Effects of Lower Tire Pressure On

Frost Weakened Roads

by

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CHAPTER 1. INTRODUCTION

Every year, thousands of miles of roads are closed or severely restricted to heavy traffic due to structural weakness during spring thaw. Spring thaw, as the period is known, varies in length depending on the severity of the winter. As thawing occurs, pavements become weak due to the high moisture content in the underlying base course and subgrade. In extreme cases, the base course and subgrade can become completely saturated and so weak that less than a hundred passes of an 18,000 pound axle will cause the pavement to fail. Most pavements with high traffic volumes in areas where roads are subject to freezing are designed to resist the effects of spring thaw. For example some agencies construct pavements where the depth of the pavement structure built of non-frost susceptible materials (such as a crushed stone base) is at least half the expected depth of freeze. This type of construction can be expensive when it is considered that the depth of freeze can be over five (5) feet. Other methods used to resist the weakening caused by spring thaw usually increase construction costs.

To reduce damage during spring thaw, some road departments place load restrictions on vehicles. These load restrictions are often as much as a 60 percent reduction of normal loads (1). Even with these load restrictions, large sums of money are still spent each year repairing damage caused during spring thaw.

Although the load restrictions do reduce pavement damage and save pavement maintenance and repair costs, these restrictions cause considerable economic impacts. Load restrictions are placed mostly on low volume roads which have not been designed nor constructed to resist the effects of spring thaw. These load restrictions can prevent transportation of goods by heavy vehicles, typically tractor-semi trailers. In many cases, companies may have to completely stop some or all of their operations during this period. This results in economic losses to employees, companies, state and local governments. Examples of industries that are affected include:

- Logging companies
- Dairy processors
- Heavy transportation companies operating in rural areas.

Essentially any type of business that relies on the use of heavy trucks in its operation can be adversely effected when load restrictions are placed on roads due to weakened pavement.

In this paper the results of a theoretical investigation of the effects of lower tire pressure on roads in a severely weakened condition, such as is found during spring thaw. With the recent technological development of Central Tire Inflation

(CTI) in the trucking industry, trucks may be able to operate on roads subject to load restrictions. CTI would allow trucks to operate at lower tire pressures on load restricted roads and then easily increase tire pressure from inside the truck cab when the truck transfers to a road not subject to load restrictions.

The second chapter reviews the results of previous studies about the effects of tire pressure, axle loads, and tire type on pavement structures. These studies found that tire pressure only had benefits on thin flexible pavements (less than four inches of asphalt concrete) or aggregate surfaced roads which are typical for low volume roads. These studies also found that axle loads played the largest role in reducing stress and strains in flexible pavements. Also in Chapter 2 is a review of the methods and results of three "AASHO type" closed loop road tests and a field test conducted by the Department of Agriculture, U.S. Forest Service on CTI applications.

In Chapter 3, the failure criterion used in this study are discussed. A computer software program designed to calculate strains in multi-layer systems called ELYSM5 was used to determine strains at the bottom of the asphalt layer and top of subgrade. The strains were used to calculate load repetitions to failure for fatigue and rutting using formulas developed by the Asphalt Institute. Strains and load repetitions to failure were determined for multiple pavement sections, subject to various loads, tire pressures, axle configurations and pavement strengths.

Chapter 4 is used to examine the effects of reduced tire load and tire pressure on the increases in the number of load repetitions to failure for rutting and fatigue. By comparing the overall effects on each pavement section, the amount of influence tire pressure and tire load reduction have in relation to pavement thickness will be seen. Also the general effects of tire pressure reduction and tire load reduction by themselves and together are evaluated. Finally recommendations on how the results of this study can be used are discussed.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

The number of references on the effects of tire pressure on pavement performance is limited. The study of the effects of tire pressure on pavement performance is a recent item of interest as very few articles were over 10 years old. The most common pavement material investigated quantitatively was asphalt concrete. How well asphalt concrete pavement performed was found to be a function of several parameters. These parameters were tire pressure, axle loads, axle configurations, tire types and pavement material properties. No information specifically addressing the effects of lower tire pressure on severely weak pavements was found.

The results of two "AASHO type" road tests and one field study conducted by the U.S. Department of Agriculture, Forest Service on the effects of Central Tire Inflation (CTI) provided excellent information about the effect of lower tire pressure on weaker road surfaces such as thin asphalt concrete, crushed aggregate and native soil. However none of the studies took measurements of actual strains.

2.2. Pavement Failure Properties

2.2.1. Pavement Failure Modes

To properly analyze the effects of lower tire pressures on weakened pavements, such as is found during spring thaw, an understanding of the failure mechanisms for asphalt concrete and aggregate roads is needed. Field testing has shown that asphalt concrete pavements fail in one of two different modes; fatigue, which shows as excessive alligator cracking; and rutting which shows as permanent vertical deformations along the wheel path (2). In one study by Marshek on asphalt concrete pavements, the tensile strain at the bottom of the asphalt concrete and the compressive strain at the top of the subgrade were studied because they were known to be critical to predicting fatigue and rutting failure respectively (3). All of the Forest Service studies used rutting as the primary failure criteria for aggregate surfaced roads, although, the phenomena known as “washboarding” was used also when it was severe enough to significantly restrict travel speeds.

2.2.1.1. Fatigue Failure

As mentioned earlier, fatigue failure is primarily a result of excess tensile strain at the bottom of the asphalt concrete. No matter whether laboratory testing or theoretical analysis was used, the idea of relating tensile strain at the bottom of the asphalt layer to the number of load repetitions to failure was adopted by

most researchers. Therefore, if an asphalt concrete pavement is to resist fatigue damage, the tensile strains in the pavement structure must be kept low (4).

The amount of fatigue cracking and hence pavement life was found to be a function of several factors. These factors included tire pressure, the stiffness of the asphalt concrete and base layer (4). The influence of these factors is discussed later in this Chapter.

2.2.1.2. Rutting Failure

Like tensile strain at the bottom of the asphalt concrete layer, there is a correlation between the vertical compressive strain and the number of load repetitions to failure for pavement rutting (2). Although it is nearly universally accepted that the tensile strain at the bottom of the asphalt concrete surface is directly linked to fatigue failure, researchers are not in total agreement at which point vertical compressive strains are more indicative of rutting failure. Most studies have found that the vertical compressive strain at the top of the subgrade to be the best indicator of rutting failure. Marshek found that 70 to 95 percent of the vertical compressive strain is found in the subgrade layer and therefore, the vertical compressive strain at the top of the subgrade is of most interest in predicting rutting failure. It was their conclusion that these vertical compressive strains, particularly those in the subgrade, are responsible for rutting failure (3).

Other field and research studies have concluded that the rutting in the crushed aggregate base course contributes significantly to overall rutting of flexible pavements. For example, the Probabilistic Distress Models for Asphalt Pavements (PDMAP) study concluded vertical compressive stress of the asphalt concrete/base layer interface was a significant variable in the development of surface rutting. The PDMAP study concluded that the most significant correlation's were obtained with vertical deflection at the surface of the pavement, followed by vertical compressive stress at the interface with asphalt concrete and base layer. However this study did not measure the vertical compressive strains at the top of the subgrade and therefore the study did not compare the correlation of vertical compressive strain at the top of the subgrade to the development of surface rutting. (13)

2.2.2. Causes of Weakened Pavements

All pavements eventually fail, no matter how they are constructed. The rate at which they fail is a function of several factors which include material properties, pavement structural thickness, the environment in which they are built and traffic loading. When designing a pavement section, the designer will usually consider several specific factors which include:

- Expected pavement life (20 years for most roads and up to 40 years for major highways).
- Expected number of Equivalent Single Axle Loads (ESAL) during the design life.
- Material properties. The most important is the stiffness of each material layer.

After the pavement is constructed, it is anticipated that with proper maintenance the pavement will perform for the expected life span. Sometimes the pavement fails much earlier than expected. If the cause of the early failure can not be attributed to an unexpected increase in traffic loading or improper construction, then it is usually can be attributed to weakening of the pavement structure. This usually means a decrease in the strength or stiffness of one or all of the materials used to build the pavement.

One of the most common causes of weakening of a pavement section is excess moisture content in the base course or subgrade. As the moisture content of these materials exceeds its optimum, the material looses density and becomes weaker. In the case of paved roads, the most common reason for excess moisture content is the thawing of the pavement section in the spring. During this time water that was drawn to the upper layers of the pavement during freezing and the formation of ice lenses, can not drain through the frozen layers below it.

The severity of the weakening can be quite dramatic. One study done in eastern Washington used a falling weight deflectometer to measure insitu pavement resilient modulus. Base course values ranged from 80,000 to 22,000 psi in the summer and 30,000 to 13,000 during spring thaw. Subgrade resilient modulus values were from 20,000 to 8,500 psi during the summer and 15,000 to 5,000 during spring thaw (1). These low moduli are typical of those that occur during spring thaw and can result in either the placement of load restrictions by road agencies or the premature failure of the road structure if load restrictions are not placed.

2.3. Mechanics of Asphalt Concrete Pavement Response

2.3.1. Introduction:

How well an asphalt concrete pavement performs is directly related to how it responds to the factors that effect it. The essential factors are tire contact pressures, tire inflation pressures, axle loads, axle configuration, tire type, and pavement material properties. The two key elements included in each study reviewed were tire pressure and axle load. With the exception of axle load, all the essential factors sometimes did or did not influence asphalt pavement performance with regard to either fatigue or rutting failure depending on the

values of the other variables. The interaction of these factors is addressed in the following paragraphs.

2.3.2. Tire Contact Pressure:

Tire contact pressure is the actual pressure measured where the tire contacts the pavement surface. Three assumptions are usually made about tire contact pressure in most pavement response studies: it is uniform, it acts on the circular area, and is equal to the tire inflation pressure. This simplified theoretical analysis is believed to be of sufficient accuracy for design work. However, premature failure of some pavements designed using criteria developed from studies using these assumptions could be caused by an underestimation of the strains and stresses due to truck tire loading in those studies (5).

The correlation between inflation pressure and actual contact pressure is one area of tire performance that is not well understood. Due to the many different types of tires and their construction, a reliable model has not been developed to predict actual tire contact pressure. Analytical studies of truck tires show that the contact pressure can be two times the inflation pressure where the tire contacts the road surface. A study by Roberts found that for inflation pressures of 75 and 125 psi, resulted in peak contact pressures of about 150 and 220 psi respectively (5). The scope of the study was expanded when it was found that the basic assumption that tire/pavement contact pressure is equal to the tire inflation pressure was in error. Roberts did find that at a constant tire load, the tire contact pressure becomes more uniform at lower tire pressures(5). Marshek, in another study, used experimentally obtained tire contact pressure distributions as input to an computer analysis program (6).

2.3.3. Tire Pressure, Axle Loads and Axle Configuration

2.3.3.1. Tire Pressure

How much tire pressure effects pavement performance with regards to fatigue and rutting failure depends generally on two pavement properties: pavement thickness and stiffness of the base and subgrade layers.

2.3.3.1(a). Pavement thickness

In the studies reviewed, asphalt pavement thickness ranged from 1 to 10 inches. With regard to fatigue failure, when the asphalt concrete pavement thickness is in excess of 4 in. the effects of tire pressure on tensile strains were found to be relatively minor. Roberts found that for asphalt concrete pavement thickness 4 in. or greater, the effect of tire inflation pressure on tensile strain was less than 10 percent (5), while Sebaaly reached the same conclusion noting that “the effect of inflation pressure was as low as 1 percent for asphalt layers with

thicknesses of 4,6, and 8 in." Sebaaly also found that the effect of tire inflation pressure was greatest for asphalt concrete pavement 2 in. thick (4).

2.3.3.1(b). Stiffness of Base and Subgrade

The stiffness of the base course has been found to have an effect on the amount of influence tire inflation pressure had on strains. Roberts showed that increasing tire inflation pressure from 75 to 125 psi produced a range of 20 to 30 percent increase in the tensile strain for a 1-inch surface. This was supported by an analytical study's results which found an approximate 35 percent increase in tensile strain by increasing the inflation pressure from 75 to 110 psi. for the same thickness (3). The reason for the range of a 20 to 30 percent increase in tensile strains in the Roberts study was determined to be a function of the base course stiffness. The stiffest base course (elastic modulus equal to 60,000 psi) caused a 30 percent increase in tensile strain at the bottom of asphalt while the least stiff (elastic modulus equal to 20,000 psi) caused the lower increase of 20 percent. However, the range of base course stiffness used in the study (elastic modulus equal to 20,000 to 60,000 psi) were relatively stiff compared to values found during spring thaw (1),(4). No studies analyzing the effects of weak bases and tire inflation pressure on pavement strains were found.

The effect of tire pressure on rutting failure, which is a function of compressive strain is minimal in the cases studied. Marshek reported that increasing tire inflation pressure from 75 to 110 psi in asphalt pavements 2 to 4 inches thick, produced only a small increase in the compressive strains at the top of subgrade for the cases modeled. Therefore, they concluded that tire inflation pressure was an insignificant factor in causing subgrade rutting (6). However, this study only examined the effects of a single tire load, thereby omitting the effects of multiple tire loads.

2.3.3.2. Axle Loads

In the studies reviewed, axle load was found to be directly related to both fatigue and rutting failure. Marshek found that increasing axle loads directly resulted in increases in both horizontal tensile strain and horizontal shear strain in the asphalt surface course. In that study, Marshek concluded that of all the factors studied related to fatigue failure, axle load was the primary factor causing fatigue failure (3).

Axle load was found in several studies to be directly related to vertical compressive strain. Sebaaly observed that the effect of the axle load on the compressive strains in the subgrade was relatively uniform for all asphalt concrete surface thicknesses. Any increase in the axle load increased the maximum compressive strain by a proportional amount, regardless of asphalt concrete thickness. Sebaaly noted that a 20 percent increase in axle load

produced approximately a 20 percent increase in the critical subgrade compressive strain for the 2 to 10 in. thickness of asphalt concrete used in the study (3).

2.3.3.3. Axle Configuration

Axle configuration was found to play a minor role in pavement performance. Only a study by Sebaaly addressed this factor (2). The study found that tandem axles produce lower tensile strains but higher compressive stresses (vertical compressive strains not reported) than single axles under the same per-axle load. For example a load of 17,600 lbs. on a single axle (total load 17,600 lbs) produced a horizontal tensile strain of 145 micro strains at the bottom of the asphalt layer, while a load of 17,200 lbs/axle on a tandem axle (total load 34,400 lbs) produced only 133 micro strains. Compress stress for the same loading conditions were found to be 4.2 psi for the single axle and 6.9 for the tandem axle. The reason for lower tensile strains under a tandem axle than single axle is explained by the pavement tensile strain response. When the pavement structure is subject to a tandem-axle load, the axle on top of the point of interest produces horizontal tensile strains while the axle 50 in. away produces horizontal compressive strain. Therefore, a portion of the tensile strain is canceled by the compressive strain. In the case of the single-axle configuration, the point of interest is only subjected to tensile strain, and no canceling effect occurs. Therefore, if we compare tandem-axles with single-axles on the basis of similar per-axle load level, the passage of one tandem axle produces less fatigue than the passage of two single axles. Because tandem axles do not have any canceling effects under compression, they produce higher compressive strains than single axles on an equal per axle load (2).

2.3.3.4. Summary

In summary, tire pressure only played a significant role in pavement fatigue performance if the asphalt concrete thicknesses were less than four inches. Axle configuration's effect on tensile strain was minor, but was evident regardless of asphalt thickness. Changes in tire pressure were found to have little or no effect on pavement compressive strains regardless of the pavement thickness. The predominant factor found affecting pavement performance with regard to both fatigue and rutting failure was axle load.

2.3.4. Federal Highway Administration Study (7)

In 1987, the Federal Highway Administration (FHWA) conducted a study at its Turner-Fairbank Highway Research Center in McLean, Virginia. Using the Accelerated Loading Facility test machine the FHWA investigated the effects of tire pressure on flexible pavements. The first part of the two part study

measured actual surface deflections and strains for different combinations of loads and tire pressure using inplace monitoring equipment. The second part evaluated the extent of rutting and fatigue cracking on two pavement test sections using the same load but different tire pressures after 100,000, 200,000, 300,000, 400,000 500,000 and 600,000 passes of a simulated load..

Both parts of the study used the same two pavement sections. Lane 1 consisted of a 2 in. asphalt concrete wearing course, a 3 in. asphalt concrete binder and 5 in. of crushed aggregate base over native subgrade. Lane 2 used a 2 in. asphalt wearing course, a 5 in. asphalt concrete binder and 12 in. of crushed aggregate base.

Part one of the study used insitu strain gauges to measure actual pavement surface strains and the strains at the bottom of the asphalt. Strains at the base-subgrade interface were not measured. Total loads of 9,400, 14,100 and 19,000 lb. were applied on dual tires at tire pressures of 76 psi, 108 psi, and 140 psi. Two different tire types, bias-ply and radial, were used in the study. Table 1 lists pavement material properties.

Table 1
Average Pavement Material Properties

Layer	Pavement Thickness Test 2-2	Composite * Moduli Test 2-2	Pavement Thickness Test 2-3	Composite * Moduli Test 2-3
Asphalt Concrete	6.8 inches	41,500 psi	7.3 inches	49,400 psi
Base	11.2 inches	12,000 psi	11.8 inches	15,400 psi
Subgrade	-	7,000 psi	-	8,400 psi

*Composite Moduli is the effective stiffness found for the entire pavement structure taken as a whole, not the stiffness for that particular layer alone.

From the data in part one, it was concluded that the effects of tire pressure on the tensile strain was very small. The range of increased tensile strain measurements for a constant tire load and increased tire pressures was from 2 to 10 percent. Note that the asphalt thicknesses in the first part of the study were 5 and 7 inches, therefore the conclusions reached about the effects of tire pressure were consistent with the findings of other studies, in that tire pressure does not significantly effect tensile strains on asphalt concrete pavement over 4 in. thick.

The second conclusion reached from the first part of the study was that axle load played a significant role in the magnitude of the tensile strains. In this study , increasing the load from 9,400 lb. to 19,000 lb. resulted in an increase of 200 to 400 percent in the measured tensile strain at the bottom of the asphalt concrete.

The study did not reach any conclusion about the effect of tire type (bias-ply verses radial) due to differences in pavement temperatures at the times the tests were conducted. The temperature was from 6° to 10°F higher during the bias-ply tests than the radial tire tests. This temperature difference was found in the laboratory to result in a 100,000 psi decrease in the resilient modulus for the asphalt layer making any comparisons suspect.

The second part of the study simulated actual traffic using the Accelerated Loading Facility at the FHWA's Pavement Testing Facility (PTF). Each part of phase two of the test was conducted during different times of the year. Radial Tires were tested in part one from January to June, and bias ply tires were tested from July to December. This part of the study was designed to measure the effects of tire pressure on fatigue cracking and rutting. Table 2 was taken from Figures 8 and 9 of the study.

Table 2
Results of ALF Tests

Number of Passes	Rut Depth (in.) Test 2-2	Total Cracking Test 2-2	Number of Passes	Rut Depth (in.) Test 2-3	Total Cracking Test 2-3
75,000	0.23	0	90,000	0.02	0
125,000	0.38	0	150,000	0.06	0
425,000	0.65	110	280,000	0.18	10
550,000	0.90	340	400,000	0.45	15

Note: Test 2-2 tire pressure = 140 psi
Test 2-3 tire pressure = 100 psi

The results tend to indicate that lower tire pressure does increase pavement life for both fatigue and rutting. Unfortunately variables such as asphalt concrete and base thickness, and asphalt temperature during the testing of the two sections were varied enough that their influence on the results could not be ignored. It was recommended that in future tests, the loads be alternated every two weeks to factor out the environmental effects.

2.3.5. Tire Type

Although not included in analytical studies, the type of tire used does play a small role in pavement performance. One study by Sebaaly compared the effects of four different types of tires on pavement response (2). In the study, insitu measurements of horizontal tensile strains were taken when the pavement was subjected to identical axle loads of 17,600 lb. on single axle, 21,600 lb. on a single axle, 17,400 lb./axle on a tandem axle and 14,700 lb./axle on a tandem axle. The tensile strain was measured for each tire type which included dual

tires, 11R22.5 inflated to 105 psi and 120 psi, 245/75R22.5 dual tires at 120 psi, 385/65R22.5 single tire at 120 psi, and 425/65R22.5 single tire at 120 psi. Passes were made at a speed of 40 mph. Sebaaly converted the strain measurements made to Load Equivalency Factors (LEF). Comparing the changes in the LEF Sebaaly, concluded that:

- Tire type has a significant effect on the Load Equivalency Factor of an axle load and configuration.
- Single wide-base tires have LEFs 1.5 to 1.7 times higher than dual tires for any given pavement thickness for both fatigue and rutting.
- The effect of tire type on the LEF was uniform throughout the range of asphalt thicknesses used in the study.

2.4. Results of Central Tire Inflation Studies

2.4.1. Introduction:

The U.S. Army found that lowering tire pressures on low speed, unpaved roads had several potential benefits (8):

- Reduced road maintenance requirements
- Reduced road surfacing requirements.
- Reduced drive fatigue and injury.
- Reduced vehicle operation costs
- Increased vehicle mobility

Although preliminary studies convinced the Army to equip their 5-ton trucks (gross vehicle weight) with CTI systems for mobility purposes, no sufficient quantification of the other benefits had been accomplished.

The first four potential benefits identified by the U.S. Army were of particular interest to the Department of Agriculture, U.S. Forest Service. The Forest Service conducted a proof-of-concept study. Observations made during the proof-of-concept study done on aggregate surfaced roads indicated that high-pressure tires caused faster road surface deterioration than low pressure tires including washboarding. In fact, the low-pressure tires caused no perceptible road damage and made significant improvements in the condition of the road (9). Based on the results of the proof-of-concept study, the Forest Service had two closed loop course studies done, one at the Nevada Automotive Test Center and the other at the U.S. Army's Waterways Experiment Station. In conjunction with the studies, the Forest Service also conducted field tests in Boise, Idaho, Alabama and Oklahoma.

2.4.2. Nevada Automotive Test Center Study (10)

This study was requested by the Department of Agriculture, Forest Service to quantify the effect of lower tire pressure on tire and truck performance. The study also provided much information on roadway performance. The test was conducted over a closed loop track with several types of road surfaces. Track sections included paved highway, unpaved washboarded roads, logging roads with potholes and severe rock sections. Table 3 lists the various sections used.

Table 3
Pavement Test Sections
Nevada Automotive Test Center Study

Section	Description
1	Flat "S" curve, 90 foot radius (gravel)
2	Outslope "S" curve, 90 foot radius (gravel)
3	Potholes - 25 @ 4 foot spacing per lane
4	Curve 200 foot radius (gravel)
5	Rocks - 25 @ 4 foot spacing per lane
6	Round Aggregate, 4-inch radius
7	Washboard (gravel)
8	Double penetration chip seal (straight)
9	Double penetration chip seal (curved)
10	Type II asphalt concrete (curve, 200 foot radius)
11	Type II asphalt concrete (straight)
12	Severe rock course. 4-6 in. height, 2.25 square inch contact area

The track was driven over by two logging trucks which were able to simulate actual off road driving conditions. Each truck operated in its own lane and tire inflation pressure was determined by sidewall deflection rather than actual tire pressure. Low pressure tires had 20-22% sidewall deflection, while high pressure tires had 10-12% sidewall deflection (corresponding tire pressures were listed in the report). The truck with low tire pressure was driven 2,681 miles and the truck with high tire pressure was driven 2,676 miles.

From the proof-of-concept study, it appeared that the larger tire foot print achieved with lower tire pressure would result in reduced road construction, surfacing and maintenance costs. This hypothesis was confirmed by this study. After completion of over 2600 vehicle miles in each lane, the road maintenance material requirements were significantly lower in the low pressure lane as shown in Table 4 below. Material requirements were not broken out by test section.

Table 4
Material Required to Repair Roads After of 2,600 Miles of Testing.

High Pressure Tire Lanes	Low Pressure Tire Lanes
Approximately nine yards Class B, Type II aggregate	None
Approximately 2,200 square feet of double penetration chip seal	Approximately 75 square feet of double penetration chip seal
Approximately 1,800 square feet of 2" AC lift	Approximately 30 square feet of 2" AC lift
Approximately 28,000 gallons of water to restore grade and compaction in rutted areas	Approximately 8,000 gallons of water to restore grade and compaction in rutted areas

In addition to materials, significant differences in labor and equipment repair requirements were noted in the unpaved sections. The low tire pressure test lanes required six hours of grading and four hours of watering to return to their original conditions while, the high tire pressure lanes required 14 hours of loader and ripper time, 14 man-hours of grading and 14 man hours of watering to be returned to original condition.

The closed loop test had four paved sections: two chip sealed and two 2 in. asphalt concrete. After completion of the originally planned number of passes, neither lane required repair or maintenance in the paved sections, although the high pressure lane showed signs of rutting and fatigue cracking in sections 8 and 9. Sections 10 and 11 showed no signs of distress in either lane. During the original phase of the test, the moisture content of the base course was measure at between 4 and 6 percent. After completion of initial testing it was decided to evaluate the effect of higher moisture contents in the paved sections. By filling the ditches along the side of the test track, the moisture content the subgrade and base course of the chip sealed sections was raised between 7 and 8 percent. The effects in these sections (sections 8 and 9), became quickly apparent. Surface and base failure was evident after just 15 passes of a loaded truck in sections 8 and 9 of the high pressure tire lane. After 45 passes of a loaded truck, section 9 (curved section) failed in the low pressure lane. Section 8 (straight section) of the low pressure lane did not fail after 169 passes of a loaded truck when the additional testing was terminated.

The other paved sections (10 and 11) had the base moisture content elevated between 12 and 14% using the same methods as was used in sections 8 and 9. The high tire pressure lane developed linear cracking after just 35 passes of a

loaded truck and was considered to have failed after 55 passes. After 81 passes, testing was stopped in the high tire pressure lane. In the low tire pressure lanes, sections 10 and 11 remained undamaged until section 11 (straight section) reached failure after 121 passes. Section 10 (curved section) had not failed after 169 laps when the additional test was terminated.

One test section was constructed with washboarding already in place. In the closed loop test, the high pressure lane experienced a worsening of the washboarding, resulting in potholing and reduction in speed. No changes were noted in the low pressure lane. Because this section was constructed as a washboard course, maintenance was not required.

One potentially significant benefit found in addition to the effects on road surfaces and conditions, was the lower operating costs of the trucks operating at lower tire pressure. The trucks used in the study were identical except for miles driven. Both the high pressure and low pressure trucks were 1972 Kenworth, Model W925. The low pressure truck had 183,000 miles of use, the high pressure truck had 191,000 miles of use. Costs for fuel, tire wear, damaged parts and related wear were closely monitored. Cost of operation for the low tire pressure truck was $1.11/mile while cost of operation for the high tire pressure truck was $4.92/mile. Table 5 shows the break down of the operation costs.

Table 5.
Cost/Mile During Nevada Test Center Study

	Low Pressure Tire 2,681 Miles Driven 20-22% Tire Deflection	High Pressure Tire 2,676 Miles Driven 10-12% Tire Deflection
Fuel (1)	$0.18	$0.18
Tire Wear (2)	$0.46	$0.59
Damaged Parts (3)	$0.16	$2.28
Related Labor Cost (4)	$0.31	$1.87
Total Cost/Mile	$1.11	$4.92

(1) Based on $1.00/gal.
(2) Based on $400/tire mounted.
(3) Based on cost of replacement parts.
(4) Base on $45.00/hour.

Based on these lower operating costs, the estimated cost of $10,000 for a CTI system could be recovered by the lower operating cost in as little 2,700 miles of operation, and that does not include cost savings from reduced road maintenance.

The study concluded that lower tire pressures provided significantly longer pavement life than the higher tire pressures for the pavement sections tested, reduced road maintenance and repair requirements, and increased driver comfort.

2.4.3. Boise National Forest Field Operational Tests (8)

In conjunction with the testing being done at the Nevada Automotive Test Center and U.S. Army Waterways Experiment Station, the Forest Service also conducted a field test in the Boise National Forest. This test entailed the removal of 1.7 million board feet (MMBF) of timber over 5 miles of aggregate surfaced road and 6 miles of native surfaced road using different tire pressures. Tire pressures between 25 and 54 psi were used for hauling 1.0 MMBF and the remaining 0.7 MMBF was hauled using 100 psi tire pressure. The test was done between September and November 1986. Although the test was to determine the potential benefits of Central Tire Inflation (CTI), none of the trucks used were equipped with the system, therefore inflation pressures were adjusted manually. Driving axle tires were set for 41 psi when loaded and 25 psi when empty. Trailer and steering axle tires were kept at a constant pressures of 38 and 54 psi respectively. All tires were kept at a constant 100 psi. for the high pressure portion of the test.

The first phase of the test using lower tire pressures was conducted from September 12 - 26, 1986. During this phase, the lower tire pressure appeared to set the road up so hard and smooth that during the following high pressure runs, only areas of excessive subsurface water did the road surface break down. During the first low pressure phase the roads became saturated and so slick that the operation was temporarily shut down after a rain storm. At this point the Forest Service was preparing to repair the ruts in the road prior to starting the high pressure phase of the test. However, based upon the suggestion of the logging contractor and truck drivers, 2 days of haul were run using lowered tire pressure in lieu of grading the road surface. As the road dried out, the lower tire pressures smoothed the road surface and grader maintenance was not required.

In summary, the results of the test showed positive benefits to using lower tire pressure. Some of the particular benefits noted were:

- Road maintenance was reduced.
- Rutting was reduced. Rutting developed only in wet spots and was only 3 to 4 inches deep compared to previous years when ruts up to 16 inches deep were reported.
- Lower tire pressures helped repair damaged roads as the road surface dried out.
- The haul season was extended by use of lowered tire pressures. In wet conditions, traction improved and road damage was decreased. Several

days of hauling were allowed that would not have been possible with high tire pressures.
•On steep grades, truck traction was improved by the use of lowered tire pressure.

Although this test was qualitative only and that additional field operational tests are necessary to evaluate the benefits of lowered tire pressures over a wider range of soil, climate, and road design conditions, the positive implications of operating at lower tire pressure are worth noting.

2.4.4. U.S. Army Waterways Experiment Station Study (11)

In addition to the Nevada Automotive Test Center study, the Department of Agriculture, Forest Service, conducted another study to quantify the effect of lower tire pressure on road surface deterioration and pavement thickness requirements.

A closed loop two lane track was constructed. A total of 15 test sections, one native soil (a lean clay), five aggregate (3 to 9 in.), and nine asphalt concrete sections with varying combinations of asphalt thicknesses (2, 4, 5 and 6 in.) and base course (0, 4, 6, and 8 in.). Table 6 summarizes the pavement sections and average material properties.

Table 6
Pavement Test Sections Used in Waterways Experiment Station Study

Section	Surface Material	Surface Thickness (in.)	Base Course Thickness (in.)	Base Moisture Content (Agg.)	Average Aggregate CBR Value	Insitu Dry Density AASHTO T-180
1	Aggregate	3	N/A	1.4	35	135.4
2	Aggregate	3	N/A	1.7	22	136.0
3	Native Soil	N/A	N/A	17.3	N/A	111.6
4	Asphalt	2	4	3.5	23	142.6
5	Asphalt	2	6	3.4	28	142.3
6	Asphalt	2	8	3.4	41	142.3
7	Asphalt	4	0	N/A	N/A	114.6
8	Asphalt	4	8	2.3	34	138.6
9	Asphalt	4	6	2.4	44	138.8
10	Asphalt	4	4	2.3	39	138.6
11	Asphalt	6	0	N/A	N/A	113.8
12	Asphalt	5	0	N/A	N/A	110.4
13	Aggregate	3	N/A	2.8	35	139.6
14	Aggregate	6	N/A	2.8	32	139.6
15	Aggregate	9	N/A	3.3	32	141.9

Passes were made over each section until failure. Paved sections were considered failed when there was:

- •A surface rut of 2 in. or more at least 20 ft-long
- •Surface cracking existed to the extent that the pavement was no longer waterproof;
- •Severe shoving resulting in 2-in deep ruts or severe cracking of the AC surface existed.

The aggregate sections were considered failed when any of the following conditions existed in a 20-ft-long section of a wheel path:

- •Three inch ruts in test sections 1,2 and 13; or
- •Four-inch ruts in test sections 14 and 15; or
- •Washboarding of 3 in. deep or more.

Shoving was also a major type of distress observed during the test . Shoving occurred in the out side wheel path of a horizontal curve and was visually detected by either the outward movement of the total thickness of asphalt concrete or by the outward movement of the asphalt concrete layer in relation to the underlying layer.

Two trucks were driven over the lanes in both the loaded and unloaded condition. The high tire pressure truck was operated at typical highway pressure of 100 psi in all tires. The low-pressure truck operated at a constant tire deflection (21 percent), which required tire pressures of approximately 25 and 39 psi for the unloaded and loaded conditions, respectively. Axle loads for the high pressure tire truck were 9,590 lb. for the front axle, and an average of 16,750 lb./axle for the other 4 axles. The low pressure tire truck had a front axle load of 9,530 lb. and an average of 16,960 lb./axle for the remaining axles.

The first day of driving began after several days of rain and apparently due to the high moisture content sections 1 to 3 showed rutting after one pass. The benefits of lower tire pressure on aggregate surface roads were seen from the results of section 2 when the trucks operated empty to determine the effects of lower tire pressure on washboarding (washboarding is caused by tires bouncing which occurs mostly when trucks are empty). Washboarding was noticeable in section 2 in the high pressure lane after about 50 passes. The corrugation was 2.5 in. deep and the truck had to reduced speed to maneuver safely over Section 2. After 112 passes, severe washboarding was measured throughout the high-pressure lane of section 2. No washboarding was observed in the low pressure lane. The high-pressure traffic caused severe distress in Section 2, and required grading after a combined total of 172, 541, 624, and 1130 loaded

and unloaded passes. Grading was never required in the low pressure lane of section 2.

The benefits of lower tire pressure on asphalt concrete roads were also evident. In all cases when an asphalt concrete section was judged as failed in the high pressure lane, only hairline cracking and minor rutting were detected in a low pressure lane. Only four failures occurred in the low pressure lane, two in section 4 and one each in sections 5 and 6. The failures in sections 5 and 6 were judged failed after 2,076 passes and those in section 4 after 3,324 and 3,845 passes. Severe cracking and rutting were the mode of each of these failures. Table 7 summarizes the number of load repetitions to failure in the study.

Table 7.
Summary of Number of Passes at Time of Failure

Test Section	Tire Pressure	Number of Passes to Failure
1	High	58
1	Low	66
2	High	58
2	Low	66
3	High	58
3	Low	66
4	High	158
4	Low	3324
5	High	1,414
5	Low	2,076
6	High	1,104
6	Low	2,076
10	High	2,210
13	High	883
13	Low	1,077
14	High	883
14	Low	1,077
15	High	883
15	Low	1,077

No failure information provided for sections 7, 8, 9, 11, or 12.

Based on the results of the study, the following findings and recommendations were noted:

- The failures and distresses in the high-pressure lane of the asphalt concrete sections were more pronounced than those in the low-pressure lane.
- Where pavement failures occurred in both lanes of the same asphalt concrete section, the ratio of the number of passes to failure of the low-pressure lane to high-pressure lane ranged between 1.5 to 1 and 21 to 1.
- Considerable maintenance was required on aggregate surfaced grades after high-pressure unloaded traffic because of severe washboarding. This type of distress is not a factor under low-pressure traffic.
- There was no appreciable difference in the amount of shoving of aggregate surface horizontal curves because of different tire pressures.
- Considerable savings should be realized from operating at lower tire pressure from lower repair and maintenance of roads, the reduction of truck and tire wear and from the extension of haul seasons.

CHAPTER 3: DEVELOPMENT OF DATA AND METHODS OF ANALYSIS

3.1. Objective

The objective of this study was to determine the effects of operating heavy vehicles at lower tire pressures on roads in severely weakened condition. In order to analyze the effects of lower tire pressure on pavement performance, comparison of the number of load repetitions to failure for each pavement type, material condition, tire load and tire pressure was determined. The failure criteria used was developed by the Asphalt Institute for fatigue cracking and rutting. The formula for fatigue failure defines failure as fatigue cracking over 10 percent of the wheel path area, while rutting failure is defined as 0.5 inch depressions in the wheel paths (13). These formulas required determination of two specific strain criteria. For fatigue failure, horizontal tensile strain at the bottom of the asphalt layer was determined and the vertical compressive strain at the top of the subgrade was determined for the rutting failure. The formulas used are shown below:

Fatigue Failure:

$$\log N_f = 15.947 - 3.291 \log (\varepsilon_t/10^{-6}) - 0.854 \log (E/10^3)$$

N_f = Load repetitions to Failure

ε_t = Horizontal Tensile Strain at Bottom of Asphalt Concrete

E = Elastic Modulus of the Asphalt Concrete

Rutting Failure

$$N_f = 1.077 \times 10^{18}(10^{-6}/\varepsilon_v)^{4.4843}$$

N_f = Load repetitions to Failure

ε_v = Vertical Compressive Strain at Top of Subgrade

3.2. Determination of Strains

3.2.1. ELSYM5

Determination of horizontal tensile strain at the bottom of asphalt concrete and vertical compressive strains at the top of subgrade in both asphalt and aggregate roads were determined using the ELSYM5 computer software program developed by the Federal Highway Administration. ELSYM5 uses elastic layer theory to calculate the stresses and strains at specified points in

multi-layer pavement systems. Input variables were material properties, loading condition, and points of evaluation.

3.2.2. System Material Properties

Two road surfaces were modeled in this study, asphalt concrete and aggregate surfaced roads. Asphalt concrete roads consisted of a layer of asphalt surface course over an aggregate base over a semi-infinite subgrade. Aggregate surfaced roads were a layer of aggregate over a semi-infinite subgrade. In each system, material properties were varied under each loading condition. By varying the layer thickness and using two different elastic moduli for the asphalt concrete, a total of nine different road systems were evaluated. Table 8 lists each of the systems evaluated:

Table 8.
Layer Thicknesses and Moduli of Surface Layers Evaluated

Surface Material	Surface Thickness	Base Course Thickness
Asphalt Concrete (E_{ac}=150,000 psi)	1 inch	6 inches
Asphalt Concrete (E_{ac}=150,000 psi)	2 inches	6 inches
Asphalt Concrete (E_{ac}=150,000 psi)	3 inches	8 inches
Asphalt Concrete (E_{ac}=1,000,000 psi)*	1 inch	6 inches
Asphalt Concrete (E_{ac}=1,000,000 psi)*	2 inches	6 inches
Asphalt Concrete (E_{ac}=1,000,000 psi)*	3 inches	8 inches
Crushed Aggregate	4 inches	N/A
Crushed Aggregate	8 inches	N/A
Crushed Aggregate	12 inches	N/A

* Evaluated with tandem axle configuration only

The values for the Elastic Modulus (E) for the crushed aggregate and subgrade were assigned different values. These values were chosen to evaluate road response under varying conditions - weak to strong. The elastic modulus for asphalt concrete (E_{ac}) was held constant for each asphalt concrete system. The only material properties that were varied in each system were the values assigned to the elastic modulus. The elastic modulus of the crushed aggregate (E_b) was assigned values of 1,000, 5,000, 10,000, 20,000 or 30,000 psi. The elastic modulus of the subgrade (E_{sg}) was assigned values of 2,500, 5,000 or 10,000 psi . Each loading condition was evaluated for each possible combination of E_b and E_{sg}.

The asphalt concrete layer thicknesses were selected in order to model thinner asphalt pavement sections found in rural roads that are generally subject to load restrictions during spring thaw. The asphalt concrete elastic moduli were selected to model a cracked asphalt concrete (E_{ac}=150,000 psi) and a

moderately strong asphalt concrete (E_{ac}=1,000,000 psi). The elastic moduli for the crushed aggregate and subgrade were selected to simulate those that have been found in the field during spring thaw. (1)

Poisson's Ratios were held constant throughout the study. Values used were 0.35 for asphalt concrete, 0.40 for crushed aggregate and 0.45 for subgrade.

3.2.3. Loading Conditions

The strains at the bottom of asphalt and top of subgrade were determined for each road system combination and loading condition to calculate the number of load repetitions to failure. Loading conditions evaluated included two axle configurations, three tire loads, and three tire pressures.

The two axle configurations were a dual tired single axle and a dual tired tandem axle. These are the most common configurations found on tractor- semi trailer vehicles.

Tire loads used were 4,250, 3,750, and 3,250 lb. per tire. The 4,250 lb. per tire load was chosen as it is the maximum per tire load allowed for dual tandem axle configurations (34,000 lb. maximum). Tire loads of 3,750 and 3,250 lb. per tire represent 88 percent and 76 percent of maximum tire loads respectively for dual tandem axles. These loads were used as they were above the commonly used value of 60 percent of maximum load allowed during periods of load restrictions(1). The same tire loads were used for the single axle configuration in order to permit easy comparison of axle configuration.

Tire pressures of 40, 70 and 100 psi were used. To simulate loading conditions found on most operating trucks, 100 psi was selected (6). Selection of 40 psi as the lowest pressure was done to approximate the average low pressures found in the studies reviewed. For a median value, 70 psi was selected. Although other studies have shown that tire contact pressure and tire inflation pressure are not always equal, tire contact pressure and tire inflation pressure are assumed to be equal for this study. Since the ratio between tire contact pressure and tire inflation pressure varies depending on tire type, this assumption eliminated tire type as variable in this study.

3.2.4. Points of Evaluation

Evaluation points were determined depending on failure criteria and axle configuration. In asphalt concrete pavements, the failure criteria were fatigue and rutting, therefore strains at the bottom of the asphalt concrete and top of subgrade were used to determine the load repetitions to failure for fatigue and rutting respectively. In the aggregate surfaced roads, rutting failure was the only

criteria of interest, therefore the strain at the top of subgrade was the only one determined for the aggregate road structure.

Strains directly under a tire, between the dual tires and between the axles were calculated for the dual tandem axle configuration. For the single axle configuration, the strains under and between the tires were determined.

Only the largest strain found for each loading condition was used in determining the load repetitions to failure. Other strains were not considered. Strain values found for single axle and tandem axle are found in Appendix A and Appendix B respectively.

3.3. Calculation of Load repetitions to Failure

For each pavement and loading condition, the strains at the selected points of interest were calculated using the ELSYM5 program. Using the strain calculated by ELSYM5 and the Asphalt Institute failure formulas, the number of load repetitions to failure for each combination of pavement and loading condition was determined. These are shown in Appendices C and D for single and tandem axles respectively.

CHAPTER 4: RESULTS

4.1. Introduction

The results obtained were analyzed by comparing average increases in load repetitions to failure and average percentage increases in load repetitions to failures obtained by reducing tire pressure and tire load separately and combined. Averages were used because of the large number of different pavement sections and loading conditions examined. By using average increases in load repetitions to failure the trends of reducing tire pressure and tire load can be more easily examined and discussed. Although some results show large percentage increases in load repetitions to failure, the reader must be careful to realize that while the percentage increase may extremely large, the actual number of load repetitions to failures may be few, in some less than 100. This is especially true when the increases for load repetitions to failure of very weak soils and thin road surfaces are reviewed. Because of this, it is very important that if the results of this study are used to aide the decision whether to require lower tire loads or tire pressures on weakened roads, that the reader ensure that actual field conditions are considered in conjunction with the results of this study.

For simplicity, the results of the data analysis are divided into four different groups shown on Table 9 below. Each group is used to examine the effect of reducing tire pressure and tire load for a specific pavement type and failure criteria. The effects of reducing tire pressure and tire load on fatigue failure for each asphalt concrete stiffness are examined separately.

Table 9
Data Analysis Groups

Group	Pavement Type	Material Properties	Failure Criteria
1	Aggregate Surface	All	Rutting
2	Asphalt Concrete	All	Rutting
3	Asphalt Concrete	E_{ac} = 1,000,000 psi	Fatigue
4	Asphalt Concrete	E_{ac} = 150,000 psi	Fatigue

In the aggregate surfaced roads only rutting failure is considered. The results indicate that in most cases, rutting failure will also be the failure that governs the asphalt concrete pavement structure as the number of load repetitions to rutting failure are usually far less than the number of load repetitions to fatigue failure. The results show that reducing either tire pressure or tire load will result in increases in load repetitions to failure for both rutting and fatigue, and that if both tire load and tire pressure are reduced together, the resulting increase in load repetitions to failure for both rutting and fatigue is greater than the sum of the two individually.

4.2. Aggregate Surface Roads.

4.2.1. Effects of Reducing Tire Pressure.

Using the load repetitions to failure calculated for each loading condition, the effects of reduced tire pressure were determined. For each tire load, the load repetitions to failure for tires inflated to 100 psi was used as the base against which increases or decreases were measured. Table 10 summarizes the average percentage increase in load repetitions to rutting failure when the tire pressure is reduced from 100 psi to 70 psi and 100 psi to 40 psi respectively. Appendix E contains data used to calculate the averages for single and tandem axles.

The data in Table 10 shows that reducing tire pressure results in an increase in load repetitions to failure and that the larger the pressure reduction the larger the increase in load repetitions to failure, i.e. reducing the pressure from 100 psi to 40 psi will provide 3 to 10 times the increase in load repetitions to failure that are obtained by reducing tire pressure from 100 psi to 70 psi.

Table 10 also shows that as the aggregate layer gets thicker, the percentage increase in load repetitions to failure decreases. This means that as aggregate roads get thicker, the effects of reducing tire pressure becomes less effective in reducing the vertical compressive strain at the top of the subgrade.

It must be cautioned that reduced tire pressure will not always allow usage of aggregate roads in a weakened condition. In some cases, the number of load repetitions to failure even operating at reduced tire pressure could be reached in a very short time. Note for example that the average increases in load repetitions to failure for a 4 inch aggregate road were always less than 100. Even with minimal heavy vehicle traffic, it would not take long to reach 100 load repetitions. However, in thicker aggregate surface roads, the effects of reducing tire pressure may be sufficient by itself to allow trucks to operate without load reductions. This would greatly improve profitability for heavy truck operators.

Table 10.
Summary of Average Increase in Load repetitions to Rutting Failure by Reducing Tire Pressure - Aggregate Surfaced Roads

Increase In Load repetitions to Rutting Failure				
	Tire Pressure Reduction From 100 psi to 70 psi		Tire Pressure Reduction From 100 psi to 40 psi	
Road Structure and Tire Load	Average Increase in Load repetitions to Failure	Percentage Increase in Load repetitions to Failure	Average Increase in Load repetitions to Failure	Percentage Increase in Load repetitions to Failure
Single Axle				
4 inch Aggregate				
3,250 lb./tire	45	158%	448	1,756%
3,750 lb./tire	38	179%	417	2,204%
4,250 lb./tire	34	199%	403	2,685%
8 inch Aggregate				
3,250 lb./tire	613	40%	2,978	203%
3,750 lb./tire	417	46%	2,105	243%
4,250 lb./tire	300	52%	1,569	285%
12 inch Aggregate				
3,250 lb./tire	3,527	15%	10,155	49%
3,750 lb./tire	2,180	16%	5,542	51%
4,250 lb./tire	1,342	17%	3,230	47%
Tandem Axle				
4 inch Aggregate				
3,250 lb./tire	46	162%	452	1,758%
3,750 lb./tire	39	180%	421	2,211%
4,250 lb./tire	26	141%	287	2,293%
8 inch Aggregate				
3,250 lb./tire	636	40%	3,086	205%
3,750 lb./tire	433	46%	2,182	246%
4,250 lb./tire	158	47%	809	267%
12 inch Aggregate				
3,250 lb./tire	3,787	15%	10,940	50%
3,750 lb./tire	2,330	16%	5,973	52%
4,250 lb./tire	636	15%	1761	55%

4.2.2. Effects of Reducing Tire Load.

Table 11 summarizes the average percentage increase in load repetitions to rutting failure when the tire load is reduced from 4,250 lb./tire to 3,750 lb./tire

and from 4,250 lb./tire to 3,250 lb./tire respectively. Appendix F contains data used to calculate the averages for single and tandem axles respectively.

Table 11.
Summary of Average Increase in Load repetitions to Rutting Failure by Reducing Tire Load - Aggregate Surfaced Roads

Increase In Load repetitions to Rutting Failure				
Road Structure and Tire Pressure	Tire Load Reduction From 4250 to 3750 lb./tire		Tire Load Reduction From 4250 to 3250 lb./tire	
Single Axle	Average Increase in Load repetitions to Failure	Percentage Increase in Load repetitions to Failure	Average Increase in Load repetitions to Failure	Percentage Increase in Load repetitions to Failure
4 inches Aggregate				
40 psi	43	5%	115	34%
70 psi	14	19%	38	64%
100 psi	7	31%	20	83%
8 inches Aggregate				
40 psi	883	40%	2,420	111%
70 psi	464	54%	1,325	148%
100 psi	347	52%	1,011	159%
12 inches Aggregate				
40 psi	7,741	72%	23,298	208%
70 psi	6,269	66%	18,558	196%
100 psi	5,430	67%	16,373	201%
Tandem Axle				
4 inches Aggregate				
40 psi	143	101%	181	132%
70 psi	20	84%	36	154%
100 psi	8	78%	16	136%
8 inches Aggregate				
40 psi	2,027	183%	3,614	327%
70 psi	911	174%	1,794	341%
100 psi	635	173%	1,316	360%
12 inches Aggregate				
40 psi	13,837	200%	30,416	441%
70 psi	11,197	188%	24,255	417%
100 psi	9,546	198%	21,145	439%

Table 11 shows decreasing the tire load results in increases in load repetitions to rutting failure. However, the effects of larger decreases in load are more linear than the effects of larger tire pressure reductions. For example,

decreasing the tire pressure from 100 psi to 40 psi resulted in 3 to 10 times the increase in load repetitions to failure obtained by reducing tire pressure from 100 psi to 70 psi, whereas decreasing the tire load from 4,250 lb./tire to 3,250 lb./tire resulted in only 1 to 3 times the increase load repetitions to failure obtained by decreasing the tire load from 4,250 lb./tire to 3,750 lb./tire. This indicates that vertical compressive strain is a fairly linear function of tire load, that is each pound of tire load reduction results in an equal reduction in vertical compressive strain at the top of the subgrade.

The effect of the aggregate thickness on increase in load repetitions to failure is opposite that of tire pressure reduction. As the aggregate gets thicker, the percentage increase in load repetitions to failure increases. thus indicating that as aggregate gets thicker, tire load is more critical to the development of vertical compressive strain than tire pressure.

4.2.3. Combined Effects of Reducing Tire Load and Pressure:

In order to measure the combined effects of reducing tire load and tire pressure, a base load was selected. The base load was 4250 lb./tire on a tire inflated to 100 psi. Holding tire pressure constant, the average increase and percentage increase in load repetitions to failure were determined for reducing tire load to 3250 lb./tire. Holding load constant, the average increase and percentage increase in load repetitions to failure were determined for reducing tire pressure to 40 psi. Then the average increase and percentage increase in load repetitions to failure for reducing both tire load and pressure were determined by comparing the load repetitions to failure for a load of 4250 lb./tire at 100 psi and a load of 3250 lb./tire at 40 psi. It was noted that the increase in load repetitions to failure of the combined effects of tire pressure and load reduction was greater than the sum of the separate increase due to tire pressure and tire load reduction. A final calculation called the Synergistic Factor was determined by dividing the increase in load repetitions to failure of the combined effects by the sum of the individual increases realized by reducing tire pressure or tire load alone. This synergistic factor shows that when both tire pressure and tire load are reduced simultaneously, much larger increases in load repetitions to failure can be achieved. Table 12 summarizes the results for each aggregate thickness and is listed in appendix G.

Based on the percentage increase in load repetitions to failure, the individual effects of tire load reduction verses tire pressure reduction in Table 11 shows that reducing tire pressure becomes less influential on vertical compressive strain as the aggregate thickness increases while reducing tire load becomes more influential.

When the combined effects of tire pressure and tire load reduction are reviewed, again as aggregate layer gets thicker, the percentage increase in load repetitions to failure gets less, but the actual number of load repetitions to failure increases. This emphasizes the importance of taking into consideration the road structure rather than the percentage increase in load repetitions to failure when determining whether to allow either full loads at reduced tire pressure, require lighter loads at normal tire pressure, or requiring both lighter loads and reduced tire pressure.

Table 12
Summary of Average Increase in Load repetitions to Failure
by Reducing Tire Pressure and Tire Load Individually and Combined -
Aggregate Surfaced Roads

	Increase In Load repetitions to Rutting Failure			
Road Structure	Reducing Tire Load From 4,250 to 3,250 lb./tire		Reducing Tire Pressure From 100 psi to 40 psi	
Single Axle	Average Increase	Percentage Increase	Average Increase	Percentage Increase
4 Inch Aggregate	18	83%	447	1,465%
8 Inch Aggregate	948	149%	1,471	260%
12 Inch Aggregate	15,349	188%	3,028	38%
Tandem Axle				
4 Inch Aggregate	16	185%	286	2,040%
8 Inch Aggregate	1,316	360%	790	235%
12 Inch Aggregate	21,145	439%	1,678	57%
	Reducing Tire Load and Tire Pressure			
Single Axle	Average Increase	Percentage Increase	Synergistic Factor*	
4 Inch Aggregate	550	1,710%	1.18	
8 Inch Aggregate	3,470	508%	1.43	
12 Inch Aggregate	24,870	260%	1.35	
Tandem Axle				
4 Inch Aggregate	467	3,977%	1.55	
8 Inch Aggregate	4,403	1,232%	2.09	
12 Inch Aggregate	32,094	683%	1.41	

*See text for description

4.3. Asphalt Surfaced Roads:

The effect of reducing tire pressure and tire load on increases in load repetitions to failure for both rutting and fatigue were reviewed. During the analysis of the data it was noted that the values for load repetitions to rutting failure and the

strains obtained were found to be within a reasonable range for both asphalt stiffnesses evaluated. However, when the load repetitions to failure were determined for the asphalt concrete section with elastic modulus of 150,000 psi (attempting to simulate a cracked pavement) the results obtained were extremely large and are not considered reasonable. Therefore, discussion of the results for the asphalt section is broken into three parts. Part 1 addresses rutting failure, Part 2 addresses fatigue failure for the asphalt sections with an elastic modulus of 1,000,000 psi, and Part 3 discusses fatigue failure for the asphalt section with the lower elastic modulus of 150,000 psi.

4.3.1. Rutting Failure.

4.3.1.1. Effects of Reduced Tire Pressure on Rutting Failure.

The results obtained for average increase in load repetitions to rutting failure show the same trends as those found in the aggregate surface road which were:

- Reducing tire pressure results in increases in load repetitions to rutting failure.
- The larger the pressure reduction, the larger the increase in load repetitions to failure.
- Reducing tire pressure from 100 psi to 40 psi provides 3 to 5 times the increase in load repetitions to rutting failure obtained by only reducing tire pressure from 100 psi to 70 psi.
- As the asphalt gets thicker and stiffer, the percentage increase in load repetitions to failure decreases meaning that reducing tire pressure becomes less effective reducing the vertical compressive strain at the top of the subgrade.

The results of the effects of reducing tire pressure are summarized in Table 13. Values in Table 13 are taken from the data and calculations in appendix H.

4.3.1.2 Effects of Reducing Tire Load on Rutting Failure

Using identical methods to analyze the effect of reduced tire load on rutting failure of an asphalt concrete road as was used to analyze the effect of reduced tire load on an aggregate road, the values shown in Table 14 indicated similar trends as was found for the aggregate road. Those trends were:

- Decreasing tire load results in increases in load repetitions to rutting failure.
- Decreasing tire load from 4,250 lb./tire to 3,250 lb./tire results in 2 to 3 times the average increase in load repetitions to rutting failure obtained by reducing tire load from 4,250 lb./tire to 3,750 lb./tire.

• As the asphalt concrete gets thicker, the percentage increase in load repetitions to failure becomes smaller.

Table 13.
Summary of Average Increase in Load repetitions to Rutting Failure by Reducing Tire Pressure - Asphalt Surfaced Roads

	Increase In Load repetitions to Rutting Failure			
Road Structure and Tire Load	Tire Pressure Reduction From 100 psi to 70 psi		Tire Pressure Reduction From 100 psi to 40 psi	
Single Axle E(ac) = 150,000 psi	Average Increase in Load repetitions to Failure	Percentage Increase in Load repetitions to Failure	Average Increase in Load repetitions to Failure	Percentage Increase in Load repetitions to Failure
1 Inch Asphalt				
3,250 lb./tire	515	37%	2,568	180%
3,750 lb./tire	352	43%	2,258	236%
4,250 lb./tire	256	48%	1,387	250%
2 Inch Asphalt				
3,250 lb./tire	1,350	19%	5,764	78%
3,750 lb./tire	884	21%	3,883	89%
4,250 lb./tire	607	24%	2,659	95%
3 Inch Asphalt				
3,250 lb./tire	3,594	5%	11,697	17%
3,750 lb./tire	1,962	5%	7,119	19%
4,250 lb./tire	1,197	6%	4,675	22%
Tandem Axle E(ac) = 150,000 psi				
1 Inch Asphalt				
3,250 lb./tire	529	37%	2,650	182%
3,750 lb./tire	362	43%	1,894	217%
4,250 lb./tire	263	48%	1,433	253%
2 Inch Asphalt				
3,250 lb./tire	1,406	19%	6,004	79%
3,750 lb./tire	910	22%	3,995	90%
4,250 lb./tire	630	24%	2,787	96%
3 Inch Asphalt				
3,250 lb./tire	3,904	5%	13,515	19%
3,750 lb./tire	1,931	5%	6,909	19%
4,250 lb./tire	1,295	6%	5,080	23%

Tandem Axle E(ac)=1,000,000 psi				
1 Inch Asphalt				
3,250 lb./tire	1,085	20%	4,551	88%
3,750 lb./tire	667	24%	3,028	105%
4,250 lb./tire	468	27%	2,173	118%
2 Inch Asphalt				
3,250 lb./tire	6,436	6%	21,001	19%
3,750 lb./tire	4,282	6%	14,286	19%
4,250 lb./tire	2,455	7%	8,275	23%
3 Inch Asphalt				
3,250 lb./tire	46,990	3%	173,737	13%
3,750 lb./tire	29,379	4%	107,229	15%
4,250 lb./tire	19,059	5%	70,908	17%

Table 14.
Summary of Average Increase in Load repetitions to Rutting Failure by Reducing Tire Load Only - Asphalt Surfaced Roads

	Increase In Load repetitions to Rutting Failure			
Road Structure and Tire Pressure	Tire Load Reduction From 4,250 to 3,750 lb./tire		Tire Load Reduction From 4,250 to 3,250 lb./tire	
Single Axle E(ac)=150,000 psi	Average Increase in Load repetitions to Failure	Percentage Increase in Load repetitions to Failure	Average Increase in Load repetitions to Failure	Percentage Increase in Load repetitions to Failure
1 Inch Asphalt				
3,250 lb./tire	1,139	48%	1,958	113%
3,750 lb./tire	382	49%	1,090	144%
4,250 lb./tire	286	57%	795	166%
2 Inch Asphalt				
3,250 lb./tire	3,032	61%	8,711	173%
3,750 lb./tire	2,265	62%	6,737	183%
4,250 lb./tire	1,857	65%	5,605	195%
3 Inch Asphalt				
3,250 lb./tire	16,840	68%	51,013	207%
3,750 lb./tire	15,161	72%	46,387	219%
4,250 lb./tire	14,420	73%	44,015	222%
Tandem Axle E(ac)=150,000 psi				
1 Inch Asphalt				
3,250 lb./tire	734	41%	2,010	113%
3,750 lb./tire	372	51%	1,058	146%
4,250 lb./tire	273	54%	793	161%
2 Inch Asphalt				
3,250 lb./tire	3,114	61%	8,950	172%
3,750 lb./tire	2,186	61%	6,509	182%
4,250 lb./tire	1,906	65%	5,703	195%
3 Inch Asphalt				
3,250 lb./tire	17,898	68%	55,073	212%
3,750 lb./tire	16,137	72%	49,283	220%
4,250 lb./tire	15,062	70%	46,437	218%
Tandem Axle E(ac)=1,000,000 psi				
1 Inch Asphalt				
3,250 lb./tire	2,267	55%	6,567	158%
3,750 lb./tire	1,612	60%	4,806	178%
4,250 lb./tire	1,412	64%	4,189	195%

2 Inch Asphalt				
3,250 lb./tire	41,024	91%	87,497	209%
3,750 lb./tire	36,839	95%	78,749	217%
4,250 lb./tire	35,018	96%	74,775	219%
3 Inch Asphalt				
3,250 lb./tire	365,986	70%	1,118,350	212%
3,750 lb./tire	339,984	72%	1,043,452	222%
4,250 lb./tire	329,865	75%	1,015,721	228%

See Appendix I for data used to derive figures in Table 14.

