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16. Abstract

This report summarizes the development of a new method of predicting load equivalence factors for flexible pavement within the state of Texas. The new method was developed primarily because the current method used by the Texas Highway Department (the AASHO method) is not appropriate for the Texas environment and soil. The new method is based on VESYS-IVB output data from the Cost Allocation Study for the Federal Highway Department.

The new method has the following advantages over the current method: (1) it considers four environmental zones in Texas; (2) it used the elastic modulus of the subgrade; (3) it makes use of the S-shaped curve; and (4) it considers different types, namely rutting, alligator cracking and loss of serviceability index.

Different tables of load equivalence factors are produced for each environmental zone and each distress type. Three levels of subgrade stiffness, three levels of pavement structural number and six levels of asphaltic concrete thickness are presented in these tables.

The format of each table is the same as those produced from the AASHO Road Test but the values of the load equivalence factors are different from those of the AASHO Road Test, because of all the factors mentioned above.

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THE DEVELOPMENT OF NEW LOAD EQUIVALENCE FACTORS FOR FLEXIBLE PAVEMENT DESIGN IN TEXAS

by

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Freddy L. Roberts

and

Zakaria Hajeer

Research Report 476-1

Preliminary Review Copy

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Texas A&M University

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April 1987

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

PREFACE

This research was conducted to improve the method for predicting the total number of 18-kip ESAL's used in flexible pavement thickness design for the State of Texas. In this report pavement damage is defined for two types of distress and load equivalence factor tables are generated for fatigue cracking and rutting as well as for loss of serviceability index. The report contains a methodology for developing these load equivalence factors that are a function of axle load, load configuration, thickness of asphalt concrete, distress type, environmental zone, and the subgrade stiffness.

This report was completed with the assistance of many people. Special appreciation is extended to Mr. Chester Michalak for his help with the computer work. Appreciation is also extended to the secretarial staff of the Materials, Pavements, and Construction Division of TTI who prepared the manuscript materials.

Robert L. Lytton
Freddy L. Roberts
Zakaria Hajeer

SUMMARY

This report summarizes a new method of calculating load equivalence factors for the State of Texas. This method considers the environment and the stiffness of the subgrade for the various regions of the State. Tables of load equivalence factors were developed for each environmental zone and each distress type.

The calculated results show that the axle load equivalence factors are a function of axle load, load configuration, thickness of asphalt concrete, structural number, modulus of elasticity for the subgrade, environmental zone, and distress type. A complete set of load equivalence tables has been prepared with the format the same as those in the AASHTO Interim Guides, however the values of the load equivalence factors are those expressly developed for Texas. A comparison between the load equivalence factors developed at the AASHO Road Test for Ottawa, Illinois and a set developed using the methodology in this report for Ottawa show remarkably similar load equivalence factors.

IMPLEMENTATION STATEMENT

Implementation of the axle load equivalence factors developed in this research should significantly affect flexible pavement design in Texas. Since the AASHO Road Test, the load equivalence factors developed for Ottawa, Illinois have been used for flexible pavement design even though those researchers suggested that satelite road test projects be selected to regionalize their results to other environmental locations. This research regionalizes the axle load equivalence factors to Texas.

These equivalence factors require that the number of 18-kip ESAL's be calculated in an iterative manner. Since the axle load equivalence factors are different for each environmental zone and subgrade condition, it is important that designers select the proper combination of tables. In addition, since the factors vary with pavement thickness, a thickness must be assumed; 18 kip-ESAL's calculated for the assumed pavement thickness for fatigue cracking, rutting and serviceability index; the pavement thickness designed using the 18 kip-ESAL, subgrade, etc. and compared against the assumed for the controlling distress or serviceability index. Since this design process is considerably different from the current method, a set of materials needs to be developed for training the design personnel of the Department.

If implemented, the use of these axle load equivalence factors should permit flexible pavement designers to more accurately design flexible pavements, especially for the more critical environmental areas of Texas. Implementation should result in pavement designs that more accurately reflect the needs of each site. These pavements should more nearly serve for the design life and result in more economical service to the highway user of Texas.

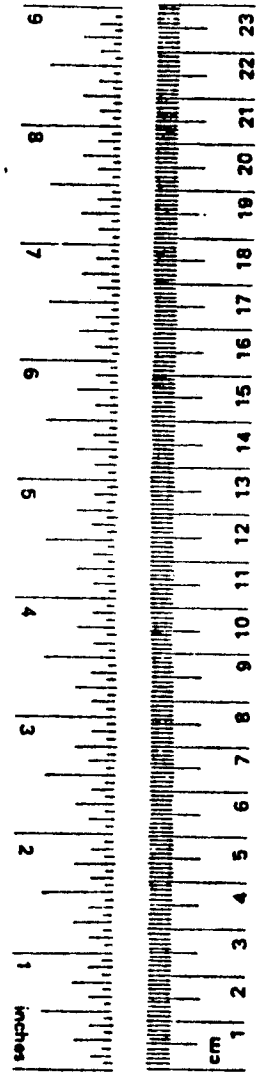
DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration. This report does not constitute a standard, specification or regulation.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

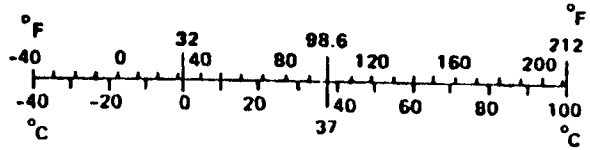
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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CHAPTER I

INTRODUCTION

This report summarizes a new method of predicting load equivalence factors for flexible pavement design within the state of Texas. The proposed method represents improvements over the method developed from the AASHO Road Test data. That method was used to tabulate load equivalence factors which varied with: (1) load level, (2) axle type and (3) structural number. The new method presented here considers all of these and the following as well: (1) asphalt thickness, (2) elastic modulus of the subgrade, (3) the environmental zone for which the pavement will be designed, and (4) three different types of distress, instead of the single one used at the AASHO Road Test. This study is conducted using the output data of the FHWA's VESYS-IVB computer program from the Cost Allocation Study (2,3,4).

In this report, damage is defined for each type of distress: loss of serviceability index, rutting, and cracking based upon an S-shaped performance curve.

Four environmental zones are used in this report: (1) wet freeze zone, (2) dry freeze zone, (3) wet no-freeze zone, and (4) dry no-freeze zone. Tables of load equivalence factors are produced for each environmental zone and for each distress type. Also equations to calculate the load equivalence factors are provided in this report. Not surprisingly, the load equivalence factors that are produced from this study are different from those produced from the AASHO Road Test in Illinois. For areas where the subgrade modulus is very high, the load equivalence factors are much lower than those factors from the AASHO. Conversely, in areas with low subgrade modulus, the factors are much higher than those produced by the AASHO Road Test.

One of the primary benefits resulting from this study will be pavement thickness design that reflects more accurate estimates of traffic loadings. As a result, the incidence of premature distress resulting from underestimated traffic should be reduced. In addition,

situations of overdesign can be minimized. These situations occur when equivalence factors are developed using distresses that are not prevalent in the area where the pavement is being placed. Many of these problems can be eliminated by using the equivalence factors that are produced from this report.

CHAPTER II

GENERAL BACKGROUND ON DAMAGE EQUATIONS

The AASHO Equations

In the AASHO Road Test, damage is defined as follows:

$$g = \left(\frac{N}{\rho_1}\right)^{\beta_1} \qquad (1)$$

in which

g = the damage function (ranges from 0 to 1.0 as the distress increases)

ρ_1 = a curve fit parameter which represents the applied load when g reaches value of 1.00, and thus it gives the scale of the curve.

β_1 = a curve fit parameter which dictates the degree of curvature of the curve relating g to the ratio of N/ρ_1. A high value of β_1 (greater than 1.0) indicates that g remains low over the majority of the life of the pavement.

N = the number of passes of a load.

The damage also can be defined in terms of Present Serviceability Index (PSI), which measures the quality of riding conditions from the point of view of the traveling public. The PSI ranges from 0 at the worst condition to 5 at the best condition. The following equation is used to define damage in terms of PSI:

$$g = \frac{P_i - P}{P_i - P_t} \qquad (2)$$

in which

P_i = the initial serviceability index (4.2 in this study)

P = the present serviceability index

P_t = the terminal serviceability index (the serviceability at which the pavement is no longer suitable for carrying traffic and must be repaired. At the AASHO Road Test, this was 1.5. In this report it equals 2.5.

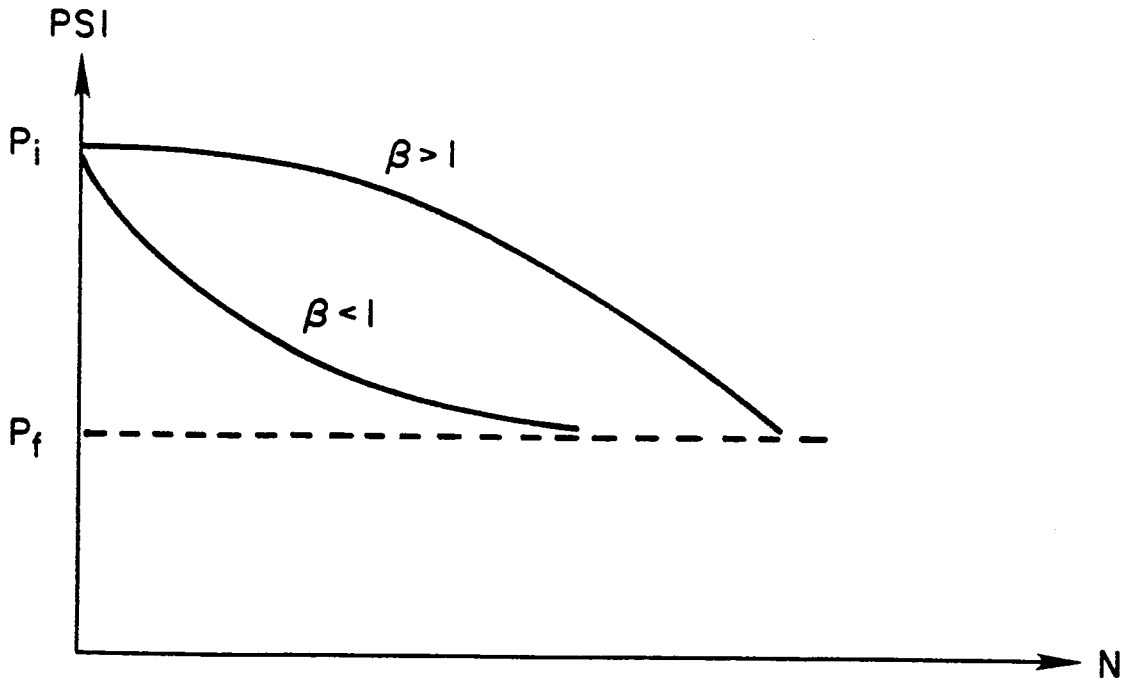

Figure 1. The AASHO Performance Curve.

Combining Equations (1) and (2) we obtain the following equation:

$$P = P_i - (P_i - P_t)\left(\frac{N}{\rho_1}\right)^{\beta_1} \qquad (3)$$

This equation can be represented by a graph as in Figure 1. There are several reasons for the concern of using equation (1) (see Reference 5). The shape of the functional performance curve can be predicted from the boundary conditions placed on the Serviceability Index scale as well as from long-term observations of field data. The serviceability rating scale ranges between zero to five and, as it is defined, can be neither greater than five nor less than zero. The serviceability rating can be decreased but will never drop below zero no matter how much traffic passes over the pavement. Thus the performance curve starts out horizontally bounded from above by a rating of five. As load repetitions increase, the curve is bounded from below by a rating zero. These boundary conditions imply that a functional performance curve should be S-shaped (see Reference 1). The original present serviceability index equation as developed for the AASHO Road Test is shown in the following equation for flexible pavement:

$$PSI = 5.03 - 1.9 \text{ Log } (1 + SV) - 0.01 \sqrt{c + P} - 1.38 \overline{RD}^2$$

where

PSI = Present Serviceability Index
SV = slope variance, a measure of pavement roughness
c = bituminous patching in ft^2 per 1000 ft^2 area
RD = Rut Depth in inches (both wheel tracks) measured with a 4-foot straightedge.

Taking the derivative of the above equation with respect to slope variance we obtain

$$\left.\frac{\partial PSI}{\partial SV}\right|_{SV \to \infty} = \left.-\frac{1.91\ (0.4343)}{(1 + SV)}\right|_{SV \to \infty} = 0$$

This shows that in the original AASHO Road Test equation for present serviceability index, as the road becomes rougher (i.e. the slope variance approaches infinity) the slope of the PSI - versus - slope

variance curve approaches zero. However, the slope of the AASHO Road Test performance curve, when the pavement becomes infinitely rough, does not equal zero; indicating that it does not meet conditions on serviceability index that were established at the beginning of the AASHO Road Test. The primary concern in the use of $g = (N/\rho_1)^{\beta_1}$, which is not S-shaped, arises from the following imposed boundary conditions (Reference 5):

a) The functional (structural) performance curve must have a maximum (minimum) value, at the traffic level or time equal to zero, and must be strictly decreasing (increasing) as traffic level or time increases,

b) The performance curve can not predict negative values of serviceability index nor can it predict a distressed area greater than 100 percent of the total area for large values of traffic level or time,

c) The performance curve should asymptotically approach the limiting values, as it is physically unrealistic to predict complete pavement failure, i.e. PSI = 0 or distress area = 100 percent, at a specific traffic level or point in time.

Although the AASHO equation satisfies the first condition, it is found to be deficient in terms of the last two conditions. In order to overcome these limitations we will use the following performance curve.

The S-Shaped Performance Curve

Based on studies of field data collected in Texas, the Texas Transportation Institute has adopted the use of the S-shaped performance curve (see Figure 2,3,4), (Reference 1,5). The equation is

$$g = c\, e^{-\left(\frac{\rho_2}{N}\right)^{\beta_2}} \qquad (4)$$

where

$$c = \frac{P_i - P_f}{P_i - P_t}$$

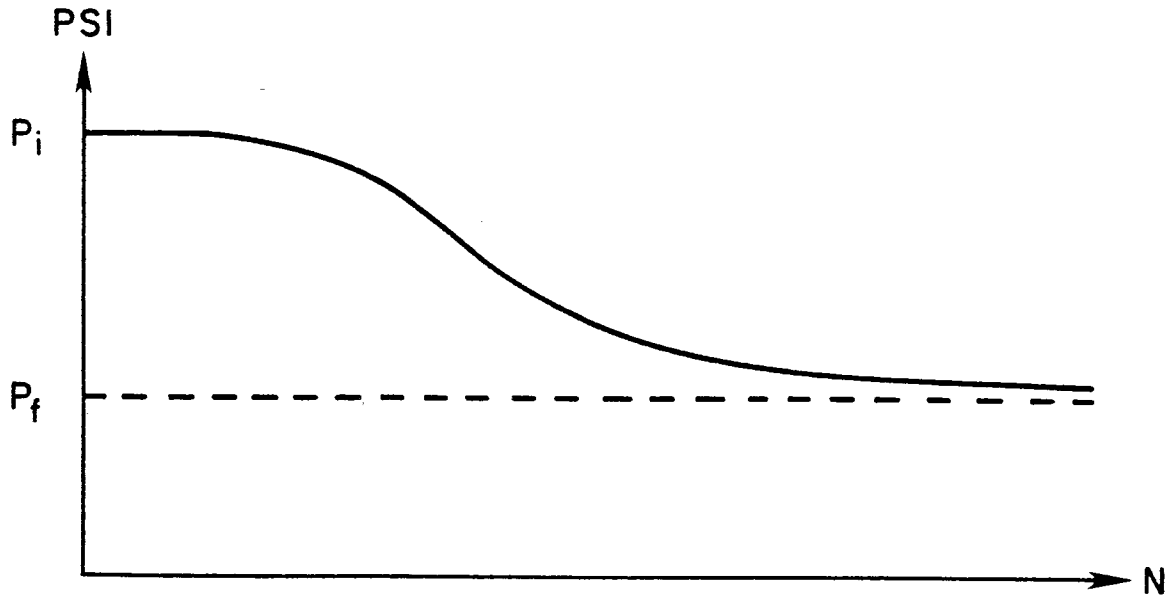

Figure 2. The S-shaped Performance Curve

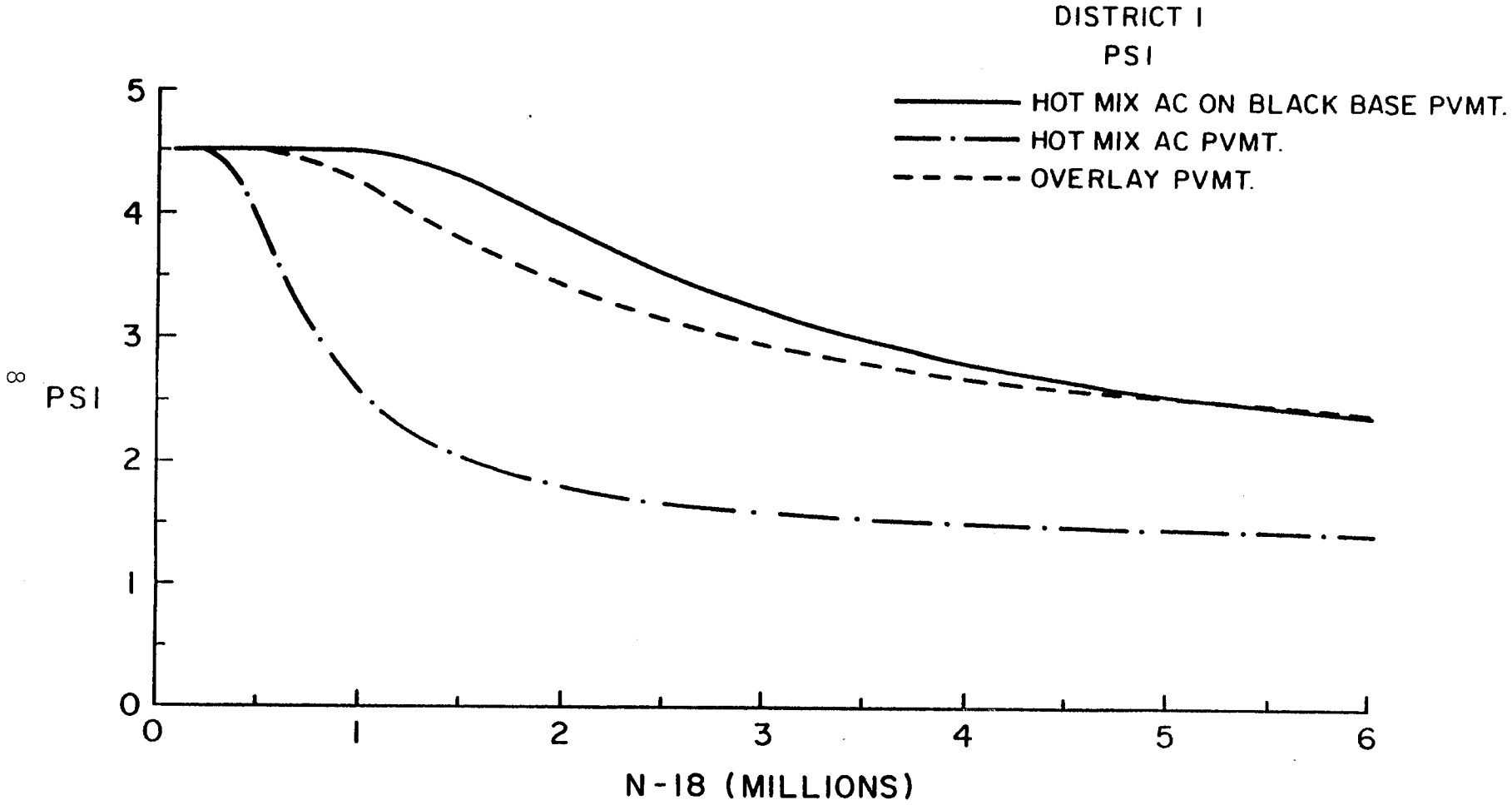

Figure 3. The S-shaped Performance Curve (Sensitivity Study Results Reference 1)

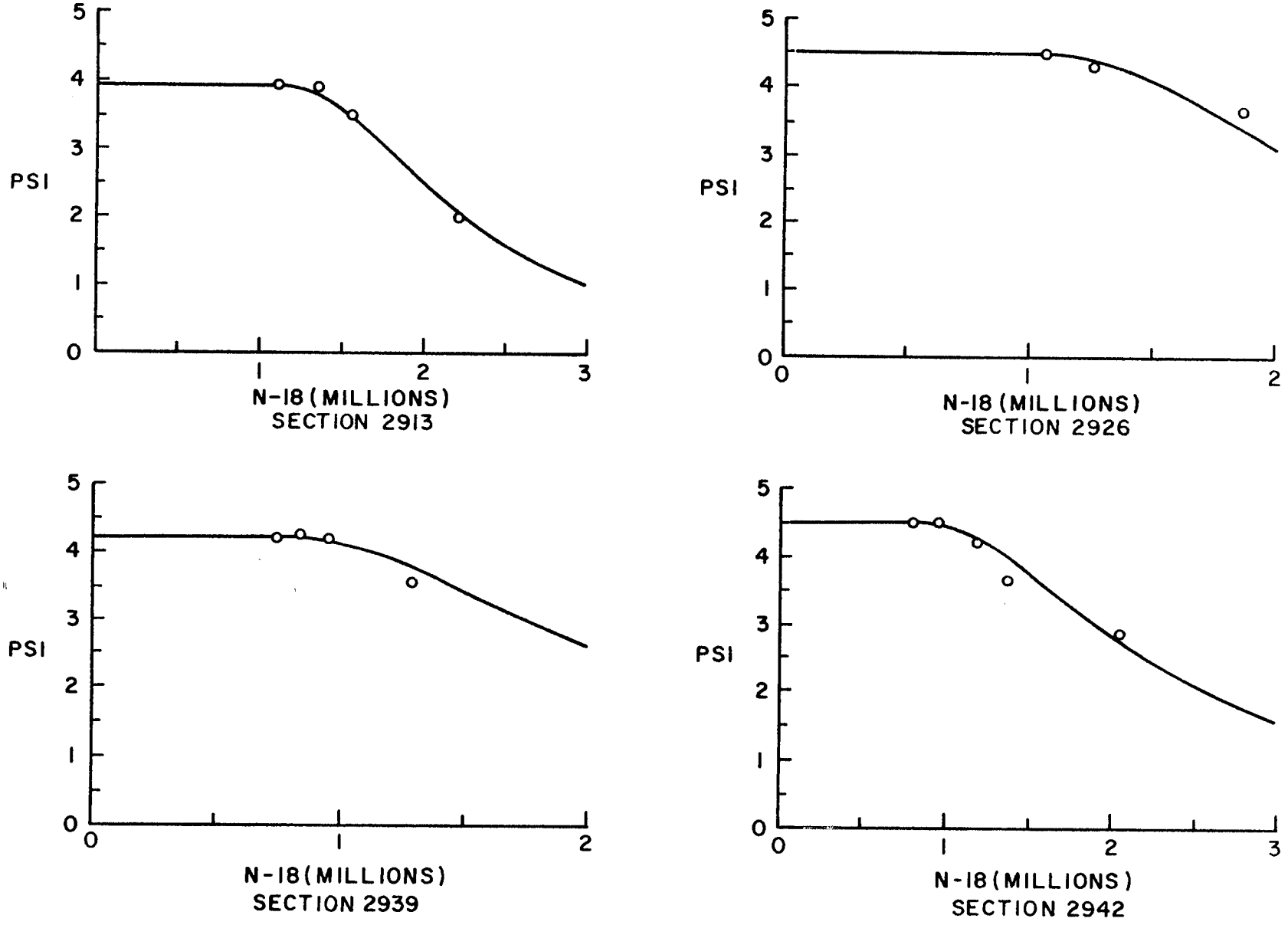

Figure 4. PSI - Performance Curves (Reference 1)

ρ_2 = a curve fit parameter coefficient which gives the scale of the curve (it is different than ρ_1)

β_2 = a curve fit parameter which indicates the degree of curvature (it is different than β_1)

P_f = the final serviceability index

P_i = the initial serviceability index

P_t = the terminal serviceability index

CHAPTER III

LOAD EQUIVALENCE FACTORS BASED ON SERVICEABILITY INDEX

Derivations of the Parameters ρ_2 and β_2 Using the Common Point

Plotting both performance curves (AASHO and the S-shaped) on Log (g) versus Log (N) graph (see Figure 5), we can see that there is a point which has the same slope on both curves for a specified level of damage. This is known as a common point. The first derivative of equation (1) is

$$\frac{dg}{dN} = \beta_1 \left(\frac{N^{\beta_1 - 1}}{\rho_1^{\beta_1}} \right)$$

$$\frac{dg}{dN} = \frac{\beta_1}{N} \, g \tag{5}$$

The first derivative of equation (4) is

$$\frac{dg}{dN} = c\, e^{-\left(\frac{\rho_2}{N}\right)^{\beta_2}} \cdot -\left(\rho_2\right)^2 \cdot \left(-\beta_2\right) N^{-\beta_2 - 1}$$

$$\frac{dg}{dN} = c\, e^{-\left(\frac{\rho_2}{N}\right)^{\beta_2}} \cdot \left(\frac{\rho_2}{N}\right)^{\beta_2} \cdot \left(\frac{\beta_2}{N}\right)$$

$$\frac{dg}{dN} = g \left(\frac{\rho_2}{N}\right)^{\beta_2} \cdot \left(\frac{\beta_2}{N}\right)$$

$$\frac{dg}{dN} = \frac{\beta_2 g}{N} \left(\frac{\rho_2}{N}\right)^{\beta_2} \tag{6}$$

$$-\ln\left(\frac{g}{c}\right) = \left(\frac{\rho_2}{N}\right)^{\beta_2} \tag{7}$$

Combining equations (6) and (7)

$$\frac{dg}{dN} = \frac{\beta_2 g}{N} \cdot \left(-\ln\left(\frac{g}{c}\right)\right) \tag{8}$$

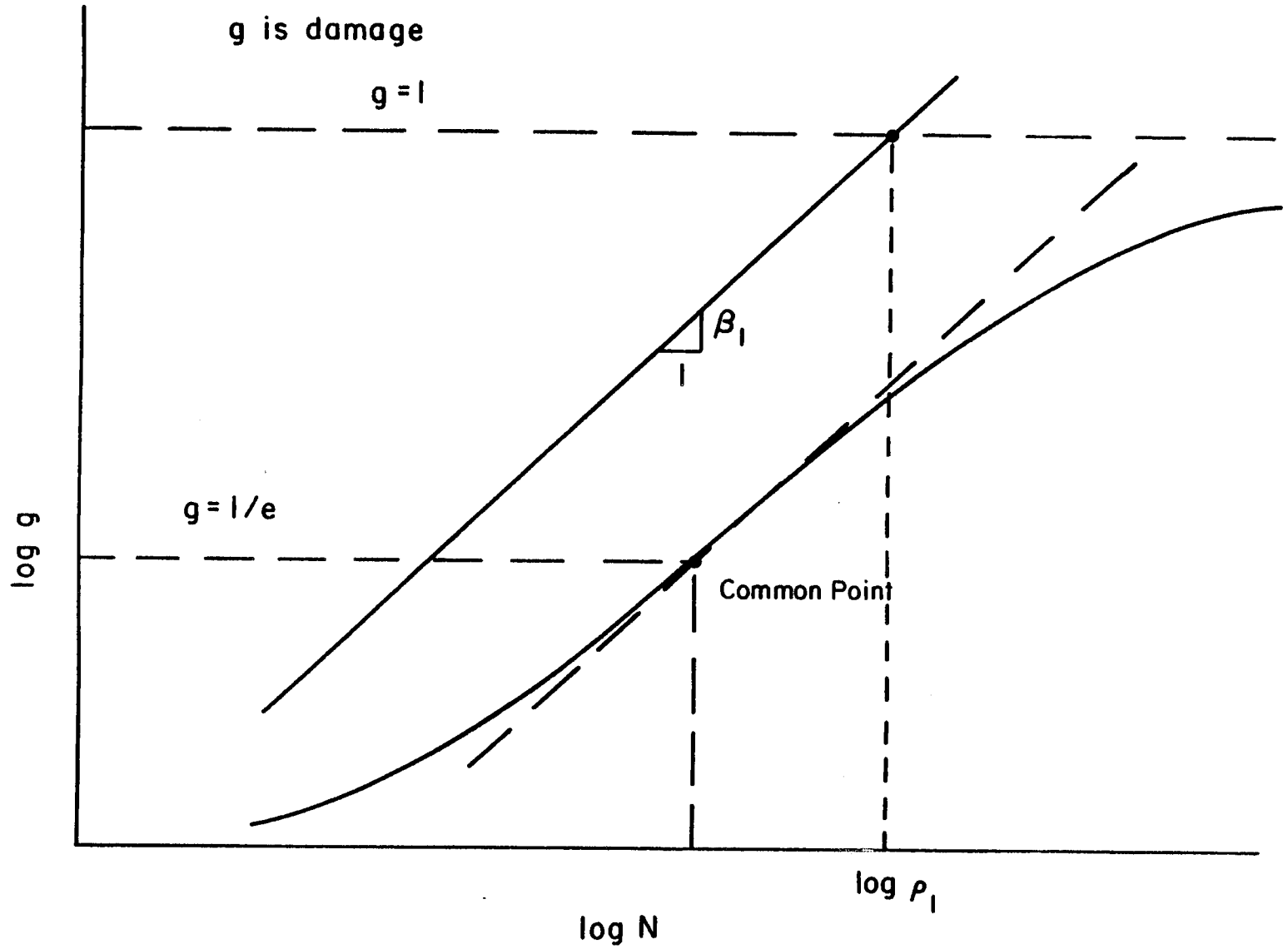

Figure 5. Damage,g, vs. Number of Repetitions, N, on Log-Log Scale

Setting equations (8) and (5) equal, we obtain relation between β_1 and β_2 for which the rate of damage accumulation, dg/dN, is equal to

$$\beta_1 \frac{g}{N} = \beta_2 \frac{g}{N} \left(-\ln\left(\frac{g}{c}\right)\right) = \frac{dg}{dN} \tag{9}$$

or

$$\beta_2 = \frac{\beta_1}{-\ln\left(\frac{g}{c}\right)} \tag{10}$$

This is the equation which relates β_2 to β_1.
From equation (7) we obtain the relation

$$-\ln(g) + \ln(c) = \left(\frac{\rho_2}{N}\right)^{\beta_2}$$

$$\left(-\ln(g) + \ln(c)\right)^{1/\beta_2} = \frac{\rho_2}{N}$$

or

$$\rho_2 = \left(-\ln(g) + \ln(c)\right)^{1/\beta_2} \cdot N \tag{11}$$

This is the equation that gives ρ_2 once β_2 is known.

To calculate ρ_2, β_2 and c

$$g = c\, e^{-\left(\frac{\rho_2}{N}\right)^{\beta_2}}$$

The VESYS-IVB output has 10 computed values of PSI corresponding to 10 values of N from which we can calculate 10 values of damage (g) based on PSI. The following are the steps to calculate ρ_2, β_2 and c.

