



Pavement Damage from Vehicle and Tire Configurations

First a little history, the truck began to grow as a freight carrying mode with the invention of the pneumatic tire in the 1920's. The pneumatic tire gave a better ride and allowed for higher speeds. The dual rear tires came at about the same time to enable a higher load capacity on the rear axle. This was not driven by regulations, but by the limitation of the tire/wheel capacity.

The number of paved roads grew during the 1930's as the Federal highway system came into existence and so did the number of trucks. In 1930, there were 329,000 registered in the United States. These trucks were running on bias ply tires and the tire cord or structure was changing from cotton to rayon for more strength.. The rayon was replaced by nylon during the 1940's, while their construction remained bias, meaning the sidewall belts were at an angle to the tread.

As load capacity increased more belts or plies were added to carry the load. Adding addition plies made the sidewall of the tire stiffer, which meant that they absorb less shock and transmit more back to the road surface. These stiffer sidewalls also tended to reduce the tire contact patch, the area of tread on the road, as load was increased. The bias ply design has been replaced by radial designed tires. The changed occurred on passenger cars during the 1960's and on highway trucks during the 1980's. In 1966 Congress gave the responsibility for highway safety to the Department of Transportation, and the National Highway and Traffic Safety Administration, NHTSA, was formed. Tires would begin to become rated and regulated.

At the same time, states were busy constructing the Interstate Highway System. In 1980 the trucking industry was deregulated and the maximum weight limit for the five axle tractor semi-trailer was raised to 80,000 lb. The maximum weight structure changed for the Federal Highway system, but regulations of equipment and enforcement was only destined to grow with the founding of the Commercial Vehicle Safety Alliance, CVSA, in 1982. So this brings us to where we are today, nearly thirty years later.

Although the weight limits have remained the same for the past thirty years, vehicles have improved. There have been many advances in vehicle technology over the same time frame. Tractors have become far more comfortable for the driver, which has had a side benefit for highways.

In order to provide a better ride for the driver, softer front tapered leaf spring suspensions with better damping were installed that replaced the much stiffer multi-leaf stacked front springs without shock absorbers. These softer front suspensions were matched by air ride rear suspensions with large shock absorbers.

While providing for a better ride because of reduced impacts to the chassis and the driver, these suspensions also reduce the impact to the road surface. Trailer suspensions have also trended toward air suspensions as driven by competition for cargo protection. These five axle tractor & semi-trailer combinations represent more than 81% of the heavy air brake vehicles on the highway today. The industry moved to radial tires primarily for better fuel economy, and also gained better ride and handling.

The same radial sidewall tire characteristics also help the road surface as they absorb impacts and maintain the tire's contact to the road.

Thus, with the vehicle's having better, softer, more road friendly tires and main suspensions our road damage should be reduced with the same amount of maintenance. In other countries, these more road friendly vehicles are rewarded with higher allowable load limits.

As far as the new generation of wide base, NGWB, tires, they fit into the same category. At the same axle load limits, they have virtually the same tire contact patch as their dual counter parts, and operate at the same tire pressures. This is different from the earlier "super single" wide base tires which had a lesser tire contact patch and operated with 25% greater air pressure. The higher air pressure led to greater pavement impact, and the potential for rutting.

These tires are still used in certain heavy front axle configurations, but should not be confused with the NGWB tires, which have been proven to provide fuel savings and reduced emissions. They should not be penalized for the problems of previous designs, but should be allowed to carry the same load as their dual counterparts.



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