4.3.1.3 Combined Effects of Reducing Tire Load and Pressure

Table 15 below summarizes the results of comparing the effects of reducing tire pressure and tire load each individually and combined. When results of the asphalt thicknesses are compared, note that the percentage increase in load repetitions to rutting failure for tire load reduction increases as the asphalt becomes thicker. This indicates that the influence of tire load increases as the asphalt becomes thicker. This is further supported by the smaller percentage increase in load repetitions to failure by reducing tire pressure as the asphalt gets thicker. It can also be seen that as asphalt gets thicker, the synergistic factor decreases. This is explained by the fact that tire load, which effects vertical compressive strain in a linear manner, becomes more influential as the asphalt gets thicker.

It is also noted that axle configuration has little influence on load repetitions to rutting failure. In fact the average increase and percentage increase in load repetitions to rutting failure are nearly identical. There results indicated that axle configuration has little influence on load repetitions to rutting failure for asphalt concrete roads.

When comparisons are made between tire load and tire pressure reduction, the results summarized in Table 15 confirm the results of other studies which concluded that the effects of tire pressure reduction lessened as asphalt layer became thicker.

Table 15
Summary of Average Increase in Load repetitions to Rutting Failure by Reducing Tire Pressure and Load Individually and Combined
Asphalt Surfaced Roads

	Increase In Load repetitions to Rutting Failure			
Road Structure	Reducing Tire Load From 4,250 to 3,250 lb./tire		Reducing Tire Pressure From 100 psi to 40 psi	
Single Axle E(ac)=150,000 psi	Average Increase	Percentage Increase	Average Increase	Percentage Increase
1 Inch Asphalt,	795	166%	1,405	254%
2 Inch Asphalt,	5,605	195%	2,659	95%
3 Inch Asphalt,	44,015	222%	4,699	22%
Tandem Axle E(ac)=150,000 psi				
1 Inch Asphalt,	793	161%	1,432	249%
2 Inch Asphalt,	5,703	195%	2,787	96%
3 Inch Asphalt,	46,437	218%	4,880	21%
Tandem Axle E(ac)=1,000,000 psi				
1 Inch Asphalt,	4,189	189%	2,173	118%
2 Inch Asphalt,	75,755	219%	8,281	23%
3 Inch Asphalt,	1,015,721	228%	71,108	18%
	Reducing Tire Load and Tire Pressure			
Single Axle E(ac)=150,000 psi	Average Increase	Percentage Increase	Synergistic Factor	
1 Inch Asphalt	3,363	646%	1.54	
2 Inch Asphalt,	11,370	420%	1.44	
3 Inch Asphalt,	55,712	276%	1.13	
Tandem Axle E(ac)=150,000 psi				
1 Inch Asphalt,	3,443	635%	1.55	
2 Inch Asphalt,	11,737	423%	1.44	
3 Inch Asphalt,	59,952	277%	1.17	
Tandem Axle E(ac)=1,000,000 psi				
1 Inch Asphalt,	8,740	448%	1.42	
2 Inch Asphalt	95,778	279%	1.15	
3 Inch Asphalt,	1,189,458	269%	1.10	

See Appendix J for complete data tables.

4.3.2 Fatigue Failure

In nearly all the asphalt pavement sections and loading conditions examined, fatigue failure was not the governing failure criteria in an asphalt concrete pavement. This is due to rutting failure being mostly a direct function of the stiffness of the base and subgrade, and fatigue failure being strongly dependent on the stiffness of the asphalt. Since the strengths used for the base and subgrade were relatively much weaker than those used for the asphalt pavements, rutting was generally the governing criteria. However the effects of reducing tire pressure and tire load on fatigue failure indicate positive benefits of reducing tire pressure and are worth discussion.

The results of the fatigue failure analysis has been broken down into two parts. Each part addresses a different asphalt stiffness. The first section analyzes the results of asphalt pavement sections with an elastic modulus of 1,000,000 psi. The second discusses asphalt pavements sections with an elastic modulus of 150,000 psi. The value of 150,000 psi was chosen to simulate an asphalt pavement section that already had moderate fatigue cracking.

4.3.2.1 Effects of Reduced Tire Pressure and Tire Load on Fatigue Failure on a Moderate Strength Asphalt Concrete Pavement.

Effects of tire pressure and tire load reduction on an asphalt concrete pavement with an elastic modulus of 1,000,000 psi were examined for tandem axle loading only. The effects of reduced tire pressure are summarized in Table 15. As would be expected, the average increase in load repetitions to failure increases as asphalt thickness increases, however the percentage increase in load repetitions to failure decreases with increased asphalt thickness. This confirms other study findings that the influence of reduced tire pressure on pavement life lessens as asphalt pavement sections thicken. Unlike rutting however, at 3 inch thickness, reducing tire pressure significantly increases average load repetitions to fatigue failure. For example, load repetitions to fatigue failure is increased 105 percent for a tandem axle loaded at 3,750 lb./tire when the tire pressure is reduced from 100 psi to 40 psi (Table 16). For the same axle configuration and tire load, the average increase in load repetitions to rutting failure is only increased 15 percent for the same tire pressure reduction. (Table 13). This demonstrates that tire pressure plays a larger role in tensile strain at the bottom of asphalt than it does in vertical compressive strain at the top of subgrade and that if fatigue failure governs over rutting, then tire pressure reduction will significantly extend the asphalt pavement life.

Table 16.
Summary of Average Increase in Load repetitions to Fatigue Failure by Reducing Tire Pressure - Asphalt Surfaced Roads

	Increase In Load repetitions to Fatigue Failure			
Road Structure and Tire Load	Tire Pressure Reduction From 100 psi to 70 psi		Tire Pressure Reduction From 100 psi to 40 psi	
Tandem Axle E(ac)=1,000,000 psi	Average Increase in Load repetitions to Failure	Percentage Increase in Load repetitions to Failure	Average Increase in Load repetitions to Failure	Percentage Increase in Load repetitions to Failure
1 Inch Asphalt				
3,250 lb./tire	40,262	127%	380,039	995%
3,750 lb./tire	40,290	136%	276,538	820%
4,250 lb./tire	40,976	145%	197,667	649%
2 Inch Asphalt				
3,250 lb./tire	44,255	56%	181,265	205%
3,750 lb./tire	38,563	56%	126,693	168%
4,250 lb./tire	28,968	60%	84,714	161%
3 Inch Asphalt				
3,250 lb./tire	122,921	41%	394,588	120%
3,750 lb./tire	92,535	42%	246,945	105%
4,250 lb./tire	71,561	42%	171,650	97%

Data taken from data and calculations in Appendix H

Table 17 summarizes the effects of tire load on fatigue failure on an asphalt road, however before discussing the results, an explanation of the results listed for the 1-inch thick pavement is needed.

The average increase in load repetitions to fatigue failure for the 1 inch asphalt, listed in Table 17, are much lower than expected. When the strains calculated by ELSYM5 were reviewed it was noted that for the 1 inch asphalt, that as the tire load decreased, the strain at the bottom of the asphalt increased for both the 100 psi and 70 psi. The strain values determined by ELSYM5 were thoroughly checked by entering the same loading conditions into another strain calculating software program, Everstrs (developed for the Washington State Department of Transportation) and found to be accurate. Why strain values increase when tire load is decreased is not clear and goes beyond the scope of this study. However the reasons for this may warrant further study. Exact pavement stiffnesses and loading conditions where this phenomena occurs can be examined in appendix K which lists results for each individual loading condition.

Table 17 shows that reducing tire load increases the average number of load repetitions to failure. Decreasing tire load from 4,250 lb./tire to 3,250 lb./tire resulted in 2 to 3 times the increase in load repetitions to fatigue failure obtained by reducing tire load 4,250 lb./tire to 3,750 lb./tire. It should be noted that the percentage increase in load repetitions to fatigue failure due to tire load reduction was only about half the percentage increase found for increases in load repetitions to rutting failure due to tire load reduction. This small percentage increase in load repetitions to failure indicates that tire load has less influence on tensile strain than it does on vertical compressive strain.

Table 17.
Summary of Average Increase in Load repetitions to Fatigue Failure by Reducing Tire Load - Asphalt Surface Roads

	Increase In Load repetitions to Fatigue Failure			
Road Structure and Tire Pressure	Tire Load Reduction From 4,250 to 3,750 lb./tire		Tire Load Reduction From 4,250 to 3,250 lb./tire	
Tandem Axle E(ac)=1,000,000 psi	Average Increase in Load repetitions to Failure	Percentage Increase in Load repetitions to Failure	Average Increase in Load repetitions to Failure	Percentag e Increase in Load repetitions to Failure
1 Inch Asphalt				
40 psi	79,947	35%	185,181	83%
70 psi	390	10%	2,095	26%
100 psi	1,076	14%	2,809	35%
2 Inch Asphalt				
40 psi	60,393	58%	123,253	101%
70 psi	28,008	51%	41,959	71%
100 psi	18,413	54%	26,701	74%
3 Inch Asphalt				
40 psi	123,065	39%	345,929	109%
70 psi	68,745	35%	174,351	87%
100 psi	47,765	34%	122,985	88%

Taken from tables in Appendix L

Table 18 compares the overall effect of tire pressure and tire load reduction on load repetitions to fatigue failure individually and combined. Table 18 supports the previous findings that tire pressure is more influential than tire load on fatigue failure. As was the case for rutting failure, Table 18 shows that the combined effects of tire pressure and tire load reduction together, will double the average increase in load repetitions to fatigue failure than either one alone.

Table 18.
Summary of Average Increase in Load repetitions to Fatigue Failure by Reducing Tire Pressure and Load Individually and Combined - Asphalt Surfaced Roads

	Increase in Load repetitions to Fatigue Failure			
Road Structure	Reducing Tire Load From 4,250 to 3,250 lb./tire		Reducing Tire Pressure From 100 psi to 40 psi	
Tandem Axle E(ac)=1,000,000 psi	Average Increase	Percentage Increase	Average Increase	Percentage Increase
1 Inch Asphalt,	2,809	35%	197,667	649%
2 Inch Asphalt,	26,701	74%	84,713	161%
3 Inch Asphalt,	122,985	88%	171,644	97%
	Reducing Tire Load and Tire Pressure			
Tandem Axle E(ac)=1,000,000 psi	Average Increase	Percentage Increase	Synergistic Factor	
1 Inch Asphalt,	382,848	1,262%	1.83	
2 Inch Asphalt,	207,967	423%	1.77	
3 Inch Asphalt,	517,573	311%	1.67	

4.3.2.2. Effects of Reducing Tire Pressure and Tire Load on a Weak Asphalt Pavement

In this study, asphalt pavement with an elastic modulus of 150,000 psi. was used to model a cracked pavement. From the load repetitions to fatigue failure calculated and shown in appendix H, it appears that the Asphalt Institute's formula for fatigue failure does not accurately predict load repetitions to failure for a cracked pavement, although their rutting failure formula does appear to accurately predict rutting failure. Therefore, if the pavement section under evaluation is considered to have failed due to fatigue, then that pavement could best be thought of as an aggregate road with a very stiff surface layer of aggregate.

While the average increase in load repetitions to fatigue failure shown in Appendices H, M and N are not realistic in terms of magnitude, they do reflect the same positive trends of tire pressure and tire load reduction on fatigue failure found in Section 4.3.3.1

4.4 Comparison of Field Studies and Computer Model

Most of the field studies reviewed did not contain the information needed to compare the results of the field study with results obtained from ELSYM5 and the Asphalt Institute's failure criteria. Only the U.S. Army Waterways Experiment

Station Study (11) contained enough information that could permit a comparison between the two.

Using section 5 for a comparison, input values were determined from the information given in the study. Pavement section thicknesses of 3.5 inches of asphalt and 4.5 inches of base were used in the low pressure lane, while 2.3 inches of asphalt and 6 inches of base were used in for the high pressure lane.

The study did not give any values for elastic modulus, but did provide California Bearing Ratios (CBR) for the base and subgrade. These values were converted to elastic modulus using Figures 5.34 and 5.35 of reference 12. The low pressure lane had CBRs of 33 and 5 for the base and subgrade. These converted to elastic moduli of 20,000 and 5,000 psi respectively. The high pressure land had CBRs of 20 and 5 which converted to elastic moduli of 15,000 psi and 5,000 psi respectively for the base and subgrade. The only information provided about the asphalt concrete was that it was to meet Louisiana Department of Transportation and Development criteria. From the gradation chart in the report, it appears that the asphalt mix used in the study has a similar gradation as Washington Department of Transportation (WSDOT)class A mix design. WSDOT class a mix design uses a elastic modulus of 500,000 psi for design purposes (12), therefore this value was used in the comparison.

Tire loading was determined by dividing the total loaded weight of the logging truck by 18. This gave tire loads of 4,295 lbs/tire for the low pressure lane and 4,250 lbs/tire for the high pressure lane.

In the field study, failure was due to rutting and occurred after 2,076 logging truck passes in the low pressure lane and 1,414 passes in the high pressure lane. The logging trucks used in the study consisted of two tandem axles and one singe axle, or roughly equivalent to 2-1/2 tandem axle loads per pass. Therefore tandem axle load repetitions to failure would be 5,190 for the low pressure lane and 3,535 for the high pressure lane.

Using the strains at the top of the subgrade determined by ELSYM5 and the Asphalt Institute's load repetitions to rutting failure formula, tandem axle load repetitions to failure for the low pressure lane were estimated to be 119,739 and 2,860 for the high pressure lane. The load repetitions to failure observed in the high pressure lane (3,535) and predicted by ELSYM5 and the failure formula (2,860) are relatively close. However, the comparison of the low tire pressure values, 119,739 predicted and 5,190 observed do not compare favorably. This does not necessarily mean that ELYSM5 should not be used to predict strains in pavement sections. It may indicate that the Asphalt Institutes formula for rutting failure may not be applicable for use with low tire pressures, but further field study is required to determine this. There are many other possible reasons for

the differences, including selection of the values used as input into ELSYM5 or conversion of CBRs to elastic moduli.

4.5 Conclusions and Recommendations

This preliminary study indicates that reducing tire pressure will reduce pavement strains and extend pavement life . This is true for both fatigue and rutting failure. The extent of the increases depends greatly on the pavement material properties. In some instances, the pavement may be so weak that no amount of tire pressure or load reduction would lower strains to an acceptable level. In other instances, reducing tire pressure alone or in combination with reduced tire load would reduce strains to acceptable levels. The pavement section stiffness is critical to making the determination whether to allow any heavy vehicles with or without reduced tire pressure or tire load or both. Therefore it is important to have a reasonable idea of the strength of the pavement before making a decision whether or not to allow heavy vehicle traffic and what loading modifications are required.

As was discussed earlier, the effect of reducing tire pressure is larger on thinner pavement sections and larger for fatigue failure (tensile strain) than rutting failure (vertical compressive strain). While the study indicates that reduced tire pressure will increase load repetitions to failure, the increased number of load repetitions to failure must be considered before deciding to allow heavy vehicles (tractor semi-trailers) on weakened roads. For example reducing tire pressure may increase the load repetitions to failure by 200 percent, but the actual load repetitions to failure may only be 500. Another possible scenario is that reducing tire pressure would result in a 40% increase in load repetitions to failure, but represents an increase of 500,000 load repetitions to failure. These examples emphasize the need to consider the actual number of load repetitions to failure when considering whether reduced tire pressure alone or in combination with reduced tire load would allow the operation of heavy vehicles on weakened roads.

While this study does indicate positive results from reduced tire pressure on increasing the load repetitions to failure, additional studies are warranted. Some items that should be investigated include:

- Development of guidelines to relate pavement stiffness to the pavement freezing index and thawing index. These guidelines would greatly aid road agencies to place vehicle restrictions (tire load and pressure) without having to go to the expense of conducting field tests.

- Measurement of actual in-place strains on various pavement types, pavement conditions, tire types, axle configurations, and loading conditions.

In summary, reducing tire pressure will reduce strains in pavements. Whether the reduced strains are within acceptable levels must be determined by the agency responsible for the road. It is recommended that road agencies follow the following steps when deciding on what combination of tire pressure and tire load is acceptable.

- Determine the horizontal tensile strain at the bottom of the asphalt and vertical compressive strain at the top of the subgrade associated with the acceptable number of load repetitions to failure for the road under review.
- Determine the pavement material properties when it is in a severely weakened condition, preferably by doing a field test.
- Using the pavement stiffness determined in step 2, determine what combination of tire load and/or tire pressure will result in strains less than those determined in step 1.

Using the above procedures in combination with local knowledge, road agencies can establish under what conditions heavy vehicles could possibly operate during periods weakened pavements such as spring thaw.

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Appendix A: Strains Induced by a Single Axle Load

TABLE A.1
STRAIN (IN/IN) AT TOP OF SUBGRADE FOR 4 INCH AGGREGATE ROAD, SINGLE AXLE, TIRE LOAD, P=3,250 LBS

	E(BASE) = 1,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.009728	0.016140	0.020790
	E(SG) = 5,000 PSI	0.004972	0.008420	0.010950
	E(SG) = 10,000 PSI	0.002509	0.004300	0.005626
	E(BASE) =5,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.008072	0.012150	0.014960
	E(SG) = 5,000 PSI	0.004522	0.007160	0.009024
	E(SG) = 10,000 PSI	0.002400	0.003951	0.005067
	E(BASE) = 10,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.006742	0.009567	0.011460
	E(SG) = 5,000 PSI	0.004036	0.006076	0.007478
	E(SG) = 10,000 PSI	0.002261	0.003580	0.004512
	E(BASE) = 20,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.005280	0.007051	0.008205
	E(SG) = 5,000 PSI	0.003371	0.004784	0.005729
	E(SG) = 10,000 PSI	0.002018	0.003038	0.003739
	E(BASE) = 30,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.004464	0.005762	0.006598
	E(SG) = 5,000 PSI	0.002943	0.004029	0.004745
	E(SG) = 10,000 PSI	0.001831	0.002665	0.003229

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE A.2
STRAIN (IN/IN) AT TOP OF SUBGRADE FOR 4 INCH AGGREGATE ROAD, SINGLE AXLE, TIRE LOAD, P=3,750 LBS

	E(BASE) = 1,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.009654	0.016570	0.021810
	E(SG) = 5,000 PSI	0.004904	0.008605	0.011450
	E(SG) = 10,000 PSI	0.002466	0.004383	0.005868
	E(BASE) =5,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.008254	0.012750	0.015950
	E(SG) = 5,000 PSI	0.004553	0.007430	0.009543
	E(SG) = 10,000 PSI	0.002392	0.004065	0.005324
	E(BASE) = 10,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.007023	0.010170	0.012350
	E(SG) = 5,000 PSI	0.004127	0.006375	0.007977
	E(SG) = 10,000 PSI	0.002276	0.003715	0.004771
	E(BASE) = 20,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.005605	0.007600	0.008937
	E(SG) = 5,000 PSI	0.003511	0.005086	0.006174
	E(SG) = 10,000 PSI	0.002064	0.003188	0.003989
	E(BASE) = 30,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.004787	0.006258	0.007229
	E(SG) = 5,000 PSI	0.003100	0.004319	0.005145
	E(SG) = 10,000 PSI	0.001893	0.002818	0.003465

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE A.3
STRAIN (IN/IN) AT TOP OF SUBGRADE FOR 4 INCH AGGREGATE ROAD, SINGLE AXLE, TIRE LOAD, P=4,250 LBS

STRAIN TOP OF SUBGRADE	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.009526	0.016840	0.022580
	E(SG) = 5,000 PSI	0.004812	0.008704	0.011810
	E(SG) = 10,000 PSI	0.002413	0.004422	0.006043
STRAIN TOP OF SUBGRADE	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.008374	0.013230	0.016790
	E(SG) = 5,000 PSI	0.004552	0.007625	0.009960
	E(SG) = 10,000 PSI	0.002366	0.004138	0.005522
STRAIN TOP OF SUBGRADE	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.007249	0.010690	0.013120
	E(SG) = 5,000 PSI	0.004187	0.006614	0.008396
	E(SG) = 10,000 PSI	0.002276	0.003812	0.004980
STRAIN TOP OF SUBGRADE	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.005888	0.008087	0.009597
	E(SG) = 5,000 PSI	0.003624	0.005343	0.006562
	E(SG) = 10,000 PSI	0.002093	0.003307	0.004198
STRAIN TOP OF SUBGRADE	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.005078	0.006708	0.007808
	E(SG) = 5,000 PSI	0.003233	0.004571	0.005502
	E(SG) = 10,000 PSI	0.001939	0.002944	0.003667

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE A.4
STRAIN (IN/IN) AT TOP OF SUBGRADE FOR 8 INCH AGGREGATE ROAD, SINGLE AXLE, TIRE LOAD, P=3,250 LBS

	E(BASE) = 1,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.006687	0.008223	0.009011
	E(SG) = 5,000 PSI	0.003527	0.004376	0.004813
	E(SG) = 10,000 PSI	0.001814	0.002262	0.002492
	E(BASE) =5,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.004859	0.005734	0.006178
	E(SG) = 5,000 PSI	0.002908	0.003506	0.003810
	E(SG) = 10,000 PSI	0.001630	0.001996	0.002184
	E(BASE) = 10,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.003779	0.004353	0.004642
	E(SG) = 5,000 PSI	0.002429	0.002867	0.003089
	E(SG) = 10,000 PSI	0.001454	0.001753	0.001905
	E(BASE) = 20,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.002753	0.003097	0.003269
	E(SG) = 5,000 PSI	0.001890	0.002177	0.002321
	E(SG) = 10,000 PSI	0.001215	0.001434	0.001544
	E(BASE) = 30,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.002230	0.002477	0.002599
	E(SG) = 5,000 PSI	0.001581	0.001796	0.001904
	E(SG) = 10,000 PSI	0.001058	0.001231	0.001318

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE A.5
STRAIN (IN/IN) AT TOP OF SUBGRADE FOR 8 INCH AGGREGATE ROAD, SINGLE AXLE, TIRE LOAD, P=3,750 LBS

	E(BASE) = 1,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.007212	0.009072	0.010050
	E(SG) = 5,000 PSI	0.003792	0.004819	0.005363
	E(SG) = 10,000 PSI	0.001947	0.002488	0.002776
	E(BASE) =5,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.005315	0.006381	0.006936
	E(SG) = 5,000 PSI	0.003158	0.003884	0.004264
	E(SG) = 10,000 PSI	0.001760	0.002204	0.002439
	E(BASE) = 10,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.004168	0.004869	0.005231
	E(SG) = 5,000 PSI	0.002658	0.003191	0.003468
	E(SG) = 10,000 PSI	0.001579	0.001942	0.002132
	E(BASE) = 20,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.003061	0.003482	0.003697
	E(SG) = 5,000 PSI	0.002084	0.002435	0.002616
	E(SG) = 10,000 PSI	0.001329	0.001595	0.001734
	E(BASE) = 30,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.002490	0.002792	0.002946
	E(SG) = 5,000 PSI	0.001752	0.002015	0.002150
	E(SG) = 10,000 PSI	0.001162	0.001374	0.001483

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE A.6
STRAIN (IN/IN) AT TOP OF SUBGRADE FOR 8 INCH AGGREGATE ROAD, SINGLE AXLE, TIRE LOAD, P=4,250 LBS

STRAIN TOP OF SUBGRADE	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.007664	0.009840	0.011030
	E(SG) = 5,000 PSI	0.004018	0.005219	0.005875
	E(SG) = 10,000 PSI	0.002059	0.002692	0.003038
STRAIN TOP OF SUBGRADE	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.005728	0.006983	0.007654
	E(SG) = 5,000 PSI	0.003379	0.004231	0.004691
	E(SG) = 10,000 PSI	0.001873	0.002394	0.002676
STRAIN TOP OF SUBGRADE	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.004527	0.005355	0.005794
	E(SG) = 5,000 PSI	0.002864	0.003491	0.003827
	E(SG) = 10,000 PSI	0.001690	0.002116	0.002345
STRAIN TOP OF SUBGRADE	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.003350	0.003849	0.004110
	E(SG) = 5,000 PSI	0.002264	0.002678	0.002897
	E(SG) = 10,000 PSI	0.001432	0.001746	0.001914
STRAIN TOP OF SUBGRADE	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.002747	0.003095	0.003282
	E(SG) = 5,000 PSI	0.001912	0.002223	0.002386
	E(SG) = 10,000 PSI	0.001258	0.001508	0.001640

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE A.7

STRAIN (IN/IN) AT TOP OF SUBGRADE FOR A 12 INCH AGGREGATE ROAD, SINGLE AXLE, TIRE LOAD, P=3,250

STRAIN TOP OF SUBGRADE	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.004278	0.004688	0.004875
	E(SG) = 5,000 PSI	0.002264	0.002491	0.002594
	E(SG) = 10,000 PSI	0.001166	0.001286	0.001341
STRAIN TOP OF SUBGRADE	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.003110	0.003274	0.003380
	E(SG) = 5,000 PSI	0.001855	0.002003	0.002075
	E(SG) = 10,000 PSI	0.001041	0.001139	0.001183
STRAIN TOP OF SUBGRADE	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.002403	0.002472	0.002541
	E(SG) = 5,000 PSI	0.001555	0.001637	0.001690
	E(SG) = 10,000 PSI	0.000928	0.001001	0.001038
STRAIN TOP OF SUBGRADE	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.001719	0.001753	0.001778
	E(SG) = 5,000 PSI	0.001201	0.001236	0.001270
	E(SG) = 10,000 PSI	0.000778	0.000818	0.000845
STRAIN TOP OF SUBGRADE	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.001371	0.001396	0.001405
	E(SG) = 5,000 PSI	0.000996	0.001017	0.001039
	E(SG) = 10,000 PSI	0.000675	0.000701	0.000722

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE A.8
STRAIN (IN/IN) AT TOP OF SUBGRADE FOR A 12 INCH AGGREGATE ROAD, SINGLE AXLE, TIRE LOAD, P=3,750 LBS

	E(BASE) = 1,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.004828	0.005305	0.005545
	E(SG) = 5,000 PSI	0.002530	0.002816	0.002949
	E(SG) = 10,000 PSI	0.001302	0.001453	0.001524
	E(BASE) =5,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.003557	0.003719	0.003855
	E(SG) = 5,000 PSI	0.002121	0.002271	0.002364
	E(SG) = 10,000 PSI	0.001180	0.001289	0.001347
	E(BASE) = 10,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.002750	0.002821	0.002902
	E(SG) = 5,000 PSI	0.001778	0.001859	0.001927
	E(SG) = 10,000 PSI	0.001060	0.001135	0.001182
	E(BASE) = 20,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.001969	0.002015	0.002034
	E(SG) = 5,000 PSI	0.001375	0.001410	0.001451
	E(SG) = 10,000 PSI	0.000889	0.000930	0.000964
	E(BASE) = 30,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.001571	0.001605	0.001618
	E(SG) = 5,000 PSI	0.001141	0.001168	0.001188
	E(SG) = 10,000 PSI	0.000773	0.000797	0.000824

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE A.9
STRAIN (IN/IN) AT TOP OF SUBGRADE FOR 12 INCH AGGREGATE ROAD, SINGLE AXLE, TIRE LOAD, P=4,250 LBS

	E(BASE) = 1,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.005417	0.005898	0.006197
	E(SG) = 5,000 PSI	0.002839	0.003129	0.003294
	E(SG) = 10,000 PSI	0.001454	0.001614	0.001701
	E(BASE) =5,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.003994	0.004150	0.004320
	E(SG) = 5,000 PSI	0.002529	0.002529	0.002645
	E(SG) = 10,000 PSI	0.001324	0.001434	0.001505
	E(BASE) = 10,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.003090	0.003183	0.003257
	E(SG) = 5,000 PSI	0.001997	0.002075	0.002160
	E(SG) = 10,000 PSI	0.001190	0.001265	0.001323
	E(BASE) = 20,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.002214	0.002274	0.002297
	E(SG) = 5,000 PSI	0.001545	0.001592	0.001628
	E(SG) = 10,000 PSI	0.000998	0.001037	0.001080
	E(BASE) = 30,000 PSI			
STRAIN TOP OF SUBGRADE	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
	E(SG) = 2,500 PSI	0.001767	0.001812	0.001829
	E(SG) = 5,000 PSI	0.001282	0.001319	0.001334
	E(SG) = 10,000 PSI	0.000868	0.000895	0.000924

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE A.10
STRAINS INDUCED BY A DUAL SINGLE AXLE LOAD ON 1 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 3,250 LBS/TIRE

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.002618	0.004136	0.005276
	E(SG) =5,000 PSI	0.002454	0.004127	0.005092
	E(SG) =10,000 PSI	0.002361	0.003858	0.004988
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.005251	0.005975	0.006317
	E(SG) =5,000 PSI	0.002730	0.003132	0.003322
	E(SG) =10,000 PSI	0.001387	0.001600	0.001701
	E(BASE)=5,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000826	0.001602	0.002288
	E(SG) =5,000 PSI	0.000775	0.001543	0.002226
	E(SG) =10,000 PSI	0.000738	0.001500	0.002180
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.004842	0.005635	0.006026
	E(SG) =5,000 PSI	0.002916	0.003464	0.003735
	E(SG) =10,000 PSI	0.001631	0.001970	0.002138
	E(BASE)=10,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000332	0.000796	0.001259
	E(SG) =5,000 PSI	0.000347	0.000809	0.001271
	E(SG) =10,000 PSI	0.000356	0.000815	0.001276
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.003890	0.004503	0.004811
	E(SG) =5,000 PSI	0.002543	0.003017	0.003256
	E(SG) =10,000 PSI	0.001534	0.001861	0.002027
	E(BASE)=20,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000029	0.000274	0.000546
	E(SG) =5,000 PSI	0.000071	0.000317	0.000589
	E(SG) =10,000 PSI	0.000117	0.000347	0.000619
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.002879	0.003291	0.003500
	E(SG) =5,000 PSI	0.002014	0.002362	0.002540
	E(SG) =10,000 PSI	0.001313	0.001581	0.001719
	E(BASE)=30,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	NO TENSION	0.000089	0.000275
	E(SG) =5,000 PSI	NO TENSION	0.000142	0.000327
	E(SG) =10,000 PSI	0.000026	0.000182	0.000367
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.002362	0.002673	0.002833
	E(SG) =5,000 PSI	0.001702	0.001976	0.002116
	E(SG) =10,000 PSI	0.001154	0.001376	0.001492

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE A.11
STRAINS INDUCED BY A DUAL SINGLE AXLE LOAD ON 1INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 3,750 LBS/TIRE

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.002754	0.004286	0.005543
	E(SG) =5,000 PSI	0.002545	0.004084	0.005333
	E(SG) =10,000 PSI	0.002427	0.003969	0.005215
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.005802	0.006706	0.007143
	E(SG) =5,000 PSI	0.003008	0.003510	0.003752
	E(SG) =10,000 PSI	0.001525	0.001791	0.001919
	E(BASE)=5,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000900	0.001580	0.002301
	E(SG) =5,000 PSI	0.000838	0.001514	0.002231
	E(SG) =10,000 PSI	0.000793	0.001466	0.002179
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.005317	0.006291	0.006784
	E(SG) =5,000 PSI	0.003180	0.003851	0.004193
	E(SG) =10,000 PSI	0.001768	0.002182	0.002394
	E(BASE)=10,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000382	0.000748	0.001220
	E(SG) =5,000 PSI	0.000401	0.000763	0.001233
	E(SG) =10,000 PSI	0.000412	0.000770	0.001239
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.004283	0.005032	0.005418
	E(SG) =5,000 PSI	0.002776	0.003353	0.003653
	E(SG) =10,000 PSI	0.001662	0.002059	0.002267
	E(BASE)=20,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000014	0.000223	0.000490
	E(SG) =5,000 PSI	0.000085	0.000271	0.000538
	E(SG) =10,000 PSI	0.000141	0.000306	0.000574
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.003186	0.003686	0.003948
	E(SG) =5,000 PSI	0.002210	0.002631	0.002853
	E(SG) =10,000 PSI	0.001248	0.001752	0.001924
	E(BASE)=30,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	NO TENSION	0.000043	0.000220
	E(SG) =5,000 PSI	NO TENSION	0.000102	0.000280
	E(SG) =10,000 PSI	0.000026	0.000148	0.000326
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.002623	0.003001	0.003199
	E(SG) =5,000 PSI	0.001874	0.002205	0.002381
	E(SG) =10,000 PSI	0.001259	0.001528	0.001671

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE A.12
STRAINS INDUCED BY A DUAL SINGLE AXLE LOAD ON A 1 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 4,250 LBS/TIRE

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.002998	0.004398	0.005764
	E(SG) =5,000 PSI	0.002767	0.004173	0.005529
	E(SG) =10,000 PSI	0.002637	0.004045	0.005396
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.006307	0.007398	0.007935
	E(SG) =5,000 PSI	0.003260	0.003865	0.004163
	E(SG) =10,000 PSI	0.001650	0.001970	0.002128
	E(BASE)=5,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000992	0.001550	0.002299
	E(SG) =5,000 PSI	0.000924	0.001477	0.002222
	E(SG) =10,000 PSI	0.000875	0.001424	0.002163
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.005749	0.006906	0.007506
	E(SG) =5,000 PSI	0.003414	0.004210	0.004625
	E(SG) =10,000 PSI	0.001887	0.002377	0.002635
	E(BASE)=10,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000426	0.000700	0.001175
	E(SG) =5,000 PSI	0.000448	0.000718	0.001191
	E(SG) =10,000 PSI	0.000461	0.000726	0.001198
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.004644	0.005529	0.005997
	E(SG) =5,000 PSI	0.002986	0.003666	0.004029
	E(SG) =10,000 PSI	0.001774	0.002241	0.002492
	E(BASE)=20,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000021	0.000174	0.000434
	E(SG) =5,000 PSI	0.000100	0.000229	0.000489
	E(SG) =10,000 PSI	0.000163	0.000269	0.000529
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.003472	0.004060	0.004377
	E(SG) =5,000 PSI	0.002388	0.002883	0.003151
	E(SG) =10,000 PSI	0.001529	0.001909	0.002120
	E(BASE)=30,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	NO TENSION	NO TENSION	0.000168
	E(SG) =5,000 PSI	NO TENSION	0.000066	0.000236
	E(SG) =10,000 PSI	0.000035	0.000118	0.000288
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.002868	0.003312	0.003552
	E(SG) =5,000 PSI	0.002033	0.002421	0.002633
	E(SG) =10,000 PSI	0.001353	0.001668	0.001840

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE A.13
STRAINS INDUCED BY A DUAL SINGLE AXLE LOAD ON A 2 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 3,250 LBS/TIRE

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.001952	0.002430	0.002805
	E(SG) =5,000 PSI	0.001787	0.002275	0.002648
	E(SG) =10,000 PSI	0.001690	0.002184	0.002556
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.003308	0.003404	0.003441
	E(SG) =5,000 PSI	0.001725	0.001777	0.001798
	E(SG) =10,000 PSI	0.000876	0.000904	0.000914
	E(BASE)=5,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.001044	0.001461	0.001768
	E(SG) =5,000 PSI	0.000930	0.001345	0.001650
	E(SG) =10,000 PSI	0.000850	0.001260	0.001563
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.003422	0.003676	0.003811
	E(SG) =5,000 PSI	0.002037	0.002238	0.002332
	E(SG) =10,000 PSI	0.001136	0.001262	0.001320
	E(BASE)=10,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000675	0.001010	0.001268
	E(SG) =5,000 PSI	0.000616	0.000948	0.001205
	E(SG) =10,000 PSI	0.000567	0.000896	0.001152
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.002935	0.003201	0.003325
	E(SG) =5,000 PSI	0.001917	0.002123	0.002220
	E(SG) =10,000 PSI	0.001155	0.001298	0.001366
	E(BASE)=20,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000349	0.000588	0.000786
	E(SG) =5,000 PSI	0.000337	0.000575	0.000772
	E(SG) =10,000 PSI	0.000324	0.000561	0.000758
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.002290	0.002499	0.002599
	E(SG) =5,000 PSI	0.001608	0.001785	0.001870
	E(SG) =10,000 PSI	0.001051	0.001188	0.001254
	E(BASE)=30,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000194	0.000378	0.000539
	E(SG) =5,000 PSI	0.000201	0.000386	0.000546
	E(SG) =10,000 PSI	0.000206	0.000390	0.000551
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.001912	0.002084	0.002166
	E(SG) =5,000 PSI	0.001388	0.001539	0.001612
	E(SG) =10,000 PSI	0.000947	0.001070	0.001130

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE A.14

STRAINS INDUCED BY A DUAL SINGLE AXLE LOAD ON 2 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 3,750 LBS/TIRE

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.002183	0.002636	0.003060
	E(SG) =5,000 PSI	0.001996	0.002458	0.002880
	E(SG) =10,000 PSI	0.001885	0.002354	0.002774
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.003777	0.003905	0.003955
	E(SG) =5,000 PSI	0.001968	0.002039	0.002066
	E(SG) =10,000 PSI	0.000999	0.001036	0.001051
	E(BASE)=5,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.001167	0.001553	0.001894
	E(SG) =5,000 PSI	0.001028	0.001420	0.001758
	E(SG) =10,000 PSI	0.000926	0.001324	0.001659
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.003915	0.004168	0.004340
	E(SG) =5,000 PSI	0.002299	0.002531	0.002651
	E(SG) =10,000 PSI	0.001266	0.001424	0.001498
	E(BASE)=10,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000746	0.001057	0.001339
	E(SG) =5,000 PSI	0.000672	0.000986	0.001267
	E(SG) =10,000 PSI	0.000610	0.000927	0.001206
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.003324	0.003624	0.003784
	E(SG) =5,000 PSI	0.002139	0.002396	0.002520
	E(SG) =10,000 PSI	0.001282	0.001461	0.001547
	E(BASE)=20,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000380	0.000598	0.000810
	E(SG) =5,000 PSI	0.000365	0.000584	0.000795
	E(SG) =10,000 PSI	0.000348	0.000568	0.000779
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.002569	0.002829	0.002956
	E(SG) =5,000 PSI	0.001794	0.002014	0.002122
	E(SG) =10,000 PSI	0.001166	0.001335	0.001419
	E(BASE)=30,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000208	0.000373	0.000543
	E(SG) =5,000 PSI	0.000216	0.000382	0.000551
	E(SG) =10,000 PSI	0.000222	0.000387	0.000556
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.002147	0.002359	0.002464
	E(SG) =5,000 PSI	0.001550	0.001736	0.001829
	E(SG) =10,000 PSI	0.001050	0.001202	0.001278

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE A.15
STRAINS INDUCED BY A DUAL SINGLE AXLE LOAD ON 2 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 4,250 LBS/TIRE

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.002395	0.002825	0.003297
	E(SG) =5,000 PSI	0.002185	0.002625	0.003093
	E(SG) =10,000 PSI	0.002062	0.002508	0.002974
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.004234	0.004401	0.004465
	E(SG) =5,000 PSI	0.002205	0.002296	0.002332
	E(SG) =10,000 PSI	0.001119	0.001167	0.001186
	E(BASE)=5,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.001278	0.001634	0.002006
	E(SG) =5,000 PSI	0.001122	0.001485	0.001854
	E(SG) =10,000 PSI	0.000895	0.001377	0.001742
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.004398	0.004643	0.004856
	E(SG) =5,000 PSI	0.002581	0.002812	0.002960
	E(SG) =10,000 PSI	0.001405	0.001578	0.001671
	E(BASE)=10,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000817	0.001097	0.001400
	E(SG) =5,000 PSI	0.000735	0.001017	0.001319
	E(SG) =10,000 PSI	0.000666	0.000951	0.001250
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.003740	0.004033	0.004230
	E(SG) =5,000 PSI	0.002368	0.002658	0.002811
	E(SG) =10,000 PSI	0.001401	0.001615	0.001721
	E(BASE)=20,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000416	0.000605	0.000828
	E(SG) =5,000 PSI	0.000399	0.000589	0.000812
	E(SG) =10,000 PSI	0.000381	0.000571	0.000793
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.002894	0.003148	0.003304
	E(SG) =5,000 PSI	0.001969	0.002233	0.002365
	E(SG) =10,000 PSI	0.001272	0.001475	0.001577
	E(BASE)=30,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000227	0.000366	0.000542
	E(SG) =5,000 PSI	0.000237	0.000376	0.000552
	E(SG) =10,000 PSI	0.000243	0.000382	0.000558
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.002417	0.002626	0.002754
	E(SG) =5,000 PSI	0.001703	0.001925	0.002038
	E(SG) =10,000 PSI	0.001146	0.001328	0.001420

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE A.16
STRAINS INDUCED BY A DUAL SINGLE AXLE LOAD ON 3 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 3,250 LBS/TIRE

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.001440	0.001639	0.001821
	E(SG) =5,000 PSI	0.001346	0.001549	0.001731
	E(SG) =10,000 PSI	0.001290	0.001495	0.001677
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.002113	0.002163	0.002183
	E(SG) =5,000 PSI	0.001126	0.001154	0.001166
	E(SG) =10,000 PSI	0.000580	0.000595	0.000601
	E(BASE)=5,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000882	0.001086	0.001248
	E(SG) =5,000 PSI	0.000804	0.001012	0.001173
	E(SG) =10,000 PSI	0.000745	0.000957	0.001116
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.002364	0.002423	0.002446
	E(SG) =5,000 PSI	0.001454	0.001494	0.001510
	E(SG) =10,000 PSI	0.000824	0.000848	0.000858
	E(BASE)=10,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000615	0.000807	0.000951
	E(SG) =5,000 PSI	0.000570	0.000764	0.000907
	E(SG) =10,000 PSI	0.000530	0.000727	0.000869
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.002029	0.002077	0.002095
	E(SG) =5,000 PSI	0.001353	0.001388	0.001402
	E(SG) =10,000 PSI	0.000826	0.000850	0.000859
	E(BASE)=20,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000366	0.000528	0.000647
	E(SG) =5,000 PSI	0.000353	0.000514	0.000634
	E(SG) =10,000 PSI	0.000340	0.000501	0.000620
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.001559	0.001592	0.001604
	E(SG) =5,000 PSI	0.001118	0.001144	0.001153
	E(SG) =10,000 PSI	0.000740	0.000759	0.000766
	E(BASE)=30,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000245	0.000380	0.000480
	E(SG) =5,000 PSI	0.000244	0.000380	0.000482
	E(SG) =10,000 PSI	0.000242	0.000377	0.000480
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.001288	0.001312	0.001322
	E(SG) =5,000 PSI	0.000955	0.000975	0.000983
	E(SG) =10,000 PSI	0.000661	0.000676	0.000690

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE A.17

STRAINS INDUCED BY A DUAL SINGLE AXLE LOAD ON 3 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 3,750 LBS/TIRE

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.001620	0.001807	0.002017
	E(SG) =5,000 PSI	0.001512	0.001704	0.001913
	E(SG) =10,000 PSI	0.001448	0.001642	0.001850
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.002418	0.002484	0.002511
	E(SG) =5,000 PSI	0.001288	0.001325	0.001340
	E(SG) =10,000 PSI	0.000663	0.000683	0.000691
	E(BASE)=5,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000989	0.001180	0.001364
	E(SG) =5,000 PSI	0.000899	0.001096	0.001278
	E(SG) =10,000 PSI	0.000832	0.001032	0.001213
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.002704	0.002780	0.002813
	E(SG) =5,000 PSI	0.001661	0.001714	0.001735
	E(SG) =10,000 PSI	0.000940	0.000973	0.000986
	E(BASE)=10,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000689	0.000868	0.001029
	E(SG) =5,000 PSI	0.000637	0.000818	0.000979
	E(SG) =10,000 PSI	0.000592	0.000776	0.000936
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.002322	0.002385	0.002410
	E(SG) =5,000 PSI	0.001546	0.001594	0.001612
	E(SG) =10,000 PSI	0.000944	0.000975	0.000988
	E(BASE)=20,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000406	0.000557	0.000690
	E(SG) =5,000 PSI	0.000390	0.000542	0.000675
	E(SG) =10,000 PSI	0.000373	0.000526	0.000659
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.001786	0.001829	0.001846
	E(SG) =5,000 PSI	0.001278	0.001313	0.001327
	E(SG) =10,000 PSI	0.000846	0.000872	0.000881
	E(BASE)=30,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000266	0.000395	0.000508
	E(SG) =5,000 PSI	0.000265	0.000394	0.000507
	E(SG) =10,000 PSI	0.000262	0.000392	0.000505
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.001476	0.001509	0.001521
	E(SG) =5,000 PSI	0.001093	0.001121	0.001131
	E(SG) =10,000 PSI	0.000755	0.000776	0.000788

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE

E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE A.18
STRAINS INDUCED BY A DUAL SINGLE AXLE LOAD ON 3 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 4250 LBS/TIRE

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.001788	0.001966	0.002202
	E(SG) =5,000 PSI	0.001667	0.001849	0.002084
	E(SG) =10,000 PSI	0.001595	0.001780	0.002014
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.002717	0.002802	0.002836
	E(SG) =5,000 PSI	0.001446	0.001494	0.001514
	E(SG) =10,000 PSI	0.000745	0.000770	0.000781
	E(BASE)=5,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.001087	0.001269	0.001472
	E(SG) =5,000 PSI	0.000987	0.001172	0.001375
	E(SG) =10,000 PSI	0.000912	0.001101	0.001302
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.003036	0.003137	0.003177
	E(SG) =5,000 PSI	0.001863	0.001932	0.001959
	E(SG) =10,000 PSI	0.001054	0.001096	0.001113
	E(BASE)=10,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000756	0.000923	0.001101
	E(SG) =5,000 PSI	0.000697	0.000867	0.001044
	E(SG) =10,000 PSI	0.000647	0.000819	0.000996
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.002609	0.002690	0.002722
	E(SG) =5,000 PSI	0.001736	0.001797	0.001821
	E(SG) =10,000 PSI	0.001058	0.001099	0.001115
	E(BASE)=20,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000444	0.000583	0.000728
	E(SG) =5,000 PSI	0.000426	0.000566	0.000710
	E(SG) =10,000 PSI	0.000408	0.000548	0.000692
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.002008	0.002064	0.002086
	E(SG) =5,000 PSI	0.001436	0.001482	0.001499
	E(SG) =10,000 PSI	0.000950	0.000983	0.000996
	E(BASE)=30,000 PSI			
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000290	0.000407	0.000529
	E(SG) =5,000 PSI	0.000289	0.000406	0.000528
	E(SG) =10,000 PSI	0.000286	0.000403	0.000526
STRAIN BOTTOM OF SUBGRADE	E(SG) =2,500 PSI	0.001661	0.001704	0.001720
	E(SG) =5,000 PSI	0.001229	0.001265	0.001278
	E(SG) =10,000 PSI	0.000848	0.000876	0.000886

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

Appendix B: Loads to Rutting and Fatigue Failure for a Single Axle Load

TABLE B.1
STRAIN AT TOP OF SUBGRADE FOR A 4 INCH AGGREGATE ROAD, TANDEM AXLE, TIRE LOAD OF 4,250 LB./TIRE

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.011480	0.019260	0.025260
	E(SG) = 5,000 PSI	0.005765	0.009896	0.013130
	E(SG) = 10,000 PSI	0.002881	0.005010	0.006694
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.008354	0.013200	0.016770
	E(SG) = 5,000 PSI	0.004543	0.007614	0.009947
	E(SG) = 10,000 PSI	0.002858	0.004746	0.006195
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.007228	0.010660	0.013100
	E(SG) = 5,000 PSI	0.004177	0.006602	0.008384
	E(SG) = 10,000 PSI	0.002271	0.003807	0.004974
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.007657	0.010090	0.011740
	E(SG) = 5,000 PSI	0.004587	0.006466	0.007777
	E(SG) = 10,000 PSI	0.002593	0.003905	0.004853
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.005060	0.008542	0.009745
	E(SG) = 5,000 PSI	0.003222	0.004561	0.005492
	E(SG) = 10,000 PSI	0.001934	0.002938	0.003661

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.2
STRAIN AT TOP OF SUBGRADE FOR A 4 INCH AGGREGATE ROAD, TANDEM AXLE, TIRE LOAD OF 3,750 LB./TIRE.

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.009640	0.016550	0.021780
	E(SG) = 5,000 PSI	0.004897	0.008595	0.011440
	E(SG) = 10,000 PSI	0.002463	0.004378	0.005862
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.008237	0.012730	0.015940
	E(SG) = 5,000 PSI	0.004545	0.007420	0.009532
	E(SG) = 10,000 PSI	0.002388	0.004060	0.005318
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.007005	0.010150	0.012330
	E(SG) = 5,000 PSI	0.004118	0.006365	0.007969
	E(SG) = 10,000 PSI	0.002272	0.003710	0.004766
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.005587	0.007582	0.008919
	E(SG) = 5,000 PSI	0.003502	0.005076	0.006164
	E(SG) = 10,000 PSI	0.002059	0.003183	0.003985
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.004770	0.006240	0.007212
	E(SG) = 5,000 PSI	0.003091	0.004309	0.005136
	E(SG) = 10,000 PSI	0.001888	0.002813	0.003460

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.3
STRAIN AT TOP OF SUBGRADE FOR A 4 INCH AGGREGATE ROAD, TANDEM AXLE, TIRE LOAD OF 3,250 LB./TIRE.

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.009714	0.016120	0.020770
	E(SG) = 5,000 PSI	0.004965	0.008410	0.010940
	E(SG) = 10,000 PSI	0.002506	0.004296	0.005612
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.008056	0.012130	0.014940
	E(SG) = 5,000 PSI	0.004515	0.007151	0.009015
	E(SG) = 10,000 PSI	0.002400	0.003946	0.005062
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.006726	0.009553	0.011440
	E(SG) = 5,000 PSI	0.004028	0.006066	0.007470
	E(SG) = 10,000 PSI	0.002258	0.003575	0.004508
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.005265	0.007036	0.008190
	E(SG) = 5,000 PSI	0.003363	0.004776	0.005721
	E(SG) = 10,000 PSI	0.002014	0.003033	0.003735
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.004448	0.005476	0.006583
	E(SG) = 5,000 PSI	0.002935	0.004022	0.004737
	E(SG) = 10,000 PSI	0.001827	0.002660	0.003225

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.4
STRAIN AT TOP OF SUBGRADE FOR AN 8 INCH AGGREGATE ROAD, TANDEM AXLE, TIRE LOAD OF 3,250 LB./TIRE

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.006657	0.008193	0.008981
	E(SG) = 5,000 PSI	0.003512	0.004361	0.004798
	E(SG) = 10,000 PSI	0.001806	0.002254	0.002485
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.004828	0.005704	0.006147
	E(SG) = 5,000 PSI	0.002893	0.003491	0.003795
	E(SG) = 10,000 PSI	0.001622	0.001989	0.002177
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.003746	0.004321	0.004609
	E(SG) = 5,000 PSI	0.002414	0.002852	0.003074
	E(SG) = 10,000 PSI	0.001446	0.001745	0.001898
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.002718	0.003062	0.003233
	E(SG) = 5,000 PSI	0.001873	0.002160	0.002305
	E(SG) = 10,000 PSI	0.001207	0.001426	0.001537
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.002200	0.002443	0.002565
	E(SG) = 5,000 PSI	0.001564	0.001779	0.001886
	E(SG) = 10,000 PSI	0.001050	0.001223	0.001310

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.5
STRAIN AT TOP OF SUBGRADE FOR AN 8 INCH AGGREGATE ROAD, TANDEM AXLE, TIRE LOAD OF 3,750 LB./TIRE.

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.007177	0.009038	0.010020
	E(SG) = 5,000 PSI	0.003775	0.004802	0.005346
	E(SG) = 10,000 PSI	0.001938	0.002479	0.002767
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.005280	0.006346	0.006901
	E(SG) = 5,000 PSI	0.003141	0.003866	0.004247
	E(SG) = 10,000 PSI	0.001752	0.002196	0.002430
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.004130	0.004831	0.005193
	E(SG) = 5,000 PSI	0.002640	0.003173	0.003450
	E(SG) = 10,000 PSI	0.001570	0.001933	0.002124
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.003020	0.003441	0.003657
	E(SG) = 5,000 PSI	0.002065	0.002416	0.002597
	E(SG) = 10,000 PSI	0.001320	0.001586	0.001725
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.002450	0.002753	0.002907
	E(SG) = 5,000 PSI	0.001732	0.001995	0.002130
	E(SG) = 10,000 PSI	0.001153	0.001364	0.001474

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.6
STRAIN AT TOP OF SUBGRADE FOR 8 INCH AGGREGATE ROAD
TANDEM AXLE, TIRE LOAD = 4250 LB./TIRE

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.008540	0.010770	0.011970
	E(SG) = 5,000 PSI	0.004445	0.005666	0.006328
	E(SG) = 10,000 PSI	0.002267	0.002909	0.003253
	E(BASE) = 5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.006602	0.007911	0.008607
	E(SG) = 5,000 PSI	0.003826	0.004705	0.005177
	E(SG) = 10,000 PSI	0.002094	0.002627	0.002914
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.005337	0.006211	0.006671
	E(SG) = 5,000 PSI	0.003301	0.003956	0.004304
	E(SG) = 10,000 PSI	0.001913	0.002353	0.002589
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.004068	0.004587	0.004864
	E(SG) = 5,000 PSI	0.002668	0.003105	0.003335
	E(SG) = 10,000 PSI	0.001650	0.001978	0.002152
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.002700	0.003757	0.003956
	E(SG) = 5,000 PSI	0.002288	0.002618	0.002791
	E(SG) = 10,000 PSI	0.001469	0.001731	0.001869

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.7
STRAIN AT TOP OF SUBGRADE FOR A 12 INCH AGGREGATE ROAD, TANDEM AXLE, TIRE LOAD OF 4,250 LB./TIRE

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.005961	0.006390	0.006692
	E(SG) = 5,000 PSI	0.003107	0.003367	0.003534
	E(SG) = 10,000 PSI	0.001586	0.001730	0.001818
	E(BASE) = 5,000			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.004511	0.004653	0.004811
	E(SG) = 5,000 PSI	0.002651	0.002780	0.002898
	E(SG) = 10,000 PSI	0.001460	0.001558	0.001630
	E(BASE) = 10,000			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.003563	0.003667	0.003710
	E(SG) = 5,000 PSI	0.002256	0.002326	0.002406
	E(SG) = 10,000 PSI	0.001325	0.001390	0.001449
	E(BASE) = 20,000			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.002040	0.002183	0.002227
	E(SG) = 5,000 PSI	0.001782	0.001833	0.001855
	E(SG) = 10,000 PSI	0.001128	0.001163	0.001203
	E(BASE) = 30,000			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.001750	0.002208	0.002227
	E(SG) = 5,000 PSI	0.001503	0.001544	0.001559
	E(SG) = 10,000 PSI	0.000991	0.001021	0.001042

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.8
STRAIN AT TOP OF SUBGRADE FOR A 12 INCH AGGREGATE ROAD, TANDEM AXLE, TIRE LOAD OF 3,750 LB./TIRE

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.004783	0.005261	0.005502
	E(SG) = 5,000 PSI	0.002508	0.002795	0.002928
	E(SG) = 10,000 PSI	0.001291	0.001443	0.001513
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.003507	0.003670	0.003806
	E(SG) = 5,000 PSI	0.002097	0.002247	0.002341
	E(SG) = 10,000 PSI	0.001168	0.001278	0.001336
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.002703	0.002774	0.002856
	E(SG) = 5,000 PSI	0.001753	0.001835	0.001903
	E(SG) = 10,000 PSI	0.001049	0.001124	0.001170
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.001937	0.001983	0.002002
	E(SG) = 5,000 PSI	0.001352	0.001387	0.001428
	E(SG) = 10,000 PSI	0.000877	0.000918	0.000952
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.001550	0.001588	0.001600
	E(SG) = 5,000 PSI	0.001121	0.001149	0.001168
	E(SG) = 10,000 PSI	0.000760	0.000785	0.000812

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.9
STRAIN AT TOP OF SUBGRAGE FOR 12 INCH AGGREGATE ROAD, TANDEM AXLE, TIRE LOAD OF 3,250 LB./TIRE.