1. Assume a value of c

2. Calculate $\bar{\beta}_2 = \dfrac{\sum_{i=1}^{n} \dfrac{\beta_1}{-\ln(g_i) + \ln(c)}}{n}$

3. Calculate $\rho_2 = \dfrac{\sum_{i=1}^{n} (-\ln g_i + \ln c)^{1/\beta_2} \cdot N_i}{n}$

$$\sum_{i=1}^{n} \frac{g_i}{e^{-\left(\bar{\rho}_2/N_i\right)^{\bar{\beta}_2}}}$$

4. Calculate $\bar{c} = \dfrac{\bar{c}}{n}$

5. Check if $\bar{c}$ equals to the assumed value of c

Development of ρ_2 and β_2 for 18 Kips Single Axle

The values of ρ_2 and β_2 are dependent upon the load level, axle configuration, structural number of the pavement, thickness of asphaltic concrete, the climatic zone, and the elastic modulus of the subgrade. The Cost Allocation Study (Reference 2) suggests the following equation which relates these independent variables to the dependent variable ρ_2 and β_2.(For the Climatic Zones, see Figure 6)

$$Y = a\,(L_1 + L_2)^{b_1 + b_2 T_1 + b_3 T_1^2 + e_2 E_s + e_3 E_s^2}$$

$$(L_2)^{c_1 + c_2 T_1 + c_3 T_1^2 + g_2 E_s + g_3 E_s^2}\,(E_s)^d\,(SN)^e\,(T_1)^f \qquad (12)$$

where

$Y = \rho_2$ or $(\beta_2 - c)$

L_1 = Load on one single axle or one tandem axle in kips

L_2 = Axle code (1 for single axle and 2 for tandem axle)

SN = Structural Number

T_1 = Thickness of asphalt layer in inches

E_s = Subgrade modulus of elasticity (selected for stress state around 18 to 20 inches below top of subgrade to be representative of entire subgrade)

Equation 12 may be transformed into a linear one by taking the logarithm of both sides of the equation as follows:

$$\begin{aligned}\text{Log } Y = {} & \text{Log } (a) + (\text{Log}(L_1 + L_2))\,(b_1 + b_2 T_1 + b_3 T_1^2 + e_2 Es + e_3 Es^2) + \\ & \text{Log } (L_2)\,(c_1 + c_2 T_1 + c_3 T_1^2 + g_2 Es + g_3 Es^2) + d \text{ Log } (Es) + \\ & e \text{ Log}(SN) + f \text{ Log } (T_1)\end{aligned}$$

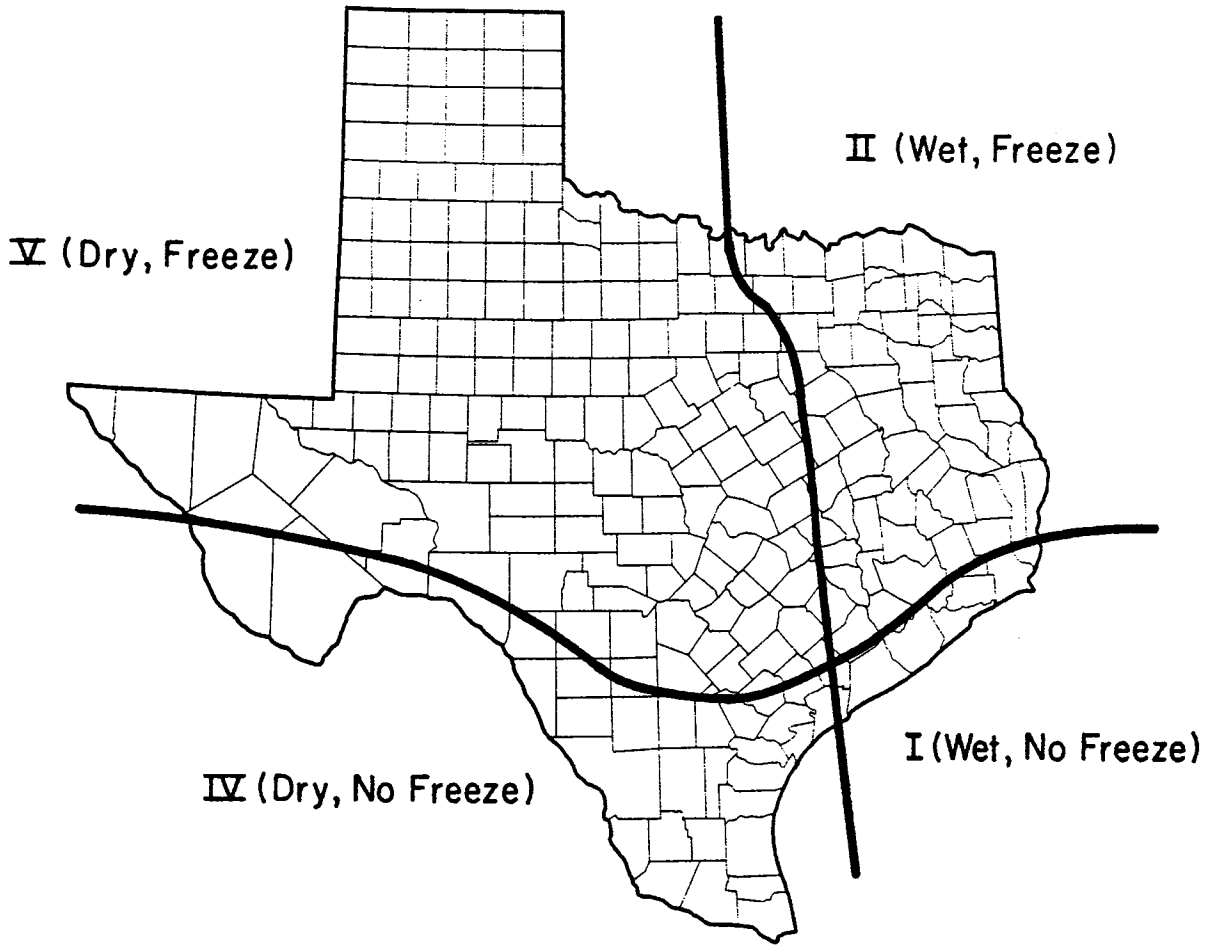

Figure 6. Location of the Four Climatic Zones in Texas

This equation can be written as follows:

$$Y_1 = a_1 + b_1x_1 + b_2x_2 + b_3x_3 + e_2x_4 + e_3x_5 + c_1x_6 + c_2x_7 + c_3x_8 + g_2x_9 + g_3x_{10} + dx_{11} + ex_{12} + fx_{13} + \varepsilon \quad (13)$$

where the lower case letters in this equation are coefficients of regression.

where

a_1 = Log(a)

x_1 = Log $(L_1 + L_2)$

x_2 = Log $(L_1 + L_2)T_1$

x_3 = Log $(L_1 + L_2)T_1^2$

x_4 = Log $(L_1 + L_2)$ Es

x_5 = Log $(L_1 + L_2)$ Es^2

x_6 = Log (L_2)

x_7 = Log (L_2) T_1

x_8 = Log (L_2) T_1^2

x_9 = Log (L_2) Es

x_{10} = Log (L_2) Es^2

x_{11} = Log (Es)

x_{12} = Log (SN)

x_{13} = Log (T_1)

Y_1 = Log (Y)

By regression analysis, all the lower case letters in equation (13) (a_1, b_1. b_2, b_3, . . ., etc.) are estimated. The R^2 value from regression analysis using the AASHO Road Test equation is lower than the lowest R^2 value using the seven equations that were studied by the Cost Allocation Study (Reference 2). (Figure 6 shows the climatic regions in the state of Texas)

Equations for Load Equivalence Factors

Load equivalence factor is the ratio of the number of passes of a standard load (18-kip) to the number of passes of some other load to cause the same amount of damage.

$$\text{Load Equivalence Factor (L.E.F.)} = \frac{N_{18}}{N_i}$$

where

N_{18} = Number of passes of 18-kip single axle

N_i = Number of passes of the load we are interested in

$$\text{L.E.F.} = \frac{\rho_2\ (18\text{-kip})}{\rho_{2i}} \left(-\ln\left(\frac{g}{c}\right)\right)^{\left(\frac{1}{\beta_{2i}} - \frac{1}{\beta_2\ (18\text{-kip})}\right)}$$

To calculate ρ_2 and β_2 for the 18-kip single axle, all of the coefficients (a_1, b_1, b_2, . . , etc.) that were obtained from the regression analysis are used to calculate ρ_2 and β_2 for 18-kip single axle. In this step a reference value of ES= 15000 psi is chosen to represent a datum subgrade modulus for the entire state of Texas. This is done only when ρ_2 and β_2 for the 18-kip single axle are calculated.

Steps to Calculate Load Equivalence Factors Based on PSI

1. Estimate all the lower case letters in Equation (13) by regression analysis. This is done for every environmental zone independently (see Table 1).
2. Use all these coefficients to calculate ρ_2 (18-kip) and β_2 (18-kip), using Es = 15000 psi as the datum subgrade modulus of elasticity for the entire state of Texas.
3. $$\text{L.E.F.} = \frac{\rho_2\ (18\text{-kip})}{\rho_{2i}} \left(-\ln\left(\frac{g}{c}\right)\right)^{\left(\frac{1}{\beta_{2i}} - \frac{1}{\beta_2\ (18\text{-kip})}\right)}$$

   (see Figure 7)

Equations for ρ_2 and β_2 are provided in Appendix 1, also Tables for equivalence factors are provided in Appendix 2.

Table 1. Coefficients of Regression for Equation (13) Based on PSI

Y	c	a	b_1	b_2	b_3	e_2	e_3	c_1	c_2	c_3	g_2	g_3	d	e	f	R^2
Wet-Frz																
PSI β_2	.07	5.7540	-0.2736	0.1008	-0.0016	4.352E-5	-5.801E-10	-1.2783	0.5582	-0.0470	-6.842E-5	1.438E-9	-1.4593	0.4965	-2.2156	0.572
PSI ρ_2	.00	-5.7851	-1.8997	-0.7201	0.0353	-2.145E-5	1.783E-10	-0.2087	1.0053	-0.0628	1.071E-5	7.515E-10	2.8571	2.7465	6.2881	0.954
Wet-NFrz																
PSI β_2	.07	3.2877	0.3599	0.0318	-0.0020	1.963E-5	-2.822E-10	-0.4190	0.2332	-0.0161	-8.094E-5	1.927E-9	-1.1635	0.3318	-0.2620	0.534
PSI ρ_2	.00	-6.6201	-2.0836	-0.5719	0.0335	-9.623E-5	2.000E-9	1.2230	0.9080	-0.0648	-2.650E-5	1.483E-9	3.4420	2.6160	3.9700	0.957
Dry-Frz																
PSI β_2	.04	4.2302	0.0208	-0.0370	0.0083	4.834E-5	-7.573E-10	-0.0317	0.2344	-0.0237	-8.030E-5	1.651E-9	-1.1714	0.8811	-1.9734	0.602
PSI ρ_2	.00	-6.1208	-2.5205	-0.5833	0.0242	-2.155E-5	1.023E-10	2.8645	-0.0524	0.01928	2.267E-5	5.987E-11	3.0503	1.9528	7.1783	0.934
Dry-NFrz																
PSI β_2	.05	1.9844	0.4007	0.0035	0.0003	1.409E-5	-2.138E-10	-0.2653	0.1480	-0.0119	-4.130E-5	6.448E-10	-0.8642	0.1018	0.07906	0.555
PSI ρ_2	.00	-5.0316	-2.9784	-0.3943	0.0270	-.0001	2.830E-9	1.4754	0.5653	-0.0478	0.00011	-2.303E-9	3.5824	1.9561	2.3259	0.952

In calculating the load equivalence factors, the value of damage, g, at which the L.E.F.'s are calculated is 1.0. That is the reference conditions for which the 18-kip single axle load equivalents are calculated are a PSI damage, g, of 1.0 on a subgrade with a 15000 psi elastic modulus.

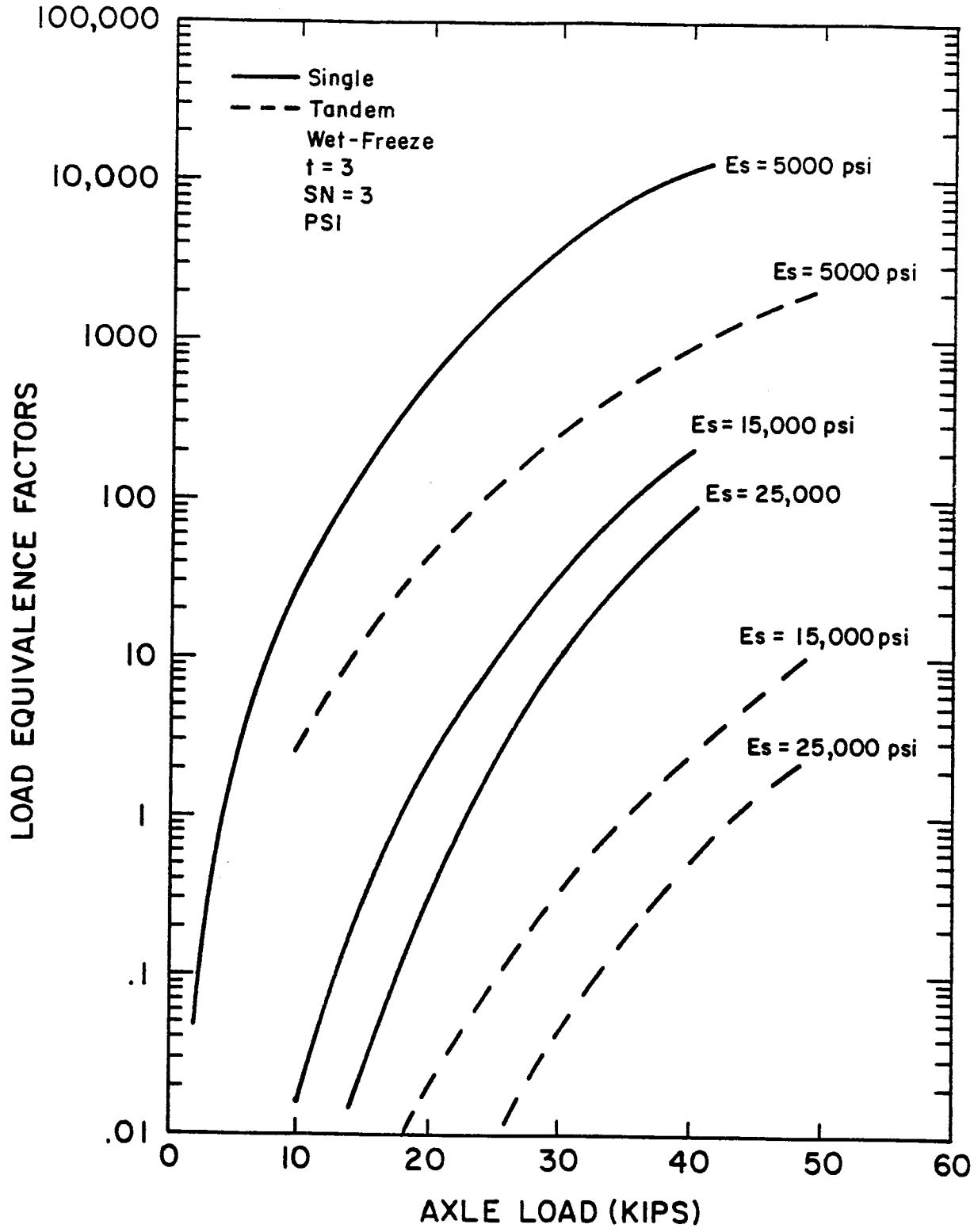

Figure 7. Load Equivalence Factors for t=3, SN=3 for Different Values of Es in the WET- FREEZE Zone Based on PSI

CHAPTER IV

LOAD EQUIVALENCE FACTORS BASED ON RUTTING

The procedure to derive the equations for this section is similar to the one used in the PSI section. The equations for this section will be written in their final form. For more details about the derivation see the section about the load equivalence factors based on PSI.

$$g = \left(\frac{N}{\rho_1}\right)^{\beta_1} \tag{14}$$

$$g = c\, e^{-\left(\frac{\rho_2}{N}\right)^{\beta_2}} \tag{15}$$

$$c = \frac{r_f}{r_t} \tag{16}$$

$$g = \frac{r}{r_t} = \frac{r_f}{r_t}\, e^{-\left(\frac{\rho_2}{N}\right)^{\beta_2}} \tag{17}$$

Where

r_f = failure rut depth

r_t = terminal rut depth or maximum allowable rut depth (for this study it equals one-half inch)

r = rut depth after any number of load repetitions, N.

Equations for ρ_2 and β_2 Using the Common Point

$$\beta_2 = \frac{\beta_1}{\left(-\mathrm{Ln}\left(\frac{g}{c}\right)\right)} \tag{18}$$

$$\rho_2 = (-Ln(g) + Ln(c))^{1/\beta_2} \cdot N \qquad (19)$$

Development of ρ_2 and β_2 for 18-kip Single Axle

As before, find all of the coefficients of the equations for ρ_2 and β_2 by regression analysis. Then calculate ρ_2 and β_2 for 18-kip single axle using Es = 15,000 psi as a datum subgrade modulus for the entire state of Texas. (See the section about PSI for more details).

Equations for Load Equivalence Factors

$$L.E.F. = \frac{N_{18}}{N_i}$$

$$L.E.F. = \frac{\rho_2\ (18\text{-kip})}{\rho_{2i}} - (-Ln\left(\frac{g}{c}\right))^{\left(\frac{1}{\beta_{2i}} - \frac{1}{\beta_2\ (18\text{-kip})}\right)}$$

Summary

$$g = c\, e^{-\left(\frac{\rho_2}{N}\right)^{\beta_2}}$$

1. Assume a value for c.

2. Calculate $\overline{\beta}_2 = \dfrac{\sum_{i=1}^{n} \dfrac{\beta_1}{-\mathrm{Ln}(g_i) + \mathrm{Ln}(c)}}{n}$

3. Calculate $\overline{\rho}_2 = \dfrac{\sum_{i=1}^{n} \left(-\mathrm{Ln}(g_i) + \mathrm{Ln}(c)\right)^{1/\beta_2} \cdot N}{n}$

4. Calculate $\overline{c} = \dfrac{\sum_{i=1}^{n} \dfrac{g_i}{e^{-(\rho_2/N_i)^{\beta_2}}}}{n}$

5. Check if $\overline{c}$ equals the assumed value of c.

6. Find all of the regression coeffients in equation (13) by regression analysis (this is done for every environmental zone independently). The results are given in Table 2.

7. Use all of these coeffients to calculate ρ_2 (18-kip) and β_2 (18-kip), using Es = 15,000 psi as the datum subgrade modulus of elasticity for the entire state of Texas.

8. Calculate L.E.F. = $\dfrac{\rho_2(18\text{-kip})}{\rho_{2i}} \left(-\mathrm{Ln}\left(\frac{g}{c}\right)\right)^{\left(\frac{1}{\beta_{2i}} - \frac{1}{\beta_2\,(18\text{-kip})}\right)}$

Table 2. Coefficients of Regression for Equation (13) Based on Rutting

Y	c	a	b_1	b_2	b_3	e_2	e_3	c_1	c_2	c_3	g_2	g_3	d	e	f	R^2
Wet-Frz																
RD β_2	0.00	-1.3748	-0.7412	-0.0229	0.0020	-2.956E-5	6.532E-10	-0.1685	0.0638	-0.0049	-1.601E-5	3.552E-10	0.1097	1.2895	-1.5957	0.904
RD ρ_2	0.00	-15.9525	-3.2694	-0.7647	0.0313	-0.0001	1.542E-9	2.5529	0.6382	-0.0438	7.613E-5	-5.964E-10	5.6967	-0.6868	12.8105	0.918
Wet-NFrz																
RD β_2	0.00	-2.0682	0.4110	0.0767	-0.0047	-3.910E-5	7.855E-10	0.3096	-0.1025	0.0084	-1.678E-5	4.754E-10	0.1684	0.6310	-0.4842	0.970
RD ρ_2	0.00	-14.4013	-2.8548	-0.8522	0.0463	-0.0001	2.629E-9	1.9432	0.7510	-0.0542	9.036E-5	-1.297E-9	6.2755	0.2164	6.8630	0.960
Dry-Frz																
RD β_2	0.00	-1.2085	0.4432	-0.0408	0.0022	-5,769E-6	1.369E-10	0.1080	-0.0348	0.0029	-1.110E-5	2.392E-10	-0.0273	1.0141	-0.9690	0.959
RD ρ_2	0.00	-14.6349	-1.5174	-1.7273	0.0780	-6.190E-5	7.8000E-10	0.7076	1.0112	-0.0612	0.0002	-3.474E-9	5.2718	-6.9644	26.7891	0.913
Dry-NFrz																
RD β_2	0.00	-1.3123	-0.0391	0.0689	-0.0039	-1.057E-5	2.092E-10	0.2651	-0.0799	0.0056	-3.681E-6	9.869E-11	-0.0055	0.3528	-0.3201	0.954
RD ρ_2	0.00	1.6659	-3.0490	-1.5058	0.0856	8.674E-5	-1.310E-9	-1.2244	1.6627	-0.1148	8.283E-5	-1.996E-9	3.9250	-3.9205	8.2909	0.956

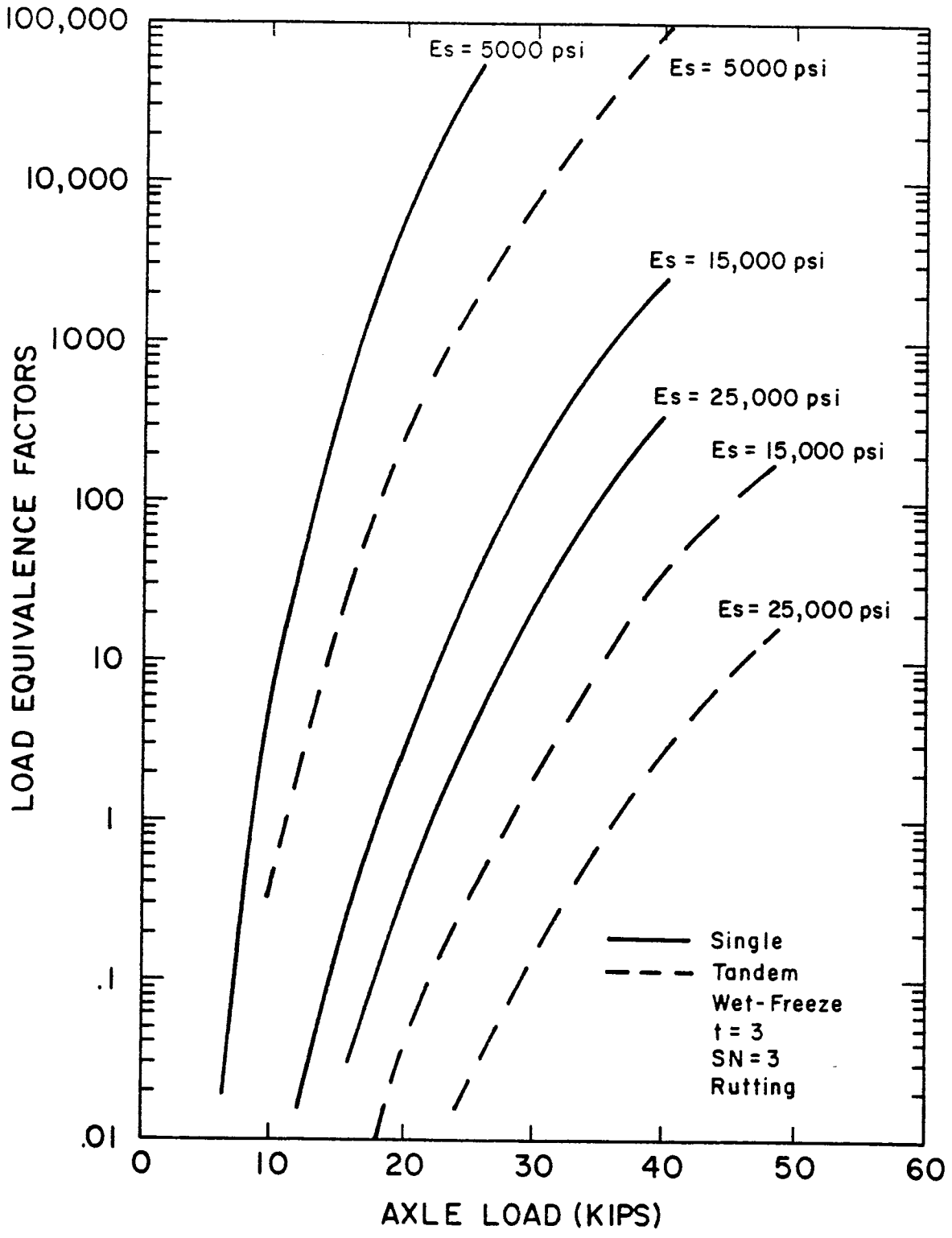

Figure 8. Load Equivalence Factors for t=3, SN=3 and for different Values of Es in the WET- FREEZE Zone Based on Rutting

Equations for ρ_2 and β_2 are provided in Appendix 1 at the end of this report. Also, tables for equivalence factors are provided in Appendix 3. In calculating the load equivalence factors, the value of the damage, g, at which the L.E.F.'s are calculated is 1.0. That is the reference conditions for which the 18-kip single axle load equivalents are calculated as a rutting damage, g, of 1.0 on a subgrade with a 15,000 psi elastic modulus. (Figure 8 shows load equivalence factors based on Rutting.)

CHAPTER V

LOAD EQUIVALENCE FACTORS BASED ON CRACKING

Derivations of the Parameters ρ_2 and β_2

For alligator cracking, damage (g) is defined as the damage index (DI) per one thousand square foot area.

$$g = \frac{DI}{1000} = e^{-(\frac{\rho_2}{N})^{\beta_2}} \qquad (20)$$

where $DI = \sum \frac{n_i}{N f_i}$ = Miner's rule sum.

The damage, g, can be viewed as an ordinate of a cumulative probability distribution. The ordinate of the corresponding probability density function, $P(N_i)$, is:

$$P(N_i) = \frac{dg}{dN} = (\frac{\rho_2}{N_i})^{\beta_2} \cdot \frac{\beta_2}{N_i} \cdot e^{-(\frac{\rho_2}{N_i})^{\beta_2}} \qquad (21)$$

The maximum likelihood estimation procedure is used to estimate the values of ρ_2 and β_2. This is done by choosing the values of ρ_2 and β_2 which maximize the product of $\rho(N_i)$. Maximizing the product may be accomplished by maximizing the sum of the Logarithms of $\rho(N_i)$.

$$\sum_{i=1}^{n} \text{Log}_e \left(P(N_i)\right) = \sum_{i=1}^{n} \beta_2 \text{Log}_e (\frac{\rho_2}{N_i}) + \sum_{i=1}^{n} \text{Log}_e (\frac{\beta_2}{N_i}) - \sum_{i=1}^{n} (\frac{\rho_2}{N_i})^{\beta_2} \qquad (22)$$

The "best" values ρ_2 and β_2 are found by taking the derivation of the expression given above with respect to ρ_2 and β_2 in turn, then setting each expression equal to zero, and solving the two equations simultaneously. Taking the derivative with respect to β_2 and setting it equal to zero gives:

$$\frac{\partial \sum_{i=1}^{n} \text{Log}_e P(N_i)}{\partial \beta_2} = \sum_{i=1}^{n} \text{Log}_e \left(\frac{\rho_2}{N_i}\right) + \sum_{i=1}^{n} \frac{1}{\beta_2} -$$

$$\sum_{i=1}^{n} (\rho_2)^{\beta_2} (N_i)^{-\beta_2} \cdot \left[\text{Ln}(N_i (-1)) + \text{Ln}(\rho_2)\right] = 0 \qquad (23)$$

Taking the derivative with respect to ρ_2 and setting it equal to zero gives

$$\frac{\partial \sum_{i=1}^{n} \text{Log}_e\left(P(N_i)\right)}{\partial \rho_2} = \sum_{i=1}^{n} \frac{1}{(N_i)^{\beta 2}} \cdot \beta_2 (\rho_2)^{\beta_2 - 1} + \beta_2 \sum_{i=1}^{n} \frac{1}{\rho_2} = 0 \qquad (24)$$

From Equation (24)

$$\beta_2 \frac{n}{\rho_2} - \frac{\beta_2}{\rho_2} \sum_{i=1}^{n} \left(\frac{\rho_2}{N_i}\right)^{\beta_2} = 0$$

$$n = \sum_{i=1}^{n} \left(\frac{\rho_2}{N_i}\right)^{\beta_2} \qquad (25)$$

From Equation (23)

$$\frac{n}{\beta_2} + \sum_{i=1}^{n} \text{Ln}\left(\frac{\rho_2}{N_i}\right) + \sum_{i=1}^{n}\left(\frac{\rho_2}{N_i}\right)^{\beta_2}\left(\text{Ln}(N_i) - \text{Ln}(\rho_2)\right) = 0$$

$$\frac{n}{\beta_2} = \sum_{i=1}^{n} \text{Ln}\left(\frac{\rho_2}{N_i}\right) - \sum_{i=1}^{n}\left(\frac{\rho_2}{N_i}\right)^{\beta_2}\left(\text{Ln}(N_i) - \text{Ln}(\rho_2)\right) = 0$$

$$\frac{n}{\beta_2} = \sum_{i=1}^{n}\left(\frac{\rho_2}{N_i}\right)^{\beta_2}\left(\text{Ln}\left(\frac{\rho_2}{N_i}\right)\right) - \sum_{i=1}^{n} \text{Ln}\left(\frac{\rho_2}{N_i}\right)$$

$$\frac{n}{\beta_2} = \sum_{i=1}^{n}(-\text{Ln}(g_i))\left(\text{Ln}\left(\frac{\rho_2}{N_i}\right)\right) - \sum_{i=1}^{n} \text{Ln}\left(\frac{\rho_2}{N_i}\right)$$

(26)

$$\beta_2 = \frac{n}{\sum_{i=1}^{n}(-\text{Ln}\, g_i)\,\text{Ln}\left(\frac{\rho_2}{N_i}\right) - \sum_{i=1}^{n}\text{Ln}\left(\frac{\rho_2}{N_i}\right)}$$

This gives an expression for β_2 once ρ_2 is known.
From Equation (20)

$$\sum_{i=1}^{n}-\text{Ln}\left|g_i\right| = \sum_{i=1}^{n}\left(\frac{\rho_2}{N_i}\right)^{\beta_2} = (\rho_2)^{\beta_2}\sum_{i=1}^{n}(N_i)^{-\beta_2} \qquad (27)$$

$$(\rho_2)^{\beta_2} = \frac{\sum_{i=1}^{n} (-Ln(g_i))}{\sum_{i=1}^{n} (\frac{1}{N_i})^{\beta_2}} \qquad (28)$$

$$\rho_2 = \left(\frac{\sum_{i=1}^{n} (-Ln(g_i))}{\sum_{i=1}^{n} (\frac{1}{N_i})^{\beta_2}} \right)^{1/\beta_2} \qquad (29)$$

This gives an expression for ρ_2 once β_2 is known. since Equation (26) and (29) are nonlinear, the solution for these two constants requires an iterative procedure such as it is summarized below:

1. Assume a value for β_2

2. From equation (29) calculate ρ_2.

3. From equation (26) calculate β_2 using ρ_2(calculated) and β_2(assumed).

4. If β_2(calculated) does not equal β_2(assumed), use β_2(calculated) in step 1 and repeat steps 2 and 3 until an acceptably precise value of β_2 is found.

Development of ρ_2 and β_2 for 18-kip Single Axle

The Cost Allocation Study (See Ref. 2) suggests an equation to predict the manner in which the values ρ_2 and β_2 depend on load,

structural number, asphalt thickness, and subgrade modulus. This equation offers the best fit and most useful mix of significant independent variables for distress prediction and load equivalence factors:

$$Y = c + a(L_1 + L_2)^{b_1 + b_2T_1 + b_3T_1^2 + e_2Es + e_3Es^2}$$

$$(L_2)^{c_1 + c_2T_1 + c_3T_1^2 + g_2Es + g_3Es^2} \cdot (Es)^d \, (SN)^e \, (T_1)^f$$

where

$Y = \rho_2$ or β_2

L_1 = Load on one single axle or one tandem axle in kips

L_2 = Axle Code (1 for single axle and 2 for tandem axle)

SN = Structural Number

T_1 = Thickness of the asphalt layer in inches

Es = Subgrade modulus of elasticity (selected for stress state at around 18 to 20 inches below top of subgrade to be representative of the entire subgrade

This equation may be transformed into a linear one by taking a logarithm of both sides of the equation.

$$\text{Log } Y = \text{Log}(a) + (\text{Log}(L_1 + L_2))(b_1 + b_2T_1 + b_3T_1^2 + e_2Es + e_3Es^2)$$
$$+ \text{Log}(L_2)(c_1 + c_2T_1 + c_3T_1^2 + g_2Es + g_3Es^2)$$
$$+ d \, \text{Log}(Es) + e \, \text{Log}(SN) + f \, \text{Log}(T_1)$$

This equation can be written as follows:

$$Y_1 = a_1 + b_1x_1 + b_2x_2 + b_3x_3 + e_2x_4 + e_3x_5 + c_1x_6 + c_2x_7 +$$

$$c_3x_8 + g_2x_9 + g_3x_{10} + dx_{11} + ex_{12} + fx_{13}$$

where the lower case letters in this equation are coefficients of regression (See Table 3) and

$a_1 = \text{Log}(a)$

$x_1 = \text{Log}(L_1 + L_2)$

$x_2 = x_1T_1$

$x_3 = x_1T_1^2$

$x_4 = x_1Es$

$x_5 = x_1Es^2$

$x_6 = \text{Log}(L_2)$

$x_7 = x_6T_1$

$x_8 = x_6T_1^2$

$x_9 = x_6Es$

$x_{10} = x_6Es^2$

$x_{11} = \text{Log}(Es)$

$x_{12} = \text{Log}(SN)$

$x_{13} = \text{Log}(T_1)$

Table 3. Coefficients of Regression For Equation (13) Based on Alligator Cracking Damage Index

Y	c	a_1	b_1	b_2	b_3	e_2	e_3	c_1	c_2	c_3	g_2	g_3	d	e	f	R^2
Wet-Frz Cracking																
ρ_2	0.0	3.5403	-4.2825	-0.0653	0.0013	0.000004	0.0	3.8808	0.1196	-0.0014	-0.000075	0.0	0.9521	7.0853	0.6156	0.99
β_2	0.0	-0.5828	0.5490	-0.0439	0.0046	-0.000021	0.0	-1.1368	0.1511	-0.0156	0.000087	0.0	0.2252	-0.7701	0.3015	0.64
Wet-NFrz Cracking																
ρ_2	0.0	1.1276	-3.7004	-0.1154	0.0036	-0.00003	0.0	3.2664	0.1912	-0.00695	-0.000043	0.0	1.4481	7.0240	1.0826	0.99
β_2	0.0	0.5832	0.2875	-0.0273	0.0021	0.0000043	0.0	-0.2143	-0.1456	0.0106	0.000063	0.0	-0.0693	-0.7527	0.3733	0.44
Dry-Frz Cracking																
ρ_2	0.0	3.9819	-4.2229	-0.1012	0.0051	0.000026	0.0	3.9858	0.2444	-0.0171	-0.00014	0.0	0.8040	6.7426	0.6841	0.99
β_2	0.0	-0.1548	0.1756	0.0254	-0.0017	-0.000018	0.0	0.0484	-0.2486	0.0181	0.000086	0.0	0.1126	-0.4291	0.2545	0.56
Dry-NFrz Cracking																
ρ_2	0.0	-1.5284	-2.4938	-0.3347	0.0173	-0.000054	0.0	1.1154	0.7428	-0.0540	0.000059	0.0	1.8706	6.9348	2.2325	0.99
β_2	0.0	4.0502	-0.6758	0.0946	-0.0053	0.000045	0.0	1.1932	-0.2918	0.0258	-0.000093	0.0	-0.7533	-0.7607	-0.3016	0.64

As before, find all of the coefficients of the equations for ρ_2 and β_2 by regression analysis, also equation to calculate ρ_2 and β_2 are provided in Appendix 1. Then use all of these coefficients to calculate ρ_2 and β_2 for 18-kip singl axle load. In this step a reference value of Es=1500 psi is used as a reference subgrade modulus for the state of Texas. This is done in order to calculate reference values of ρ_2 and β_2 for the 18-kip single axle load.

Equations for Load Equivalence Factors

A load equivalence factor is the ratio of the number of passes of a standard load (18-kip) acting under reference conditions to the number of passes of some other load to cause the same amount of damage acting under other conditions.

$$\text{Load Equivalence Factor (L.E.F.)} = \frac{N_{18}}{N_i}$$

Where

N_{18} = Number of passes of an 18-kip single axle load

N_i = Number of passes of the load we are intereted in

$$\text{L.E.F.} = \frac{\rho_2\ (18\text{-kip})}{\rho_{2i}} (-\text{Ln } g) \left(\frac{1}{\beta_{2i}} - \frac{1}{\beta_2(18\text{-kip})}\right)$$

(see Figure 9)

In calculating the load equivalence factors, the value of damage, g, at which the L.E.F.'s are calculated is 0.5. That is the reference conditions for which the 18-kip single axle load equivalents are calculated, are an alligator cracking damage, g, of 0.5 on a subgrade

with a 15000 psi elastic modulus. Tables of load equivalence factors based on cracking are provided in Appendix 4. Figure 10 shows load equivalence factors for the three types of distress namely PSI, Rutting, and Cracking, for SN= 3.0, t= 3.0 in., Es= 5,000 psi in the WET-FREEZE Zone, comparing to the curve that was produced from the AASHO Road Test.

Figure 11 shows the calculated load equivalence factors for rutting, cracking, and loss of PSI as compared with the AASHO Road Test equivalence factors for the WET-FREEZE Zone and a subgrade modulus of 5,000 psi. This is a condition which is as close as it can be made to the actual conditions at the AASHO Road Test. It is noteworthy how close the AASHO load equivalence factors are to those generated by the equations developed in this report and particularly for the loss of serviceability index.

