the proper construction and vocation has been selected, is good tire/vehicle maintenance. Two major components of this maintenance are complete vehicle alignment and proper tire inflation maintenance.

Proper alignment is the key to long tire life. There is no question that you cannot obtain the full treadwear advantage of today's radial truck tires without paying attention to complete vehicle alignment.

Total vehicle alignment applies to all of your truck or tractor power units. Attention must be paid to the basic frame geometry. Axles, both steer and drive, must be perpendicular to the frame centerline and tandem drive axles must be parallel to each other.

Here is an illustration of a chassis alignment. From a bar set up perpendicular to the frame, measurements are made to the rear drive axle. From the rear drive axle center, measurements are made to the front drive axle. Measurements are also made from the bar to the front axle. Left side and right side measurements should be within 1/8 inch of each other in all cases.

Once the perpendicularity of the front axle has been established, front axle toe-in, camber and caster must be checked.

Toe-in is checked by measuring the difference in distance between the center line at the front of the steer tires vs. the rear of the steer tires.

Excessive toe-in or toe-out will cause one-sided wear on the steer tires. This is often visible as feather wear and will cause a loss in tread wear and may result in steering wander.

The effect of excessive toe-in is across the tire, as if the tire were running sideways down the road.

The next alignment check is camber and this is a measurement of each tire's angle away from vertical. Each wheel position is measured separately and more camber is usually specified for the left side of the vehicle than the right side to compensate for road crown.

Excessive camber will cause abnormal wear on one shoulder and may also result in steering pull.

The final steer axle check is for caster. Caster is the angle between the axle centerline and the point where the axle is bolted to the suspension. A certain amount of positive caster is required for steering control.

Excessive caster will result in hard steering and abnormal road shock. Excessive left-to-right caster differential will result in steering pull. Insufficient caster will cause road wander and make driving in a straight line difficult.

Attempts to properly align a vehicle will often disclose other problems that are causes of irregular tire wear. These include problems with wheel bearings, tire rod ends, springs, torque arms and bushings. In addition, improper or uneven loading can cause tire wear problems.

We have published our recommended front end alignment settings and most of the trucking industry and truck manufacturing industry agree with these settings. Further test work indicates that even lower toe and camber settings may improve tire wear and more testing is being done in this area.

A number of common threads run through treadwear data collected from many vehicles over a long period of time:

- Steer axle tires wear faster on tandem drive vehicles than on single drives because it is more difficult to make a tandem axle change direction.

- Left front tires wear faster than right front tires because the left front is directly connected to the steering box and, therefore, does most of the fine steering corrections.

- Rear tandem drive tires wear slightly faster than front tandem drive tires as the vehicle pivots about the front tandem drive causing the rear tandem drive to do more sideways sliding.

- Steer axle tires applied in spring/summer wear faster than those applied in fall/winter because of the effect of higher ambient and higher road temperatures on full nonskid tires.

The last point I want to touch on in tire management is proper tire inflation. It is the air in the tire that carries the load.

Remember that a tire is an air container but each load imposed on the tire has a proper inflation pressure. Because underinflation is so much more

destructive to a tire, the inflation pressure should always be set so as to support the maximum load that the tire may experience.

Underinflation causes a rapid loss of treadwear. Even more important is the fact that underinflation causes excessive tire heat buildup that can lead to tire failure.

We have produced a radial truck tire service manual that covers most aspects of proper tire and vehicle maintenance. If anyone wants a copy, I will be glad to take your card and mail one to you.