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.004185	0.004650	0.004837
	E(SG) = 5,000 PSI	0.002245	0.002472	0.002576
	E(SG) = 10,000 PSI	0.001157	0.001277	0.001332
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.003067	0.003232	0.003338
	E(SG) = 5,000 PSI	0.001835	0.001983	0.002055
	E(SG) = 10,000 PSI	0.001031	0.001129	0.001174
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.002363	0.002432	0.002501
	E(SG) = 5,000 PSI	0.001533	0.001616	0.001669
	E(SG) = 10,000 PSI	0.000917	0.000991	0.001028
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.001692	0.001725	0.001750
	E(SG) = 5,000 PSI	0.001180	0.001216	0.001250
	E(SG) = 10,000 PSI	0.000767	0.000808	0.000834
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN TOP OF SUBGRADE	E(SG) = 2,500 PSI	0.001360	0.001381	0.001390
	E(SG) = 5,000 PSI	0.000979	0.000999	0.001022
	E(SG) = 10,000 PSI	0.000665	0.000691	0.000711

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.10

STRAINS INDUCED BY A TANDEM AXLE LOAD ON A 1 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 3,250 LBS/TIRE, E=150,000 PSI

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.002614	0.004125	0.005273
	E(SG) =5,000 PSI	0.002450	0.003947	0.005090
	E(SG) =10,000 PSI	0.002358	0.003847	0.004986
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.005232	0.005956	0.006298
	E(SG) =5,000 PSI	0.002722	0.003124	0.003315
	E(SG) =10,000 PSI	0.001384	0.001597	0.001697
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000830	0.001599	0.002286
	E(SG) =5,000 PSI	0.000777	0.001539	0.002222
	E(SG) =10,000 PSI	0.000739	0.001495	0.002175
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.004808	0.005601	0.005993
	E(SG) =5,000 PSI	0.002902	0.003450	0.003721
	E(SG) =10,000 PSI	0.001625	0.001963	0.002132
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000342	0.000800	0.001263
	E(SG) =5,000 PSI	0.000346	0.000809	0.001271
	E(SG) =10,000 PSI	0.000360	0.000812	0.001273
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.003852	0.004466	0.004774
	E(SG) =5,000 PSI	0.002526	0.003000	0.003239
	E(SG) =10,000 PSI	0.001527	0.001854	0.002019
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000024	0.000263	0.000535
	E(SG) =5,000 PSI	0.000077	0.000310	0.000582
	E(SG) =10,000 PSI	0.000122	0.000343	0.000615
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002842	0.003253	0.003463
	E(SG) =5,000 PSI	0.001996	0.002344	0.002522
	E(SG) =10,000 PSI	0.001305	0.001573	0.001711
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000096	0.000094	0.000262
	E(SG) =5,000 PSI	0.000069	0.000134	0.000320
	E(SG) =10,000 PSI	0.000022	0.000177	0.000363
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002328	0.002639	0.002798
	E(SG) =5,000 PSI	0.001684	0.001957	0.002098
	E(SG) =10,000 PSI	0.001145	0.001368	0.001484

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS

E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.11
STRAINS INDUCED BY A TANDEM AXLE LOAD ON A 1 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 3,750 LBS/TIRE, E=150,000 PSI

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.002749	0.004274	0.005539
	E(SG) =5,000 PSI	0.002542	0.004073	0.005331
	E(SG) =10,000 PSI	0.002424	0.003959	0.005212
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.005780	0.006685	0.007121
	E(SG) =5,000 PSI	0.002999	0.003501	0.003743
	E(SG) =10,000 PSI	0.001522	0.001787	0.001915
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000906	0.001578	0.002298
	E(SG) =5,000 PSI	0.000842	0.001511	0.002226
	E(SG) =10,000 PSI	0.000795	0.001461	0.002172
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.005278	0.006253	0.006746
	E(SG) =5,000 PSI	0.003163	0.003835	0.004177
	E(SG) =10,000 PSI	0.001761	0.002175	0.002387
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000395	0.000754	0.001224
	E(SG) =5,000 PSI	0.000408	0.000764	0.001233
	E(SG) =10,000 PSI	0.000417	0.000769	0.001236
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.004239	0.004989	0.005375
	E(SG) =5,000 PSI	0.002757	0.003334	0.003634
	E(SG) =10,000 PSI	0.001654	0.002051	0.002258
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000036	0.000210	0.000477
	E(SG) =5,000 PSI	0.000097	0.000254	0.000518
	E(SG) =10,000 PSI	0.000148	0.000302	0.000567
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.003143	0.003643	0.003904
	E(SG) =5,000 PSI	0.002189	0.002611	0.002833
	E(SG) =10,000 PSI	0.001418	0.001743	0.001914
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000109	0.000108	0.000205
	E(SG) =5,000 PSI	0.000079	0.000094	0.000271
	E(SG) =10,000 PSI	0.000045	0.000143	0.000321
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002583	0.002961	0.003159
	E(SG) =5,000 PSI	0.001853	0.002184	0.002360
	E(SG) =10,000 PSI	0.001249	0.001518	0.001662

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.12
STRAINS INDUCED BY A TANDEM AXLE LOAD ON A 1 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 4,250 LBS/TIRE, E=150,000 PSI

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.002993	0.004386	0.005747
	E(SG) =5,000 PSI	0.002764	0.004162	0.005514
	E(SG) =10,000 PSI	0.002635	0.004036	0.005381
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.006282	0.007373	0.007911
	E(SG) =5,000 PSI	0.003250	0.003855	0.004153
	E(SG) =10,000 PSI	0.001646	0.001966	0.002124
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000999	0.001550	0.002295
	E(SG) =5,000 PSI	0.000929	0.001476	0.002215
	E(SG) =10,000 PSI	0.000878	0.001421	0.002156
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.005705	0.006862	0.007463
	E(SG) =5,000 PSI	0.003395	0.004191	0.004607
	E(SG) =10,000 PSI	0.001879	0.002369	0.002627
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000441	0.000708	0.001179
	E(SG) =5,000 PSI	0.000457	0.000721	0.001190
	E(SG) =10,000 PSI	0.000466	0.000726	0.001194
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.004594	0.005480	0.005948
	E(SG) =5,000 PSI	0.002964	0.003644	0.004007
	E(SG) =10,000 PSI	0.001764	0.002231	0.002482
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000091	0.000160	0.000420
	E(SG) =5,000 PSI	0.000114	0.000220	0.000480
	E(SG) =10,000 PSI	0.000171	0.000267	0.000524
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.003423	0.004012	0.004328
	E(SG) =5,000 PSI	0.002364	0.002859	0.003127
	E(SG) =10,000 PSI	0.001519	0.001898	0.002105
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000120	0.000123	0.000151
	E(SG) =5,000 PSI	0.000087	0.000088	0.000226
	E(SG) =10,000 PSI	0.000049	0.000112	0.000282
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002823	0.003267	0.003506
	E(SG) =5,000 PSI	0.002009	0.002398	0.002609
	E(SG) =10,000 PSI	0.001342	0.001657	0.001829

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.13
STRAINS INDUCED BY A TANDEM AXLE LOAD ON A 1 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 3,250 LBS/TIRE, E=1,000,000 PSI

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.001088	0.001376	0.001593
	E(SG) =5,000 PSI	0.000989	0.001282	0.001498
	E(SG) =10,000 PSI	0.000930	0.001227	0.001442
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.003437	0.003538	0.003577
	E(SG) =5,000 PSI	0.001784	0.001839	0.001860
	E(SG) =10,000 PSI	0.000903	0.000932	0.000947
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000617	0.000871	0.001056
	E(SG) =5,000 PSI	0.000540	0.000789	0.000972
	E(SG) =10,000 PSI	0.000482	0.000728	0.000910
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.003626	0.003970	0.004130
	E(SG) =5,000 PSI	0.002172	0.002409	0.002520
	E(SG) =10,000 PSI	0.001206	0.001353	0.001422
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000428	0.000638	0.000798
	E(SG) =5,000 PSI	0.000379	0.000585	0.000744
	E(SG) =10,000 PSI	0.000337	0.000540	0.000697
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.003172	0.003493	0.003645
	E(SG) =5,000 PSI	0.002068	0.002316	0.002433
	E(SG) =10,000 PSI	0.001241	0.001412	0.001494
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000253	0.000410	0.000540
	E(SG) =5,000 PSI	0.000232	0.000387	0.000516
	E(SG) =10,000 PSI	0.000210	0.000364	0.000492
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002475	0.002730	0.002853
	E(SG) =5,000 PSI	0.001743	0.001959	0.002063
	E(SG) =10,000 PSI	0.001141	0.001307	0.001388
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000166	0.000292	0.000401
	E(SG) =5,000 PSI	0.000157	0.000282	0.000391
	E(SG) =10,000 PSI	0.000146	0.000270	0.000379
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002051	0.002260	0.002361
	E(SG) =5,000 PSI	0.001497	0.001681	0.001771
	E(SG) =10,000 PSI	0.001026	0.001177	0.001251

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.14
STRAINS INDUCED BY A TANDEM AXLE LOAD ON A 1 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 3,750 LBS/TIRE, E=1,000,000 PSI

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.001214	0.001490	0.001736
	E(SG) =5,000 PSI	0.001101	0.001383	0.001627
	E(SG) =10,000 PSI	0.001034	0.001320	0.001562
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.003923	0.004059	0.004111
	E(SG) =5,000 PSI	0.002035	0.002109	0.002138
	E(SG) =10,000 PSI	0.001030	0.001069	0.001083
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000688	0.000925	0.001130
	E(SG) =5,000 PSI	0.000590	0.000832	0.001034
	E(SG) =10,000 PSI	0.000518	0.000762	0.000963
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.004110	0.004493	0.004697
	E(SG) =5,000 PSI	0.002420	0.002719	0.002861
	E(SG) =10,000 PSI	0.001338	0.001523	0.001611
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000473	0.000668	0.000844
	E(SG) =5,000 PSI	0.000411	0.000608	0.000782
	E(SG) =10,000 PSI	0.000358	0.000557	0.000729
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.003546	0.003947	0.004141
	E(SG) =5,000 PSI	0.002299	0.002608	0.002757
	E(SG) =10,000 PSI	0.001372	0.001585	0.001689
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000279	0.000421	0.000560
	E(SG) =5,000 PSI	0.000253	0.000395	0.000533
	E(SG) =10,000 PSI	0.000225	0.000368	0.000505
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002767	0.003083	0.003239
	E(SG) =5,000 PSI	0.001936	0.002204	0.002336
	E(SG) =10,000 PSI	0.001259	0.001465	0.001567
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000185	0.000294	0.000409
	E(SG) =5,000 PSI	0.000173	0.000283	0.000398
	E(SG) =10,000 PSI	0.000160	0.000269	0.000383
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002294	0.002552	0.002681
	E(SG) =5,000 PSI	0.001664	0.001891	0.002005
	E(SG) =10,000 PSI	0.001133	0.001318	0.001412

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.15
STRAINS INDUCED BY A TANDEM AXLE LOAD ON A 1 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 4,250 LBS/TIRE, E=1,000,000 PSI

		E(BASE)=1,000 PSI		
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.001332	0.001592	0.001869
	E(SG) =5,000 PSI	0.001206	0.001472	0.001746
	E(SG) =10,000 PSI	0.001131	0.001401	0.001673
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.004396	0.004574	0.004641
	E(SG) =5,000 PSI	0.002280	0.002376	0.002413
	E(SG) =10,000 PSI	0.001153	0.001204	0.001223
		E(BASE)=5,000 PSI		
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000753	0.000972	0.001197
	E(SG) =5,000 PSI	0.000644	0.000867	0.001089
	E(SG) =10,000 PSI	0.000563	0.000790	0.001009
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.004617	0.004996	0.005249
	E(SG) =5,000 PSI	0.002680	0.003015	0.003190
	E(SG) =10,000 PSI	0.001461	0.001685	0.001794
		E(BASE)=10,000 PSI		
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000518	0.000694	0.000884
	E(SG) =5,000 PSI	0.000449	0.000627	0.000814
	E(SG) =10,000 PSI	0.000390	0.000569	0.000754
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.003956	0.004380	0.004622
	E(SG) =5,000 PSI	0.002514	0.002886	0.003070
	E(SG) =10,000 PSI	0.001493	0.001749	0.001876
		E(BASE)=20,000 PSI		
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000307	0.000429	0.000576
	E(SG) =5,000 PSI	0.000277	0.000400	0.000546
	E(SG) =10,000 PSI	0.000247	0.000370	0.000514
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.003057	0.003423	0.003614
	E(SG) =5,000 PSI	0.002117	0.002437	0.002599
	E(SG) =10,000 PSI	0.001367	0.001613	0.001738
		E(BASE)=30,000 PSI		
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000203	0.000294	0.000415
	E(SG) =5,000 PSI	0.000191	0.000282	0.000401
	E(SG) =10,000 PSI	0.000176	0.000266	0.000385
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002533	0.002834	0.002991
	E(SG) =5,000 PSI	0.001820	0.002092	0.002230
	E(SG) =10,000 PSI	0.001230	0.001451	0.001565

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.16
STRAINS INDUCED BY A TANDEM AXLE LOAD ON A 2 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 3,250 LBS/TIRE, E=150,000 PSI

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.001942	0.002421	0.002795
	E(SG) =5,000 PSI	0.001781	0.002270	0.002642
	E(SG) =10,000 PSI	0.001685	0.002069	0.002470
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.003290	0.003386	0.003423
	E(SG) =5,000 PSI	0.001719	0.001772	0.001792
	E(SG) =10,000 PSI	0.000874	0.000902	0.000912
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.001037	0.001452	0.001762
	E(SG) =5,000 PSI	0.000927	0.001340	0.001647
	E(SG) =10,000 PSI	0.000848	0.001256	0.001561
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.003385	0.003640	0.003774
	E(SG) =5,000 PSI	0.002022	0.002224	0.002317
	E(SG) =10,000 PSI	0.001130	0.001256	0.001314
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000671	0.001005	0.001263
	E(SG) =5,000 PSI	0.000615	0.000945	0.001202
	E(SG) =10,000 PSI	0.000567	0.000894	0.001149
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002894	0.003168	0.003285
	E(SG) =5,000 PSI	0.001899	0.002102	0.002202
	E(SG) =10,000 PSI	0.001147	0.001290	0.001358
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000351	0.000589	0.000787
	E(SG) =5,000 PSI	0.000339	0.000575	0.000773
	E(SG) =10,000 PSI	0.000325	0.000561	0.000758
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002253	0.002462	0.002562
	E(SG) =5,000 PSI	0.001588	0.001765	0.001850
	E(SG) =10,000 PSI	0.001042	0.001179	0.001245
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000201	0.000384	0.000545
	E(SG) =5,000 PSI	0.000206	0.000389	0.000549
	E(SG) =10,000 PSI	0.000208	0.000391	0.000552
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001881	0.002052	0.002135
	E(SG) =5,000 PSI	0.001368	0.001519	0.001592
	E(SG) =10,000 PSI	0.000937	0.001060	0.001120

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.17

STRAINS INDUCED BY A TANDEM AXLE LOAD ON A 2 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 3,750 LBS/TIRE, E=150,000 PSI

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.002172	0.002626	0.003049
	E(SG) =5,000 PSI	0.001989	0.002453	0.002872
	E(SG) =10,000 PSI	0.001880	0.002350	0.002768
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.003756	0.003885	0.003934
	E(SG) =5,000 PSI	0.001961	0.002032	0.002060
	E(SG) =10,000 PSI	0.000997	0.001034	0.001048
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.001159	0.001543	0.001885
	E(SG) =5,000 PSI	0.001024	0.001415	0.001754
	E(SG) =10,000 PSI	0.000923	0.001319	0.001656
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.003872	0.004125	0.004297
	E(SG) =5,000 PSI	0.002282	0.002514	0.002634
	E(SG) =10,000 PSI	0.001259	0.001417	0.001491
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000742	0.001051	0.001333
	E(SG) =5,000 PSI	0.000671	0.000983	0.001263
	E(SG) =10,000 PSI	0.000610	0.000925	0.001203
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.003277	0.003577	0.003737
	E(SG) =5,000 PSI	0.002118	0.002375	0.002499
	E(SG) =10,000 PSI	0.001274	0.001452	0.001538
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000383	0.000600	0.000811
	E(SG) =5,000 PSI	0.000367	0.000584	0.000795
	E(SG) =10,000 PSI	0.000350	0.000568	0.000778
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002526	0.002786	0.002913
	E(SG) =5,000 PSI	0.001771	0.001991	0.002098
	E(SG) =10,000 PSI	0.001155	0.001325	0.001409
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000216	0.000380	0.000549
	E(SG) =5,000 PSI	0.000222	0.000386	0.000554
	E(SG) =10,000 PSI	0.000225	0.000389	0.000557
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002111	0.002323	0.002428
	E(SG) =5,000 PSI	0.001527	0.001713	0.001806
	E(SG) =10,000 PSI	0.001039	0.001191	0.001267

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.18
STRAINS INDUCED BY A TANDEM AXLE LOAD ON A 2 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 4,250 LBS/TIRE, E=150,000 PSI

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.002381	0.002812	0.003284
	E(SG) =5,000 PSI	0.002176	0.002617	0.003085
	E(SG) =10,000 PSI	0.002055	0.002502	0.002967
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.004210	0.004377	0.004442
	E(SG) =5,000 PSI	0.002197	0.002289	0.002325
	E(SG) =10,000 PSI	0.001116	0.001165	0.001183
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.001268	0.001623	0.001995
	E(SG) =5,000 PSI	0.001118	0.001479	0.001847
	E(SG) =10,000 PSI	0.001006	0.001373	0.001737
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.004349	0.004595	0.004808
	E(SG) =5,000 PSI	0.002562	0.002793	0.002941
	E(SG) =10,000 PSI	0.001397	0.001571	0.001663
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000812	0.001090	0.001393
	E(SG) =5,000 PSI	0.000733	0.001014	0.001315
	E(SG) =10,000 PSI	0.000666	0.000949	0.001247
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.003686	0.003980	0.004177
	E(SG) =5,000 PSI	0.002344	0.002634	0.002787
	E(SG) =10,000 PSI	0.001390	0.001605	0.001711
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000419	0.000607	0.000829
	E(SG) =5,000 PSI	0.000402	0.000590	0.000812
	E(SG) =10,000 PSI	0.000383	0.000572	0.000793
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002845	0.003099	0.003255
	E(SG) =5,000 PSI	0.001942	0.002206	0.002339
	E(SG) =10,000 PSI	0.001260	0.001463	0.001566
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000236	0.000374	0.000550
	E(SG) =5,000 PSI	0.000243	0.000380	0.000556
	E(SG) =10,000 PSI	0.000246	0.000384	0.000559
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002377	0.002585	0.002713
	E(SG) =5,000 PSI	0.001677	0.001899	0.002013
	E(SG) =10,000 PSI	0.001133	0.001315	0.001408

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.19
STRAINS INDUCED BY A TANDEM AXLE LOAD ON A 2 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 3,250 LBS/TIRE, E=1,000,000 PSI

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000570	0.000630	0.000693
	E(SG) =5,000 PSI	0.000526	0.000589	0.000651
	E(SG) =10,000 PSI	0.000498	0.000561	0.000623
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001621	0.001656	0.001670
	E(SG) =5,000 PSI	0.000879	0.000900	0.000908
	E(SG) =10,000 PSI	0.000458	0.000469	0.000474
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000442	0.000507	0.000566
	E(SG) =5,000 PSI	0.000387	0.000455	0.000513
	E(SG) =10,000 PSI	0.000342	0.000412	0.000470
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002105	0.002153	0.002172
	E(SG) =5,000 PSI	0.001298	0.001331	0.001344
	E(SG) =10,000 PSI	0.000737	0.000758	0.000766
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000369	0.000434	0.000491
	E(SG) =5,000 PSI	0.000323	0.000391	0.000446
	E(SG) =10,000 PSI	0.000281	0.000351	0.000406
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002004	0.002048	0.002064
	E(SG) =5,000 PSI	0.001319	0.001351	0.001363
	E(SG) =10,000 PSI	0.000798	0.000820	0.000828
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000280	0.000344	0.000395
	E(SG) =5,000 PSI	0.000250	0.000315	0.000366
	E(SG) =10,000 PSI	0.000219	0.000286	0.000336
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001715	0.001748	0.001760
	E(SG) =5,000 PSI	0.001198	0.001224	0.001237
	E(SG) =10,000 PSI	0.000778	0.000800	0.000824
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000224	0.000285	0.000333
	E(SG) =5,000 PSI	0.000203	0.000265	0.000313
	E(SG) =10,000 PSI	0.000181	0.000243	0.000291
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001493	0.001519	0.001532
	E(SG) =5,000 PSI	0.001074	0.001097	0.001127
	E(SG) =10,000 PSI	0.000726	0.000759	0.000784

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.20

STRAINS INDUCED BY A TANDEM AXLE LOAD ON A 2 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 3,750 LBS/TIRE, E=1,000,000 PSI

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000598	0.000651	0.000716
	E(SG) =5,000 PSI	0.000553	0.000607	0.000671
	E(SG) =10,000 PSI	0.000523	0.000578	0.000642
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001776	0.001820	0.001838
	E(SG) =5,000 PSI	0.000964	0.000990	0.001001
	E(SG) =10,000 PSI	0.000502	0.000517	0.000522
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000471	0.000526	0.000588
	E(SG) =5,000 PSI	0.000412	0.000470	0.000531
	E(SG) =10,000 PSI	0.000364	0.000424	0.000484
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002325	0.002387	0.002411
	E(SG) =5,000 PSI	0.001436	0.001479	0.001495
	E(SG) =10,000 PSI	0.000817	0.000844	0.000854
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000397	0.000453	0.000511
	E(SG) =5,000 PSI	0.000348	0.000406	0.000463
	E(SG) =10,000 PSI	0.000303	0.000363	0.000420
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002229	0.002285	0.002306
	E(SG) =5,000 PSI	0.001468	0.001510	0.001526
	E(SG) =10,000 PSI	0.000890	0.000918	0.000929
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000306	0.000360	0.000414
	E(SG) =5,000 PSI	0.000272	0.000328	0.000381
	E(SG) =10,000 PSI	0.000239	0.000296	0.000349
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001922	0.001966	0.001982
	E(SG) =5,000 PSI	0.001343	0.001377	0.001390
	E(SG) =10,000 PSI	0.000873	0.000898	0.000916
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000248	0.000300	0.000350
	E(SG) =5,000 PSI	0.000224	0.000277	0.000327
	E(SG) =10,000 PSI	0.000199	0.000253	0.000302
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001682	0.001717	0.001729
	E(SG) =5,000 PSI	0.001210	0.001238	0.001257
	E(SG) =10,000 PSI	0.000818	0.000843	0.000873

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.21
STRAINS INDUCED BY A TANDEM AXLE LOAD ON A 2 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 4,250 LBS/TIRE, E=1,000,000 PSI

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000709	0.000772	0.000844
	E(SG) =5,000 PSI	0.000653	0.000718	0.000789
	E(SG) =10,000 PSI	0.000617	0.000677	0.000753
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002086	0.002147	0.002171
	E(SG) =5,000 PSI	0.001130	0.001165	0.001180
	E(SG) =10,000 PSI	0.000588	0.000607	0.000615
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000549	0.000607	0.000682
	E(SG) =5,000 PSI	0.000479	0.000539	0.000613
	E(SG) =10,000 PSI	0.000421	0.000484	0.000557
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002707	0.002790	0.002823
	E(SG) =5,000 PSI	0.001666	0.001723	0.001746
	E(SG) =10,000 PSI	0.000944	0.000980	0.000994
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000458	0.000516	0.000586
	E(SG) =5,000 PSI	0.000399	0.000459	0.000528
	E(SG) =10,000 PSI	0.000346	0.000408	0.000477
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002579	0.002655	0.002684
	E(SG) =5,000 PSI	0.001694	0.001750	0.001771
	E(SG) =10,000 PSI	0.001023	0.001061	0.001075
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000346	0.000402	0.000466
	E(SG) =5,000 PSI	0.000307	0.000364	0.000428
	E(SG) =10,000 PSI	0.000268	0.000327	0.000389
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002209	0.002268	0.002290
	E(SG) =5,000 PSI	0.001540	0.001587	0.001604
	E(SG) =10,000 PSI	0.000998	0.001032	0.001054
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000278	0.000329	0.000388
	E(SG) =5,000 PSI	0.000250	0.000303	0.000361
	E(SG) =10,000 PSI	0.000222	0.000275	0.000333
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001926	0.001973	0.001990
	E(SG) =5,000 PSI	0.001383	0.001421	0.001445
	E(SG) =10,000 PSI	0.000933	0.000963	0.001002

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.22
STRAINS INDUCED BY A TANDEM AXLE ON A 3 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 3,250 LBS/TIRE.

E(AC)=150,000 PSI	E(BASE)=1000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.001418	0.001619	0.001801
	E(SG) =5,000 PSI	0.001340	0.001543	0.001725
	E(SG) =10,000 PSI	0.001291	0.001497	0.001678
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002071	0.002121	0.002141
	E(SG) =5,000 PSI	0.001108	0.001136	0.001148
	E(SG) =10,000 PSI	0.000572	0.000588	0.000594
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000865	0.001070	0.001232
	E(SG) =5,000 PSI	0.000796	0.001004	0.001165
	E(SG) =10,000 PSI	0.000741	0.000952	0.001113
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002323	0.002382	0.002405
	E(SG) =5,000 PSI	0.001434	0.001474	0.001490
	E(SG) =10,000 PSI	0.000816	0.000841	0.000851
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000604	0.000796	0.000940
	E(SG) =5,000 PSI	0.000564	0.000758	0.000902
	E(SG) =10,000 PSI	0.000528	0.000724	0.000867
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001996	0.002043	0.002061
	E(SG) =5,000 PSI	0.001332	0.001367	0.001381
	E(SG) =10,000 PSI	0.000817	0.000841	0.000850
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000362	0.000524	0.000643
	E(SG) =5,000 PSI	0.000351	0.000512	0.000632
	E(SG) =10,000 PSI	0.000339	0.000499	0.000619
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001542	0.001574	0.001586
	E(SG) =5,000 PSI	0.001099	0.001125	0.001135
	E(SG) =10,000 PSI	0.000730	0.000749	0.000756
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000246	0.000381	0.000484
	E(SG) =5,000 PSI	0.000245	0.000380	0.000483
	E(SG) =10,000 PSI	0.000243	0.000378	0.000481
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001282	0.001306	0.001315
	E(SG) =5,000 PSI	0.000893	0.000960	0.000968
	E(SG) =10,000 PSI	0.000650	0.000665	0.000679

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.23
STRAINS INDUCED BY A TANDEM AXLE ON A 3 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 3,750 LBS/TIRE.

E(AC)=150,000 PSI	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.001595	0.001784	0.001993
	E(SG) =5,000 PSI	0.001505	0.001698	0.001906
	E(SG) =10,000 PSI	0.001450	0.001645	0.001852
STRAIN TOP SUBGRADE	E(SG) =2,500 PSI	0.002369	0.002435	0.002462
	E(SG) =5,000 PSI	0.001267	0.001304	0.001320
	E(SG) =10,000 PSI	0.000654	0.000674	0.000683
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000969	0.001163	0.001346
	E(SG) =5,000 PSI	0.000890	0.001087	0.001270
	E(SG) =10,000 PSI	0.000827	0.001028	0.001209
STRAIN TOP SUBGRADE	E(SG) =2,500 PSI	0.002656	0.002734	0.002765
	E(SG) =5,000 PSI	0.001638	0.001692	0.001713
	E(SG) =10,000 PSI	0.000932	0.000964	0.000977
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000675	0.000855	0.001016
	E(SG) =5,000 PSI	0.000630	0.000811	0.000973
	E(SG) =10,000 PSI	0.000589	0.000772	0.000933
STRAIN TOP SUBGRADE	E(SG) =2,500 PSI	0.002283	0.002346	0.002371
	E(SG) =5,000 PSI	0.001522	0.001569	0.001588
	E(SG) =10,000 PSI	0.000933	0.000964	0.000977
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000402	0.000553	0.000686
	E(SG) =5,000 PSI	0.000388	0.000540	0.000673
	E(SG) =10,000 PSI	0.000373	0.000525	0.000658
STRAIN TOP SUBGRADE	E(SG) =2,500 PSI	0.001766	0.001809	0.001825
	E(SG) =5,000 PSI	0.001257	0.001292	0.001305
	E(SG) =10,000 PSI	0.000834	0.000859	0.000869
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000268	0.000396	0.000509
	E(SG) =5,000 PSI	0.000266	0.000395	0.000508
	E(SG) =10,000 PSI	0.000263	0.000392	0.000505
STRAIN TOP SUBGRADE	E(SG) =2,500 PSI	0.001469	0.001502	0.001514
	E(SG) =5,000 PSI	0.001076	0.001104	0.001114
	E(SG) =10,000 PSI	0.000743	0.000764	0.000776

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.24
STRAINS INDUCED BY A TANDEM AXLE ON A 3 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 4,250 LBS/TIRE.

E(AC)=150,000 PSI	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.001761	0.001940	0.002176
	E(SG) =5,000 PSI	0.001661	0.001843	0.002077
	E(SG) =10,000 PSI	0.001599	0.001783	0.002016
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002661	0.002747	0.002781
	E(SG) =5,000 PSI	0.001422	0.001471	0.001490
	E(SG) =10,000 PSI	0.000734	0.000760	0.000771
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.001065	0.001248	0.001451
	E(SG) =5,000 PSI	0.000977	0.001163	0.001365
	E(SG) =10,000 PSI	0.000906	0.001096	0.001297
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002983	0.003083	0.003123
	E(SG) =5,000 PSI	0.001838	0.001907	0.001934
	E(SG) =10,000 PSI	0.001044	0.001086	0.001103
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000740	0.000908	0.001086
	E(SG) =5,000 PSI	0.000690	0.000859	0.001037
	E(SG) =10,000 PSI	0.000643	0.000815	0.000992
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.002565	0.002646	0.002678
	E(SG) =5,000 PSI	0.001708	0.001769	0.001793
	E(SG) =10,000 PSI	0.001046	0.001087	0.001103
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000439	0.000578	0.000722
	E(SG) =5,000 PSI	0.000424	0.000563	0.000707
	E(SG) =10,000 PSI	0.000407	0.000547	0.000690
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001986	0.002042	0.002063
	E(SG) =5,000 PSI	0.001412	0.001458	0.001475
	E(SG) =10,000 PSI	0.000936	0.000969	0.000982
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000292	0.000408	0.000530
	E(SG) =5,000 PSI	0.000290	0.000407	0.000529
	E(SG) =10,000 PSI	0.000287	0.000404	0.000526
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001653	0.001696	0.001712
	E(SG) =5,000 PSI	0.001210	0.001245	0.001259
	E(SG) =10,000 PSI	0.000835	0.000862	0.000872

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.25
STRAINS INDUCED BY A TANDEM AXLE LOAD ON A 3 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 3,250 LBS/TIRE, E=1,000,000 PSI

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000334	0.000361	0.000391
	E(SG) =5,000 PSI	0.000316	0.000343	0.000373
	E(SG) =10,000 PSI	0.000305	0.000332	0.000362
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.000889	0.000902	0.000907
	E(SG) =5,000 PSI	0.000482	0.000489	0.000492
	E(SG) =10,000 PSI	0.000251	0.000255	0.000257
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000281	0.000309	0.000338
	E(SG) =5,000 PSI	0.000257	0.000286	0.000314
	E(SG) =10,000 PSI	0.000237	0.000267	0.000295
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001219	0.001240	0.001248
	E(SG) =5,000 PSI	0.000766	0.000781	0.000788
	E(SG) =10,000 PSI	0.000446	0.000456	0.000460
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000247	0.000275	0.000303
	E(SG) =5,000 PSI	0.000225	0.000254	0.000282
	E(SG) =10,000 PSI	0.000205	0.000235	0.000263
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001197	0.001218	0.001226
	E(SG) =5,000 PSI	0.000805	0.000822	0.000828
	E(SG) =10,000 PSI	0.000503	0.000515	0.000520
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000200	0.000230	0.000256
	E(SG) =5,000 PSI	0.000184	0.000214	0.000240
	E(SG) =10,000 PSI	0.000169	0.000199	0.000225
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001061	0.001079	0.001087
	E(SG) =5,000 PSI	0.000755	0.000771	0.000777
	E(SG) =10,000 PSI	0.000507	0.000519	0.000524
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000160	0.000198	0.000223
	E(SG) =5,000 PSI	0.000157	0.000187	0.000212
	E(SG) =10,000 PSI	0.000145	0.000175	0.000200
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.000943	0.000959	0.000966
	E(SG) =5,000 PSI	0.000690	0.000704	0.000710
	E(SG) =10,000 PSI	0.000481	0.000492	0.000497

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.26
STRAINS INDUCED BY A TANDEM AXLE LOAD ON A 3 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 3,750 LBS/TIRE, E=1,000,000 PSI

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000378	0.000403	0.000436
	E(SG) =5,000 PSI	0.000357	0.000382	0.000416
	E(SG) =10,000 PSI	0.000344	0.000370	0.000403
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001021	0.001038	0.001045
	E(SG) =5,000 PSI	0.000553	0.000563	0.000567
	E(SG) =10,000 PSI	0.000288	0.000293	0.000295
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000318	0.000344	0.000377
	E(SG) =5,000 PSI	0.000290	0.000317	0.000349
	E(SG) =10,000 PSI	0.000268	0.000295	0.000327
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001397	0.001425	0.001437
	E(SG) =5,000 PSI	0.000878	0.000898	0.000906
	E(SG) =10,000 PSI	0.000511	0.000524	0.000529
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000278	0.000305	0.000337
	E(SG) =5,000 PSI	0.000253	0.000281	0.000312
	E(SG) =10,000 PSI	0.000231	0.000259	0.000290
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001372	0.001400	0.001412
	E(SG) =5,000 PSI	0.000922	0.000944	0.000953
	E(SG) =10,000 PSI	0.000576	0.000592	0.000598
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000225	0.000253	0.000283
	E(SG) =5,000 PSI	0.000207	0.000236	0.000265
	E(SG) =10,000 PSI	0.000189	0.000218	0.000247
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001217	0.001241	0.001251
	E(SG) =5,000 PSI	0.000865	0.000886	0.000894
	E(SG) =10,000 PSI	0.000580	0.000596	0.000603
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000190	0.000218	0.000246
	E(SG) =5,000 PSI	0.000176	0.000204	0.000233
	E(SG) =10,000 PSI	0.000162	0.000191	0.000219
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001082	0.001103	0.001111
	E(SG) =5,000 PSI	0.000791	0.000809	0.000816
	E(SG) =10,000 PSI	0.000551	0.000565	0.000571

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE B.27
STRAINS INDUCED BY A TANDEM AXLE LOAD ON A 3 INCH ASPHALT CONCRETE PAVEMENT, TIRE LOAD = 4,250 LBS/TIRE, E=1,000,000 PSI

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000420	0.000451	0.000481
	E(SG) =5,000 PSI	0.000397	0.000427	0.000458
	E(SG) =10,000 PSI	0.000382	0.000412	0.000443
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001151	0.001173	0.001182
	E(SG) =5,000 PSI	0.000623	0.000636	0.000641
	E(SG) =10,000 PSI	0.000324	0.000331	0.000334
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000353	0.000381	0.000414
	E(SG) =5,000 PSI	0.000322	0.000349	0.000383
	E(SG) =10,000 PSI	0.000296	0.000323	0.000358
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001574	0.001610	0.001624
	E(SG) =5,000 PSI	0.000988	0.001014	0.001024
	E(SG) =10,000 PSI	0.000574	0.000591	0.000598
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000308	0.000334	0.000369
	E(SG) =5,000 PSI	0.000280	0.000306	0.000341
	E(SG) =10,000 PSI	0.000255	0.000282	0.000317
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001545	0.001581	0.001596
	E(SG) =5,000 PSI	0.001037	0.001065	0.001077
	E(SG) =10,000 PSI	0.000647	0.000667	0.000675
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000249	0.000276	0.000309
	E(SG) =5,000 PSI	0.000229	0.000255	0.000288
	E(SG) =10,000 PSI	0.000209	0.000236	0.000269
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001370	0.001402	0.001414
	E(SG) =5,000 PSI	0.000973	0.001000	0.001010
	E(SG) =10,000 PSI	0.000652	0.000672	0.000681
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
STRAIN BOTTOM OF ASPHALT	E(SG) =2,500 PSI	0.000210	0.000236	0.000267
	E(SG) =5,000 PSI	0.000194	0.000221	0.000252
	E(SG) =10,000 PSI	0.000179	0.000206	0.000237
STRAIN TOP OF SUBGRADE	E(SG) =2,500 PSI	0.001219	0.001246	0.001257
	E(SG) =5,000 PSI	0.000890	0.000913	0.000923
	E(SG) =10,000 PSI	0.000619	0.000638	0.000646

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

Appendix C: Strains Induced by a Tandem Axle Load

TABLE C.1
LOADS TO RUTTING FAILURE FOR A 4 INCH AGGREGATE ROAD CAUSED BY A SINGLE AXLE, WITH TIRE LOAD OF 3250 LBS.

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	1	0	0
	E(SG) = 5,000 PSI	29	3	1
	E(SG) = 10,000 PSI	614	55	16
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	3	1	0
	E(SG) = 5,000 PSI	44	6	2
	E(SG) = 10,000 PSI	749	80	26
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	7	2	1
	E(SG) = 5,000 PSI	73	12	5
	E(SG) = 10,000 PSI	978	125	44
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	22	6	3
	E(SG) = 5,000 PSI	163	34	15
	E(SG) = 10,000 PSI	1,629	260	103
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	46	15	8
	E(SG) = 5,000 PSI	300	73	35
	E(SG) = 10,000 PSI	2,520	468	198

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE C.2
LOADS TO RUTTING FAILURE FOR A 4 INCH AGGREGATE ROAD
CAUSED BY A SINGLE AXLE, WITH TIRE LOAD OF 3,750 LBS.

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	1	0	0
	E(SG) = 5,000 PSI	30	2	1
	E(SG) = 10,000 PSI	663	50	14
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	3	0	0
	E(SG) = 5,000 PSI	42	5	2
	E(SG) = 10,000 PSI	760	70	21
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	6	1	0
	E(SG) = 5,000 PSI	66	9	3
	E(SG) = 10,000 PSI	950	106	34
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	17	4	2
	E(SG) = 5,000 PSI	136	26	11
	E(SG) = 10,000 PSI	1,473	210	77
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	34	10	5
	E(SG) = 5,000 PSI	238	54	25
	E(SG) = 10,000 PSI	2,170	364	144

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE C.3

LOADS TO RUTTING FAILURE FOR A 4 INCH AGGREGATE ROAD CAUSED BY A SINGLE AXLE, WITH TIRE LOAD OF 4250 LBS.

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	2	0	0
	E(SG) = 5,000 PSI	33	2	1
	E(SG) = 10,000 PSI	731	48	12
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	3	0	0
	E(SG) = 5,000 PSI	42	4	1
	E(SG) = 10,000 PSI	798	65	18
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	5	1	0
	E(SG) = 5,000 PSI	62	8	3
	E(SG) = 10,000 PSI	950	94	28
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	13	3	1
	E(SG) = 5,000 PSI	118	21	8
	E(SG) = 10,000 PSI	1,383	178	61
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	26	7	4
	E(SG) = 5,000 PSI	197	42	18
	E(SG) = 10,000 PSI	1,949	300	112

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE C.4
LOADS TO RUTTING FAILURE FOR A 8 INCH AGGREGATE ROAD
CAUSED BY A SINGLE AXLE, WITH TIRE LOAD OF 3250 LBS.

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	8	3	2
	E(SG) = 5,000 PSI	133	51	33
	E(SG) = 10,000 PSI	2,627	976	633
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	32	15	11
	E(SG) = 5,000 PSI	317	137	94
	E(SG) = 10,000 PSI	4,244	1,711	1,143
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	98	52	39
	E(SG) = 5,000 PSI	709	337	241
	E(SG) = 10,000 PSI	7,085	3,063	2,110
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	405	239	187
	E(SG) = 5,000 PSI	2,186	1,159	870
	E(SG) = 10,000 PSI	15,851	7,539	5,412
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	1,041	650	524
	E(SG) = 5,000 PSI	4,867	2,747	2,114
	E(SG) = 10,000 PSI	29,479	14,948	11,005

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE C.5
LOADS TO RUTTING FAILURE FOR A 8 INCH AGGREGATE ROAD
CAUSED BY A SINGLE AXLE, WITH TIRE LOAD OF 3,750 LBS.

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO	E(SG) = 2,500 PSI	5	2	1
RUTTING	E(SG) = 5,000 PSI	96	33	20
FAILURE	E(SG) = 10,000 PSI	1,913	637	390
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO	E(SG) = 2,500 PSI	21	9	6
RUTTING	E(SG) = 5,000 PSI	219	86	57
FAILURE	E(SG) = 10,000 PSI	3,009	1,097	697
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO	E(SG) = 2,500 PSI	63	31	23
RUTTING	E(SG) = 5,000 PSI	474	209	144
FAILURE	E(SG) = 10,000 PSI	4,895	1,935	1,273
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO	E(SG) = 2,500 PSI	252	141	108
RUTTING	E(SG) = 5,000 PSI	1,410	702	509
FAILURE	E(SG) = 10,000 PSI	10,602	4,678	3,216
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO	E(SG) = 2,500 PSI	635	380	299
RUTTING	E(SG) = 5,000 PSI	3,071	1,640	1,226
FAILURE	E(SG) = 10,000 PSI	19,360	9,131	6,484

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE C.6
LOADS TO RUTTING FAILURE FOR A 8 INCH AGGREGATE ROAD CAUSED BY A SINGLE AXLE, WITH TIRE LOAD OF 4,250 LBS.

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	4	1	1
	E(SG) = 5,000 PSI	74	23	14
	E(SG) = 10,000 PSI	1,489	447	260
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	15	6	4
	E(SG) = 5,000 PSI	161	59	37
	E(SG) = 10,000 PSI	2,276	757	460
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	43	20	14
	E(SG) = 5,000 PSI	339	139	92
	E(SG) = 10,000 PSI	3,609	1,317	831
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	168	90	67
	E(SG) = 5,000 PSI	973	458	322
	E(SG) = 10,000 PSI	7,586	3,118	2,065
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	409	239	184
	E(SG) = 5,000 PSI	2,075	1,056	769
	E(SG) = 10,000 PSI	13,562	6,016	4,129

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE C.7
LOADS TO RUTTING FAILURE FOR A 12 INCH AGGREGATE ROAD
CAUSED BY A SINGLE AXLE, WITH TIRE LOAD OF 3,250 LBS.

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	56	37	31
	E(SG) = 5,000 PSI	973	634	528
	E(SG) = 10,000 PSI	19,064	12,287	10,183
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	234	186	161
	E(SG) = 5,000 PSI	2,377	1,685	1,438
	E(SG) = 10,000 PSI	31,700	21,176	17,866
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	745	656	580
	E(SG) = 5,000 PSI	5,243	4,163	3,609
	E(SG) = 10,000 PSI	53,172	37,789	32,113
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	3,344	3,063	2,874
	E(SG) = 5,000 PSI	16,696	14,678	12,997
	E(SG) = 10,000 PSI	117,340	93,343	80,824
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	9,221	8,504	8,262
	E(SG) = 5,000 PSI	38,613	35,195	31,975
	E(SG) = 10,000 PSI	220,751	186,708	163,763

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE C.8
LOADS TO RUTTING FAILURE FOR A 12 INCH AGGREGATE ROAD CAUSED BY A SINGLE AXLE, WITH TIRE LOAD OF 3,750 LBS.

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	33	21	18
	E(SG) = 5,000 PSI	591	366	297
	E(SG) = 10,000 PSI	11,624	7,107	5,738
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	128	105	89
	E(SG) = 5,000 PSI	1,303	959	801
	E(SG) = 10,000 PSI	18,071	12,159	9,981
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	407	363	319
	E(SG) = 5,000 PSI	2,874	2,354	2,004
	E(SG) = 10,000 PSI	29,231	21,513	17,934
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	1,819	1,640	1,572
	E(SG) = 5,000 PSI	9,102	8,132	7,151
	E(SG) = 10,000 PSI	64,271	52,635	44,805
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	5,007	4,549	4,387
	E(SG) = 5,000 PSI	21,010	18,918	17,531
	E(SG) = 10,000 PSI	120,715	104,945	90,432

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE C.9
LOADS TO RUTTING FAILURE FOR A 12 INCH AGGREGATE ROAD
CAUSED BY A SINGLE AXLE, WITH TIRE LOAD OF 4,250 LBS.

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	19	13	11
	E(SG) = 5,000 PSI	353	228	181
	E(SG) = 10,000 PSI	7,085	4,436	3,506
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	76	64	54
	E(SG) = 5,000 PSI	592	592	484
	E(SG) = 10,000 PSI	10,783	7,539	6,070
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	241	211	190
	E(SG) = 5,000 PSI	1,707	1,438	1,201
	E(SG) = 10,000 PSI	17,400	13,229	10,819
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	1,075	954	912
	E(SG) = 5,000 PSI	5,396	4,718	4,268
	E(SG) = 10,000 PSI	38,233	32,252	26,880
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	2,956	2,640	2,532
	E(SG) = 5,000 PSI	12,460	10,967	10,425
	E(SG) = 10,000 PSI	71,690	62,456	54,081

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE C.10
LOADS TO FAILURE BASED ON STRAINS CAUSED BY DUAL SINGLE AXLE, TIRE LOAD = 3,250 LBS/TIRE AND ASPHALT INSTITUTE FAILURE CRITERIA FOR FATIGUE AND RUTTING.
1INCH ASPHALT CONCRETE (E=150,000 PSI).

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
FATIGUE FAILURE	E(SG) =2,500 PSI	692	154	69
	E(SG) =5,000 PSI	856	155	77
	E(SG) =10,000 PSI	972	193	83
RUTTING FAILURE	E(SG) =2,500 PSI	22	13	10
	E(SG) =5,000 PSI	420	227	174
	E(SG) =10,000 PSI	8,754	4,613	3,506
	E(BASE)=5,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	30,845	3,484	1,078
	E(SG) =5,000 PSI	38,061	3,942	1,180
	E(SG) =10,000 PSI	44,752	4,326	1,264
RUTTING FAILURE	E(SG) =2,500 PSI	32	16	12
	E(SG) =5,000 PSI	313	144	103
	E(SG) =10,000 PSI	4,233	1,815	1,257
	E(BASE)=10,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	621,880	34,768	7,699
	E(SG) =5,000 PSI	535,049	33,030	7,462
	E(SG) =10,000 PSI	491,354	32,263	7,367
RUTTING FAILURE	E(SG) =2,500 PSI	86	45	33
	E(SG) =5,000 PSI	578	268	191
	E(SG) =10,000 PSI	5,572	2,343	1,597
	E(BASE)=20,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	##########	1,158,500	120,225
	E(SG) =5,000 PSI	98,836,992	724,249	94,055
	E(SG) =10,000 PSI	19,260,328	534,542	79,604
RUTTING FAILURE	E(SG) =2,500 PSI	331	182	138
	E(SG) =5,000 PSI	1,644	804	581
	E(SG) =10,000 PSI	11,194	4,867	3,344
	E(BASE)=30,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	O TENSION	47,221,462	1,152,959
	E(SG) =5,000 PSI	O TENSION	10,196,706	650,491
	E(SG) =10,000 PSI	##########	4,498,637	443,348
RUTTING FAILURE	E(SG) =2,500 PSI	804	462	356
	E(SG) =5,000 PSI	3,496	1,790	1,317
	E(SG) =10,000 PSI	19,969	9,072	6,311

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE C.11
LOADS TO FAILURE BASED ON STRAINS CAUSED BY DUAL SINGLE AXLE, TIRE LOAD = 3,750 LBS/TIRE AND ASPHALT INSTITUTE FAILURE CRITERIA FOR FATIGUE AND RUTTING.
1 INCH ASPHALT CONCRETE (E=150,000 PSI).

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
FATIGUE FAILURE	E(SG) =2,500 PSI	586	137	59
	E(SG) =5,000 PSI	759	160	67
	E(SG) =10,000 PSI	888	176	72
RUTTING FAILURE	E(SG) =2,500 PSI	14	7	6
	E(SG) =5,000 PSI	272	136	101
	E(SG) =10,000 PSI	5,721	2,782	2,041
	E(BASE)=5,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	23,213	3,646	1,058
	E(SG) =5,000 PSI	29,438	4,196	1,171
	E(SG) =10,000 PSI	35,305	4,665	1,266
RUTTING FAILURE	E(SG) =2,500 PSI	21	10	7
	E(SG) =5,000 PSI	212	90	61
	E(SG) =10,000 PSI	2,948	1,148	757
	E(BASE)=10,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	389,313	42,718	8,539
	E(SG) =5,000 PSI	333,500	40,033	8,246
	E(SG) =10,000 PSI	305,300	38,798	8,116
RUTTING FAILURE	E(SG) =2,500 PSI	56	27	19
	E(SG) =5,000 PSI	390	167	114
	E(SG) =10,000 PSI	3,890	1,489	967
	E(BASE)=20,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	##########	2,302,877	172,210
	E(SG) =5,000 PSI	54,772,697	1,204,098	126,130
	E(SG) =10,000 PSI	10,364,252	805,827	102,279
RUTTING FAILURE	E(SG) =2,500 PSI	210	109	80
	E(SG) =5,000 PSI	1,084	496	345
	E(SG) =10,000 PSI	14,056	3,071	2,018
	E(BASE)=30,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	O TENSION	##########	2,407,994
	E(SG) =5,000 PSI	O TENSION	29,889,260	1,086,531
	E(SG) =10,000 PSI	##########	8,817,011	655,756
RUTTING FAILURE	E(SG) =2,500 PSI	503	275	206
	E(SG) =5,000 PSI	2,271	1,095	776
	E(SG) =10,000 PSI	13,514	5,671	3,797

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE C.12
LOADS TO FAILURE BASED ON STRAINS CAUSED BY DUAL SINGLE AXLE, TIRE LOAD = 4,250 LBS/TIRE AND ASPHALT INSTITUTE FAILURE CRITERIA FOR FATIGUE AND RUTTING.
1 INCH ASPHALT CONCRETE (E=150,000 PSI).

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
FATIGUE FAILURE	E(SG) =2,500 PSI	443	126	52
	E(SG) =5,000 PSI	577	149	59
	E(SG) =10,000 PSI	676	165	64
RUTTING FAILURE	E(SG) =2,500 PSI	10	5	4
	E(SG) =5,000 PSI	190	88	63
	E(SG) =10,000 PSI	4,018	1,815	1,284
	E(BASE)=5,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	16,864	3,884	1,061
	E(SG) =5,000 PSI	21,326	4,552	1,187
	E(SG) =10,000 PSI	25,496	5,134	1,297
RUTTING FAILURE	E(SG) =2,500 PSI	15	7	5
	E(SG) =5,000 PSI	154	60	40
	E(SG) =10,000 PSI	2,201	782	493
	E(BASE)=10,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	271,785	53,137	9,663
	E(SG) =5,000 PSI	231,494	48,990	9,243
	E(SG) =10,000 PSI	210,678	47,064	9,066
RUTTING FAILURE	E(SG) =2,500 PSI	39	18	12
	E(SG) =5,000 PSI	281	112	73
	E(SG) =10,000 PSI	2,904	1,018	633
	E(BASE)=20,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	#########	5,187,648	255,847
	E(SG) =5,000 PSI	31,897,922	2,100,872	172,674
	E(SG) =10,000 PSI	6,392,644	1,239,842	133,326
RUTTING FAILURE	E(SG) =2,500 PSI	143	71	51
	E(SG) =5,000 PSI	766	329	221
	E(SG) =10,000 PSI	5,654	2,090	1,306
	E(BASE)=30,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	O TENSION	O TENSION	5,868,570
	E(SG) =5,000 PSI	O TENSION	#########	1,916,002
	E(SG) =10,000 PSI	#########	18,779,876	989,131
RUTTING FAILURE	E(SG) =2,500 PSI	337	177	129
	E(SG) =5,000 PSI	1,576	720	494
	E(SG) =10,000 PSI	9,784	3,828	2,465

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE C.13
LOADS TO FAILURE BASED ON STRAINS CAUSED BY DUAL SINGLE AXLE, TIRE LOAD = 3,250 LBS/TIRE AND ASPHALT INSTITUTE FAILURE CRITERIA FOR FATIGUE AND RUTTING. 2 INCH ASPHALT CONCRETE (E=150,000 PSI).

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
FATIGUE FAILURE	E(SG) =2,500 PSI	1,818	884	551
	E(SG) =5,000 PSI	2,432	1,098	666
	E(SG) =10,000 PSI	2,922	1,256	749
RUTTING FAILURE	E(SG) =2,500 PSI	178	156	149
	E(SG) =5,000 PSI	3,292	2,882	2,734
	E(SG) =10,000 PSI	68,730	59,775	56,729
	E(BASE)=5,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	14,259	4,718	2,519
	E(SG) =5,000 PSI	20,861	6,194	3,161
	E(SG) =10,000 PSI	28,070	7,679	3,778
RUTTING FAILURE	E(SG) =2,500 PSI	153	111	94
	E(SG) =5,000 PSI	1,562	1,024	852
	E(SG) =10,000 PSI	21,428	13,370	10,930
	E(BASE)=10,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	59,835	15,900	7,521
	E(SG) =5,000 PSI	80,800	19,586	8,894
	E(SG) =10,000 PSI	106,064	23,582	10,313
RUTTING FAILURE	E(SG) =2,500 PSI	304	206	174
	E(SG) =5,000 PSI	2,051	1,298	1,062
	E(SG) =10,000 PSI	19,892	11,786	9,374
	E(BASE)=20,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	526,016	94,477	36,350
	E(SG) =5,000 PSI	589,674	101,520	38,435
	E(SG) =10,000 PSI	669,164	110,034	40,873
RUTTING FAILURE	E(SG) =2,500 PSI	924	625	524
	E(SG) =5,000 PSI	4,511	2,824	2,292
	E(SG) =10,000 PSI	30,370	17,531	13,757
	E(BASE)=30,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	3,638,621	403,029	125,745
	E(SG) =5,000 PSI	3,205,962	377,807	120,225
	E(SG) =10,000 PSI	2,971,580	363,964	117,092
RUTTING FAILURE	E(SG) =2,500 PSI	2,075	1,410	1,186
	E(SG) =5,000 PSI	8,726	5,491	4,461
	E(SG) =10,000 PSI	48,527	28,025	21,943

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE C.14

LOADS TO FAILURE BASED ON STRAINS CAUSED BY DUAL SINGLE AXLE, TIRE LOAD OF 3,750 LBS/TIRE AND ASPHALT INSTITUTE FAILURE CRITERIA FOR FATIGUE AND RUTTING.

2 INCH ASPHALT CONCRETE (E=150,000 PSI)

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
FATIGUE FAILURE	E(SG) =2,500 PSI	1,258	677	414
	E(SG) =5,000 PSI	1,690	852	506
	E(SG) =10,000 PSI	2,040	982	572
RUTTING FAILURE	E(SG) =2,500 PSI	98	84	80
	E(SG) =5,000 PSI	1,823	1,555	1,466
	E(SG) =10,000 PSI	38,130	32,392	30,370
	E(BASE)=5,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	9,883	3,859	2,008
	E(SG) =5,000 PSI	15,002	5,181	2,566
	E(SG) =10,000 PSI	21,197	6,524	3,105
RUTTING FAILURE	E(SG) =2,500 PSI	83	63	53
	E(SG) =5,000 PSI	908	590	479
	E(SG) =10,000 PSI	13,182	7,779	6,198
	E(BASE)=10,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	43,020	13,689	6,286
	E(SG) =5,000 PSI	60,659	17,198	7,540
	E(SG) =10,000 PSI	83,399	21,084	8,870
RUTTING FAILURE	E(SG) =2,500 PSI	174	118	97
	E(SG) =5,000 PSI	1,255	754	602
	E(SG) =10,000 PSI	12,460	6,934	5,365
	E(BASE)=20,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	397,468	89,128	32,883
	E(SG) =5,000 PSI	454,652	96,625	34,970
	E(SG) =10,000 PSI	530,006	105,696	37,437
RUTTING FAILURE	E(SG) =2,500 PSI	552	358	294
	E(SG) =5,000 PSI	2,761	1,644	1,300
	E(SG) =10,000 PSI	19,064	10,390	7,903
	E(BASE)=30,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	2,901,502	421,074	122,870
	E(SG) =5,000 PSI	2,530,967	390,657	116,673
	E(SG) =10,000 PSI	2,337,239	373,647	113,256
RUTTING FAILURE	E(SG) =2,500 PSI	1,234	809	665
	E(SG) =5,000 PSI	5,319	3,200	2,532
	E(SG) =10,000 PSI	30,500	16,634	12,636

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE C.15
LOADS TO FAILURE BASED ON STRAINS CAUSED BY DUAL SINGLE AXLE, TIRE LOAD = 4250 LBS/TIRE AND ASPHALT INSTITUTE FAILURE CRITERIA FOR FATIGUE AND RUTTING. 2 INCH ASPHALT CONCRETE (E=150,000 PSI).

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
FATIGUE FAILURE	E(SG) =2,500 PSI	928	539	324
	E(SG) =5,000 PSI	1,255	686	400
	E(SG) =10,000 PSI	1,518	797	455
RUTTING FAILURE	E(SG) =2,500 PSI	59	49	46
	E(SG) =5,000 PSI	1,095	913	852
	E(SG) =10,000 PSI	22,927	18,991	17,664
	E(BASE)=5,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	7,329	3,264	1,662
	E(SG) =5,000 PSI	11,248	4,472	2,154
	E(SG) =10,000 PSI	23,651	5,733	2,644
RUTTING FAILURE	E(SG) =2,500 PSI	50	39	32
	E(SG) =5,000 PSI	540	368	292
	E(SG) =10,000 PSI	8,262	4,908	3,797
	E(BASE)=10,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	31,939	12,114	5,429
	E(SG) =5,000 PSI	45,316	15,543	6,605
	E(SG) =10,000 PSI	62,630	19,390	7,883
RUTTING FAILURE	E(SG) =2,500 PSI	102	73	59
	E(SG) =5,000 PSI	795	474	369
	E(SG) =10,000 PSI	8,368	4,424	3,327
	E(BASE)=20,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	295,734	86,014	30,527
	E(SG) =5,000 PSI	338,759	94,003	32,657
	E(SG) =10,000 PSI	394,384	103,819	35,202
RUTTING FAILURE	E(SG) =2,500 PSI	323	222	179
	E(SG) =5,000 PSI	1,819	1,035	800
	E(SG) =10,000 PSI	12,905	6,644	4,922
	E(BASE)=30,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	2,174,992	448,954	123,019
	E(SG) =5,000 PSI	1,886,842	411,202	115,979
	E(SG) =10,000 PSI	1,735,216	390,657	112,059
RUTTING FAILURE	E(SG) =2,500 PSI	725	500	404
	E(SG) =5,000 PSI	3,487	2,013	1,559
	E(SG) =10,000 PSI	20,602	10,638	7,878

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE C.16
LOADS TO FAILURE BASED ON STRAINS CAUSED BY DUAL SINGLE AXLE, TIRE LOAD =3,250 LBS/TIRE AND ASPHALT INSTITUTE FAILURE CRITERIA FOR FATIGUE AND RUTTING.
3 INCH ASPHALT CONCRETE (E=150,000 PSI).