Use of New Load Equivalence Factors in Design

The use of the new load equivalence factors in design will require an iterative process which is diagrammed in Figure 12. Because the load equivalence factors depend upon the thicknesses of each layer in the pavement, the calculation of the 18-kip single axle load equivalence of a given traffic stream first requires the layer thicknesses and structural number to be assumed.

The load equivalences for each type of distress are calculated and the assumed pavement is checked to see if it will carry the expected traffic for the desired number of years. Each type of distress will have a different number of 18-kip equivalent single axle loads for the same traffic stream. If the pavement cannot carry the 18-kip ESALs as calculated from any kind of distress, the assumed pavement is considered to be inadequate, a new pavement is assumed, and a new set of 18-kip ESALs is calculated. The process continues to iterate until a pavement is assumed which can carry all of the 18-kip ESALs as calculated for each type of distress.

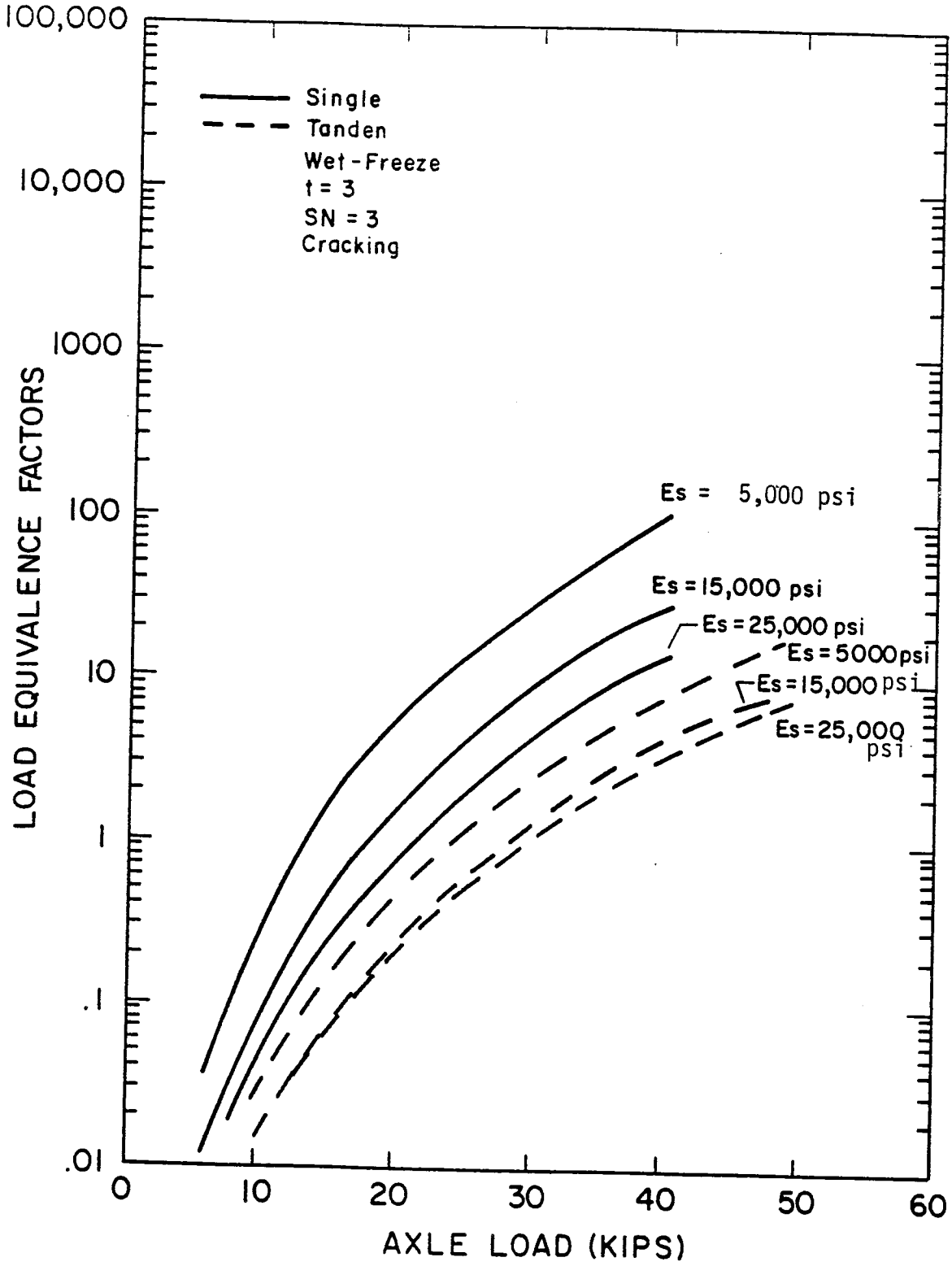

Figure 9. Load Equivalence Factors for t=3, SN=3 and for Different Values of Es in the WET-FREEZE Zone Based on Cracking

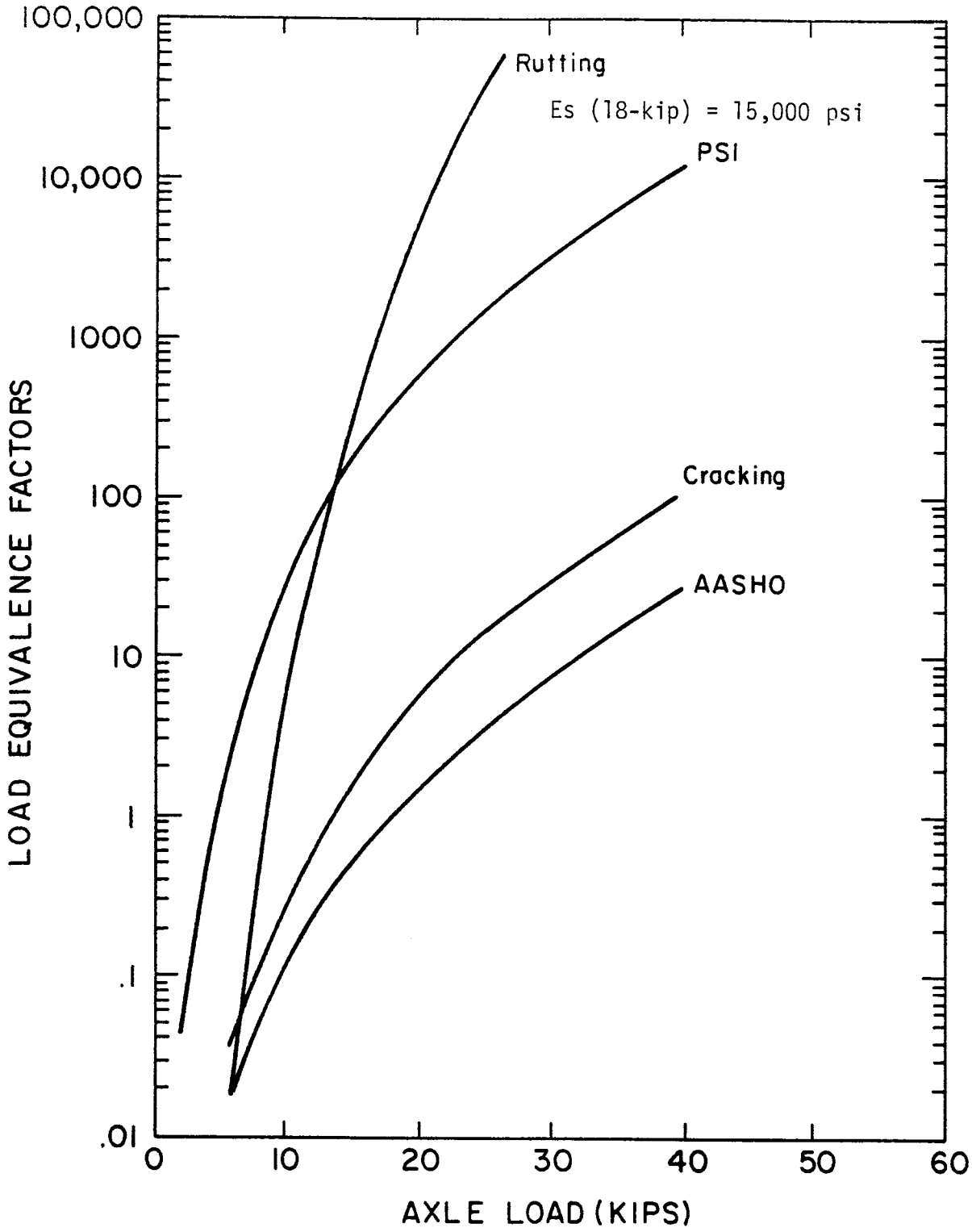

Figure 10. Load Equivalence Factors for the Three Types of Distresses, Namely PSI, Rutting, and Cracking, for SN=3, t=3, Es=15,000 psi in the WET-FREEZE Zone, Compared With the AASHO Curve for SN=3, P_t=2.5

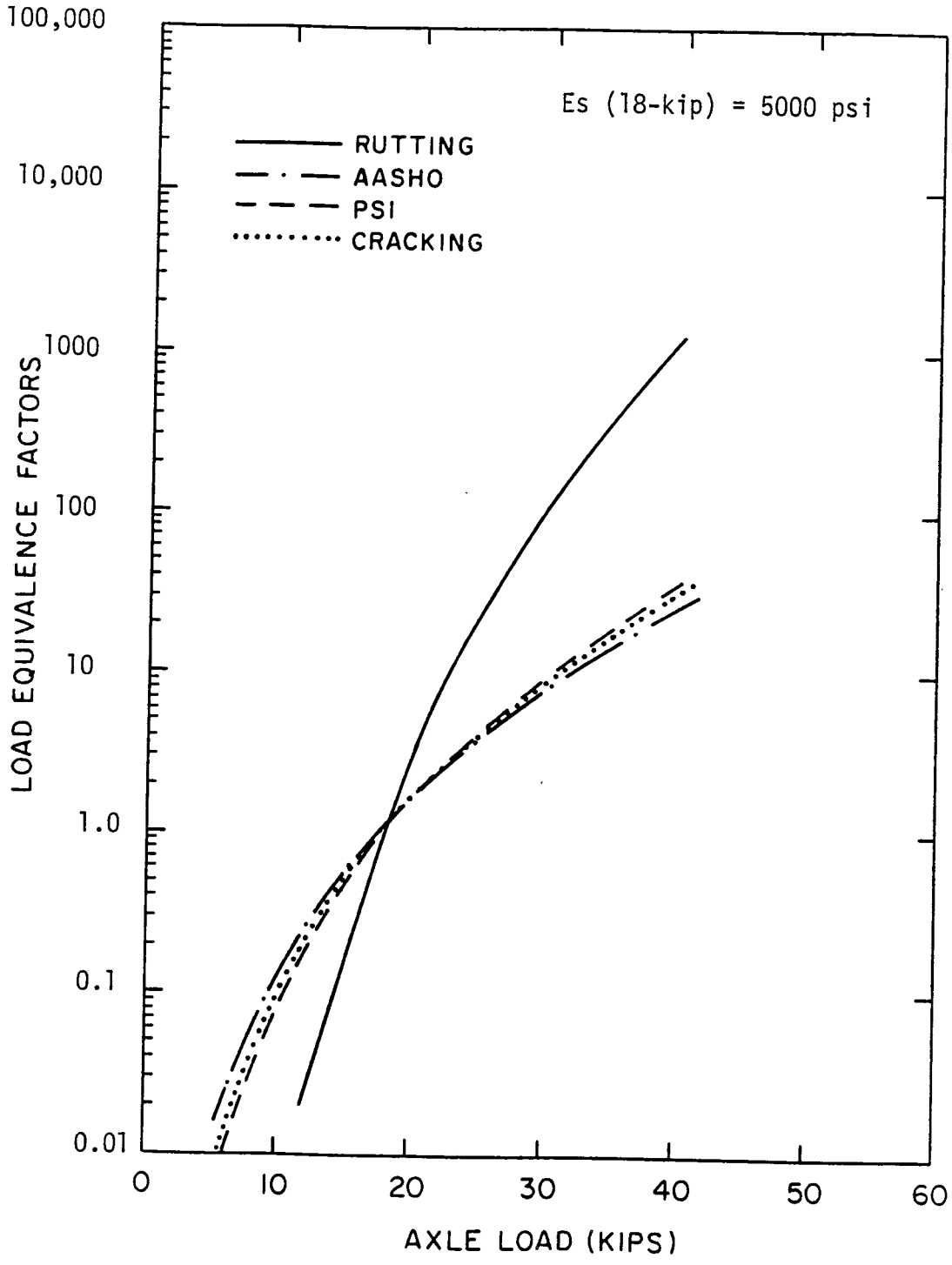

Figure 11. Load Equivalence Factors for the Three Types of Distresses, Namely, PSI, Rutting and Cracking, for SN=3, t=3, Es=5000 psi in the WET-FREEZE Zone, Compared with the AASHO Curve for SN=3, P_t=2.5.

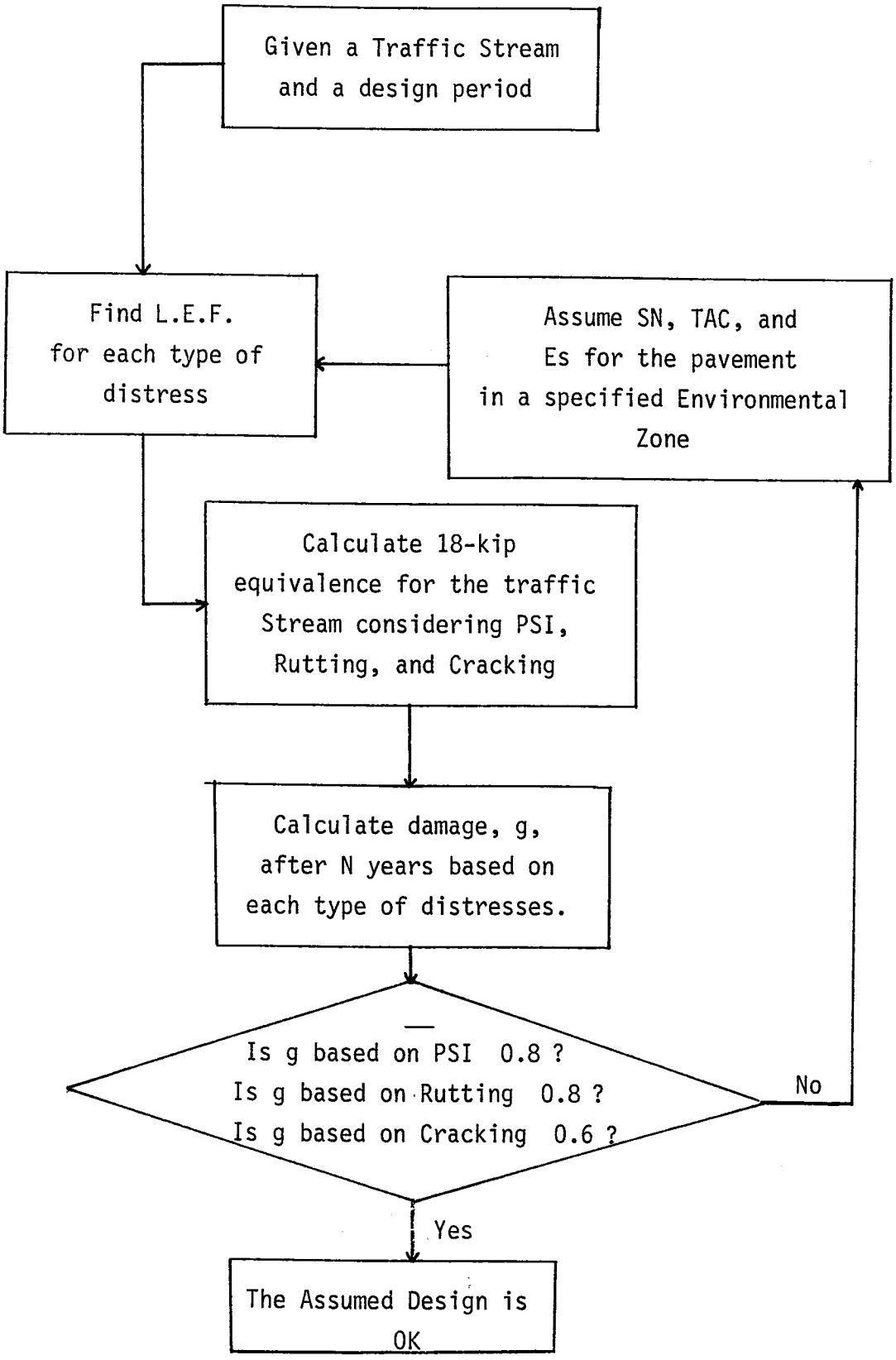

Figure 12. Flow Chart of Using the New Load Equivalence Factors in Pavement Design.

An example of this design procedure is given in the next chapter of this report.

CHAPTER VI

SAMPLE DESIGN USING THE NEW LOAD EQUIVALENCE FACTORS

Assume the following axle distribution to be based on the axle weights obtained from 3146 trucks.

Axle Load Groups, lbs	Representative Axle Load, lbs	No. of Axles
Single Axles		
Under 3000	2000	512
3000-6999	5000	536
7000-7999	7500	239
8000-11999	10000	1453
12000-15999	14000	249
16000-18000	17000	106
18001-10000	19000	43
20001-21999	21000	4
22000-23999	23000	3
24000 and over	-	0
Tandem Axles		
Under 5000	4000	9
5000-11999	9000	337
12000-17999	15000	396
18000-23999	21000	457
24000-29999	27000	815
30000-32000	31000	342
32001-33999	33000	243
34000-35999	35000	173
36000-37999	37000	71
38000-39999	39000	9
40000-41999	41000	0
42000-43999	43000	1
44000 and over	-	0

The Traffic Problem:

Initial ADT = 4000 vehicles per day
20-year ADT = 6000 vehicles per day
Percent Trucks = 20% (based on 24-hour traffic volume)
The design period = 20 years

Solution

Average ADT for a 20-year design period in both directions

$\frac{4000 + 6000}{2}$ = 5000 vehicles per average day

Average 20-year ADT in one direction = $\frac{5000}{2}$ = 2500 vehicles

The average number of trucks per day in one direction for the 20-year design period= 20% trucks x 2500 vehicles = 500 trucks

The total number of trucks in one direction for the 20-year design period = 500 trucks x 20 years x 365 days/year = 3,650,000 trucks

Trial No 1 SN=3, t=3 in, Es= 15000 psi (based on PSI in the WET-FREEZE Zone)

Axle Load Groups, lbs	Representative Axle	Equivalent Factor	No. of Axles	Equivalent 18-kip Single Axle
Single Axles				
Under 3000	2000	0	512	0
3000-6999	5000	0	536	0
7000-7999	7500	.002	239	0.5
8000-11999	10000	.015	1453	21.8
12000-15999	14000	.171	279	47.7
16000-18000	17000	.72	106	76.3
18001-20000	19000	1.535	43	66.0
20001-21999	21000	3.02	4	12.1
22000-23999	23000	5.56	3	16.68
24000 and over	-	-	0	0
			Subtotal	241.10
Tandem Axles				
under 6000	400	0	9	0
6000-11999	9000	0	337	0
12000-17999	15000	0.0025	396	.99
18000-23999	21000	0.0285	457	13.02
24000-29999	27000	0.171	815	139.36
30000-32000	31000	0.451	342	154.24
32001-33999	33000	0.697	243	169.37
34000-35999	35000	1.047	173	181.13
36000-37999	37000	1.536	71	109.06
38000-39999	39000	2.204	9	19.836
40000-41999	41000	3.101	0	0
42000-43999	43000	4.285	1	4.285
44000 and over	-	-	0	0
			Subtotal	791.29
			Total	1032.39

The 18-kip (80 kN) rate per truck would be

$$\frac{1032.39}{3146} = 0.32816 \quad \text{18 kip axle loads/trucks}$$

The 18-kip equivalent single axle loading for average day in 20-year design period would be: 500 x 0.32816 = 164.08 equivalent 18-kip single axle loads per day.

For total loads during the design period = 3,650,000 x 0.32816 = 1,197,784 equivalent 18-kip single axle loads.

$$\text{Log } (\rho_2) = -5.7851 - \text{Log } (19)\,(1.8997 + 0.7201 \times 3 - 0.0353 \times 9 + 2.145 \times 10^{-5} \times 15000 - 1.783 \times 10^{-10} \times 15000 \times 15000) + 2.8571 \text{ Log } (15000) + 2.7465 \text{ Log } (3) + 6.2881 \text{ Log } (3)$$

$$\rho_2 = 204{,}829.2$$

$$\text{Log } (\beta_2 - 0.07) = 5.754 - \text{Log } (19)\,(0.2736 - 0.1008 \times 3 + 0.0016 \times 9 - 4.352 \times 10^{-5} \times 15000 + 5.801 \times 10^{-10} \times 15000^2) - 1.4593 \text{ Log } (15000) + 0.4965 \text{ Log } (3) - 2.2156 \text{ Log } (3)$$

$$\beta_2 = 0.405652$$

$$g = c\, e^{-\left(\frac{\rho_2}{N_{18}}\right)^{\beta 2}} = 1.05\, e^{-\left(\frac{204829.2}{1{,}197{,}784}\right)^{0.405652}}$$

$$g = 0.614$$

Trial No. 1 (Continued)

SN=3, t=3 in, Es=15000 psi (based on Rutting in the WET-FREEZE Zone)

Axle Load Groups, lbs	Representative Axle Load, lbs	Equivalent Factor	No. of Axles	Equivalent 18-kip Single Axle
Single Axles				
Under 3000	2000	0	512	0
3000-6999	5000	0	536	0
7000-7999	75000	0	239	0
8000-11999	10000	.002	1453	2.906
12000-15999	14000	.074	279	20.646
16000-18000	17000	.649	106	68.794
18001-20000	19000	1.959	43	84.237
20001-21999	21000	5.265	4	21.06
22000-23999	23000	12.87	3	38.61
24000 and over	-	-	0	-
			Subtotal	236.253
Tandem Axles				
Under 6000	4000	0	9	0
6000-11999	9000	0	337	0
12000-17999	15000	.0025	396	0.99
18000-23999	21000	.0635	457	29.0195
24000-29999	27000	.7485	815	610.0275
30000-32000	31000	2.868	342	980.856
32001-33999	33000	5.247	243	1275.021
34000-35999	35000	9.244	173	1599.212
36000-37999	37000	15.7495	71	1118.2145
38000-39999	39000	26.0405	9	234.3645
40000-41999	41000	41.909	0	0
42000-43999	43000	65.825	1	65.825
44000 and over	-	-	0	0
			Subtotal	5913.53
			Total	6149.783

The 18-kip rate per truck would be $\frac{6149.783}{3146} = 1.9547943$ 18 kip axle loads/truck.

The 18-kip equivalent single axle loading for average day in 20-year design period would be:

500 x 1.9547943 = 977.4 equivalent 18 kip single axle loads per day

For total loads during the design period = 3,650,000 x 1.9547943 = 7,134,999.348 equivalent 18 kip single axle loads.

$$\text{Log}(\rho_2) = -15.9525 - \text{Log}(18+1)(3.2694 + 0.7647 * 3 - 0.0313 * 3^2 + 0.0001 * 15000 - 1.542 \times 10^{-9} * 15000^2) + 5.6967 * \text{Log}(15000) - 0.6868 * \text{Log}(3) + 12.8105 * \text{Log}(3)$$

$$\text{Log}(\rho_2) = 5.393374135$$

$$\rho_2 = 247385.44$$

$$\text{Log}(\beta_2) = -1.3748 + \text{Log}(18+1)(.7412 - 0.0229 * 3 + 0.002 * 3^2 - 2.956 \times 10^{-5} * 15000 + 6.532 \times 10^{-10} * 15000^2) + 0.1097 * \text{Log}(15000) + 1.2895 * \text{Log}(3) - 1.5957 * \text{Log}(3)$$

$$\text{Log}(\beta_2) = -0.558858885$$

$$\beta_2 = 0.2761475$$

$$g = 1.05 \; e^{-\left(\frac{247385.44}{7134999.348}\right)^{0.2761475}}$$

$$g = 0.7072$$

Trial No. 1 (Continue)

SN=3, t=3 in, Es=15000 psi (based on Cracking in the WET-FREEZE Zone).

Axle Load Groups, lbs	Representative Axle Load, lbs	Equivalent Factor	No. of Axles	Equivalent 18-kip Single Axle
Single Axles				
Under 3000	2000	0	512	0
3000-6999	5000	.0075	536	4.02
7000-7999	75000	.0300	239	7.17
8000-11999	10000	.089	1453	129.317
12000-15999	14000	.351	279	97.929
16000-18000	17000	.8055	106	85.383
18001-20000	19000	1.279	43	54.997
20001-21999	21000	1.9445	4	7.778
22000-23999	23000	2.852	3	8.556
24000 and over	-	-	0	-
			Subtotal	395.15
Tandem Axles				
Under 6000	4000	0.016	9	0.144
6000-11999	9000	0.016	337	5.392
12000-17999	15000	0.078	396	30.888
18000-23999	21000	.2935	457	134.1295
24000-29999	27000	.8145	815	663.8175
30000-32000	31000	1.44	342	492.48
32001-33999	33000	1.867	243	453.681
34000-35999	35000	2.3865	173	412.8645
36000-37999	37000	3.0115	71	213.8165
38000-39999	39000	3.756	9	33.804
40000-41999	41000	4.6355	0	0
42000-43999	43000	5.6665	1	5.6665
44000 and over	-	-	0	0
			Subtotal	2446.68
			Total	2841.83

The 18-kip (80 KN) rate per truck would be $\frac{2841.83}{3176}$ = 0.903315321 18 kip axle loads/truck.

The 18-kip equivalent single axle loading for average day in 20-year design period would be:

500 x 0.90331521 = 451.66 equivalent 18 kip single axle loads per day

For total loads during the design period = 3,650,000 x 0.903315321 = 3,297,100.92 equivalent 18 kip single axle loads

$$\text{Log } (\rho_2) = 3.54028542 + \text{Log } (18 + 1)\ (-4.282459 - 0.06530508 * 3 + 0.001343 * 3^2 + 0.000004 * 15000) + \text{Log } (1)\ (3.8808 + 0.1196 * 3 - 0.0014 * 3^2 - .000075 * 15000) + 0.952092 * \text{Log } (15000) + 7.08527 * \text{Log } (3) + 0.0615593 * \text{Log } (3)$$

$$\text{Log } (\rho_2) = 5.555998241$$

$$\rho_2 = 359,747.9$$

$$\text{Log } (\beta_2) = -0.582834 + \text{Log } (18 + 1)\ (0.54902 - 0.043927 * 3 + 0.0046266 * 3^2 - 0.0000214 * 15000) + \text{Log } (1)\ (-1.1368 + 0.1511 * 3 - 0.0156 * 3^2 + 0.000087 * 15000) + 0.2252093 * \text{Log}(15000) - 0.77013 * \text{Log}(3) + 0.301531 * \text{Log}(3)$$

$$\text{Log } (\beta_2) = .310394546$$

$$\beta_2 = 2.043593661$$

$$g = e^{-\left(\frac{\rho_2}{N_{18}}\right)^{\beta_2}} = e^{-\left(\frac{359,747.9}{3,297,100.92}\right)^{2.043593661}}$$

g = .98925 too much, try SN=4.0

Trial No. 2

SN=4, t=3, Es=15000 psi (based on PSI in the WET-FREEZE Zone)

Axle Load Groups, lbs	Representative Axle Loads, lbs	Equivalent Factor	No. of Axles	Equivalent 18-kip Single Axle
Single Axles				
Under 3000	2000	0	5.2	0
3000-6999	5000	.0005	536	.268
7000-7999	75000	.00325	239	.77675
8000-11999	10000	.018	1453	26.154
12000-15999	14000	.184	279	51.336
16000-18000	17000	.7275	106	77.115
18001-20000	19000	1.5045	43	64.6935
20001-21999	21000	2.88	4	11.52
22000-23999	23000	5.174	3	15.522
24000 and over	-	-	0	0
			Subtotal	247.38525
Tandem Axles				
Under 6000	4000	0	9	0
6000-11999	9000	0	337	0
12000-17999	15000	.0035	396	1.386
18000-23999	21000	.0345	457	15.7665
24000-29999	27000	.193	815	157.295
30000-32000	31000	.4935	342	168.777
32001-33999	33000	.752	243	182.736
34000-35999	35000	1.1155	173	192.9815
36000-37999	37000	1.616	71	114.736
38000-39999	39000	2.2915	9	20.6235
40000-41999	41000	3.188	0	0
42000-43999	43000	4.36	1	4.36
44000 and over	-	-	0	0
			Subtotal	858.6615
			Total	1106.05

The 18-kip (80 KN) rate per truck would be $\frac{1106.05}{3176}$ = 0.351573426 18 kip axle loads per truck.

The 18-kip equivalent single axle loading for average day in 20-year design period would be:

500 x 0.351573426 = 175.79 equivalent 18 kip single axle loads per day

For total loads during the design period = 3,650,000 x 0.351573426 = 1,283,243 equivalent 18 kip single axle loads

$\text{Log } (\rho_2) = 5.65453609$

$\rho_2 = 451,373.53$

$\text{Log } (\beta_2 - 0.07) = -0.412078754$

$\beta_2 = 0.457187426$

$g = 0.565$ OK

Trial No. 2 (Continue)

SN=4, t=3.0, Es=15000 psi (based on Rutting in the WET-FREEZE Zone).

Axle Load Groups, lbs	Representative Axle Loads, lbs	Equivalent Factor	No. of Axles	Equivalent 18-kip Single Axle
Single Axles				
Under 3000	2000	0	5.2	0
3000-6999	5000	0	536	0
7000-7999	75000	.00075	239	.17925
8000-11999	10000	.005	1453	7.265
12000-15999	14000	.104	279	29.016
16000-18000	17000	.6735	106	71.391
18001-20000	19000	1.7795	43	76.5185
20001-21999	21000	4.2565	4	17.026
22000-23999	23000	9.3805	3	28.1416
24000 and over	-	-	0	0
			Subtotal	229.54
Tandem Axles				
Under 6000	4000	0	9	0
6000-11999	9000	0	337	0
12000-17999	15000	.004	396	1.584
18000-23999	21000	.074	457	33.818
24000-29999	27000	.645	815	525.675
30000-3200	31000	2.11	342	721.62
32001-33999	33000	3.601	243	875.043
34000-35999	35000	5.9485	173	1029.0905
36000-37999	37000	9.5465	71	677.8015
38000-39999	39000	14.929	9	134.361
40000-41999	41000	22.806	0	0
42000-43999	43000	34.1105	1	34.1105
44000 and over	-	-	0	0
			Subtotal	4033.1035
			Total	4262.643

The 18-kip (80 KN) rate per truck would be $\frac{4262.643}{3176}$ = 1.35494056 18 kip axle loads/truck.

The 18-kip equivalent single axle loading for average day in 20-year design period would be:

500 x 1.35494056 = 677.47 equivalent 18 kip single axle loads per day

For total loads during the design period = 3,650,000 x 1.35494056 = 4,945,533 equivalent 18 kip single axle load

$\text{Log } (\rho_2) = 5.30756621$

$\rho_2 = 203,032.8$

$\text{Log } (\beta_2) = -0.397750383$

$\beta_2 = 0.400174689$

$g = 0.795$ OK

Trial No. 2 (Continue)

SN=4, t=3.0 in, Es=15000 psi (based on Cracking in the WET-FREEZE Zone).

Axle Load Groups, lbs	Representative Axle Loads, lbs	Equivalent Factor	No. of Axles	Equivalent 18-kip Single Axle
Single Axles				
Under 3000	2000	0	512	0
3000-6999	5000	.0075	536	4.02
7000-7999	7500	.03	239	7.17
8000-11999	10000	.088	1453	127.864
12000-15999	14000	.350	279	97.65
16000-18000	17000	.805	106	85.33
18001-20000	19000	1.2835	43	55.19
20001-21999	21000	1.9465	4	7.786
22000-23999	23000	2.8565	3	8.57
24000 and over	-	-	0	0
			Subtotal	393.58
Tandem Axles				
Under 6000	4000	.016	9	0.144
6000-11999	9000	.016	337	5.392
12000-17999	15000	.079	396	31.284
18000-23999	21000	.2975	457	135.96
24000-29999	27000	.826	815	673.19
30000-32000	31000	1.461	342	499.662
32001-33999	33000	1.8945	243	460.3635
34000-35999	35000	2.422	173	419.006
36000-37999	37000	3.0565	71	217.012
38000-39999	39000	3.8125	9	34.3125
40000-41999	41000	4.706	0	0
42000-43999	43000	6.139	1	6.319
44000 and over	-	-	0	0
			Subtotal	2482.645
			Total	2876.225

The-kip (80 KN)rate per truck would be $\frac{2876.225}{3146}$ = 0.914248251 18 kip axle loads/truck.

The 18-kip equivalent single axle loading for average day in 20-year design period would be:

500 x 0.914248251 = 457.12 equivalent 18 kip single axle loads per day

For total loads during the design period = 3,650,000 x 0.914248251 = 3,337,006.12 equivalent 18 kip single axle loads

$\text{Log } (\rho_2) = 6.44122$

$\rho_2 = 2{,}761{,}995.22$

$\text{Log } (\beta_2) = 0.214262748$

$\beta_2 = 1.6378$

$g = 0.48$ OK

CHAPTER VII

CONCLUSION AND DISCUSSION

The new method of predicting load equivalence factors, specifically for Texas conditions, has the following advantages over the current method (the AASHO Road Test Method):

1. It uses the elastic modulus of the subgrade .
2. It considers four environmental zones for the state of Texas .
3. It considers different distress types (loss of Serviceability Index, Rutting and Cracking.)
4. It uses the S-shaped curve.

One of the primary benefits resulting from this new set of load equivalence factors is pavement thickness design that reflects more accurate estimates of traffic loadings. It is clear from Fig 10 and 11 that the AASHO load equivalence factors are very low compared to the load equivalence factors from this report for any type of distress, which implies that the AASHO will underpredict the Traffic flow for the design period which will underdesign the thickness of pavement. The example used in this report to demonstrate the use of the new load equivalence factors shows that the pavement is satisfactory when we consider the PSI distress like the AASHO procedure, but the pavement failed the cracking requirement even though it is acceptable considering the PSI and Rutting. So cracking controlled the design which implies using higher value of SN or increasing the thickness of the pavement. As a result the incidence of premature distress resulting from underestimating traffic should be reduced. In addition, situations of overdesign can be minimized. These situations occur when equivalence factors are developed using distresses that are not prevalent in the area where the pavement is being placed.

