EXPERIMENTAL DETERMINATION OF THE VARIATION IN PRESSURE INTENSITY OVER THE CONTACT AREA OF TIRES

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(In Abstract*)

In order to obtain basic data concerning the actual variations in pressure intensities in the contact area between vehicle tires and pavement surfaces, the Bureau of Public Roads has recently developed a new method for determining such unit pressures and has applied it to two tires representing extreme conditions of cushioning—a solid rubber tire and a thin-walled, low-pressure pneumatic tire (airplane type), each under a 4,000-lb load Both had smooth treads

Each tire was loaded in a universal testing machine, a smoothly-ground steel bearing plate being used to receive the reaction On this bearing plate a 5/16-in wide friction bar of polished brass and suitable filler plates of equal thickness were placed. The tire reaction was transmitted to this built-up plane surface through a sheet of thin steel shim stock which provided a constant friction surface to the upper face of the friction bar The average force required to overcome initial friction in sliding the friction bar between the steel shim and the ground bearing plate was determined for successive parallel positions 5/16-in apart transversely until the entire area of contact had been covered By allocating the total test load to the various elemental 5/16-in wide longitudinal contact strips in proportion to the ratio of frictional force required for each strip to the summation of all frictional forces, a first differentiation, in effect, of the total load on the contact area was accomplished

A second differentiation which apportioned the load applied to each elemental strip according to average differences in initial frictional force required for various lengths of the friction bar covered by the tire, a stationary dummy bar being placed over the remaining portions of the elemental strip, was then accomplished in a similar manner The total load being thus broken down into individual loads on elemental areas, the unit pressure at the center of each elemental area was considered to be equal to the average pressure over that area Such points of unit pressure were then respectively plotted on an outline tracing of the gross contact area, and lines of equal pressure intensity were drawn

The tests show that the maximum load intensities occur in two transversely symmetrical zones rather than at the geometric centers of the areas Analysis of the data suggests the possibility that an ellipsoidal distribution, in which the pressure intensity varies as the ordinates to a semi-ellipsoidal surface of definite proportions, may be a conventionalization which more nearly represents the actual pressure intensity distribution than does the assumption of a uniformly loaded circular area frequently used

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DISCUSSION ON TIRE PRESSURE INTENSITY

MR G M SPROWLS, *Goodyear Tire and Rubber Company* · We have also done some work on the intensity of pressure distribution on pneumatic tires While we have used a different method of making measurements, the type of curves secured from our data follows the same general trend as just shown by Teller and Buchanan Our work has been confined largely to standard truck and passenger tires with tread designs It is to be expected that the intensity of pressure under such conditions would be greater than with a smooth tread tire, and a rather thin tread at that, mounted on a carcass more flexible due to a fewer number of plies We have found relatively higher intensities of pressure than indicated by Teller and Buchanan, but we do not believe this to be contradictory to their findings

Our equipment consisted of a platten with a small hole (about 3/16 in dia) in the center A plunger, passing thru the platten, is balanced by adding water to a bucket at the opposite end of a horizontal lever The plunger is placed flush with the surface of the platten and its vertical position located by the cross hairs in a telescope The portion of tread where intensity of pressure was desired was then moved on the platten until it came directly over the plunger and load applied Weight is then added to the bucket until the pressure is balanced

Our work indicated that the intensity of pressure on a 5 00-19 tire with 800 lb load and 30 lb inflation pressure varies from 2½ to 3 times the inflation pressure This is considering a conventional 3 rib tire with design on the shoulders outside of the ribs—the pressure per square inch on the center rib varying from 2 3 to 2 6 times the inflation pres-

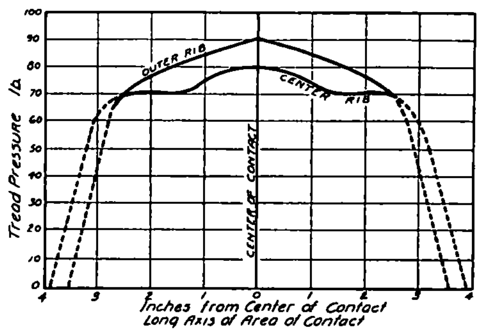

Figure 1

sure and the outer rib from 2 3 to 3 0 times the inflation pressure—varying from the center to end of contact area (See Fig 1.)

While the above work was on a passenger tire, it is assumed that larger tires would follow the same trend

Whether or not distribution over the area of contact would lead to significant differences in pavement stress is rather questionable However, this is more of a question for road engineers to decide