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
FATIGUE FAILURE	E(SG) =2,500 PSI	4,948	3,232	2,285
	E(SG) =5,000 PSI	6,179	3,892	2,700
	E(SG) =10,000 PSI	7,107	4,374	2,997
RUTTING FAILURE	E(SG) =2,500 PSI	1,325	1,193	1,145
	E(SG) =5,000 PSI	22,295	19,969	19,064
	E(SG) =10,000 PSI	436,355	388,568	371,204
	E(BASE)=5,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	24,873	12,523	7,925
	E(SG) =5,000 PSI	33,753	15,797	9,718
	E(SG) =10,000 PSI	43,325	19,012	11,449
RUTTING FAILURE	E(SG) =2,500 PSI	801	717	688
	E(SG) =5,000 PSI	7,085	6,273	5,980
	E(SG) =10,000 PSI	90,679	79,508	75,554
	E(BASE)=10,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	81,320	33,273	19,417
	E(SG) =5,000 PSI	104,722	39,895	22,670
	E(SG) =10,000 PSI	132,418	46,957	26,040
RUTTING FAILURE	E(SG) =2,500 PSI	1,590	1,432	1,377
	E(SG) =5,000 PSI	9,784	8,726	8,342
	E(SG) =10,000 PSI	89,260	78,672	74,965
	E(BASE)=20,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	449,358	134,577	68,784
	E(SG) =5,000 PSI	506,170	146,556	73,764
	E(SG) =10,000 PSI	573,829	160,069	79,350
RUTTING FAILURE	E(SG) =2,500 PSI	5,182	4,718	4,562
	E(SG) =5,000 PSI	23,019	20,764	20,047
	E(SG) =10,000 PSI	146,194	130,567	125,156
	E(BASE)=30,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	1,682,180	396,094	183,552
	E(SG) =5,000 PSI	1,695,809	398,503	181,183
	E(SG) =10,000 PSI	1,742,293	405,848	183,804
RUTTING FAILURE	E(SG) =2,500 PSI	12,202	11,232	10,856
	E(SG) =5,000 PSI	46,643	42,464	41,012
	E(SG) =10,000 PSI	243,815	219,874	200,822

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE C.17
LOADS TO FAILURE BASED ON STRAINS CAUSED BY DUAL SINGLE AXLE, TIRE LOAD = 3,750 LBS/TIRE AND ASPHALT INSTITUTE FAILURE CRITERIA FOR FATIGUE AND RUTTING.
3-INCH ASPHALT CONCRETE, E=150,000 PSI

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
FATIGUE FAILURE	E(SG) =2,500 PSI	3,358	2,344	1,632
	E(SG) =5,000 PSI	4,214	2,843	1,943
	E(SG) =10,000 PSI	4,859	3,212	2,169
RUTTING FAILURE	E(SG) =2,500 PSI	724	642	611
	E(SG) =5,000 PSI	12,202	10,746	10,217
	E(SG) =10,000 PSI	239,395	209,396	198,617
	E(BASE)=5,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	17,067	9,529	5,915
	E(SG) =5,000 PSI	23,315	12,151	7,329
	E(SG) =10,000 PSI	30,083	14,811	8,702
RUTTING FAILURE	E(SG) =2,500 PSI	439	387	367
	E(SG) =5,000 PSI	3,900	3,388	3,208
	E(SG) =10,000 PSI	50,098	42,976	40,510
	E(BASE)=10,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	56,115	26,199	14,954
	E(SG) =5,000 PSI	72,664	31,811	17,624
	E(SG) =10,000 PSI	92,340	37,884	20,424
RUTTING FAILURE	E(SG) =2,500 PSI	868	770	735
	E(SG) =5,000 PSI	5,381	4,691	4,461
	E(SG) =10,000 PSI	49,223	42,464	40,144
	E(BASE)=20,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	318,607	112,456	55,688
	E(SG) =5,000 PSI	364,271	123,318	60,040
	E(SG) =10,000 PSI	420,332	135,844	64,943
RUTTING FAILURE	E(SG) =2,500 PSI	2,817	2,532	2,429
	E(SG) =5,000 PSI	12,636	11,194	10,674
	E(SG) =10,000 PSI	80,312	70,263	66,862
	E(BASE)=30,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	1,283,313	349,606	152,327
	E(SG) =5,000 PSI	1,299,319	351,947	153,218
	E(SG) =10,000 PSI	1,343,856	359,094	155,627
RUTTING FAILURE	E(SG) =2,500 PSI	6,623	5,998	5,789
	E(SG) =5,000 PSI	25,476	22,744	21,856
	E(SG) =10,000 PSI	133,539	118,088	110,364

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE C.18
LOADS TO FAILURE BASED ON STRAINS CAUSED BY DUAL SINGLE AXLE, TIRE LOAD = 4250 LBS/TIRE AND ASPHALT INSTITUTE FAILURE CRITERIA FOR FATIGUE AND RUTTING.
3 INCH ASPHALT CONCRETE (E=150,000 PSI).

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
FATIGUE FAILURE	E(SG) =2,500 PSI	2,427	1,776	1,223
	E(SG) =5,000 PSI	3,057	2,173	1,466
	E(SG) =10,000 PSI	3,535	2,463	1,640
RUTTING FAILURE	E(SG) =2,500 PSI	429	374	354
	E(SG) =5,000 PSI	7,262	6,273	5,910
	E(SG) =10,000 PSI	142,189	122,340	115,199
	E(BASE)=5,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	12,485	7,501	4,603
	E(SG) =5,000 PSI	17,169	9,745	5,761
	E(SG) =10,000 PSI	22,287	11,970	6,893
RUTTING FAILURE	E(SG) =2,500 PSI	261	225	213
	E(SG) =5,000 PSI	2,331	1,980	1,861
	E(SG) =10,000 PSI	29,984	25,165	23,486
	E(BASE)=10,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	41,338	21,402	11,970
	E(SG) =5,000 PSI	53,868	26,308	14,259
	E(SG) =10,000 PSI	68,819	31,683	16,669
RUTTING FAILURE	E(SG) =2,500 PSI	515	449	426
	E(SG) =5,000 PSI	3,200	2,741	2,582
	E(SG) =10,000 PSI	29,479	24,858	23,298
	E(BASE)=20,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	237,200	97,062	46,787
	E(SG) =5,000 PSI	272,205	107,241	50,714
	E(SG) =10,000 PSI	315,019	119,001	55,160
RUTTING FAILURE	E(SG) =2,500 PSI	1,666	1,473	1,404
	E(SG) =5,000 PSI	7,492	6,504	6,180
	E(SG) =10,000 PSI	47,889	41,012	38,735
	E(BASE)=30,000 PSI			
FATIGUE FAILURE	E(SG) =2,500 PSI	966,850	317,576	133,409
	E(SG) =5,000 PSI	979,023	319,901	134,242
	E(SG) =10,000 PSI	1,013,252	326,742	136,525
RUTTING FAILURE	E(SG) =2,500 PSI	3,900	3,478	3,335
	E(SG) =5,000 PSI	15,057	13,229	12,636
	E(SG) =10,000 PSI	79,382	68,765	65,286

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

Appendix D: Loads to Rutting and Fatigue Failure for a Tandem Axle Load

TABLE D.1
LOADS TO RUTTING FAILURE FOR A 4 INCH AGGREGATE ROAD CAUSED BY A TANDEM AXLE WITH A LOAD OF 4,250 LB./TIRE.

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	1	0	0
	E(SG) = 5,000 PSI	15	1	0
	E(SG) = 10,000 PSI	330	28	8
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	3	0	0
	E(SG) = 5,000 PSI	43	4	1
	E(SG) = 10,000 PSI	342	35	11
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	5	1	0
	E(SG) = 5,000 PSI	62	8	3
	E(SG) = 10,000 PSI	959	95	29
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	4	1	1
	E(SG) = 5,000 PSI	41	9	4
	E(SG) = 10,000 PSI	529	84	32
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	26	3	1
	E(SG) = 5,000 PSI	200	42	18
	E(SG) = 10,000 PSI	1,971	302	113

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.2
LOADS TO RUTTING FAILURE FOR A 4 INCH AGGREGATE ROAD CAUSED BY A TANDEM AXLE, WITH A TIRE LOAD OF 3,750 LB./TIRE.

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	1	0	0
	E(SG) = 5,000 PSI	31	2	1
	E(SG) = 10,000 PSI	667	51	14
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	3	0	0
	E(SG) = 5,000 PSI	43	5	2
	E(SG) = 10,000 PSI	766	71	21
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	6	1	0
	E(SG) = 5,000 PSI	67	9	3
	E(SG) = 10,000 PSI	957	106	35
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	17	4	2
	E(SG) = 5,000 PSI	138	26	11
	E(SG) = 10,000 PSI	1,489	211	77
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	34	10	5
	E(SG) = 5,000 PSI	241	54	25
	E(SG) = 10,000 PSI	2,196	367	145

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.3
LOADS TO RUTTING FAILURE FOR A 4 INCH AGGREGATE ROAD CAUSED BY A TANDEM AXLE, WITH A TIRE LOAD OF 3,250 LB./TIRE

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	1	0	0
	E(SG) = 5,000 PSI	29	3	1
	E(SG) = 10,000 PSI	617	55	17
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	3	1	0
	E(SG) = 5,000 PSI	44	6	2
	E(SG) = 10,000 PSI	749	81	26
	E E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	7	2	1
	E(SG) = 5,000 PSI	73	12	5
	E(SG) = 10,000 PSI	984	125	44
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	22	6	3
	E(SG) = 5,000 PSI	165	34	15
	E(SG) = 10,000 PSI	1,644	262	103
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	47	19	8
	E(SG) = 5,000 PSI	304	74	35
	E(SG) = 10,000 PSI	2,544	472	199

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.4
LOADS TO RUTTING FAILURE FOR AN 8 INCH AGGREGATE RO.
CAUSED BY A TANDEM AXLE WITH A LOAD OF 3,250 LBS/TIRE

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	8	3	2
	E(SG) = 5,000 PSI	136	51	34
	E(SG) = 10,000 PSI	2,680	992	641
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	33	15	11
	E(SG) = 5,000 PSI	324	139	96
	E(SG) = 10,000 PSI	4,339	1,738	1,159
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	102	54	40
	E(SG) = 5,000 PSI	729	345	247
	E(SG) = 10,000 PSI	7,262	3,126	2,145
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	429	251	197
	E(SG) = 5,000 PSI	2,276	1,201	897
	E(SG) = 10,000 PSI	16,327	7,730	5,523
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	1,106	691	556
	E(SG) = 5,000 PSI	5,109	2,867	2,207
	E(SG) = 10,000 PSI	30,500	15,391	11,309

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.5
LOADS TO RUTTING FAILURE FOR AN 8 INCH AGGREGATE ROAD CAUSED BY A TANDEM AXLE, WITH A TIRE LOAD OF 3,750 LB./TIRE.

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	6	2	1
	E(SG) = 5,000 PSI	98	33	21
	E(SG) = 10,000 PSI	1,953	648	396
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	22	10	7
	E(SG) = 5,000 PSI	224	88	58
	E(SG) = 10,000 PSI	3,071	1,115	708
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	66	33	24
	E(SG) = 5,000 PSI	488	214	147
	E(SG) = 10,000 PSI	5,022	1,976	1,295
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	267	149	113
	E(SG) = 5,000 PSI	1,469	727	526
	E(SG) = 10,000 PSI	10,930	4,798	3,292
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	683	405	317
	E(SG) = 5,000 PSI	3,233	1,715	1,279
	E(SG) = 10,000 PSI	20,047	9,436	6,664

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.6
LOADS TO RUTTING FAILURE FOR AN 8 INCH AGGREGATE ROA
CAUSED BY A TANDEM AXLE, WITH A LOAD OF 4250 LBS/TIRE.

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	3	1	1
	E(SG) = 5,000 PSI	47	16	10
	E(SG) = 10,000 PSI	967	316	191
	E(BASE) = 5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	8	4	2
	E(SG) = 5,000 PSI	92	37	24
	E(SG) = 10,000 PSI	1,380	499	314
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	21	11	8
	E(SG) = 5,000 PSI	179	80	55
	E(SG) = 10,000 PSI	2,070	818	533
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	70	41	32
	E(SG) = 5,000 PSI	466	236	171
	E(SG) = 10,000 PSI	4,018	1,782	1,221
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	442	100	80
	E(SG) = 5,000 PSI	928	507	381
	E(SG) = 10,000 PSI	6,766	3,241	2,298

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.7
LOADS TO RUTTING FAILURE FOR A 12 INCH AGGREGATE ROAD CAUSED BY A TANDEM AXLE WITH A LOAD OF 4,250 LB./TIRE.

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2.5KSI	13	9	8
	E(SG) = 5.0KSI	235	164	132
	E(SG) = 10.0KSI	4,798	3,250	2,601
	E(BASE) = 5,000			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2.5KSI	44	38	33
	E(SG) = 5.0KSI	479	387	321
	E(SG) = 10.0KSI	6,955	5,197	4,244
	E(BASE) = 10,000			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2.5KSI	127	112	106
	E(SG) = 5.0KSI	988	862	740
	E(SG) = 10.0KSI	10,746	8,670	7,195
	E(BASE) =20,000			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2.5KSI	1,552	1,145	1,047
	E(SG) = 5.0KSI	2,846	2,507	2,377
	E(SG) = 10.0KSI	22,118	19,286	16,572
	C E(BASE) = 30,000			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2.5KSI	3,086	1,088	1,047
	E(SG) = 5.0KSI	6,106	5,412	5,182
	E(SG) = 10.0KSI	39,494	34,581	31,564

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.8
LOADS TO RUTTING FAILURE FOR A 12 INCH AGGREGATE ROAD CAUSED BY A TANDEM AXLE WITH A LOAD OF 3,750 LB./TIRE.

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO	E(SG) = 2,500 PSI	34	22	18
RUTTING	E(SG) = 5,000 PSI	615	378	307
FAILURE	E(SG) = 10,000 PSI	12,075	7,330	5,927
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO	E(SG) = 2,500 PSI	137	111	95
RUTTING	E(SG) = 5,000 PSI	1,371	1,006	837
FAILURE	E(SG) = 10,000 PSI	18,918	12,636	10,355
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO	E(SG) = 2,500 PSI	439	391	343
RUTTING	E(SG) = 5,000 PSI	3,063	2,495	2,119
FAILURE	E(SG) = 10,000 PSI	30,630	22,473	18,774
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO	E(SG) = 2,500 PSI	1,958	1,762	1,688
RUTTING	E(SG) = 5,000 PSI	9,817	8,754	7,682
FAILURE	E(SG) = 10,000 PSI	68,484	55,847	47,417
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO	E(SG) = 2,500 PSI	5,319	4,771	4,613
RUTTING	E(SG) = 5,000 PSI	22,744	20,362	18,918
FAILURE	E(SG) = 10,000 PSI	129,722	112,332	96,635

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.9
LOADS TO RUTTING FAILURE FOR A 12 INCH AGGREGATE ROAD CAUSED BY A SINGLE AXLE, WITH A TIRE LOAD OF 3,250 LB./TIRE.

	E(BASE) = 1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	62	39	32
	E(SG) = 5,000 PSI	1,010	656	545
	E(SG) = 10,000 PSI	19,738	12,680	10,495
	E(BASE) =5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	249	197	171
	E(SG) = 5,000 PSI	2,495	1,762	1,502
	E(SG) = 10,000 PSI	33,102	22,030	18,489
	E(BASE) = 10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	803	706	622
	E(SG) = 5,000 PSI	5,588	4,412	3,817
	E(SG) = 10,000 PSI	55,902	39,458	33,538
	E(BASE) = 20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	3,590	3,292	3,086
	E(SG) = 5,000 PSI	18,071	15,792	13,955
	E(SG) = 10,000 PSI	124,937	98,744	85,486
	E(BASE) = 30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	9,561	8,926	8,670
	E(SG) = 5,000 PSI	41,730	38,061	34,430
	E(SG) = 10,000 PSI	236,982	199,781	174,886

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.10
LOADS TO FAILURE ON A 1 INCH ASPHALT CONCRETE PAVEMENT, E=150,000 PSI, FOR A TANDEM AXLE WITH TIRE LOAD = 3,250 LBS/TIRE.

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	695	155	69
	E(SG) =5,000 PSI	861	179	78
	E(SG) =10,000 PSI	976	195	83
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	23	13	10
	E(SG) =5,000 PSI	426	230	176
	E(SG) =10,000 PSI	8,839	4,652	3,543
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	30,393	3,505	1,081
	E(SG) =5,000 PSI	37,690	3,976	1,187
	E(SG) =10,000 PSI	44,551	4,374	1,274
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	33	17	12
	E(SG) =5,000 PSI	319	147	105
	E(SG) =10,000 PSI	4,303	1,844	1,273
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	562,826	34,198	7,619
	E(SG) =5,000 PSI	539,107	33,042	7,462
	E(SG) =10,000 PSI	476,206	32,576	7,424
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	90	46	34
	E(SG) =5,000 PSI	595	275	195
	E(SG) =10,000 PSI	5,688	2,382	1,626
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	3,418,795,691	1,330,400	128,703
	E(SG) =5,000 PSI	75,240,464	778,707	97,773
	E(SG) =10,000 PSI	16,642,507	556,904	81,404
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	351	191	145
	E(SG) =5,000 PSI	1,711	832	599
	E(SG) =10,000 PSI	11,505	4,979	3,415
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	36,951,133	39,358,291	1,347,178
	E(SG) =5,000 PSI	106,777,575	12,134,950	700,635
	E(SG) =10,000 PSI	4,827,693,385	4,876,403	460,844
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	858	489	376
	E(SG) =5,000 PSI	3,667	1,870	1,368
	E(SG) =10,000 PSI	20,683	9,312	6,465

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.11
LOADS TO FAILURE ON A 1 INCH ASPHALT CONCRETE PAVEMENT, E=150,000 PSI, FOR A TANDEM AXLE WITH TIRE LOAD = 3,750 LBS/TIRE.

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	589	138	59
	E(SG) =5,000 PSI	762	162	67
	E(SG) =10,000 PSI	891	177	72
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	15	8	6
	E(SG) =5,000 PSI	276	138	102
	E(SG) =10,000 PSI	5,772	2,810	2,061
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	22,718	3,661	1,063
	E(SG) =5,000 PSI	28,967	4,223	1,180
	E(SG) =10,000 PSI	34,939	4,718	1,279
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	22	10	7
	E(SG) =5,000 PSI	217	92	62
	E(SG) =10,000 PSI	3,001	1,164	767
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	349,591	41,626	8,447
	E(SG) =5,000 PSI	313,233	39,825	8,246
	E(SG) =10,000 PSI	293,391	39,046	8,180
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	58	28	20
	E(SG) =5,000 PSI	402	171	117
	E(SG) =10,000 PSI	3,975	1,515	984
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	890,113,914	2,802,452	188,146
	E(SG) =5,000 PSI	35,492,306	1,493,799	143,498
	E(SG) =10,000 PSI	8,797,080	841,405	106,615
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	223	115	84
	E(SG) =5,000 PSI	1,131	513	356
	E(SG) =10,000 PSI	7,928	3,142	2,065
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	24,251,648	25,306,655	3,024,252
	E(SG) =5,000 PSI	70,446,256	39,579,572	1,201,130
	E(SG) =10,000 PSI	439,024,091	9,871,655	689,925
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	539	292	218
	E(SG) =5,000 PSI	2,388	1,143	807
	E(SG) =10,000 PSI	14,006	5,840	3,890

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.12
LOADS TO FAILURE ON A 1 INCH ASPHALT CONCRETE PAVEMENT, E=150,000 PSI, FOR A TANDEM AXLE WITH TIRE LOAD = 4,250 LBS/TIRE.

		E(BASE)=1,000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	445	127	52
	E(SG) =5,000 PSI	579	150	60
	E(SG) =10,000 PSI	677	167	65
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	10	5	4
	E(SG) =5,000 PSI	192	89	64
	E(SG) =10,000 PSI	4,062	1,831	1,295
		E(BASE)=5,000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	16,488	3,883	1,067
	E(SG) =5,000 PSI	20,964	4,562	1,199
	E(SG) =10,000 PSI	25,200	5,169	1,311
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	15	7	5
	E(SG) =5,000 PSI	158	61	40
	E(SG) =10,000 PSI	2,244	794	499
		E(BASE)=10,000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	243,263	51,113	9,555
	E(SG) =5,000 PSI	216,804	48,320	9,268
	E(SG) =10,000 PSI	202,170	47,062	9,166
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	41	18	13
	E(SG) =5,000 PSI	291	115	75
	E(SG) =10,000 PSI	2,978	1,039	644
		E(BASE)=20,000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	44,286,566	6,907,400	286,543
	E(SG) =5,000 PSI	20,920,903	2,393,522	183,419
	E(SG) =10,000 PSI	5,461,407	1,273,780	137,983
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	152	75	53
	E(SG) =5,000 PSI	801	342	229
	E(SG) =10,000 PSI	5,823	2,145	1,348
		E(BASE)=30,000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	17,476,152	16,376,178	8,289,603
	E(SG) =5,000 PSI	51,667,710	49,788,019	2,193,962
	E(SG) =10,000 PSI	340,416,315	22,046,920	1,056,372
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	362	188	137
	E(SG) =5,000 PSI	1,662	752	515
	E(SG) =10,000 PSI	10,149	3,943	2,532

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.13
LOADS TO FAILURE ON A 1 INCH ASPHALT CONCRETE PAVEMENT, E=1,000,000 PSI, FOR A TANDEM AXLE WITH TIRE LOAD = 3,250 LBS/TIRE.

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) = 2,500 PSI	2,463	1,137	702
	E(SG) = 5,000 PSI	3,374	1,435	860
	E(SG) =10,000 PSI	4,129	1,658	975
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	150	131	125
	E(SG) = 5,000 PSI	2,831	2,471	2,348
	E(SG) =10,000 PSI	59,923	52,080	48,504
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) = 2,500 PSI	15,911	5,125	2,717
	E(SG) = 5,000 PSI	24,760	7,097	3,566
	E(SG) =10,000 PSI	35,802	9,250	4,439
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	118	78	66
	E(SG) = 5,000 PSI	1,171	736	602
	E(SG) =10,000 PSI	16,388	9,784	7,828
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) = 2,500 PSI	52,916	14,289	6,834
	E(SG) = 5,000 PSI	79,264	18,969	8,607
	E(SG) =10,000 PSI	117,136	24,760	10,659
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	214	139	139
	E(SG) = 5,000 PSI	1,460	878	704
	E(SG) =10,000 PSI	14,415	8,080	6,273
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) = 2,500 PSI	298,289	60,945	24,730
	E(SG) = 5,000 PSI	399,403	73,683	28,649
	E(SG) =10,000 PSI	554,547	90,697	33,644
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	652	420	345
	E(SG) = 5,000 PSI	3,142	1,861	1,476
	E(SG) =10,000 PSI	21,010	11,426	8,726
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) = 2,500 PSI	1,191,362	186,610	65,612
	E(SG) = 5,000 PSI	1,439,774	209,522	71,474
	E(SG) =10,000 PSI	1,824,468	241,759	79,540
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	1,515	980	806
	E(SG) = 5,000 PSI	6,217	3,697	2,926
	E(SG) =10,000 PSI	33,832	18,278	13,905

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.14
LOADS TO FAILURE ON A 1 INCH ASPHALT CONCRETE PAVEMENT, E=1,000,000 PSI, FOR A TANDEM AXLE WITH TIRE LOAD = 3,750 LBS/TIRE.

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	1,717	875	529
	E(SG) =5,000 PSI	2,369	1,118	655
	E(SG) =10,000 PSI	2,912	1,304	749
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	83	71	67
	E(SG) =5,000 PSI	1,569	1,337	1,257
	E(SG) =10,000 PSI	33,247	28,143	26,548
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	11,125	4,202	2,174
	E(SG) =5,000 PSI	18,435	5,967	2,912
	E(SG) =10,000 PSI	28,395	7,952	3,683
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	67	45	37
	E(SG) =5,000 PSI	721	428	341
	E(SG) =10,000 PSI	10,286	5,755	4,473
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	38,197	12,253	5,685
	E(SG) =5,000 PSI	60,701	16,690	7,299
	E(SG) =10,000 PSI	95,977	22,370	9,216
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	130	80	65
	E(SG) =5,000 PSI	908	516	402
	E(SG) =10,000 PSI	9,191	4,812	3,619
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	216,008	55,995	21,939
	E(SG) =5,000 PSI	301,018	69,177	25,799
	E(SG) =10,000 PSI	438,594	87,256	30,814
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	396	244	195
	E(SG) =5,000 PSI	1,962	1,097	845
	E(SG) =10,000 PSI	13,514	6,849	5,065
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	843,446	182,875	61,485
	E(SG) =5,000 PSI	1,042,171	208,304	67,699
	E(SG) =10,000 PSI	1,364,014	245,029	76,374
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	917	569	456
	E(SG) =5,000 PSI	3,869	2,180	1,677
	E(SG) =10,000 PSI	21,684	11,005	8,080

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.15
LOADS TO FAILURE ON A 1 INCH ASPHALT CONCRETE PAVEMENT, E=1,000,000 PSI, FOR A TANDEM AXLE WITH TIRE LOAD = 4,250 LBS/TIRE.

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	1,265	704	415
	E(SG) =5,000 PSI	1,755	911	519
	E(SG) =10,000 PSI	2,168	1,072	598
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	50	42	39
	E(SG) =5,000 PSI	942	783	731
	E(SG) =10,000 PSI	20,047	16,511	15,391
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	8,287	3,567	1,799
	E(SG) =5,000 PSI	13,856	5,192	2,456
	E(SG) =10,000 PSI	21,506	7,071	3,156
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	40	28	22
	E(SG) =5,000 PSI	456	269	209
	E(SG) =10,000 PSI	6,934	3,657	2,761
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	28,269	10,811	4,887
	E(SG) =5,000 PSI	45,238	15,107	6,394
	E(SG) =10,000 PSI	71,896	20,769	8,226
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	80	50	40
	E(SG) =5,000 PSI	608	327	248
	E(SG) =10,000 PSI	6,292	3,094	2,260
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	158,426	52,632	19,985
	E(SG) =5,000 PSI	221,701	66,371	23,875
	E(SG) =10,000 PSI	324,067	85,866	29,018
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	253	152	119
	E(SG) =5,000 PSI	1,314	699	524
	E(SG) =10,000 PSI	9,343	4,449	3,183
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	614,069	182,262	58,983
	E(SG) =5,000 PSI	759,217	210,503	65,612
	E(SG) =10,000 PSI	994,160	252,678	74,949
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	588	355	279
	E(SG) =5,000 PSI	2,589	1,386	1,041
	E(SG) =10,000 PSI	15,002	7,151	5,094

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.16
LOADS TO FAILURE ON A 2 INCH ASPHALT CONCRETE PAVEMENT, E=150,000 PSI, FOR A TANDEM AXLE WITH TIRE LOAD = 3,250 LBS/TIRE.

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	1,849	895	558
	E(SG) =5,000 PSI	2,459	1,106	671
	E(SG) =10,000 PSI	2,950	1,501	838
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	182	160	152
	E(SG) =5,000 PSI	3,344	2,918	2,775
	E(SG) =10,000 PSI	69,402	60,371	57,261
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	14,578	4,815	2,547
	E(SG) =5,000 PSI	21,122	6,271	3,180
	E(SG) =10,000 PSI	28,321	7,760	3,794
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	160	116	98
	E(SG) =5,000 PSI	1,615	1,054	877
	E(SG) =10,000 PSI	21,943	13,659	11,156
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	60,987	16,162	7,619
	E(SG) =5,000 PSI	81,364	19,777	8,967
	E(SG) =10,000 PSI	106,434	23,773	10,402
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	323	216	183
	E(SG) =5,000 PSI	2,140	1,357	1,102
	E(SG) =10,000 PSI	20,522	12,117	9,624
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	515,243	93,950	36,214
	E(SG) =5,000 PSI	579,424	101,288	38,370
	E(SG) =10,000 PSI	661,746	110,163	40,926
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	994	668	559
	E(SG) =5,000 PSI	4,771	2,971	2,406
	E(SG) =10,000 PSI	31,564	18,140	14,208
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	3,237,596	383,340	121,391
	E(SG) =5,000 PSI	2,995,429	368,608	118,148
	E(SG) =10,000 PSI	2,865,007	360,606	116,395
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	2,233	1,512	1,265
	E(SG) =5,000 PSI	9,312	5,823	4,718
	E(SG) =10,000 PSI	50,772	29,231	22,835

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.17
LOADS TO FAILURE ON A 2 INCH ASPHALT CONCRETE PAVEMENT, E=150,000 PSI, FOR A TANDEM AXLE WITH TIRE LOAD = 3,750 LBS/TIRE.

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	1,279	685	419
	E(SG) =5,000 PSI	1,709	857	510
	E(SG) =10,000 PSI	2,058	987	576
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	100	86	82
	E(SG) =5,000 PSI	1,853	1,579	1,485
	E(SG) =10,000 PSI	38,526	32,674	30,762
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	10,109	3,942	2,040
	E(SG) =5,000 PSI	15,196	5,242	2,585
	E(SG) =10,000 PSI	21,379	6,605	3,124
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	88	66	55
	E(SG) =5,000 PSI	939	608	493
	E(SG) =10,000 PSI	13,514	7,953	6,330
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	43,846	13,948	6,380
	E(SG) =5,000 PSI	61,047	17,366	7,619
	E(SG) =10,000 PSI	83,624	21,250	8,943
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	185	125	103
	E(SG) =5,000 PSI	1,311	785	625
	E(SG) =10,000 PSI	12,815	7,129	5,507
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	387,309	88,494	32,763
	E(SG) =5,000 PSI	444,941	96,244	34,926
	E(SG) =10,000 PSI	520,593	105,696	37,500
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	595	384	314
	E(SG) =5,000 PSI	2,926	1,731	1,368
	E(SG) =10,000 PSI	19,892	10,746	8,157
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	2,534,820	396,437	118,148
	E(SG) =5,000 PSI	2,337,239	378,453	114,471
	E(SG) =10,000 PSI	2,232,834	368,920	112,522
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	1,331	867	711
	E(SG) =5,000 PSI	5,688	3,397	2,680
	E(SG) =10,000 PSI	31,975	17,334	13,135

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.18
LOADS TO FAILURE ON A 2 INCH ASPHALT CONCRETE PAVEMENT, E=150,000 PSI, FOR A TANDEM AXLE WITH TIRE LOAD = 4,250 LBS/TIRE.

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	946	547	328
	E(SG) =5,000 PSI	1,272	693	403
	E(SG) =10,000 PSI	1,535	803	458
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	60	51	47
	E(SG) =5,000 PSI	1,113	926	863
	E(SG) =10,000 PSI	23,205	19,138	17,866
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	7,521	3,338	1,692
	E(SG) =5,000 PSI	11,381	4,532	2,181
	E(SG) =10,000 PSI	16,109	5,788	2,670
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	52	41	33
	E(SG) =5,000 PSI	559	379	301
	E(SG) =10,000 PSI	8,476	5,007	3,879
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	32,577	12,372	5,519
	E(SG) =5,000 PSI	45,601	15,694	6,672
	E(SG) =10,000 PSI	62,753	19,518	7,946
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	109	77	62
	E(SG) =5,000 PSI	832	493	383
	E(SG) =10,000 PSI	8,670	4,549	3,415
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	287,907	85,085	30,406
	E(SG) =5,000 PSI	331,046	93,375	32,617
	E(SG) =10,000 PSI	387,976	103,580	35,275
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	349	238	191
	E(SG) =5,000 PSI	1,935	1,093	840
	E(SG) =10,000 PSI	13,466	6,891	5,079
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	1,892,101	417,382	117,583
	E(SG) =5,000 PSI	1,737,571	395,409	113,458
	E(SG) =10,000 PSI	1,655,347	383,669	111,269
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	782	537	432
	E(SG) =5,000 PSI	3,736	2,140	1,647
	E(SG) =10,000 PSI	21,684	11,118	8,183

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.19
LOADS TO FAILURE ON A 2 INCH ASPHALT CONCRETE PAVEMENT, E=1,000,000 PSI, FOR A TANDEM AXLE WITH TIRE LOAD = 3,250 LBS/TIRE.

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	20,721	14,857	10,878
	E(SG) =5,000 PSI	26,879	18,611	13,371
	E(SG) =10,000 PSI	32,284	21,785	15,429
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	4,351	3,954	3,807
	E(SG) =5,000 PSI	67,719	60,945	58,487
	E(SG) =10,000 PSI	1,265,389	1,133,158	1,084,622
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	47,602	30,357	21,158
	E(SG) =5,000 PSI	73,683	43,494	29,279
	E(SG) =10,000 PSI	110,730	60,217	39,142
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	1,348	1,219	1,171
	E(SG) =5,000 PSI	11,786	10,531	10,082
	E(SG) =10,000 PSI	148,881	131,575	125,523
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	86,635	50,548	33,893
	E(SG) =5,000 PSI	134,034	71,715	46,281
	E(SG) =10,000 PSI	210,996	101,761	63,043
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	1,681	1,525	1,473
	E(SG) =5,000 PSI	10,967	9,850	9,467
	E(SG) =10,000 PSI	104,181	92,630	88,634
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	214,488	109,044	69,004
	E(SG) =5,000 PSI	313,502	146,023	89,075
	E(SG) =10,000 PSI	482,952	201,187	117,596
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	3,379	3,102	3,009
	E(SG) =5,000 PSI	16,885	15,335	14,625
	E(SG) =10,000 PSI	117,138	103,540	90,383
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	445,062	202,118	120,998
	E(SG) =5,000 PSI	617,059	258,058	149,119
	E(SG) =10,000 PSI	909,774	341,031	189,156
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	6,292	5,823	5,605
	E(SG) =5,000 PSI	27,560	25,062	22,206
	E(SG) =10,000 PSI	159,656	130,490	113,105

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.20
LOADS TO FAILURE ON A 2 INCH ASPHALT CONCRETE PAVEMENT, E=1,000,000 PSI, FOR A TANDEM AXLE WITH TIRE LOAD = 3,750 LBS/TIRE.

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	17,626	13,378	9,779
	E(SG) =5,000 PSI	22,867	16,845	12,073
	E(SG) =10,000 PSI	27,476	19,792	13,984
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	2,889	2,589	2,477
	E(SG) =5,000 PSI	44,742	39,691	37,789
	E(SG) =10,000 PSI	833,056	734,504	698,630
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	38,842	26,879	18,684
	E(SG) =5,000 PSI	60,169	39,006	26,121
	E(SG) =10,000 PSI	90,533	54,702	35,342
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	863	767	734
	E(SG) =5,000 PSI	7,492	6,563	6,254
	E(SG) =10,000 PSI	93,804	81,298	76,953
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	67,924	44,001	29,563
	E(SG) =5,000 PSI	105,270	63,350	40,922
	E(SG) =10,000 PSI	165,774	91,440	56,612
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	1,043	933	896
	E(SG) =5,000 PSI	6,787	5,980	5,704
	E(SG) =10,000 PSI	64,045	55,738	52,915
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	160,482	93,544	59,312
	E(SG) =5,000 PSI	235,387	127,426	77,768
	E(SG) =10,000 PSI	363,150	178,839	104,378
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	2,027	1,831	1,766
	E(SG) =5,000 PSI	10,115	9,043	8,670
	E(SG) =10,000 PSI	69,903	61,618	56,369
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	320,636	170,920	102,913
	E(SG) =5,000 PSI	446,371	221,964	128,973
	E(SG) =10,000 PSI	660,987	299,454	166,678
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	3,687	3,362	3,258
	E(SG) =5,000 PSI	16,147	14,572	13,610
	E(SG) =10,000 PSI	93,548	81,601	69,831

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.21
LOADS TO FAILURE ON A 2 INCH ASPHALT CONCRETE PAVEMENT, E=1,000,000 PSI, FOR A TANDEM AXLE WITH TIRE LOAD = 4,250 LBS/TIRE.

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	10,072	7,612	5,672
	E(SG) =5,000 PSI	13,190	9,663	7,085
	E(SG) =10,000 PSI	15,954	11,736	8,258
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	1,404	1,234	1,174
	E(SG) =5,000 PSI	21,943	19,138	18,071
	E(SG) =10,000 PSI	412,243	355,829	336,031
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	23,350	16,808	11,444
	E(SG) =5,000 PSI	36,695	24,851	16,247
	E(SG) =10,000 PSI	55,995	35,462	22,291
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	436	381	362
	E(SG) =5,000 PSI	3,848	3,309	3,118
	E(SG) =10,000 PSI	49,060	41,521	38,980
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	42,563	28,723	18,895
	E(SG) =5,000 PSI	66,865	42,107	26,530
	E(SG) =10,000 PSI	106,881	61,982	37,256
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	542	476	453
	E(SG) =5,000 PSI	3,571	3,086	2,926
	E(SG) =10,000 PSI	34,279	29,107	27,445
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	106,475	65,290	40,147
	E(SG) =5,000 PSI	157,749	90,288	53,242
	E(SG) =10,000 PSI	246,836	129,233	72,445
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	1,086	965	924
	E(SG) =5,000 PSI	5,475	4,785	4,562
	E(SG) =10,000 PSI	38,250	32,959	29,984
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	220,913	125,653	73,371
	E(SG) =5,000 PSI	310,217	165,234	92,780
	E(SG) =10,000 PSI	463,847	226,776	121,237
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	2,008	1,803	1,734
	E(SG) =5,000 PSI	8,868	7,853	7,285
	E(SG) =10,000 PSI	51,781	45,056	37,621

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.22

LOADS TO FAILURE FOR A TANDEM AXLE, TIRE LOAD OF 3,250 LB./TIRE ON A 3 INCH ASPHALT CONCRETE ROAD

E(AC)=150,000 PSI		E(BASE)=1000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	5,205	3,365	2,370
	E(SG) =5,000 PSI	6,271	3,942	2,731
	E(SG) =10,000 PSI	7,089	4,355	2,991
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	1,450	1,303	1,249
	E(SG) =5,000 PSI	23,965	21,428	20,442
	E(SG) =10,000 PSI	463,664	411,929	392,990
		E(BASE)=5,000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	26,479	13,150	8,268
	E(SG) =5,000 PSI	34,840	16,215	9,939
	E(SG) =10,000 PSI	44,099	19,290	11,551
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	867	774	742
	E(SG) =5,000 PSI	7,539	6,664	6,349
	E(SG) =10,000 PSI	94,373	82,607	78,465
		E(BASE)=10,000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	86,578	34,840	20,168
	E(SG) =5,000 PSI	108,246	40,855	23,111
	E(SG) =10,000 PSI	134,829	47,579	26,308
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	1,711	1,542	1,482
	E(SG) =5,000 PSI	10,495	9,343	8,926
	E(SG) =10,000 PSI	93,959	82,695	78,755
		E(BASE)=20,000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	464,220	138,076	70,166
	E(SG) =5,000 PSI	514,760	148,639	74,535
	E(SG) =10,000 PSI	578,861	161,445	79,816
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	5,444	4,965	4,798
	E(SG) =5,000 PSI	24,858	22,384	21,513
	E(SG) =10,000 PSI	156,057	139,148	133,301
		E(BASE)=30,000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	1,653,136	393,024	178,853
	E(SG) =5,000 PSI	1,673,173	396,437	180,074
	E(SG) =10,000 PSI	1,725,837	405,141	183,301
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	12,460	11,465	11,118
	E(SG) =5,000 PSI	62,959	45,499	43,940
	E(SG) =10,000 PSI	261,980	235,866	214,982

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.23
LOADS TO FAILURE FOR A TANDEM AXLE, TIRE LOAD
OF 3,270 LBS/TIRE ON A 3 INCH ASPHALT CONCRETE ROAD

E(AC)=150,000 PSI		E(BASE)=1,000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	3,535	2,445	1,698
	E(SG) =5,000 PSI	4,279	2,877	1,967
	E(SG) =10,000 PSI	4,837	3,193	2,162
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	794	702	668
	E(SG) =5,000 PSI	13,135	11,545	10,930
	E(SG) =10,000 PSI	254,696	222,076	210,360
		E(BASE)=5,000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	18,229	9,995	6,179
	E(SG) =5,000 PSI	24,109	12,485	7,482
	E(SG) =10,000 PSI	30,661	15,002	8,797
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	475	417	397
	E(SG) =5,000 PSI	4,152	3,590	3,397
	E(SG) =10,000 PSI	52,181	44,680	42,076
		E(BASE)=10,000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	59,835	27,565	15,593
	E(SG) =5,000 PSI	75,160	32,683	18,002
	E(SG) =10,000 PSI	94,055	38,484	20,670
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	937	829	791
	E(SG) =5,000 PSI	5,772	5,036	4,771
	E(SG) =10,000 PSI	51,880	44,659	42,192
		E(BASE)=20,000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	329,963	115,565	56,763
	E(SG) =5,000 PSI	370,801	125,209	60,600
	E(SG) =10,000 PSI	423,683	137,040	65,236
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	2,528	2,336	2,269
	E(SG) =5,000 PSI	7,739	7,071	6,841
	E(SG) =10,000 PSI	29,893	27,061	26,080
		E(BASE)=30,000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	1,258,234	346,132	151,345
	E(SG) =5,000 PSI	1,278,561	349,315	152,524
	E(SG) =10,000 PSI	1,328,793	357,890	155,425
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	6,766	6,125	5,910
	E(SG) =5,000 PSI	27,331	24,357	23,392
	E(SG) =10,000 PSI	143,654	126,780	118,224

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.24
LOADS TO FAILURE FOR A TANDEM AXLE, TIRE LOAD
OF 4,250 LBS/TIRE ON A 3 INCH ASPHALT CONCRETE ROAD

E(AC)=150,000 PSI		E(BASE)=1,000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	2,552	1,856	1,272
	E(SG) =5,000 PSI	3,093	2,197	1,482
	E(SG) =10,000 PSI	3,506	2,450	1,635
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	471	409	387
	E(SG) =5,000 PSI	7,828	6,725	6,349
	E(SG) =10,000 PSI	151,721	129,799	122,055
		E(BASE)=5,000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	13,354	7,925	4,826
	E(SG) =5,000 PSI	17,767	9,995	5,901
	E(SG) =10,000 PSI	22,711	12,151	6,981
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	282	244	230
	E(SG) =5,000 PSI	2,477	2,100	1,971
	E(SG) =10,000 PSI	31,294	26,221	24,457
		E(BASE)=10,000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	44,237	22,580	12,523
	E(SG) =5,000 PSI	55,847	27,061	14,578
	E(SG) =10,000 PSI	70,238	32,211	16,881
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	556	483	458
	E(SG) =5,000 PSI	3,442	2,941	2,768
	E(SG) =10,000 PSI	31,026	26,113	24,457
		E(BASE)=20,000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	246,017	99,853	47,927
	E(SG) =5,000 PSI	277,097	108,880	51,402
	E(SG) =10,000 PSI	317,834	120,008	55,635
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	1,750	1,545	1,476
	E(SG) =5,000 PSI	8,080	6,998	6,644
	E(SG) =10,000 PSI	51,188	43,737	41,275
		E(BASE)=30,000 PSI		
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	947,354	314,004	132,500
	E(SG) =5,000 PSI	962,473	317,063	133,492
	E(SG) =10,000 PSI	1,001,671	325,411	136,269
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	3,986	3,552	3,406
	E(SG) =5,000 PSI	16,147	14,208	13,514
	E(SG) =10,000 PSI	85,440	73,840	70,047

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.25
LOADS TO FAILURE ON A 3 INCH ASPHALT CONCRETE PAVEMENT, E=1,000,000 PSI, FOR A TANDEM AXLE WITH TIRE LOAD = 3,250 LBS/TIRE.

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	119,929	93,374	71,654
	E(SG) =5,000 PSI	143,906	110,200	83,465
	E(SG) =10,000 PSI	162,221	122,686	92,190
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	64,304	60,251	58,718
	E(SG) =5,000 PSI	1,005,182	936,168	910,026
	E(SG) =10,000 PSI	18,813,297	17,431,367	16,919,444
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	211,243	154,418	115,772
	E(SG) =5,000 PSI	284,023	200,032	146,943
	E(SG) =10,000 PSI	369,227	251,123	180,842
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	15,619	14,467	14,056
	E(SG) =5,000 PSI	125,376	114,737	110,742
	E(SG) =10,000 PSI	1,414,145	1,281,639	1,232,436
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	326,235	226,776	165,954
	E(SG) =5,000 PSI	441,813	294,446	210,750
	E(SG) =10,000 PSI	595,563	379,651	265,244
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	16,948	15,676	15,223
	E(SG) =5,000 PSI	100,461	91,673	88,442
	E(SG) =10,000 PSI	824,923	744,147	714,440
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	648,031	411,547	289,546
	E(SG) =5,000 PSI	852,527	517,932	356,225
	E(SG) =10,000 PSI	1,140,932	658,804	441,813
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	29,107	26,992	26,113
	E(SG) =5,000 PSI	133,618	121,984	117,679
	E(SG) =10,000 PSI	796,857	718,151	689,112
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	1,344,509	666,485	452,322
	E(SG) =5,000 PSI	1,451,912	814,074	540,012
	E(SG) =10,000 PSI	1,891,799	1,007,307	652,313
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	49,293	45,755	44,432
	E(SG) =5,000 PSI	200,171	183,166	176,885
	E(SG) =10,000 PSI	1,008,934	910,855	874,437

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.26

LOADS TO FAILURE ON A 3 INCH ASPHALT CONCRETE PAVEMENT, E=1,000,000 PSI, FOR A TANDEM AXLE WITH TIRE LOAD = 3,750 LBS/TIRE.

	E(BASE)=1,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	79,817	64,970	49,940
	E(SG) =5,000 PSI	96,154	77,034	58,471
	E(SG) =10,000 PSI	108,524	86,096	64,758
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	34,581	32,113	31,160
	E(SG) =5,000 PSI	542,969	500,206	483,801
	E(SG) =10,000 PSI	10,161,223	9,319,158	8,998,165
	E(BASE)=5,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	140,949	108,836	80,939
	E(SG) =5,000 PSI	190,230	142,417	103,594
	E(SG) =10,000 PSI	248,051	180,238	128,455
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	8,476	7,755	7,468
	E(SG) =5,000 PSI	68,135	61,495	59,039
	E(SG) =10,000 PSI	771,303	688,523	658,142
	E(BASE)=10,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	219,868	161,522	117,022
	E(SG) =5,000 PSI	299,454	211,986	149,907
	E(SG) =10,000 PSI	406,284	276,170	190,445
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	9,191	8,395	8,080
	E(SG) =5,000 PSI	54,688	49,176	47,150
	E(SG) =10,000 PSI	450,808	399,889	381,621
	E(BASE)=20,000 PSI			
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	437,954	297,901	207,337
	E(SG) =5,000 PSI	578,697	379,121	257,417
	E(SG) =10,000 PSI	779,206	487,337	322,345
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	15,734	14,415	13,905
	E(SG) =5,000 PSI	72,699	65,418	62,738
	E(SG) =10,000 PSI	436,018	386,235	368,175
	E(BASE)=30,000 PSI			
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	771,129	490,288	328,422
	E(SG) =5,000 PSI	988,594	604,237	395,460
	E(SG) =10,000 PSI	1,295,997	756,602	482,227
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	26,658	24,457	23,677
	E(SG) =5,000 PSI	108,870	98,198	94,269
	E(SG) =10,000 PSI	551,422	489,583	466,948

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE D.27
LOADS TO FAILURE ON A 3 INCH ASPHALT CONCRETE PAVEMENT, E=1,000,000 PSI, FOR A TANDEM AXLE WITH TIRE LOAD = 4,250 LBS/TIRE.

			E(BASE)=1,000 PSI	
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	56,523	44,810	36,196
	E(SG) =5,000 PSI	68,262	53,530	42,563
	E(SG) =10,000 PSI	77,300	60,121	47,284
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	20,204	18,559	17,934
	E(SG) =5,000 PSI	317,793	289,462	278,883
	E(SG) =10,000 PSI	5,961,853	5,401,956	5,194,725
			E(BASE)=5,000 PSI	
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	100,343	78,037	59,359
	E(SG) =5,000 PSI	136,103	103,985	76,506
	E(SG) =10,000 PSI	178,442	134,307	95,537
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	4,965	4,486	4,315
	E(SG) =5,000 PSI	40,144	35,665	34,129
	E(SG) =10,000 PSI	456,111	400,799	380,763
			E(BASE)=10,000 PSI	
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	156,573	120,165	86,557
	E(SG) =5,000 PSI	214,488	159,621	111,802
	E(SG) =10,000 PSI	292,548	210,012	143,159
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	5,396	4,867	4,665
	E(SG) =5,000 PSI	32,252	28,620	27,218
	E(SG) =10,000 PSI	267,101	233,026	220,898
			E(BASE)=20,000 PSI	
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	314,746	225,965	155,573
	E(SG) =5,000 PSI	418,100	290,293	194,606
	E(SG) =10,000 PSI	566,007	377,010	245,629
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	9,252	8,342	8,029
	E(SG) =5,000 PSI	42,877	38,010	36,303
	E(SG) =10,000 PSI	258,396	225,053	213,147
			E(BASE)=30,000 PSI	
	TIRE PRESSURE	40PSI	70 PSI	100 PSI
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	555,418	375,960	249,581
	E(SG) =5,000 PSI	716,321	468,007	302,987
	E(SG) =10,000 PSI	943,754	591,760	372,832
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	15,619	14,157	13,610
	E(SG) =5,000 PSI	64,142	57,036	54,476
	E(SG) =10,000 PSI	326,875	285,213	270,270

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

Appendix E: Effects of Lower Tire Pressure on Rutting Failure of Aggregate Roads

TABLE E.1

INCREASE IN LOADS TO RUTTING FAILURE OF A 4 INCH AGGREGATE ROAD BY REDUCING TIRE PRESSURE ON A SINGLE AXLE WITH A TIRE LOAD OF 3250 LBS.

		E(BASE) = 1,000 PSI			100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	1	0	0	0	211%	1	2913%
	E(SG) = 5,000 PSI	29	3	1	2	225%	28	3348%
	E(SG) = 10,000 PSI	614	55	16	38	234%	597	3638%
		E(BASE) =5,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	3	1	0	0	154%	3	1491%
	E(SG) = 5,000 PSI	44	6	2	4	182%	42	2116%
	E(SG) = 10,000 PSI	749	80	26	54	205%	723	2753%
		E(BASE) = 10,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	7	2	1	1	125%	7	979%
	E(SG) = 5,000 PSI	73	12	5	7	154%	68	1489%
	E(SG) = 10,000 PSI	978	125	44	80	182%	934	2116%
		E(BASE) = 20,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	22	6	3	3	97%	19	622%
	E(SG) = 5,000 PSI	163	34	15	19	124%	148	979%
	E(SG) = 10,000 PSI	1,629	260	103	158	154%	1,527	1489%
		E(BASE) = 30,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	46	15	8	7	84%	38	477%
	E(SG) = 5,000 PSI	300	73	35	38	108%	265	752%
	E(SG) = 10,000 PSI	2,520	468	198	270	137%	2,322	1173%
				AVERAGE =	45	158%	448	1756%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE E.2

INCREASE IN LOADS TO RUTTING FAILURE OF A 4 INCH AGGREGATE ROAD BY REDUCING TIRE PRESSURE ON A SINGLE AXLE WITH A TIRE LOAD OF 3,750 LBS.

	E(BASE) = 1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	1	0	0	0	243%	1	3766%
	E(SG) = 5,000 PSI	30	2	1	2	260%	30	4381%
	E(SG) = 10,000 PSI	663	50	14	37	270%	649	4779%
	E(BASE) =5,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	3	0	0	0	173%	3	1818%
	E(SG) = 5,000 PSI	42	5	2	3	207%	41	2662%
	E(SG) = 10,000 PSI	760	70	21	49	235%	739	3516%
	E(BASE) = 10,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	6	1	0	1	139%	6	1157%
	E(SG) = 5,000 PSI	66	9	3	6	173%	62	1821%
	E(SG) = 10,000 PSI	950	106	34	71	207%	915	2663%
	E(BASE) = 20,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	17	4	2	2	107%	15	710%
	E(SG) = 5,000 PSI	136	26	11	15	139%	125	1157%
	E(SG) = 10,000 PSI	1,473	210	77	133	173%	1,396	1820%
	E(BASE) = 30,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	34	10	5	5	91%	29	535%
	E(SG) = 5,000 PSI	238	54	25	29	119%	213	870%
	E(SG) = 10,000 PSI	2,170	364	144	220	153%	2,026	1404%
				AVERAGE =	38	179%	417	2204%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE E.3

INCREASE IN LOADS TO RUTTING FAILURE OF A 4 INCH AGGREGATE ROAD BY REDUCING TIRE PRESSURE ON A SINGLE AXLE WITH A TIRE LOAD OF 4250 LBS.

	E(BASE) = 1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	2	0	0	0	273%	2	4695%
	E(SG) = 5,000 PSI	33	2	1	2	293%	32	5505%
	E(SG) = 10,000 PSI	731	48	12	36	306%	719	6036%
	E(BASE) =5,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	3	0	0	0	191%	3	2164%
	E(SG) = 5,000 PSI	42	4	1	3	231%	41	3249%
	E(SG) = 10,000 PSI	798	65	18	47	265%	780	4373%
	E(BASE) = 10,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	5	1	0	1	151%	5	1330%
	E(SG) = 5,000 PSI	62	8	3	5	191%	59	2165%
	E(SG) = 10,000 PSI	950	94	28	66	232%	921	3249%
	E(BASE) = 20,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	13	3	1	2	115%	12	794%
	E(SG) = 5,000 PSI	118	21	8	12	151%	110	1333%
	E(SG) = 10,000 PSI	1,383	178	61	117	191%	1,322	2167%
	E(BASE) = 30,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	26	7	4	4	98%	22	588%
	E(SG) = 5,000 PSI	197	42	18	24	130%	179	985%
	E(SG) = 10,000 PSI	1,949	300	112	188	168%	1,837	1642%
				AVERAGE =	34	199%	403	2685%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE E.4

INCREASE IN LOADS TO RUTTING FAILURE OF AN 8 INCH AGGREGATE ROAD BY REDUCING TIRE PRESSURE ON A SINGLE AXLE WITH A TIRE LOAD OF 3250 LBS.

	E(BASE) = 1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	8	3	2	1	51%	6	281%
	E(SG) = 5,000 PSI	133	51	33	18	53%	100	303%
	E(SG) = 10,000 PSI	2,627	976	633	344	54%	1,995	315%
	E(BASE) =5,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	32	15	11	4	40%	21	194%
	E(SG) = 5,000 PSI	317	137	94	43	45%	222	236%
	E(SG) = 10,000 PSI	4,244	1,711	1,143	568	50%	3,101	271%
	E(BASE) = 10,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	98	52	39	13	33%	59	152%
	E(SG) = 5,000 PSI	709	337	241	96	40%	468	194%
	E(SG) = 10,000 PSI	7,085	3,063	2,110	953	45%	4,975	236%
	E(BASE) = 20,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	405	239	187	51	27%	217	116%
	E(SG) = 5,000 PSI	2,186	1,159	870	289	33%	1,316	151%
	E(SG) = 10,000 PSI	15,851	7,539	5,412	2,127	39%	10,439	193%
	E(BASE) = 30,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	1,041	650	524	126	24%	517	99%
	E(SG) = 5,000 PSI	4,867	2,747	2,114	633	30%	2,752	130%
	E(SG) = 10,000 PSI	29,479	14,948	11,005	3,943	36%	18,474	168%
				AVERAGE =	614	40%	2,978	203%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS

E(SG) = SUBGRADE ELASTIC MODULUS

TABLE E.5

INCREASE IN LOADS TO RUTTING FAILURE OF A 8 INCH AGGREGATE ROAD BY REDUCING TIRE PRESSURE ON A SINGLE AXLE WITH A TIRE LOAD OF 3,750 LBS.

	E(BASE) = 1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	5	2	1	1	58%	4	343%
	E(SG) = 5,000 PSI	96	33	20	13	62%	76	373%
	E(SG) = 10,000 PSI	1,913	637	390	247	63%	1,523	391%
	E(BASE) =5,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	21	9	6	3	45%	15	230%
	E(SG) = 5,000 PSI	219	86	57	30	52%	162	284%
	E(SG) = 10,000 PSI	3,009	1,097	697	401	58%	2,312	332%
	E(BASE) = 10,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	63	31	23	9	38%	40	177%
	E(SG) = 5,000 PSI	474	209	144	65	45%	330	230%
	E(SG) = 10,000 PSI	4,895	1,935	1,273	662	52%	3,621	284%
	E(BASE) = 20,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	252	141	108	33	31%	144	133%
	E(SG) = 5,000 PSI	1,410	702	509	193	38%	901	177%
	E(SG) = 10,000 PSI	10,602	4,678	3,216	1,462	45%	7,386	230%
	E(BASE) = 30,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	635	380	299	81	27%	336	113%
	E(SG) = 5,000 PSI	3,071	1,640	1,226	414	34%	1,844	150%
	E(SG) = 10,000 PSI	19,360	9,131	6,484	2,647	41%	12,876	199%
				AVERAGE =	417	46%	2,105	243%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE E.6

INCREASE IN LOADS TO RUTTING FAILURE OF A 8 INCH AGGREGATE ROAD BY REDUCING TIRE PRESSURE ON A SINGLE AXLE WITH A TIRE LOAD OF 4,250 LBS.

	E(BASE) = 1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	4	1	1	1	67%	3	412%
	E(SG) = 5,000 PSI	74	23	14	9	70%	61	449%
	E(SG) = 10,000 PSI	1,489	447	260	187	72%	1,228	472%
	E(BASE) =5,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	15	6	4	2	51%	11	267%
	E(SG) = 5,000 PSI	161	59	37	22	59%	124	335%
	E(SG) = 10,000 PSI	2,276	757	460	298	65%	1,816	395%
	E(BASE) = 10,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	43	20	14	6	42%	29	202%
	E(SG) = 5,000 PSI	339	139	92	47	51%	247	267%
	E(SG) = 10,000 PSI	3,609	1,317	831	486	59%	2,778	334%
	E(BASE) = 20,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	168	90	67	23	34%	101	150%
	E(SG) = 5,000 PSI	973	458	322	136	42%	651	202%
	E(SG) = 10,000 PSI	7,586	3,118	2,065	1,053	51%	5,521	267%
	E(BASE) = 30,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	409	239	184	55	30%	225	122%
	E(SG) = 5,000 PSI	2,075	1,056	769	287	37%	1,306	170%
	E(SG) = 10,000 PSI	13,562	6,016	4,129	1,887	46%	9,432	228%
				AVERAGE =	300	52%	1,569	285%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE E.7

INCREASE IN LOADS TO FAILURE OF A 12 INCH AGGREGATE ROAD BY REDUCING TIRE PRESSURE ON A SINGLE AXLE WITH A TIRE LOAD OF 3,250 LBS.

	E(BASE) = 1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	56	37	31	6	19%	25	80%
	E(SG) = 5,000 PSI	973	634	528	105	20%	444	84%
	E(SG) = 10,000 PSI	19,064	12,287	10,183	2,104	21%	8,881	87%
	E(BASE) =5,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	234	186	161	25	15%	73	45%
	E(SG) = 5,000 PSI	2,377	1,685	1,438	247	17%	939	65%
	E(SG) = 10,000 PSI	31,700	21,176	17,866	3,310	19%	13,834	77%
	E(BASE) = 10,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	745	656	580	76	13%	165	28%
	E(SG) = 5,000 PSI	5,243	4,163	3,609	554	15%	1,633	45%
	E(SG) = 10,000 PSI	53,172	37,789	32,113	5,676	18%	21,059	66%
	E(BASE) = 20,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	3,344	3,063	2,874	188	7%	470	16%
	E(SG) = 5,000 PSI	16,696	14,678	12,997	1,682	13%	3,700	28%
	E(SG) = 10,000 PSI	117,340	93,343	80,824	12,518	15%	36,516	45%
	E(BASE) = 30,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	9,221	8,504	8,262	242	3%	959	12%
	E(SG) = 5,000 PSI	38,613	35,195	31,975	3,221	10%	6,638	21%
	E(SG) = 10,000 PSI	220,751	186,708	163,763	22,944	14%	56,988	35%
				AVERAGE =	3,527	15%	10,155	49%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE E.8

INCREASE IN LOADS TO RUTTING FAILURE OF A 12 INCH AGGREGATE ROAD BY REDUCING TIRE PRESSURE ON A SINGLE AXLE WITH A TIRE LOAD OF 3,750 LBS.