A distress such as alligator cracking in East Texas may not be predominant in West Texas. Therefore, if equivalence factors are based on one kind of distress which is predominant in East Texas only, the pavement in West Texas can be overdesigned. Also, the soil and the weather in East Texas is different than in West Texas. Many of these problems would be rectified using the equivalence factors that are developed from this study specifically for Texas conditions.

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APPENDIX 1

EQUATIONS FOR ρ_2, β_2

Equations for ρ_2 and β_2 Based On PSI

WET-FRZ

$$\text{Log}(\rho_2) = -5.7851 - \text{Log}(L_1 + L_2)(1.8997 + 0.7201\,T_1 - 0.0353\,T_1^2 + 2.145 \times 10^{-5}\,Es - 1.783 \times 10^{-10}\,Es^2) - \text{Log}(L_2)(0.2087 - 1.0053\,T_1 + 0.0628\,T_1^2 - 1.071 \times 10^{-5}\,Es - 7.515 \times 10^{-10}\,Es^2) + 2.8571\,\text{Log}(Es) + 2.7465\,\text{Log}(SN) - 6.2881\,\text{Log}(T_1)$$

$$\text{Log}(\beta_2 - 0.07) = 5.754 - \text{Log}(L_1 + L_2)(0.2736 - 0.1008\,T_1 + 0.0016\,T_1^2 - 4.352 \times 10^{-5}\,Es + 5.801 \times 10^{-10}\,Es^2) - \text{Log}(L_2)(1.2783 - 0.5582\,T_1 + 0.047\,T_1^2 + 6.842 \times 10^{-5}\,Es - 1.438 \times 10^{-9}\,Es^2) - 1.4593\,\text{Log}(Es) + 0.4965\,\text{Log}(SN) - 2.2156\,\text{Log}(T_1)$$

WET-NFRZ

$$\text{Log}(\rho_2) = -6.6201 - \text{Log}(L_1 + L_2)(2.0836 + 0.5719\,T_1 - 0.0335\,T_1^2 + 9.623 \times 10^{-5}\,Es - 2.00 \times 10^{-9}\,Es^2) + \text{Log}(L_2)(1.223 + 0.908\,T_1 - 0.0648\,T_1^2 - 2.65 \times 10^{-5}\,Es + 1.483 \times 10^{-9}\,Es^2) + 3.442\,\text{Log}(Es) + 2.616\,\text{Log}(SN) + 3.97\,\text{Log}(T_1)$$

$$\text{Log}(\beta_2 - 0.07) = 3.2871 + \text{Log}(L_1 + L_2)(0.3599 + 0.0318\,T_1 - 0.002\,T_1^2 + 1.963 \times 10^{-5}\,Es - 2.82 \times 10^{-10}\,Es^2) - \text{Log}(L_2)(0.419 - 0.2332\,T_1 + 0.0161\,T_1^2 + 8.094 \times 10^{-5}\,Es - 1.927 \times 10^{-9}\,Es^2) - 1.1635\,\text{Log}(Es) + 0.3318\,\text{Log}(SN) + 0.2620\,\text{Log}(T_1)$$

DRY-FRZ

$$\text{Log}(\rho_2) = -6.1208 - \text{Log}(L_1 + L_2)(2.5205 + 0.5833\,T_1 - 0.0242\,T_1^2 + 2.155 \times 10^{-5}\,Es - 1.023 \times 10^{-10}\,Es^2) + \text{Log}(L_2)(2.8645 - 0.0524\,T_1 + 0.01928\,T_1^2 + 2.267 \times 10^{-5}\,Es + 5.987 \times 10^{-11}\,Es^2) + 3.0503\,\text{Log}(Es) + 1.9528\,\text{Log}(SN) + 7.1783\,\text{Log}(T_1)$$

$$\text{Log}(\beta_2 - 0.04) = 4.2302 + \text{Log}(L_1 + L_2)(0.0208 - 0.0370\,T_1 + 0.0083\,T_1^2 + 4.834 \times 10^{-5}\,Es - 7.573 \times 10^{-10}\,Es^2) - \text{Log}(L_2)(0.0317 - 0.2344\,T_1 + 0.0237\,T_1^2 + 8.03 \times 10^{-5}\,Es - 1.651 \times 10^{-9}\,Es^2) - 1.1714\,\text{Log}(Es) - 0.8811\,\text{Log}(SN) - 1.9734\,\text{Log}(T_1)$$

DRY-NFRZ

$$\text{Log}(\rho_2) = -5.0316 - \text{Log}(L_1 + L_2)(2.9784 + 0.3943\,T_1 - 0.0270\,T_1^2 + 0.0001\,Es - 2.83 \times 10^{-9}\,Es^2) + \text{Log}(L_2)(1.4754 + 0.5653\,T_1 - 0.0478\,T_1^2 + 0.00011\,Es - 2.303 \times 10^{-9}\,Es^2) + 3.5824\,\text{Log}(Es) + 1.9561\,\text{Log}(SN) + 2.3259\,\text{Log}(T_1)$$

$$\text{Log}(\beta_2 - 0.05) = 1.9844 + \text{Log}(L_1 + L_2)(0.4007 + 0.0035\,T_1 + 0.0003\,T_1^2 + 1.409 \times 10^{-5}\,Es - 2.138 \times 10^{-10}\,Es^2) - \text{Log}(L_2)(0.2653 - 0.148\,T_1 + 0.0119\,T_1^2 - 4.13 \times 10^{-5}\,Es - 6.448 \times 10^{-10}\,Es^2) - 0.8642\,\text{Log}(Es) + 0.1018\,\text{Log}(SN) + 0.07906\,\text{Log}(T_1)$$

Equations For ρ_2 and β_2 Based On Rutting

WET-FRZ

$$\text{Log } (\beta_2) = -1.3748 + \text{Log } (L_1 + L_2)\ (0.7412 - 0.0229\ T_1 + 0.0020\ T_1^2 - 2.956 \times 10^{-5}\ Es + 6.532 \times 10^{-10}\ Es^2) - \text{Log } (L_2)\ (0.1685 - 0.0638\ T_1 + 0.0049\ T_1^2 + 1.601 \times 10^{-5} Es - 3.552 \times 10^{-10}\ Es^2) + 0.1097\ \text{Log } (Es) + 1.2895\ \text{Log } (SN) - 1.5957\ \text{Log } (T_1)$$

$$\text{Log } (\rho_2) = -15.9525 - \text{Log } (L_1 + L_2)\ (3.2694 + 0.7647\ T_1 - 0.0313\ T_1^2 + 0.0001\ Es - 1.542 \times 10^{-9}\ Es^2) + \text{Log } (L_2)\ (2.5529 + 0.6382\ T_1 - 0.0438\ T_1^2 + 7.613 \times 10^{-5}\ Es - 5.964 \times 10^{-10}\ Es^2) + 5.6967\ \text{Log } (Es) - 0.6868\ \text{Log } (SN) + 12.8105\ \text{Log } (T_1)$$

WET-NFRZ

$$\text{Log } (\beta_2) = -2.0682 + \text{Log } (L_1 + L_2)\ (0.4110 + 0.0767\ T_1 - 0.0047\ T_1^2 - 3.910 \times 10^{-5}\ Es + 7.855 \times 10^{-10}\ Es^2) + \text{Log } (L_2)\ (0.3096 - 0.1025\ T_1 + 0.0084\ T_1^2 - 1.678 \times 10^{-5}\ Es + 4.754 \times 10^{-10}\ Es^2) + 0.1684\ \text{Log } (Es) + 0.6310\ \text{Log } (SN) - 0.4842\ \text{Log } (T_1)$$

$$\text{Log } (\rho_2) = -14.4013 - \text{Log } (L_1 + L_2)\ (2.8548 + 0.8522\ T_1 - 0.0463\ T_1^2 + 0.0001\ Es - 2.629 \times 10^{-9}\ Es^2) + \text{Log } (L_2)\ (1.9432 + 0.7510\ T_1 - 0.0542\ T_1^2 + 9.036 \times 10^{-5} Es - 1.297 \times 10^{-9}\ Es^2) + 6.2755\ \text{Log } (Es) + 0.2164\ \text{Log } (SN) + 6.8630\ \text{Log } (T_1)$$

DRY-FRZ

$$\text{Log}(\beta_2) = -1.2085 + \text{Log}(L_1 + L_2)(0.4432 - 0.0408\,T_1 + 0.0022\,T_1^2 - 5.769 \times 10^{-6}\,Es + 1.396 \times 10^{-10}\,Es^2) + \text{Log}(L_2)(0.1080 - 0.0348\,T_1 + 0.0029\,T_1^2 - 1.110 \times 10^{-5}\,Es + 2.392 \times 10^{-10}\,Es^2) - 0.0273\,\text{Log}(Es) + 1.0141\,\text{Log}(SN) - 0.9690\,\text{Log}(T_1)$$

$$\text{Log}(\rho_2) = -14.6349 - \text{Log}(L_1 + L_2)(1.5174 + 1.7237\,T_1 - 0.0780\,T_1^2 + 6.190 \times 10^{-5}\,Es - 7.800 \times 10^{-10}\,Es^2) + \text{Log}(L_2)(0.7076 + 1.0112\,T_1 - 0.0612\,T_1^2 + 0.0002\,Es - 3.474 \times 10^{-9}\,Es^2) + 5.2718\,\text{Log}(Es) - 6.9644\,\text{Log}(SN) + 26.7891\,\text{Log}(T_1)$$

DRY-NFRZ

$$\text{Log}(\beta_2) = -1.3123 - \text{Log}(L_1 + L_2)(0.0391 - 0.0689\,T_1 + 0.0039\,T_1^2 + 1.075 \times 10^{-5}\,Es - 2.092 \times 10^{-10}\,Es^2) + \text{Log}(L_2)(0.2651 - 0.0799\,T_1 + 0.0056\,T_1^2 - 3.681 \times 10^{-6}\,Es + 9.869 \times 10^{-11}\,Es^2) - 0.0055\,\text{Log}(Es) + 0.3528\,\text{Log}(SN) - 0.3201\,\text{Log}(T_1)$$

$$\text{Log}(\rho_2) = 1.6659 - \text{Log}(L_1 + L_2)(3.0490 + 1.5058\,T_1 - 0.0856\,T_1^2 - 8.674 \times 10^{-5}\,Es + 1.310 \times 10^{-9}\,Es^2) - \text{Log}(L_2)(1.2244 - 1.6627\,T_1 + 0.1148\,T_1^2 - 8.283 \times 10^{-5}\,Es + 1.996 \times 10^{-9}\,Es^2 + 3.9250\,\text{Log}(Es) - 3.9205\,\text{Log}(SN) + 8.2909\,\text{Log}(T_1)$$

Equations For ρ_2 and β_2 Based On Cracking

WET-FRZ

$$\text{Log}(\rho_2) = 3.5403 - \text{Log}(L_1 + L_2)(4.2825 + 0.0653\,T_1 - 0.0013\,T_1^2 - 0.000004\,Es) + \text{Log}(L_2)(3.8808 + 0.1196\,T_1 - 0.0014\,T_1^2 - 0.000075\,Es) + 0.9521\,\text{Log}(Es) + 7.0853\,\text{Log}(SN) + 0.6156\,\text{Log}(T_1)$$

$$\text{Log}(\beta_2) = -0.5828 + \text{Log}(L_1 + L_2)(0.5490 - 0.0439\,T_1 + 0.0046\,T_1^2 - 0.000021\,Es) - \text{Log}(L_2)(1.1368 - 0.1511\,T_1 + 0.0156\,T_1^2 - 0.000087\,Es) + 0.2252\,\text{Log}(Es) - 0.7701\,\text{Log}(SN) + 0.3015\,\text{Log}(T_1)$$

WET-NFRZ

$$\text{Log}(\rho_2) = 1.1276 - \text{Log}(L_1 + L_2)(3.7004 + 0.1154\,T_1 - 0.0036\,T_1^2 + 0.00003\,Es) + \text{Log}(L_2)(3.2664 + 0.1912\,T_1 - 0.00695\,T_1^2 - 0.000043\,Es) + 1.4481\,\text{Log}(Es) + 7.0240\,\text{Log}(SN) + 1.0826\,\text{Log}(T_1)$$

$$\text{Log}(\beta_2) = 0.5832 + \text{Log}(L_1 + L_2)(0.2875 - 0.0273\,T_1 + 0.0021\,T_1^2 + 0.0000043\,Es) - \text{Log}(L_2)(0.2143 + 0.1456\,T_1 - 0.0106\,T_1^2 - 0.000063\,Es) - 0.0693\,\text{Log}(Es) - 0.7527\,\text{Log}(SN) + 0.3733\,\text{Log}(T_1)$$

DRY-FRZ

$$\text{Log}(\rho_2) = 3.9819 - \text{Log}(L_1 + L_2)(4.2229 + 0.1012\,T_1 - 0.0051\,T_1^2 - 0.000026\,Es) + \text{Log}(L_2)(3.9858 + 0.2444\,T_1 - 0.0171\,T_1^2 - 0.00014\,Es) + 0.8040\,\text{Log}(Es) + 6.7426\,\text{Log}(SN) + 0.6841\,\text{Log}(T_1)$$

$$\text{Log}(\beta_2) = -0.1548 + \text{Log}(L_1 + L_2)(0.1756 + 0.0254\,T_1 - 0.0017\,T_1^2 - 0.000018\,Es) + \text{Log}(L_2)(0.0484 - 0.2486\,T_1 + 0.0181\,T_1^2 + 0.000086\,Es) + 0.1126\,\text{Log}(Es) - 0.4291\,\text{Log}(SN) + 0.2545\,\text{Log}(T_1)$$

DRY-NFRZ

$$\text{Log}(\rho_2) = -1.5284 - \text{Log}(L_1 + L_2)(2.4938 + 0.3347\,T_1 - 0.0173\,T_1^2 + 0.000054\,Es) + \text{Log}(L_2)(1.1154 + 0.7428\,T_1 - 0.0540\,T_1^2 + 0.000059\,Es) + 1.8706\,\text{Log}(Es)\,6.9348\,\text{Log}(SN) + 2.2325\,\text{Log}(T_1)$$

$$\text{Log}(\beta_2) = 4.0502 - \text{Log}(L_1 + L_2)(0.6758 - 0.0946\,T_1 + 0.0053\,T_1^2 - 0.000045\,Es) + \text{Log}(L_2)(1.1932 - 0.2918\,T_1 + 0.0258\,T_1^2 - 0.00093\,Es) - 0.7533\,\text{Log}(Es) - 0.7607\,\text{Log}(SN) - 0.3016\,\text{Log}(T_1)$$

APPENDIX 2

Tables of Load Equivalence Factors Based PSI

Table 1.1. Load Equivalence Factors for SN=3, Subgrade Modulus=5000 psi. WET FRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.174	0.127	0.049	0.010	0.001	0.000
4.	0.693	0.812	0.608	0.261	0.079	0.020
6.	1.724	2.742	3.107	2.175	1.088	0.458
8.	3.405	6.788	10.381	10.291	7.393	4.424
10.	5.862	13.975	27.006	34.998	33.149	25.931
12.	9.214	25.469	59.577	95.862	113.343	109.810
14.	13.573	42.558	116.941	225.419	320.330	370.192
16.	19.047	66.645	210.403	473.327	786.339	1054.688
18.	25.738	99.242	353.912	910.862	1732.313	2641.183
20.	33 747	141.957	564.228	1635.548	3502.897	5973.273
22.	43.170	196.493	861.049	2776.068	6608.000	12440.480
24.	54.101	264.643	1267.196	4497.297	11770.460	24207.620
26.	66.630	348.287	1808.676	7005.582	19980.260	44498.520
28.	80.849	449.388	2514.894	10554.020	32555.260	77938.870
30.	96.844	569.979	3418.598	15447.160	51204.040	130953.900
32.	114.700	712.176	4556.188	22047.870	78104.430	212235.100
34.	134.501	878.175	5967.664	30781.730	115972.000	333278.800
36.	156.332	1070.222	7696.832	42142.900	168149.800	508978.100
38.	180.272	1290.650	9791.238	56698.950	238698.000	758291.500
40.	206.401	1541.860	12302.290	75098.680	332476.900	1104981.000

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	2.030	1.588	2.443	4.106	8.417	4.838
12.	3.088	2.801	5.108	10.227	16.048	17.078
14.	4.442	4.575	9.652	22.391	40.634	50.018
16.	6.121	7.049	16.878	44.470	91.388	127.305
18.	8.154	10.371	27.773	81.825	187.383	290.487
20.	10.569	14.701	43.519	141.597	356.776	607.452
22.	13.394	20.210	65.500	232.994	639.335	1182.941
24.	16.655	27.077	95.311	367.595	1089.248	2171.205
26.	20.377	35.492	134.775	559.638	1778.177	3790.955
28.	24.586	45.651	185.942	826.346	2798.572	6342.652
30.	29.308	57.764	251.104	1188.228	4267.441	10228.200
32.	34.565	72.044	332.802	1669.386	6329.965	15973.120
34.	40.382	88.716	433.828	2297.846	9163.480	24250.410
36.	46.785	108.012	557.238	3105.847	12981.920	35908.370
38.	53.794	130.169	706.344	4130.188	18040.290	51997.550
40.	61.433	155.436	884.757	5412.516	24639.350	73806.930
42.	69.724	184.068	1096.341	6999.621	33130.410	102893.000
44.	78.690	216.324	1345.264	8943.867	43919.070	141113.900
46.	88.353	252.478	1636.005	11303.560	57474.920	190694.000
48.	98.734	292.799	1973.257	14142.680	74327.250	254205.800

Table 1.2. Load Equivalence Factors for SN=4, Subgrade Modulus=5000 psi. WET FRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.161	0.108	0.043	0.009	0.001	0.000
4.	0.641	0.678	0.499	0.225	0.073	0.020
6.	1.594	2.260	2.461	1.766	0.930	0.414
8.	3.145	5.544	8.018	8.000	5.958	3.726
10.	5.412	11.333	20.450	26.297	25.500	20.637
12.	8.504	20.534	44.395	70.058	83.907	83.349
14.	12.523	34.144	85.971	160.941	229.554	269.846
16.	17.567	53.243	152.893	331.225	547.910	742.231
18.	23.732	78.989	254.575	626.311	1177.692	1801.990
20.	31.109	112.612	402.214	1107.239	2329.872	3964.336
22.	39.786	155.409	608.858	1853.307	4309.703	8053.855
24.	49.849	208.743	889.501	2964.729	7541.352	15322.680
26.	61.382	274.036	1261.127	4565.359	12595.460	27592.960
28.	74.467	352.774	1742.800	6805.492	20219.480	47424.750
30.	89.184	446.490	2355.640	9863.977	31368.120	78306.930
32.	105.611	556.776	3122.994	13952.100	47241.590	124876.600
34.	123.826	685.283	4070.376	19315.330	69318.560	193168.600
36.	143.903	833.697	5225.637	26236.500	99397.810	290886.600
38.	165.919	1003.764	6618.809	35038.000	139640.200	427697.500
40.	189.943	1197.279	8282.324	46085.790	192606.300	615565.400

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.) 1	2	3	4	5	6
10.	2.052	1.520	2.143	3.370	4.311	3.868
12.	3.121	2.667	4.429	8.234	12.440	13.208
14.	4.487	4.336	8.281	17.737	30.800	37.604
16.	6.180	6.654	14.351	34.730	67.939	93.382
18.	8.230	9.755	23.429	63.110	136.947	208.515
20.	10.664	13.786	36.454	108.004	256.818	427.709
22.	13.510	18.898	54.519	175.947	453.974	818.604
24.	16.794	25.254	78.875	275.079	763.935	1479.093
26.	20.542	33.023	110.943	415.321	1233.112	2545.811
28.	24.780	42.383	152.315	608.579	1920.706	4203.848
30.	29.532	53.519	204.762	868.924	2900.904	6697.578
32.	34.822	66.622	270.238	1212.786	4264.898	10342.780
34.	40.676	81.892	350.883	1659.133	6123.156	15539.420
36.	47.115	99.536	449.029	2229.692	8607.840	22786.660
38.	54.164	119.764	567.197	2949.082	11875.370	32696.960
40.	61.845	142.796	708.122	3845.073	16108.950	46015.000
42.	70.181	168.858	874.727	4948.668	21521.200	63632.870
44.	79.194	198.179	1070.151	6294.445	28355.960	86607.250
46.	88.906	231.001	1297.764	7920.723	36894.390	116194.500
48.	99.338	267.560	1561.081	9869.414	47451.230	153837.300

Table 1.3. Load Equivalence Factors for SN=5, Subgrade Modulus=5000 psi. WET FRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.153	0.097	0.038	0.009	0.001	0.000
4.	0.608	0.596	0.431	0.201	0.068	0.020
6.	1.510	1.971	2.075	1.507	0.822	0.381
8.	2.978	4.803	6.636	6.611	5.034	3.246
10.	5.122	9.769	16.686	21.192	20.798	17.202
12.	8.046	17.627	35.806	55.315	66.479	66.990
14.	11.845	29.210	68.668	124.916	177.496	210.284
16.	16.613	45.413	121.109	253.334	414.872	563.171
18.	22.439	67.198	200.191	472.925	875.558	1335.661
20.	29.409	95.580	314.257	826.636	1704.293	2878.104
22.	37.605	131.628	472.969	1369.650	3107.115	5739.465
24.	47.110	176.464	687.370	2171.012	5366.207	10737.730
26.	58.002	231.259	969.908	3315.314	8856.328	19043.240
28.	70.358	297.228	1334.493	4904.367	14062.560	32275.600
30.	84.253	375.630	1796.465	7058.453	21597.950	52610.900
32.	99.761	467.764	2372.725	9918.707	32225.780	82905.620
34.	116.955	574.982	3081.699	13648.050	46877.680	126833.000
36.	135.905	698.658	3943.393	18433.280	66677.680	189033.000
38.	156.683	840.217	4979.355	24486.000	92966.060	275268.200
40.	179.355	1001.118	6212.777	32045.310	127318.600	392606.000

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.) 1	2	3	4	5	6
10.	1.998	1.689	2.918	5.331	7.275	6.418
12.	3.042	3.001	6.205	13.626	22.320	23.662
14.	4.378	4.933	11.890	30.504	58.236	71.944
16.	6.037	7.642	21.050	61.763	134.434	189.194
18.	8.046	11.299	35.018	115.596	282.065	444.373
20.	10.434	16.088	55.410	203.101	548.200	953.588
22.	13.229	22.205	84.133	338.812	1000.729	1900.801
24.	16.456	29.859	123.412	541.252	1733.892	3563.484
26.	20.141	39.269	175.801	833.479	2874.462	6343.586
28.	24.310	50.667	244.196	1243.709	4588.477	10804.230
30.	28.987	64.295	331.857	1805.873	7089.070	17712.240
32.	34.198	80.407	442.421	2560.247	10644.100	28086.850
34.	39.965	99.264	579.904	3554.052	15584.780	43253.280
36.	46.313	121.143	748.727	4842.074	22314.980	64905.640
38.	53.265	146.322	953.700	6487.336	31321.060	95169.680
40.	60.843	175.097	1200.098	8561.637	43182.470	136684.500
42.	69.071	207.768	1493.593	11146.220	58582.170	192675.300
44.	77.969	244.648	1840.310	14332.610	78314.870	267034.500
46.	87.562	286.061	2246.882	18223.200	103309.000	364463.100
48.	97.869	332.326	2720.268	22931.190	134618.600	490458.800

Table 1.4. Load Equivalence Factors for SN=3, Subgrade Modulus=15000 psi. WET FRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.002	0.000	0.000	0.000	0.000	0.000
4.	0.010	0.001	0.000	0.000	0.000	0.000
6.	0.034	0.004	0.000	0.000	0.000	0.000
8.	0.080	0.017	0.003	0.001	0.000	0.000
10.	0.160	0.053	0.015	0.005	0.002	0.001
12.	0.281	0.132	0.057	0.026	0.013	0.007
14.	0.455	0.287	0.171	0.106	0.069	0.048
16.	0.691	0.558	0.439	0.351	0.288	0.243
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.392	1.679	2.070	2.521	2.999	3.486
22.	1.879	2.676	3.972	5.759	7.995	10.626
24.	2.471	4.085	7.158	12.135	19.351	28.998
26.	3.178	6.013	12.242	23.902	43.193	72.119
28.	4.012	8.586	20.032	44.472	90.029	165.796
30.	4.985	11.941	31.562	78.794	176.940	356.269
32.	6.106	16.233	48.125	133.831	330.543	722.131
34.	7.387	21.632	71.308	219.077	590.689	1390.919
36.	8.839	28.323	103.036	347.189	1015.234	2561.737
38.	10.474	36.508	145.596	534.635	1685.774	4534.578
40.	12.303	46.405	201.678	802.484	2714.400	7747.977

(b) Tandem

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.012	0.000	0.000	0.000	0.000	0.000
12.	0.022	0.001	0.000	0.000	0.000	0.000
14.	0.036	0.003	0.001	0.001	0.001	0.001
16.	0.058	0.006	0.004	0.004	0.005	0.004
18.	0.087	0.012	0.009	0.012	0.017	0.017
20.	0.125	0.022	0.019	0.031	0.049	0.055
22.	0.174	0.037	0.038	0.072	0.129	0.163
24.	0.235	0.060	0.072	0.153	0.306	0.432
26.	0.310	0.092	0.127	0.304	0.675	1.051
28.	0.402	0.138	0.215	0.572	1.396	2.375
30.	0.511	0.200	0.351	1.026	2.730	5.038
32.	0.639	0.283	0.552	1.765	5.085	10.110
34.	0.789	0.392	0.842	2.928	9.074	19.326
36.	0.963	0.532	1.253	4.702	15.594	35.391
38.	1.162	0.709	1.820	7.339	25.917	62.381
40.	1.389	0.931	2.589	11.164	41.803	106.269
42.	1.645	1.205	3.613	16.595	65.637	175.574
44.	1.933	1.539	4.957	24.156	100.577	282.140
46.	2.254	1.943	6.697	34.507	150.772	442.223
48.	2.612	2.427	8.919	48.448	221.513	677.474

Table 1.5. Load Equivalence Factors for SN=4, Subgrade Modulus=15000 psi. WET FRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.002	0.000	0.000	0.000	0.000	0.000
4.	0.011	0.001	0.000	0.000	0.000	0.000
6.	0.036	0.005	0.001	0.000	0.000	0.000
8.	0.084	0.020	0.004	0.001	0.000	0.000
10.	0.165	0.059	0.018	0.006	0.002	0.001
12.	0.288	0.143	0.064	0.030	0.015	0.008
14.	0.461	0.300	0.184	0.115	0.076	0.053
16.	0.695	0.570	0.455	0.366	0.301	0.254
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.385	1.648	2.009	2.429	2.879	3.340
22.	1.860	2.583	3.751	5.364	7.391	9.778
24.	2.434	3.885	6.597	10.960	17.273	25.689
26.	3.119	5.644	11.036	20.987	37.323	61.655
28.	3.923	7.961	17.698	38.042	75.478	137.081
30.	4.858	10.950	27.370	65.793	144.219	285.459
32.	5.933	14.735	41.022	109.269	262.408	561.770
34.	7.158	19.451	59.824	175.167	457.491	1052.376
36.	8.543	25.245	85.170	272.225	768.272	1888.084
38.	10.099	32.277	118.695	411.580	1248.146	3260.451
40.	11.836	40.715	162.296	607.219	1968.779	5442.145

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.015	0.001	0.000	0.000	0.000	0.000
12.	0.027	0.002	0.001	0.000	0.000	0.000
14.	0.044	0.004	0.002	0.002	0.002	0.001
16.	0.070	0.009	0.005	0.005	0.006	0.005
18.	0.103	0.016	0.011	0.014	0.019	0.018
20.	0.148	0.028	0.023	0.035	0.053	0.058
22.	0.204	0.047	0.046	0.079	0.134	0.165
24.	0.274	0.074	0.083	0.164	0.310	0.427
26.	0.360	0.113	0.145	0.319	0.668	1.012
28.	0.464	0.166	0.241	0.588	1.351	2.233
30.	0.586	0.239	0.387	1.035	2.586	4.627
32.	0.731	0.334	0.600	1.751	4.721	9.082
34.	0.898	0.458	0.904	2.857	8.269	17.001
36.	1.091	0.616	1.327	4.518	13.961	30.523
38.	1.311	0.814	1.905	6.949	22.818	52.798
40.	1.562	1.060	2.678	10.426	36.224	88.352
42.	1.843	1.360	3.698	15.297	56.027	143.518
44.	2.159	1.725	5.022	21.994	84.631	226.934
46.	2.511	2.163	6.719	31.049	125.149	350.267
48.	2.901	2.684	8.866	43.107	181.496	528.787

Table 1.6. Load Equivalence Factors for SN=5, Subgrade Modulus=15000 psi. WET FRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.002	0.000	0.000	0.000	0.000	0.000
4.	0.012	0.001	0.000	0.000	0.000	0.000
6.	0.038	0.006	0.001	0.000	0.000	0.000
8.	0.087	0.022	0.005	0.001	0.000	0.000
10.	0.169	0.064	0.021	0.007	0.003	0.001
12.	0.292	0.151	0.070	0.033	0.017	0.009
14.	0.466	0.310	0.194	0.123	0.082	0.057
16.	0.698	0.579	0.466	0.378	0.312	0.264
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.379	1.626	1.964	2.360	2.786	3.224
22.	1.846	2.519	3.595	5.079	6.944	9.138
24.	2.409	3.749	6.210	10.137	15.790	23.291
26.	3.078	5.394	10.221	18.999	33.270	54.349
28.	3.863	7.543	16.149	33.768	65.733	117.711
30.	4.772	10.294	24.637	57.351	122.914	239.209
32.	5.816	13.751	36.467	93.662	219.192	460.130
34.	7.003	18.032	52.567	147.823	375.047	843.756
36.	8.344	23.259	74.036	226.412	618.871	1483.768
38.	9.847	29.566	102.146	337.686	989.022	2514.461
40.	11.523	37.096	138.360	491.886	1536.116	4123.246

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.008	0.000	0.000	0.000	0.000	0.000
12.	0.016	0.001	0.000	0.000	0.000	0.000
14.	0.027	0.002	0.001	0.001	0.001	0.001
16.	0.044	0.004	0.003	0.004	0.004	0.004
18.	0.067	0.009	0.007	0.010	0.015	0.015
20.	0.098	0.016	0.015	0.027	0.046	0.052
22.	0.138	0.027	0.031	0.064	0.123	0.159
24.	0.188	0.045	0.059	0.140	0.301	0.437
26.	0.251	0.070	0.107	0.286	0.684	1.099
28.	0.327	0.106	0.185	0.552	1.456	2.562
30.	0.419	0.157	0.308	1.014	2.923	5.596
32.	0.528	0.225	0.493	1.784	5.584	11.546
34.	0.656	0.316	0.767	3.022	10.207	22.665
36.	0.805	0.435	1.160	4.953	17.946	42.568
38.	0.977	0.587	1.713	7.879	30.480	76.861
40.	1.174	0.779	2.474	12.203	50.188	133.985
42.	1.397	1.018	3.502	18.454	80.368	226.287
44.	1.649	1.314	4.871	27.306	125.480	371.347
46.	1.932	1.675	6.666	39.618	191.501	593.858
48.	2.248	2.111	8.989	56.460	286.210	927.435

Table 1.7. Load Eqiuvalence Factors for SN=3, Subgrade Modulus=25000 psi. WET FRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.001	0.000	0.000	0.000	0.000	0.000
6.	0.005	0.000	0.000	0.000	0.000	0.000
8.	0.015	0.001	0.000	0.000	0.000	0.000
10.	0.033	0.005	0.001	0.000	0.000	0.000
12.	0.066	0.015	0.004	0.001	0.004	0.002
14.	0.116	0.040	0.015	0.007	0.021	0.016
16.	0.188	0.093	0.049	0.030	0.095	0.088
18.	0.289	0.193	0.137	0.109	0.361	0.391
20.	0.423	0.365	0.339	0.341	1.181	1.479
22.	0.596	0.645	0.758	0.938	3.414	4.872
24.	0.813	1.076	1.559	2.321	8.909	14.302
26.	1.081	1.713	2.992	5.263	21.320	38.077
28.	1.407	2.619	5.420	11.086	47.373	93.221
30.	1.795	3.871	9.345	21.930	98.737	212.251
32.	2.252	5.556	15.444	41.093	194.642	453.690
34.	2.786	7.777	24.599	73.469	365.422	917.503
36.	3.402	10.645	37.938	126.056	657.162	1766.932
38.	4.108	14.287	56.873	208.577	1137.440	3257.982
40.	4.909	18.844	83.132	334.178		

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.001	0.000	0.000	0.000	0.000	0.000
12.	0.002	0.000	0.000	0.000	0.000	0.000
14.	0.004	0.000	0.000	0.000	0.000	0.000
16.	0.007	0.000	0.000	0.000	0.000	0.000
18.	0.012	0.001	0.000	0.001	0.001	0.001
20.	0.019	0.002	0.001	0.002	0.002	0.002
22.	0.029	0.004	0.003	0.005	0.008	0.009
24.	0.042	0.007	0.006	0.012	0.022	0.029
26.	0.059	0.012	0.013	0.028	0.058	0.085
28.	0.081	0.019	0.025	0.061	0.140	0.227
30.	0.109	0.031	0.046	0.124	0.315	0.558
32.	0.143	0.048	0.081	0.241	0.665	1.278
34.	0.184	0.072	0.136	0.445	1.331	2.754
36.	0.233	0.104	0.221	0.788	2.540	5.627
38.	0.292	0.149	0.349	1.347	4.643	10.957
40.	0.361	0.208	0.535	2.225	8.173	20.447
42.	0.440	0.284	0.800	3.570	13.905	36.726
44.	0.532	0.383	1.171	5.577	22.941	63.728
46.	0.638	0.507	1.680	8.502	36.815	107.200
48.	0.758	0.663	2.365	12.681	57.609	175.291

Table 1.8. Load Equivalence Factors for SN=4, Subgrade Modulus=25000 psi. WET FRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.001	0.000	0.000	0.000	0.000	0.000
6.	0.006	0.000	0.000	0.000	0.000	0.000
8.	0.016	0.001	0.000	0.000	0.000	0.000
10.	0.036	0.006	0.001	0.001	0.001	0.000
12.	0.070	0.018	0.005	0.008	0.004	0.003
14.	0.122	0.046	0.018	0.034	0.024	0.018
16.	0.195	0.103	0.056	0.119	0.103	0.094
18.	0.296	0.206	0.149	0.354	0.373	0.401
20.	0.429	0.379	0.353	0.932	1.162	1.445
22.	0.600	0.652	0.760	2.213	3.215	4.546
24.	0.813	1.063	1.510	4.832	8.051	12.776
26.	1.073	1.656	2.810	9.828	18.535	32.634
28.	1.388	2.486	4.946	18.823	39.719	76.828
30.	1.761	3.614	8.308	34.231	80.022	168.580
32.	2.199	5.109	13.403	59.516	152.809	347.989
34.	2.708	7.051	20.878	99.493	278.440	680.956
36.	3.293	9.528	31.543	160.667	486.870	1271.274
38.	3.961	12.636	46.390	251.615	820.712	2276.297
40.	4.718	16.483	66.609			

