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Future Truck Program Position Paper: 2004-4

Expectations for Future Tires

Developed by the Technology & Maintenance Council's (TMC)
Future Tire Reliability/Productivity Task Force

ABSTRACT
This TMC Future Truck Position Paper defines the future performance requirements of tires based on fleet/equipment user descriptions of their needs and concerns. This paper covers all aspects of new tires, retreaded tires, tire repairs, and all associated maintenance issues.

INTRODUCTION
This TMC Future Truck Position Paper defines future features and expectations for tires and wheels in terms of product performance, maintainability, reliability, durability, serviceability, environmental and educational issues. The paper's objective is improving tire and wheel value to fleets/equipment users.

PERFORMANCE EXPECTATIONS
The focus of all tire performance is ultimately to improve tire value. It is expected that continued advances in technology will yield longer tread life, both in terms of miles per 32nd rate of wear and actual removal mileage, even with the greater engine horsepower we see now and in the future. Future tires are expected to generate less irregular wear and be more tolerant of vehicle misalignment. Future tires should provide better traction—in both wet and dry environments—for starting, stopping and cornering. However traction is improved—whether it be by compound or tread design, for example—tire noise must be controlled, resistance to flat spotting must improve, the tendency for hydroplaning must be reduced, and tire-related splash and spray must be minimized. Future tires should experience less stone retention and, therefore, less stone drilling-type casing damage. Tires should also feature improved casing retreadability and repairability, as well as improved appearance with respect to ozone or weather checking—a tire's natural aging condition.

Future tire performance will require greater tire uniformity to improve vehicle ride, reduce vibration or the need for balancing a tire/wheel assembly. More uniform tire construction should reduce driver complaints on pulling,

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(radial force, ply steer, connicity), and lopping or wobble, (radial and lateral runout, improper bead seating). Better uniformity should also produce casings of identical dimensions enhancing dual matching and retreadability using mold cure systems.

Tires should be more resistant to heat caused by speed, load and varying internal pressure. They should reach their operating temperature more quickly and maintain it more evenly. Tires need to be more durable in terms of surviving impacts, road hazards, and punctures. They must also be better at resisting damage from mounting procedures and tools. Tire innerliners should improve retention of whatever gaseous inflation medium is used—i.e., air, nitrogen. Performance should be achieved while maintaining—or improving—tire rolling resistance and vehicle fuel economy.

MAINTAINABILITY EXPECTATIONS

Tires should be as maintenance free as possible. This could be accomplished by the development of run-flat truck tires, non-pneumatic tires or even self-contained and disposable tire/wheel assemblies. In the shorter term, making future tires easier to maintain means making air pressure maintenance easier. This could be achieved by the use of flow through/self-sealing valve caps and clearer accessibility to the inside tire of the dual assembly. Also, valves could be designed with the flow through cap concept as a permanent feature and not require any separate, removable valve cap. Pressure can be more easily maintained if there was only one valve to check and adjust pressure through, such as connecting duals with a pressure equalizer or even replacing duals with single wide-base tire. Pressure maintenance would be faster if shop compressors developed greater air volumes more quickly, allowing the maintenance of pressures over 100 psi without a time penalty. The adoption of large bore valves for commercial trucks would also speed up air pressure maintenance.

Air pressure maintenance systems are also being developed. Electronic tire tags could consist of miniature pressure sensors that would allow a driver or technician to read tire pressure without touching the tire itself. On-board pressure management systems could not only monitor tire pressure and keep drivers alerted, but also could adjust tire pressure automatically and continuously—even when the vehicle is in use. Such systems could also be used to optimize the pressure for the load to develop the largest tire footprint, reducing possible tire/load induced road damage. On-board pressure monitoring systems can alert drivers to a leaking tire, record the time of the notification and confirm what action is taken and when. Better pressure maintenance should further reduce the occurrence of tires running underinflated for the load carried and subsequently reduce the tire debris currently found on the road. The use of electronic sensors, instant satellite communications, and maintenance software packages should help fleets plan tire maintenance and purchases more accurately.

Future tires will continue to require better and drier air to enhance casing life. Nitrogen or some other alternative inflation medium may be developed to easily and inexpensively maintain tire pressure and enhance casing durability. Also, foam or other semi-solid materials could be developed so air pressure is not needed, eliminating penetrations/other road hazards and reducing vehicle down time and tire repairs.

If a gaseous fill is used, improvements should be made in valve stems, valve stem grommets/seals, and valve cores, to make inflation, deflation, inspection and air chamber sealing more reliable in all applications and climate conditions.

Future tires must be clearly marked and easier to mount, especially when considering directional tread designs. Tires must be easier to inspect both on and off the vehicle, and easier to accurately measure remaining tread depth. For example, tire brand, tire size, ply rating, DOT numbers, high point marks (HPM), and balance marks must be large and legible. However, accuracy cannot be sacrificed.

RELIABILITY EXPECTATIONS

Tires of the future need to be more reliable in all operations at all times, assuming proper application. Tires should be able to operate at higher sustained speeds, in all climate conditions and must minimize any occurrence of casing component separation, air pressure loss, and be balanced for life to reduce any irregular wear and eliminate vehicle ride disturbances. Tires must continue to meet and/or exceed all future legislative regulations.

DURABILITY EXPECTATIONS

Depending on application, tires should be engineered in such a way as to match the service/maintenance life of the vehicle on which they are mounted. For example, in linehaul service future tires should be able to achieve a million cumulative miles for original tread and all subsequent retreads. Fewer tire changes and longer service intervals should improve tire cost per mile. Tires should be more resistant to road hazard failures, and see reduced pressure loss through the tire casing.

SERVICEABILITY EXPECTATIONS

Future tires should be easier to mount and dismount from a wheel. They should not require additional external lubricant and the bead should be of a design that ensures perfect, concentric seating every time. These tires should have a standard and more visible rim centering ring to confirm at a glance the perfect concentric seating of the tire to the wheel.

Future tires should be marked more clearly and in an industry-standard fashion for match mounting to wheels for both original equipment and replacement markets. This marking should become unnecessary as tires are designed and constructed with greater uniformity. Also, basic tire marking, such a size, max. load and pressures, DOT, a unique tire ID, and other pertinent data, should be designed and molded to be more easily readable when mounted on a vehicle. These markings could also be designed to be scanned by hand-held readers to create electronic tire files instead of hand written records.

Tire weight should be reduced to facilitate easier handling, better rolling resistance and fuel economy characteristics and reduced Federal Excise Tax to the user. Tires may become repairable from the outside (not requiring a dismount), designed to be self-sealing for punctures, or have a the capability to run without air for short periods of time and mileage before replacement. There should no longer be a need for a “spare” tire.

Tires should be smaller to facilitate greater cubic capacity for trucks and trailers. Also, these smaller tires should operate at lower pressures (less than 100 psi) and should incorporate the largest possible footprint at the lowest pressure to reduce the possibility of road surface damage.

ENVIRONMENTAL ISSUES

Future tires must be designed and used with environment quality in mind. Future tires—at the end of their useful lives—should be totally and safely recyclable. Tire construction materials should be non-toxic. And, as long as tires are held before disposal/recycling, the innerliner should include some material to make the tire interior inhospitable to insects and other small; undesirable wildlife.

EDUCATION/ TRAINING EXPECTATIONS

Future tire/wheel systems should feature new and more efficient means of training personnel. A comprehensive, objective, and recognized program must be made readily available, easy to understand and conducted in a short period of time. ❑