					100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	E(BASE) = 1,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	33	21	18	4	22%	15	86%
RUTTING	E(SG) = 5,000 PSI	591	366	297	68	23%	294	99%
FAILURE	E(SG) = 10,000 PSI	11,624	7,107	5,738	1,369	24%	5,886	103%
	E(BASE) =5,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	128	105	89	16	17%	39	43%
RUTTING	E(SG) = 5,000 PSI	1,303	959	801	158	20%	502	63%
FAILURE	E(SG) = 10,000 PSI	18,071	12,159	9,981	2,178	22%	8,089	81%
	E(BASE) = 10,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	407	363	319	43	14%	87	27%
RUTTING	E(SG) = 5,000 PSI	2,874	2,354	2,004	350	17%	871	43%
FAILURE	E(SG) = 10,000 PSI	29,231	21,513	17,934	3,579	20%	11,297	63%
	E(BASE) = 20,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	1,819	1,640	1,572	68	4%	247	16%
RUTTING	E(SG) = 5,000 PSI	9,102	8,132	7,151	981	14%	1,951	27%
FAILURE	E(SG) = 10,000 PSI	64,271	52,635	44,805	7,830	17%	19,466	43%
	E(BASE) = 30,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	5,007	4,549	4,387	162	4%	620	14%
RUTTING	E(SG) = 5,000 PSI	21,010	18,918	17,531	1,387	8%	3,479	20%
FAILURE	E(SG) = 10,000 PSI	120,715	104,945	90,432	14,513	16%	30,283	33%
				AVERAGE =	2,180	16%	5,542	51%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE E.9
INCREASE IN LOADS TO RUTTING FAILURE OF A 12 INCH AGGREGATE ROAD BY REDUCING TIRE PRESSURE ON A SINGLE AXLE WITH A TIRE LOAD OF 4,250 LBS.

	E(BASE) = 1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	19	13	11	3	25%	9	83%
	E(SG) = 5,000 PSI	353	228	181	47	26%	172	95%
	E(SG) = 10,000 PSI	7,085	4,436	3,506	931	27%	3,579	102%
	E(BASE) =5,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	76	64	54	11	20%	23	42%
	E(SG) = 5,000 PSI	592	592	484	108	22%	108	22%
	E(SG) = 10,000 PSI	10,783	7,539	6,070	1,469	24%	4,713	78%
	E(BASE) = 10,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	241	211	190	21	11%	51	27%
	E(SG) = 5,000 PSI	1,707	1,438	1,201	237	20%	506	42%
	E(SG) = 10,000 PSI	17,400	13,229	10,819	2,409	22%	6,580	61%
	E(BASE) = 20,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	1,075	954	912	42	5%	164	18%
	E(SG) = 5,000 PSI	5,396	4,718	4,268	450	11%	1,129	26%
	E(SG) = 10,000 PSI	38,233	32,252	26,880	5,372	20%	11,352	42%
	E(BASE) = 30,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	2,956	2,640	2,532	108	4%	423	17%
	E(SG) = 5,000 PSI	12,460	10,967	10,425	542	5%	2,035	20%
	E(SG) = 10,000 PSI	71,690	62,456	54,081	8,375	15%	17,610	33%
				AVERAGE =	1,342	17%	3,230	47%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE E.10

INCREASE IN LOADS TO RUTTING FAILURE OF A 4 INCH AGGREGATE ROAD BY REDUCING TIRE PRESSURE ON A TANDEM AXLE WITH A TIRE LOAD OF 4,250 LB./TIRE

	E(BASE)=1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	1	0	0	0	237%	1	3334%
RUTTING	E(SG) = 5,000 PSI	15	1	0	1	39%	14	3909%
FAILURE	E(SG) = 10,000 PSI	330	28	8	20	267%	323	4284%
	E(BASE)=5,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	3	0	0	0	193%	3	2176%
RUTTING	E(SG) = 5,000 PSI	43	4	1	3	43%	42	3259%
FAILURE	E(SG) = 10,000 PSI	342	35	11	25	230%	331	3111%
	E(BASE)=10,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	5	1	0	1	152%	5	1339%
RUTTING	E(SG) = 5,000 PSI	62	8	3	5	52%	60	2175%
FAILURE	E(SG) = 10,000 PSI	959	95	29	66	232%	931	3264%
	E(BASE)=20,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	4	1	1	1	97%	4	580%
RUTTING	E(SG) = 5,000 PSI	41	9	4	5	78%	37	967%
FAILURE	E(SG) = 10,000 PSI	529	84	32	53	165%	497	1562%
	E(BASE)=30,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	26	3	1	1	81%	25	1790%
RUTTING	E(SG) = 5,000 PSI	200	42	18	24	77%	182	993%
FAILURE	E(SG) = 10,000 PSI	1,971	302	113	190	168%	1,859	1649%
				AVERAGE =	26	141%	287	2293%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE E.11

INCREASE IN LOADS TO RUTTING FAILURE OF A 4 INCH AGGREGATE ROAD CAUSED BY A TANDEM AXLE, WITH A TIRE LOAD OF 3,750 LB./TIRE.

	E(BASE) = 1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	1	0	0	0	243%	1	3767%
RUTTING	E(SG) = 5,000 PSI	31	2	1	2	260%	30	4392%
FAILURE	E(SG) = 10,000 PSI	667	51	14	37	270%	653	4783%
	E(BASE) =5,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	3	0	0	0	174%	3	1831%
RUTTING	E(SG) = 5,000 PSI	43	5	2	3	207%	41	2669%
FAILURE	E(SG) = 10,000 PSI	766	71	21	50	235%	745	3525%
	E(BASE) = 10,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	6	1	0	1	139%	6	1162%
RUTTING	E(SG) = 5,000 PSI	67	9	3	6	174%	63	1831%
FAILURE	E(SG) = 10,000 PSI	957	106	35	72	207%	923	2672%
	E(BASE) = 20,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	17	4	2	2	107%	15	715%
RUTTING	E(SG) = 5,000 PSI	138	26	11	15	139%	127	1162%
FAILURE	E(SG) = 10,000 PSI	1,489	211	77	134	174%	1,412	1832%
	E(BASE) = 30,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	34	10	5	5	91%	29	538%
RUTTING	E(SG) = 5,000 PSI	241	54	25	30	120%	216	875%
FAILURE	E(SG) = 10,000 PSI	2,196	367	145	222	153%	2,051	1413%
				AVERAGE =	39	180%	421	2211%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE E.12

INCREASE IN LOADS TO RUTTING FAILURE OF A 4 INCH AGGREGATE ROAD CAUSED BY A TANDEM AXLE, WITH A TIRE LOAD OF 3,250 LB./TIRE.

	E(BASE) = 1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	1	0	0	0	212%	1	2920%
RUTTING	E(SG) = 5,000 PSI	29	3	1	2	225%	28	3356%
FAILURE	E(SG) = 10,000 PSI	617	55	17	38	231%	600	3616%
	E(BASE) =5,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	3	1	0	0	155%	3	1495%
RUTTING	E(SG) = 5,000 PSI	44	6	2	4	183%	42	2122%
FAILURE	E(SG) = 10,000 PSI	749	81	26	54	206%	722	2741%
	E(BASE) = 10,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	7	2	1	1	124%	7	982%
RUTTING	E(SG) = 5,000 PSI	73	12	5	7	154%	69	1495%
FAILURE	E(SG) = 10,000 PSI	984	125	44	81	183%	940	2121%
	E(BASE) = 20,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	22	6	3	3	98%	19	625%
RUTTING	E(SG) = 5,000 PSI	165	34	15	19	125%	150	983%
FAILURE	E(SG) = 10,000 PSI	1,644	262	103	159	154%	1,541	1495%
	E(BASE) = 30,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	47	19	8	10	128%	39	480%
RUTTING	E(SG) = 5,000 PSI	304	74	35	38	108%	268	756%
FAILURE	E(SG) = 10,000 PSI	2,544	472	199	273	137%	2,345	1178%
				AVERAGE =	46	162%	452	1758%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS

E(SG) = SUBGRADE ELASTIC MODULUS

TABLE E.13

INCREASE IN LOADS TO RUTTING FAILURE OF AN 8 INCH AGGREGATE ROAD BY REDUCING TIRE PRESSURE ON A TANDEM AXLE WITH A TIRE LOAD OF 3,250 LB./TIRE

		E(BASE) = 1,000 PSI			100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	8	3	2	1	51%	6	283%
	E(SG) = 5,000 PSI	136	51	34	18	53%	102	305%
	E(SG) = 10,000 PSI	2,680	992	641	352	55%	2,039	318%
		E(BASE) =5,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	33	15	11	4	40%	22	195%
	E(SG) = 5,000 PSI	324	139	96	44	45%	228	238%
	E(SG) = 10,000 PSI	4,339	1,738	1,159	579	50%	3,179	274%
		E(BASE) = 10,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	102	54	40	13	34%	62	153%
	E(SG) = 5,000 PSI	729	345	247	99	40%	483	196%
	E(SG) = 10,000 PSI	7,262	3,126	2,145	982	46%	5,118	239%
		E(BASE) = 20,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	429	251	197	54	28%	232	118%
	E(SG) = 5,000 PSI	2,276	1,201	897	304	34%	1,379	154%
	E(SG) = 10,000 PSI	16,327	7,730	5,523	2,207	40%	10,804	196%
		E(BASE) = 30,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	1,106	691	556	136	24%	550	99%
	E(SG) = 5,000 PSI	5,109	2,867	2,207	661	30%	2,902	132%
	E(SG) = 10,000 PSI	30,500	15,391	11,309	4,082	36%	19,190	170%
				AVERAGE =	636	40%	3,086	205%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE E.14
INCREASE IN LOADS TO RUTTING FAILURE OF AN 8 INCH AGGREGATE ROAD CAUSED BY A TANDEM AXLE, WITH A TIRE LOAD OF 3,750 LB./TIRE.

	E(BASE) = 1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	6	2	1	1	59%	4	347%
RUTTING	E(SG) = 5,000 PSI	98	33	21	13	62%	78	376%
FAILURE	E(SG) = 10,000 PSI	1,953	648	396	252	64%	1,558	394%
	E(BASE) =5,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	22	10	7	3	46%	15	232%
RUTTING	E(SG) = 5,000 PSI	224	88	58	30	52%	166	287%
FAILURE	E(SG) = 10,000 PSI	3,071	1,115	708	407	57%	2,363	334%
	E(BASE) = 10,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	66	33	24	9	38%	42	179%
RUTTING	E(SG) = 5,000 PSI	488	214	147	67	46%	341	232%
FAILURE	E(SG) = 10,000 PSI	5,022	1,976	1,295	681	53%	3,727	288%
	E(BASE) = 20,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	267	149	113	36	31%	154	136%
RUTTING	E(SG) = 5,000 PSI	1,469	727	526	201	38%	944	180%
FAILURE	E(SG) = 10,000 PSI	10,930	4,798	3,292	1,506	46%	7,638	232%
	E(BASE) = 30,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	683	405	317	88	28%	366	115%
RUTTING	E(SG) = 5,000 PSI	3,233	1,715	1,279	436	34%	1,954	153%
FAILURE	E(SG) = 10,000 PSI	20,047	9,436	6,664	2,772	42%	13,383	201%
				AVERAGE =	433	46%	2,182	246%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE E.15

INCREASE IN LOADS TO RUTTING FAILURE OF A 8 INCH AGGREGATE ROAD BY REDUCING TIRE PRESSURE ON A TANDEM AXLE WITH A LOAD OF 4250 LB./TIRE.

		E(BASE) = 1,000 PSI			100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	3	1	1	0	61%	2	355%
	E(SG) = 5,000 PSI	47	16	10	6	64%	38	387%
	E(SG) = 10,000 PSI	967	316	191	125	65%	775	405%
		E(BASE) = 5,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	8	4	2	1	46%	6	228%
	E(SG) = 5,000 PSI	92	37	24	13	54%	69	288%
	E(SG) = 10,000 PSI	1,380	499	314	186	59%	1,067	340%
		E(BASE) = 10,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	21	11	8	3	38%	13	172%
	E(SG) = 5,000 PSI	179	80	55	25	46%	125	229%
	E(SG) = 10,000 PSI	2,070	818	533	285	54%	1,537	288%
		E(BASE) = 20,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	70	41	32	9	30%	39	123%
	E(SG) = 5,000 PSI	466	236	171	65	38%	295	172%
	E(SG) = 10,000 PSI	4,018	1,782	1,221	561	46%	2,797	229%
		E(BASE) = 30,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	442	100	80	21	26%	362	455%
	E(SG) = 5,000 PSI	928	507	381	126	33%	547	144%
	E(SG) = 10,000 PSI	6,766	3,241	2,298	943	41%	4,468	194%
				AVERAGE =	158	47%	809	267%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE E.16
INCREASE IN LOADS TO RUTTING FAILURE OF A 12 INCH AGGREGATE ROAD BY REDUCING TIRE PRESSURE ON A TANDEM AXLE WITH A TIRE LOAD OF 4,250 LB./TIRE

	E(BASE) = 1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2.5KSI	13	9	8	2	23%	5	68%
RUTTING	E(SG) = 5.0KSI	235	164	132	32	24%	103	78%
FAILURE	E(SG) = 10.0KSI	4,798	3,250	2,601	648	25%	2,197	84%
	E(BASE) = 5,000							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2.5KSI	44	38	33	5	16%	11	33%
RUTTING	E(SG) = 5.0KSI	479	387	321	66	20%	158	49%
FAILURE	E(SG) = 10.0KSI	6,955	5,197	4,244	953	22%	2,711	64%
	E(BASE) = 10,000							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2.5KSI	127	112	106	6	5%	21	20%
RUTTING	E(SG) = 5.0KSI	988	862	740	121	16%	248	33%
FAILURE	E(SG) = 10.0KSI	10,746	8,670	7,195	1,474	20%	3,551	49%
	E(BASE) =20,000							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2.5KSI	1,552	1,145	1,047	98	9%	505	48%
RUTTING	E(SG) = 5.0KSI	2,846	2,507	2,377	131	5%	469	20%
FAILURE	E(SG) = 10.0KSI	22,118	19,286	16,572	2,714	16%	5,546	33%
	E(BASE) = 30,000							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2.5KSI	3,086	1,088	1,047	41	4%	2,039	195%
RUTTING	E(SG) = 5.0KSI	6,106	5,412	5,182	230	4%	924	18%
FAILURE	E(SG) = 10.0KSI	39,494	34,581	31,564	3,017	10%	7,930	25%
				AVERAGE =	636	15%	1,761	55%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE E.17

INCREASE IN LOADS TO RUTTING FAILURE OF A 12 INCH AGGREGATE ROAD BY REDUCING TIRE PRESSURE ON A TANDEM AXLE WITH A TIRE LOAD OF 3,750 LB./TIRE

	E(BASE) = 1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	34	22	18	4	22%	16	87%
RUTTING	E(SG) = 5,000 PSI	615	378	307	71	23%	308	100%
FAILURE	E(SG) = 10,000 PSI	12,075	7,330	5,927	1,403	24%	6,148	104%
	E(BASE) =5,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	137	111	95	17	18%	42	44%
RUTTING	E(SG) = 5,000 PSI	1,371	1,006	837	169	20%	534	64%
FAILURE	E(SG) = 10,000 PSI	18,918	12,636	10,355	2,280	22%	8,563	83%
	E(BASE) = 10,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	439	391	343	48	14%	96	28%
RUTTING	E(SG) = 5,000 PSI	3,063	2,495	2,119	376	18%	943	45%
FAILURE	E(SG) = 10,000 PSI	30,630	22,473	18,774	3,699	20%	11,857	63%
	E(BASE) = 20,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	1,958	1,762	1,688	74	4%	269	16%
RUTTING	E(SG) = 5,000 PSI	9,817	8,754	7,682	1,072	14%	2,135	28%
FAILURE	E(SG) = 10,000 PSI	68,484	55,847	47,417	8,430	18%	21,067	44%
	E(BASE) = 30,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	5,319	4,771	4,613	158	3%	706	15%
RUTTING	E(SG) = 5,000 PSI	22,744	20,362	18,918	1,444	8%	3,826	20%
FAILURE	E(SG) = 10,000 PSI	129,722	112,332	96,635	15,697	16%	33,088	34%
				AVERAGE =	2,330	16%	5,973	52%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS

E(SG) = SUBGRADE ELASTIC MODULUS

TABLE E.18

INCREASE IN LOADS TO RUTTING FAILURE OF A 12 INCH AGGREGFATE ROAD BY REDUCING TIRE PRESSURE ON A TANDEM AXLE WITH A TIRE LOAD OF 3,250 LB./TIRE.

		E(BASE) = 1,000 PSI			100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	62	39	32	6	19%	30	91%
RUTTING	E(SG) = 5,000 PSI	1,010	656	545	111	20%	465	85%
FAILURE	E(SG) = 10,000 PSI	19,738	12,680	10,495	2,185	21%	9,243	88%
		E(BASE) =5,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	249	197	171	27	16%	79	46%
RUTTING	E(SG) = 5,000 PSI	2,495	1,762	1,502	260	17%	993	66%
FAILURE	E(SG) = 10,000 PSI	33,102	22,030	18,489	3,542	19%	14,614	79%
		E(BASE) = 10,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	803	706	622	83	13%	180	29%
RUTTING	E(SG) = 5,000 PSI	5,588	4,412	3,817	594	16%	1,771	46%
FAILURE	E(SG) = 10,000 PSI	55,902	39,458	33,538	5,920	18%	22,364	67%
		E(BASE) = 20,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	3,590	3,292	3,086	206	7%	504	16%
RUTTING	E(SG) = 5,000 PSI	18,071	15,792	13,955	1,837	13%	4,115	29%
FAILURE	E(SG) = 10,000 PSI	124,937	98,744	85,486	13,258	16%	39,450	46%
		E(BASE) = 30,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO	E(SG) = 2,500 PSI	9,561	8,926	8,670	256	3%	891	10%
RUTTING	E(SG) = 5,000 PSI	41,730	38,061	34,430	3,632	11%	7,300	21%
FAILURE	E(SG) = 10,000 PSI	236,982	199,781	174,886	24,895	14%	62,096	36%
				AVERAGE =	3,787	15%	10,940	50%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

Appendix F: Effects of Lower Tire Load on Rutting Failure on Aggregate Roads

TABLE F.1

INCREASE IN LOADS TO RUTTING FAILURE OF 4 INCH AGGREGATE ROAD SUBJECT TO A SINGLE AXLE LOAD BY REDUCING TIRE LOAD.

4-INCH AGGREGATE SURFACED ROAD		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	2	1	1	-1	-50%	-1	-50%
1,000	5,000	33	30	29	-3	-9%	-4	-12%
1,000	10,000	731	663	614	-68	-9%	-117	-16%
5,000	2,500	3	3	3	0	0%	0	0%
5,000	5,000	42	42	44	0	0%	2	5%
5,000	10,000	798	760	749	-38	-5%	-49	-6%
10,000	2,500	5	6	7	1	20%	2	40%
10,000	5,000	62	66	73	4	6%	11	18%
10,000	10,000	950	950	978	0	0%	28	3%
20,000	2,500	13	17	22	4	31%	9	69%
20,000	5,000	118	136	163	18	15%	45	38%
20,000	10,000	1,383	1,473	1,629	90	7%	246	18%
30,000	2,500	26	34	46	8	31%	20	77%
30,000	5,000	197	238	300	41	21%	103	52%
30,000	10,000	1,949	2,170	2,520	221	11%	571	29%
				AVERAGE	43	14%	115	34%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE F.2
INCREASE IN LOADS TO RUTTING FAILURE OF 4 INCH AGGREGATE ROAD SUBJECT TO A SINGLE AXLE LOAD BY REDUCING TIRE LOAD.

4-INCH AGGREGATE SURFACED ROAD		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	0	0	0	0	N/A	0	N/A
1,000	5,000	2	2	3	0	0%	1	50%
1,000	10,000	48	50	55	2	4%	7	15%
5,000	2,500	0	0	1	0	N/A	1	N/A
5,000	5,000	4	5	6	1	25%	2	50%
5,000	10,000	65	70	80	5	8%	15	23%
10,000	2,500	1	1	2	0	0%	1	100%
10,000	5,000	8	9	12	1	13%	4	50%
10,000	10,000	94	106	125	12	13%	31	33%
20,000	2,500	3	4	6	1	33%	3	100%
20,000	5,000	21	26	34	5	24%	13	62%
20,000	10,000	178	210	260	32	18%	82	46%
30,000	2,500	7	10	15	3	43%	8	114%
30,000	5,000	42	54	73	12	29%	31	74%
30,000	10,000	300	364	468	64	21%	168	56%
				AVERAGE	14	19%	38	64%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE F.3

INCREASE IN LOADS TO RUTTING FAILURE OF 4 INCH AGGREGATE ROAD SUBJECT TO A SINGLE AXLE LOAD BY REDUCING TIRE LOAD.

4-INCH AGGREGATE SURFACED ROAD		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	0	0	0	0	N/A	0	N/A
1,000	5,000	1	1	1	0	0%	0	0%
1,000	10,000	12	14	16	2	17%	4	33%
5,000	2,500	0	0	0	0	N/A	0	N/A
5,000	5,000	1	2	2	1	100%	1	100%
5,000	10,000	18	21	26	3	17%	8	44%
10,000	2,500	0	0	1	0	N/A	1	N/A
10,000	5,000	3	3	5	0	0%	2	67%
10,000	10,000	28	34	44	6	21%	16	57%
20,000	2,500	1	2	3	1	100%	2	200%
20,000	5,000	8	11	15	3	38%	7	88%
20,000	10,000	61	77	103	16	26%	42	69%
30,000	2,500	4	5	8	1	25%	4	100%
30,000	5,000	18	25	35	7	39%	17	94%
30,000	10,000	112	144	198	32	29%	86	77%
				AVERAGE	7	31%	20	83%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE F.4

INCREASE IN LOADS TO RUTTING FAILURE OF 8 INCH AGGREGATE ROAD SUBJECT TO A SINGLE AXLE LOAD BY REDUCING TIRE LOAD.

8-INCH AGGREGATE SURFACED ROAD		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	4	5	8	1	25%	4	100%
1,000	5,000	74	96	133	22	30%	59	80%
1,000	10,000	1,489	1,913	2,627	424	28%	1,138	76%
5,000	2,500	15	21	32	6	40%	17	113%
5,000	5,000	161	219	317	58	36%	156	97%
5,000	10,000	2,276	3,009	4,244	733	32%	1,968	86%
10,000	2,500	43	63	98	20	47%	55	128%
10,000	5,000	339	474	709	135	40%	370	109%
10,000	10,000	3,609	4,895	7,085	1,286	36%	3,476	96%
20,000	2,500	168	252	405	84	50%	237	141%
20,000	5,000	973	1,410	2,186	437	45%	1,213	125%
20,000	10,000	7,586	10,602	15,851	3,016	40%	8,265	109%
30,000	2,500	406	635	1,041	229	56%	635	156%
30,000	5,000	2,075	3,071	4,867	996	48%	2,792	135%
30,000	10,000	13,562	19,360	29,479	5,798	43%	15,917	117%
				AVERAGE	883	40%	2,420	111%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS

E(SG) = SUBGRADE ELASTIC MODULUS

TABLE F.5
INCREASE IN LOADS TO RUTTING FAILURE OF 8 INCH AGGREGATE ROAD SUBJECT TO A SINGLE AXLE LOAD BY REDUCING TIRE LOAD.

8-INCH AGGREGATE SURFACED ROAD		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	1	2	3	1	100%	2	200%
1,000	5,000	23	33	51	10	43%	28	122%
1,000	10,000	447	637	976	190	43%	529	118%
5,000	2,500	6	9	15	3	50%	9	150%
5,000	5,000	59	86	137	27	46%	78	132%
5,000	10,000	757	1,097	1,711	340	45%	954	126%
10,000	2,500	20	31	52	11	55%	32	160%
10,000	5,000	139	209	337	70	50%	198	142%
10,000	10,000	1,317	1,935	3,063	618	47%	1,746	133%
20,000	2,500	90	141	239	51	57%	149	166%
20,000	5,000	458	702	1,159	244	53%	701	153%
20,000	10,000	3,118	4,678	7,539	1,560	50%	4,421	142%
30,000	2,500	239	380	650	141	59%	411	172%
30,000	5,000	1,056	1,640	2,747	584	55%	1,691	160%
30,000	10,000	6,016	9,131	14,948	3,115	52%	8,932	148%
				AVERAGE	464	54%	1,325	148%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE F.6

INCREASE IN LOADS TO RUTTING FAILURE OF 8 INCH AGGREGATE ROAD SUBJECT TO A SINGLE AXLE LOAD BY REDUCING TIRE LOAD.

8-INCH AGGREGATE SURFACED ROAD		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	1	1	2	0	0%	1	100%
1,000	5,000	14	20	33	6	43%	19	136%
1,000	10,000	260	390	633	130	50%	373	143%
5,000	2,500	4	6	11	2	50%	7	175%
5,000	5,000	37	57	94	20	54%	57	154%
5,000	10,000	460	697	1,143	237	52%	683	148%
10,000	2,500	14	23	39	9	64%	25	179%
10,000	5,000	92	144	241	52	57%	149	162%
10,000	10,000	831	1,273	2,110	442	53%	1,279	154%
20,000	2,500	67	108	187	41	61%	120	179%
20,000	5,000	322	509	870	187	58%	548	170%
20,000	10,000	2,065	3,216	5,412	1,151	56%	3,347	162%
30,000	2,500	184	299	524	115	63%	340	185%
30,000	5,000	769	1,226	2,114	457	59%	1,345	175%
30,000	10,000	4,129	6,484	11,005	2,355	57%	6,876	167%
				AVERAGE	347	52%	1,011	159%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE F.7
INCREASE IN LOADS TO RUTTING FAILURE OF 12 INCH AGGREGATE ROAD SUBJECT TO A SINGLE AXLE LOAD BY REDUCING TIRE LOAD.

12-INCH AGGREGATE SURFACED ROAD		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	19	33	56	14	74%	37	195%
1,000	5,000	353	591	973	238	67%	620	176%
1,000	10,000	7,085	11,624	19,064	4,539	64%	11,979	169%
5,000	2,500	76	128	234	52	68%	158	208%
5,000	5,000	592	1,303	2,377	711	120%	1,785	302%
5,000	10,000	10,783	18,071	31,700	7,288	68%	20,917	194%
10,000	2,500	241	407	745	166	69%	504	209%
10,000	5,000	1,707	2,874	5,243	1,167	68%	3,536	207%
10,000	10,000	17,400	29,231	53,172	11,831	68%	35,772	206%
20,000	2,500	1,075	1,819	3,344	744	69%	2,269	211%
20,000	5,000	5,396	9,102	16,696	3,706	69%	11,300	209%
20,000	10,000	38,233	64,271	117,340	26,038	68%	79,107	207%
30,000	2,500	2,956	5,007	9,221	2,051	69%	6,265	212%
30,000	5,000	12,460	21,010	38,613	8,550	69%	26,153	210%
30,000	10,000	71,690	120,715	220,751	49,025	68%	149,061	208%
				AVERAGE	7,741	72%	23,298	208%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE F.8

INCREASE IN LOADS TO RUTTING FAILURE OF 12 INCH AGGREGATE ROAD SUBJECT TO A SINGLE AXLE LOAD BY REDUCING TIRE LOAD.

12-INCH AGGREGATE SURFACED ROAD		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	13	21	37	8	62%	24	185%
1,000	5,000	228	366	634	138	61%	406	178%
1,000	10,000	4,436	7,107	12,287	2,671	60%	7,851	177%
5,000	2,500	64	105	186	41	64%	122	191%
5,000	5,000	592	959	1,685	367	62%	1,093	185%
5,000	10,000	7,539	12,159	21,176	4,620	61%	13,637	181%
10,000	2,500	211	363	656	152	72%	445	211%
10,000	5,000	1,438	2,354	4,163	916	64%	2,725	189%
10,000	10,000	13,229	21,513	37,789	8,284	63%	24,560	186%
20,000	2,500	954	1,640	3,063	686	72%	2,109	221%
20,000	5,000	4,718	8,132	14,678	3,414	72%	9,960	211%
20,000	10,000	32,252	52,635	93,343	20,383	63%	61,091	189%
30,000	2,500	2,640	4,549	8,504	1,909	72%	5,864	222%
30,000	5,000	10,967	18,918	35,195	7,951	72%	24,228	221%
30,000	10,000	62,456	104,945	186,708	42,489	68%	124,252	199%
				AVERAGE	6,269	66%	18,558	196%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE F.9
INCREASE IN LOADS TO RUTTING FAILURE OF 12 INCH AGGREGATE ROAD SUBJECT TO A SINGLE AXLE LOAD BY REDUCING TIRE LOAD.

12-INCH AGGREGATE SURFACED ROAD		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	11	18	31	7	64%	20	182%
1,000	5,000	181	297	528	116	64%	347	192%
1,000	10,000	3,506	5,738	10,183	2,232	64%	6,677	190%
5,000	2,500	54	89	161	35	65%	107	198%
5,000	5,000	484	801	1,438	317	65%	954	197%
5,000	10,000	6,070	9,981	17,866	3,911	64%	11,796	194%
10,000	2,500	190	319	580	129	68%	390	205%
10,000	5,000	1,201	2,004	3,609	803	67%	2,408	200%
10,000	10,000	10,819	17,934	32,113	7,115	66%	21,294	197%
20,000	2,500	912	1,572	2,874	660	72%	1,962	215%
20,000	5,000	4,268	7,151	12,997	2,883	68%	8,729	205%
20,000	10,000	26,880	44,805	80,824	17,925	67%	53,944	201%
30,000	2,500	2,532	4,387	8,262	1,855	73%	5,730	226%
30,000	5,000	10,425	17,531	31,975	7,106	68%	21,550	207%
30,000	10,000	54,081	90,432	163,763	36,351	67%	109,682	203%
				AVERAGE	5,430	67%	16,373	201%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE F.10

INCREASE IN LOADS TO FAILURE OF A 4 INCH AGGREGATE ROAD SUBJECT TO TANDEM AXLE LOADING BY REDUCING TIRE LOAD.

4-INCH AGGREGATE SURFACE ROAD		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	1	1	1	0	0%	0	0%
1,000	5,000	15	31	29	16	107%	14	93%
1,000	10,000	330	667	617	337	102%	287	87%
5,000	2,500	3	3	3	0	0%	0	0%
5,000	5,000	43	43	44	0	0%	1	2%
5,000	10,000	342	766	749	424	124%	407	119%
10,000	2,500	5	6	7	1	20%	2	40%
10,000	5,000	62	67	73	5	8%	11	18%
10,000	10,000	959	957	984	-2	0%	25	3%
20,000	2,500	4	17	22	13	325%	18	450%
20,000	5,000	41	138	165	97	237%	124	302%
20,000	10,000	529	1,489	1,644	960	181%	1,115	211%
30,000	2,500	7	34	47	27	386%	40	571%
30,000	5,000	200	241	304	41	21%	104	52%
30,000	10,000	1,971	2,196	2,544	225	11%	573	29%
				AVERAGE =	143	101%	181	132%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE F.11

INCREASE IN LOADS TO FAILURE OF A 4 INCH AGGREGATE ROAD SUBJECT TO TANDEM AXLE LOADING BY REDUCING TIRE LOAD.

4-INCH AGGREGATE SURFACE ROAD		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	0	0	0	0	0%	0	0%
1,000	5,000	1	2	3	1	100%	2	200%
1,000	10,000	28	51	55	23	82%	27	96%
5,000	2,500	0	0	1	0	0%	1	0%
5,000	5,000	4	5	6	1	25%	2	50%
5,000	10,000	35	71	81	36	103%	46	131%
10,000	2,500	1	1	2	0	0%	1	100%
10,000	5,000	8	9	12	1	13%	4	50%
10,000	10,000	95	106	125	11	12%	30	32%
20,000	2,500	1	4	6	3	300%	5	500%
20,000	5,000	9	26	34	17	189%	25	278%
20,000	10,000	84	211	262	127	151%	178	212%
30,000	2,500	3	10	19	7	233%	16	533%
30,000	5,000	42	54	74	12	29%	32	76%
30,000	10,000	302	367	472	65	22%	170	56%
				AVERAGE =	20	84%	36	154%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS

E(SG) = SUBGRADE ELASTIC MODULUS

TABLE F.12

INCREASE IN LOADS TO FAILURE OF A 4 INCH AGGREGATE ROAD SUBJECT TO TANDEM AXLE LOADING BY REDUCING TIRE LOAD.

4-INCH AGGREGATE SURFACE ROAD		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	0	0	0	0	0%	0	0%
1,000	5,000	0	1	1	1	0%	1	0%
1,000	10,000	8	14	17	6	75%	9	113%
5,000	2,500	0	0	0	0	0%	0	0%
5,000	5,000	1	2	2	1	100%	1	100%
5,000	10,000	11	21	26	10	91%	15	136%
10,000	2,500	0	0	1	0	0%	1	0%
10,000	5,000	3	3	5	0	0%	2	67%
10,000	10,000	29	35	44	6	21%	15	52%
20,000	2,500	1	2	3	1	100%	2	200%
20,000	5,000	4	11	15	7	175%	11	275%
20,000	10,000	32	77	103	45	141%	71	222%
30,000	2,500	1	5	8	4	400%	7	700%
30,000	5,000	18	25	35	7	39%	17	94%
30,000	10,000	113	145	199	32	28%	86	76%
				AVERAGE =	8	78%	16	136%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE F.13

INCREASE IN LOADS TO FAILURE OF A 8 INCH AGGREGATE ROAD SUBJECT TO TANDEM AXLE LOADING BY REDUCING TIRE LOAD.

8-INCH AGGREGATE SURFACE ROAD		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	3	6	8	3	100%	5	167%
1,000	5,000	47	98	136	51	109%	89	189%
1,000	10,000	967	1,953	2,680	986	102%	1,713	177%
5,000	2,500	8	22	33	14	175%	25	313%
5,000	5,000	92	224	324	132	143%	232	252%
5,000	10,000	1,380	3,071	4,339	1,691	123%	2,959	214%
10,000	2,500	21	66	102	45	214%	81	386%
10,000	5,000	179	488	729	309	173%	550	307%
10,000	10,000	2,070	5,022	7,262	2,952	143%	5,192	251%
20,000	2,500	70	267	429	197	281%	359	513%
20,000	5,000	466	1,469	2,276	1,003	215%	1,810	388%
20,000	10,000	4,018	10,930	16,327	6,912	172%	12,309	306%
30,000	2,500	151	681	1,115	530	351%	964	638%
30,000	5,000	928	3,233	5,109	2,305	248%	4,181	451%
30,000	10,000	6,766	20,047	30,500	13,281	196%	23,734	351%
				AVERAGE =	2,027	183%	3,614	327%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS

E(SG) = SUBGRADE ELASTIC MODULUS

TABLE F.14

INCREASE IN LOADS TO FAILURE OF A 8 INCH AGGREGATE ROAD SUBJECT TO TANDEM AXLE LOADING BY REDUCING TIRE LOAD.

8-INCH AGGREGATE SURFACE ROAD		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	1	2	3	1	100%	2	200%
1,000	5,000	16	33	51	17	106%	35	219%
1,000	10,000	316	648	992	332	105%	676	214%
5,000	2,500	4	10	15	6	150%	11	275%
5,000	5,000	37	88	139	51	138%	102	276%
5,000	10,000	499	1,115	1,738	616	123%	1,239	248%
10,000	2,500	11	33	54	22	200%	43	391%
10,000	5,000	80	214	345	134	168%	265	331%
10,000	10,000	818	1,976	3,126	1,158	142%	2,308	282%
20,000	2,500	41	149	251	108	263%	210	512%
20,000	5,000	236	727	1,201	491	208%	965	409%
20,000	10,000	1,782	4,798	7,730	3,016	169%	5,948	334%
30,000	2,500	100	405	691	305	305%	591	591%
30,000	5,000	507	1,715	2,867	1,208	238%	2,360	465%
30,000	10,000	3,241	9,436	15,391	6,195	191%	12,150	375%
				AVERAGE =	911	174%	1,794	341%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE F.15

INCREASE IN LOADS TO FAILURE OF A 8 INCH AGGREGATE ROAD SUBJECT TO TANDEM AXLE LOADING BY REDUCING TIRE LOAD.

8-INCH AGGREGATE SURFACE ROAD		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	1	1	2	0	0%	1	100%
1,000	5,000	10	21	34	11	110%	24	240%
1,000	10,000	191	396	641	205	107%	450	236%
5,000	2,500	2	7	11	5	250%	9	450%
5,000	5,000	24	58	96	34	142%	72	300%
5,000	10,000	314	708	1,159	394	125%	845	269%
10,000	2,500	8	24	40	16	200%	32	400%
10,000	5,000	55	147	247	92	167%	192	349%
10,000	10,000	533	1,295	2,145	762	143%	1,612	302%
20,000	2,500	32	113	197	81	253%	165	516%
20,000	5,000	171	526	897	355	208%	726	425%
20,000	10,000	1,221	3,292	5,523	2,071	170%	4,302	352%
30,000	2,500	80	317	556	237	296%	476	595%
30,000	5,000	381	1,279	2,207	898	236%	1,826	479%
30,000	10,000	2,298	6,664	11,309	4,366	190%	9,011	392%
				AVERAGE =	635	173%	1,316	360%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE F.16
INCREASE IN LOADS TO FAILURE OF A 12 INCH AGGREGATE ROAD SUBJECT TO TANDEM AXLE LOADING BY REDUCING TIRE LOAD.

12-INCH AGGREGATE SURFACE ROAD		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	13	34	62	21	162%	49	377%
1,000	5,000	235	615	1,010	380	162%	775	330%
1,000	10,000	4,798	12,075	19,738	7,277	152%	14,940	311%
5,000	2,500	44	137	249	93	211%	205	466%
5,000	5,000	479	1,371	2,495	892	186%	2,016	421%
5,000	10,000	6,955	18,918	33,102	11,963	172%	26,147	376%
10,000	2,500	127	439	803	312	246%	676	532%
10,000	5,000	988	3,063	5,588	2,075	210%	4,600	466%
10,000	10,000	10,746	30,630	55,902	19,884	185%	45,156	420%
20,000	2,500	1,552	1,958	3,590	406	26%	2,038	131%
20,000	5,000	2,846	9,817	18,071	6,971	245%	15,225	535%
20,000	10,000	22,118	68,484	124,937	46,366	210%	102,819	465%
30,000	2,500	1,206	5,258	9,688	4,052	336%	8,482	703%
30,000	5,000	6,106	22,744	41,730	16,638	272%	35,624	583%
30,000	10,000	39,494	129,722	236,982	90,228	228%	197,488	500%
				AVERAGE =	13,837	200%	30,416	441%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE F.17

INCREASE IN LOADS TO FAILURE OF A 12 INCH AGGREGATE ROAD SUBJECT TO TANDEM AXLE LOADING BY REDUCING TIRE LOAD.

12-INCH AGGREGATE SURFACE ROAD		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	9	22	39	13	144%	30	333%
1,000	5,000	164	378	656	214	130%	492	300%
1,000	10,000	3,250	7,330	12,680	4,080	126%	9,430	290%
5,000	2,500	38	111	197	73	192%	159	418%
5,000	5,000	387	1,006	1,762	619	160%	1,375	355%
5,000	10,000	5,197	12,636	22,030	7,439	143%	16,833	324%
10,000	2,500	112	391	706	279	249%	594	530%
10,000	5,000	862	2,495	4,412	1,633	189%	3,550	412%
10,000	10,000	8,670	22,473	39,458	13,803	159%	30,788	355%
20,000	2,500	1,145	1,762	3,292	617	54%	2,147	188%
20,000	5,000	2,507	8,754	15,792	6,247	249%	13,285	530%
20,000	10,000	19,286	55,847	98,744	36,561	190%	79,458	412%
30,000	2,500	1,088	4,771	8,926	3,683	339%	7,838	720%
30,000	5,000	5,412	20,362	38,061	14,950	276%	32,649	603%
30,000	10,000	34,581	112,332	199,781	77,751	225%	165,200	478%
				AVERAGE =	11,197	188%	24,255	417%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE F.18

INCREASE IN LOADS TO FAILURE OF A 12 INCH AGGREGATE ROAD SUBJECT TO TANDEM AXLE LOADING BY REDUCING TIRE LOAD.

12-INCH AGGREGATE SURFACE ROAD		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	8	18	32	10	125%	24	300%
1,000	5,000	132	307	545	175	133%	413	313%
1,000	10,000	2,601	5,927	10,495	3,326	128%	7,894	303%
5,000	2,500	33	95	171	62	188%	138	418%
5,000	5,000	321	837	1,502	516	161%	1,181	368%
5,000	10,000	4,244	10,355	18,489	6,111	144%	14,245	336%
10,000	2,500	106	343	622	237	224%	516	487%
10,000	5,000	740	2,119	3,817	1,379	186%	3,077	416%
10,000	10,000	7,195	18,774	33,538	11,579	161%	26,343	366%
20,000	2,500	422	1,688	3,086	1,266	300%	2,664	631%
20,000	5,000	2,377	7,682	13,955	5,305	223%	11,578	487%
20,000	10,000	16,572	47,417	85,486	30,845	186%	68,914	416%
30,000	2,500	1,047	4,613	8,670	3,566	341%	7,623	728%
30,000	5,000	5,182	18,918	34,430	13,736	265%	29,248	564%
30,000	10,000	31,564	96,635	174,886	65,071	206%	143,322	454%
				AVERAGE =	9,546	198%	21,145	439%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

Appendix G: Effects of Lower Tire Pressure and Tire Load on Rutting Failure of Aggregate Roads

TABLE G.1

PERCENT INCREASE IN LOADS TO RUTTING FAILURE FOR 4 INCH AGGREGATE ROAD SUBJECT TO A SINGLE AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED.

FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
0	N/A	2	N/A	1	0%	0.50
0	0%	32	3200%	28	2800%	0.88
4	33%	719	5992%	602	5017%	0.83
0	N/A	3	N/A	3	0%	1.00
1	100%	41	4100%	43	4300%	1.02
8	44%	780	4333%	731	4061%	0.93
1	N/A	5	N/A	7	0%	1.17
2	67%	59	1967%	70	2333%	1.15
16	57%	922	3293%	950	3393%	1.01
2	200%	12	1200%	21	2100%	1.50
7	88%	110	1375%	155	1938%	1.32
42	69%	1,322	2167%	1,568	2570%	1.15
4	100%	22	550%	42	1050%	1.62
17	94%	179	994%	282	1567%	1.44
86	77%	1,837	1640%	2,408	2150%	1.25
18 AVERAGE	83% AVERAGE	447 AVERAGE	1465% AVERAGE	550 AVERAGE	1710% AVERAGE	1.16 AVERAGE

NOTE: N/A REPRESENTS PERCTANGE INCREASES THAT CAN NOT BE CALCULATED DUE TO THE REFERENCE LOADS TO FAILURE BEING ZERO (0)

TABLE G.2
PERCENT INCREASE IN LOADS TO RUTTING FAILURE FOR 8 INCH AGGREGATE ROAD SUBJECT TO A SINGLE AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED.

FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
1	100%	3	300%	7	0%	1.75
19	136%	60	429%	119	850%	1.51
373	143%	1,229	473%	2,367	910%	1.48
7	175%	11	275%	28	0%	1.56
57	154%	124	335%	280	757%	1.55
683	148%	1,816	395%	3,784	823%	1.51
25	179%	29	207%	84	0%	1.56
149	162%	247	268%	617	671%	1.56
1,279	154%	2,778	334%	6,254	753%	1.54
120	179%	101	151%	338	504%	1.53
548	170%	651	202%	1,864	579%	1.55
3,347	162%	5,521	267%	13,786	668%	1.55
340	185%	222	121%	857	466%	1.52
1,345	175%	1,306	170%	4,098	533%	1.55
6,876	167%	9,433	228%	25,350	614%	1.55
948 AVERAGE	149% AVERAGE	1,471 AVERAGE	260% AVERAGE	3,740 AVERAGE	508% AVERAGE	1.45 AVERAGE

TABLE G.3
PERCENT INCREASE IN LOADS TO RUTTING FAILURE FOR 12 INCH AGGREGATE ROAD SUBJECT TO A SINGLE AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED.

FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
20	182%	8	26%	45	0%	1.61
347	192%	172	95%	792	438%	1.53
6,677	190%	3,579	102%	15,558	444%	1.52
107	198%	22	14%	180	0%	1.40
954	197%	108	22%	1,893	391%	1.78
11,796	194%	4,713	78%	25,630	422%	1.55
390	205%	51	9%	555	0%	1.26
2,408	200%	506	42%	4,042	337%	1.39
21,294	197%	6,581	61%	42,353	391%	1.52
1,962	215%	163	18%	2,432	267%	1.14
8,729	205%	1,128	26%	12,428	291%	1.26
53,944	201%	11,353	42%	90,460	337%	1.39
5,730	226%	424	17%	6,689	264%	1.09
21,550	207%	2,035	20%	28,188	270%	1.20
109,682	203%	17,609	33%	166,670	308%	1.31
15,349 AVERAGE	188% AVERAGE	3,028 AVERAGE	38% AVERAGE	24,870 AVERAGE	260% AVERAGE	1.31 AVERAGE

TABLE G.4

PERCENT INCREASE IN LOADS TO RUTTING FAILURE FOR A 4 INCH AGGREGATE ROAD SUBJECT TO A TANDEM AXLE LOAD BY REDUCING TIRE LOAD AND TIRE PRESSURE INDIVIDUALLY AND COMBINED.

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
0	N/A	1	N/A	1	N/A	1.00
1	N/A	15	N/A	29	N/A	1.81
9	113%	322	4025%	609	7613%	1.84
0	N/A	3	N/A	3	N/A	1.00
1	100%	42	4200%	43	4300%	1.00
15	136%	331	3009%	738	6709%	2.13
1	N/A	5	N/A	7	N/A	1.17
2	67%	59	1967%	70	2333%	1.15
15	52%	930	3207%	955	3293%	1.01
2	200%	3	300%	21	2100%	4.20
11	275%	37	925%	161	4025%	3.35
71	222%	497	1553%	1,612	5038%	2.84
7	700%	6	600%	46	4600%	3.54
17	94%	182	1011%	286	1589%	1.44
86	76%	1,858	1644%	2,431	2151%	1.25
16 AVERAGE	185% AVERAGE	286 AVERAGE	2040% AVERAGE	467 AVERAGE	3977% AVERAGE	1.92 AVERAGE

NOTE: N/A REPRESENTS PERCENTAGE INCREASES THAT CAN NOT BE CALCULATED DUE TO THE REFERENCE LOADS TO FAILURE BEING ZERO (0).

TABLE G.5
PERCENT INCREASE IN LOADS TO RUTTING FAILURE FOR A 8 INCH AGGREGATE ROAD SUBJECT TO A TANDEM AXLE LOAD BY REDUCING TIRE LOAD AND TIRE PRESSURE INDIVIDUALLY AND COMBINED.

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
1	100%	2	200%	7	700%	2.33
24	240%	37	370%	126	1260%	2.07
450	236%	776	406%	2,489	1303%	2.03
9	450%	6	300%	31	1550%	2.07
72	300%	68	283%	300	1250%	2.14
845	269%	1,066	339%	4,025	1282%	2.11
32	400%	13	163%	94	1175%	2.09
192	349%	124	225%	674	1225%	2.13
1,612	302%	1,537	288%	6,729	1262%	2.14
165	516%	38	119%	397	1241%	1.96
726	425%	295	173%	2,105	1231%	2.06
4,302	352%	2,797	229%	15,106	1237%	2.13
476	595%	71	89%	1,035	1294%	1.89
1,826	479%	547	144%	4,728	1241%	1.99
9,011	392%	4,468	194%	28,202	1227%	2.09
1,316 AVERAGE	360% AVERAGE	790 AVERAGE	235% AVERAGE	4,403 AVERAGE	1232% AVERAGE	2.08 AVERAGE

TABLE G.6

PERCENT INCREASE IN LOADS TO RUTTING FAILURE FOR A 12 INCH AGGREGATE ROAD SUBJECT TO A TANDEM AXLE LOAD BY REDUCING TIRE LOAD AND TIRE PRESSURE INDIVIDUALLY AND COMBINED.

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
24	300%	5	63%	54	675%	1.86
413	313%	103	78%	878	665%	1.70
7,894	303%	2,197	84%	17,137	659%	1.70
138	418%	11	33%	216	655%	1.45
1,181	368%	158	49%	2,174	677%	1.62
14,245	336%	2,711	64%	28,858	680%	1.70
516	487%	21	20%	697	658%	1.30
3,077	416%	248	34%	4,848	655%	1.46
26,343	366%	3,551	49%	48,707	677%	1.63
2,664	631%	1,130	268%	3,168	751%	0.84
11,578	487%	469	20%	15,694	660%	1.30
68,914	416%	5,546	33%	108,365	654%	1.46
7,623	728%	159	15%	8,641	825%	1.11
29,248	564%	924	18%	36,548	705%	1.21
143,322	454%	7,930	25%	205,418	651%	1.36
21,145 AVERAGE	439% AVERAGE	1,678 AVERAGE	57% AVERAGE	32,094 AVERAGE	683% AVERAGE	1.45 AVERAGE

Appendix H: Effects of Lower Tire Pressure on Fatigue and Rutting Failure of Asphalt Concrete Roads

TABLE H.1
INCREASE IN LOADS TO FAILURE FOR A 1 INCH ASPHALT, E=150,000 PSI, CONCRETE ROAD BY REDUCING TIRE PRESSURE OF A DUAL TIRE SINGLE AXLE LOAD OF 3,250 LBS/TIRE.

		E(BASE)=1,000 PSI			100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
FATIGUE FAILURE	E(SG) =2,500 PSI	692	154	69	85	123%	623	904%
	E(SG) =5,000 PSI	856	155	77	77	100%	779	1005%
	E(SG) =10,000 PSI	972	193	83	110	133%	889	1072%
RUTTING FAILURE	E(SG) =2,500 PSI	22	13	10	3	28%	13	129%
	E(SG) =5,000 PSI	420	227	174	53	30%	246	141%
	E(SG) =10,000 PSI	8,754	4,613	3,506	1,107	32%	5,248	150%
		E(BASE)=5,000 PSI						
FATIGUE FAILURE	E(SG) =2,500 PSI	30,845	3,484	1,078	2,406	223%	29,767	2761%
	E(SG) =5,000 PSI	38,061	3,942	1,180	2,762	234%	36,881	3125%
	E(SG) =10,000 PSI	44,752	4,326	1,264	3,062	242%	43,488	3440%
RUTTING FAILURE	E(SG) =2,500 PSI	32	16	12	4	35%	20	167%
	E(SG) =5,000 PSI	313	144	103	41	40%	210	203%
	E(SG) =10,000 PSI	4,233	1,815	1,257	557	44%	2,975	237%
		E(BASE)=10,000 PSI						
FATIGUE FAILURE	E(SG) =2,500 PSI	621,880	34,768	7,699	27,069	352%	614,181	7977%
	E(SG) =5,000 PSI	535,049	33,030	7,462	25,568	343%	527,587	7070%
	E(SG) =10,000 PSI	491,354	32,263	7,367	24,896	338%	483,988	6570%
RUTTING FAILURE	E(SG) =2,500 PSI	86	45	33	11	35%	53	159%
	E(SG) =5,000 PSI	578	268	191	78	41%	387	203%
	E(SG) =10,000 PSI	5,572	2,343	1,597	746	47%	3,975	249%
		E(BASE)=20,000 PSI						
FATIGUE FAILURE	E(SG) =2,500 PSI	1,802,191,509	1,158,500	120,225	1,038,275	864%	1,802,071,284	1498920%
	E(SG) =5,000 PSI	98,836,992	724,249	94,055	630,194	670%	98,742,937	104984%
	E(SG) =10,000 PSI	19,260,328	534,542	79,604	454,938	572%	19,180,724	24095%
RUTTING FAILURE	E(SG) =2,500 PSI	331	182	138	44	32%	193	140%
	E(SG) =5,000 PSI	1,644	804	581	224	39%	1,063	183%
	E(SG) =10,000 PSI	11,194	4,867	3,344	1,523	46%	7,850	235%
		E(BASE)=30,000 PSI						
FATIGUE FAILURE	E(SG) =2,500 PSI	NO TENSION	47,221,462	1,152,959	46,068,502	3996%	NO TENSION	NO TENSION
	E(SG) =5,000 PSI	NO TENSION	10,196,706	650,491	9,546,215	1468%	NO TENSION	NO TENSION
	E(SG) =10,000 PSI	2,700,170,360	4,498,637	443,348	4,055,289	915%	2,699,727,012	608940%
RUTTING FAILURE	E(SG) =2,500 PSI	804	462	356	106	30%	448	126%
	E(SG) =5,000 PSI	3,496	1,790	1,317	473	36%	2,179	165%
	E(SG) =10,000 PSI	19,969	9,072	6,311	2,761	44%	13,659	216%
				RUTTING AVERAGE =	515	37%	2,568	180%
				FATIGUE AVERAGE =	4,125,297	705%	355,496,934	174682%

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE H.2
INCREASE IN LOADS TO FAILURE FOR A 1 INCH ASPHALT, E=150,000 PSI, CONCRETE ROAD BY REDUCING TIRE PRESSURE OF A DUAL TIRE SINGLE AXLE LOAD OF 3,750 LBS/TIRE.

		E(BASE)=1,000 PSI			100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
FATIGUE FAILURE	E(SG) =2,500 PSI	586	137	59	78	133%	527	899%
	E(SG) =5,000 PSI	759	160	67	94	141%	693	1041%
	E(SG) =10,000 PSI	888	176	72	104	146%	816	1139%
RUTTING FAILURE	E(SG) =2,500 PSI	14	7	6	2	33%	9	154%
	E(SG) =5,000 PSI	272	136	101	35	35%	171	169%
	E(SG) =10,000 PSI	5,721	2,782	2,041	741	36%	3,680	180%
		E(BASE)=5,000 PSI						
FATIGUE FAILURE	E(SG) =2,500 PSI	23,213	3,646	1,058	2,588	245%	22,155	2094%
	E(SG) =5,000 PSI	29,438	4,196	1,171	3,024	258%	28,266	2413%
	E(SG) =10,000 PSI	35,305	4,665	1,266	3,399	269%	34,039	2689%
RUTTING FAILURE	E(SG) =2,500 PSI	21	10	7	3	40%	14	198%
	E(SG) =5,000 PSI	212	90	61	28	46%	151	246%
	E(SG) =10,000 PSI	2,948	1,148	757	390	52%	2,191	289%
		E(BASE)=10,000 PSI						
FATIGUE FAILURE	E(SG) =2,500 PSI	389,313	42,718	8,539	34,179	400%	380,774	4459%
	E(SG) =5,000 PSI	333,500	40,033	8,246	31,787	385%	325,254	3944%
	E(SG) =10,000 PSI	305,300	38,798	8,116	30,682	378%	297,184	3662%
RUTTING FAILURE	E(SG) =2,500 PSI	56	27	19	8	39%	36	187%
	E(SG) =5,000 PSI	390	167	114	53	47%	276	243%
	E(SG) =10,000 PSI	3,890	1,489	967	522	54%	2,923	302%
		E(BASE)=20,000 PSI						
FATIGUE FAILURE	E(SG) =2,500 PSI	18,942,617,591	2,302,877	172,210	2,130,668	1237%	18,942,445,381	10999627%
	E(SG) =5,000 PSI	54,772,697	1,204,098	126,130	1,077,968	855%	54,646,567	43326%
	E(SG) =10,000 PSI	10,364,252	805,827	102,279	703,548	688%	10,261,973	10033%
RUTTING FAILURE	E(SG) =2,500 PSI	210	109	80	29	36%	130	162%
	E(SG) =5,000 PSI	1,084	496	345	151	44%	739	214%
	E(SG) =10,000 PSI	14,056	3,071	2,018	1,053	52%	12,038	597%
		E(BASE)=30,000 PSI						
FATIGUE FAILURE	E(SG) =2,500 PSI	NO TENSION	528,706,548	2,407,994	526,298,554	21856%	NO TENSION	NO TENSION
	E(SG) =5,000 PSI	NO TENSION	29,889,260	1,086,531	28,802,729	2651%	NO TENSION	NO TENSION
	E(SG) =10,000 PSI	2,837,815,543	8,817,011	655,756	8,161,255	1245%	2,837,159,787	432655%
RUTTING FAILURE	E(SG) =2,500 PSI	503	275	206	68	33%	296	144%
	E(SG) =5,000 PSI	2,271	1,095	776	319	41%	1,495	193%
	E(SG) =10,000 PSI	13,514	5,671	3,797	1,874	49%	9,717	256%
				RUTTING AVERAGE =	352	43%	2,258	236%
				FATIGUE AVERAGE =	37,818,710	2059%	1,680,431,032	885229%

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE H.3
INCREASE IN LOADS TO FAILURE FOR AN 1 INCH ASPHALT, E=150,000 PSI, CONCRETE ROAD BY REDUCING TIRE PRESSURE OF A DUAL TIRE SINGLE AXLE LOAD OF 4,250 LBS/TIRE.