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.001	0.000	0.000	0.000	0.000	0.000
12.	0.003	0.000	0.000	0.000	0.000	0.000
14.	0.005	0.000	0.000	0.000	0.000	0.000
16.	0.009	0.001	0.000	0.001	0.000	0.000
18.	0.015	0.001	0.001	0.001	0.001	0.001
20.	0.024	0.003	0.002	0.002	0.003	0.003
22.	0.036	0.005	0.004	0.006	0.009	0.010
24.	0.051	0.009	0.008	0.014	0.024	0.031
26.	0.071	0.015	0.016	0.031	0.061	0.088
28.	0.097	0.025	0.030	0.066	0.144	0.226
30.	0.129	0.039	0.054	0.132	0.314	0.540
32.	0.167	0.059	0.092	0.250	0.648	1.204
34.	0.214	0.087	0.152	0.453	1.266	2.528
36.	0.269	0.125	0.243	0.786	2.361	5.039
38.	0.335	0.176	0.376	1.317	4.224	9.583
40.	0.411	0.242	0.568	2.137	7.284	17.486
42.	0.499	0.327	0.838	3.369	12.153	30.744
44.	0.600	0.436	1.209	5.175	19.682	52.272
46.	0.715	0.572	1.710	7.767	31.033	86.239
48.	0.846	0.740	2.377	11.413	47.752	138.432

Table 1.9. Load Equivalence Factors for SN=5, Subgrade Modulus=25000 psi. WET FRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.002	0.000	0.000	0.000	0.000	0.000
6.	0.006	0.000	0.000	0.000	0.000	0.000
8.	0.018	0.002	0.000	0.000	0.000	0.000
10.	0.039	0.007	0.001	0.000	0.000	0.000
12.	0.074	0.021	0.006	0.002	0.001	0.000
14.	0.126	0.051	0.020	0.009	0.005	0.003
16.	0.201	0.111	0.062	0.038	0.027	0.020
18.	0.302	0.216	0.159	0.127	0.110	0.100
20.	0.434	0.389	0.365	0.365	0.382	0.409
22.	0.603	0.657	0.762	0.927	1.147	1.417
24.	0.812	1.053	1.476	2.133	3.065	4.296
26.	1.068	1.617	2.682	4.524	7.431	11.660
28.	1.375	2.396	4.622	8.963	16.601	28.824
30.	1.738	3.441	7.616	16.752	34.593	65.807
32.	2.163	4 812	12.071	29.785	67.906	140.309
34.	2.656	6.575	18.501	50.717	126.566	281.946
36.	3.220	8.804	27.536	83.155	225.461	537.985
38.	3.863	11.578	39.937	131.880	385.975	980.882
40.	4.589	14.985	56.607	203.079	637.856	1717.744

(b) Tandem

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.001	0.000	0.000	0.000	0.000	0.000
12.	0.001	0.000	0.000	0.000	0.000	0.000
14.	0.003	0.000	0.000	0.000	0.000	0.000
16.	0.005	0.000	0.000	0.000	0.000	0.000
18.	0.009	0.001	0.000	0.000	0.001	0.000
20.	0.014	0.001	0.001	0.001	0.002	0.002
22.	0.022	0.002	0.002	0.004	0.007	0.008
24.	0.032	0.005	0.005	0.010	0.020	0.027
26.	0.046	0.008	0.010	0.024	0.054	0.083
28.	0.063	0.014	0.020	0.054	0.136	0.228
30.	0.086	0.023	0.038	0.114	0.315	0.580
32.	0.114	0.036	0.068	0.229	0.687	1.375
34.	0.149	0.055	0.117	0.434	1.418	3.061
36.	0.190	0.082	0.195	0.791	2.785	6.452
38.	0.240	0.118	0.315	1.386	5.235	12.946
40.	0.299	0.168	0.493	2.346	9.461	24.861
42.	0.368	0.234	0.753	3.850	16.509	45.899
44.	0.448	0.320	1.123	6.146	27.903	81.770
46.	0.541	0.430	1.640	9.568	45.823	141.063
48.	0.647	0.569	2.349	14.556	73.305	236.307

Table 2.1. Load Equivalence Factors for SN=3, Subgrade Modulus=5000 psi. WET NFRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.025	0.006	0.002	0.001	0.000	0.000
4.	0.963	0.432	0.202	0.105	0.062	0.042
6.	9.085	5.746	3.481	2.229	1.556	1.199
8.	44.605	35.989	26.197	19.429	15.249	12.876
10.	151.202	146.991	123.135	102.159	87.703	79.431
12.	404.461	456.708	428.274	388.748	358.625	343.592
14.	918.685	1174.785	1209.863	1183.338	1158.766	1163.230
16.	1852.082	2633.140	2937.063	3061.039	3153.539	3293.992
18.	3410.701	5316.121	6355.059	6998.719	7534.824	8146.266
20.	5851.191	9889.902	12566.910	14528.630	16259.970	18120.830
22.	9482.848	17229.920	23118.910	27911.290	32336.520	37024.850
24.	14668.670	28445.570	40088.810	50325.770	60149.900	70568.560
26.	21826.500	44906.250	66175.000	86074.000	105830.100	126940.300
28.	31428.530	68261.000	104785.700	140796.600	177658.800	217452.500
30.	44003.250	100459.600	160130.300	221703.000	286508.300	357281.600
32.	60133.100	143773.200	237305.600	337794.500	446296.600	566232.100
34.	80454.250	200804.000	342372.500	500109.300	674491.300	869602.500
36.	105660.100	274514.100	482479.400	721981.800	992660.100	1299169.000
38.	136492.800	368228.800	665885.500	1019280.000	1426952.000	1894041.000
40.	173749.600	485651.500	902098.100	1410629.000	2008714.000	2701821.000

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	5.297	8.065	10.590	12.602	14.122	15.323
12.	15.411	25.919	36.356	45.490	53.108	59.690
14.	37.987	69.477	102.992	134.402	162.402	188.014
16.	82.736	162.638	252.801	342.026	425.685	505.516
18.	163.760	342.877	555.528	775.694	990.731	1203.083
20.	300.415	665.226	1118.132	1605.606	2098.443	2599.200
22.	518.145	1206.469	2095.835	3086.215	4117.770	5191.977
24.	849.219	2069.357	3703.850	5579.969	7586.109	9721.039
26.	1333.524	3387.243	6230.355	9584.199	13255.930	17239.250
28.	2019.097	5328.090	10049.550	15759.660	22144.870	29194.200
30.	2962.925	8099.391	15635.850	24961.000	35593.920	47520.010
32.	4231.379	11952.210	23577.660	38270.440	55325.440	74736.180
34.	5900.699	17185.090	34592.660	57028.800	83509.750	114056.300
36.	8057.313	24148.410	49540.830	82875.620	122830.500	169503.800
38.	10798.660	33248.620	69440.120	117778.800	176559.800	246034.500
40.	14233.270	44952.400	95485.000	164081.800	248641.800	349687.800
42.	18480.950	59789.660	129052.100	224530.700	343747.000	487692.800
44.	23672.900	78356.000	171721.100	302315.100	467369.600	668618.800
46.	29953.690	101321.900	225298.900	401134.200	625944.800	902592.500
48.	37478.670	129428.800	291808.600	525182.700	826838.600	1201349.000

Table 2.2 Load Equivalence Factors for SN=4, Subgrade Modulus=5000 psi. WET NFRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.025	0.007	0.002	0.001	0.000	0.000
4.	0.883	0.402	0.190	0.100	0.059	0.040
6.	7.845	4.998	3.051	1.967	1.380	1.068
8.	36.905	29.861	21.844	16.275	12.821	10.854
10.	121.086	117.631	98.799	82.199	70.732	64.163
12.	315.575	355.050	333.180	302.847	279.716	268.181
14.	701.556	891.671	917.478	897.521	879.114	882.471
16.	1388.913	1958.465	2179.609	2269.725	2337.067	2439.521
18.	2518.115	3885.554	4629.059	5089.273	5472.477	5909.344
20.	4261.426	7119.047	9006.031	10386.420	11603.280	12909.170
22.	6823.582	12236.320	16331.300	19655.730	22719.320	25958.080
24.	10442.160	19959.370	27957.330	34967.670	41678.070	48775.330
26.	15387.710	31169.150	45618.680	59088.260	72420.680	86620.430
28.	21963.200	46915.120	71481.750	95602.120	120206.400	146670.800
30.	30504.910	68426.620	108196.000	149042.700	191867.100	238448.400
32.	41380.560	97124.310	158938.900	225017.300	296063.500	374256.100
34.	54989.350	134621.600	227461.500	330342.600	443566.500	569662.500
36.	71763.430	182744.300	318149.800	473192.000	647570.400	844064.000
38.	92162.810	243527.100	436040.800	663213.300	923951.000	1221159.000
40.	116679.300	319222.200	586890.800	911667.800	1291613.000	1729562.000

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	4.652	6.681	8.369	9.601	10.479	11.185
12.	13.052	20.669	27.624	33.299	37.846	41.822
14.	31.192	53.635	75.696	95.122	111.857	127.276
16.	66.141	122.079	180.555	235.158	284.762	332.277
18.	127.868	251.113	386.952	520.027	646.136	770.804
20.	229.714	476.669	761.762	1052.692	1338.304	1628.198
22.	388.832	847.750	1399.852	1983.633	2574.407	3187.905
24.	626.546	1428.615	2430.125	3523.023	4658.855	5862.617
26.	968.759	2301.160	4022.146	5954.117	8010.469	10229.460
28.	1446.154	3566.865	6392.477	9647.363	13186.730	17069.730
30.	2094.625	5349.250	9811.809	15075.000	20912.070	27412.550
32.	2955.407	7795.750	14611.320	22827.320	32104.740	42581.190
34.	4075.275	11079.500	21190.020	33626.970	47908.810	64243.950
36.	5506.711	15401.470	30020.800	48347.650	69722.930	94467.000
38.	7308.191	20992.090	41657.620	68028.180	99236.370	135770.600
40.	9544.305	28113.700	56743.950	93893.120	138466.000	191198.000
42.	12285.610	37061.140	76015.500	127365.900	189779.800	264360.300
44.	15608.770	48163.090	100308.300	170085.600	255941.300	359504.100
46.	19597.650	61786.820	130572.300	223938.800	340165.800	481614.900
48.	24341.560	78334.680	167863.500	291051.700	446103.300	636422.100

Table 2.3. Load Equivalence Factors for SN=5, Subgrade Modulus=5000 psi. WET NFRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.024	0.006	0.002	0.001	0.000	0.000
4.	1.079	0.476	0.219	0.113	0.066	0.044
6.	11.008	6.887	4.127	2.619	1.815	1.390
8.	57.202	45.896	33.165	24.439	19.083	16.051
10.	202.540	196.665	164.031	135.515	115.940	104.740
12.	561.055	635.135	594.450	538.308	495.606	474.166
14.	1311.752	1687.017	1737.645	1698.144	1661.573	1667.240
16.	2710.048	3885.608	4342.387	4527.926	4665.902	4875.559
18.	5097.156	8031.379	9634.094	10627.150	11454.240	12397.350
20.	8907.383	15252.160	19473.550	22572.400	25310.830	28256.170
22.	14673.890	27061.090	36527.590	44253.570	51402.990	58990.170
24.	23032.850	45411.380	64449.890	81252.430	97425.250	114618.400
26.	34726.860	72753.060	108067.800	141259.600	174333.500	209782.600
28.	50606.330	112078.700	173571.800	234521.700	297173.400	365057.600
30.	71633.500	166973.700	268716.800	374322.600	485996.300	608469.000
32.	98880.560	241664.700	403005.700	577468.200	766821.500	977100.100
34.	133529.500	341043.100	587875.000	864810.300	1172691.000	1518919.000
36.	176879.800	470736.400	836944.500	1261824.000	1744878.000	2294863.000
38.	230333.300	637110.300	1166117.000	1799102.000	2533928.000	3380742.000
40.	295407.000	847327.900	1593841.000	2512919.000	3601052.000	4869749.000

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	4.211	5.779	6.980	7.787	8.329	8.778
12.	11.492	17.368	22.367	26.206	29.181	31.829
14.	26.831	43.979	59.778	72.990	84.074	94.401
16.	55.756	98.010	139.552	176.578	209.422	241.092
18.	105.902	197.915	293.525	383.198	466.287	548.727
20.	187.291	369.596	568.362	762.949	949.884	1139.880
22.	312.603	647.787	1029.160	1416.613	1800.475	2198.970
24.	497.367	1077.356	1763.071	2482.887	3215.511	3990.614
26.	760.205	1714.734	2883.238	4146.301	5463.184	6880.207
28.	1122.918	2629.009	4532.473	6645.398	8896.422	11356.730
30.	1610.728	3903.348	6887.324	10281.080	13969.100	18057.660
32.	2252.347	5636.066	10161.810	15425.950	21251.290	27795.160
34.	3080.051	7941.574	14611.350	22532.190	31446.750	41584.170
36.	4129.715	10951.520	20536.370	32142.140	45410.070	60672.510
38.	5441.051	14815.780	28285.980	44895.810	64164.590	86570.370
40.	7057.641	19703.600	38262.890	61542.700	88925.310	121090.300
42.	9026.703	25804.210	50924.710	82948.500	121110.000	166369.500
44.	11399.230	33326.870	66788.060	110104.100	162362.800	224906.300
46.	14230.820	42504.500	86437.180	144144.600	214584.000	299619.100
48.	17580.160	53590.470	110517.300	186340.600	279927.200	393846.800

Table 2.4. Load Equivalence Factors for SN=5, Subgrade Modulus=15000 psi. WET NFRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.000	0.000	0.000	0.000	0.000	0.000
8.	0.001	0.000	0.000	0.001	0.001	0.001
10.	0.005	0.003	0.002	0.010	0.008	0.007
12.	0.026	0.017	0.013	0.059	0.052	0.048
14.	0.106	0.082	0.068	0.268	0.254	0.244
16.	0.352	0.312	0.287	1.000	1.000	1.000
18.	1.000	1.000	1.000	3.184	3.337	3.462
20.	2.503	2.783	3.002	8.928	9.755	10.460
22.	5.662	6.922	7.986	22.559	25.592	28.265
24.	11.791	15.700	19.248	52.262	61.336	69.589
26.	22.918	32.982	42.724	112.522	136.215	158.377
28.	42.033	64.945	88.465	227.575	283.443	337.067
30.	73.364	121.012	172.625	436.069	557.560	676.974
32.	122.693	214.986	320.032	797.211	1044.396	1292.756
34.	197.703	366.408	567.428	1398.551	1874.133	2361.850
36.	308.360	602.152	967.496	2365.844	3238.045	4149.766
38.	467.310	958.305	1593.631	3874.383	5408.973	7041.938
40.	690.283	1482.075	2545.494			

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.000	0.000	0.000	0.000	0.000	0.000
16.	0.000	0.000	0.000	0.001	0.001	0.001
18.	0.000	0.000	0.001	0.002	0.004	0.005
20.	0.001	0.002	0.004	0.008	0.014	0.019
22.	0.002	0.004	0.012	0.025	0.043	0.062
24.	0.004	0.012	0.031	0.067	0.120	0.176
26.	0.009	0.027	0.076	0.170	0.308	0.459
28.	0.019	0.061	0.173	0.396	0.732	1.107
30.	0.038	0.127	0.371	0.867	1.627	2.494
32.	0.073	0.252	0.754	1.793	3.411	5.295
34.	0.133	0.478	1.461	3.527	6.796	10.672
36.	0.234	0.870	2.712	6.640	12.943	20.545
38.	0.397	1.526	4.845	12.021	23.683	37.967
40.	0.655	2.590	8.368	21.012	41.810	67.651
42.	1.049	4.270	14.015	35.591	71.470	116.653
44.	1.641	6.854	22.833	58.589	118.663	195.266
46.	2.508	10.738	36.278	93.995	191.905	318.203
48.	3.755	16.457	56.329	147.282	302.954	505.999

Table 2.5. Load Equivalence Factors for SN=4, Subgrade Modulus=15000 psi. WET NFRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.000	0.000	0.000	0.000	0.000	0.000
8.	0.001	0.000	0.000	0.000	0.000	0.000
10.	0.005	0.003	0.002	0.001	0.001	0.001
12.	0.028	0.019	0.014	0.011	0.009	0.008
14.	0.112	0.087	0.072	0.063	0.056	0.051
16.	0.362	0.321	0.295	0.276	0.262	0.251
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	2.443	2.713	2.924	3.100	3.247	3.367
22.	5.407	6.595	7.596	8.482	9.258	9.920
24.	11.036	14.646	17.913	20.955	23.738	26.190
26.	21.064	30.180	38.972	47.555	55.705	63.115
28.	37.989	58.379	79.217	100.456	121.325	140.829
30.	65.290	107.000	151.953	199.617	247.945	294.274
32.	107.637	187.207	277.256	376.275	479.620	581.033
34.	171.149	314.548	484.340	677.456	884.465	1092.035
36.	263.646	510.085	814.440	1171.592	1564.097	1965.670
38.	394.929	801.711	1324.180	1955.513	2665.591	3405.826
40.	577.036	1225.430	2089.375	3162.337	4395.707	5704.223

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.000	0.000	0.000	0.000	0.000	0.000
16.	0.000	0.000	0.000	0.001	0.001	0.001
18.	0.000	0.001	0.001	0.003	0.004	0.006
20.	0.001	0.002	0.005	0.009	0.015	0.021
22.	0.002	0.005	0.013	0.027	0.046	0.064
24.	0.005	0.014	0.034	0.072	0.125	0.180
26.	0.011	0.032	0.083	0.178	0.313	0.457
28.	0.023	0.069	0.185	0.406	0.726	1.074
30.	0.045	0.141	0.390	0.870	1.577	2.365
32.	0.085	0.275	0.776	1.761	3.237	4.914
34.	0.153	0.512	1.475	3.397	6.320	9.704
36.	0.265	0.916	2.689	6.278	11.809	18.321
38.	0.443	1.581	4.724	11.164	21.219	33.240
40.	0.719	2.642	8.025	19.188	36.819	58.200
42.	1.137	4.291	13.233	31.980	61.911	98.697
44.	1.753	6.788	21.238	51.840	101.191	162.607
46.	2.645	10.490	33.262	81.949	161.214	260.999
48.	3.909	15.864	50.939	126.606	250.883	409.073

Table 2.6. Load Equivalence Factors for SN=5, Subgrade Modulus=15000 psi. WET NFRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.000	0.000	0.000	0.000	0.000	0.000
8.	0.000	0.000	0.000	0.000	0.000	0.000
10.	0.004	0.002	0.001	0.001	0.001	0.001
12.	0.023	0.015	0.011	0.009	0.007	0.006
14.	0.098	0.076	0.063	0.054	0.048	0.044
16.	0.340	0.301	0.276	0.258	0.245	0.235
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	2.583	2.875	3.104	3.295	3.455	3.586
22.	6.012	7.366	8.514	9.534	10.429	11.191
24.	12.849	17.169	21.107	24.795	28.177	31.156
26.	25.577	36.985	48.085	58.996	69.399	78.858
28.	47.952	74.540	101.992	130.203	158.065	184.135
30.	85.416	141.915	203.527	269.467	336.735	401.359
32.	145.574	257.234	385.272	527.543	677.076	824.265
34.	238.742	446.711	696.551	983.990	1294.545	1607.173
36.	378.550	747.129	1209.559	1758.987	2368.106	2994.250
38.	582.605	1208.808	2026.860	3028.626	4166.098	5358.438
40.	873.170	1898.751	3290.245	5043.016	7078.656	9251.703

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.000	0.000	0.000	0.000	0.000	0.000
16.	0.000	0.000	0.000	0.001	0.001	0.002
18.	0.000	0.001	0.002	0.003	0.005	0.006
20.	0.001	0.002	0.005	0.010	0.016	0.022
22.	0.003	0.006	0.015	0.029	0.048	0.067
24.	0.006	0.016	0.038	0.077	0.129	0.182
26.	0.013	0.036	0.089	0.185	0.317	0.454
28.	0.027	0.076	0.196	0.414	0.721	1.049
30.	0.052	0.154	0.405	0.871	1.539	2.269
32.	0.096	0.295	0.794	1.737	3.107	4.635
34.	0.171	0.541	1.487	3.299	5.971	9.007
36.	0.292	0.954	2.672	6.007	10.993	16.752
38.	0.482	1.626	4.631	10.537	19.475	29.964
40.	0.774	2.684	7.768	17.874	33.345	51.761
42.	1.210	4.307	12.653	29.421	55.363	86.660
44.	1.846	6.738	20.071	47.127	89.405	141.047
46.	2.756	10.300	31.086	73.658	140.810	223.785
48.	4.034	15.416	47.102	112.569	216.742	346.891

Table 2.7. Load Equivalence Factors for SN=3, Subgrade Modulus=25000 psi. WET NFRZ Zone, based on PSI

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.000	0.000	0.000	0.000	0.000	0.000
8.	0.000	0.000	0.000	0.000	0.000	0.000
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.001	0.000	0.000	0.000	0.000	0.000
16.	0.002	0.002	0.001	0.001	0.001	0.001
18.	0.008	0.007	0.006	0.006	0.006	0.006
20.	0.026	0.024	0.024	0.025	0.026	0.026
22.	0.072	0.074	0.080	0.086	0.092	0.096
24.	0.178	0.200	0.231	0.263	0.292	0.314
26.	0.405	0.496	0.607	0.722	0.831	0.920
28.	0.856	1.132	1.462	1.815	2.158	2.453
30.	1.701	2.417	3.279	4.230	5.182	6.034
32.	3.204	4.863	6.908	9.229	11.628	13.845
34.	5.759	9.296	13.779	19.020	24.593	29.890
36.	9.936	16.988	26.199	37.279	49.380	61.176
38.	16.535	29.839	47.749	69.902	94.694	119.442
40.	26.647	50.584	83.805	125.993	174.313	223.591

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.000	0.000	0.000	0.000	0.000	0.000
16.	0.000	0.000	0.000	0.000	0.000	0.000
18.	0.000	0.000	0.000	0.000	0.000	0.000
20.	0.000	0.000	0.000	0.000	0.000	0.000
22.	0.000	0.000	0.000	0.000	0.000	0.000
24.	0.000	0.000	0.000	0.000	0.000	0.001
26.	0.000	0.000	0.000	0.001	0.001	0.002
28.	0.000	0.000	0.001	0.002	0.004	0.006
30.	0.000	0.001	0.002	0.005	0.010	0.016
32.	0.000	0.001	0.004	0.011	0.024	0.039
34.	0.001	0.003	0.010	0.026	0.054	0.089
36.	0.001	0.006	0.020	0.055	0.116	0.193
38.	0.003	0.011	0.040	0.111	0.238	0.399
40.	0.005	0.021	0.076	0.215	0.467	0.792
42.	0.009	0.038	0.141	0.403	0.884	1.513
44.	0.015	0.067	0.252	0.730	1.616	2.788
46.	0.025	0.114	0.439	1.282	2.862	4.977
48.	0.040	0.191	0.742	2.190	4.926	8.628

Table 2.8. Load Equivalence Factors for SN=4. Subgrade Modulus=25000 psi. WET NFRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.000	0.000	0.000	0.000	0.000	0.000
8.	0.000	0.000	0.000	0.000	0.000	0.000
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.001	0.000	0.000	0.000	0.000	0.000
14.	0.003	0.002	0.002	0.002	0.001	0.001
16.	0.010	0.008	0.007	0.007	0.007	0.007
18.	0.029	0.027	0.027	0.028	0.028	0.028
20.	0.078	0.080	0.086	0.093	0.099	0.104
22.	0.189	0.212	0.244	0.277	0.307	0.330
24.	0.421	0.514	0.627	0.745	0.855	0.945
26.	0.874	1.150	1.480	1.832	2.172	2.466
28.	1.704	2.408	3.254	4.183	5.112	5.941
30.	3.154	4.760	6.730	8.957	11.252	13.369
32.	5.578	8.948	13.194	18.136	23.372	28.338
34.	9.480	16.095	24.679	34.954	46.132	57.006
36.	15.552	27.849	44.289	64.511	87.048	109.492
38.	24.727	46.546	76.601	114.541	157.805	201.808
40.						

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.000	0.000	0.000	0.000	0.000	0.000
16.	0.000	0.000	0.000	0.000	0.000	0.000
18.	0.000	0.000	0.000	0.000	0.000	0.000
20.	0.000	0.000	0.000	0.000	0.000	0.000
22.	0.000	0.000	0.000	0.000	0.000	0.000
24.	0.000	0.000	0.000	0.000	0.000	0.000
26.	0.000	0.000	0.000	0.000	0.000	0.000
28.	0.000	0.000	0.000	0.000	0.000	0.000
30.	0.000	0.001	0.001	0.000	0.001	0.000
32.	0.001	0.002	0.002	0.001	0.002	0.001
34.	0.002	0.003	0.005	0.002	0.004	0.002
36.	0.003	0.007	0.011	0.006	0.011	0.007
38.	0.006	0.013	0.023	0.013	0.026	0.018
40.	0.011	0.025	0.045	0.029	0.059	0.042
42.	0.018	0.044	0.085	0.060	0.124	0.094
44.	0.030	0.076	0.154	0.120	0.249	0.201
46.	0.049	0.129	0.272	0.229	0.480	0.408
48.		0.212	0.466	0.422	0.893	0.796
			0.777	0.751	1.604	1.492
				1.298	2.794	2.702
				2.183	4.732	4.743
						8.091

Table 2.9. Load Equivalence Factors for SN=5, Subgrade Modulus=25000 psi. WET NFRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.000	0.000	0.000	0.000	0.000	0.000
8.	0.000	0.000	0.000	0.000	0.000	0.000
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.000	0.001	0.001	0.001	0.001	0.001
16.	0.002	0.006	0.006	0.005	0.005	0.005
18.	0.007	0.021	0.021	0.022	0.023	0.023
20.	0.023	0.067	0.072	0.078	0.084	0.088
22.	0.065	0.186	0.216	0.246	0.274	0.295
24.	0.165	0.474	0.582	0.695	0.802	0.890
26.	0.385	1.110	1.440	1.795	2.140	2.438
28.	0.835	2.427	3.311	4.289	5.273	6.155
30.	1.698	4.997	7.141	9.587	12.125	14.474
32.	3.269	9.762	14.565	20.213	26.245	31.989
34.	6.001	18.210	28.283	40.482	53.866	66.946
36.	10.560	32.612	52.591	77.479	105.474	133.497
38.	17.905	56.315	94.074	142.394	198.044	254.969
40.	29.367					

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.000	0.000	0.000	0.000	0.000	0.000
16.	0.000	0.000	0.000	0.000	0.000	0.000
18.	0.000	0.000	0.000	0.000	0.000	0.000
20.	0.000	0.000	0.000	0.000	0.000	0.000
22.	0.000	0.000	0.000	0.000	0.001	0.001
24.	0.000	0.000	0.000	0.000	0.002	0.003
26.	0.000	0.000	0.000	0.001	0.005	0.008
28.	0.000	0.000	0.001	0.003	0.012	0.019
30.	0.000	0.001	0.003	0.006	0.029	0.045
32.	0.001	0.002	0.006	0.015	0.063	0.099
34.	0.001	0.004	0.013	0.032	0.130	0.208
36.	0.002	0.008	0.026	0.065	0.258	0.416
38.	0.004	0.015	0.050	0.128	0.491	0.799
40.	0.008	0.028	0.092	0.240	0.899	1.476
42.	0.013	0.050	0.166	0.437	1.594	2.637
44.	0.022	0.085	0.289	0.768	2.741	4.567
46.	0.035	0.142	0.490	1.311	4.585	7.692
48.	0.056	0.231	0.806	2.178		

Table 3.1. Load Equivalence Factors for SN=3, Subgrade Modulus=5000 psi. DRY FRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.040	0.013	0.004	0.001	0.000	0.000
4.	0.236	0.140	0.085	0.039	0.010	0.002
6.	0.752	0.662	0.646	0.498	0.242	0.071
8.	1.783	2.091	2.872	3.252	2.431	1.149
10.	3.544	5.200	9.324	14.261	14.903	10.207
12.	6.268	11.050	24.634	48.157	66.105	61.114
14.	10.205	21.007	56.273	135.258	233.450	277.202
16.	15.619	36.754	115.375	331.360	696.238	1023.892
18.	22.784	60.309	217.598	730.586	1823.092	3229.354
20.	31.987	94.033	384.061	1481.547	4305.879	8987.828
22.	43.526	140.635	642.237	2806.936	9353.137	22603.000
24.	57.708	203.184	1026.916	5026.488	18955.570	52269.990
26.	74.846	285.122	1581.308	8584.738	36243.990	112673.300
28.	95.267	390.255	2357.777	14080.850	65941.000	228748.600
30.	119.302	522.774	3419.224	22304.100	114952.600	441074.500
32.	147.287	687.237	4839.566	34272.810	193055.000	813194.000
34.	179.573	888.619	6705.613	51276.510	313807.300	1441545.000
36.	216.509	1132.244	9117.027	74920.500	495494.500	2467903.000
38.	258.458	1423.898	12188.610	107185.900	762540.500	4096572.000
40.	305.782	1769.669	16049.890	150466.500	1146587.000	6613910.000

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.536	0.889	2.395	5.569	7.105	4.317
12.	0.910	1.767	5.613	15.449	23.569	17.396
14.	1.438	3.197	11.693	37.194	66.144	57.662
16.	2.151	5.384	22.271	80.404	163.479	164.782
18.	3.083	8.567	39.540	159.718	365.678	419.123
20.	4.267	13.027	66.336	296.405	754.875	970.661
22.	5.739	19.080	106.220	520.081	1458.691	2081.122
24.	7.536	27.083	163.585	870.821	2667.295	4183.430
26.	9.695	37.432	243.722	1401.265	4653.961	7962.012
28.	12.254	50.562	352.928	2179.038	7799.906	14457.520
30.	15.254	66.953	498.577	3289.492	12623.400	25204.510
32.	18.735	87.121	689.270	4838.578	19814.120	42400.840
34.	22.739	111.626	934.780	6955.180	30270.970	69111.500
36.	27.306	141.075	1246.379	9796.152	45148.870	109543.000
38.	32.482	176.106	1636.611	13546.680	65902.680	169319.500
40.	38.308	217.415	2119.785	18428.520	94356.870	255905.900
42.	44.830	265.726	2711.599	24697.400	132740.200	378915.200
44.	52.092	321.813	3429.568	32652.730	183792.000	550776.300
46.	60.141	386.502	4293.180	42642.240	250807.500	787186.100
48.	69.023	460.651	5323.461	55058.780	337725.100	1107741.000

Table 3.2. Load Equivalence Factors for SN=4, Subgrade Modulus=5000 psi. DRY FRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.041	0.014	0.004	0.001	0.000	0.000
4.	0.234	0.134	0.080	0.038	0.011	0.002
6.	0.733	0.597	0.543	0.417	0.218	0.072
8.	1.714	1.802	2.218	2.412	1.876	0.975
10.	3.370	4.325	6.746	9.618	10.174	7.451
12.	5.911	8.934	16.905	30.055	40.782	39.364
14.	9.557	16.585	36.941	79.069	132.159	160.429
16.	14.540	28.435	72.907	183.078	365.842	539.796
18.	21.101	45.842	133.000	384.158	897.094	1567.642
20.	29.491	70.370	227.915	745.472	1998.248	4052.210
22.	39.968	103.788	371.168	1357.552	4117.211	9531.996
24.	52.797	148.073	579.437	2345.276	7952.809	20740.710
26.	68.252	205.419	872.956	3876.097	14551.190	42277.480
28.	86.612	278.225	1275.737	6168.402	25421.190	81513.370
30.	108.163	369.109	1816.057	9501.352	42679.330	149823.100
32.	133.193	480.895	2526.568	14225.030	69209.250	264158.200
34.	162.002	616.638	3444.983	20771.590	108870.900	449093.600
36.	194.891	779.582	4613.945	29666.220	166698.300	739238.500
38.	232.166	973.232	6081.824	41542.350	249213.400	1182510.000
40.	274.139	1201.248	7902.535	57149.650	364614.300	1843558.000

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.524	0.754	1.698	3.634	4.790	3.210
12.	0.882	1.464	3.837	9.622	15.054	12.185
14.	1.384	2.597	7.747	22.256	40.305	38.305
16.	2.058	4.298	14.361	46.448	95.548	104.382
18.	2.934	6.738	24.892	89.425	205.885	254.303
20.	4.043	10.110	40.873	161.348	410.855	566.208
22.	5.415	14.630	64.187	275.956	769.731	1170.754
24.	7.083	20.541	97.116	451.366	1367.991	2275.778
26.	9.081	28.108	142.355	710.802	2324.819	4198.129
28.	11.442	37.619	203.066	1083.451	3801.967	7403.754
30.	14.202	49.391	282.895	1605.410	6013.750	12558.530
32.	17.395	63.761	386.036	2320.642	9238.648	20588.770
34.	21.059	81.093	517.197	3281.684	13831.420	32750.900
36.	25.230	101.777	681.741	4551.457	20238.660	50725.870
38.	29.945	126.222	885.576	6203.063	29011.800	76706.310
40.	35.242	154.871	1135.358	8322.781	40829.340	113536.100
42.	41.161	188.183	1438.341	11008.780	56505.730	164796.600
44.	47.739	226.645	1802.515	14374.440	77025.310	235025.900
46.	55.018	270.774	2236.718	18549.830	103553.400	329840.000
48.	63.037	321.106	2750.381	23680.040	137461.500	456112.600