	E(BASE)=1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
FATIGUE FAILURE	E(SG) =2,500 PSI	443	126	52	74	144%	391	760%
	E(SG) =5,000 PSI	577	149	59	90	152%	518	876%
	E(SG) =10,000 PSI	676	165	64	101	158%	612	955%
RUTTING FAILURE	E(SG) =2,500 PSI	10	5	4	1	37%	6	180%
	E(SG) =5,000 PSI	190	88	63	25	40%	126	199%
	E(SG) =10,000 PSI	4,018	1,815	1,284	531	41%	2,734	213%
	E(BASE)=5,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	16,864	3,884	1,061	2,822	266%	15,803	1489%
	E(SG) =5,000 PSI	21,326	4,552	1,187	3,365	284%	20,139	1697%
	E(SG) =10,000 PSI	25,496	5,134	1,297	3,837	296%	24,199	1866%
RUTTING FAILURE	E(SG) =2,500 PSI	15	7	5	2	45%	10	231%
	E(SG) =5,000 PSI	154	60	40	21	52%	115	290%
	E(SG) =10,000 PSI	2,201	782	493	289	59%	1,709	347%
	E(BASE)=10,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	271,785	53,137	9,663	43,474	450%	262,121	2713%
	E(SG) =5,000 PSI	231,494	48,990	9,243	39,748	430%	222,251	2405%
	E(SG) =10,000 PSI	210,678	47,064	9,066	37,998	419%	201,612	2224%
RUTTING FAILURE	E(SG) =2,500 PSI	39	18	12	5	44%	26	215%
	E(SG) =5,000 PSI	281	112	73	39	53%	208	283%
	E(SG) =10,000 PSI	2,904	1,018	633	386	61%	2,271	359%
	E(BASE)=20,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	5,608,047,422	5,187,648	255,847	4,931,801	1928%	5,607,791,574	2191851%
	E(SG) =5,000 PSI	31,897,922	2,100,872	172,674	1,928,198	1117%	31,725,248	18373%
	E(SG) =10,000 PSI	6,392,644	1,239,842	133,326	1,106,516	830%	6,259,318	4695%
RUTTING FAILURE	E(SG) =2,500 PSI	143	71	51	20	40%	92	183%
	E(SG) =5,000 PSI	766	329	221	108	49%	545	247%
	E(SG) =10,000 PSI	5,654	2,090	1,306	784	60%	4,348	333%
	E(BASE)=30,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	N/A	N/A	5,868,570	N/A	N/A	N/A	N/A
	E(SG) =5,000 PSI	N/A	125,848,909	1,916,002	123,932,907	6468%	N/A	N/A
	E(SG) =10,000 PSI	1,034,832,653	18,779,876	989,131	17,790,745	1799%	1,033,843,523	104520%
RUTTING FAILURE	E(SG) =2,500 PSI	337	177	129	48	37%	208	161%
	E(SG) =5,000 PSI	1,576	720	494	226	46%	1,082	219%
	E(SG) =10,000 PSI	9,784	3,828	2,465	1,363	55%	7,320	297%
				RUTTING AVERAGE =	256	48%	1,387	250%
				FATIGUE AVERAGE =	10,701,548	1053%	513,874,408	179571%

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE H.4
INCREASE IN LOADS TO FAILURE FOR A 2 INCH ASPHALT, E=150,000 PSI, CONCRETE ROAD BY REDUCING TIRE PRESSURE OF A DUAL TIRE SINGLE AXLE LOAD OF 3,250 LBS/TIRE.

	E(BASE)=1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
FATIGUE FAILURE	E(SG) =2,500 PSI	1,818	884	551	333	60%	1,267	230%
	E(SG) =5,000 PSI	2,432	1,098	666	432	65%	1,765	265%
	E(SG) =10,000 PSI	2,922	1,256	749	508	68%	2,173	290%
RUTTING FAILURE	E(SG) =2,500 PSI	178	156	149	7	5%	29	19%
	E(SG) =5,000 PSI	3,292	2,882	2,734	148	5%	558	20%
	E(SG) =10,000 PSI	68,730	59,775	56,729	3,045	5%	12,001	21%
	E(BASE)=5,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	14,259	4,718	2,519	2,199	87%	11,740	466%
	E(SG) =5,000 PSI	20,861	6,194	3,161	3,033	96%	17,700	560%
	E(SG) =10,000 PSI	28,070	7,679	3,778	3,901	103%	24,291	643%
RUTTING FAILURE	E(SG) =2,500 PSI	153	111	94	17	18%	58	62%
	E(SG) =5,000 PSI	1,562	1,024	852	173	20%	710	83%
	E(SG) =10,000 PSI	21,428	13,370	10,930	2,440	22%	10,498	96%
	E(BASE)=10,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	59,835	15,900	7,521	8,379	111%	52,314	696%
	E(SG) =5,000 PSI	80,800	19,586	8,894	10,692	120%	71,906	808%
	E(SG) =10,000 PSI	106,064	23,582	10,313	13,269	129%	95,751	928%
RUTTING FAILURE	E(SG) =2,500 PSI	304	206	174	32	19%	130	75%
	E(SG) =5,000 PSI	2,051	1,298	1,062	236	22%	989	93%
	E(SG) =10,000 PSI	19,892	11,786	9,374	2,412	26%	10,518	112%
	E(BASE)=20,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	526,016	94,477	36,350	58,127	160%	489,665	1347%
	E(SG) =5,000 PSI	589,674	101,520	38,435	63,085	164%	551,239	1434%
	E(SG) =10,000 PSI	669,164	110,034	40,873	69,161	169%	628,291	1537%
RUTTING FAILURE	E(SG) =2,500 PSI	924	625	524	101	19%	400	76%
	E(SG) =5,000 PSI	4,511	2,824	2,292	532	23%	2,219	97%
	E(SG) =10,000 PSI	30,370	17,531	13,757	3,775	27%	16,613	121%
	E(BASE)=30,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	3,638,621	403,029	125,745	277,284	221%	3,512,876	2794%
	E(SG) =5,000 PSI	3,205,962	377,807	120,225	257,583	214%	3,085,737	2567%
	E(SG) =10,000 PSI	2,971,580	363,964	117,092	246,872	211%	2,854,488	2438%
RUTTING FAILURE	E(SG) =2,500 PSI	2,075	1,410	1,186	224	19%	889	75%
	E(SG) =5,000 PSI	8,726	5,491	4,461	1,030	23%	4,265	96%
	E(SG) =10,000 PSI	48,527	28,025	21,943	6,082	28%	26,584	121%
				RUTTING AVERAGE =	1,350	19%	5,764	78%
				FATIGUE AVERAGE =	67,657	132%	760,080	1134%

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE H.5
INCREASE IN LOADS TO FAILURE FOR A 2 INCH ASPHALT, E=150,000 PSI, CONCRETE ROAD BY REDUCING TIRE PRESSURE OF A DUAL TIRE SINGLE AXLE LOAD OF 3,250 LBS/TIRE.

		E(BASE)=1,000 PSI			100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
FATIGUE FAILURE	E(SG) =2,500 PSI	1,258	677	414	262	63%	844	204%
	E(SG) =5,000 PSI	1,690	852	506	346	68%	1,184	234%
	E(SG) =10,000 PSI	2,040	982	572	410	72%	1,468	257%
RUTTING FAILURE	E(SG) =2,500 PSI	98	84	80	5	6%	18	23%
	E(SG) =5,000 PSI	1,823	1,555	1,466	89	6%	357	24%
	E(SG) =10,000 PSI	38,130	32,392	30,370	2,022	7%	7,760	26%
		E(BASE)=5,000 PSI						
FATIGUE FAILURE	E(SG) =2,500 PSI	9,883	3,859	2,008	1,851	92%	7,875	392%
	E(SG) =5,000 PSI	15,002	5,181	2,566	2,615	102%	12,436	485%
	E(SG) =10,000 PSI	21,197	6,524	3,105	3,418	110%	18,092	583%
RUTTING FAILURE	E(SG) =2,500 PSI	83	63	53	10	20%	31	59%
	E(SG) =5,000 PSI	908	590	479	111	23%	429	89%
	E(SG) =10,000 PSI	13,182	7,779	6,198	1,581	26%	6,983	113%
		E(BASE)=10,000 PSI						
FATIGUE FAILURE	E(SG) =2,500 PSI	43,020	13,689	6,286	7,403	118%	36,734	584%
	E(SG) =5,000 PSI	60,659	17,198	7,540	9,658	128%	53,119	704%
	E(SG) =10,000 PSI	83,399	21,084	8,870	12,215	138%	74,529	840%
RUTTING FAILURE	E(SG) =2,500 PSI	174	118	97	21	21%	77	79%
	E(SG) =5,000 PSI	1,255	754	602	153	25%	653	109%
	E(SG) =10,000 PSI	12,460	6,934	5,365	1,569	29%	7,095	132%
		E(BASE)=20,000 PSI						
FATIGUE FAILURE	E(SG) =2,500 PSI	397,468	89,128	32,883	56,246	171%	364,586	1109%
	E(SG) =5,000 PSI	454,652	96,625	34,970	61,655	176%	419,683	1200%
	E(SG) =10,000 PSI	530,006	105,696	37,437	68,259	182%	492,569	1316%
RUTTING FAILURE	E(SG) =2,500 PSI	552	358	294	64	22%	258	88%
	E(SG) =5,000 PSI	2,761	1,644	1,300	343	26%	1,461	112%
	E(SG) =10,000 PSI	19,064	10,390	7,903	2,487	31%	11,161	141%
		E(BASE)=30,000 PSI						
FATIGUE FAILURE	E(SG) =2,500 PSI	2,901,502	421,074	122,870	298,204	243%	2,778,632	2261%
	E(SG) =5,000 PSI	2,530,967	390,657	116,673	273,985	235%	2,414,294	2069%
	E(SG) =10,000 PSI	2,337,239	373,647	113,256	260,390	230%	2,223,983	1964%
RUTTING FAILURE	E(SG) =2,500 PSI	1,234	809	665	143	22%	569	85%
	E(SG) =5,000 PSI	5,319	3,200	2,532	668	26%	2,787	110%
	E(SG) =10,000 PSI	30,500	16,634	12,636	3,998	32%	17,864	141%
				RUTTING AVERAGE =	884	21%	3,833	89%
				FATIGUE AVERAGE =	70,461	142%	593,335	947%

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE H.6
INCREASE IN LOADS TO FAILURE FOR A 2 INCH ASPHALT, E=150,000 PSI, CONCRETE ROAD BY REDUCING TIRE PRESSURE OF A DUAL TIRE SINGLE AXLE LOAD OF 4,250 LBS/TIRE.

	E(BASE)=1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
FATIGUE FAILURE	E(SG) =2,500 PSI	928	539	324	215	66%	604	186%
	E(SG) =5,000 PSI	1,255	686	400	286	72%	855	214%
	E(SG) =10,000 PSI	1,518	797	455	342	75%	1,063	234%
RUTTING FAILURE	E(SG) =2,500 PSI	59	49	46	3	7%	12	27%
	E(SG) =5,000 PSI	1,095	913	852	62	7%	243	29%
	E(SG) =10,000 PSI	22,927	18,991	17,664	1,327	8%	5,263	30%
	E(BASE)=5,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	7,329	3,264	1,662	1,602	96%	5,667	341%
	E(SG) =5,000 PSI	11,248	4,472	2,154	2,318	108%	9,094	422%
	E(SG) =10,000 PSI	23,651	5,733	2,644	3,089	117%	21,007	794%
RUTTING FAILURE	E(SG) =2,500 PSI	50	39	32	7	22%	18	56%
	E(SG) =5,000 PSI	540	368	292	76	26%	248	85%
	E(SG) =10,000 PSI	8,262	4,908	3,797	1,112	29%	4,465	118%
	E(BASE)=10,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	31,939	12,114	5,429	6,685	123%	26,510	488%
	E(SG) =5,000 PSI	45,316	15,543	6,605	8,937	135%	38,711	586%
	E(SG) =10,000 PSI	62,630	19,390	7,883	11,507	146%	54,747	694%
RUTTING FAILURE	E(SG) =2,500 PSI	102	73	59	14	24%	43	74%
	E(SG) =5,000 PSI	795	474	369	105	29%	427	116%
	E(SG) =10,000 PSI	8,368	4,424	3,327	1,097	33%	5,042	152%
	E(BASE)=20,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	295,734	86,014	30,527	55,487	182%	265,206	869%
	E(SG) =5,000 PSI	338,759	94,003	32,657	61,346	188%	306,103	937%
	E(SG) =10,000 PSI	394,384	103,819	35,202	68,617	195%	359,182	1020%
RUTTING FAILURE	E(SG) =2,500 PSI	323	222	179	43	24%	145	81%
	E(SG) =5,000 PSI	1,819	1,035	800	235	29%	1,019	127%
	E(SG) =10,000 PSI	12,905	6,644	4,922	1,721	35%	7,983	162%
	E(BASE)=30,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	2,174,992	448,954	123,019	325,935	265%	2,051,973	1668%
	E(SG) =5,000 PSI	1,886,842	411,202	115,979	295,223	255%	1,770,863	1527%
	E(SG) =10,000 PSI	1,735,216	390,657	112,059	278,599	249%	1,623,157	1448%
RUTTING FAILURE	E(SG) =2,500 PSI	725	500	404	96	24%	321	80%
	E(SG) =5,000 PSI	3,487	2,013	1,559	454	29%	1,929	124%
	E(SG) =10,000 PSI	20,602	10,638	7,878	2,760	35%	12,724	162%
				AVERAGE =	607	24%	2,659	95%
				AVERAGE =	74,679	151%	435,649	762%

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE H.7
INCREASE IN LOADS TO FAILURE FOR A 3 INCH ASPHALT, E=150,000 PSI, CONCRETE ROAD BY REDUCING TIRE PRESSURE OF A DUAL TIRE SINGLE AXLE LOAD OF 3,250 LBS/TIRE.

E(BASE)=1,000 PSI					100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
FATIGUE FAILURE	E(SG) =2,500 PSI	4,948	3,232	2,285	946	41%	2,663	117%
	E(SG) =5,000 PSI	6,179	3,892	2,700	1,192	44%	3,479	129%
	E(SG) =10,000 PSI	7,107	4,374	2,997	1,377	46%	4,110	137%
RUTTING FAILURE	E(SG) =2,500 PSI	1,325	1,193	1,145	48	4%	180	16%
	E(SG) =5,000 PSI	22,295	19,969	19,064	905	5%	3,230	17%
	E(SG) =10,000 PSI	436,355	388,568	371,204	17,364	5%	65,150	18%
	E(BASE)=5,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	24,873	12,523	7,925	4,598	58%	16,948	214%
	E(SG) =5,000 PSI	33,753	15,797	9,718	6,079	63%	24,035	247%
	E(SG) =10,000 PSI	43,325	19,012	11,449	7,564	66%	31,876	278%
RUTTING FAILURE	E(SG) =2,500 PSI	801	717	688	30	4%	114	17%
	E(SG) =5,000 PSI	7,085	6,273	5,980	293	5%	1,104	18%
	E(SG) =10,000 PSI	90,679	79,508	75,554	3,953	5%	15,124	20%
	E(BASE)=10,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	81,320	33,273	19,417	13,857	71%	61,903	319%
	E(SG) =5,000 PSI	104,722	39,895	22,670	17,225	76%	82,052	362%
	E(SG) =10,000 PSI	132,418	46,957	26,040	20,917	80%	106,378	409%
RUTTING FAILURE	E(SG) =2,500 PSI	1,590	1,432	1,377	54	4%	213	15%
	E(SG) =5,000 PSI	9,784	8,726	8,342	384	5%	1,443	17%
	E(SG) =10,000 PSI	89,260	78,672	74,965	3,708	5%	14,296	19%
	E(BASE)=20,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	449,358	134,577	68,784	65,793	96%	380,573	553%
	E(SG) =5,000 PSI	506,170	146,556	73,764	72,792	99%	432,406	586%
	E(SG) =10,000 PSI	573,829	160,069	79,350	80,719	102%	494,479	623%
RUTTING FAILURE	E(SG) =2,500 PSI	5,182	4,718	4,562	156	3%	621	14%
	E(SG) =5,000 PSI	23,019	20,764	20,047	717	4%	2,972	15%
	E(SG) =10,000 PSI	146,194	130,567	125,156	5,411	4%	21,038	17%
	E(BASE)=30,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	1,682,180	396,094	183,552	212,542	116%	1,498,628	816%
	E(SG) =5,000 PSI	1,695,809	398,503	181,183	217,321	120%	1,514,626	836%
	E(SG) =10,000 PSI	1,742,293	405,848	183,804	222,043	121%	1,558,489	848%
RUTTING FAILURE	E(SG) =2,500 PSI	12,202	11,232	10,856	376	3%	1,345	12%
	E(SG) =5,000 PSI	46,643	42,464	41,012	1,453	4%	5,631	14%
	E(SG) =10,000 PSI	243,815	219,874	200,822	19,052	9%	42,993	21%
				RUTTING AVERAGE =	3,594	5%	11,697	17%
				FATIGUE AVERAGE =	62,998	80%	414,176	432%

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE H.8
INCREASE IN LOADS TO FAILURE FOR A 3 INCH ASPHALT, E=150,000 PSI, CONCRETE ROAD BY REDUCING TIRE PRESSURE OF A DUAL TIRE SINGLE AXLE LOAD OF 3,750 LBS/TIRE.

		E(BASE)=1,000 PSI			100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
FATIGUE FAILURE	E(SG) =2,500 PSI	3,358	2,344	1,632	712	44%	1,726	106%
	E(SG) =5,000 PSI	4,214	2,843	1,943	900	46%	2,271	117%
	E(SG) =10,000 PSI	4,859	3,212	2,169	1,043	48%	2,689	124%
RUTTING FAILURE	E(SG) =2,500 PSI	724	642	611	30	5%	113	18%
	E(SG) =5,000 PSI	12,202	10,746	10,217	529	5%	1,984	19%
	E(SG) =10,000 PSI	239,395	209,396	198,617	10,778	5%	40,778	21%
		E(BASE)=5,000 PSI						
FATIGUE FAILURE	E(SG) =2,500 PSI	17,067	9,529	5,915	3,614	61%	11,152	189%
	E(SG) =5,000 PSI	23,315	12,151	7,329	4,822	66%	15,986	218%
	E(SG) =10,000 PSI	30,083	14,811	8,702	6,109	70%	21,381	246%
RUTTING FAILURE	E(SG) =2,500 PSI	439	387	367	20	5%	71	19%
	E(SG) =5,000 PSI	3,900	3,388	3,208	180	6%	692	22%
	E(SG) =10,000 PSI	50,098	42,976	40,510	2,465	6%	9,588	24%
		E(BASE)=10,000 PSI						
FATIGUE FAILURE	E(SG) =2,500 PSI	56,115	26,199	14,954	11,245	75%	41,161	275%
	E(SG) =5,000 PSI	72,664	31,811	17,624	14,187	80%	55,040	312%
	E(SG) =10,000 PSI	92,340	37,884	20,424	17,459	85%	71,916	352%
RUTTING FAILURE	E(SG) =2,500 PSI	868	770	735	35	5%	133	18%
	E(SG) =5,000 PSI	5,381	4,691	4,461	230	5%	920	21%
	E(SG) =10,000 PSI	49,223	42,464	40,144	2,321	6%	9,079	23%
		E(BASE)=20,000 PSI						
FATIGUE FAILURE	E(SG) =2,500 PSI	318,607	112,456	55,688	56,768	102%	262,919	472%
	E(SG) =5,000 PSI	364,271	123,318	60,040	63,278	105%	304,231	507%
	E(SG) =10,000 PSI	420,332	135,844	64,943	70,900	109%	355,389	547%
RUTTING FAILURE	E(SG) =2,500 PSI	2,817	2,532	2,429	103	4%	388	16%
	E(SG) =5,000 PSI	12,636	11,194	10,674	520	5%	1,962	18%
	E(SG) =10,000 PSI	80,312	70,263	66,862	3,402	5%	13,450	20%
		E(BASE)=30,000 PSI						
FATIGUE FAILURE	E(SG) =2,500 PSI	1,283,313	349,606	152,327	197,279	130%	1,130,986	742%
	E(SG) =5,000 PSI	1,299,319	351,947	153,218	198,729	130%	1,146,101	748%
	E(SG) =10,000 PSI	1,343,856	359,094	155,627	203,466	131%	1,188,229	764%
RUTTING FAILURE	E(SG) =2,500 PSI	6,623	5,998	5,789	209	4%	835	14%
	E(SG) =5,000 PSI	25,476	22,744	21,856	888	4%	3,620	17%
	E(SG) =10,000 PSI	133,539	118,088	110,364	7,723	7%	23,174	21%
				AVERAGE =	1,962	5%	7,119	19%
				AVERAGE =	56,701	86%	307,412	381%

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE H.9
INCREASE IN LOADS TO FAILURE FOR A 3 INCH ASPHALT, E=150,000 PSI, CONCRETE ROAD BY REDUCING TIRE PRESSURE OF A DUAL TIRE SINGLE AXLE LOAD OF 4250 LBS/TIRE.

	E(BASE)=1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT TOTAL
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
FATIGUE FAILURE	E(SG) =2,500 PSI	2,427	1,776	1,223	553	45%	1,204	98%
	E(SG) =5,000 PSI	3,057	2,173	1,466	707	48%	1,591	108%
	E(SG) =10,000 PSI	3,535	2,463	1,640	823	50%	1,894	115%
RUTTING FAILURE	E(SG) =2,500 PSI	429	374	354	20	6%	75	21%
	E(SG) =5,000 PSI	7,262	6,273	5,910	363	6%	1,352	23%
	E(SG) =10,000 PSI	142,189	122,340	115,199	7,140	6%	26,990	23%
	E(BASE)=5,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	12,485	7,501	4,603	2,898	63%	7,882	171%
	E(SG) =5,000 PSI	17,169	9,745	5,761	3,984	69%	11,409	198%
	E(SG) =10,000 PSI	22,287	11,970	6,893	5,077	74%	15,394	223%
RUTTING FAILURE	E(SG) =2,500 PSI	261	225	213	12	6%	48	23%
	E(SG) =5,000 PSI	2,331	1,980	1,861	119	6%	470	25%
	E(SG) =10,000 PSI	29,984	25,165	23,486	1,678	7%	6,498	28%
	E(BASE)=10,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	41,338	21,402	11,970	9,432	79%	29,368	245%
	E(SG) =5,000 PSI	53,868	26,308	14,259	12,050	85%	39,610	278%
	E(SG) =10,000 PSI	68,819	31,683	16,669	15,014	90%	52,150	313%
RUTTING FAILURE	E(SG) =2,500 PSI	515	449	426	23	5%	89	21%
	E(SG) =5,000 PSI	3,200	2,741	2,582	158	6%	617	24%
	E(SG) =10,000 PSI	29,479	24,858	23,298	1,560	7%	6,181	27%
	E(BASE)=20,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	237,200	97,062	46,787	50,274	107%	190,413	407%
	E(SG) =5,000 PSI	272,205	107,241	50,714	56,527	111%	221,491	437%
	E(SG) =10,000 PSI	315,019	119,001	55,160	63,842	116%	259,860	471%
RUTTING FAILURE	E(SG) =2,500 PSI	1,666	1,473	1,404	68	5%	262	19%
	E(SG) =5,000 PSI	7,492	6,504	6,180	324	5%	1,312	21%
	E(SG) =10,000 PSI	47,889	41,012	38,735	2,277	6%	9,154	24%
	E(BASE)=30,000 PSI							
FATIGUE FAILURE	E(SG) =2,500 PSI	966,850	317,576	133,409	184,167	138%	833,441	625%
	E(SG) =5,000 PSI	979,023	319,901	134,242	185,659	138%	844,781	629%
	E(SG) =10,000 PSI	1,013,252	326,742	136,525	190,216	139%	876,726	642%
RUTTING FAILURE	E(SG) =2,500 PSI	3,900	3,478	3,335	143	4%	565	17%
	E(SG) =5,000 PSI	15,057	13,229	12,636	593	5%	2,421	19%
	E(SG) =10,000 PSI	79,382	68,765	65,286	3,479	5%	14,096	22%
				RUTTING AVERAGE =	1,197	6%	4,675	22%
				FATIGUE AVERAGE =	52,082	90%	225,814	331%

NOTE: E(BASE) = ELASTIC MODULUS OF AGGREGATE
E(SG) = ELASTIC MODULUS OF SUBGRADE

TABLE H.10

INCREASE IN LOADS TO FAILURE FOR 1 INCH ASPHALT CONCRETE, E=150,000 PSI, ROAD BY REDUCING TIRE PRESSURE OF A TANDEM AXLE WITH A TIRE LOAD OF 3,250 LBS/TIRE.

	E(BASE)=1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	695	155	69	86	124%	626	907%
	E(SG) =5,000 PSI	861	179	78	102	131%	783	1009%
	E(SG) =10,000 PSI	976	195	83	112	135%	893	1076%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	23	13	10	3	28%	13	130%
	E(SG) =5,000 PSI	426	230	176	54	30%	250	142%
	E(SG) =10,000 PSI	8,839	4,652	3,543	1,109	31%	5,296	149%
	E(BASE)=5,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	30,394	3,506	1,081	2,424	224%	29,312	2711%
	E(SG) =5,000 PSI	37,691	3,976	1,187	2,789	235%	36,503	3075%
	E(SG) =10,000 PSI	44,553	4,374	1,274	3,100	243%	43,278	3398%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	33	17	12	4	35%	21	169%
	E(SG) =5,000 PSI	319	147	105	42	40%	215	205%
	E(SG) =10,000 PSI	4,303	1,844	1,273	571	45%	3,030	238%
	E(BASE)=10,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	562,850	34,199	7,619	26,579	349%	555,208	7287%
	E(SG) =5,000 PSI	539,129	33,044	7,462	25,580	343%	531,645	7125%
	E(SG) =10,000 PSI	476,226	32,577	7,424	25,153	339%	468,783	6315%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	90	46	34	12	35%	55	162%
	E(SG) =5,000 PSI	595	275	195	80	41%	400	205%
	E(SG) =10,000 PSI	5,688	2,382	1,626	757	47%	4,062	250%
	E(BASE)=20,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	3,418,937,901	1,330,456	128,708	1,201,697	934%	3,418,666,989	2656251%
	E(SG) =5,000 PSI	75,243,594	778,739	97,778	680,933	696%	75,142,690	76854%
	E(SG) =10,000 PSI	16,643,199	556,928	81,407	475,501	584%	16,561,103	20344%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	351	191	145	47	32%	206	143%
	E(SG) =5,000 PSI	1,711	832	599	233	39%	1,112	185%
	E(SG) =10,000 PSI	11,505	4,979	3,415	1,564	46%	8,090	237%
	E(BASE)=30,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	36,952,670	39,359,928	1,347,234	38,011,113	2822%	35,603,955	2643%
	E(SG) =5,000 PSI	106,782,016	12,135,455	700,664	11,434,315	1632%	106,076,939	15140%
	E(SG) =10,000 PSI	4,827,894,201	4,876,605	460,863	4,415,559	958%	4,827,232,542	1047477%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	858	489	376	113	30%	482	128%
	E(SG) =5,000 PSI	3,667	1,870	1,368	501	37%	2,299	168%
	E(SG) =10,000 PSI	20,683	9,312	6,465	2,848	44%	14,218	220%
				RUTTING AVERAGE =	529	37%	2,650	182%
				FATIGUE AVERAGE =	3,753,670	650%	565,396,750	256774%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS

E(SG) = SUBGRADE ELASTIC MODULUS

TABLE H.11

INCREASE IN LOADS TO FAILURE FOR 1 INCH ASPHALT CONCRETE, E=150,000 PSI, ROAD BY REDUCING TIRE PRESSURE OF A TANDEM AXLE WITH A TIRE LOAD OF 3,750 LBS/TIRE.

	E(BASE)=1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	589	138	59	79	135%	530	903%
	E(SG) =5,000 PSI	762	162	67	95	142%	696	1044%
	E(SG) =10,000 PSI	891	177	72	106	147%	820	1142%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	15	8	6	2	33%	9	155%
	E(SG) =5,000 PSI	276	138	102	36	35%	174	170%
	E(SG) =10,000 PSI	5,772	2,810	2,061	749	36%	3,711	180%
	E(BASE)=5,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	22,719	3,661	1,063	2,599	245%	21,656	2038%
	E(SG) =5,000 PSI	28,968	4,223	1,180	3,043	258%	27,787	2355%
	E(SG) =10,000 PSI	34,941	4,718	1,279	3,438	269%	33,660	2631%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	22	10	7	3	41%	15	201%
	E(SG) =5,000 PSI	217	92	62	29	47%	155	248%
	E(SG) =10,000 PSI	3,001	1,164	767	397	52%	2,234	291%
	E(BASE)=10,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	349,606	41,627	8,448	33,178	393%	341,144	4039%
	E(SG) =5,000 PSI	313,246	39,826	8,246	31,579	383%	304,987	3699%
	E(SG) =10,000 PSI	293,403	39,047	8,181	30,866	377%	285,211	3487%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	58	28	20	8	40%	38	190%
	E(SG) =5,000 PSI	402	171	117	55	47%	286	245%
	E(SG) =10,000 PSI	3,975	1,515	984	531	54%	2,991	304%
	E(BASE)=20,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	890,150,940	2,802,568	188,154	2,614,306	1390%	889,925,768	472997%
	E(SG) =5,000 PSI	35,493,783	1,493,861	143,504	1,350,302	941%	35,348,809	24634%
	E(SG) =10,000 PSI	8,797,446	841,440	106,620	734,790	689%	8,690,465	8151%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	223	115	84	31	36%	139	164%
	E(SG) =5,000 PSI	1,131	513	356	157	44%	775	218%
	E(SG) =10,000 PSI	7,928	3,142	2,065	1,077	52%	5,862	284%
	E(BASE)=30,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	24,252,656	25,307,708	3,024,378	22,282,403	737%	21,227,395	702%
	E(SG) =5,000 PSI	70,449,186	39,581,218	1,201,180	38,378,442	3195%	69,245,126	5765%
	E(SG) =10,000 PSI	439,042,352	9,872,066	689,953	9,181,730	1331%	438,334,166	63534%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	539	292	218	74	34%	320	147%
	E(SG) =5,000 PSI	2,388	1,143	807	336	42%	1,581	196%
	E(SG) =10,000 PSI	14,006	5,840	3,890	1,950	50%	10,116	260%
				RUTTING AVERAGE =	362	43%	1,894	217%
				FATIGUE AVERAGE =	4,976,464	709%	97,585,881	39808%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE H.12
INCREASE IN LOADS TO FAILURE FOR 1 INCH ASPHALT CONCRETE, E=150,000 PSI, ROAD BY REDUCING TIRE PRESSURE OF A TANDEM AXLE WITH A TIRE LOAD OF 4,250 LBS/TIRE.

		E(BASE)=1,000 PSI			100 PSI TO	PERCENT	100 PSI TO	PERCENT
	TIRE PRESSURE	40PSI	70 PSI	100 PSI	70 PSI	INCREASE	40 PSI	INCREASE
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	445	127	52	75	143%	393	756%
	E(SG) =5,000 PSI	579	150	60	91	152%	519	871%
	E(SG) =10,000 PSI	677	167	65	102	158%	613	948%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	10	5	4	1	37%	6	181%
	E(SG) =5,000 PSI	192	89	64	25	40%	128	200%
	E(SG) =10,000 PSI	4,062	1,831	1,295	537	41%	2,767	214%
		E(BASE)=5,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	16,489	3,884	1,067	2,816	264%	15,421	1445%
	E(SG) =5,000 PSI	20,965	4,562	1,199	3,362	280%	19,765	1648%
	E(SG) =10,000 PSI	25,201	5,169	1,311	3,858	294%	23,889	1822%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	15	7	5	2	46%	11	234%
	E(SG) =5,000 PSI	158	61	40	21	53%	118	293%
	E(SG) =10,000 PSI	2,244	794	499	294	59%	1,744	349%
		E(BASE)=10,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	243,273	51,116	9,556	41,558	435%	233,708	2446%
	E(SG) =5,000 PSI	216,813	48,322	9,268	39,052	421%	207,536	2239%
	E(SG) =10,000 PSI	202,178	47,064	9,166	37,896	413%	193,004	2106%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	41	18	13	6	44%	28	218%
	E(SG) =5,000 PSI	291	115	75	40	53%	215	287%
	E(SG) =10,000 PSI	2,978	1,039	644	395	61%	2,334	362%
		E(BASE)=20,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	44,288,408	6,907,687	286,554	6,620,857	2311%	44,000,024	15355%
	E(SG) =5,000 PSI	20,921,773	2,393,622	183,427	2,210,103	1205%	20,737,484	11306%
	E(SG) =10,000 PSI	5,461,634	1,273,833	137,989	1,135,796	823%	5,323,423	3858%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	152	75	53	22	40%	99	186%
	E(SG) =5,000 PSI	801	342	229	113	49%	573	251%
	E(SG) =10,000 PSI	5,823	2,145	1,348	796	59%	4,475	332%
		E(BASE)=30,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	17,476,879	16,376,859	8,289,947	8,086,575	98%	9,186,550	111%
	E(SG) =5,000 PSI	51,669,859	49,790,090	2,194,053	47,594,057	2169%	49,473,748	2255%
	E(SG) =10,000 PSI	340,430,475	22,047,837	1,056,416	20,990,548	1987%	339,359,943	32125%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	362	188	137	51	37%	225	164%
	E(SG) =5,000 PSI	1,662	752	515	237	46%	1,147	223%
	E(SG) =10,000 PSI	10,149	3,943	2,532	1,411	56%	7,617	301%
				RUTTING AVERAGE =	263	48%	1,433	253%
				FATIGUE AVERAGE =	5,784,450	744%	31,251,735	5286%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE H.13

INCREASE IN LOADS TO FAILURE FOR 1 INCH ASPHALT CONCRETE, E=1,000,000 PSI, ROAD BY REDUCING TIRE PRESSURE OF A TANDEM AXLE WITH A TIRE LOAD OF 3,250 LBS/TIRE.

	E(BASE)=1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) = 2,500 PSI	2,463	1,137	702	435	62%	1,761	251%
	E(SG) = 5,000 PSI	3,374	1,435	860	576	67%	2,514	292%
	E(SG) =10,000 PSI	4,129	1,658	975	683	70%	3,155	324%
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	150	131	125	6	5%	25	20%
	E(SG) = 5,000 PSI	2,831	2,471	2,348	123	5%	483	21%
	E(SG) =10,000 PSI	59,923	52,080	48,504	3,576	7%	11,419	24%
	E(BASE)=5,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) = 2,500 PSI	15,911	5,125	2,717	2,408	89%	13,194	486%
	E(SG) = 5,000 PSI	24,760	7,097	3,566	3,531	99%	21,194	594%
	E(SG) =10,000 PSI	35,802	9,250	4,439	4,811	108%	31,363	707%
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	118	78	66	13	19%	52	79%
	E(SG) = 5,000 PSI	1,171	736	602	135	22%	570	95%
	E(SG) =10,000 PSI	16,388	9,784	7,828	1,956	25%	8,560	109%
	E(BASE)=10,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) = 2,500 PSI	52,916	14,289	6,834	7,455	109%	46,081	674%
	E(SG) = 5,000 PSI	79,264	18,969	8,607	10,362	120%	70,657	821%
	E(SG) =10,000 PSI	117,136	24,760	10,659	14,101	132%	106,477	999%
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	214	139	115	0	0%	75	54%
	E(SG) = 5,000 PSI	1,460	878	704	174	25%	756	107%
	E(SG) =10,000 PSI	14,415	8,080	6,273	1,807	29%	8,142	130%
	E(BASE)=20,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) = 2,500 PSI	298,289	60,945	24,730	36,215	146%	273,559	1106%
	E(SG) = 5,000 PSI	399,403	73,683	28,649	45,033	157%	370,754	1294%
	E(SG) =10,000 PSI	554,547	90,697	33,644	57,053	170%	520,903	1548%
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	652	420	345	75	22%	307	89%
	E(SG) = 5,000 PSI	3,142	1,861	1,476	385	26%	1,667	113%
	E(SG) =10,000 PSI	21,010	11,426	8,726	2,701	31%	12,285	141%
	E(BASE)=30,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) = 2,500 PSI	1,191,362	186,610	65,612	120,998	184%	1,125,750	1716%
	E(SG) = 5,000 PSI	1,439,774	209,522	71,474	138,049	193%	1,368,300	1914%
	E(SG) =10,000 PSI	1,824,468	241,759	79,540	162,219	204%	1,744,928	2194%
LOADS TO RUTTING FAILURE	E(SG) = 2,500 PSI	1,515	980	806	175	22%	709	88%
	E(SG) = 5,000 PSI	6,217	3,697	2,926	771	26%	3,291	112%
	E(SG) =10,000 PSI	33,832	18,278	13,905	4,373	31%	19,927	143%
				RUTTING AVERAGE =	1,085	20%	4,551	88%
				FATIGUE AVERAGE =	40,262	127%	380,039	995%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS

E(SG) = SUBGRADE ELASTIC MODULUS

TABLE H.14

INCREASE IN LOADS TO FAILURE FOR 1 INCH ASPHALT CONCRETE, E=1,000,000 PSI, ROAD BY REDUCING TIRE PRESSURE OF A TANDEM AXLE WITH A TIRE LOAD OF 3,750 LBS/TIRE.

	E(BASE)=1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	1,717	875	529	346	65%	1,188	224%
	E(SG) =5,000 PSI	2,369	1,118	655	463	71%	1,713	262%
	E(SG) =10,000 PSI	2,912	1,304	749	555	74%	2,163	289%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	83	71	67	4	6%	16	23%
	E(SG) =5,000 PSI	1,569	1,337	1,257	79	6%	312	25%
	E(SG) =10,000 PSI	33,247	28,143	26,548	1,595	6%	6,699	25%
	E(BASE)=5,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	11,125	4,202	2,174	2,027	93%	8,950	412%
	E(SG) =5,000 PSI	18,435	5,967	2,912	3,055	105%	15,523	533%
	E(SG) =10,000 PSI	28,395	7,952	3,683	4,269	116%	24,712	671%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	67	45	37	8	22%	30	82%
	E(SG) =5,000 PSI	721	428	341	87	26%	381	112%
	E(SG) =10,000 PSI	10,286	5,755	4,473	1,281	29%	5,813	130%
	E(BASE)=10,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	38,197	12,253	5,685	6,568	116%	32,512	572%
	E(SG) =5,000 PSI	60,701	16,690	7,299	9,391	129%	53,402	732%
	E(SG) =10,000 PSI	95,977	22,370	9,216	13,154	143%	86,761	941%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	130	80	65	16	24%	65	100%
	E(SG) =5,000 PSI	908	516	402	114	28%	506	126%
	E(SG) =10,000 PSI	9,191	4,812	3,619	1,193	33%	5,573	154%
	E(BASE)=20,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	216,008	55,995	21,939	34,056	155%	194,068	885%
	E(SG) =5,000 PSI	301,018	69,177	25,799	43,377	168%	275,218	1067%
	E(SG) =10,000 PSI	438,594	87,256	30,814	56,442	183%	407,780	1323%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	396	244	195	48	25%	200	103%
	E(SG) =5,000 PSI	1,962	1,097	845	252	30%	1,117	132%
	E(SG) =10,000 PSI	13,514	6,849	5,065	1,784	35%	8,449	167%
	E(BASE)=30,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	843,446	182,875	61,485	121,390	197%	781,961	1272%
	E(SG) =5,000 PSI	1,042,171	208,304	67,699	140,605	208%	974,472	1439%
	E(SG) =10,000 PSI	1,364,014	245,029	76,374	168,654	221%	1,287,640	1686%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	917	569	456	113	25%	461	101%
	E(SG) =5,000 PSI	3,869	2,180	1,677	503	30%	2,192	131%
	E(SG) =10,000 PSI	21,684	11,005	8,080	2,925	36%	13,604	168%
RUTTING AVERAGE =					667	24%	3,028	105%
FATIGUE AVERAGE =					40,290	136%	276,538	820%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS

E(SG) = SUBGRADE ELASTIC MODULUS

TABLE H.15
INCREASE IN LOADS TO FAILURE FOR 1 INCH ASPHALT CONCRETE, E=1,000,000 PSI, ROAD BY REDUCING TIRE PRESSURE OF A TANDEM AXLE WITH A TIRE LOAD OF 4,250 LBS/TIRE.

		E(BASE)=1,000 PSI			100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	1,265	704	415	289	70%	850	205%
	E(SG) =5,000 PSI	1,755	911	519	391	75%	1,236	238%
	E(SG) =10,000 PSI	2,168	1,072	598	474	79%	1,570	263%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	50	42	39	3	7%	11	28%
	E(SG) =5,000 PSI	942	783	731	52	7%	212	29%
	E(SG) =10,000 PSI	20,047	16,511	15,391	1,119	7%	4,656	30%
		E(BASE)=5,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	8,287	3,567	1,799	1,768	98%	6,489	361%
	E(SG) =5,000 PSI	13,856	5,192	2,456	2,736	111%	11,400	464%
	E(SG) =10,000 PSI	21,506	7,071	3,156	3,914	124%	18,350	581%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	40	28	22	6	25%	17	78%
	E(SG) =5,000 PSI	456	269	209	60	29%	247	118%
	E(SG) =10,000 PSI	6,934	3,657	2,761	896	32%	4,173	151%
		E(BASE)=10,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	28,269	10,811	4,887	5,924	121%	23,382	478%
	E(SG) =5,000 PSI	45,238	15,107	6,394	8,713	136%	38,844	607%
	E(SG) =10,000 PSI	71,896	20,769	8,226	12,543	152%	63,670	774%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	80	50	40	11	27%	40	101%
	E(SG) =5,000 PSI	608	327	248	79	32%	360	145%
	E(SG) =10,000 PSI	6,292	3,094	2,260	835	37%	4,032	178%
		E(BASE)=20,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	158,426	52,632	19,985	32,647	163%	138,442	693%
	E(SG) =5,000 PSI	221,701	66,371	23,875	42,496	178%	197,826	829%
	E(SG) =10,000 PSI	324,067	85,866	29,018	56,848	196%	295,049	1017%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	253	152	119	33	28%	134	112%
	E(SG) =5,000 PSI	1,314	699	524	175	33%	790	151%
	E(SG) =10,000 PSI	9,343	4,449	3,183	1,265	40%	6,160	194%
		E(BASE)=30,000 PSI						
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	614,069	182,262	58,983	123,279	209%	555,086	941%
	E(SG) =5,000 PSI	759,217	210,503	65,612	144,891	221%	693,605	1057%
	E(SG) =10,000 PSI	994,160	252,678	74,949	177,729	237%	919,211	1226%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	588	355	279	76	27%	309	111%
	E(SG) =5,000 PSI	2,589	1,386	1,041	345	33%	1,548	149%
	E(SG) =10,000 PSI	15,002	7,151	5,094	2,057	40%	9,908	195%
				RUTTING AVERAGE =	468	27%	2,173	118%
				FATIGUE AVERAGE =	40,976	145%	197,667	649%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE H.16

INCREASE IN LOADS TO FAILURE FOR 2 INCH ASPHALT CONCRETE, E=150,000 PSI, ROAD BY REDUCING TIRE PRESSURE OF A TANDEM AXLE WITH A TIRE LOAD OF 3,250 LBS/TIRE.

	E(BASE)=1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	1,849	895	558	337	60%	1,291	231%
	E(SG) =5,000 PSI	2,459	1,106	671	435	65%	1,787	266%
	E(SG) =10,000 PSI	2,950	1,501	838	663	79%	2,112	252%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	182	160	152	8	5%	30	19%
	E(SG) =5,000 PSI	3,344	2,918	2,775	143	5%	569	21%
	E(SG) =10,000 PSI	69,402	60,371	57,261	3,111	5%	12,141	21%
	E(BASE)=5,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	14,578	4,815	2,547	2,268	89%	12,031	472%
	E(SG) =5,000 PSI	21,122	6,271	3,180	3,090	97%	17,941	564%
	E(SG) =10,000 PSI	28,321	7,760	3,794	3,965	105%	24,527	646%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	160	116	98	17	18%	62	63%
	E(SG) =5,000 PSI	1,615	1,054	877	177	20%	738	84%
	E(SG) =10,000 PSI	21,943	13,659	11,156	2,503	22%	10,787	97%
	E(BASE)=10,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	60,987	16,162	7,619	8,543	112%	53,368	700%
	E(SG) =5,000 PSI	81,364	19,777	8,967	10,810	121%	72,396	807%
	E(SG) =10,000 PSI	106,434	23,773	10,402	13,371	129%	96,032	923%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	323	216	183	32	18%	140	77%
	E(SG) =5,000 PSI	2,140	1,357	1,102	255	23%	1,038	94%
	E(SG) =10,000 PSI	20,522	12,117	9,624	2,493	26%	10,898	113%
	E(BASE)=20,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	515,243	93,950	36,214	57,736	159%	479,030	1323%
	E(SG) =5,000 PSI	579,424	101,288	38,370	62,918	164%	541,054	1410%
	E(SG) =10,000 PSI	661,746	110,163	40,926	69,237	169%	620,819	1517%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	994	668	559	109	20%	435	78%
	E(SG) =5,000 PSI	4,771	2,971	2,406	565	23%	2,366	98%
	E(SG) =10,000 PSI	31,564	18,140	14,208	3,931	28%	17,355	122%
	E(BASE)=30,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	3,237,596	383,340	121,391	261,949	216%	3,116,205	2567%
	E(SG) =5,000 PSI	2,995,429	368,608	118,148	250,460	212%	2,877,281	2435%
	E(SG) =10,000 PSI	2,865,007	360,606	116,395	244,212	210%	2,748,612	2361%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	2,233	1,512	1,265	246	19%	968	76%
	E(SG) =5,000 PSI	9,312	5,823	4,718	1,105	23%	4,595	97%
	E(SG) =10,000 PSI	50,772	29,231	22,835	6,395	28%	27,937	122%
				RUTTING AVERAGE =	1,406	19%	6,004	79%
				FATIGUE AVERAGE =	66,000	132%	710,966	1098%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS

E(SG) = SUBGRADE ELASTIC MODULUS

TABLE H.17

INCREASE IN LOADS TO FAILURE FOR 2 INCH ASPHALT CONCRETE, E=150,000 PSI, ROAD BY REDUCING TIRE PRESSURE OF A TANDEM AXLE WITH A TIRE LOAD OF 3,750 LBS/TIRE.

	E(BASE)=1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	1,279	685	419	266	63%	860	205%
	E(SG) =5,000 PSI	1,709	857	510	347	68%	1,199	235%
	E(SG) =10,000 PSI	2,058	987	576	411	71%	1,482	257%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	100	86	82	5	6%	19	23%
	E(SG) =5,000 PSI	1,853	1,579	1,485	94	6%	367	25%
	E(SG) =10,000 PSI	38,526	32,674	30,762	1,912	6%	7,764	25%
	E(BASE)=5,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	10,109	3,942	2,040	1,902	93%	8,070	396%
	E(SG) =5,000 PSI	15,196	5,242	2,585	2,656	103%	12,610	488%
	E(SG) =10,000 PSI	21,379	6,605	3,124	3,481	111%	18,255	584%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	88	66	55	11	20%	33	60%
	E(SG) =5,000 PSI	939	608	493	115	23%	445	90%
	E(SG) =10,000 PSI	13,514	7,953	6,330	1,623	26%	7,184	113%
	E(BASE)=10,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	43,846	13,948	6,380	7,569	119%	37,466	587%
	E(SG) =5,000 PSI	61,047	17,366	7,619	9,747	128%	53,428	701%
	E(SG) =10,000 PSI	83,624	21,250	8,943	12,307	138%	74,682	835%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	185	125	103	22	22%	82	80%
	E(SG) =5,000 PSI	1,311	785	625	160	26%	687	110%
	E(SG) =10,000 PSI	12,815	7,129	5,507	1,621	29%	7,307	133%
	E(BASE)=20,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	387,309	88,494	32,763	55,731	170%	354,546	1082%
	E(SG) =5,000 PSI	444,941	96,244	34,926	61,318	176%	410,014	1174%
	E(SG) =10,000 PSI	520,593	105,696	37,500	68,195	182%	483,093	1288%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	595	384	314	70	22%	281	90%
	E(SG) =5,000 PSI	2,926	1,731	1,368	362	26%	1,557	114%
	E(SG) =10,000 PSI	19,892	10,746	8,157	2,589	32%	11,735	144%
	E(BASE)=30,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	2,534,820	396,437	118,148	278,289	236%	2,416,672	2045%
	E(SG) =5,000 PSI	2,337,239	378,453	114,471	263,982	231%	2,222,768	1942%
	E(SG) =10,000 PSI	2,232,834	368,920	112,522	256,398	228%	2,120,311	1884%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	1,331	867	711	156	22%	620	87%
	E(SG) =5,000 PSI	5,688	3,397	2,680	717	27%	3,008	112%
	E(SG) =10,000 PSI	31,975	17,334	13,135	4,199	32%	18,840	143%
				RUTTING AVERAGE =	910	22%	3,995	90%
				FATIGUE AVERAGE =	68,173	141%	547,697	914%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE H.18
INCREASE IN LOADS TO FAILURE FOR 2 INCH ASPHALT CONCRETE, E=150,000 PSI, ROAD BY REDUCING TIRE PRESSURE OF A TANDEM AXLE WITH A TIRE LOAD OF 4,250 LBS/TIRE.

	E(BASE)=1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	946	547	328	219	67%	617	188%
	E(SG) =5,000 PSI	1,272	693	403	290	72%	869	215%
	E(SG) =10,000 PSI	1,535	803	458	345	75%	1,077	235%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	60	51	47	3	7%	13	27%
	E(SG) =5,000 PSI	1,113	926	863	63	7%	250	29%
	E(SG) =10,000 PSI	23,205	19,138	17,866	1,272	7%	5,339	30%
	E(BASE)=5,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	7,521	3,338	1,692	1,645	97%	5,828	344%
	E(SG) =5,000 PSI	11,381	4,532	2,181	2,351	108%	9,200	422%
	E(SG) =10,000 PSI	16,109	5,788	2,670	3,119	117%	13,439	503%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	52	41	33	7	23%	19	57%
	E(SG) =5,000 PSI	559	379	301	78	26%	258	86%
	E(SG) =10,000 PSI	8,476	5,007	3,879	1,128	29%	4,597	118%
	E(BASE)=10,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	32,577	12,372	5,519	6,853	124%	27,058	490%
	E(SG) =5,000 PSI	45,601	15,694	6,672	9,023	135%	38,930	584%
	E(SG) =10,000 PSI	62,753	19,518	7,946	11,572	146%	54,808	690%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	109	77	62	15	24%	47	75%
	E(SG) =5,000 PSI	832	493	383	110	29%	449	117%
	E(SG) =10,000 PSI	8,670	4,549	3,415	1,134	33%	5,255	154%
	E(BASE)=20,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	287,907	85,085	30,406	54,678	180%	257,501	847%
	E(SG) =5,000 PSI	331,046	93,375	32,617	60,757	186%	298,429	915%
	E(SG) =10,000 PSI	387,976	103,580	35,275	68,305	194%	352,700	1000%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	349	238	191	47	25%	158	83%
	E(SG) =5,000 PSI	1,935	1,093	840	252	30%	1,095	130%
	E(SG) =10,000 PSI	13,466	6,891	5,079	1,812	36%	8,386	165%
	E(BASE)=30,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	1,892,101	417,382	117,583	299,799	255%	1,774,518	1509%
	E(SG) =5,000 PSI	1,737,571	395,409	113,458	281,951	249%	1,624,113	1431%
	E(SG) =10,000 PSI	1,655,347	383,669	111,269	272,400	245%	1,544,078	1388%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	782	537	432	105	24%	350	81%
	E(SG) =5,000 PSI	3,736	2,140	1,647	492	30%	2,089	127%
	E(SG) =10,000 PSI	21,684	11,118	8,183	2,934	36%	13,500	165%
				RUTTING AVERAGE =	630	24%	2,787	96%
				FATIGUE AVERAGE =	71,554	150%	400,211	717%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE H.19

INCREASE IN LOADS TO FAILURE FOR 2 INCH ASPHALT CONCRETE, E=1,000,000 PSI, ROAD BY REDUCING TIRE PRESSURE OF A TANDEM AXLE WITH A TIRE LOAD OF 3,250 LBS/TIRE.

	E(BASE)=1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	20,721	14,857	10,878	3,978	37%	9,843	90%
	E(SG) =5,000 PSI	26,879	18,611	13,371	5,240	39%	13,508	101%
	E(SG) =10,000 PSI	32,284	21,785	15,429	6,356	41%	16,855	109%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	4,351	3,954	3,807	146	4%	544	14%
	E(SG) =5,000 PSI	67,719	60,945	58,487	2,458	4%	9,232	16%
	E(SG) =10,000 PSI	1,265,389	1,133,158	1,084,622	48,537	4%	180,767	17%
	E(BASE)=5,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	47,602	30,357	21,158	9,198	43%	26,443	125%
	E(SG) =5,000 PSI	73,683	43,494	29,279	14,214	49%	44,404	152%
	E(SG) =10,000 PSI	110,730	60,217	39,142	21,075	54%	71,588	183%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	1,348	1,219	1,171	47	4%	177	15%
	E(SG) =5,000 PSI	11,786	10,531	10,082	449	4%	1,704	17%
	E(SG) =10,000 PSI	148,881	131,575	125,523	6,052	5%	23,358	19%
	E(BASE)=10,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	86,635	50,548	33,893	16,655	49%	52,742	156%
	E(SG) =5,000 PSI	134,034	71,715	46,281	25,434	55%	87,753	190%
	E(SG) =10,000 PSI	210,996	101,761	63,043	38,718	61%	147,953	235%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	1,681	1,525	1,473	52	4%	208	14%
	E(SG) =5,000 PSI	10,967	9,850	9,467	383	4%	1,501	16%
	E(SG) =10,000 PSI	104,181	92,630	88,634	3,996	5%	15,547	18%
	E(BASE)=20,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	214,488	109,044	69,004	40,040	58%	145,484	211%
	E(SG) =5,000 PSI	313,502	146,023	89,075	56,948	64%	224,427	252%
	E(SG) =10,000 PSI	482,952	201,187	117,596	83,591	71%	365,356	311%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	3,379	3,102	3,009	94	3%	371	12%
	E(SG) =5,000 PSI	16,885	15,335	14,625	710	5%	2,259	15%
	E(SG) =10,000 PSI	117,138	103,540	90,383	13,157	15%	26,755	30%
	E(BASE)=30,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	445,062	202,118	120,998	81,120	67%	324,064	268%
	E(SG) =5,000 PSI	617,059	258,058	149,119	108,938	73%	467,940	314%
	E(SG) =10,000 PSI	909,774	341,031	189,156	151,875	80%	720,618	381%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	6,292	5,823	5,605	218	4%	687	12%
	E(SG) =5,000 PSI	27,560	25,062	22,206	2,856	13%	5,354	24%
	E(SG) =10,000 PSI	159,656	130,490	113,105	17,385	15%	46,551	41%
				RUTTING AVERAGE =	6,436	6%	21,001	19%
				FATIGUE AVERAGE =	44,225	56%	181,265	205%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE H.20

INCREASE IN LOADS TO FAILURE FOR 2 INCH ASPHALT CONCRETE, E=1,000,000 PSI, ROAD BY REDUCING TIRE PRESSURE OF A TANDEM AXLE WITH A TIRE LOAD OF 3,750 LBS/TIRE.

	E(BASE)=1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	17,626	13,378	9,779	3,599	37%	7,848	80%
	E(SG) =5,000 PSI	22,867	16,845	12,073	4,771	40%	10,794	89%
	E(SG) =10,000 PSI	27,476	19,792	13,984	5,808	42%	13,492	96%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	2,889	2,589	2,477	112	5%	412	17%
	E(SG) =5,000 PSI	44,742	39,691	37,789	1,902	5%	6,953	18%
	E(SG) =10,000 PSI	833,056	734,504	698,630	35,875	5%	134,427	19%
	E(BASE)=5,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	38,842	26,879	18,684	8,196	44%	20,158	108%
	E(SG) =5,000 PSI	60,169	39,006	26,121	12,885	49%	34,048	130%
	E(SG) =10,000 PSI	90,533	54,702	35,342	19,360	55%	55,191	156%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	863	767	734	34	5%	130	18%
	E(SG) =5,000 PSI	7,492	6,563	6,254	309	5%	1,238	20%
	E(SG) =10,000 PSI	93,804	81,298	76,953	4,345	6%	16,852	22%
	E(BASE)=10,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	67,924	44,001	29,563	14,438	49%	38,361	130%
	E(SG) =5,000 PSI	105,270	63,350	40,922	22,429	55%	64,349	157%
	E(SG) =10,000 PSI	165,774	91,440	56,612	34,828	62%	109,162	193%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	1,043	933	896	38	4%	147	16%
	E(SG) =5,000 PSI	6,787	5,980	5,704	276	5%	1,083	19%
	E(SG) =10,000 PSI	64,045	55,738	52,915	2,823	5%	11,130	21%
	E(BASE)=20,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	160,482	93,544	59,312	34,232	58%	101,170	171%
	E(SG) =5,000 PSI	235,387	127,426	77,768	49,658	64%	157,619	203%
	E(SG) =10,000 PSI	363,150	178,839	104,378	74,460	71%	258,772	248%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	2,027	1,831	1,766	65	4%	261	15%
	E(SG) =5,000 PSI	10,115	9,043	8,670	373	4%	1,446	17%
	E(SG) =10,000 PSI	69,903	61,618	56,369	5,249	9%	13,534	24%
	E(BASE)=30,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	320,636	170,920	102,913	68,007	66%	217,723	212%
	E(SG) =5,000 PSI	446,371	221,964	128,973	92,992	72%	317,398	246%
	E(SG) =10,000 PSI	660,987	299,454	166,678	132,776	80%	494,309	297%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	3,687	3,362	3,258	103	3%	429	13%
	E(SG) =5,000 PSI	16,147	14,572	13,610	962	7%	2,536	19%
	E(SG) =10,000 PSI	93,548	81,601	69,831	11,770	17%	23,716	34%
				RUTTING AVERAGE =	4,282	6%	14,286	19%
				FATIGUE AVERAGE =	38,563	56%	126,693	168%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS

E(SG) = SUBGRADE ELASTIC MODULUS

TABLE H.21

INCREASE IN LOADS TO FAILURE FOR 2 INCH ASPHALT CONCRETE, E=1,000,000 PSI, ROAD BY REDUCING TIRE PRESSURE OF A TANDEM AXLE WITH A TIRE LOAD OF 4,250 LBS/TIRE.

					100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	E(BASE)=1,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	10,072	7,612	5,672	1,940	34%	4,400	78%
	E(SG) =5,000 PSI	13,190	9,663	7,085	2,577	36%	6,105	86%
	E(SG) =10,000 PSI	15,954	11,736	8,258	3,478	42%	7,695	93%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	1,404	1,234	1,174	60	5%	230	20%
	E(SG) =5,000 PSI	21,943	19,138	18,071	1,067	6%	3,872	21%
	E(SG) =10,000 PSI	412,243	355,829	336,031	19,798	6%	76,212	23%
	E(BASE)=5,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	23,350	16,808	11,444	5,364	47%	11,905	104%
	E(SG) =5,000 PSI	36,695	24,851	16,247	8,604	53%	20,449	126%
	E(SG) =10,000 PSI	55,995	35,462	22,291	13,171	59%	33,704	151%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	436	381	362	20	5%	75	21%
	E(SG) =5,000 PSI	3,848	3,309	3,118	191	6%	730	23%
	E(SG) =10,000 PSI	49,060	41,521	38,980	2,541	7%	10,080	26%
	E(BASE)=10,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	42,563	28,723	18,895	9,828	52%	23,668	125%
	E(SG) =5,000 PSI	66,865	42,107	26,530	15,577	59%	40,335	152%
	E(SG) =10,000 PSI	106,881	61,982	37,256	24,726	66%	69,625	187%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	542	476	453	23	5%	89	20%
	E(SG) =5,000 PSI	3,571	3,086	2,926	161	5%	645	22%
	E(SG) =10,000 PSI	34,279	29,107	27,445	1,662	6%	6,834	25%
	E(BASE)=20,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	106,475	65,290	40,147	25,144	63%	66,329	165%
	E(SG) =5,000 PSI	157,749	90,288	53,242	37,046	70%	104,507	196%
	E(SG) =10,000 PSI	246,836	129,233	72,445	56,788	78%	174,392	241%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	1,086	965	924	41	4%	162	18%
	E(SG) =5,000 PSI	5,475	4,785	4,562	223	5%	914	20%
	E(SG) =10,000 PSI	38,250	32,959	29,984	2,975	10%	8,266	28%
	E(BASE)=30,000 PSI							
	TIRE PRESSURE	40 PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	220,913	125,653	73,371	52,282	71%	147,542	201%
	E(SG) =5,000 PSI	310,217	165,234	92,780	72,455	78%	217,437	234%
	E(SG) =10,000 PSI	463,847	226,776	121,237	105,539	87%	342,610	283%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	2,008	1,803	1,734	68	4%	274	16%
	E(SG) =5,000 PSI	8,868	7,853	7,285	568	8%	1,583	22%
	E(SG) =10,000 PSI	51,781	45,056	37,621	7,435	20%	14,160	38%
				RUTTING AVERAGE =	2,455	7%	8,275	23%
				FATIGUE AVERAGE =	28,968	60%	84,714	161%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE H.22

INCREASE IN LOADS TO FAILURE FOR A 3 INCH ASPHALT CONCRETE, E=150,000 PSI, ROAD BY REDUCING TIRE PRESSURE OF A TANDEM AXLE WITH A TIRE LOAD OF 3,250 LBS/TIRE.