Table 3.3. Load Equivalence Factors for SN=5, Subgrade Modulus=5000 psi. DRY FRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.042	0.014	0.005	0.001	0.000	0.000
4.	0.233	0.131	0.077	0.038	0.012	0.003
6.	0.721	0.559	0.483	0.368	0.202	0.074
8.	1.672	1.637	1.865	1.953	1.548	0.858
10.	3.266	3.843	5.432	7.290	7.671	5.845
12.	5.698	7.795	13.143	21.583	28.566	28.090
14.	9.173	14.253	27.887	54.269	86.994	105.661
16.	13.904	24.123	53.669	120.861	228.260	331.699
18.	20.114	38.455	95.775	245.116	534.038	906.345
20.	28.032	58.447	160.962	461.505	1140.908	2219.089
22.	37.896	85.440	257.603	817.961	2264.166	4971.238
24.	49.947	120.924	395.863	1378.838	4227.168	10348.210
26.	64.435	166.536	587.884	2228.379	7497.633	20256.170
28.	81.615	224.060	847.886	3473.997	12729.260	37626.470
30.	101.747	295.427	1192.400	5250.281	20813.230	66814.310
32.	125.092	382.709	1640.300	7722.887	32931.740	114087.400
34.	151.923	488.137	2213.139	11092.780	50628.690	188241.100
36.	182.512	614.072	2935.075	15600.310	75872.310	301295.100
38.	217.139	763.048	3833.240	21530.920	111158.800	469427.800
40.	256.082	937.706	4937.609	29217.730	159561.900	713891.400

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.516	0.676	1.333	2.625	3.457	2.462
12.	0.865	1.293	2.936	6.716	10.413	8.885
14.	1.351	2.264	5.803	15.085	26.873	26.731
16.	2.002	3.707	10.557	30.686	61.682	70.060
18.	2.845	5.754	18.000	57.752	129.144	164.819
20.	3.908	8.559	29.124	102.099	251.124	355.530
22.	5.221	12.290	45.133	171.429	459.527	714.167
24.	6.813	17.133	67.466	275.714	799.259	1351.786
26.	8.715	23.292	97.804	427.516	1331.554	2433.033
28.	10.960	30.988	138.096	642.385	2137.825	4193.820
30.	13.578	40.460	190.570	939.280	3323.953	6963.363
32.	16.603	51.964	257.763	1340.983	5025.066	11189.490
34.	20.068	65.773	342.501	1874.387	7410.582	17467.220
36.	24.007	82.179	447.977	2571.328	10690.470	26577.160
38.	28.454	101.486	577.682	3468.401	15120.290	39518.800
40.	33.443	124.025	735.525	4608.348	21010.180	57566.610
42.	39.012	150.135	925.732	6039.375	28728.110	82299.120
44.	45.194	180.174	1152.937	7816.559	38712.710	115685.600
46.	52.027	214.525	1422.229	10002.680	51477.910	160128.100
48.	59.546	253.578	1739.018	12667.070	67621.180	218525.000

Table 3.4. Load Equivalence Factors for SN=3, Subgrade Modulus=15000 psi. DRY FRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.003	0.000	0.000	0.000	0.000	0.000
6.	0.013	0.001	0.000	0.000	0.000	0.000
8.	0.042	0.005	0.000	0.000	0.000	0.000
10.	0.100	0.023	0.004	0.001	0.000	0.000
12.	0.205	0.077	0.023	0.007	0.003	0.001
14.	0.376	0.207	0.100	0.049	0.026	0.014
16.	0.633	0.481	0.344	0.247	0.182	0.139
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.504	1.906	2.553	3.421	4.467	5.672
22.	2.172	3.391	5.878	10.212	16.918	26.568
24.	3.034	5.702	12.439	27.278	55.976	106.353
26.	4.123	9.148	24.545	66.438	165.502	373.465
28.	5.472	14.108	45.663	149.708	445.021	1174.028
30.	7.117	21.037	80.802	315.708	1103.555	3357.709
32.	9.094	30.469	136.943	628.860	2551.870	8850.945
34.	11.442	43.027	223.551	1191.897	5552.863	21730.850
36.	14.201	59.424	353.134	2162.844	11454.760	50126.660
38.	17.413	80.473	541.889	3776.822	22544.260	109435.000
40.	21.121	107.085	810.367	6373.633	42545.860	227490.800

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.006	0.001	0.000	0.000	0.000	0.000
12.	0.013	0.002	0.001	0.000	0.000	0.000
14.	0.025	0.005	0.002	0.001	0.001	0.000
16.	0.042	0.013	0.007	0.005	0.004	0.002
18.	0.067	0.027	0.018	0.016	0.015	0.010
20.	0.102	0.052	0.043	0.048	0.050	0.038
22.	0.149	0.094	0.095	0.125	0.149	0.128
24.	0.210	0.161	0.196	0.301	0.407	0.393
26.	0.288	0.263	0.379	0.672	1.023	1.100
28.	0.386	0.413	0.696	1.407	2.394	2.847
30.	0.507	0.626	1.220	2.790	5.268	6.886
32.	0.654	0.923	2.056	5.275	10.984	15.691
34.	0.829	1.326	3.347	9.564	21.838	33.919
36.	1.037	1.863	5.282	16.709	41.625	69.971
38.	1.282	2.563	8.112	28.241	76.402	138.406
40.	1.565	3.463	12.156	46.339	135.569	263.650
42.	1.893	4.605	17.820	74.028	233.298	485.312
44.	2.268	6.034	25.607	115.434	390.512	866.093
46.	2.695	7.801	36.139	176.090	637.346	1502.507
48.	3.178	9.965	50.169	263.290	1016.514	2540.055

Table 3.5. Load Equivalence Factors for SN=4, Subgrade Modulus=15000 psi. DRY FRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.004	0.000	0.000	0.000	0.000	0.000
6.	0.016	0.001	0.000	0.000	0.000	0.000
8.	0.048	0.008	0.001	0.000	0.000	0.000
10.	0.111	0.032	0.007	0.001	0.000	0.000
12.	0.219	0.096	0.034	0.012	0.004	0.002
14.	0.391	0.237	0.126	0.066	0.036	0.020
16.	0.644	0.511	0.383	0.283	0.213	0.164
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.481	1.809	2.327	3.027	3.884	4.873
22.	2.111	3.074	4.937	8.105	12.968	19.870
24.	2.915	4.963	9.714	19.627	38.253	70.027
26.	3.921	7.681	17.954	43.737	101.828	218.672
28.	5.157	11.469	31.484	90.882	248.616	616.695
30.	6.651	16.608	52.790	177.924	563.949	1594.648
32.	8.436	23.423	85.162	330.935	1200.658	3826.834
34.	10.542	32.280	132.851	588.686	2419.269	8606.727
36.	13.003	43.592	201.236	1007.108	4644.922	18287.410
38.	15.854	57.822	297.002	1664.591	8547.211	36959.810
40.	19.128	75.478	428.323	2668.335	15143.460	71447.810

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.008	0.001	0.000	0.000	0.000	0.000
12.	0.017	0.003	0.001	0.000	0.000	0.000
14.	0.030	0.008	0.003	0.002	0.001	0.001
16.	0.049	0.018	0.010	0.007	0.005	0.003
18.	0.077	0.036	0.024	0.021	0.018	0.011
20.	0.115	0.066	0.054	0.057	0.056	0.042
22.	0.165	0.115	0.113	0.139	0.159	0.136
24.	0.229	0.188	0.220	0.316	0.412	0.397
26.	0.311	0.296	0.404	0.668	0.984	1.062
28.	0.411	0.450	0.708	1.328	2.192	2.626
30.	0.533	0.661	1.187	2.510	4.604	6.077
32.	0.680	0.947	1.920	4.536	9.179	13.263
34.	0.855	1.324	3.007	7.879	17.485	27.494
36.	1.060	1.814	4.578	13.218	31.987	54.456
38.	1.298	2.440	6.797	21.497	56.446	103.547
40.	1.574	3.226	9.865	34.006	96.446	189.839
42.	1.890	4.204	14.032	52.468	160.057	336.718
44.	2.250	5.405	19.597	79.143	258.727	579.680
46.	2.657	6.864	26.919	116.962	408.320	971.193
48.	3.115	8.622	36.422	169.656	630.509	1587.281

Table 3.6. Load Equivalence Factors for SN=5, Subgrade Modulus=15000 psi. DRY FRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.004	0.000	0.000	0.000	0.000	0.000
6.	0.019	0.002	0.000	0.000	0.000	0.000
8.	0.052	0.011	0.002	0.000	0.000	0.000
10.	0.118	0.040	0.010	0.002	0.001	0.000
12.	0.228	0.111	0.044	0.017	0.006	0.003
14.	0.401	0.258	0.148	0.081	0.046	0.027
16.	0.651	0.532	0.411	0.313	0.240	0.187
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.467	1.749	2.186	2.776	3.500	4.331
22.	2.074	2.885	4.391	6.883	10.643	15.876
24.	2.843	4.540	8.229	15.561	28.862	50.805
26.	3.800	6.866	14.562	32.594	71.184	145.278
28.	4.969	10.042	24.552	64.026	162.100	377.935
30.	6.376	14.273	39.725	119.073	344.914	907.231
32.	8.050	19.790	62.031	211.274	692.264	2032.460
34.	10.017	26.853	93.913	359.832	1320.724	4288.367
36.	12.308	35.749	138.378	591.286	2410.225	8585.824
38.	14.952	46.798	199.069	941.369	4229.930	16414.630
40.	17.980	60.345	280.335	1457.175	7169.574	30121.610

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.010	0.002	0.000	0.000	0.000	0.000
12.	0.019	0.005	0.002	0.001	0.000	0.000
14.	0.034	0.011	0.005	0.003	0.001	0.001
16.	0.055	0.023	0.013	0.009	0.006	0.003
18.	0.085	0.044	0.030	0.025	0.021	0.013
20.	0.124	0.078	0.064	0.065	0.062	0.046
22.	0.176	0.131	0.128	0.152	0.169	0.144
24.	0.243	0.209	0.239	0.328	0.416	0.401
26.	0.325	0.321	0.424	0.664	0.951	1.027
28.	0.427	0.476	0.716	1.270	2.032	2.435
30.	0.550	0.686	1.164	2.311	4.103	5.412
32.	0.697	0.963	1.828	4.033	7.881	11.366
34.	0.871	1.323	2.786	6.779	14.492	22.710
36.	1.074	1.783	4.135	11.027	25.639	43.421
38.	1.309	2.361	5.994	17.420	43.827	79.822
40.	1.579	3.079	8.507	26.809	72.647	141.677
42.	1.888	3.959	11.847	40.300	117.128	243.605
44.	2.238	5.026	16.219	59.303	184.177	407.053
46.	2.633	6.309	21.863	85.604	283.095	662.695
48.	3.075	7.837	29.057	121.420	426.232	1053.625

Table 3.7. Load Equivalence Factors for SN=3, Subgrade Modulus=25000 psi. DRY FRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.002	0.000	0.000	0.000	0.000	0.000
8.	0.008	0.000	0.000	0.000	0.000	0.000
10.	0.023	0.002	0.000	0.000	0.000	0.000
12.	0.054	0.011	0.002	0.000	0.001	0.001
14.	0.107	0.037	0.010	0.003	0.013	0.009
16.	0.193	0.104	0.049	0.024	0.113	0.100
18.	0.322	0.251	0.183	0.138	0.718	0.836
20.	0.506	0.541	0.581	0.636	3.686	5.468
22.	0.760	1.065	1.604	2.447	15.843	29.215
24.	1.098	1.953	3.961	8.117	58.802	131.912
26.	1.537	3.374	8.925	23.840	192.932	516.857
28.	2.094	5.549	18.633	63.246	570.136	1795.011
30.	2.787	8.754	36.470	153.946	1539.944	5619.496
32.	3.637	13.325	67.555	348.083	3848.387	16080.140
34.	4.663	19.666	119.328	738.470	8985.066	42531.680
36.	5.889	28.255	202.233	1482.048	19766.440	104996.400
38.	7.336	39.647	330.550	2833.146	41245.390	243805.800
40.	9.029	54.479	523.244	5187.672		

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.001	0.000	0.000	0.000	0.000	0.000
12.	0.002	0.000	0.000	0.000	0.000	0.000
14.	0.004	0.000	0.000	0.000	0.000	0.000
16.	0.008	0.001	0.000	0.000	0.000	0.000
18.	0.014	0.003	0.001	0.001	0.001	0.000
20.	0.024	0.007	0.004	0.003	0.002	0.002
22.	0.036	0.014	0.009	0.009	0.010	0.008
24.	0.054	0.028	0.023	0.028	0.033	0.029
26.	0.078	0.050	0.053	0.075	0.100	0.100
28.	0.108	0.087	0.111	0.185	0.280	0.313
30.	0.147	0.143	0.220	0.426	0.727	0.900
32.	0.195	0.227	0.415	0.924	1.765	2.406
34.	0.255	0.348	0.748	1.901	4.037	6.026
36.	0.327	0.518	1.296	3.729	8.758	14.251
38.	0.414	0.753	2.165	7.011	18.120	32.002
40.	0.516	1.069	3.506	12.692	35.930	68.602
42.	0.637	1.488	5.521	22.207	68.556	140.970
44.	0.777	2.032	8.474	37.678	126.342	278.812
46.	0.939	2.731	12.712	62.172	225.571	532.499
48.	1.125	3.615	18.677	100.021	391.292	985.073

Table 3.8. Load Equivalence Factors for SN=4, Subgrade Modulus 25000 psi. DRY FRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.003	0.000	0.000	0.000	0.000	0.000
8.	0.011	0.001	0.000	0.000	0.000	0.000
10.	0.028	0.004	0.000	0.000	0.000	0.000
12.	0.060	0.016	0.003	0.001	0.000	0.000
14.	0.115	0.048	0.016	0.005	0.002	0.001
16.	0.202	0.122	0.063	0.033	0.019	0.013
18.	0.328	0.269	0.206	0.160	0.132	0.116
20.	0.505	0.538	0.576	0.627	0.700	0.805
22.	0.745	0.995	1.422	2.081	3.046	4.412
24.	1.060	1.726	3.181	6.056	11.269	20.037
26.	1.463	2.842	6.565	15.807	36.469	77.874
28.	1.969	4.476	12.666	37.679	105.535	265.637
30.	2.593	6.794	23.088	83.185	277.837	811.351
32.	3.350	9.987	40.090	171.998	674.504	2254.418
34.	4.259	14.282	66.755	336.083	1526.957	5772.898
36.	5.336	19.937	107.173	625.144	3252.241	13765.980
38.	6.599	27.247	166.648	1113.776	6567.527	30843.110
40.	8.069	36.543	251.903	1910.094	12650.370	65397.100

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.) 1	2	3	4	5	6
10.	0.001	0.000	0.000	0.000	0.000	0.000
12.	0.003	0.000	0.000	0.000	0.000	0.000
14.	0.006	0.001	0.000	0.000	0.000	0.000
16.	0.011	0.002	0.001	0.000	0.000	0.000
18.	0.018	0.005	0.002	0.001	0.001	0.000
20.	0.028	0.010	0.005	0.004	0.003	0.002
22.	0.042	0.020	0.013	0.012	0.012	0.009
24.	0.062	0.036	0.030	0.034	0.037	0.032
26.	0.087	0.062	0.064	0.084	0.107	0.106
28.	0.118	0.102	0.126	0.194	0.282	0.314
30.	0.158	0.161	0.235	0.421	0.692	0.856
32.	0.207	0.246	0.419	0.862	1.589	2.171
34.	0.267	0.363	0.716	1.675	3.442	5.168
36.	0.338	0.523	1.181	3.114	7.085	11.621
38.	0.423	0.736	1.885	5.565	13.936	24.843
40.	0.523	1.015	2.924	9.598	26.317	50.754
42.	0.638	1.374	4.421	16.038	47.907	99.512
44.	0.772	1.829	6.532	26.041	84.373	188.022
46.	0.925	2.400	9.451	41.205	144.199	343.481
48.	1.100	3.106	13.418	63.686	239.814	608.516

Table 3.9. Load Equivalence Factors for SN=5, Subgrade Modulus=25000 psi. DRY FRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.001	0.000	0.000	0.000	0.000	0.000
6.	0.004	0.000	0.000	0.000	0.000	0.000
8.	0.012	0.001	0.000	0.000	0.000	0.000
10.	0.031	0.006	0.001	0.000	0.000	0.000
12.	0.065	0.021	0.005	0.001	0.000	0.000
14.	0.121	0.057	0.022	0.008	0.003	0.002
16.	0.207	0.135	0.076	0.042	0.025	0.017
18.	0.332	0.281	0.224	0.178	0.148	0.131
20.	0.505	0.537	0.572	0.620	0.687	0.781
22.	0.736	0.953	1.311	1.855	2.643	3.736
24.	1.037	1.595	2.745	4.925	8.754	14.992
26.	1.419	2.545	5.344	11.839	25.642	52.055
28.	1.895	3.900	9.785	26.201	67.774	160.185
30.	2.478	5.775	17.016	54.081	164.254	445.145
32.	3.183	8.303	28.313	105.166	369.617	1133.809
34.	4.025	11.637	45.350	194.263	780.272	2679.101
36.	5.017	15.950	70.265	343.138	1557.977	5929.996
38.	6.178	21.437	105.747	582.834	2963.270	12397.420
40.	7.523	28.312	155.096	956.263	5398.594	24643.750

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.002	0.000	0.000	0.000	0.000	0.000
12.	0.004	0.000	0.000	0.000	0.000	0.000
14.	0.007	0.001	0.000	0.000	0.000	0.000
16.	0.013	0.003	0.001	0.000	0.000	0.000
18.	0.020	0.007	0.003	0.002	0.001	0.001
20.	0.032	0.013	0.007	0.005	0.004	0.003
22.	0.047	0.025	0.017	0.015	0.014	0.010
24.	0.067	0.043	0.037	0.039	0.042	0.036
26.	0.093	0.072	0.073	0.092	0.113	0.111
28.	0.125	0.114	0.138	0.203	0.285	0.314
30.	0.166	0.175	0.246	0.418	0.663	0.815
32.	0.215	0.259	0.421	0.816	1.452	1.973
34.	0.275	0.374	0.694	1.518	3.005	4.485
36.	0.346	0.526	1.105	2.708	5.923	9.649
38.	0.429	0.725	1.708	4.655	11.177	19.766
40.	0.526	0.980	2.570	7.740	20.291	38.755
42.	0.639	1.303	3.777	12.492	35.574	73.040
44.	0.769	1.707	5.433	19.630	60.439	132.853
46.	0.917	2.204	7.665	30.109	99.805	233.975
48.	1.085	2.811	10.628	45.179	160.611	400.164

Table 4.1. Load Equivalence Factors for SN=3, Subgrade Modulus=5000 psi. DRY NFRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.096	0.057	0.036	0.024	0.018	0.014
6.	4.044	2.467	1.643	1.166	0.875	0.692
8.	56.811	35.554	24.561	18.014	13.862	11.135
10.	428.190	273.425	194.328	146.187	114.619	93.036
12.	2167.703	1407.745	1024.119	786.419	625.793	511.944
14.	8339.738	5495.684	4078.441	3186.309	2566.818	2112.891
16.	26270.190	17539.610	13244.060	10503.080	8550.207	7073.668
18.	71122.620	48053.130	36847.960	29609.950	24325.620	20211.000
20.	171041.600	116832.200	90847.120	73869.620	61179.580	51019.390
22.	374116.200	258141.800	203295.000	167083.000	139393.700	116623.600
24.	757213.600	527469.500	420292.200	348835.500	292965.100	245821.900
26.	1436820.000	1009876.000	813457.000	681306.400	575701.200	484316.600
28.	2581863.000	1830121.000	1489215.000	1257842.000	1068894.000	901376.300
30.	4429148.000	3164818.000	2599914.000	2213360.000	1890780.000	1598019.000
32.	7299323.000	5255983.000	4356796.000	3736538.000	3207769.000	2716681.000
34.	11616370.000	8426124.000	7044337.000	6083810.000	5247152.000	4452414.000
36.	17928800.000	13097110.000	11037920.000	9596148.000	8312776.000	7066608.000
38.	26930640.000	19806760.000	16821770.000	14716710.000	12801700.000	10901140.000
40.	39488620.000	29233230.000	25011000.000	22012480.000	19223980.000	16396690.000

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	3.787	5.130	6.166	6.710	6.732	6.312
12.	15.144	20.567	24.890	27.295	27.585	26.035
14.	49.263	66.960	81.451	89.859	91.345	86.653
16.	137.126	186.382	227.634	252.373	257.775	245.549
18.	338.062	459.222	562.734	626.522	642.529	614.164
20.	756.340	1026.501	1261.426	1409.581	1450.674	1390.719
22.	1563.045	2119.163	2610.671	2926.775	3021.502	2903.997
24.	3024.111	4095.645	5056.742	5685.867	5886.465	5670.047
26.	5534.602	7487.504	9263.239	10444.170	10840.280	10462.780
28.	9659.023	13053.260	16180.020	18288.170	19027.250	18397.510
30.	16180.730	21845.270	27125.780	30733.620	32045.090	31036.190
32.	26153.940	35276.760	43878.440	49825.910	52060.520	50496.820
34.	40969.490	55211.900	68788.060	78278.500	81947.680	79598.370
36.	62420.010	84053.750	104884.700	119601.600	125438.300	122002.000
38.	92778.680	124843.100	156023.300	178266.300	187295.400	182386.100
40.	134884.000	181383.500	227028.800	259888.400	273511.700	266650.200
42.	192220.100	258335.900	323822.500	371373.500	391474.100	382065.400
44.	269019.600	361367.500	453623.400	521165.300	550229.600	537569.700
46.	370394.800	497320.600	625169.300	719498.700	760772.000	744009.800
48.	502364.300	674270.300	848781.100	978518.000	1036166.000	1014296.000

Table 4.2. Load Equivalence Factors for SN=4, Subgrade Modulus=5000 psi. DRY NFRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.095	0.056	0.036	0.024	0.017	0.014
6.	3.839	2.346	1.565	1.112	0.836	0.663
8.	52.273	32.766	22.671	16.656	12.839	10.333
10.	384.467	245.951	175.099	131.945	103.634	84.273
12.	1908.083	1241.732	904.999	696.169	554.965	454.834
14.	7220.227	4769.168	3546.252	2775.660	2240.104	1847.402
16.	22424.210	15011.130	11358.800	9025.465	7361.273	6101.723
18.	59968.760	40634.500	31229.670	25146.400	20699.320	17231.990
20.	142668.300	97757.810	76197.810	62090.440	51528.750	43058.710
22.	309068.500	213980.800	168945.900	139162.600	116345.900	97544.560
24.	620178.300	433573.800	346399.700	288175.800	242550.500	203958.800
26.	1167633.000	823823.100	665452.100	558693.400	473162.200	398937.500
28.	2083271.000	1482660.000	1210007.000	1024576.000	872705.600	737613.700
30.	3550538.000	2547759.000	2099368.000	1791873.000	1534412.000	1299864.000
32.	5816234.000	4206593.000	3497948.000	3007987.000	2588713.000	2197668.000
34.	9204699.000	6707532.000	5625885.000	4872163.000	4212803.000	3583544.000
36.	14133220.000	10373680.000	8772134.000	7647956.000	6642395.000	5660849.000
38.	21126890.000	15615040.000	13307720.000	11676260.000	10184020.000	8694436.000
40.	30838680.000	22946080.000	19701740.000	17391520.000	15229870.000	13024180.000

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	3.676	4.917	5.851	6.322	6.314	5.909
12.	14.547	19.497	23.353	25.420	25.570	24.085
14.	46.879	62.861	75.670	82.851	83.821	79.351
16.	129.404	173.468	209.636	230.656	234.465	222.875
18.	316.620	424.107	514.214	568.156	579.880	553.104
20.	703.496	941.392	1144.607	1269.354	1300.118	1243.727
22.	1444.675	1931.090	2353.866	2618.988	2690.905	2580.758
24.	2778.855	3710.400	4532.902	5058.672	5212.461	5010.203
26.	5058.340	6746.738	8259.484	9243.152	9548.891	9197.035
28.	8783.637	11703.290	14355.720	16106.610	16679.970	16094.460
30.	14645.440	19495.230	23957.620	26945.770	27967.000	27031.010
32.	23568.410	31345.560	38588.750	43502.480	45247.970	43800.100
34.	36766.980	48860.110	60254.970	68077.370	70949.680	68778.810
36.	55799.350	74100.430	91531.560	103635.500	108213.000	105042.600
38.	82633.120	109664.100	135682 000	153938.800	161030.500	156507.300
40.	119715.700	158789.300	196777.500	223695.800	234409.000	228095.500
42.	170039.600	225429.100	279795.800	318679.200	334502.100	325853.700
44.	237227.800	314373.700	390788.300	445925.100	468821.400	457197.000
46.	325643.000	431390.600	537057.800	613939.300	646471.700	631092.600
48.	440402.000	583265.600	727199.600	832784.500	878243.600	858195.100

Table 4.3. Load Equivalence Factors for SN=5, Subgrade Modulus=5000 psi. DRY NFRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.095	0.056	0.035	0.024	0.017	0.014
6.	3.688	2.256	1.507	1.072	0.807	0.641
8.	49.014	30.763	21.313	15.679	12.103	9.755
10.	353.767	226.654	161.583	121.927	95.900	78.097
12.	1729.120	1127.213	822.759	633.809	505.976	415.292
14.	6460.191	4275.516	3184.290	2496.063	2017.436	1666.258
16.	19847.070	13314.890	10092.680	8032.031	6561.047	5446.738
18.	52579.260	35712.420	27497.530	22177.750	18284.620	15245.790
20.	124057.100	85224.930	66559.180	54329.940	45162.830	37800.530
22.	266780.000	185215.400	146536.300	120921.100	101268.200	85045.870
24.	531793.800	372882.200	298557.300	248841.700	209814.800	176736.600
26.	995259.100	704399.000	570279.800	479725.000	407026.200	343785.900
28.	1766075.000	1261046.000	1031585.000	875264.100	746928.000	632462.500
30.	2994954.000	2156486.000	1781332.000	1523597.000	1307212.000	1109472.000
32.	4883611.000	3544751.000	2955105.000	2546661.000	2196054.000	1867908.000
34.	7695920.000	5628965.000	4733666.000	4108576.000	3559825.000	3034058.000
36.	11769830.000	8672352.000	7353385.000	6425627.000	5592466.000	4775675.000
38.	17529280.000	13007650.000	11116570.000	9776562.000	8545375.000	7310498.000
40.	25499040.000	19050940.000	16404310.000	14515360.000	12738980.000	10916930.000

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.) 1	2	3	4	5	6
10.	3.591	4.757	5.617	6.034	6.006	5.613
12.	14.093	18.697	22.218	24.046	24.102	22.668
14.	45.086	59.827	71.440	77.769	78.395	74.102
16.	123.643	163.990	196.582	215.041	217.799	206.713
18.	300.746	398.531	479.296	526.509	535.428	509.908
20.	664.651	879.831	1061.110	1169.973	1194.011	1140.438
22.	1358.217	1795.923	2171.458	2402.194	2459.339	2355.005
24.	2600.749	3435.122	4162.926	4619.387	4742.953	4551.879
26.	4714.355	6220.211	7554.176	8406.215	8653.848	8322.266
28.	8154.543	10748.420	13080.070	14593.510	15060.660	14510.100
30.	13547.170	17840.580	21751.950	24329.910	25165.680	24287.320
32.	21727.100	28589.330	34921.510	39153.210	40586.580	39230.560
34.	33786.300	44424.450	54361.990	61087.490	63452.820	61422.980
36.	51121.580	67175.500	82342.930	92733.500	96511.180	93551.870
38.	75490.750	99140.680	121732.300	137382.500	143245.300	139029.900
40.	109073.800	143176.500	176097.400	199141.600	208011.400	202135.000
42.	154528.500	202761.000	249789.800	283034.600	296151.500	288111.800
44.	215064.400	282097.500	348085.100	395171.000	414170.200	403375.300
46.	294536.800	386236.100	477336.500	542917.800	569934.900	555667.200
48.	397454.500	521101.800	645005.100	734975.100	772754.800	754173.500

Table 4.4. Load Equivalence Factors forSn=3, Subgrade Modulus=15000 psi. DRY NFRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.000	0.000	0.000	0.000	0.000	0.000
8.	0.000	0.000	0.000	0.000	0.000	0.000
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.004	0.004	0.004	0.004	0.004	0.004
14.	0.035	0.035	0.034	0.033	0.033	0.033
16.	0.211	0.211	0.208	0.206	0.205	0.205
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	3.925	3.935	3.970	4.001	4.020	4.024
22.	13.258	13.315	13.533	13.733	13.855	13.870
24.	39.583	39.816	40.740	41.589	42.099	42.143
26.	106.663	107.430	110.583	113.487	115.215	115.296
28.	263.561	265.759	275.060	283.638	288.684	288.751
30.	604.927	610.576	635.115	657.795	670.973	670.754
32.	1302.646	1316.119	1375.429	1430.225	1461.799	1460.380
34.	2653.525	2683.414	2816.677	2939.808	3010.079	3005.045
36.	5148.672	5211.559	5492.707	5752.797	5899.902	5885.879
38.	9568.953	9694.598	10257.510	10778.230	11070.710	11036.070
40.	17116.320	17356.990	18433.040	19428.550	19983.670	19906.510

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.000	0.000	0.000	0.000	0.001	0.001
16.	0.000	0.001	0.001	0.002	0.002	0.003
18.	0.001	0.002	0.004	0.006	0.009	0.010
20.	0.003	0.007	0.013	0.021	0.028	0.033
22.	0.008	0.019	0.037	0.060	0.082	0.096
24.	0.021	0.051	0.098	0.158	0.215	0.254
26.	0.051	0.122	0.237	0.383	0.525	0.621
28.	0.114	0.275	0.536	0.868	1.193	1.415
30.	0.241	0.585	1.142	1.854	2.553	3.031
32.	0.486	1.181	2.312	3.758	5.182	6.160
34.	0.937	2.281	4.470	7.274	10.041	11.948
36.	1.738	4.231	8.300	13.519	18.675	22.235
38.	3.112	7.574	14.866	24.225	33.482	39.882
40.	5.398	13.130	25.776	42.018	58.091	69.214
42.	9.099	22.110	43.401	70.758	97.839	116.585
44.	14.942	36.263	71.161	116.010	160.413	191.157
46.	23.963	58.066	113.894	185.639	256.672	305.849
48	37.602	90.957	178.295	290.533	401.636	478.521

Table 4.5. Load Equivalence Factors for SN=4, Subgrade Modulus=15000 psi. DRY NFRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.000	0.000	0.000	0.000	0.000	0.000
8.	0.000	0.000	0.000	0.000	0.000	0.000
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.005	0.004	0.004	0.004	0.004	0.004
14.	0.036	0.036	0.035	0.035	0.034	0.034
16.	0.215	0.214	0.212	0.210	0.209	0.209
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	3.865	3.875	3.908	3.939	3.957	3.960
22.	12.873	12.927	13.137	13.330	13.446	13.459
24.	37.946	38.164	39.045	39.853	40.336	40.372
26.	101.056	101.774	104.749	107.486	109.105	109.165
28.	247.011	249.066	257.762	265.768	270.458	270.478
30.	561.272	566.539	589.291	610.275	622.425	622.135
32.	1197.375	1209.933	1264.486	1314.785	1343.676	1342.214
34.	2417.877	2445.714	2567.361	2679.554	2743.433	2738.623
36.	4653.230	4711.691	4966.582	5201.934	5334.836	5321.898
38.	8581.973	8698.688	9205.707	9673.855	9936.578	9905.383
40.	15240.230	15463.390	16426.750	17316.320	17812.340	17744.070

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.) 1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.000	0.000	0.000	0.000	0.001	0.001
16.	0.000	0.001	0.001	0.002	0.002	0.003
18.	0.001	0.002	0.004	0.007	0.009	0.010
20.	0.003	0.007	0.013	0.021	0.028	0.033
22.	0.008	0.020	0.038	0.061	0.082	0.097
24.	0.022	0.052	0.099	0.159	0.216	0.255
26.	0.052	0.124	0.239	0.383	0.523	0.618
28.	0.116	0.278	0.537	0.864	1.182	1.399
30.	0.244	0.588	1.139	1.836	2.516	2.980
32.	0.491	1.182	2.294	3.702	5.080	6.023
34.	0.943	2.273	4.415	7.132	9.795	11.622
36.	1.743	4.200	8.162	13.194	18.130	21.524
38.	3.110	7.488	14.555	23.538	32.355	38.424
40.	5.376	12.931	25.134	40.651	55.891	66.387
42.	9.032	21.694	42.154	68.175	93.738	111.347
44.	14.784	35.451	68.852	111.334	153.069	181.822
46.	23.635	56.567	109.792	177.483	243.976	289.772
48.	36.972	88.308	171.264	276.754	380.353	451.663

Table 4.6. Load Equivalence Factors for SN=5, Subgrade Modulus=15000 psi. DRY NFRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.000	0.000	0.000	0.000	0.000	0.000
8.	0.000	0.000	0.000	0.000	0.000	0.000
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.005	0.005	0.005	0.004	0.004	0.004
14.	0.037	0.037	0.036	0.036	0.035	0.035
16.	0.218	0.217	0.215	0.213	0.212	0.211
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	3.819	3.828	3.861	3.891	3.910	3.912
22.	12.583	12.635	12.839	13.026	13.139	13.151
24.	36.724	36.934	37.784	38.563	39.027	39.058
26.	96.918	97.606	100.455	103.072	104.616	104.664
28.	234.920	236.885	245.154	252.756	257.198	257.195
30.	529.670	534.708	556.196	575.988	587.425	587.113
32.	1121.838	1133.826	1185.043	1232.190	1259.240	1257.812
34.	2250.150	2276.700	2390.246	2494.818	2554.322	2549.788
36.	4303.242	4358.957	4595.609	4813.785	4936.973	4925.070
38.	7889.715	8000.746	8469.145	8901.004	9143.445	9115.141
40.	13933.140	14145.160	15030.920	15847.680	16303.510	16242.340

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.) 1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.000	0.000	0.000	0.000	0.001	0.001
16.	0.000	0.001	0.001	0.002	0.002	0.003
18.	0.001	0.002	0.004	0.007	0.009	0.010
20.	0.003	0.007	0.014	0.021	0.029	0.034
22.	0.009	0.020	0.039	0.061	0.083	0.097
24.	0.022	0.053	0.100	0.160	0.217	0.255
26.	0.053	0.125	0.240	0.384	0.522	0.615
28.	0.117	0.280	0.538	0.861	1.174	1.386
30.	0.247	0.591	1.136	1.822	2.487	2.940
32.	0.495	1.183	2.280	3.659	5.002	5.918
34.	0.948	2.267	4.372	7.023	9.606	11.374
36.	1.747	4.176	8.055	12.944	17.714	20.983
38.	3.109	7.421	14.316	23.012	31.500	37.323
40.	5.360	12.777	24.641	39.611	54.227	64.260
42.	8.980	21.371	41.199	66.217	90.651	107.422
44.	14.661	34.824	67.092	107.805	147.565	174.855
46.	23.378	55.414	106.678	171.349	234.497	277.821
48.	36.480	86.278	165.944	266.431	364.520	431.771