		E(BASE)=1000 PSI			100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	5,205	3,365	2,370	995	42%	2,836	120%
	E(SG) =5,000 PSI	6,271	3,942	2,731	1,211	44%	3,540	130%
	E(SG) =10,000 PSI	7,089	4,355	2,991	1,364	46%	4,098	137%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	1,450	1,303	1,249	54	4%	201	16%
	E(SG) =5,000 PSI	23,965	21,428	20,442	986	5%	3,524	17%
	E(SG) =10,000 PSI	463,664	411,929	392,990	18,939	5%	70,675	18%
		E(BASE)=5,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	26,479	13,150	8,268	4,881	59%	18,210	220%
	E(SG) =5,000 PSI	34,840	16,215	9,939	6,276	63%	24,901	251%
	E(SG) =10,000 PSI	44,099	19,290	11,551	7,739	67%	32,549	282%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	867	774	742	33	4%	125	17%
	E(SG) =5,000 PSI	7,539	6,664	6,349	315	5%	1,190	19%
	E(SG) =10,000 PSI	94,373	82,607	78,465	4,142	5%	15,907	20%
		E(BASE)=10,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	86,578	34,840	20,168	14,672	73%	66,410	329%
	E(SG) =5,000 PSI	108,246	40,855	23,111	17,744	77%	85,135	368%
	E(SG) =10,000 PSI	134,829	47,579	26,308	21,271	81%	108,521	412%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	1,711	1,542	1,482	59	4%	229	15%
	E(SG) =5,000 PSI	10,495	9,343	8,926	417	5%	1,570	18%
	E(SG) =10,000 PSI	93,959	82,695	78,755	3,940	5%	15,204	19%
		E(BASE)=20,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	464,220	138,076	70,166	67,909	97%	394,054	562%
	E(SG) =5,000 PSI	514,760	148,639	74,535	74,103	99%	440,225	591%
	E(SG) =10,000 PSI	578,861	161,445	79,816	81,629	102%	499,045	625%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	5,444	4,965	4,798	166	3%	645	13%
	E(SG) =5,000 PSI	24,858	22,384	21,513	871	4%	3,345	16%
	E(SG) =10,000 PSI	156,057	139,148	133,301	5,847	4%	22,756	17%
		E(BASE)=30,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	1,653,136	393,024	178,853	214,171	120%	1,474,283	824%
	E(SG) =5,000 PSI	1,673,173	396,437	180,074	216,363	120%	1,493,099	829%
	E(SG) =10,000 PSI	1,725,837	405,141	183,301	221,840	121%	1,542,536	842%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	12,460	11,465	11,118	348	3%	1,342	12%
	E(SG) =5,000 PSI	62,959	45,499	43,940	1,560	4%	19,019	43%
	E(SG) =10,000 PSI	261,980	235,866	214,982	20,884	10%	46,998	22%
				AVERAGE FOR RUTTING =	3,904	5%	13,515	19%
				AVERAGE FOR FATIGUE =	5,619	81%	19,428	435%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE H.23

INCREASE IN LOADS TO FAILURE FOR A 3 INCH ASPHALT CONCRETE, E=150,000 PSI ROAD BY REDUCING TIRE PRESSURE OF A TANDEM AXLE WITH A TIRE LOAD OF 3,750 LBS/TIRE.

E(AC)=150,000 PSI		E(BASE)=1,000 PSI			100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	3,535	2,445	1,698	747	44%	1,837	108%
	E(SG) =5,000 PSI	4,279	2,877	1,967	910	46%	2,312	118%
	E(SG) =10,000 PSI	4,837	3,193	2,162	1,031	48%	2,675	124%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	794	702	668	34	5%	126	19%
	E(SG) =5,000 PSI	13,135	11,545	10,930	614	6%	2,205	20%
	E(SG) =10,000 PSI	254,696	222,076	210,360	11,715	6%	44,336	21%
		E(BASE)=5,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	18,229	9,995	6,179	3,816	62%	12,050	195%
	E(SG) =5,000 PSI	24,109	12,485	7,482	5,003	67%	16,627	222%
	E(SG) =10,000 PSI	30,661	15,002	8,797	6,205	71%	21,864	249%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	475	417	397	21	5%	78	20%
	E(SG) =5,000 PSI	4,152	3,590	3,397	193	6%	755	22%
	E(SG) =10,000 PSI	52,181	44,680	42,076	2,604	6%	10,105	24%
		E(BASE)=10,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	59,835	27,565	15,593	11,972	77%	44,242	284%
	E(SG) =5,000 PSI	75,160	32,683	18,002	14,681	82%	57,158	318%
	E(SG) =10,000 PSI	94,055	38,484	20,670	17,814	86%	73,385	355%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	937	829	791	38	5%	146	18%
	E(SG) =5,000 PSI	5,772	5,036	4,771	265	6%	1,000	21%
	E(SG) =10,000 PSI	51,880	44,659	42,192	2,467	6%	9,688	23%
		E(BASE)=20,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	329,963	115,565	56,763	58,802	104%	273,200	481%
	E(SG) =5,000 PSI	370,801	125,209	60,600	64,609	107%	310,202	512%
	E(SG) =10,000 PSI	423,683	137,040	65,236	71,803	110%	358,447	549%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	2,963	2,660	2,557	67	3%	259	11%
	E(SG) =5,000 PSI	13,610	12,033	11,505	229	3%	898	13%
	E(SG) =10,000 PSI	85,809	74,926	71,247	981	4%	3,814	15%
		E(BASE)=30,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	1,258,234	346,132	151,345	194,788	129%	1,106,889	731%
	E(SG) =5,000 PSI	1,278,561	349,315	152,524	196,790	129%	1,126,037	738%
	E(SG) =10,000 PSI	1,328,793	357,890	155,425	202,465	130%	1,173,368	755%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	6,766	6,125	5,910	215	4%	856	14%
	E(SG) =5,000 PSI	27,331	24,357	23,392	965	4%	3,939	17%
	E(SG) =10,000 PSI	143,654	126,780	118,224	8,556	7%	25,429	22%
				AVERAGE FOR RUTTING =	1,931	5%	6,909	19%
				AVERAGE FOR FATIGUE =	2,775	86%	9,916	383%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE H.24

INCREASE IN LOADS TO FAILURE FOR A 3 INCH ASPHALT CONCRETE, E=150,000 PSI ROAD BY REDUCING TIRE PRESSURE OF A TANDEM AXLE WITH A TIRE LOAD OF 4,250 LBS/TIRE.

E(AC)=150,000 PSI		E(BASE)=1,000 PSI			100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 70 PSI	PERCENT INCREASE
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	2,552	1,856	1,272	584	46%	1,280	101%
	E(SG) =5,000 PSI	3,093	2,197	1,482	714	48%	1,611	109%
	E(SG) =10,000 PSI	3,506	2,450	1,635	814	50%	1,870	114%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	471	409	387	22	6%	85	22%
	E(SG) =5,000 PSI	7,828	6,725	6,349	376	6%	1,479	23%
	E(SG) =10,000 PSI	151,721	129,799	122,055	7,744	6%	29,665	24%
		E(BASE)=5,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	13,354	7,925	4,826	3,099	64%	8,528	177%
	E(SG) =5,000 PSI	17,767	9,995	5,901	4,095	69%	11,866	201%
	E(SG) =10,000 PSI	22,711	12,151	6,981	5,169	74%	15,730	225%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	282	244	230	14	6%	52	23%
	E(SG) =5,000 PSI	2,477	2,100	1,971	128	7%	506	26%
	E(SG) =10,000 PSI	31,294	26,221	24,457	1,764	7%	6,837	28%
		E(BASE)=10,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	44,237	22,580	12,523	10,057	80%	31,714	253%
	E(SG) =5,000 PSI	55,847	27,061	14,578	12,483	86%	41,270	283%
	E(SG) =10,000 PSI	70,238	32,211	16,881	15,330	91%	53,358	316%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	556	483	458	25	6%	98	21%
	E(SG) =5,000 PSI	3,442	2,941	2,768	172	6%	674	24%
	E(SG) =10,000 PSI	31,026	26,113	24,457	1,656	7%	6,570	27%
		E(BASE)=20,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	246,017	99,853	47,927	51,926	108%	198,090	413%
	E(SG) =5,000 PSI	277,097	108,880	51,402	57,479	112%	225,695	439%
	E(SG) =10,000 PSI	317,834	120,008	55,635	64,373	116%	262,199	471%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	1,750	1,545	1,476	69	5%	274	19%
	E(SG) =5,000 PSI	8,080	6,998	6,644	354	5%	1,436	22%
	E(SG) =10,000 PSI	51,188	43,737	41,275	2,462	6%	9,913	24%
		E(BASE)=30,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	947,354	314,004	132,500	181,504	137%	814,854	615%
	E(SG) =5,000 PSI	962,473	317,063	133,492	183,571	138%	828,981	621%
	E(SG) =10,000 PSI	1,001,671	325,411	136,269	189,142	139%	865,402	635%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	3,986	3,552	3,406	146	4%	580	17%
	E(SG) =5,000 PSI	16,147	14,208	13,514	695	5%	2,633	19%
	E(SG) =10,000 PSI	85,440	73,840	70,047	3,794	5%	15,394	22%
				AVERAGE FOR RUTTING =	1,295	6%	5,080	23%
				AVERAGE FOR FATIGUE =	52,023	90%	224,163	332%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE H.25

INCREASE IN LOADS TO FAILURE FOR 3 INCH ASPHALT CONCRETE, E=1,000,000 PSI, ROAD BY REDUCING TIRE PRESSURE OF A TANDEM AXLE WITH A TIRE LOAD OF 3,250 LBS/TIRE.

	E(BASE)=1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	119,929	93,374	71,654	21,719	30%	48,274	67%
	E(SG) =5,000 PSI	143,906	110,200	83,465	26,734	32%	60,440	72%
	E(SG) =10,000 PSI	162,221	122,686	92,190	30,496	33%	70,031	76%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	64,304	60,251	58,718	1,533	3%	5,586	10%
	E(SG) =5,000 PSI	1,005,182	936,168	910,026	26,141	3%	95,156	10%
	E(SG) =10,000 PSI	18,813,297	17,431,367	16,919,444	511,923	3%	1,893,852	11%
	E(BASE)=5,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	211,243	154,418	115,772	38,646	33%	95,471	82%
	E(SG) =5,000 PSI	284,023	200,032	146,943	53,089	36%	137,080	93%
	E(SG) =10,000 PSI	369,227	251,123	180,842	70,281	39%	188,384	104%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	15,619	14,467	14,056	411	3%	1,563	11%
	E(SG) =5,000 PSI	125,376	114,737	110,742	3,995	4%	14,634	13%
	E(SG) =10,000 PSI	1,414,145	1,281,639	1,232,436	49,203	4%	181,709	15%
	E(BASE)=10,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	326,235	226,776	165,954	60,822	37%	160,281	97%
	E(SG) =5,000 PSI	441,813	294,446	210,750	83,696	40%	231,063	110%
	E(SG) =10,000 PSI	595,563	379,651	265,244	114,407	43%	330,319	125%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	16,948	15,676	15,223	454	3%	1,725	11%
	E(SG) =5,000 PSI	100,461	91,673	88,442	3,231	4%	12,019	14%
	E(SG) =10,000 PSI	824,923	744,147	714,440	29,707	4%	110,483	15%
	E(BASE)=20,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	648,031	411,547	289,546	122,001	42%	358,485	124%
	E(SG) =5,000 PSI	852,527	517,932	356,225	161,707	45%	496,301	139%
	E(SG) =10,000 PSI	1,140,932	658,804	441,813	216,992	49%	699,119	158%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	29,107	26,992	26,113	879	3%	2,994	11%
	E(SG) =5,000 PSI	133,618	121,984	117,679	4,305	4%	15,938	14%
	E(SG) =10,000 PSI	796,857	718,151	689,112	29,038	4%	107,745	16%
	E(BASE)=30,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO FATIGUE FAILURE	E(SG) =2,500 PSI	1,344,509	666,485	452,322	214,163	47%	892,188	197%
	E(SG) =5,000 PSI	1,451,912	814,074	540,012	274,062	51%	911,900	169%
	E(SG) =10,000 PSI	1,891,799	1,007,307	652,313	354,994	54%	1,239,486	190%
LOADS TO RUTTING FAILURE	E(SG) =2,500 PSI	49,293	45,755	44,432	1,324	3%	4,862	11%
	E(SG) =5,000 PSI	200,171	183,166	176,885	6,282	4%	23,286	13%
	E(SG) =10,000 PSI	1,008,934	910,855	874,437	36,418	4%	134,497	15%
RUTTING AVERAGE =					46,990	3%	173,737	13%
FATIGUE AVERAGE =					122,921	41%	394,588	120%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE H.26
INCREASE IN LOADS TO FAILURE FOR 3 INCH ASPHALT CONCRETE, E=1,000,000 PSI, ROAD BY REDUCING TIRE PRESSURE OF A TANDEM AXLE WITH A TIRE LOAD OF 3,750 LBS/TIRE.

	E(BASE)=1,000 PSI				100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) =2,500 PSI	79,817	64,970	49,940	15,030	30%	29,877	60%
FATIGUE	E(SG) =5,000 PSI	96,154	77,034	58,471	18,563	32%	37,683	64%
FAILURE	E(SG) =10,000 PSI	108,524	86,096	64,758	21,337	33%	43,765	68%
LOADS TO	E(SG) =2,500 PSI	34,581	32,113	31,160	953	3%	3,422	11%
RUTTING	E(SG) =5,000 PSI	542,969	500,206	483,801	16,405	3%	59,168	12%
FAILURE	E(SG) =10,000 PSI	10,161,223	9,319,158	8,998,165	320,993	4%	1,163,059	13%
	E(BASE)=5,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) =2,500 PSI	140,949	108,836	80,939	27,897	34%	60,010	74%
FATIGUE	E(SG) =5,000 PSI	190,230	142,417	103,594	38,824	37%	86,636	84%
FAILURE	E(SG) =10,000 PSI	248,051	180,238	128,455	51,784	40%	119,597	93%
LOADS TO	E(SG) =2,500 PSI	8,476	7,755	7,468	286	4%	1,008	13%
RUTTING	E(SG) =5,000 PSI	68,135	61,495	59,039	2,456	4%	9,096	15%
FAILURE	E(SG) =10,000 PSI	771,303	688,523	658,142	30,381	5%	113,161	17%
	E(BASE)=10,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) =2,500 PSI	219,868	161,522	117,022	44,500	38%	102,846	88%
FATIGUE	E(SG) =5,000 PSI	299,454	211,986	149,907	62,079	41%	149,547	100%
FAILURE	E(SG) =10,000 PSI	406,284	276,170	190,445	85,724	45%	215,839	113%
LOADS TO	E(SG) =2,500 PSI	9,191	8,395	8,080	315	4%	1,111	14%
RUTTING	E(SG) =5,000 PSI	54,688	49,176	47,150	2,027	4%	7,539	16%
FAILURE	E(SG) =10,000 PSI	450,808	399,889	381,621	18,268	5%	69,187	18%
	E(BASE)=20,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) =2,500 PSI	437,954	297,901	207,337	90,565	44%	230,618	111%
FATIGUE	E(SG) =5,000 PSI	578,697	379,121	257,417	121,704	47%	321,280	125%
FAILURE	E(SG) =10,000 PSI	779,206	487,337	322,345	164,991	51%	456,861	142%
LOADS TO	E(SG) =2,500 PSI	15,734	14,415	13,905	510	4%	1,829	13%
RUTTING	E(SG) =5,000 PSI	72,699	65,418	62,738	2,680	4%	9,961	16%
FAILURE	E(SG) =10,000 PSI	436,018	386,235	368,175	18,060	5%	67,843	18%
	E(BASE)=30,000 PSI							
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) =2,500 PSI	771,129	490,288	328,422	161,866	49%	442,707	135%
FATIGUE	E(SG) =5,000 PSI	988,594	604,237	395,460	208,778	53%	593,134	150%
FAILURE	E(SG) =10,000 PSI	1,295,997	756,602	482,227	274,376	57%	813,771	169%
LOADS TO	E(SG) =2,500 PSI	26,658	24,457	23,677	780	3%	2,982	13%
RUTTING	E(SG) =5,000 PSI	108,870	98,198	94,269	3,929	4%	14,601	15%
FAILURE	E(SG) =10,000 PSI	551,422	489,583	466,948	22,635	5%	84,474	18%
				RUTTING AVERAGE =	29,379	4%	107,229	15%
				FATIGUE AVERAGE =	92,535	42%	246,945	105%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE H.27

INCREASE IN LOADS TO FAILURE FOR 3 INCH ASPHALT CONCRETE, E=1,000,000 PSI, ROAD BY REDUCING TIRE PRESSURE OF A TANDEM AXLE WITH A TIRE LOAD OF 4,250 LBS/TIRE.

		E(BASE)=1,000 PSI			100 PSI TO 70 PSI	PERCENT INCREASE	100 PSI TO 40 PSI	PERCENT INCREASE
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) =2,500 PSI	56,523	44,810	36,196	8,614	24%	20,328	56%
FATIGUE	E(SG) =5,000 PSI	68,262	53,530	42,563	10,967	26%	25,700	60%
FAILURE	E(SG) =10,000 PSI	77,300	60,121	47,284	12,837	27%	30,015	63%
LOADS TO	E(SG) =2,500 PSI	20,204	18,559	17,934	625	3%	2,270	13%
RUTTING	E(SG) =5,000 PSI	317,793	289,462	278,883	10,579	4%	38,909	14%
FAILURE	E(SG) =10,000 PSI	5,961,853	5,401,956	5,194,725	207,230	4%	767,127	15%
		E(BASE)=5,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) =2,500 PSI	100,343	78,037	59,359	18,678	31%	40,984	69%
FATIGUE	E(SG) =5,000 PSI	136,103	103,985	76,506	27,480	36%	59,597	78%
FAILURE	E(SG) =10,000 PSI	178,442	134,307	95,537	38,770	41%	82,905	87%
LOADS TO	E(SG) =2,500 PSI	4,965	4,486	4,315	171	4%	650	15%
RUTTING	E(SG) =5,000 PSI	40,144	35,665	34,129	1,535	4%	6,014	18%
FAILURE	E(SG) =10,000 PSI	456,111	400,799	380,763	20,036	5%	75,348	20%
		E(BASE)=10,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) =2,500 PSI	156,573	120,165	86,557	33,608	39%	70,015	81%
FATIGUE	E(SG) =5,000 PSI	214,488	159,621	111,802	47,819	43%	102,686	92%
FAILURE	E(SG) =10,000 PSI	292,548	210,012	143,159	66,853	47%	149,389	104%
LOADS TO	E(SG) =2,500 PSI	5,396	4,867	4,665	202	4%	731	16%
RUTTING	E(SG) =5,000 PSI	32,252	28,620	27,218	1,402	5%	5,035	18%
FAILURE	E(SG) =10,000 PSI	267,101	233,026	220,898	12,128	5%	46,203	21%
		E(BASE)=20,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) =2,500 PSI	314,746	225,965	155,573	70,392	45%	159,173	102%
FATIGUE	E(SG) =5,000 PSI	418,100	290,293	194,606	95,687	49%	223,494	115%
FAILURE	E(SG) =10,000 PSI	566,007	377,010	245,629	131,380	53%	320,378	130%
LOADS TO	E(SG) =2,500 PSI	9,252	8,342	8,029	313	4%	1,223	15%
RUTTING	E(SG) =5,000 PSI	42,877	38,010	36,303	1,708	5%	6,574	18%
FAILURE	E(SG) =10,000 PSI	258,396	225,053	213,147	11,906	6%	45,249	21%
		E(BASE)=30,000 PSI						
	TIRE PRESSURE	40PSI	70 PSI	100 PSI				
LOADS TO	E(SG) =2,500 PSI	555,418	375,960	249,581	126,378	51%	305,836	123%
FATIGUE	E(SG) =5,000 PSI	716,321	468,007	302,987	165,020	54%	413,335	136%
FAILURE	E(SG) =10,000 PSI	943,754	591,760	372,832	218,928	59%	570,921	153%
LOADS TO	E(SG) =2,500 PSI	15,619	14,157	13,610	547	4%	2,009	15%
RUTTING	E(SG) =5,000 PSI	64,142	57,036	54,476	2,560	5%	9,666	18%
FAILURE	E(SG) =10,000 PSI	326,875	285,213	270,270	14,943	6%	56,605	21%
				RUTTING AVERAGE =	19,059	5%	70,908	17%
				FATIGUE AVERAGE =	71,561	42%	171,650	97%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

Appendix I: Effects of Lower Tire Load on Rutting Failure of Asphalt Concrete Roads

TABLE I.1

INCREASE IN LOADS TO RUTTING FAILURE OF 1 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD, BY REDUCING THE PER TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	10	14	22	4	40%	12	120%
1,000	5,000	190	272	420	82	43%	230	121%
1,000	10,000	4,018	5,721	8,754	1,703	42%	4,736	118%
5,000	2,500	15	21	32	6	40%	17	113%
5,000	5,000	154	212	313	58	38%	159	103%
5,000	10,000	2,201	2,948	4,233	747	34%	2,032	92%
10,000	2,500	39	56	86	17	44%	47	121%
10,000	5,000	281	390	578	109	39%	297	106%
10,000	10,000	2,904	3,890	5,572	986	34%	2,668	92%
20,000	2,500	143	210	331	67	47%	188	131%
20,000	5,000	766	1,084	1,644	318	42%	878	115%
20,000	10,000	5,654	14,056	11,194	8,402	149%	5,540	98%
30,000	2,500	337	503	804	166	49%	467	139%
30,000	5,000	1,576	2,271	3,496	695	44%	1,920	122%
30,000	10,000	9,784	13,514	19,969	3,730	38%	10,185	104%
				AVERAGE =	1,139	48%	1,958	113%

TABLE I.2

INCREASE IN LOADS TO RUTTIING FAILURE OF 2 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD, BY REDUCING THE PER TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	59	98	178	39	66%	119	202%
1,000	5,000	1,095	1,823	3,292	728	66%	2,197	201%
1,000	10,000	22,927	38,130	68,730	15,203	66%	45,803	200%
5,000	2,500	50	83	153	33	66%	103	206%
5,000	5,000	540	908	1,562	368	68%	1,022	189%
5,000	10,000	8,262	13,182	21,428	4,920	60%	13,166	159%
10,000	2,500	102	174	304	72	71%	202	198%
10,000	5,000	795	1,255	2,051	460	58%	1,256	158%
10,000	10,000	8,368	12,460	19,892	4,092	49%	11,524	138%
20,000	2,500	323	552	924	229	71%	601	186%
20,000	5,000	1,819	2,761	4,511	942	52%	2,692	148%
20,000	10,000	12,905	19,064	30,370	6,159	48%	17,465	135%
30,000	2,500	725	1,234	2,075	509	70%	1,350	186%
30,000	5,000	3,487	5,319	8,726	1,832	53%	5,239	150%
30,000	10,000	20,602	30,500	48,527	9,898	48%	27,925	136%
				AVERAGE =	3,032	61%	8,711	173%

TABLE I.3

INCREASE IN LOADS TO RUTTING FAILURE OF 3 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE LOAD, BY REDUCING THE PER TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	429	724	1,325	295	69%	896	209%
1,000	5,000	7,262	12,202	22,295	4,940	68%	15,033	207%
1,000	10,000	142,189	239,395	436,355	97,206	68%	294,166	207%
5,000	2,500	261	439	801	178	68%	540	207%
5,000	5,000	2,331	3,900	7,085	1,569	67%	4,754	204%
5,000	10,000	29,984	50,098	90,679	20,114	67%	60,695	202%
10,000	2,500	515	868	1,590	353	69%	1,075	209%
10,000	5,000	3,200	5,381	9,784	2,181	68%	6,584	206%
10,000	10,000	29,479	49,223	89,260	19,744	67%	59,781	203%
20,000	2,500	1,666	2,814	5,182	1,148	69%	3,516	211%
20,000	5,000	7,492	12,636	23,019	5,144	69%	15,527	207%
20,000	10,000	47,889	80,312	146,194	32,423	68%	98,305	205%
30,000	2,500	3,900	6,623	12,202	2,723	70%	8,302	213%
30,000	5,000	15,057	25,476	46,643	10,419	69%	31,586	210%
30,000	10,000	79,382	133,539	243,815	54,157	68%	164,433	207%
				AVERAGE =	16,840	68%	51,013	207%

TABLE I.4

INCREASE IN LOADS TO RUTTING FAILURE OF 1 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD, BY REDUCING THE PER TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	5	7	13	2	40%	8	160%
1,000	5,000	88	136	227	48	55%	139	158%
1,000	10,000	1,815	2,782	4,613	967	53%	2,798	154%
5,000	2,500	7	10	16	3	43%	9	129%
5,000	5,000	60	90	144	30	50%	84	140%
5,000	10,000	782	1,148	1,815	366	47%	1,033	132%
10,000	2,500	18	27	45	9	50%	27	150%
10,000	5,000	112	167	268	55	49%	156	139%
10,000	10,000	1,018	1,489	2,343	471	46%	1,325	130%
20,000	2,500	71	109	182	38	54%	111	156%
20,000	5,000	329	496	804	167	51%	475	144%
20,000	10,000	2,090	3,071	4,867	981	47%	2,777	133%
30,000	2,500	177	275	462	N/A	N/A	N/A	N/A
30,000	5,000	720	1,095	1,790	375	52%	1,070	149%
30,000	10,000	3,828	5,670	9,072	1,842	48%	5,244	137%
				AVERAGE =	382	49%	1,090	144%

TABLE I.5

INCREASE IN LOADS TO RUTTIING FAILURE OF 2 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD, BY REDUCING THE PER TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	49	84	156	35	71%	107	218%
1,000	5,000	913	1,555	2,882	642	70%	1,969	216%
1,000	10,000	18,991	32,392	59,775	13,401	71%	40,784	215%
5,000	2,500	39	63	111	24	62%	72	185%
5,000	5,000	368	590	1,024	222	60%	656	178%
5,000	10,000	4,908	7,779	13,370	2,871	58%	8,462	172%
10,000	2,500	73	118	206	45	62%	133	182%
10,000	5,000	474	754	1,298	280	59%	824	174%
10,000	10,000	4,424	6,934	11,786	2,510	57%	7,362	166%
20,000	2,500	222	358	625	136	61%	403	182%
20,000	5,000	1,035	1,644	2,824	609	59%	1,789	173%
20,000	10,000	6,644	10,390	17,531	3,746	56%	10,887	164%
30,000	2,500	500	809	1,410	N/A	N/A	N/A	N/A
30,000	5,000	2,013	3,200	5,491	1,187	59%	3,478	173%
30,000	10,000	10,638	16,634	28,025	5,996	56%	17,387	163%
				AVERAGE =	2,265	62%	6,737	183%

TABLE I.6

INCREASE IN LOADS TO RUTTING FAILURE OF 3 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE LOAD, BY REDUCING THE PER TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	374	642	1,193	268	72%	819	219%
1,000	5,000	6,273	10,746	19,969	4,473	71%	13,696	218%
1,000	10,000	122,340	209,396	388,568	87,056	71%	266,228	218%
5,000	2,500	225	387	717	162	72%	492	219%
5,000	5,000	1,980	3,388	6,273	1,408	71%	4,293	217%
5,000	10,000	25,165	42,976	79,508	17,811	71%	54,343	216%
10,000	2,500	449	770	1,432	321	71%	983	219%
10,000	5,000	2,741	4,691	8,726	1,950	71%	5,985	218%
10,000	10,000	24,858	42,464	78,672	17,606	71%	53,814	216%
20,000	2,500	1,473	2,532	4,718	1,059	72%	3,245	220%
20,000	5,000	6,504	11,194	20,764	4,690	72%	14,260	219%
20,000	10,000	41,012	70,263	130,567	29,251	71%	89,555	218%
30,000	2,500	3,478	5,998	11,232	2,520	72%	7,754	223%
30,000	5,000	13,229	22,744	42,464	9,515	72%	29,235	221%
30,000	10,000	68,765	118,088	219,874	49,323	72%	151,109	220%
				AVERAGE =	15,161	72%	46,387	219%

TABLE I.7

INCREASE IN LOADS TO RUTTING FAILURE OF 1 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD, BY REDUCING THE PER TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	4	6	10	2	50%	6	150%
1,000	5,000	63	101	174	38	60%	111	176%
1,000	10,000	1,284	2,041	3,506	757	59%	2,222	173%
5,000	2,500	5	7	12	2	40%	7	140%
5,000	5,000	40	61	103	21	53%	63	158%
5,000	10,000	493	757	1,257	264	54%	764	155%
10,000	2,500	12	19	33	7	58%	21	175%
10,000	5,000	73	114	191	41	56%	118	162%
10,000	10,000	633	967	1,597	334	53%	964	152%
20,000	2,500	51	80	138	29	57%	87	171%
20,000	5,000	221	345	581	124	56%	360	163%
20,000	10,000	1,036	2,018	3,344	982	95%	2,308	223%
30,000	2,500	129	206	356	77	60%	227	176%
30,000	5,000	494	776	1,317	282	57%	823	167%
30,000	10,000	2,465	3,797	6,311	1,332	54%	3,846	156%
				AVERAGE =	286	57%	795	166%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE I.8

INCREASE IN LOADS TO RUTTIING FAILURE OF 2 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD, BY REDUCING THE PER TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	46	80	149	34	74%	103	224%
1,000	5,000	852	1,466	2,734	614	72%	1,882	221%
1,000	10,000	17,664	30,370	56,729	12,706	72%	39,065	221%
5,000	2,500	32	53	94	21	66%	62	194%
5,000	5,000	292	479	852	187	64%	560	192%
5,000	10,000	3,797	6,198	10,930	2,401	63%	7,133	188%
10,000	2,500	59	97	174	38	64%	115	195%
10,000	5,000	369	602	1,062	233	63%	693	188%
10,000	10,000	3,327	5,365	9,374	2,038	61%	6,047	182%
20,000	2,500	179	294	524	115	64%	345	193%
20,000	5,000	800	1,300	2,292	500	63%	1,492	187%
20,000	10,000	4,922	7,903	13,757	2,981	61%	8,835	180%
30,000	2,500	404	665	1,186	261	65%	782	194%
30,000	5,000	1,559	2,532	4,461	973	62%	2,902	186%
30,000	10,000	7,878	12,636	21,943	4,758	60%	14,065	179%
				AVERAGE =	1,857	65%	5,605	195%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE I.9

INCREASE IN LOADS TO RUTTING FAILURE OF 3 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE LOAD, BY REDUCING THE PER TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	354	611	1,145	257	73%	791	223%
1,000	5,000	5,910	10,217	19,064	4,307	73%	13,154	223%
1,000	10,000	115,199	198,617	371,204	83,418	72%	256,005	222%
5,000	2,500	213	367	688	154	72%	475	223%
5,000	5,000	1,861	3208	5,980	1,347	72%	4,119	221%
5,000	10,000	23,486	40,510	75,554	17,024	72%	52,068	222%
10,000	2,500	426	735	1,377	309	73%	951	223%
10,000	5,000	2,582	4,461	8,342	1,879	73%	5,760	223%
10,000	10,000	23,298	40,144	74,965	16,846	72%	51,667	222%
20,000	2,500	1,404	2,429	4,562	1,025	73%	3,158	225%
20,000	5,000	6,180	10,674	20,047	4,494	73%	13,867	224%
20,000	10,000	38,375	66,862	125,156	28,487	74%	86,781	226%
30,000	2,500	3,335	5,789	10,856	2,454	74%	7,521	226%
30,000	5,000	12,636	21,856	41,012	9,220	73%	28,376	225%
30,000	10,000	65,286	110,364	200,822	45,078	69%	135,536	208%
				AVERAGE =	14,420	73%	44,015	222%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS

E(SG) = SUBGRADE ELASTIC MODULUS

TABLE I.10

INCREASE IN LOADS TO RUTTING FAILURE OF 1-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)=150,000 PSI

		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	10	15	23	5	50%	13	130%
1,000	5,000	192	276	426	84	44%	234	122%
1,000	10,000	4,062	5,772	8,839	1,710	42%	4,777	118%
5,000	2,500	15	22	33	7	47%	18	120%
5,000	5,000	158	217	319	59	37%	161	102%
5,000	10,000	2,244	3,001	4,303	757	34%	2,059	92%
10,000	2,500	41	58	90	17	41%	49	120%
10,000	5,000	291	402	595	111	38%	304	104%
10,000	10,000	2,978	3,975	5,688	997	33%	2,710	91%
20,000	2,500	152	223	351	71	47%	199	131%
20,000	5,000	801	1,131	1,711	330	41%	910	114%
20,000	10,000	5,823	7,928	11,505	2,105	36%	5,682	98%
30,000	2,500	362	539	858	177	49%	496	137%
30,000	5,000	1,662	2,388	3,667	726	44%	2,005	121%
30,000	10,000	10,149	14,006	20,683	3,857	38%	10,534	104%
				AVERAGE =	734	41%	2,010	113%

TABLE I.11

INCREASE IN LOADS TO RUTTING FAILURE OF 1-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)=1,000,000 PSI

		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	50	83	150	33	66%	100	200%
1,000	5,000	942	1,569	2,831	627	67%	1,889	201%
1,000	10,000	20,047	33,247	59,923	13,200	66%	39,876	199%
5,000	2,500	40	67	118	27	68%	78	195%
5,000	5,000	456	721	1,171	265	58%	715	157%
5,000	10,000	6,934	10,286	16,388	3,352	48%	9,454	136%
10,000	2,500	80	130	214	50	63%	134	168%
10,000	5,000	608	908	1,460	300	49%	852	140%
10,000	10,000	6,292	9,191	14,415	2,899	46%	8,123	129%
20,000	2,500	253	396	652	143	57%	399	158%
20,000	5,000	1,314	1,962	3,142	648	49%	1,828	139%
20,000	10,000	9,343	13,514	21,010	4,171	45%	11,667	125%
30,000	2,500	588	917	1,515	329	56%	927	158%
30,000	5,000	2,589	3,869	6,217	1,280	49%	3,628	140%
30,000	10,000	15,002	21,684	33,832	6,682	45%	18,830	126%
				AVERAGE =	2,267	55%	6,567	158%

TABLE I.12

INCREASE IN LOADS TO RUTTING FAILURE OF 2-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)=150,000

		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	60	100	182	40	67%	122	203%
1,000	5,000	1,113	1,853	3,344	740	66%	2,231	200%
1,000	10,000	23,205	38,526	69,402	15,321	66%	46,197	199%
5,000	2,500	52	88	160	36	69%	108	208%
5,000	5,000	559	939	1,615	380	68%	1,056	189%
5,000	10,000	8,476	13,514	21,943	5,038	59%	13,467	159%
10,000	2,500	109	185	323	76	70%	214	196%
10,000	5,000	832	1,311	2,140	479	58%	1,308	157%
10,000	10,000	8,670	12,815	20,522	4,145	48%	11,852	137%
20,000	2,500	349	595	994	246	70%	645	185%
20,000	5,000	1,935	2,926	4,771	991	51%	2,836	147%
20,000	10,000	13,466	19,892	31,564	6,426	48%	18,098	134%
30,000	2,500	782	1,331	2,233	549	70%	1,451	186%
30,000	5,000	3,736	5,688	9,312	1,952	52%	5,576	149%
30,000	10,000	21,684	31,975	50,772	10,291	47%	29,088	134%
				AVERAGE =	3,114	61%	8,950	172%

TABLE I.13

INCREASE IN LOADS TO RUTTING FAILURE OF 2-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC) = 1,000,000 PSI

		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	1,404	2,889	4,351	1,485	106%	2,947	210%
1,000	5,000	21,943	44,742	67,719	22,799	104%	45,776	209%
1,000	10,000	412,243	833,056	1,265,389	420,813	102%	853,146	207%
5,000	2,500	436	863	1,384	427	98%	948	217%
5,000	5,000	3,848	7,492	11,786	3,644	95%	7,938	206%
5,000	10,000	49,060	93,804	148,881	44,744	91%	99,821	203%
10,000	2,500	542	1,043	1,681	501	92%	1,139	210%
10,000	5,000	3,571	6,787	10,967	3,216	90%	7,396	207%
10,000	10,000	34,279	64,045	104,181	29,766	87%	69,902	204%
20,000	2,500	1,086	2,027	3,379	941	87%	2,293	211%
20,000	5,000	5,475	10,115	16,885	4,640	85%	11,410	208%
20,000	10,000	38,250	69,903	117,138	31,653	83%	78,888	206%
30,000	2,500	2,008	3,687	6,292	1,679	84%	4,284	213%
30,000	5,000	8,868	16,147	27,560	7,279	82%	18,692	211%
30,000	10,000	51,781	93,548	159,656	41,767	81%	107,875	208%
				AVERAGE =	41,024	91%	87,497	209%

TABLE I.14

INCREASE IN LOADS TO RUTTING FAILURE OF 3-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	471	794	1,450	323	69%	979	208%
1,000	5,000	7,828	13,135	23,965	5,307	68%	16,137	206%
1,000	10,000	151,721	254,696	463,664	102,975	68%	311,943	206%
5,000	2,500	282	475	867	193	68%	585	207%
5,000	5,000	2,477	4,152	7,539	1,675	68%	5,062	204%
5,000	10,000	31,294	52,181	94,373	20,887	67%	63,079	202%
10,000	2,500	556	937	1,711	381	69%	1,155	208%
10,000	5,000	3,442	5,772	10,495	2,330	68%	7,053	205%
10,000	10,000	31,026	51,880	93,959	20,854	67%	62,933	203%
20,000	2,500	1,750	2,963	5,444	1,213	69%	3,694	211%
20,000	5,000	8,080	13,610	24,858	5,530	68%	16,778	208%
20,000	10,000	51,188	85,809	156,057	34,621	68%	104,869	205%
30,000	2,500	3,986	6,766	12,460	2,780	70%	8,474	213%
30,000	5,000	16,147	27,331	62,959	11,184	69%	46,812	290%
30,000	10,000	85,440	143,654	261,980	58,214	68%	176,540	207%
				AVERAGE =	17,898	68%	55,073	212%

TABLE I.15

INCREASE IN LOADS TO RUTTING FAILURE OF 3-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC) = 1,000,000 PSI

		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	20,204	34,581	64,304	14,377	71%	44,100	218%
1,000	5,000	317,793	542,969	1,005,182	225,176	71%	687,389	216%
1,000	10,000	5,961,853	10,161,223	18,813,297	4,199,370	70%	12,851,444	216%
5,000	2,500	4,965	8,476	15,619	3,511	71%	10,654	215%
5,000	5,000	40,144	68,135	125,376	27,991	70%	85,232	212%
5,000	10,000	456,111	771,303	1,414,145	315,192	69%	958,034	210%
10,000	2,500	5,396	9,191	16,948	3,795	70%	11,552	214%
10,000	5,000	32,252	54,688	100,461	22,436	70%	68,209	211%
10,000	10,000	267,101	450,808	824,923	183,707	69%	557,822	209%
20,000	2,500	9,252	15,734	29,107	6,482	70%	19,855	215%
20,000	5,000	42,877	72,699	133,618	29,822	70%	90,741	212%
20,000	10,000	258,396	436,018	796,857	177,622	69%	538,461	208%
30,000	2,500	15,619	26,658	49,293	11,039	71%	33,674	216%
30,000	5,000	64,142	108,870	200,171	44,728	70%	136,029	212%
30,000	10,000	326,875	551,422	1,008,934	224,547	69%	682,059	209%
				AVERAGE =	365,986	70%	1,118,350	213%

TABLE I.16

INCREASE IN LOADS TO RUTTING FAILURE OF 1-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)=150,000 PSI

		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	5	8	13	3	60%	8	160%
1,000	5,000	89	138	230	49	55%	141	158%
1,000	10,000	1,831	2,810	4,652	979	53%	2,821	154%
5,000	2,500	7	10	17	3	43%	10	143%
5,000	5,000	61	92	147	31	51%	86	141%
5,000	10,000	794	1,164	1,844	370	47%	1,050	132%
10,000	2,500	18	28	46	10	56%	28	156%
10,000	5,000	115	171	275	56	49%	160	139%
10,000	10,000	1,039	1,515	2,382	476	46%	1,343	129%
20,000	2,500	75	115	191	40	53%	116	155%
20,000	5,000	342	513	832	171	50%	490	143%
20,000	10,000	2,145	3,142	4,979	997	46%	2,834	132%
30,000	2,500	188	292	489	104	55%	301	160%
30,000	5,000	752	1,143	1,870	391	52%	1,118	149%
30,000	10,000	3,943	5,840	9,312	1,897	48%	5,369	136%
				AVERAGE =	372	51%	1,058	146%

TABLE I.17

INCREASE IN LOADS TO RUTTING FAILURE OF 1-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)=1,000,000 PSI

		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	42	71	131	29	69%	89	212%
1,000	5,000	783	1,337	2,471	554	71%	1,688	216%
1,000	10,000	16,511	28,143	52,080	11,632	70%	35,569	215%
5,000	2,500	28	45	78	17	61%	50	179%
5,000	5,000	269	428	736	159	59%	467	174%
5,000	10,000	3,657	5,755	9,784	2,098	57%	6,127	168%
10,000	2,500	50	80	139	30	60%	89	178%
10,000	5,000	327	516	878	189	58%	551	169%
10,000	10,000	3,094	4,812	8,080	1,718	56%	4,986	161%
20,000	2,500	152	244	420	92	61%	268	176%
20,000	5,000	699	1,097	1,861	398	57%	1,162	166%
20,000	10,000	4,449	6,849	11,426	2,400	54%	6,977	157%
30,000	2,500	355	569	980	214	60%	625	176%
30,000	5,000	1,386	2,180	3,697	794	57%	2,311	167%
30,000	10,000	7,151	11,005	18,278	3,854	54%	11,127	156%
				AVERAGE =	1,612	60%	4,806	178%

TABLE I.18

INCREASE IN LOADS TO RUTTING FAILURE OF 2-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)=150,000

		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	51	86	160	35	69%	109	214%
1,000	5,000	926	1,579	2,918	653	71%	1,992	215%
1,000	10,000	19,138	32,674	60,371	13,536	71%	41,233	215%
5,000	2,500	41	66	116	25	61%	75	183%
5,000	5,000	379	608	1,054	229	60%	675	178%
5,000	10,000	5,007	7,953	13,659	2,946	59%	8,652	173%
10,000	2,500	77	125	216	48	62%	139	181%
10,000	5,000	493	785	1,357	292	59%	864	175%
10,000	10,000	4,549	7,129	12,117	2,580	57%	7,568	166%
20,000	2,500	238	384	668	146	61%	430	181%
20,000	5,000	1,093	1,731	2,971	638	58%	1,878	172%
20,000	10,000	6,891	10,746	18,140	3,855	56%	11,249	163%
30,000	2,500	537	867	1,512	330	61%	975	182%
30,000	5,000	2,140	3,397	5,823	1,257	59%	3,683	172%
30,000	10,000	11,118	17,334	29,231	6,216	56%	18,113	163%
				AVERAGE =	2,186	61%	6,509	182%

TABLE I.19

INCREASE IN LOADS TO RUTTING FAILURE OF 2-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC) = 1,000,000 PSI

		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	1,234	2,589	3,954	1,355	110%	2,720	220%
1,000	5,000	19,138	39,691	60,945	20,553	107%	41,807	218%
1,000	10,000	355,829	734,504	1,133,158	378,675	106%	777,329	218%
5,000	2,500	381	767	1,219	386	101%	838	220%
5,000	5,000	3,309	6,563	10,531	3,254	98%	7,222	218%
5,000	10,000	41,521	81,298	131,575	39,777	96%	90,054	217%
10,000	2,500	476	933	1,525	457	96%	1,049	220%
10,000	5,000	3,086	5,980	9,850	2,894	94%	6,764	219%
10,000	10,000	29,107	55,738	92,630	26,631	91%	63,523	218%
20,000	2,500	965	1,831	3,102	866	90%	2,137	221%
20,000	5,000	4,785	9,043	15,335	4,258	89%	10,550	220%
20,000	10,000	32,959	61,618	103,540	28,659	87%	70,581	214%
30,000	2,500	1,803	3,362	5,823	1,559	86%	4,020	223%
30,000	5,000	7,853	14,572	25,062	6,719	86%	17,209	219%
30,000	10,000	45,056	81,601	130,490	36,545	81%	85,434	190%
				AVERAGE =	36,839	95%	78,749	217%

TABLE I.20

INCREASE IN LOADS TO RUTTING FAILURE OF 3-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	409	702	1,303	293	72%	894	219%
1,000	5,000	6,725	11,545	21,428	4,820	72%	14,703	219%
1,000	10,000	129,799	222,076	411,929	92,277	71%	282,130	217%
5,000	2,500	244	417	774	173	71%	530	217%
5,000	5,000	2,100	3,590	6,664	1,490	71%	4,564	217%
5,000	10,000	26,221	44,680	82,607	18,459	70%	56,386	215%
10,000	2,500	483	829	1,542	346	72%	1,059	219%
10,000	5,000	2,941	5,036	9,343	2,095	71%	6,402	218%
10,000	10,000	26,113	44,659	82,695	18,546	71%	56,582	217%
20,000	2,500	1,545	2,660	4,965	1,115	72%	3,420	221%
20,000	5,000	6,445	12,033	22,384	5,588	87%	15,939	247%
20,000	10,000	43,737	74,926	139,148	31,189	71%	95,411	218%
30,000	2,500	3,552	6,125	11,465	2,573	72%	7,913	223%
30,000	5,000	14,208	24,357	45,499	10,149	71%	31,291	220%
30,000	10,000	73,840	126,780	235,866	52,940	72%	162,026	219%
				AVERAGE =	16,137	72%	49,283	220%

TABLE I.21
INCREASE IN LOADS TO RUTTING FAILURE OF 3-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC) = 1,000,000 PSI

		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	18,559	32,113	60,251	13,554	73%	41,692	225%
1,000	5,000	289,462	500,206	936,168	210,744	73%	646,706	223%
1,000	10,000	5,401,956	9,319,158	17,431,367	3,917,202	73%	12,029,411	223%
5,000	2,500	4,486	7,755	14,467	3,269	73%	9,981	222%
5,000	5,000	35,665	61,495	114,737	25,830	72%	79,072	222%
5,000	10,000	400,799	688,523	1,281,639	287,724	72%	880,840	220%
10,000	2,500	4,867	8,395	15,676	3,528	72%	10,809	222%
10,000	5,000	28,620	49,176	91,673	20,556	72%	63,053	220%
10,000	10,000	233,026	399,889	744,147	166,863	72%	511,121	219%
20,000	2,500	8,342	14,415	26,992	6,073	73%	18,650	224%
20,000	5,000	38,010	65,418	121,984	27,408	72%	83,974	221%
20,000	10,000	225,053	386,235	718,151	161,182	72%	493,098	219%
30,000	2,500	14,157	24,457	45,755	10,300	73%	31,598	223%
30,000	5,000	57,036	98,198	183,166	41,162	72%	126,130	221%
30,000	10,000	285,213	489,583	910,855	204,370	72%	625,642	219%
				AVERAGE =	339,984	72%	1,043,452	222%

TABLE I.22

INCREASE IN LOADS TO RUTTING FAILURE OF 1-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)=150,000 PSI

		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	4	6	10	2	50%	6	150%
1,000	5,000	64	102	176	38	59%	112	175%
1,000	10,000	1,295	2,061	3,543	766	59%	2,248	174%
5,000	2,500	5	7	12	2	40%	7	140%
5,000	5,000	40	62	105	22	55%	65	163%
5,000	10,000	499	767	1,273	268	54%	774	155%
10,000	2,500	13	20	34	7	54%	21	162%
10,000	5,000	75	117	195	42	56%	120	160%
10,000	10,000	644	984	1,626	340	53%	982	152%
20,000	2,500	53	84	145	31	58%	92	174%
20,000	5,000	229	356	599	127	55%	370	162%
20,000	10,000	1,348	2,065	3,415	717	53%	2,067	153%
30,000	2,500	137	218	376	81	59%	239	174%
30,000	5,000	515	807	1,368	292	57%	853	166%
30,000	10,000	2,532	3,890	6,465	1,358	54%	3,933	155%
				AVERAGE =	273	54%	793	161%

TABLE I.23

INCREASE IN LOADS TO RUTTING FAILURE OF 1-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)=1,000,000 PSI

		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	39	67	125	28	72%	86	221%
1,000	5,000	731	1,257	2,348	526	72%	1,617	221%
1,000	10,000	15,391	26,548	48,504	11,157	72%	33,113	215%
5,000	2,500	22	37	66	15	68%	44	200%
5,000	5,000	209	341	602	132	63%	393	188%
5,000	10,000	2,761	4,473	7,828	1,712	62%	5,067	184%
10,000	2,500	40	65	139	25	63%	99	248%
10,000	5,000	248	402	704	154	62%	456	184%
10,000	10,000	2,260	3,619	6,273	1,359	60%	4,013	178%
20,000	2,500	119	195	345	76	64%	226	190%
20,000	5,000	524	845	1,476	321	61%	952	182%
20,000	10,000	3,183	5,065	8,726	1,882	59%	5,543	174%
30,000	2,500	279	456	806	177	63%	527	189%
30,000	5,000	1,041	1,677	2,926	636	61%	1,885	181%
30,000	10,000	5,094	8,080	13,905	2,986	59%	8,811	173%
				AVERAGE =	1,412	64%	4,189	195%

TABLE I.24

INCREASE IN LOADS TO RUTTING FAILURE OF 2-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)=150,000

		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	47	82	152	35	74%	105	223%
1,000	5,000	863	1,485	2,775	622	72%	1,912	222%
1,000	10,000	17,866	30,762	57,261	12,896	72%	39,395	221%
5,000	2,500	33	55	98	22	67%	65	197%
5,000	5,000	301	493	877	192	64%	576	191%
5,000	10,000	3,879	6,330	11,156	2,451	63%	7,277	188%
10,000	2,500	62	103	183	41	66%	121	195%
10,000	5,000	383	625	1,102	242	63%	719	188%
10,000	10,000	3,415	5,507	9,624	2,092	61%	6,209	182%
20,000	2,500	191	314	559	123	64%	368	193%
20,000	5,000	840	1,368	2,406	528	63%	1,566	186%
20,000	10,000	5,079	8,157	14,208	3,078	61%	9,129	180%
30,000	2,500	432	711	1,265	279	65%	833	193%
30,000	5,000	1,647	2,680	4,718	1,033	63%	3,071	186%
30,000	10,000	8,183	13,135	22,385	4,952	61%	14,202	174%
				AVERAGE =	1,906	65%	5,703	195%

TABLE I.25

INCREASE IN LOADS TO RUTTING FAILURE OF 2-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC) = 1,000,000 PSI

		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	1,174	2,477	3,807	1,303	111%	2,633	224%
1,000	5,000	18,071	37,789	58,487	19,718	109%	40,416	224%
1,000	10,000	336,031	698,630	1,084,622	362,599	108%	748,591	223%
5,000	2,500	362	734	1,171	372	103%	809	223%
5,000	5,000	3,118	6,254	10,082	3,136	101%	6,964	223%
5,000	10,000	38,890	76,953	125,523	38,063	98%	86,633	223%
10,000	2,500	453	896	1,473	443	98%	1,020	225%
10,000	5,000	2,926	5,704	9,467	2,778	95%	6,541	224%
10,000	10,000	27,445	52,915	88,634	25,470	93%	61,189	223%
20,000	2,500	924	1,766	3,009	842	91%	2,085	226%
20,000	5,000	4,562	8,670	14,625	4,108	90%	10,063	221%
20,000	10,000	29,984	56,369	90,383	26,385	88%	60,399	201%
30,000	2,500	1,734	3,258	5,605	1,524	88%	3,871	223%
30,000	5,000	7,285	13,610	22,206	6,325	87%	14,921	205%
30,000	10,000	37,621	69,831	113,105	32,210	86%	75,484	201%
				AVERAGE =	35,018	96%	74,775	219%

TABLE I.26

INCREASE IN LOADS TO RUTTING FAILURE OF 3-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	387	668	1,249	281	73%	862	223%
1,000	5,000	6,349	10,930	20,442	4,581	72%	14,093	222%
1,000	10,000	122,055	210,360	392,990	88,305	72%	270,935	222%
5,000	2,500	230	397	742	167	73%	512	223%
5,000	5,000	1,971	3,397	6,349	1,426	72%	4,378	222%
5,000	10,000	24,457	42,076	78,465	17,619	72%	54,008	221%
10,000	2,500	458	791	1,482	333	73%	1,024	224%
10,000	5,000	2,768	4,771	8,926	2,003	72%	6,158	222%
10,000	10,000	24,457	42,192	78,755	17,735	73%	54,298	222%
20,000	2,500	1,476	2,557	4,798	1,081	73%	3,322	225%
20,000	5,000	6,644	11,505	21,513	4,861	73%	14,869	224%
20,000	10,000	41,275	71,247	133,301	29,972	73%	92,026	223%
30,000	2,500	3,406	5,910	11,118	2,504	74%	7,712	226%
30,000	5,000	16,514	23,392	43,940	6,878	42%	27,426	166%
30,000	10,000	70,047	118,224	214,982	48,177	69%	144,935	207%
				AVERAGE =	15,062	70%	46,437	218%

TABLE I.27

INCREASE IN LOADS TO RUTTING FAILURE OF 3-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC) = 1,000,000 PSI

		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	17,934	31,160	58,718	13,226	74%	40,784	227%
1,000	5,000	278,883	483,801	910,026	204,918	73%	631,143	226%
1,000	10,000	5,194,725	8,998,165	16,919,444	3,803,440	73%	11,724,719	226%
5,000	2,500	4,315	7,468	14,056	3,153	73%	9,741	226%
5,000	5,000	34,129	59,039	110,742	24,910	73%	76,613	224%
5,000	10,000	380,763	658,142	1,232,426	277,379	73%	851,663	224%
10,000	2,500	4,665	8,080	15,223	3,415	73%	10,558	226%
10,000	5,000	24,218	47,150	88,442	22,932	95%	64,224	265%
10,000	10,000	220,898	381,621	714,440	160,723	73%	493,542	223%
20,000	2,500	8,029	13,905	26,113	5,876	73%	18,084	225%
20,000	5,000	36,303	62,738	117,679	26,435	73%	81,376	224%
20,000	10,000	213,147	368,175	689,112	155,028	73%	475,965	223%
30,000	2,500	13,610	23,677	44,432	10,067	74%	30,822	226%
30,000	5,000	54,476	94,269	176,885	39,793	73%	122,409	225%
30,000	10,000	270,270	466,948	874,437	196,678	73%	604,167	224%
				AVERAGE =	329,865	75%	1,015,721	228%

Appendix J: Effects of Lower Tire Pressure and Tire Load on Rutting Failure of Asphalt Concrete Roads

TABLE J.1
PERCENT INCREASE IN LOADS TO RUTTING FAILURE FOR A 1 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED. E(AC)=150,000 PSI

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
6	150%	6	150%	18	450%	1.50
111	176%	127	202%	357	567%	1.50
2,222	173%	2,734	213%	7,470	582%	1.51
7	140%	10	200%	27	540%	1.59
63	158%	114	285%	273	683%	1.54
764	155%	1,708	346%	3,740	759%	1.51
21	175%	27	225%	74	617%	1.54
118	162%	208	285%	505	692%	1.55
964	152%	2,271	359%	4,939	780%	1.53
87	171%	92	180%	280	549%	1.56
360	163%	545	247%	1,423	644%	1.57
2,308	223%	4,618	446%	10,158	981%	1.47
227	176%	208	161%	675	523%	1.55
823	167%	1,082	219%	3,002	608%	1.58
3,846	156%	7,319	297%	17,504	710%	1.57
795 AVERAGE	166% AVERAGE	1,405 AVERAGE	254% AVERAGE	3,363 AVERAGE	646% AVERAGE	1.54 AVERAGE

TABLE J.2

PERCENT INCREASE IN LOADS TO RUTTING FAILURE FOR A 2 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED. E(AC)=150,000 PSI

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
103	224%	13	28%	132	287%	1.14
1,882	221%	243	29%	2,440	286%	1.15
39,065	221%	5,263	30%	51,066	289%	1.15
62	194%	18	56%	121	378%	1.51
560	192%	248	85%	1,270	435%	1.57
7,133	188%	4,465	118%	17,631	464%	1.52
115	195%	43	73%	245	415%	1.55
693	188%	426	115%	1,682	456%	1.50
6,047	182%	5,041	152%	16,565	498%	1.49
345	193%	144	80%	745	416%	1.52
1,492	187%	1,019	127%	3,711	464%	1.48
8,835	180%	7,983	162%	25,448	517%	1.51
782	194%	321	79%	1,671	414%	1.51
2,902	186%	1,928	124%	7,167	460%	1.48
14,065	179%	12,724	162%	40,649	516%	1.52
5,605 AVERAGE	195% AVERAGE	2,659 AVERAGE	95% AVERAGE	11,370 AVERAGE	420% AVERAGE	1.44 AVERAGE

TABLE J.3

PERCENT INCREASE IN LOADS TO RUTTING FAILURE FOR A 3 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED. E(AC)=150,000 PSI

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
791	223%	75	21%	971	274%	1.12
13,154	223%	1,352	23%	16,385	277%	1.13
256,005	222%	26,990	23%	321,156	279%	1.13
475	223%	48	23%	588	276%	1.12
4,119	221%	470	25%	5,224	281%	1.14
52,068	222%	6,498	28%	67,193	286%	1.15
951	223%	89	21%	1,164	273%	1.12
5,760	223%	618	24%	7,202	279%	1.13
51,667	222%	6,181	27%	65,962	283%	1.14
3,158	225%	262	19%	3,778	269%	1.10
13,867	224%	1,312	21%	16,839	272%	1.11
86,781	226%	9,514	25%	107,819	281%	1.12
7,521	226%	565	17%	8,867	266%	1.10
28,376	225%	2,421	19%	34,007	269%	1.10
135,536	208%	14,096	22%	178,529	273%	1.19
44,015 AVERAGE	222% AVERAGE	4,699 AVERAGE	22% AVERAGE	55,712 AVERAGE	276% AVERAGE	1.13 AVERAGE

TABLE J.4

INCREASE IN LOADS TO RUTTING FAILURE FOR AN 1-INCH ASPHALT CONCRETE ROADE SUBJECT TO A TANDEM AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED.

E(AC) = 150,000 PSI

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
6	150%	6	150%	19	475%	1.58
112	175%	128	200%	362	566%	1.51
2,248	174%	2,767	214%	7,544	583%	1.50
7	140%	10	200%	28	560%	1.65
65	163%	118	295%	279	698%	1.52
774	155%	1,745	350%	3,804	762%	1.51
21	162%	28	215%	77	592%	1.57
120	160%	216	288%	520	693%	1.55
982	152%	2,334	362%	5,044	783%	1.52
92	174%	99	187%	298	562%	1.56
370	162%	572	250%	1,482	647%	1.57
2,067	153%	4,475	332%	10,157	753%	1.55
239	174%	225	164%	721	526%	1.55
853	166%	1,147	223%	3,152	612%	1.58
3,933	155%	7,617	301%	18,151	717%	1.57
793 AVERAGE	161% AVERAGE	1,432 AVERAGE	249% AVERAGE	3,443 AVERAGE	635% AVERAGE	1.55 AVERAGE

TABLE J.5

INCREASE IN LOADS TO RUTTING FAILURE FOR AN 1-INCH ASPHALT CONCRETE ROADE SUBJECT TO A TANDEM AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED.

E(AC) = 1,000,000 PSI

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
86	221%	11	28%	111	285%	1.14
1,617	221%	211	29%	2,100	287%	1.15
33,113	215%	4,656	30%	44,532	289%	1.18
44	200%	18	82%	96	436%	1.55
393	188%	247	118%	962	460%	1.50
5,067	184%	4,173	151%	13,627	494%	1.47
99	248%	40	100%	174	435%	1.25
456	184%	360	145%	1,212	489%	1.49
4,013	178%	4,032	178%	12,155	538%	1.51
226	190%	134	113%	533	448%	1.48
952	182%	790	151%	2,618	500%	1.50
5,543	174%	6,160	194%	17,827	560%	1.52
527	189%	309	111%	1,236	443%	1.48
1,885	181%	1,548	149%	5,176	497%	1.51
8,811	173%	9,908	195%	28,738	564%	1.54
4,189 AVERAGE	195% AVERAGE	2,173 AVERAGE	118% AVERAGE	8,740 AVERAGE	448% AVERAGE	1.42 AVERAGE

TABLE J.6

INCREASE IN LOADS TO RUTTING FAILURE FOR AN 2-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED.

E(AC) = 150,000 PSI

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
105	223%	13	28%	135	287%	1.14
1,912	222%	250	29%	2,481	287%	1.15
39,395	221%	5,339	30%	51,536	288%	1.15
65	197%	19	58%	127	385%	1.51
576	191%	258	86%	1,314	437%	1.58
7,277	188%	4,597	119%	18,064	466%	1.52
121	195%	47	76%	261	421%	1.55
719	188%	449	117%	1,757	459%	1.50
6,209	182%	5,255	154%	17,107	501%	1.49
368	193%	158	83%	803	420%	1.53
1,566	186%	1,095	130%	3,931	468%	1.48
9,129	180%	8,387	165%	26,485	521%	1.51
833	193%	350	81%	1,801	417%	1.52
3,071	186%	2,089	127%	7,665	465%	1.49
14,202	174%	13,501	165%	42,589	520%	1.54
5,703 AVERAGE	195% AVERAGE	2,787 AVERAGE	96% AVERAGE	11,737 AVERAGE	423% AVERAGE	1.44 AVERAGE

TABLE J.7

INCREASE IN LOADS TO RUTTINGFAILURE FOR AN 2-INCH ASPHALT CONCRETE ROADE SUBJECT TO A TANDEM AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED.

E(AC) = 1,000,000 PSI

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
2,633	224%	230	20%	3,177	271%	1.11
40,416	224%	3,872	21%	49,648	275%	1.12
748,591	223%	76,212	23%	929,358	277%	1.13
809	223%	74	20%	1,022	282%	1.16
6,964	223%	730	23%	8,668	278%	1.13
86,633	223%	10,170	26%	109,991	283%	1.14
1,020	225%	89	20%	1,228	271%	1.11
6,541	224%	645	22%	8,041	275%	1.12
61,189	223%	6,834	25%	76,736	280%	1.13
2,085	226%	162	18%	2,455	266%	1.09
10,063	221%	913	20%	12,323	270%	1.12
60,399	201%	8,266	28%	87,154	291%	1.27
3,871	223%	274	16%	4,558	263%	1.10
14,921	205%	1,583	22%	20,275	278%	1.23
75,484	201%	14,160	38%	122,035	324%	1.36
74,775 AVERAGE	219% AVERAGE	8,281 AVERAGE	23% AVERAGE	95,778 AVERAGE	279% AVERAGE	1.15 AVERAGE

TABLE J.8

INCREASE IN LOADS TO RUTTING FAILURE FOR AN 3-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED.

E(AC) = 150,000 PSI

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
862	223%	84	22%	1,063	275%	1.12
14,093	222%	1,479	23%	17,616	277%	1.13
270,935	222%	29,666	24%	341,609	280%	1.14
512	223%	52	23%	637	277%	1.13
4,378	222%	506	26%	5,568	282%	1.14
54,008	221%	6,837	28%	69,916	286%	1.15
1,024	224%	98	21%	1,253	274%	1.12
6,158	222%	674	24%	7,727	279%	1.13
54,298	222%	6,569	27%	69,502	284%	1.14
3,322	225%	274	19%	3,968	269%	1.10
14,869	224%	1,436	22%	18,214	274%	1.12
92,026	223%	9,913	24%	114,782	278%	1.13
7,712	226%	580	17%	9,054	266%	1.09
27,426	166%	-367	-2%	46,445	281%	1.72
144,935	207%	15,393	22%	191,933	274%	1.20
46,437 AVERAGE	218% AVERAGE	4,880 AVERAGE	21% AVERAGE	59,952 AVERAGE	277% AVERAGE	1.17 AVERAGE

TABLE J.9

INCREASE IN LOADS TO RUTTING FAILURE FOR AN 3-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED.

E(AC) = 1,000,000 PSI

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
40,784	227%	2,270	13%	46,370	259%	1.08
631,143	226%	38,910	14%	726,299	260%	1.08
11,724,719	226%	767,128	15%	13,618,572	262%	1.09
9,741	226%	650	15%	11,304	262%	1.09
76,613	224%	6,015	18%	91,247	267%	1.10
851,663	224%	75,348	20%	1,033,382	271%	1.11
10,558	226%	731	16%	12,283	263%	1.09
64,224	265%	8,034	33%	76,243	315%	1.06
493,542	223%	46,203	21%	604,025	273%	1.12
18,084	225%	1,223	15%	21,078	263%	1.09
81,376	224%	6,574	18%	97,315	268%	1.11
475,965	223%	45,249	21%	583,710	274%	1.12
30,822	226%	2,009	15%	35,683	262%	1.09
122,409	225%	9,666	18%	145,695	267%	1.10
604,167	224%	56,605	21%	738,664	273%	1.12
1,015,721 AVERAGE	228% AVERAGE	71,108 AVERAGE	18% AVERAGE	1,189,458 AVERAGE	269% AVERAGE	1.10 AVERAGE

Appendix K: Effects of Lower Tire Load on Fatigue Failure of Asphalt Concrete Roads [E(ac)= 1,000,000 psi]

TABLE K.1

INCREASE IN LOADS TO FATIGUE FAILURE OF 1-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)=1,000,000 PSI

		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	1,265	1,717	2,463	452	36%	1,198	95%
1,000	5,000	1,755	2,369	3,374	614	35%	1,619	92%
1,000	10,000	2,168	2,912	4,129	744	34%	1,961	90%
5,000	2,500	8,287	11,125	15,911	2,838	34%	7,624	92%
5,000	5,000	13,856	18,435	24,760	4,579	33%	10,904	79%
5,000	10,000	21,506	28,395	35,802	6,889	32%	14,296	66%
10,000	2,500	28,269	38,197	52,916	9,928	35%	24,647	87%
10,000	5,000	45,238	60,701	79,264	15,463	34%	34,026	75%
10,000	10,000	71,896	95,977	117,136	24,081	33%	45,240	63%
20,000	2,500	158,426	216,008	298,289	57,582	36%	139,863	88%
20,000	5,000	221,701	301,018	399,403	79,317	36%	177,702	80%
20,000	10,000	324,067	438,594	554,547	114,527	35%	230,480	71%
30,000	2,500	614,069	843,446	1,191,362	229,377	37%	577,293	94%
30,000	5,000	759,217	1,042,171	1,439,774	282,954	37%	680,557	90%
30,000	10,000	994,160	1,364,014	1,824,468	369,854	37%	830,308	84%
				AVERAGE =	79,947	35%	185,181	83%

TABLE K.2
INCREASE IN LOADS TO FATIGUE FAILURE OF 2-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC) = 1,000,000 PSI

		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	10,072	17,626	20,721	7,554	75%	10,649	106%
1,000	5,000	13,190	22,867	26,879	9,677	73%	13,689	104%
1,000	10,000	15,954	27,476	32,284	11,522	72%	16,330	102%
5,000	2,500	23,350	38,842	47,602	15,492	66%	24,252	104%
5,000	5,000	36,695	60,169	73,683	23,474	64%	36,988	101%
5,000	10,000	55,995	90,533	110,730	34,538	62%	54,735	98%
10,000	2,500	42,563	67,924	86,635	25,361	60%	44,072	104%
10,000	5,000	66,865	105,270	134,034	38,405	57%	67,169	100%
10,000	10,000	106,881	165,774	210,996	58,893	55%	104,115	97%
20,000	2,500	106,475	160,482	214,488	54,007	51%	108,013	101%
20,000	5,000	157,749	235,387	313,502	77,638	49%	155,753	99%
20,000	10,000	246,836	363,150	482,952	116,314	47%	236,116	96%
30,000	2,500	220,913	320,636	445,062	99,723	45%	224,149	101%
30,000	5,000	310,217	446,371	617,059	136,154	44%	306,842	99%
30,000	10,000	463,847	660,987	909,774	197,140	43%	445,927	96%
				AVERAGE =	60,393	58%	123,253	101%

TABLE K.3

INCREASE IN LOADS TO FATIGUE FAILURE OF 3-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC) = 1,000,000 PSI

		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	56,523	79,817	119,929	23,294	41%	63,406	112%
1,000	5,000	68,262	96,154	143,906	27,892	41%	75,644	111%
1,000	10,000	77,300	108,524	162,221	31,224	40%	84,921	110%
5,000	2,500	100,343	140,949	211,243	40,606	40%	110,900	111%
5,000	5,000	136,103	190,230	284,023	54,127	40%	147,920	109%
5,000	10,000	178,442	248,051	369,227	69,609	39%	190,785	107%
10,000	2,500	156,573	219,868	326,235	63,295	40%	169,662	108%
10,000	5,000	214,488	299,454	441,813	84,966	40%	227,325	106%
10,000	10,000	292,548	406,284	595,563	113,736	39%	303,015	104%
20,000	2,500	314,746	437,954	648,031	123,208	39%	333,285	106%
20,000	5,000	418,100	578,697	852,527	160,597	38%	434,427	104%
20,000	10,000	566,007	779,206	1,140,932	213,199	38%	574,925	102%
30,000	2,500	555,418	771,129	1,344,509	215,711	39%	789,091	142%
30,000	5,000	716,321	988,594	1,451,912	272,273	38%	735,591	103%
30,000	10,000	943,754	1,295,997	1,891,799	352,243	37%	948,045	100%
				AVERAGE =	123,065	39%	345,929	109%

TABLE K.4

INCREASE IN LOADS TO FATIGUE FAILURE OF 1-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)=1,000,000 PSI

		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	704	875	1,137	171	24%	433	62%
1,000	5,000	911	1,118	1,435	207	23%	524	58%
1,000	10,000	1,072	1,304	1,658	232	22%	586	55%
5,000	2,500	3,567	4,202	5,125	635	18%	1,558	44%
5,000	5,000	5,192	5,967	7,097	775	15%	1,905	37%
5,000	10,000	7,071	7,952	9,250	881	12%	2,179	31%
10,000	2,500	10,811	12,253	14,289	1,442	13%	3,478	32%
10,000	5,000	15,107	16,690	18,969	1,583	10%	3,862	26%
10,000	10,000	20,769	22,370	24,760	1,601	8%	3,991	19%
20,000	2,500	52,632	55,995	60,945	3,363	6%	8,313	16%
20,000	5,000	66,371	69,177	73,683	2,806	4%	7,312	11%
20,000	10,000	85,866	87,256	90,697	1,390	2%	4,831	6%
30,000	2,500	182,262	182,875	186,610	613	0%	4,348	2%
30,000	5,000	210,503	208,304	209,522	-2,199	-1%	-981	0%
30,000	10,000	252,678	245,029	241,759	-7,649	-3%	-10,919	-4%
				AVERAGE =	390	10%	2,095	26%

TABLE K.5

INCREASE IN LOADS TO FATIGUE FAILURE OF 2-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC) = 1,000,000 PSI

		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	7,612	13,378	14,857	5,766	76%	7,245	95%
1,000	5,000	9,663	16,845	18,611	7,182	74%	8,948	93%
1,000	10,000	11,736	19,792	21,785	8,056	69%	10,049	86%
5,000	2,500	16,808	26,879	30,357	10,071	60%	13,549	81%
5,000	5,000	24,851	39,006	43,494	14,155	57%	18,643	75%
5,000	10,000	35,462	54,702	60,217	19,240	54%	24,755	70%
10,000	2,500	28,723	44,001	50,548	15,278	53%	21,825	76%
10,000	5,000	42,107	63,350	71,715	21,243	50%	29,608	70%
10,000	10,000	61,982	91,440	101,761	29,458	48%	39,779	64%
20,000	2,500	65,290	93,544	109,044	28,254	43%	43,754	67%
20,000	5,000	90,288	127,426	146,023	37,138	41%	55,735	62%
20,000	10,000	129,233	178,839	201,187	49,606	38%	71,954	56%
30,000	2,500	125,653	170,920	202,118	45,267	36%	76,465	61%
30,000	5,000	165,234	221,964	258,058	56,730	34%	92,824	56%
30,000	10,000	226,776	299,454	341,031	72,678	32%	114,255	50%
				AVERAGE =	28,008	51%	41,959	71%

TABLE K.6
INCREASE IN LOADS TO FATIGUE FAILURE OF 3-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC) = 1,000,000 PSI

		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	44,810	64,970	93,374	20,160	45%	48,564	108%
1,000	5,000	53,530	77,034	110,200	23,504	44%	56,670	106%
1,000	10,000	60,121	86,096	122,686	25,975	43%	62,565	104%
5,000	2,500	78,037	108,836	154,418	30,799	39%	76,381	98%
5,000	5,000	103,985	142,417	200,032	38,432	37%	96,047	92%
5,000	10,000	134,307	180,238	251,123	45,931	34%	116,816	87%
10,000	2,500	120,165	161,522	226,776	41,357	34%	106,611	89%
10,000	5,000	159,621	211,986	294,446	52,365	33%	134,825	84%
10,000	10,000	210,012	276,170	379,651	66,158	32%	169,639	81%
20,000	2,500	225,965	297,901	411,547	71,936	32%	185,582	82%
20,000	5,000	290,293	379,121	517,932	88,828	31%	227,639	78%
20,000	10,000	377,010	487,337	658,804	110,327	29%	281,794	75%
30,000	2,500	375,960	490,288	666,485	114,328	30%	290,525	77%
30,000	5,000	468,007	604,237	814,074	136,230	29%	346,067	74%
30,000	10,000	591,760	756,602	1,007,307	164,842	28%	415,547	70%
				AVERAGE =	68,745	35%	174,351	87%

TABLE K.7

INCREASE IN LOADS TO FATIGUE FAILURE OF 1-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)=1,000,000 PSI

		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	415	529	702	114	27%	287	69%
1,000	5,000	519	655	860	136	26%	341	66%
1,000	10,000	598	749	975	151	25%	377	63%
5,000	2,500	1,799	2,174	2,717	375	21%	918	51%
5,000	5,000	2,456	2,912	3,566	456	19%	1,110	45%
5,000	10,000	3,156	3,683	4,439	527	17%	1,283	41%
10,000	2,500	4,887	5,685	6,834	798	16%	1,947	40%
10,000	5,000	6,394	7,299	8,607	905	14%	2,213	35%
10,000	10,000	8,226	9,216	10,659	990	12%	2,433	30%
20,000	2,500	19,985	21,939	24,730	1,954	10%	4,745	24%
20,000	5,000	23,875	25,799	28,649	1,924	8%	4,774	20%
20,000	10,000	29,018	30,814	33,644	1,796	6%	4,626	16%
30,000	2,500	58,983	61,485	65,612	2,502	4%	6,629	11%
30,000	5,000	65,612	67,699	71,474	2,087	3%	5,862	9%
30,000	10,000	74,949	76,374	79,540	1,425	2%	4,591	6%
				AVERAGE =	1,076	14%	2,809	35%

TABLE K.8

INCREASE IN LOADS TO FATIGUE FAILURE OF 2-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC) = 1,000,000 PSI

		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	5,672	9,779	10,878	4,107	72%	5,206	92%
1,000	5,000	7,085	12,073	13,371	4,988	70%	6,286	89%
1,000	10,000	8,258	13,984	15,429	5,726	69%	7,171	87%
5,000	2,500	11,444	18,684	21,158	7,240	63%	9,714	85%
5,000	5,000	16,247	26,121	29,279	9,874	61%	13,032	80%
5,000	10,000	22,291	35,342	39,142	13,051	59%	16,851	76%
10,000	2,500	18,895	29,563	33,893	10,668	56%	14,998	79%
10,000	5,000	26,530	40,922	46,281	14,392	54%	19,751	74%
10,000	10,000	37,256	56,612	63,043	19,356	52%	25,787	69%
20,000	2,500	40,147	59,312	69,004	19,165	48%	28,857	72%
20,000	5,000	53,242	77,768	89,075	24,526	46%	35,833	67%
20,000	10,000	72,445	104,378	117,596	31,933	44%	45,151	62%
30,000	2,500	73,371	102,913	120,998	29,542	40%	47,627	65%
30,000	5,000	92,780	128,973	149,119	36,193	39%	56,339	61%
30,000	10,000	121,237	166,678	189,156	45,441	37%	67,919	56%
				AVERAGE =	18,413	54%	26,701	74%

TABLE K.9

INCREASE IN LOADS TO FATIGUE FAILURE OF 3-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC) = 1,000,000 PSI

		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	36,295	49,940	71,654	13,645	38%	35,359	97%
1,000	5,000	42,563	58,471	83,465	15,908	37%	40,902	96%
1,000	10,000	47,284	64,758	92,190	17,474	37%	44,906	95%
5,000	2,500	59,359	80,939	115,773	21,580	36%	56,414	95%
5,000	5,000	76,506	103,594	146,943	27,088	35%	70,437	92%
5,000	10,000	95,537	128,455	180,842	32,918	34%	85,305	89%
10,000	2,500	86,557	117,022	165,954	30,465	35%	79,397	92%
10,000	5,000	111,802	149,907	210,750	38,105	34%	98,948	89%
10,000	10,000	143,159	190,445	265,244	47,286	33%	122,085	85%
20,000	2,500	155,573	207,337	289,546	51,764	33%	133,973	86%
20,000	5,000	194,606	257,417	356,225	62,811	32%	161,619	83%
20,000	10,000	245,629	322,345	441,813	76,716	31%	196,184	80%
30,000	2,500	249,581	328,422	452,322	78,841	32%	202,741	81%
30,000	5,000	302,987	395,460	540,012	92,473	31%	237,025	78%
30,000	10,000	372,832	482,227	652,313	109,395	29%	279,481	75%
				AVERAGE =	47,765	34%	122,985	88%

Appendix L: Effects of Lower Tire Pressure and Tire Load on Fatigue Failure of Asphalt Concrete Roads [E(ac)= 1,000,000 psi]

TABLE L.1

INCREASE IN LOADS TO FATIGUE FAILURE FOR AN 1-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED.

E(AC) = 1,000,000 PSI

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
287	69%	850	205%	2,048	493%	1.80
341	66%	1,236	238%	2,855	550%	1.81
377	63%	1,570	263%	3,531	590%	1.81
918	51%	6,488	361%	14,112	784%	1.91
1,110	45%	11,400	464%	22,304	908%	1.78
1,283	41%	18,350	581%	32,646	1034%	1.66
1,947	40%	23,382	478%	48,029	983%	1.90
2,213	35%	38,844	608%	72,870	1140%	1.77
2,433	30%	63,670	774%	108,910	1324%	1.65
4,745	24%	138,441	693%	278,304	1393%	1.94
4,774	20%	197,826	829%	375,528	1573%	1.85
4,626	16%	295,049	1017%	525,529	1811%	1.75
6,629	11%	555,086	941%	1,132,379	1920%	2.02
5,862	9%	693,605	1057%	1,374,162	2094%	1.96
4,591	6%	919,211	1226%	1,749,519	2334%	1.89
2,809 AVERAGE	35% AVERAGE	197,667 AVERAGE	649% AVERAGE	382,848 AVERAGE	1262% AVERAGE	1.83 AVERAGE

TABLE L.2

INCREASE IN LOADS TO FATIGUE FAILURE FOR AN 2-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED.

E(AC) = 1,000,000 PSI

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
5,206	92%	4,400	78%	15,049	265%	1.57
6,286	89%	6,105	86%	19,794	279%	1.60
7,171	87%	7,696	93%	24,026	291%	1.62
9,714	85%	11,906	104%	36,158	316%	1.67
13,032	80%	20,448	126%	57,436	354%	1.72
16,851	76%	33,704	151%	88,439	397%	1.75
14,998	79%	23,668	125%	67,740	359%	1.75
19,751	74%	40,335	152%	107,504	405%	1.79
25,787	69%	69,625	187%	173,740	466%	1.82
28,857	72%	66,328	165%	174,341	434%	1.83
35,833	67%	104,507	196%	260,260	489%	1.85
45,151	62%	174,391	241%	410,507	567%	1.87
47,627	65%	147,542	201%	371,691	507%	1.90
56,339	61%	217,437	234%	524,279	565%	1.91
67,919	56%	342,610	283%	788,537	650%	1.92
26,701 AVERAGE	74% AVERAGE	84,713 AVERAGE	161% AVERAGE	207,967 AVERAGE	423% AVERAGE	1.77 AVERAGE

TABLE L.3

INCREASE IN LOADS TO FATIGUE FAILURE FOR AN 3-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED.

E(AC) = 1,000,000 PSI

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
35,359	97%	20,228	56%	83,634	230%	1.50
40,902	96%	25,699	60%	101,343	238%	1.52
44,906	95%	30,016	63%	114,937	243%	1.53
56,414	95%	40,984	69%	151,884	256%	1.56
70,437	92%	59,597	78%	207,517	271%	1.60
85,305	89%	82,905	87%	273,690	286%	1.63
79,397	92%	70,016	81%	239,678	277%	1.60
98,948	89%	102,686	92%	330,011	295%	1.64
122,085	85%	149,389	104%	452,404	316%	1.67
133,973	86%	159,173	102%	492,458	317%	1.68
161,619	83%	223,494	115%	657,921	338%	1.71
196,184	80%	320,378	130%	895,303	364%	1.73
202,741	81%	305,837	123%	1,094,928	439%	2.15
237,025	78%	413,334	136%	1,148,925	379%	1.77
279,481	75%	570,922	153%	1,518,967	407%	1.79
122,985 AVERAGE	88% AVERAGE	171,644 AVERAGE	97% AVERAGE	517,573 AVERAGE	311% AVERAGE	1.67 AVERAGE

Appendix M: Effects of Lower Tire Load on Fatigue Failure of Asphalt Concrete Roads [E(ac)= 1,000,000 psi]

TABLE M.1

INCREASE IN LOADS TO FATIGUE FAILURE OF 1 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD, BY REDUCING THE PER TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	443	586	692	143	32%	249	56%
1,000	5,000	577	759	856	182	32%	279	48%
1,000	10,000	676	888	972	212	31%	296	44%
5,000	2,500	16,864	23,213	30,845	6,349	38%	13,981	83%
5,000	5,000	21,326	29,438	38,061	8,112	38%	16,735	78%
5,000	10,000	25,496	35,305	44,752	9,809	38%	19,256	76%
10,000	2,500	271,785	389,313	621,880	117,528	43%	350,095	129%
10,000	5,000	231,494	333,500	535,049	102,006	44%	303,555	131%
10,000	10,000	210,678	305,300	491,354	94,622	45%	280,676	133%
20,000	2,500	5,608,047,422	18,942,617,591	1,802,191,509	13,334,570,169	238%	-3,805,855,913	-68%
20,000	5,000	31,897,922	54,773,697	98,836,992	22,875,775	72%	66,939,070	210%
20,000	10,000	6,392,644	10,364,252	19,260,328	3,971,608	62%	12,867,684	201%
30,000	2,500	NO TENSION	NO TENSION	NO TENSION	NO TENSION	NO TENSION	NO TENSION	NO TENSION
30,000	5,000	NO TENSION	NO TENSION	NO TENSION	NO TENSION	NO TENSION	NO TENSION	NO TENSION
30,000	10,000	1,034,832,653	2,837,815,543	2,700,170,360	1,802,982,890	174%	1,665,337,707	161%
				AVERAGE =	1,166,518,416	68%	-158,440,487	99%

NO TENSION: NO HORIZONTAL TENSILE STRAIN CALCULATED FOR THIS LOADING CONDITION.

TABLE M.2

INCREASE IN LOADS TO FATIGUE FAILURE OF 2 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD, BY REDUCING THE PER TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	928	1,258	1,818	330	36%	890	96%
1,000	5,000	1,255	1,690	2,432	435	35%	1,177	94%
1,000	10,000	1,518	2,040	2,922	522	34%	1,404	92%
5,000	2,500	7,329	9,883	14,259	2,554	35%	6,930	95%
5,000	5,000	11,248	15,002	20,861	3,754	33%	9,613	85%
5,000	10,000	23,651	21,197	28,070	-2,454	-10%	4,419	19%
10,000	2,500	31,939	43,020	59,835	11,081	35%	27,896	87%
10,000	5,000	45,316	60,659	80,800	15,343	34%	35,484	78%
10,000	10,000	62,630	83,399	106,064	20,769	33%	43,434	69%
20,000	2,500	295,734	397,468	526,016	101,734	34%	230,282	78%
20,000	5,000	338,759	454,652	589,674	115,893	34%	250,915	74%
20,000	10,000	394,384	530,006	669,164	135,622	34%	274,780	70%
30,000	2,500	2,174,992	2,901,502	3,638,624	726,510	33%	1,463,632	67%
30,000	5,000	1,886,842	2,530,967	3,205,962	644,125	34%	1,319,120	70%
30,000	10,000	1,735,216	2,337,239	2,971,580	602,023	35%	1,236,364	71%
				AVERAGE =	158,549	31%	327,089	76%

TABLE M.3

INCREASE IN LOADS TO FATIGUE FAILURE OF 3 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD, BY REDUCING THE PER TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	2,427	3,358	4,948	931	38%	2,521	104%
1,000	5,000	3,057	4,214	6,179	1,157	38%	3,122	102%
1,000	10,000	3,535	4,859	7,107	1,324	37%	3,572	101%
5,000	2,500	12,485	17,067	24,873	4,582	37%	12,388	99%
5,000	5,000	17,169	23,315	33,753	6,146	36%	16,584	97%
5,000	10,000	22,287	30,083	43,325	7,796	35%	21,038	94%
10,000	2,500	41,338	56,115	81,320	14,777	36%	39,982	97%
10,000	5,000	53,868	72,664	104,722	18,796	35%	50,854	94%
10,000	10,000	68,819	92,340	132,418	23,521	34%	63,599	92%
20,000	2,500	237,200	318,607	449,358	81,407	34%	212,158	89%
20,000	5,000	272,205	364,271	506,170	92,066	34%	233,965	86%
20,000	10,000	315,019	420,332	573,829	105,313	33%	258,810	82%
30,000	2,500	966,850	1,283,313	1,682,180	316,463	33%	715,330	74%
30,000	5,000	979,023	1,299,319	1,695,809	320,296	33%	716,786	73%
30,000	10,000	1,013,252	1,343,856	1,742,293	330,604	33%	729,041	72%
				AVERAGE =	88,345	35%	205,317	90%

TABLE M.4

INCREASE IN LOADS TO FATIGUE FAILURE OF 1 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD, BY REDUCING THE PER TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	126	137	154	11	9%	28	22%
1,000	5,000	149	160	155	11	7%	6	4%
1,000	10,000	165	176	193	11	7%	28	17%
5,000	2,500	3,884	3,646	3,484	-238	-6%	-400	-10%
5,000	5,000	4,552	4,196	3,942	-356	-8%	-610	-13%
5,000	10,000	5,134	4,665	4,326	-469	-9%	-808	-16%
10,000	2,500	53,137	42,718	34,768	-10,419	-20%	-18,369	-35%
10,000	5,000	48,990	40,033	33,030	-8,957	-18%	-15,960	-33%
10,000	10,000	47,064	38,798	32,263	-8,266	-18%	-14,801	-31%
20,000	2,500	5,187,648	2,302,877	1,158,500	-2,884,771	-56%	-4,029,148	-78%
20,000	5,000	2,100,872	1,204,098	724,249	-896,774	-43%	-1,376,623	-66%
20,000	10,000	1,239,842	805,827	534,542	-434,015	-35%	-705,300	-57%
30,000	2,500	NO TENSION	528,706,548	47,221,462	NO TENSION	NO TENSION	NO TENSION	NO TENSION
30,000	5,000	125,848,909	29,889,260	10,196,706	-95,959,649	-76%	-115,652,203	-92%
30,000	10,000	18,779,876	8,817,011	4,498,637	-9,962,865	-53%	-14,281,239	-76%
				AVERAGE =	-7,869,053	-23%	-9,721,100	-33%

NO TENSION: NO HORIZONTAL TENSILE STRAIN CALCULATED FOR THIS LOADING CONDITION.

TABLE M.5

INCREASE IN LOADS TO FATIGUE FAILURE OF 2 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD, BY REDUCING THE PER TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	539	667	884	128	24%	345	64%
1,000	5,000	686	852	1,098	166	24%	412	60%
1,000	10,000	797	982	1,256	185	23%	459	58%
5,000	2,500	3,264	3,859	4,718	595	18%	1,454	45%
5,000	5,000	4,472	5,181	6,194	709	16%	1,722	39%
5,000	10,000	5,733	6,524	7,679	791	14%	1,946	34%
10,000	2,500	12,114	13,689	15,900	1,575	13%	3,786	31%
10,000	5,000	15,543	17,198	19,586	1,655	11%	4,043	26%
10,000	10,000	19,390	21,084	23,582	1,694	9%	4,192	22%
20,000	2,500	86,014	89,128	94,477	3,114	4%	8,463	10%
20,000	5,000	94,003	96,625	101,520	2,622	3%	7,517	8%
20,000	10,000	103,819	105,696	110,034	1,877	2%	6,215	6%
30,000	2,500	448,954	421,074	403,029	-27,880	-6%	-45,925	-10%
30,000	5,000	411,202	390,657	377,807	-20,545	-5%	-33,395	-8%
30,000	10,000	390,657	373,647	363,964	-17,010	-4%	-26,693	-7%
				AVERAGE =	-3,355	10%	-4,364	25%

TABLE M.6
INCREASE IN LOADS TO FATIGUE FAILURE OF 3 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD, BY REDUCING THE PER TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	1,776	2,344	3,232	568	32%	1,456	82%
1,000	5,000	2,173	2,843	3,892	670	31%	1,719	79%
1,000	10,000	2,463	3,212	4,374	749	30%	1,911	78%
5,000	2,500	7,501	9,529	12,523	2,028	27%	5,022	67%
5,000	5,000	9,745	12,151	15,797	2,406	25%	6,052	62%
5,000	10,000	11,970	14,811	19,012	2,841	24%	7,042	59%
10,000	2,500	21,402	26,199	33,273	4,797	22%	11,871	55%
10,000	5,000	26,308	31,811	39,895	5,503	21%	13,587	52%
10,000	10,000	31,683	37,884	46,957	6,201	20%	15,274	48%
20,000	2,500	97,062	112,456	134,577	15,394	16%	37,515	39%
20,000	5,000	107,241	123,318	146,556	16,077	15%	39,315	37%
20,000	10,000	119,001	135,844	160,069	16,843	14%	41,068	35%
30,000	2,500	317,576	349,606	396,094	32,030	10%	78,518	25%
30,000	5,000	319,901	351,947	398,503	32,046	10%	78,602	25%
30,000	10,000	326,742	359,094	405,848	32,352	10%	79,106	24%
				AVERAGE =	11,367	20%	27,871	51%

TABLE M.7

INCREASE IN LOADS TO FATIGUE FAILURE OF 1 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD, BY REDUCING THE PER TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	52	59	69	7	13%	17	33%
1,000	5,000	59	67	77	8	14%	18	31%
1,000	10,000	64	72	83	8	13%	19	30%
5,000	2,500	1,061	1,058	1,078	-3	0%	17	2%
5,000	5,000	1,187	1,171	1,180	-16	-1%	-7	-1%
5,000	10,000	1,297	1,266	1,264	-31	-2%	-33	-3%
10,000	2,500	9,663	8,539	7,699	-1,124	-12%	-1,964	-20%
10,000	5,000	9,243	8,246	7,462	-997	-11%	-1,781	-19%
10,000	10,000	9,066	8,116	7,367	-950	-10%	-1,699	-19%
20,000	2,500	255,847	172,210	120,225	-83,637	-33%	-135,622	-53%
20,000	5,000	172,674	126,130	94,055	-46,544	-27%	-78,619	-46%
20,000	10,000	133,326	102,279	79,604	-31,047	-23%	-53,722	-40%
30,000	2,500	5,868,570	2,407,994	1,152,959	-3,460,576	-59%	-4,715,611	-80%
30,000	5,000	1,916,002	1,086,531	650,491	-829,471	-43%	-1,265,511	-66%
30,000	10,000	989,131	655,756	443,348	-333,375	-34%	-545,783	-55%
				AVERAGE =	-319,183	-14%	-453,352	-20%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE M.8

INCREASE IN LOADS TO FATIGUE FAILURE OF 2 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD, BY REDUCING THE PER TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	324	414	551	90	28%	227	70%
1,000	5,000	400	506	666	106	27%	266	67%
1,000	10,000	455	572	749	117	26%	294	65%
5,000	2,500	1,662	2,008	2,519	346	21%	857	52%
5,000	5,000	2,154	2,566	3,161	412	19%	1,007	47%
5,000	10,000	2,644	3,105	3,778	461	17%	1,134	43%
10,000	2,500	5,429	6,286	7,521	857	16%	2,092	39%
10,000	5,000	6,605	7,540	8,894	935	14%	2,289	35%
10,000	10,000	7,883	8,870	10,313	987	13%	2,430	31%
20,000	2,500	30,527	32,883	36,350	2,356	8%	5,823	19%
20,000	5,000	32,657	34,970	38,435	2,313	7%	5,778	18%
20,000	10,000	35,202	37,437	40,873	2,235	6%	5,671	16%
30,000	2,500	123,019	122,870	125,745	-149	0%	2,726	2%
30,000	5,000	115,979	116,673	120,225	694	1%	4,246	4%
30,000	10,000	112,059	113,256	117,092	1,197	1%	5,033	4%
				AVERAGE =	864	14%	2,658	34%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE M.9

INCREASE IN LOADS TO FATIGUE FAILURE OF 3 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD, BY REDUCING THE PER TIRE LOAD. E(AC) = 150,000 PSI

		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	1,223	1,632	2,285	409	33%	1,062	87%
1,000	5,000	1,466	1,943	2,700	477	33%	1,234	84%
1,000	10,000	1,640	2,169	2,997	529	32%	1,357	83%
5,000	2,500	4,603	5,915	7,925	1,312	29%	3,322	72%
5,000	5,000	5,761	7,329	9,718	1,568	27%	3,957	69%
5,000	10,000	6,893	8,720	11,449	1,827	27%	4,556	66%
10,000	2,500	11,970	14,954	19,471	2,984	25%	7,501	63%
10,000	5,000	14,259	17,624	22,670	3,365	24%	8,411	59%
10,000	10,000	16,669	20,424	26,040	3,755	23%	9,371	56%
20,000	2,500	46,787	55,688	68,784	8,901	19%	21,997	47%
20,000	5,000	50,714	60,040	73,764	9,326	18%	23,050	45%
20,000	10,000	55,160	64,943	79,350	9,783	18%	24,190	44%
30,000	2,500	133,409	152,327	183,552	18,918	14%	50,143	38%
30,000	5,000	134,242	153,218	181,183	18,976	14%	46,941	35%
30,000	10,000	136,525	155,627	183,804	19,102	14%	47,279	35%
				AVERAGE =	6,749	23%	16,958	59%

NOTE: E(BASE) = AGGREGATE ELASTIC MODULUS
E(SG) = SUBGRADE ELASTIC MODULUS

TABLE M.10

INCREASE IN LOADS TO FATIGUE FAILURE OF 1-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)=150,000 PSI

		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	445	589	695	144	32%	250	56%
1,000	5,000	579	762	861	183	32%	282	49%
1,000	10,000	677	891	976	214	32%	299	44%
5,000	2,500	16,488	22,718	30,393	6,230	38%	13,905	84%
5,000	5,000	20,964	28,967	37,690	8,003	38%	16,726	80%
5,000	10,000	25,200	34,939	44,551	9,739	39%	19,351	77%
10,000	2,500	243,263	349,591	562,826	106,328	44%	319,563	131%
10,000	5,000	216,804	313,233	539,107	96,429	44%	322,303	149%
10,000	10,000	202,170	293,391	476,206	91,221	45%	274,036	136%
20,000	2,500	44,270,499	890,113,914	3,418,795,691	845,843,415	1911%	3,374,525,192	7623%
20,000	5,000	20,920,903	35,492,306	75,240,464	14,571,403	70%	54,319,561	260%
20,000	10,000	5,461,407	8,797,080	16,642,507	3,335,673	61%	11,181,100	205%
30,000	2,500	17,476,152	24,251,648	36,951,133	6,775,496	39%	19,474,981	111%
30,000	5,000	51,667,710	70,446,256	106,777,575	18,778,546	36%	55,109,865	107%
30,000	10,000	340,416,315	439,024,091	4,827,693,385	98,607,776	29%	4,487,277,070	1318%
				AVERAGE =	65,882,053	166%	533,523,632	695%

TABLE M.11

INCREASE IN LOADS TO FATIGUE FAILURE OF 2-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)=150,000

		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	946	1,279	1,849	333	35%	903	95%
1,000	5,000	1,272	1,709	2,459	437	34%	1,187	93%
1,000	10,000	1,635	2,058	2,950	423	26%	1,315	80%
5,000	2,500	7,521	10,109	14,578	2,588	34%	7,057	94%
5,000	5,000	11,381	15,196	21,222	3,815	34%	9,841	86%
5,000	10,000	16,109	21,379	28,321	5,270	33%	12,212	76%
10,000	2,500	32,577	43,846	60,987	11,269	35%	28,410	87%
10,000	5,000	45,601	61,047	81,364	15,446	34%	35,763	78%
10,000	10,000	62,753	83,624	106,434	20,871	33%	43,681	70%
20,000	2,500	287,907	387,309	515,243	99,402	35%	227,336	79%
20,000	5,000	331,046	444,941	579,424	113,895	34%	248,378	75%
20,000	10,000	387,976	520,593	661,746	132,617	34%	273,770	71%
30,000	2,500	1,892,101	2,534,820	3,237,596	642,719	34%	1,345,495	71%
30,000	5,000	1,737,571	2,337,239	2,995,429	599,668	35%	1,257,858	72%
30,000	10,000	1,655,347	2,232,834	2,865,007	577,487	35%	1,209,660	73%
				AVERAGE =	148,416	34%	313,524	80%

TABLE M.12

INCREASE IN LOADS TO FATIGUE FAILURE OF 3-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)= 150,000 PSI.

		TIRE PRESSURE = 40 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	2,552	3,535	5,205	983	39%	2,653	104%
1,000	5,000	3,093	4,279	6,271	1,186	38%	3,178	103%
1,000	10,000	3,506	4,837	7,089	1,331	38%	3,583	102%
5,000	2,500	13,354	18,229	26,479	4,875	37%	13,125	98%
5,000	5,000	17,767	24,109	34,840	6,342	36%	17,073	96%
5,000	10,000	22,711	30,661	44,099	7,950	35%	21,388	94%
10,000	2,500	44,237	59,835	86,578	15,598	35%	42,341	96%
10,000	5,000	55,847	75,160	108,246	19,313	35%	52,399	94%
10,000	10,000	70,238	94,055	134,829	23,817	34%	64,591	92%
20,000	2,500	246,017	329,963	464,220	83,946	34%	218,203	89%
20,000	5,000	277,097	370,801	514,760	93,704	34%	237,663	86%
20,000	10,000	317,834	423,683	578,861	105,849	33%	261,027	82%
30,000	2,500	947,354	1,258,234	1,653,136	310,880	33%	705,782	75%
30,000	5,000	962,473	1,278,561	1,673,173	316,088	33%	710,700	74%
30,000	10,000	1,001,671	1,328,793	1,725,837	327,122	33%	724,166	72%
				AVERAGE =	87,932	35%	205,191	90%

TABLE M.13

INCREASE IN LOADS TO FATIGUE FAILURE OF 1-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)=150,000 PSI

		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	127	138	155	11	9%	28	22%
1,000	5,000	150	162	179	12	8%	29	19%
1,000	10,000	167	177	195	10	6%	28	17%
5,000	2,500	3,883	3,661	3,505	-222	-6%	-378	-10%
5,000	5,000	4,562	4,223	3,976	-339	-7%	-586	-13%
5,000	10,000	5,169	4,718	4,374	-451	-9%	-795	-15%
10,000	2,500	51,113	41,626	34,198	-9,487	-19%	-16,915	-33%
10,000	5,000	48,320	39,825	33,042	-8,495	-18%	-15,278	-32%
10,000	10,000	47,062	39,046	32,576	-8,016	-17%	-14,486	-31%
20,000	2,500	6,907,400	2,802,452	1,330,400	-4,104,948	-59%	-5,577,000	-81%
20,000	5,000	2,393,522	1,493,799	778,707	-899,723	-38%	-1,614,815	-67%
20,000	10,000	1,273,780	841,405	556,904	-432,375	-34%	-716,876	-56%
30,000	2,500	16,376,178	25,306,655	39,358,291	8,930,477	55%	22,982,113	140%
30,000	5,000	49,788,019	39,579,572	12,134,950	-10,208,447	-21%	-37,653,069	-76%
30,000	10,000	22,046,920	9,871,655	4,876,403	-12,175,265	-55%	-17,170,517	-78%
				AVERAGE =	-1,261,151	-14%	-2,653,234	-20%

TABLE M.14

INCREASE IN LOADS TO FATIGUE FAILURE OF 2-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)=150,000

		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	547	685	895	138	25%	348	64%
1,000	5,000	693	857	1,106	164	24%	413	60%
1,000	10,000	803	987	1,501	184	23%	698	87%
5,000	2,500	3,338	3,942	4,815	604	18%	1,477	44%
5,000	5,000	4,532	5,245	6,271	713	16%	1,739	38%
5,000	10,000	5,788	6,605	7,760	817	14%	1,972	34%
10,000	2,500	12,372	13,948	16,162	1,576	13%	3,790	31%
10,000	5,000	15,694	17,399	19,777	1,705	11%	4,083	26%
10,000	10,000	19,518	21,250	23,773	1,732	9%	4,255	22%
20,000	2,500	85,085	88,494	93,950	3,409	4%	8,865	10%
20,000	5,000	93,375	96,244	101,288	2,869	3%	7,913	8%
20,000	10,000	103,580	105,696	110,163	2,116	2%	6,583	6%
30,000	2,500	417,382	396,437	383,340	-20,945	-5%	-34,042	-8%
30,000	5,000	395,409	378,453	368,608	-16,956	-4%	-26,801	-7%
30,000	10,000	383,669	368,920	360,606	-14,749	-4%	-23,063	-6%
				AVERAGE =	-2,442	10%	-2,785	27%

TABLE M.15

INCREASE IN LOADS TO FATIGUE FAILURE OF 3-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)= 150,000 PSI.

		TIRE PRESSURE = 70 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	1,856	2,445	3,365	589	32%	1,509	81%
1,000	5,000	2,197	2,877	3,942	680	31%	1,745	79%
1,000	10,000	2,450	3,193	4,355	743	30%	1,905	78%
5,000	2,500	7,925	9,995	13,150	2,070	26%	5,225	66%
5,000	5,000	9,995	12,485	16,215	2,490	25%	6,220	62%
5,000	10,000	12,151	15,002	19,290	2,851	23%	7,139	59%
10,000	2,500	22,580	27,683	34,840	5,103	23%	12,260	54%
10,000	5,000	27,061	32,683	40,855	5,622	21%	13,794	51%
10,000	10,000	32,211	38,484	47,579	6,273	19%	15,368	48%
20,000	2,500	99,853	115,565	138,076	15,712	16%	38,223	38%
20,000	5,000	108,880	125,209	148,639	16,329	15%	39,759	37%
20,000	10,000	120,008	137,040	161,445	17,032	14%	41,437	35%
30,000	2,500	314,004	346,132	393,024	32,128	10%	79,020	25%
30,000	5,000	317,063	349,315	396,437	32,252	10%	79,374	25%
30,000	10,000	325,411	357,890	405,141	32,479	10%	79,730	25%
				AVERAGE =	11,490	20%	28,181	51%

TABLE M.16

INCREASE IN LOADS TO FATIGUE FAILURE OF 1-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)=150,000 PSI

		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	52	59	69	7	13%	17	33%
1,000	5,000	60	67	78	7	12%	18	30%
1,000	10,000	65	72	83	7	11%	18	28%
5,000	2,500	1,067	1,063	1,081	-4	0%	14	1%
5,000	5,000	1,199	1,180	1,187	-19	-2%	-12	-1%
5,000	10,000	1,311	1,279	1,274	-32	-2%	-37	-3%
10,000	2,500	9,555	8,447	7,619	-1,108	-12%	-1,936	-20%
10,000	5,000	9,268	8,246	7,462	-1,022	-11%	-1,806	-19%
10,000	10,000	9,166	8,180	7,424	-986	-11%	-1,742	-19%
20,000	2,500	286,543	188,146	128,703	-98,397	-34%	-157,840	-55%
20,000	5,000	183,419	143,498	97,773	-39,921	-22%	-85,646	-47%
20,000	10,000	137,983	106,615	81,404	-31,368	-23%	-56,579	-41%
30,000	2,500	8,289,603	3,024,252	1,347,178	-5,265,351	-64%	-6,942,425	-84%
30,000	5,000	2,193,962	1,201,130	700,635	-992,832	-45%	-1,493,327	-68%
30,000	10,000	1,056,372	689,925	460,844	-366,447	-35%	-595,528	-56%
				AVERAGE =	-453,164	-15%	-622,454	-21%

TABLE M.17

INCREASE IN LOADS TO FATIGUE FAILURE OF 2-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)=150,000

		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	328	419	558	91	28%	230	70%
1,000	5,000	403	510	671	107	27%	268	67%
1,000	10,000	458	576	838	118	26%	380	83%
5,000	2,500	1,692	2,040	2,547	348	21%	855	51%
5,000	5,000	2,181	2,585	3,180	404	19%	999	46%
5,000	10,000	2,670	3,124	3,794	454	17%	1,124	42%
10,000	2,500	5,519	6,380	7,619	861	16%	2,100	38%
10,000	5,000	6,672	7,619	8,967	947	14%	2,295	34%
10,000	10,000	7,946	8,943	10,402	997	13%	2,456	31%
20,000	2,500	30,406	32,763	36,214	2,357	8%	5,808	19%
20,000	5,000	32,617	34,926	38,370	2,309	7%	5,753	18%
20,000	10,000	35,275	37,500	40,926	2,225	6%	5,651	16%
30,000	2,500	117,583	118,148	121,391	565	0%	3,808	3%
30,000	5,000	113,458	114,471	118,148	1,013	1%	4,690	4%
30,000	10,000	11,269	112,522	116,395	101,253	899%	105,126	933%
				AVERAGE =	7,603	73%	9,436	97%

TABLE M.18

INCREASE IN LOADS TO FATIGUE FAILURE OF 3-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD, BY REDUCING TIRE LOAD. E(AC)= 150,000 PSI.

		TIRE PRESSURE = 100 PSI TIRE LOAD (POUNDS)			4250 LBS TO 3750 LBS	PERCENT INCREASE	4250 LBS TO 3250 LBS	PERCENT INCREASE
E(BASE) PSI	E(SG) PSI	4,250	3,750	3,250				
1,000	2,500	1,272	1,698	2,370	426	33%	1,098	86%
1,000	5,000	1,482	1,967	2,731	485	33%	1,249	84%
1,000	10,000	1,635	2,162	2,991	527	32%	1,356	83%
5,000	2,500	4,826	6,179	8,268	1,353	28%	3,442	71%
5,000	5,000	5,901	7,482	9,936	1,581	27%	4,035	68%
5,000	10,000	6,981	8,797	11,551	1,816	26%	4,570	65%
10,000	2,500	12,523	15,593	20,168	3,070	25%	7,645	61%
10,000	5,000	14,578	18,002	23,111	3,424	23%	8,533	59%
10,000	10,000	16,881	20,670	26,308	3,789	22%	9,427	56%
20,000	2,500	47,927	56,763	70,166	8,836	18%	22,239	46%
20,000	5,000	51,402	60,600	74,535	9,198	18%	23,133	45%
20,000	10,000	55,635	65,236	79,816	9,601	17%	24,181	43%
30,000	2,500	132,500	151,345	178,853	18,845	14%	46,353	35%
30,000	5,000	133,492	152,524	180,074	19,032	14%	46,582	35%
30,000	10,000	136,269	155,425	183,301	19,156	14%	47,032	35%
				AVERAGE =	6,743	23%	16,725	58%

Appendix N: Effects of Lower Tire Pressure and Tire Load on Fatigue Failure of Asphalt Concrete Roads [E(ac)= 1,000,000 psi

TABLE N.1

PERCENT INCREASE IN LOADS TO FATIGUE FAILURE FOR A 1 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED. E(AC)=150,000 PSI

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
17	33%	391	752%	640	1231%	1.57
18	31%	518	878%	797	1351%	1.49
19	30%	612	956%	908	1419%	1.44
17	2%	15,803	1489%	29,784	2807%	1.88
-7	-1%	20,139	1697%	36,874	3106%	1.83
-33	-3%	24,199	1866%	43,455	3350%	1.80
-1,964	-20%	262,122	2713%	612,217	6336%	2.35
-1,781	-19%	222,251	2405%	525,806	5689%	2.38
-1,699	-19%	201,612	2224%	482,288	5320%	2.41
-135,622	-53%	5,607,791,575	2191854%	1,801,935,662	704302%	0.32
-78,619	-46%	31,725,248	18373%	98,664,318	57139%	3.12
-53,722	-40%	6,259,318	4695%	19,127,002	14346%	3.08
-4,715,611	-80%	1,033,843,522	104520%	2,699,181,229	272884%	2.62
-1,265,511	-66%	NO TENSION	NO TENSION	NO TENSION	NO TENSION	NO TENSION
-545,783	-55%	1,033,843,522	104520%	2,699,181,229	272884%	2.61
-453,352 AVERAGE	-20% AVERAGE	551,015,059 AVERAGE	174210% AVERAGE	522,844,444 AVERAGE	96583% AVERAGE	2.07 AVERAGE

TABLE N.2
PERCENT INCREASE IN LOADS TO FATIGUE FAILURE FOR A 2 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED. E(AC)=150,000 PSI

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
227	70%	604	186%	1,494	461%	1.80
266	67%	855	214%	2,032	508%	1.81
294	65%	1,063	234%	2,467	542%	1.82
857	52%	5,667	341%	12,597	758%	1.93
1,007	47%	9,094	422%	18,707	868%	1.85
1,134	43%	21,007	795%	25,426	962%	1.15
2,092	39%	26,510	488%	54,406	1002%	1.90
2,289	35%	38,711	586%	74,195	1123%	1.81
2,430	31%	54,747	694%	98,181	1245%	1.72
5,823	19%	265,207	869%	495,489	1623%	1.83
5,778	18%	306,102	937%	557,017	1706%	1.79
5,671	16%	359,182	1020%	633,962	1801%	1.74
2,726	2%	2,051,973	1668%	3,515,605	2858%	1.71
4,246	4%	1,770,863	1527%	3,089,983	2664%	1.74
5,033	4%	1,623,157	1448%	2,859,521	2552%	1.76
2,658 AVERAGE	34% AVERAGE	435,649 AVERAGE	762% AVERAGE	762,739 AVERAGE	1378% AVERAGE	1.76 AVERAGE

TABLE N.3
PERCENT INCREASE IN LOADS TO FATIGUE FAILURE FOR A 3 INCH ASPHALT CONCRETE ROAD SUBJECT TO A DUAL TIRE SINGLE AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED. E(AC)=150,000 PSI

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
1,062	87%	1,204	98%	3,725	305%	1.64
1,234	84%	1,591	109%	4,713	321%	1.67
1,357	83%	1,895	116%	5,467	333%	1.68
3,322	72%	7,882	171%	20,270	440%	1.81
3,957	69%	11,408	198%	27,992	486%	1.82
4,556	66%	15,394	223%	36,432	529%	1.83
7,501	63%	29,368	245%	69,350	579%	1.88
8,411	59%	39,609	278%	90,463	634%	1.88
9,371	56%	52,150	313%	115,749	694%	1.88
21,997	47%	190,413	407%	402,571	860%	1.90
23,050	45%	221,491	437%	455,456	898%	1.86
24,190	44%	259,859	471%	518,669	940%	1.83
50,143	38%	833,441	625%	1,548,771	1161%	1.75
46,941	35%	844,781	629%	1,561,567	1163%	1.75
47,279	35%	876,727	642%	1,605,768	1176%	1.74
16,958 AVERAGE	59% AVERAGE	225,814 AVERAGE	331% AVERAGE	431,131 AVERAGE	701% AVERAGE	1.79 AVERAGE

TABLE N.4

INCREASE IN LOADS TO FATIGUE FAILURE FOR AN 1-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED.

E(AC) = 150,000 PSI

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
17	33%	393	756%	643	1237%	1.57
18	30%	519	865%	801	1335%	1.49
18	28%	612	942%	911	1402%	1.45
14	1%	15,421	1445%	29,326	2748%	1.90
-12	-1%	19,765	1648%	36,491	3043%	1.85
-37	-3%	23,889	1822%	43,240	3298%	1.81
-1,936	-20%	233,708	2446%	553,271	5790%	2.39
-1,806	-19%	207,536	2239%	529,839	5717%	2.58
-1,742	-19%	193,004	2106%	467,040	5095%	2.44
-157,840	-55%	43,983,956	15350%	3,418,509,148	1193018%	78.00
-85,646	-47%	20,737,484	11306%	75,057,045	40921%	3.63
-56,579	-41%	5,323,424	3858%	16,504,524	11961%	3.13
-6,942,425	-84%	9,186,549	111%	28,661,530	346%	12.77
-1,493,327	-68%	49,473,748	2255%	104,583,613	4767%	2.18
-595,528	-56%	339,359,943	32125%	4,826,637,013	456907%	14.25
-622,454 AVERAGE	-21% AVERAGE	31,250,663 AVERAGE	5285% AVERAGE	564,774,296 AVERAGE	115839% AVERAGE	8.76 AVERAGE

TABLE N.5
INCREASE IN LOADS TO FATIGUE FAILURE FOR AN 2-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED.
E(AC) = 150,000 PSI

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
230	70%	618	188%	1,521	464%	1.79
268	67%	869	216%	2,056	510%	1.81
380	83%	1,177	257%	2,492	544%	1.60
855	51%	5,829	345%	12,886	762%	1.93
999	46%	9,200	422%	19,041	873%	1.87
1,124	42%	13,439	503%	25,651	961%	1.76
2,100	38%	27,058	490%	55,468	1005%	1.90
2,295	34%	38,929	583%	74,692	1119%	1.81
2,456	31%	54,807	690%	98,488	1239%	1.72
5,808	19%	257,501	847%	484,837	1595%	1.84
5,753	18%	298,429	915%	546,807	1676%	1.80
5,651	16%	352,701	1000%	626,471	1776%	1.75
3,808	3%	1,774,518	1509%	3,120,013	2653%	1.75
4,690	4%	1,624,113	1431%	2,881,971	2540%	1.77
105,126	933%	1,644,078	14589%	2,853,738	25324%	1.63
9,436 AVERAGE	97% AVERAGE	406,884 AVERAGE	1599% AVERAGE	720,409 AVERAGE	2869% AVERAGE	1.78 AVERAGE

TABLE N.6

INCREASE IN LOADS TO FATIGUE FAILURE FOR AN 3-INCH ASPHALT CONCRETE ROAD SUBJECT TO A TANDEM AXLE LOAD BY REDUCING TIRE LOAD AND PRESSURE INDIVIDUALLY AND COMBINED.

E(AC) = 150,000 PSI

LOAD FROM 4250 LBS TO 3250 LBS	PERCENT INCREASE	TIRE PRESSURE FROM 100 PSI TO 40 PSI	PERCENT INCREASE	COMBINED EFFECT	PERCENT INCREASE	SYNERGISTIC FACTOR
1,098	86%	1,280	101%	3,933	309%	1.65
1,249	84%	1,611	109%	4,789	323%	1.67
1,356	83%	1,871	114%	5,454	334%	1.69
3,442	71%	8,528	177%	21,653	449%	1.81
4,035	68%	11,866	201%	28,939	490%	1.82
4,570	65%	15,730	225%	37,118	532%	1.83
7,645	61%	31,714	253%	74,055	591%	1.88
8,533	59%	41,269	283%	93,668	643%	1.88
9,427	56%	53,357	316%	117,948	699%	1.88
22,239	46%	198,090	413%	416,293	869%	1.89
23,133	45%	225,695	439%	463,358	901%	1.86
24,181	43%	262,199	471%	523,226	940%	1.83
46,353	35%	814,854	615%	1,520,636	1148%	1.77
46,582	35%	828,981	621%	1,539,681	1153%	1.76
47,032	35%	865,402	635%	1,589,568	1166%	1.74
16,725 AVERAGE	58% AVERAGE	224,163 AVERAGE	332% AVERAGE	429,355 AVERAGE	703% AVERAGE	1.80 AVERAGE