Table 4.7. Load Equivalence Facotrs for SN=3, Subgrade Modulus=25000 psi. DRY NFRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.000	0.000	0.000	0.000	0.000	0.000
8.	0.000	0.000	0.000	0.000	0.000	0.000
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.000	0.000	0.000	0.000	0.000	0.000
16.	0.000	0.000	0.000	0.000	0.000	0.000
18.	0.002	0.002	0.002	0.002	0.003	0.003
20.	0.008	0.009	0.011	0.012	0.013	0.014
22.	0.033	0.040	0.045	0.051	0.056	0.061
24.	0.123	0.146	0.168	0.189	0.209	0.228
26.	0.399	0.474	0.548	0.619	0.686	0.747
28.	1.171	1.390	1.611	1.827	2.028	2.205
30.	3.143	3.726	4.334	4.931	5.480	5.946
32.	7.818	9.255	10.798	12.318	13.702	14.842
34.	18.196	21.508	25.163	28.773	32.026	34.628
36.	39.947	47.149	55.297	63.367	70.562	76.152
38.	83.289	98.157	115.383	132.478	147.569	158.967
40.	165.853	195.178	229.915	264.447	294.635	316.795

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.000	0.000	0.000	0.000	0.000	0.000
16.	0.000	0.000	0.000	0.000	0.000	0.000
18.	0.000	0.000	0.000	0.000	0.000	0.000
20.	0.000	0.000	0.000	0.000	0.000	0.000
22.	0.000	0.000	0.000	0.000	0.000	0.001
24.	0.000	0.000	0.000	0.000	0.001	0.002
26.	0.000	0.000	0.000	0.001	0.003	0.004
28.	0.000	0.001	0.001	0.002	0.008	0.010
30.	0.000	0.001	0.003	0.005	0.018	0.023
32.	0.001	0.003	0.006	0.012	0.039	0.050
34.	0.002	0.006	0.013	0.025	0.079	0.102
36.	0.004	0.012	0.027	0.051	0.155	0.201
38.	0.008	0.023	0.053	0.100	0.292	0.380
40.	0.015	0.043	0.101	0.189	0.534	0.694
42.	0.027	0.079	0.183	0.344	0.946	1.231
44.	0.047	0.139	0.324	0.609	1.630	2.123
46.	0.080	0.239	0.557	1.049	2.738	3.566
48.	0.134	0.400	0.935	1.762		

Table 4.8. Load Equivalence Factors for SN=4, Subgrade Modulus=25000 psi. DRY NFRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.000	0.000	0.000	0.000	0.000	0.000
8.	0.000	0.000	0.000	0.000	0.000	0.000
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.000	0.000	0.000	0.000	0.000	0.000
16.	0.000	0.000	0.000	0.000	0.000	0.000
18.	0.002	0.002	0.002	0.002	0.003	0.003
20.	0.008	0.010	0.011	0.013	0.014	0.015
22.	0.035	0.042	0.047	0.053	0.059	0.064
24.	0.126	0.150	0.173	0.194	0.215	0.234
26.	0.406	0.482	0.556	0.628	0.696	0.757
28.	1.175	1.395	1.616	1.831	2.032	2.207
30.	3.120	3.697	4.297	4.886	5.426	5.884
32.	7.680	9.086	10.594	12.076	13.423	14.528
34.	17.698	20.906	24.442	27.929	31.062	33.557
36.	38.492	45.402	53.212	60.934	67.798	73.108
38.	79.546	93.690	110.059	126.273	140.546	151.275
40.	157.079	184.747	217.490	249.977	278.297	298.982

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.000	0.000	0.000	0.000	0.000	0.000
16.	0.000	0.000	0.000	0.000	0.000	0.000
18.	0.000	0.000	0.000	0.000	0.000	0.000
20.	0.000	0.000	0.000	0.000	0.000	0.000
22.	0.000	0.000	0.000	0.000	0.000	0.001
24.	0.000	0.000	0.000	0.001	0.001	0.002
26.	0.000	0.000	0.001	0.002	0.003	0.004
28.	0.000	0.001	0.003	0.005	0.008	0.011
30.	0.000	0.001	0.007	0.012	0.019	0.024
32.	0.001	0.003	0.014	0.026	0.039	0.051
34.	0.002	0.006	0.028	0.052	0.080	0.104
36.	0.004	0.012	0.055	0.102	0.157	0.203
38.	0.008	0.024	0.103	0.191	0.295	0.383
40.	0.015	0.045	0.186	0.348	0.538	0.698
42.	0.027	0.081	0.328	0.614	0.949	1.232
44.	0.048	0.142	0.563	1.053	1.629	2.115
46.	0.082	0.243	0.941	1.762	2.726	3.541
48.	0.137	0.406				

Table 4.9. Load Equivalence Factors for SN=5, Subgrade Modulus=25000 psi. DRY NFRZ Zone, based on PSI.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.000	0.000	0.000	0.000	0.000	0.000
8.	0.000	0.000	0.000	0.000	0.000	0.000
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.000	0.000	0.000	0.000	0.000	0.000
16.	0.000	0.000	0.000	0.000	0.000	0.000
18.	0.002	0.002	0.002	0.003	0.003	0.003
20.	0.009	0.010	0.012	0.013	0.014	0.016
22.	0.036	0.043	0.049	0.055	0.061	0.066
24.	0.129	0.154	0.177	0.198	0.219	0.239
26.	0.411	0.488	0.563	0.635	0.704	0.765
28.	1.179	1.398	1.619	1.835	2.034	2.208
30.	3.103	3.675	4.270	4.852	5.385	5.835
32.	7.575	8.957	10.439	11.893	13.212	14.290
34.	17.321	20.451	23.899	27.293	30.337	32.754
36.	37.400	44.095	51.655	59.118	65.740	70.844
38.	76.763	90.374	106.114	121.682	135.358	145.601
40.	150.604	177.066	208.354	239.354	266.321	285.945

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.000	0.000	0.000	0.000	0.000	0.000
16.	0.000	0.000	0.000	0.000	0.000	0.000
18.	0.000	0.000	0.000	0.000	0.000	0.000
20.	0.000	0.000	0.000	0.000	0.000	0.000
22.	0.000	0.000	0.000	0.000	0.001	0.001
24.	0.000	0.000	0.000	0.000	0.001	0.002
26.	0.000	0.000	0.001	0.001	0.004	0.005
28.	0.000	0.001	0.001	0.002	0.008	0.011
30.	0.000	0.001	0.003	0.006	0.019	0.024
32.	0.001	0.003	0.007	0.012	0.040	0.052
34.	0.002	0.006	0.014	0.026	0.082	0.105
36.	0.004	0.013	0.029	0.053	0.159	0.205
38.	0.008	0.024	0.056	0.103	0.298	0.386
40.	0.016	0.046	0.104	0.194	0.541	0.700
42.	0.028	0.082	0.189	0.351	0.951	1.232
44.	0.049	0.144	0.332	0.618	1.628	2.110
46.	0.084	0.247	0.568	1.057	2.716	3.521
48.	0.140	0.411	0.947	1.763		

APPENDIX 3

Tables of Load Equivalence Factors Based on Rutting

Table 5.1. Load Equivalence Factors for SN=3, Subgrade Modulus=5000 psi. WET FRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.003	0.000	0.000	0.000	0.000	0.000
4.	0.065	0.004	0.000	0.000	0.000	0.000
6.	0.470	0.105	0.020	0.003	0.000	0.000
8.	1.950	0.949	0.475	0.247	0.129	0.065
10.	5.899	5.038	5.125	6.100	8.144	11.446
12.	14.561	19.175	33.590	75.432	205.302	628.146
14.	31.209	58.196	157.476	586.910	2816.089	15974.050
16.	60.306	150.008	581.137	3286.658	25122.200	236265.900
18.	107.655	341.927	1793.735	14418.020	163056.000	2343678.000
20.	180.533	708.148	4822.480	52423.860	829397.100	17134120.000
22.	287.848	1358.528	11619.910	164347.300	3482160.000	98561340.000
24.	440.208	2448.109	25615.770	457020.300	12526120.000	467630800.000
26.	650.164	4188.434	52471.970	1151673.000	39693040.000	1895133000.000
28.	932.145	6858.652	101063.900	2672568.000	113156400.000	6736056000.000
30.	1302.747	10818.370	184716.500	5783424.000	295000300.000	14345100000.000
32.	1780.685	16521.390	322763.900	11789920.000	712605900.000	62064690000.000
34.	2387.097	24528.940	542348.500	22819770.000	1611384000.000	**********
36.	3145.149	35526.570	880662.500	42219040.000	3440192000.000	**********
38.	4081.308	50343.180	1387571.000	75067160.000	6983774000.000	**********
40.	5223.773	69951.180	2128337.000	128840900.000	13557530000.000	**********

(b) Tandem Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.671	0.389	0.332	0.414	0.686	1.273
12.	1.563	1.364	1.913	4.213	13.123	48.659
14.	3.216	3.915	8.228	28.749	149.326	967.858
16.	6.030	9.703	28.591	146.772	1166.562	12016.440
18.	10.519	21.490	84.484	601.737	6864.824	104713.700
20.	17.326	43.563	219.899	2079.517	32417.620	693624.500
22.	27.230	82.211	516.941	6269.082	128461.600	3694407.000
24.	41.158	146.268	1118.038	16906.800	441415.300	16487800.000
26.	60.198	247.720	2256.121	41574.470	1348063.000	63591820.000
28.	85.610	402.385	4294.012	94599.680	3729078.000	217038000.000
30.	118.831	630.583	7774.395	201465.600	9484237.000	667793600.000
32.	161.470	957.896	13479.920	405288.000	22437790.000	1879818000.000
34.	215.347	1416.034	22509.480	775929.600	49859320.000	4899184000.000
36.	282.507	2043.635	36367.260	1422546.000	104889000.000	11938340000.000
38.	365.167	2887.438	57063.610	2510003.000	210258000.000	27420210000.000
40.	465.775	4002.323	87231.810	4280515.000	403773100.000	59762750000.000
42.	587.030	5453.191	130266.000	7080587.000	746299600.000	**********
44.	731.890	7316.750	190501.100	11397620.000	1332902000.000	**********
46.	903.442	9679.645	273318.800	17897560.000	2308072000.000	**********
48.	1105.195	12643.030	385411.200	27483230.000	3886060000.000	**********

Table 5.2. Load Equivalence Factors for SN=4, Subgrade Modulus=5000 psi. WET FRZ Zone, based on Rutting

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.005	0.000	0.000	0.000	0.000	0.000
4.	0.086	0.010	0.001	0.000	0.000	0.000
6.	0.537	0.155	0.040	0.010	0.002	0.000
8.	2.033	1.059	0.571	0.320	0.183	0.104
10.	5.765	4.615	4.213	4.332	4.872	5.738
12.	13.561	15.154	20.771	34.044	64.184	132.162
14.	27.990	40.963	77.870	185.472	528.314	1697.013
16.	52.460	96.135	239.688	777.558	3111.939	14402.140
18.	91.312	202.708	636.200	2680.410	14293.360	89938.680
20.	149.890	393.013	1504.964	7942.516	54201.250	443815.500
22.	234.642	712.348	3247.636	20871.690	176627.100	1818746.000
24.	353.148	1221.665	6502.293	49748.440	509160.600	6415762.000
26.	514.292	2000.857	12234.670	109408.000	1326756.000	20010890.000
28.	728.177	3151.630	21847.210	224880.100	3176912.000	56317000.000
30.	1006.341	4800.922	37307.580	436375.800	7080588.000	145283500.000
32.	1361.691	7104.543	61305.170	806034.000	14841810.000	347918000.000
34.	1808.722	10250.370	97413.250	1426159.000	29494650.000	781211600.000
36.	2363.197	14462.850	150296.200	2430443.000	55948090.000	1658338000.000
38.	3043.089	20008.150	225937.300	4007013.000	101874500.000	3351062000.000
40.	3867.398	27191.750	331846.500	6413989.000	178869500.000	6481702000.000

(b) Tandem Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.683	0.382	0.287	0.288	0.361	0.504
12.	1.515	1.161	1.265	1.929	3.829	8.791
14.	3.000	2.973	4.391	9.419	27.155	93.262
16.	5.450	6.711	12.798	36.517	143.709	689.986
18.	9.261	13.744	32.620	118.771	609.338	3888.971
20.	14.916	26.057	74.821	336.660	2173.233	17737.580
22.	22.992	46.403	157.617	854.493	6748.766	68321.810
24.	34.167	78.465	309.595	1981.140	18717.320	229331.200
26.	49.228	127.032	573.603	4260.145	47261.190	686879.500
28.	69.077	198.201	1011.438	8597.059	110266.800	1869342.000
30.	94.732	299.541	1709.413	16430.300	240515.300	4689281.000
32.	127.325	440.313	2784.539	29960.180	494961.700	10966530.000
34.	168.130	631.693	4392.328	52439.950	968410.100	24130750.000
36.	218.565	886.981	6735.305	88548.370	1812656.000	50343080.000
38.	280.161	1221.938	10071.910	144831.900	3262713.000	100204300.000
40.	354.595	1654.645	14726.600	230261.800	5671352.000	191292100.000
42.	443.714	2206.136	21101.690	356864.600	9555686.000	351784400.000
44.	549.532	2900.928	29694.280	540607.400	15655700.000	625661900.000
46.	674.131	3766.126	41098.650	802073.300	25008590.000	1079579000.000
48.	819.885	4833.066	56033.320	1167837.000	39038970.000	1812335000.000

Table 5.3. Load Equivalence Factors for SN=5, Subgrade Modulus=5000 psi. WET FRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.006	0.000	0.000	0.000	0.000	0.000
4.	0.100	0.016	0.002	0.000	0.000	0.000
6.	0.579	0.193	0.060	0.018	0.005	0.001
8.	2.081	1.126	0.632	0.370	0.222	0.134
10.	5.692	4.396	3.778	3.580	3.660	3.907
12.	13.035	13.293	15.895	21.862	33.597	55.490
14.	26.344	33.689	52.613	97.668	208.109	487.037
16.	48.544	75.042	146.390	348.507	972.897	3033.887
18.	83.315	151.517	357.254	1050.510	3686.072	14642.380
20.	135.144	283.168	786.985	2777.673	11869.420	58056.300
22.	209.407	497.282	1597.151	6616.336	33590.380	196981.600
24.	312.376	829.643	3030.889	14473.300	85599.750	589175.200
26.	451.365	1326.178	5439.457	29506.740	200036.600	1588372.000
28.	634.645	2044.228	9312.445	56687.080	434659.600	3925302.000
30.	871.622	3054.169	15312.140	103522.500	887792.100	9009785.000
32.	1172.779	4441.121	24315.400	181001.100	1719612.000	19411740.000
34.	1549.845	6306.328	37453.210	304642.500	3180237.000	39586970.000
36.	2015.525	8769.328	56164.210	495960.100	5648290.000	76946940.000
38.	2584.291	11970.440	82250.500	783997.300	9680687.000	143384800.000
40.	3271.374	16068.750	117924.000	1207135.000	16072850.000	257336400.000

(b) Tandem Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.689	0.378	0.264	0.235	0.253	0.301
12.	1.489	1.061	1.004	1.248	1.929	3.391
14.	2.885	2.551	3.096	5.061	10.513	25.351
16.	5.152	5.466	8.181	16.833	44.791	140.591
18.	8.627	10.716	19.205	48.127	158.238	621.730
20.	13.722	19.574	41.055	122.166	482.718	2303.777
22.	20.925	33.750	81.362	281.750	1308.784	7408.734
24.	30.803	55.475	151.471	600.515	3221.681	21221.220
26.	44.012	87.587	267.609	1198.394	7317.395	55213.760
28.	61.298	133.627	452.230	2262.027	15528.410	132469.900
30.	83.502	197.915	735.570	4070.239	31094.900	296590.200
32.	111.551	285.652	1157.265	7026.941	59211.750	625602.900
34.	146.487	403.031	1768.489	11700.510	107924.600	1252790.000
36.	189.467	557.327	2634.135	18872.740	189293.800	2397147.000
38.	241.734	757.068	3834.958	29593.040	320897.300	4405797.000
40.	304.645	1011.912	5470.055	45246.550	527693.200	7812627.000
42.	379.691	1333.001	7659.813	67626.310	844453.600	13415670.000
44.	468.497	1733.232	10550.390	99041.000	1318635.000	22383760.000
46.	572.735	2226.687	14312.990	142372.100	2013894.000	36383900.000
48.	694.311	2829.565	19151.410	201247.300	3014096.000	57752480.000

Table 5.4. Load Equivalence Factors for SN=3, Subgrade Modulus=15000 psi
WET FRZ Zone, based on Rutting

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.002	0.000	0.000	0.000	0.000	0.000
8.	0.011	0.002	0.000	0.000	0.000	0.000
10.	0.037	0.010	0.002	0.000	0.000	0.000
12.	0.103	0.043	0.015	0.004	0.001	0.000
14.	0.244	0.143	0.074	0.035	0.015	0.006
16.	0.516	0.403	0.298	0.210	0.143	0.094
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.807	2.241	2.918	3.952	5.538	7.991
22.	3.087	4.632	7.613	13.481	25.434	50.688
24.	5.033	8.954	18.127	40.774	100.303	266.432
26.	7.887	16.370	39.994	111.609	348.593	1198.827
28.	11.953	28.545	82.735	280.812	1089.205	4733.531
30.	17.599	47.796	161.976	657.515	3108.550	16723.720
32.	25.265	77.250	302.337	1447.063	8205.258	53698.440
34.	35.478	121.064	541.335	3016.858	20235.520	158658.500
36.	48.845	184.627	934.381	5998.215	47016.780	435863.800
38.	66.086	274.845	1561.306	11435.390	103645.100	1122999.000
40.	88.018	400.361	2534.340	20999.330	218014.300	2732597.000

(b) Tandem Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.002	0.000	0.000	0.000	0.000	0.000
12.	0.006	0.001	0.000	0.000	0.000	0.000
14.	0.014	0.004	0.001	0.000	0.000	0.000
16.	0.028	0.010	0.004	0.001	0.001	0.000
18.	0.054	0.024	0.012	0.007	0.004	0.003
20.	0.095	0.054	0.035	0.027	0.023	0.020
22.	0.161	0.112	0.092	0.092	0.106	0.128
24.	0.260	0.216	0.220	0.278	0.419	0.677
26.	0.404	0.394	0.486	0.766	1.465	3.069
28.	0.609	0.688	1.011	1.943	4.614	12.252
30.	0.891	1.153	1.992	4.588	13.302	43.843
32.	1.275	1.867	3.744	10.192	35.507	142.798
34.	1.783	2.933	6.750	21.460	88.616	428.411
36.	2.449	4.486	11.738	43.108	208.493	1195.770
38.	3.305	6.699	19.761	83.039	465.464	3130.678
40.	4.394	9.791	32.320	154.104	991.790	7743.320
42.	5.760	14.034	51.498	276.509	2026.396	18197.100
44.	7.457	19.766	80.152	481.366	3986.677	40844.770
46.	9.544	27.401	122.118	815.297	7580.324	87949.180
48.	12.088	37.435	182.471	1346.899	13971.500	182348.500

Table 5.5. Load Equivalence Factors for SN=4, Subgrade Modulus=15000 psi. WET FRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.003	0.000	0.000	0.000	0.000	0.000
8.	0.013	0.003	0.001	0.000	0.000	0.000
10.	0.043	0.016	0.005	0.001	0.000	0.001
12.	0.113	0.057	0.025	0.010	0.004	0.016
14.	0.258	0.170	0.104	0.059	0.032	0.148
16.	0.530	0.437	0.347	0.268	0.202	1.000
18.	1.000	1.000	1.000	1.000	1.000	5.365
20.	1.767	2.093	2.559	3.209	4.112	24.001
22.	2.961	4.076	5.954	9.122	14.546	92.569
24.	4.744	7.475	12.807	23.471	45.514	315.696
26.	7.322	13.037	25.801	55.592	128.582	970.599
28.	10.943	21.787	49.175	122.754	333.247	2731.597
30.	15.912	35.102	89.369	255.276	802.407	7123.402
32.	22.583	54.773	155.845	504.059	1813.063	17382.230
34.	31.380	83.110	262.135	951.130	3875.678	40014.870
36.	42.788	123.024	427.094	1724.647	7890.645	87496.250
38.	57.374	178.152	676.468	3018.624	15387.460	182733.000
40.	75.783	252.927	1044.699	5119.109	28873.910	

(b) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	0.003	0.001	0.000	0.000	0.000	0.000
12.	0.007	0.002	0.000	0.000	0.000	0.000
14.	0.016	0.006	0.002	0.001	0.000	0.000
16.	0.032	0.014	0.006	0.003	0.002	0.001
18.	0.059	0.031	0.018	0.011	0.008	0.005
20.	0.102	0.064	0.045	0.036	0.031	0.028
22.	0.169	0.124	0.103	0.100	0.109	0.124
24.	0.268	0.225	0.221	0.256	0.338	0.474
26.	0.409	0.391	0.444	0.605	0.951	1.612
28.	0.606	0.651	0.846	1.335	2.465	4.963
30.	0.876	1.045	1.537	2.780	5.946	14.017
32.	1.235	1.628	2.683	5.502	13.480	36.745
34.	1.708	2.466	4.519	10.416	28.940	90.240
36.	2.319	3.648	7.378	18.959	59.227	209.256
38.	3.098	5.281	11.715	33.323	116.144	461.113
40.	4.078	7.498	18.143	56.774	219.269	971.045
42.	5.298	10.461	27.469	94.036	400.015	1962.924
44.	6.801	14.365	40.752	151.854	707.546	3824.750
46.	8.635	19.443	59.349	239.633	1217.062	7208.488
48.	10.855	25.973	84.985	370.308	2040.713	13179.420

Table 5.6. Load Equivalence for SN=5, Subgrade Modulus=15000 psi. WET FRZ Zone, based on Rutting

(a) Single Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.003	0.001	0.000	0.000	0.000	0.000
8.	0.015	0.005	0.001	0.000	0.000	0.000
10.	0.046	0.020	0.007	0.003	0.001	0.000
12.	0.119	0.067	0.034	0.016	0.007	0.003
14.	0.266	0.187	0.125	0.079	0.049	0.029
16.	0.537	0.456	0.378	0.306	0.244	0.192
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.746	2.015	2.379	2.858	3.483	4.298
22.	2.893	3.796	5.192	7.339	10.657	15.830
24.	4.590	6.760	10.554	17.258	29.315	51.386
26.	7.024	11.484	20.214	37.713	73.797	150.187
28.	10.418	18.745	36.809	77.439	172.353	401.710
30.	15.043	29.559	64.181	150.749	377.529	996.090
32.	21.215	45.230	107.763	280.219	782.316	2313.485
34.	29.307	67.407	175.062	500.202	1544.364	5074.934
36.	39.747	98.139	276.209	861.657	2921.292	10587.720
38.	53.032	139.946	424.642	1438.055	5320.918	21130.080
40.	69.724	195.865	637.857	2333.006	9369.453	40530.370

(b) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	0.003	0.001	0.000	0.000	0.000	0.000
12.	0.008	0.003	0.001	0.000	0.000	0.000
14.	0.018	0.007	0.003	0.001	0.001	0.000
16.	0.034	0.017	0.008	0.005	0.003	0.002
18.	0.062	0.036	0.022	0.015	0.011	0.008
20.	0.107	0.071	0.051	0.041	0.037	0.033
22.	0.174	0.131	0.110	0.105	0.110	0.121
24.	0.272	0.231	0.222	0.244	0.299	0.388
26.	0.412	0.389	0.423	0.530	0.748	1.126
28.	0.605	0.631	0.766	1.084	1.738	3.001
30.	0.867	0.990	1.330	2.104	3.798	7.429
32.	1.214	1.508	2.228	3.904	7.862	17.257
34.	1.667	2.239	3.614	6.965	15.522	37.912
36.	2.250	3.251	5.698	12.001	29.392	79.293
38.	2.988	4.626	8.756	20.044	53.624	158.739
40.	3.912	6.463	13.155	32.562	94.640	305.649
42.	5.057	8.882	19.359	51.584	162.100	568.164
44.	6.461	12.026	27.964	79.888	270.230	1023.232
46.	8.168	16.063	39.715	121.198	439.607	1790.636
48.	10.225	21.190	55.538	180.455	699.296	3052.460

Table 5.7. Load Equivalence Factors for SN=3, Subgrade Modulus=25000 psi. WET FRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.000	0.000	0.000	0.000	0.000	0.000
8.	0.001	0.000	0.000	0.000	0.000	0.000
10.	0.005	0.001	0.000	0.000	0.000	0.000
12.	0.015	0.005	0.002	0.000	0.001	0.000
14.	0.037	0.019	0.008	0.003	0.008	0.004
16.	0.083	0.055	0.032	0.017	0.055	0.037
18.	0.167	0.141	0.110	0.080	0.306	0.291
20.	0.314	0.325	0.327	0.319	1.406	1.824
22.	0.556	0.693	0.872	1.103	5.567	9.523
24.	0.936	1.378	2.122	3.381	19.469	42.747
26.	1.512	2.587	4.783	9.388	61.312	168.884
28.	2.357	4.626	10.101	23.973	176.572	598.385
30.	3.563	7.934	20.175	56.981	470.759	1930.165
32.	5.243	13.117	38.397	127.306	1173.457	5737.992
34.	7.536	21.007	70.059	269.447	2757.305	15878.580
36.	10.608	32.706	123.157	543.841	6149.070	41243.490
38.	14.658	49.664	209.474	1052.366	13087.890	101253.700
40.	19.919	73.732	345.918	1961.147		

(b) Tandem Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.001	0.000	0.000	0.000	0.000	0.000
14.	0.001	0.000	0.000	0.000	0.000	0.000
16.	0.003	0.001	0.000	0.000	0.000	0.000
18.	0.006	0.002	0.001	0.000	0.000	0.000
20.	0.011	0.005	0.002	0.001	0.001	0.002
22.	0.020	0.010	0.006	0.004	0.003	0.009
24.	0.033	0.021	0.015	0.012	0.010	0.042
26.	0.052	0.039	0.033	0.033	0.036	0.170
28.	0.081	0.070	0.070	0.084	0.116	0.616
30.	0.122	0.120	0.141	0.202	0.340	2.032
32.	0.179	0.199	0.271	0.458	0.922	6.175
34.	0.256	0.319	0.498	0.982	2.337	17.474
36.	0.359	0.498	0.884	2.008	5.587	46.404
38.	0.495	0.760	1.517	3.937	12.674	116.452
40.	0.672	1.132	2.527	7.435	27.437	277.723
42.	0.898	1.653	4.101	13.570	56.951	632.685
44.	1.184	2.371	6.495	24.021	113.820	1382.718
46.	1.541	3.345	10.066	41.355	219.808	2909.837
48.	1.985	4.647	15.292	69.421	411.386	

Table 5.8. Load Equivalence Factors for SN=4, Subgrade Modulus=25000 psi. WET FRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.000	0.000	0.000	0.000	0.000	0.000
8.	0.002	0.000	0.000	0.000	0.000	0.000
10.	0.006	0.002	0.001	0.000	0.000	0.000
12.	0.017	0.008	0.003	0.001	0.000	0.000
14.	0.040	0.024	0.012	0.006	0.003	0.001
16.	0.087	0.064	0.043	0.027	0.016	0.009
18.	0.172	0.152	0.128	0.103	0.080	0.061
20.	0.315	0.330	0.337	0.337	0.333	0.325
22.	0.548	0.663	0.806	0.979	1.191	1.461
24.	0.907	1.253	1.778	2.568	3.775	5.667
26.	1.443	2.248	3.670	6.204	10.816	19.484
28.	2.218	3.858	7.160	13.965	28.441	60.472
30.	3.312	6.372	13.306	29.591	69.495	171.972
32.	4.820	10.180	23.704	59.510	159.370	453.469
34.	6.857	15.796	40.695	114.316	345.766	1119.532
36.	9.561	23.886	67.620	210.925	714.446	2608.509
38.	13.096	35.301	109.148	375.490	1413.811	5774.102
40.	17.651	51.103	171.659	647.358	2691.654	12210.390

(b) Tandem Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.001	0.000	0.000	0.000	0.000	0.000
14.	0.002	0.001	0.000	0.000	0.000	0.000
16.	0.004	0.001	0.000	0.000	0.000	0.000
18.	0.007	0.003	0.001	0.001	0.000	0.000
20.	0.013	0.007	0.004	0.002	0.001	0.001
22.	0.021	0.013	0.008	0.006	0.005	0.003
24.	0.035	0.025	0.019	0.016	0.014	0.013
26.	0.055	0.044	0.038	0.038	0.041	0.046
28.	0.084	0.075	0.075	0.085	0.108	0.145
30.	0.125	0.123	0.139	0.181	0.266	0.416
32.	0.181	0.197	0.248	0.366	0.615	1.107
34.	0.256	0.305	0.427	0.708	1.345	2.763
36.	0.355	0.460	0.712	1.313	2.801	6.513
38.	0.484	0.680	1.153	2.352	5.590	14.588
40.	0.650	0.985	1.820	4.080	10.736	31.221
42.	0.860	1.400	2.806	6.879	19.918	64.134
44.	1.125	1.958	4.238	11.301	35.817	126.964
46.	1.453	2.697	6.278	18.132	62.609	243.061
48.	1.857	3.663	9.140	28.478	106.645	451.304

Table 5.9. Load Equivanlence Factors for SN=5, Subgrade Modulus=25000 psi. WET FRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.000	0.000	0.000	0.000	0.000	0.000
8.	0.002	0.001	0.000	0.000	0.000	0.000
10.	0.007	0.003	0.001	0.000	0.000	0.000
12.	0.018	0.009	0.004	0.002	0.001	0.000
14.	0.042	0.027	0.016	0.009	0.005	0.002
16.	0.090	0.070	0.051	0.035	0.024	0.015
18.	0.174	0.159	0.140	0.119	0.098	0.080
20.	0.316	0.332	0.343	0.348	0.348	0.346
22.	0.543	0.647	0.771	0.915	1.085	1.291
24.	0.891	1.189	1.611	2.204	3.041	4.245
26.	1.405	2.079	3.167	4.926	7.798	12.581
28.	2.145	3.486	5.912	10.336	18.545	34.137
30.	3.181	5.640	10.554	20.547	41.352	85.895
32.	4.600	8.840	18.122	38.969	87.202	202.451
34.	6.507	13.478	30.075	70.925	175.120	450.709
36.	9.024	20.052	48.430	124.486	336.854	954.257
38.	12.300	29.192	75.928	211.556	623.690	1932.393
40.	16.502	41.669	116.212	349.266	1115.921	3760.592

(b) Tandem Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.001	0.000	0.000	0.000	0.000	0.000
14.	0.002	0.001	0.000	0.000	0.000	0.000
16.	0.004	0.002	0.001	0.000	0.000	0.000
18.	0.008	0.004	0.002	0.001	0.001	0.000
20.	0.013	0.008	0.005	0.003	0.002	0.001
22.	0.023	0.015	0.010	0.008	0.006	0.005
24.	0.037	0.027	0.021	0.018	0.017	0.016
26.	0.057	0.047	0.042	0.041	0.044	0.049
28.	0.086	0.078	0.078	0.086	0.104	0.132
30.	0.127	0.125	0.138	0.171	0.233	0.334
32.	0.182	0.195	0.236	0.324	0.491	0.789
34.	0.255	0.297	0.392	0.590	0.988	1.766
36.	0.352	0.440	0.631	1.037	1.907	3.760
38.	0.477	0.640	0.990	1.765	3.544	7.659
40.	0.638	0.912	1.515	2.922	6.368	15.002
42.	0.840	1.277	2.272	4.712	11.098	28.359
44.	1.093	1.760	3.341	7.427	18.816	51.921
46.	1.406	2.392	4.827	11.458	31.117	92.333
48.	1.790	3.209	6.863	17.341	50.295	159.896

Table 6.1. Load Equivalence Factors for SN=3, Subgrade Modulus=5000 psi.
WET NFRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.01	0.00	0.00	0.00	0.00	0.00
4.	4.41	0.19	0.01	0.00	0.00	0.00
6.	228.89	45.40	5.70	0.84	0.17	0.05
8.	3716.20	2010.55	553.02	153.83	53.30	24.68
10.	31375.91	35242.32	16936.98	7351.04	3672.72	2321.44
12.	174779.30	345193.10	253350.00	153414.10	100561.70	80016.31
14.	731057.60	2274090.00	2334783.00	1835373.00	1486324.00	1414283.00
16.	2482781.00	11255210.00	15210240.00	14773340.00	14185540.00	15587430.00
18.	7199235.00	44919130.00	76431200.00	88515610.00	97868160.00	121122400.00
20.	18447040.00	151652800.00	314206400.00	422495200.00	526205400.00	720099000.00
22.	42803920.00	447999200.00	1101264000.00	1684433000.00	2323972000.00	3466687000.00
24.	91562350.00	1187066000.00	3391527000.00	5804949000.00	8756838000.00	14082180000.00
26.	183069900.00	2874434000.00	9385414000.00	17747210000.00	28960830000.00	49757830000.00
28.	345646300.00	6451638000.00	23746310000.00	49074580000.00	85891670000.00	156522100000.00
30.	621503700.00	13574710000.00	55677640000.00	124635100000.00	232311100000.00	446331100000.00
32.	1071204000.00	27014520000.00	122268800000.00	294295700000.00	580616500000.00	1170143000000.00
34.	1779504000.00	51226180000.00	253728100000.00	652416500000.00	1355632000000.00	2853644000000.00
36.	2861805000.00	93095120000.00	500995800000.00	1368783000000.00	2982274000000.00	6533010000000.00
38.	4471668000.00	162956500000.00	946851400000.00	2735814000000.00	6226455000000.00	14149550000000.00
40.	6810591000.00	275910300000.00	1721518000000.00	5238145000000.00	12413150000000.00	29181580000000.00

(b) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	59414.550	26744.510	4429.863	803.747	227.292	114.981
12.	260017.900	199202.300	50594.370	12996.580	4868.871	3083.997
14.	905718.600	1072646.000	384925.900	130582.600	61167.240	46286.400
16.	2661926.000	4546125.000	2173969.000	927331.600	521536.000	456330.100
18.	6862431.000	16039970.000	9787116.000	5062515.000	3318360.000	3278215.000
20.	15942310.000	48975710.000	36878010.000	22504700.000	16809340.000	18414410.000
22.	34037610.000	133070700.000	120445200.000	84865640.000	70984350.000	85030590.000
24.	67770990.000	328485800.000	349923500.000	279823600.000	258472300.000	334826200.000
26.	127259500.000	748441500.000	922230000.000	825318100.000	832535200.000	1155793000.000
28.	227332400.000	1593207000.000	2238472000.000	2216065000.000	2418446000.000	3571845000.000
30.	389064900.000	3199871000.000	5064708000.000	5493342000.000	6436073000.000	10050350000.000
32.	641419500.000	6110560000.000	10783280000.000	12708740000.000	15879960000.000	26084500000.000
34.	1023589000.000	11167040000.000	21778170000.000	27693210000.000	36698850000.000	63132220000.000
36.	1586835000.000	19631820000.000	41984360000.000	57258570000.000	80091670000.000	143727500000.000
38.	2397887000.000	33350050000.000	76689510000.000	113027600000.000	166172900000.000	310084500000.000
40.	3540934000.000	54937470000.000	138583500000.000	214079100000.000	329612100000.000	637698800000.000
42.	5121867000.000	88047410000.000	239252600000.000	390839000000.000	628141300000.000	1256812000000.000
44.	7271976000.000	137655800000.000	401030100000.000	690239800000.000	1154754000000.000	2384073000000.000
46.	10150190000.000	210414200000.000	654459900000.000	1183127000000.000	2054949000000.000	4368767000000.000
48.	13951420000.000	315155600000.000	1042665000000.000	1973539000000.000	3551033000000.000	7760655000000.000

Table 6.2. Load Equivalence Factors for SN=4, Subgrade Modulus=5000 psi. WET NFRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.01	0.00	0.00	0.00	0.00	0.00
4.	2.88	0.18	0.01	0.00	0.00	0.00
6.	98.52	22.71	3.63	0.67	0.17	0.06
8.	1202.35	659.35	208.06	67.03	26.24	13.23
10.	8206.93	8475.65	4348.48	2066.39	1113.57	736.33
12.	38673.43	65224.96	48463.56	30850.93	21104.14	17070.09
14.	141101.30	353526.80	352698.40	282636.00	233021.00	220584.90
16.	427273.10	1487436.00	1890391.00	1827051.00	1752063.00	1883420.00
18.	1122964.00	5170342.00	8054773.00	9103480.00	9898769.00	11825220.00
20.	2641295.00	15488640.00	28731280.00	37102990.00	44879770.00	58635610.00
22.	5682636.00	41198600.00	88964640.00	128945500.00	170986600.00	241296400.00
24.	11363100.00	99460220.00	245573500.00	393795500.00	565959900.00	854381800.00
26.	21380320.00	221561600.00	616345500.00	1081271000.00	1668506000.00	2673338000.00
28.	38202840.00	461195000.00	1428233000.00	2715235000.00	4464881000.00	7544524000.00
30.	65317660.00	906077900.00	3092328000.00	6320758000.00	11006860000.00	19511150000.00
32.	107487600.00	1693489000.00	6314840000.00	13788250000.00	25289630000.00	46819040000.00
34.	171085900.00	3031038000.00	12259260000.00	28429690000.00	54680090000.00	105324800000.00
36.	264434300.00	5221941000.00	22763650000.00	55800310000.00	112102000000.00	223934600000.00
38.	398192300.00	8698466000.00	40642630000.00	104869900000.00	219319100000.00	453083500000.00
40.	585859800.00	14062590000.00	70087400000.00	189645700000.00	411694200000.00	877386600000.00

(b) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	10451.820	4753.938	957.846	212.325	69.491	37.670
12.	39910.160	28805.730	8422.633	2529.003	1058.219	698.059
14.	124163.300	130926.200	51780.360	19836.980	10097.600	7785.023
16.	331546.700	481086.000	244691.000	114650.600	68556.500	60060.460
18.	786718.700	1501661.000	946129.000	525470.100	359744.000	350837.500
20.	1699465.000	4120635.000	3124536.000	2008574.000	1543909.000	1650188.000
22.	3401626.000	10188900.000	9088436.000	6637054.000	5642083.000	6529199.000
24.	6391907.000	23122810.000	23822720.000	19469880.000	18083470.000	22440440.000
26.	11390600.000	48844760.000	57254990.000	51732680.000	51989280.000	68639520.000
28.	19400720.000	97082510.000	127867000.000	126446800.000	136370200.000	190326800.000
30.	31783720.000	183150300.000	268205500.000	287832800.000	330893800.000	485569000.000
32.	50332220.000	330216100.000	532815300.000	616083900.000	750601900.000	1152910000.000
34.	77381710.000	572305100.000	1009649000.000	1250051000.000	1606159000.000	2572319000.000
36.	115876600.000	957888200.000	1835141000.000	2420169000.000	3265686000.000	5434302000.000
38.	169526500.000	1554515000.000	3215287000.000	4495261000.000	6346457000.000	10942610000.000
40.	242865600.000	2453756000.000	5451010000.000	8046079000.000	11847240000.000	21110700000.000
42.	341436400.000	3778455000.000	8973791000.000	13934920000.000	21336960000.000	39205230000.000
44.	471930600.000	5689479000.000	14386100000.000	23425030000.000	37208540000.000	70357340000.000
46.	642235900.000	8394256000.000	22514650000.000	38336270000.000	63020390000.000	122409100000.000
48.	861802200.000	12159320000.000	34481200000.000	61223130000.000	103960200000.000	207109800000.000

Table 6.3. Load Equivalence Factors for SN=5, Subgrade Modulus=5000 psi. WET NFRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.01	0.00	0.00	0.00	0.00	0.00
4.	2.18	0.17	0.01	0.00	0.00	0.00
6.	56.49	14.38	2.70	0.58	0.16	0.06
8.	571.04	315.95	109.15	38.75	16.44	8.77
10.	3387.50	3309.79	1772.90	894.41	506.68	345.15
12.	14294.48	21722.93	16271.48	10705.58	7532.64	6158.88
14.	47657.07	103516.80	101334.80	82241.44	68612.31	64728.27
16.	133793.00	391280.80	477519.00	460022.00	440769.00	466994.50
18.	329555.10	1241605.00	1824854.00	2029528.00	2182699.00	2547306.00
20.	732558.70	3437284.00	5927247.00	7452978.00	8843121.00	11205360.00
22.	1499395.00	8531455.00	16912480.00	23657960.00	30562010.00	41577530.00
24.	2867721.00	19369150.00	43431280.00	66713660.00	92865800.00	134462200.00
26.	5183797.00	40836590.00	102201500.00	170642700.00	253781900.00	388303100.00
28.	8931729.00	80880810.00	223484400.00	402109400.00	634565300.00	1020099000.00
30.	14771880.00	151871800.00	459096500.00	883788200.00	1471506000.00	2473423000.00
32.	23577520.00	272338900.00	893637600.00	1829728000.00	3198377000.00	5598486000.00
34.	36483920.00	469213600.00	1660196000.00	3596499000.00	6573539000.00	11941330000.00
36.	54932800.00	780383400.00	2960230000.00	6755307000.00	12864050000.00	24179530000.00
38.	80725960.00	1258076000.00	5090521000.00	12190410000.00	24110900000.00	46772390000.00
40.	116093100.00	1972798000.00	8477360000.00	21229740000.00	43497410000.00	86887100000.00

(a) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	3320.563	1520.720	348.675	88.210	31.793	18.039
12.	11588.510	8041.371	2580.135	858.758	386.536	261.899
14.	33462.130	32681.680	13781.100	5720.641	3076.202	2401.038
16.	83872.620	109294.500	57896.210	28861.780	17970.710	15756.530
18.	188423.600	314654.200	202483.100	117861.300	83040.120	80296.250
20.	387963.300	804676.500	612952.300	407797.800	319454.100	335933.800
22.	744163.100	1869691.000	1651703.000	1235029.000	1061181.000	1200356.000
24.	1345930.000	4014080.000	4045267.000	3354074.000	3126609.000	3771415.000
26.	2317071.000	8066388.000	9148512.000	8318770.000	8339470.000	10651070.000
28.	3824310.000	15322950.000	19338800.000	19110300.000	20449960.000	27494700.000
30.	6087247.000	27737440.000	38586380.000	41121800.000	46687070.000	65755740.000
32.	9387039.000	48149480.000	73229950.000	83615960.000	100190100.000	147220800.000
34.	14081150.000	80579580.000	133052600.000	161859300.000	203774300.000	311301100.000
36.	20609360.000	130566800.000	232622900.000	300064200.000	395406500.000	626003700.000
38.	29514200.000	205594300.000	393140200.000	535404700.000	735959200.000	1204438000.000
40.	41445470.000	315513800.000	644505800.000	923219100.000	1319920000.000	2227664000.000
42.	57182080.000	473195700.000	1028260000.000	1544231000.000	2290181000.000	3977945000.000
44.	77649340.000	695077100.000	1600660000.000	2512752000.000	3857049000.000	6882304000.000
46.	103918200.000	1001843000.000	2436813000.000	3988571000.000	6323052000.000	11570900000.000
48.	137253400.000	1419528000.000	3636022000.000	6189330000.000	10115880000.000	18958290000.000

Table 6.4. Load Equivalence Factors for SN=3, Subgrade Modulus=15000 psi. WET NFRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.00	0.00	0.00	0.00	0.00	0.00
4.	0.00	0.00	0.00	0.00	0.00	0.00
6.	0.00	0.00	0.00	0.00	0.00	0.00
8.	0.00	0.00	0.00	0.00	0.00	0.00
10.	0.02	0.00	0.01	0.00	0.00	0.00
12.	0.07	0.02	0.05	0.03	0.02	0.01
14.	0.19	0.09	0.24	0.19	0.16	0.13
16.	0.45	0.32	1.00	1.00	1.00	1.00
18.	1.00	1.00	3.58	4.41	5.20	5.94
20.	2.03	2.76	11.29	16.69	22.79	29.28
22.	3.86	6.92	32.09	55.87	86.79	123.75
24.	6.94	16.00	83.55	168.57	294.01	460.03
26.	11.93	34.55	201.94	465.70	902.01	1534.81
28.	19.71	70.39	457.81	1192.86	2541.98	4667.97
30.	31.47	136.39	981.63	2861.79	6654.85	13102.95
32.	48.76	253.01	2004.80	6482.71	16340.29	34304.12
34.	73.59	451.68	3920.78	13960.82	37910.97	84448.50
36.	108.51	779.33	7379.95	28744.80	83649.81	196872.60
38.	156.69	1304.64	13422.88	56852.25	176493.90	437213.40
40.	222.06	2125.47				

(b) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	0.012	0.000	0.000	0.000	0.000	0.000
12.	0.035	0.002	0.000	0.000	0.000	0.000
14.	0.089	0.008	0.001	0.000	0.000	0.000
16.	0.203	0.025	0.004	0.001	0.000	0.000
18.	0.424	0.074	0.014	0.004	0.002	0.001
20.	0.824	0.195	0.048	0.017	0.009	0.007
22.	1.509	0.468	0.148	0.064	0.040	0.036
24.	2.631	1.047	0.411	0.212	0.152	0.155
26.	4.398	2.196	1.052	0.638	0.522	0.586
28.	7.090	4.364	2.509	1.765	1.624	1.993
30.	11.078	8.278	5.627	4.536	4.643	6.191
32.	16.838	15.073	11.966	10.932	12.349	17.757
34.	24.976	26.467	24.275	24.905	30.806	47.503
36.	36.249	45.009	47.238	53.995	72.660	119.506
38.	51.603	74.382	88.582	111.993	162.994	284.679
40.	72.175	119.775	160.646	223.217	349.575	645.708
42.	99.344	188.404	282.674	429.238	720.023	1401.606
44.	134.801	290.155	484.014	799.106	1430.015	2924.341
46.	180.494	438.277	808.294	1444.500	2747.228	5884.227
48.	238.764	650.355	1319.614	2541.474	5120.383	11458.280

Table 6.5. Load Equivalence Factors for SN=4, Subgrade Modulus=15000 psi. WET NFRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.00	0.00	0.00	0.00	0.00	0.00
4.	0.00	0.00	0.00	0.00	0.00	0.00
6.	0.00	0.00	0.00	0.00	0.00	0.00
8.	0.01	0.00	0.00	0.00	0.00	0.00
10.	0.02	0.01	0.01	0.01	0.00	0.00
12.	0.08	0.03	0.06	0.04	0.03	0.02
14.	0.20	0.11	0.27	0.22	0.18	0.16
16.	0.47	0.35	1.00	1.00	1.00	1.00
18.	1.00	1.00	3.22	3.86	4.47	5.02
20.	1.96	2.57	9.24	13.02	17.11	21.32
22.	3.62	6.02	24.11	39.22	57.76	78.87
24.	6.33	13.12	58.09	107.56	175.45	260.01
26.	10.60	26.82	130.76	272.41	487.45	777.87
28.	17.10	51.98	277.68	644.20	1254.32	2141.21
30.	26.71	96.17	560.38	1435.64	3020.17	5483.70
32.	40.54	170.89	1081.71	3037.04	6862.27	13188.39
34.	60.03	293.07	2007.09	6136.19	14812.88	30005.63
36.	86.93	487.03	3595.76	11902.40	30555.26	64995.30
38.	123.40	786.98	6243.00	22258.35	60524.86	134743.10
40.	172.09	1240.08				

(b) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	0.011	0.001	0.000	0.000	0.000	0.000
12.	0.031	0.002	0.000	0.000	0.000	0.000
14.	0.075	0.009	0.001	0.000	0.000	0.000
16.	0.165	0.027	0.005	0.001	0.001	0.000
18.	0.333	0.073	0.017	0.001	0.003	0.002
20.	0.628	0.179	0.054	0.006	0.013	0.010
22.	1.118	0.405	0.150	0.022	0.048	0.044
24.	1.901	0.855	0.383	0.073	0.164	0.166
26.	3.104	1.702	0.908	0.217	0.500	0.553
28.	4.897	3.223	2.015	0.593	1.401	1.676
30.	7.498	5.845	4.230	1.498	3.641	4.682
32.	11.183	10.209	8.461	3.544	8.860	12.180
34.	16.296	17.240	16.212	7.911	20.358	29.762
36.	23.260	28.265	29.907	16.783	44.473	68.818
38.	32.593	45.128	53.338	34.041	92.858	151.512
40.	44.909	70.337	92.260	66.331	186.188	319.199
42.	60.942	107.277	155.249	124.670	359.934	646.373
44.	81.579	160.442	254.808	226.830	673.331	1263.113
46.	107.830	235.675	408.783	400.754	1222.383	2389.141
48.	140.887	340.532	642.333	689.400	2159.153	4387.238
				1157.119		

Table 6.6. Load Equivalence Factors for SN=5, Subgrade Modulus=15000 psi. WET NFRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.00	0.00	0.00	0.00	0.00	0.00
4.	0.00	0.00	0.00	0.00	0.00	0.00
6.	0.00	0.00	0.00	0.00	0.00	0.00
8.	0.01	0.00	0.00	0.00	0.00	0.00
10.	0.03	0.01	0.00	0.00	0.00	0.00
12.	0.08	0.03	0.01	0.01	0.00	0.00
14.	0.21	0.12	0.07	0.05	0.03	0.03
16.	0.48	0.37	0.29	0.24	0.21	0.18
18.	1.00	1.00	1.00	1.00	1.00	1.00
20.	1.92	2.45	3.00	3.54	4.04	4.49
22.	3.47	5.50	8.09	11.05	14.16	17.29
24.	5.95	11.51	19.96	31.05	44.15	58.59
26.	9.80	22.70	45.70	79.97	124.80	178.45
28.	15.57	42.55	98.16	191.23	324.76	496.77
30.	23.97	76.37	199.64	429.01	787.06	1280.34
32.	35.90	131.90	387.10	910.65	1793.20	3086.32
34.	52.48	220.31	719.94	1841.40	3871.12	7018.46
36.	75.10	357.13	1290.19	3567.09	7967.71	15158.77
38.	105.41	563.78	2237.31	6651.86	15720.87	31280.80
40.	145.44	869.03	3767.09	11988.24	29869.88	61971.60

(b) Tandem Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.010	0.001	0.000	0.000	0.000	0.000
12.	0.028	0.003	0.000	0.000	0.000	0.000
14.	0.067	0.010	0.002	0.000	0.000	0.000
16.	0.144	0.028	0.006	0.002	0.001	0.001
18.	0.284	0.072	0.020	0.007	0.004	0.003
20.	0.525	0.170	0.058	0.026	0.016	0.013
22.	0.918	0.368	0.152	0.079	0.055	0.051
24.	1.534	0.748	0.366	0.221	0.172	0.173
26.	2.467	1.438	0.823	0.565	0.486	0.532
28.	3.836	2.639	1.743	1.345	1.271	1.495
30.	5.796	4.646	3.504	3.012	3.101	3.895
32.	8.537	7.894	6.731	6.391	7.118	9.498
34.	12.295	12.993	12.421	12.934	15.490	21.861
36.	17.357	20.794	22.120	25.107	32.169	47.813
38.	24.069	32.451	38.164	46.948	64.062	99.933
40.	32.838	49.504	63.986	84.887	122.866	200.522
42.	44.145	73.981	104.543	148.910	227.793	387.867
44.	58.569	108.525	166.859	254.160	409.634	725.892
46.	76.756	156.505	260.682	423.142	716.374	1318.042
48.	99.472	222.202	399.406	688.480	1221.321	2328.448

Table 6.7. Load Equivalence Factors for SN=3, Subgrade Modulus=25000 psi. WET NFRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.00	0.00	0.00	0.00	0.00	0.00
4.	0.00	0.00	0.00	0.00	0.00	0.00
6.	0.00	0.00	0.00	0.00	0.00	0.00
8.	0.00	0.00	0.00	0.00	0.00	0.00
10.	0.00	0.00	0.00	0.00	0.00	0.00
12.	0.00	0.00	0.00	0.00	0.00	0.00
14.	0.00	0.00	0.00	0.00	0.00	0.00
16.	0.00	0.00	0.00	0.00	0.00	0.00
18.	0.00	0.00	0.00	0.00	0.00	0.00
20.	0.00	0.00	0.00	0.00	0.00	0.00
22.	0.00	0.00	0.00	0.00	0.00	0.00
24.	0.00	0.01	0.01	0.01	0.00	0.00
26.	0.01	0.01	0.02	0.02	0.00	0.00
28.	0.01	0.02	0.05	0.05	0.01	0.01
30.	0.01	0.03	0.10	0.12	0.03	0.04
32.	0.02	0.05	0.19	0.27	0.08	0.12
34.	0.03	0.09	0.36	0.61	0.24	0.39
36.	0.04	0.13	0.66	1.30	0.62	1.12
38.	0.05	0.21	1.16	2.64	1.53	2.98
40.	0.06	0.31	1.97	5.14	3.56	7.47
				9.67	7.88	17.69
					16.68	39.86
					33.87	85.88

(b) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.000	0.000	0.000	0.000	0.000	0.000
16.	0.000	0.000	0.000	0.000	0.000	0.000
18.	0.001	0.000	0.000	0.000	0.000	0.000
20.	0.001	0.000	0.000	0.000	0.000	0.000
22.	0.002	0.000	0.000	0.000	0.000	0.000
24.	0.003	0.000	0.000	0.000	0.000	0.000
26.	0.004	0.001	0.001	0.000	0.000	0.000
28.	0.006	0.001	0.001	0.000	0.000	0.000
30.	0.008	0.002	0.002	0.001	0.001	0.001
32.	0.011	0.004	0.004	0.002	0.002	0.003
34.	0.014	0.006	0.008	0.004	0.005	0.007
36.	0.019	0.010	0.013	0.008	0.011	0.017
38.	0.025	0.015	0.023	0.016	0.023	0.040
40.	0.032	0.022	0.038	0.030	0.048	0.087
42.	0.040	0.032	0.061	0.055	0.095	0.182
44.	0.050	0.045	0.095	0.098	0.181	0.368
46.	0.063	0.064	0.148	0.170	0.335	0.720
48.	0.077	0.089		0.286	0.604	1.365

Table 6.8. Load Equivalence Factors for SN=4, Subgrade Modulus=25000 psi. WET NFRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.00	0.00	0.00	0.00	0.00	0.00
4.	0.00	0.00	0.00	0.00	0.00	0.00
6.	0.00	0.00	0.00	0.00	0.00	0.00
8.	0.00	0.00	0.00	0.00	0.00	0.00
10.	0.00	0.00	0.00	0.00	0.00	0.00
12.	0.00	0.00	0.00	0.00	0.00	0.00
14.	0.00	0.00	0.00	0.00	0.00	0.00
16.	0.00	0.00	0.00	0.00	0.00	0.00
18.	0.00	0.00	0.00	0.00	0.00	0.00
20.	0.00	0.00	0.00	0.00	0.00	0.00
22.	0.01	0.01	0.01	0.01	0.01	0.02
24.	0.01	0.01	0.02	0.03	0.05	0.06
26.	0.01	0.02	0.04	0.08	0.13	0.19
28.	0.02	0.04	0.08	0.18	0.34	0.53
30.	0.03	0.06	0.17	0.40	0.83	1.39
32.	0.04	0.10	0.31	0.85	1.90	3.42
34.	0.06	0.16	0.56	1.71	4.14	7.94
36.	0.08	0.24	0.98	3.29	8.61	17.54
38.	0.10	0.37	1.65	6.11	17.18	37.02
40.	0.13	0.54	2.72	10.98	33.03	74.99

(b) Tandem Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.000	0.000	0.000	0.000	0.000	0.000
16.	0.001	0.000	0.000	0.000	0.000	0.000
18.	0.001	0.000	0.000	0.000	0.000	0.000
20.	0.002	0.000	0.000	0.000	0.000	0.000
22.	0.003	0.000	0.000	0.000	0.000	0.000
24.	0.004	0.001	0.000	0.000	0.000	0.000
26.	0.006	0.002	0.001	0.000	0.000	0.000
28.	0.008	0.003	0.001	0.001	0.001	0.001
30.	0.011	0.004	0.002	0.002	0.002	0.002
32.	0.016	0.007	0.004	0.004	0.004	0.005
34.	0.021	0.011	0.008	0.008	0.009	0.013
36.	0.028	0.016	0.014	0.015	0.019	0.029
38.	0.036	0.024	0.023	0.027	0.038	0.061
40.	0.047	0.035	0.038	0.049	0.074	0.124
42.	0.059	0.050	0.060	0.085	0.137	0.245
44.	0.075	0.071	0.094	0.145	0.249	0.466
46.	0.093	0.099	0.143	0.241	0.440	0.863
48.	0.115	0.135	0.216	0.391	0.758	1.553

Table 6.9. Load Equivalence Factors for SN=5, Subgrade Modulus=25000 psi. WET NFRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.00	0.00	0.00	0.00	0.00	0.00
4.	0.00	0.00	0.00	0.00	0.00	0.00
6.	0.00	0.00	0.00	0.00	0.00	0.00
8.	0.00	0.00	0.00	0.00	0.00	0.00
10.	0.00	0.00	0.00	0.00	0.00	0.00
12.	0.00	0.00	0.00	0.00	0.00	0.00
14.	0.00	0.00	0.00	0.00	0.00	0.00
16.	0.00	0.00	0.00	0.00	0.00	0.00
18.	0.00	0.00	0.00	0.00	0.00	0.00
20.	0.01	0.00	0.01	0.01	0.01	0.01
22.	0.01	0.01	0.01	0.02	0.02	0.03
24.	0.02	0.02	0.03	0.05	0.07	0.08
26.	0.02	0.03	0.06	0.11	0.17	0.24
28.	0.03	0.06	0.12	0.25	0.43	0.64
30.	0.05	0.09	0.23	0.52	1.00	1.60
32.	0.07	0.15	0.42	1.06	2.19	3.74
34.	0.09	0.24	0.74	2.04	4.57	8.28
36.	0.12	0.36	1.27	3.81	9.12	17.45
38.	0.16	0.53	2.09	6.85	17.52	35.26
40.	0.21	0.78	3.37	11.95	32.50	68.57

(b) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.000	0.000	0.000	0.000	0.000	0.000
14.	0.000	0.000	0.000	0.000	0.000	0.000
16.	0.001	0.000	0.000	0.000	0.000	0.000
18.	0.001	0.000	0.000	0.000	0.000	0.000
20.	0.002	0.000	0.000	0.000	0.000	0.000
22.	0.003	0.001	0.000	0.000	0.000	0.000
24.	0.005	0.001	0.000	0.000	0.000	0.000
26.	0.007	0.002	0.001	0.001	0.001	0.001
28.	0.011	0.004	0.002	0.001	0.001	0.001
30.	0.015	0.006	0.004	0.003	0.003	0.004
32.	0.020	0.010	0.007	0.006	0.007	0.008
34.	0.027	0.015	0.012	0.012	0.014	0.019
36.	0.036	0.023	0.020	0.021	0.027	0.039
38.	0.047	0.033	0.033	0.039	0.052	0.080
40.	0.060	0.048	0.052	0.067	0.098	0.157
42.	0.077	0.068	0.081	0.114	0.176	0.297
44.	0.097	0.095	0.125	0.188	0.308	0.545
46.	0.121	0.131	0.187	0.303	0.527	0.972
48.	0.149	0.178	0.277	0.480	0.880	1.690

Table 7.1. Load Equivalence Factors for SN=3, Subgrade Modulus=5000 psi. DRY FRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.024	0.000	0.000	0.000	0.000	0.000
6.	0.289	0.010	0.001	0.000	0.000	0.000
8.	1.658	0.184	0.029	0.007	0.002	0.001
10.	6.314	1.717	0.625	0.300	0.185	0.138
12.	18.534	10.339	7.322	6.501	7.019	8.771
14.	45.495	46.079	56.911	84.481	146.262	282.516
16.	98.044	165.049	328.068	757.103	1968.115	5531.348
18.	191.465	501.059	1507.930	5117.539	18993.870	74163.870
20.	346.151	1336.572	5805.441	27736.880	141259.900	738792.000
22.	588.241	3214.307	19388.300	125903.500	851917.600	5794435.000
24.	950.171	7100.723	57631.230	494125.200	4327364.000	37357120.000
26.	1471.533	14617.720	155495.100	1718166.000	19044560.000	204452200.000
28.	2198.898	28349.430	386533.000	5392937.000	74247450.000	974359200.000
30.	3186.932	52246.600	895841.000	15505630.000	260924200.000	4123422000.000
32.	4498.512	92135.870	1954222.000	41328600.000	838177700.000	15747360000.000
34.	6205.332	156357.700	4043546.000	103102000.000	2489485000.000	54970530000.000
36.	8388.066	256538.800	7987174.000	242673100.000	6900527000.000	**********
38.	11136.400	408477.100	15141150.000	542462900.000	17993260000.000	**********
40.	14550.380	633258.100	27666570.000	1158005000.000	44418730000.000	**********

(b) Tandem Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	2.246	0.438	0.096	0.025	0.008	0.004
12.	5.936	2.238	0.911	0.426	0.247	0.196
14.	13.496	8.867	6.122	4.683	4.283	5.139
16.	27.443	29.075	31.662	37.129	50.378	86.708
18.	51.202	82.409	133.903	228.707	439.436	1040.112
20.	89.221	208.105	482.782	1153.146	3022.941	9511.801
22.	147.107	478.651	1529.419	4941.992	17150.820	69798.430
24.	231.687	1019.028	4353.953	18516.460	82956.060	426743.200
26.	351.124	2033.307	11331.010	61973.100	350906.700	2238223.000
28.	515.067	3839.887	27325.590	188459.800	1324433.000	10303320.000
30.	734.524	6916.336	61714.620	527679.800	4531267.000	42380650.000
32.	1022.289	11956.210	131667.900	1375273.000	14234530.000	158099100.000
34.	1392.665	19938.860	267263.700	3365945.000	41494760.000	541255400.000
36.	1861.520	32209.130	519087.800	7793127.000	113219700.000	1717874000.000
38.	2446.652	50580.190	969464.300	17172460.000	291271400.000	5096521000.000
40.	3167.763	77450.310	1748427.000	36209200.000	710915000.000	14233160000.000
42.	4046.482	115942.000	3055834.000	73379530.000	1655109000.000	37657000000.000
44.	5105.488	170030.600	5190398.000	143450000.000	3691016000.000	94823570000.000
46.	6370.563	244747.800	8591663.000	271439800.000	7918272000.000	**********
48.	7868.711	346369.100	13890440.000	498567600.000	16393780000.000	**********

Table 7.2. Load Equivalence Factors for SN=4, Subgrade Modulus=5000 psi. DRY FRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.002	0.000	0.000	0.000	0.000	0.000
4.	0.059	0.001	0.000	0.000	0.000	0.000
6.	0.507	0.028	0.002	0.000	0.000	0.000
8.	2.329	0.340	0.067	0.018	0.006	0.003
10.	7.534	2.318	0.906	0.446	0.269	0.192
12.	19.487	10.921	7.425	6.068	5.825	6.331
14.	43.189	39.885	43.118	53.979	76.519	118.790
16.	85.497	120.976	194.648	351.682	697.618	1473.039
18.	155.338	318.684	725.739	1807.937	4815.723	13320.130
20.	263.852	751.641	2328.789	7716.883	26718.520	93962.500
22.	424.522	1622.163	6623.254	28360.730	124300.600	542661.900
24.	653.261	3254.598	17060.070	92167.680	500427.700	2658932.000
26.	968.724	6145.211	40462.820	270344.200	1785458.000	11354060.000
28.	1391.915	11021.150	89485.060	726971.900	5750629.000	43156890.000
30.	1946.728	18913.890	186392.600	1814517.000	16964760.000	148440500.000
32.	2659.779	31244.250	368621.900	4246226.000	46384810.000	468201700.000
34.	3560.595	49923.400	696704.800	9392154.000	118662800.000	1368912000.000
36.	4681.516	77467.000	1265339.000	19768780.000	286305700.000	3744317000.000
38.	6057.633	117113.900	2218231.000	39815840.000	655824300.000	9653006000.000
40.	7727.316	172983.300	3767507.000	77096480.000	1433881000.000	23597460000.000

(b) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	2.417	0.518	0.126	0.036	0.013	0.007
12.	5.715	2.126	0.866	0.405	0.230	0.170
14.	11.863	7.026	4.443	3.120	2.575	2.678
16.	22.342	19.768	18.280	18.291	20.899	29.195
18.	39.032	49.110	63.451	86.766	132.091	239.572
20.	64.230	110.521	192.403	347.720	684.387	1567.854
22.	100.688	229.573	522.749	1215.088	3016.167	8534.902
24.	151.602	446.200	1296.874	3790.584	11624.370	39879.330
26.	220.644	820.132	2980.498	10747.460	40016.520	163849.600
28.	312.016	1437.500	6418.660	28094.740	125138.500	603352.000
30.	430.327	2418.561	13069.310	68468.870	360194.000	2021177.000
32.	580.827	3926.931	25344.650	157007.100	964587.000	6236513.000
34.	769.198	6180.371	47095.920	341274.600	2424765.000	17900670.000
36.	1001.581	9461.477	84260.620	707532.500	5763009.000	48201120.000
38.	1284.736	14132.640	145762.300	1406242.000	13030310.000	122598500.000
40.	1626.006	20651.030	244684.900	2691766.000	28174680.000	296310500.000
42.	2033.312	29586.850	399789.100	4980695.000	58525610.000	684102600.000
44.	2514.674	41634.710	637297.300	8936395.000	117204400.000	1514852000.000
46.	3079.272	57641.580	993553.600	15592520.000	227084800.000	3229833000.000
48.	3736.406	78626.250	1517726.000	26521290.000	426886600.000	6653345000.000

Table 7.3. Load Equivalence Factors for SN=5, Subgrade Modulus=5000 psi. DRY FRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.004	0.000	0.000	0.000	0.000	0.000
4.	0.101	0.002	0.000	0.000	0.000	0.000
6.	0.710	0.052	0.005	0.001	0.000	0.000
8.	2.853	0.491	0.110	0.032	0.012	0.005
10.	8.373	2.774	1.131	0.564	0.337	0.233
12.	20.080	11.285	7.488	5.823	5.210	5.210
14.	41.867	36.588	36.526	41.297	51.941	70.770
16.	78.776	100.472	142.470	222.371	375.227	667.880
18.	137.084	243.149	468.720	970.606	2120.107	4772.305
20.	224.323	532.803	1348.887	3591.583	9872.406	27391.940
22.	349.314	1077.814	3485.046	11634.170	39328.070	131740.800
24.	522.170	2041.513	8240.020	33775.870	137797.800	547767.000
26.	754.489	3660.577	18094.100	89488.120	433674.100	2016648.000
28.	1058.984	6265.129	37314.310	219390.800	1246030.000	6695826.000
30.	1449.876	10303.280	72917.620	503195.800	3310816.000	20344000.000
32.	1942.707	16368.070	135995.300	1089420.000	8220818.000	57235240.000
34.	2554.471	25228.580	243492.000	2242408.000	19235660.000	150526100.000
36.	3303.487	37863.980	420571.300	4414801.000	42715500.000	373069800.000
38.	4209.309	55495.160	703611.100	8354613.000	90552880.000	877057500.000
40.	5293.188	79631.430	1143931.000	15260780.000	184121800.000	1966632000.000

(b) Tandem Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	2.526	0.573	0.148	0.045	0.017	0.009
12.	5.588	2.062	0.840	0.392	0.220	0.156
14.	10.983	6.114	3.668	2.447	1.900	1.813
16.	19.757	15.697	13.163	11.979	12.350	15.230
18.	33.186	36.039	40.601	48.607	64.387	99.610
20.	52.773	75.708	111.009	169.814	281.578	533.652
22.	80.268	147.964	275.150	525.250	1066.965	2430.036
24.	117.649	272.343	628.711	1468.533	3590.113	9668.492
26.	167.136	476.597	1341.417	3770.628	10927.000	34327.200
28.	231.226	798.933	2699.874	9004.426	30536.310	110610.300
30.	312.592	1290.496	5167.000	20197.120	79267.620	327760.800
32.	414.251	2018.285	9464.340	42901.750	192959.500	902825.800
34.	539.404	3068.389	16682.100	86866.750	443951.300	2332249.000
36.	691.450	4548.879	28416.760	168585.500	971595.500	5691975.000
38.	874.111	6594.371	46957.600	315026.500	2033652.000	13204460.000
40.	1091.372	9370.066	75516.680	569126.700	4090070.000	29273180.000
42.	1347.498	13076.840	118515.600	997349.000	7936178.000	62301290.000
44.	1646.711	17953.190	181890.800	1700008.000	14902760.000	127744000.000
46.	1993.859	24283.550	273590.700	2825874.000	27168920.000	253246800.000
48.	2393.787	32403.050	403990.800	4590719.000	48207580.000	486814200.000

Table 7.4. Load Equivalence Factors for SN=3, Subgrade Modulus=15000 psi. DRY FRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.001	0.000	0.000	0.000	0.000	0.000
8.	0.006	0.000	0.000	0.000	0.000	0.000
10.	0.025	0.003	0.000	0.000	0.000	0.000
12.	0.079	0.017	0.004	0.001	0.000	0.000
14.	0.209	0.080	0.033	0.015	0.007	0.004
16.	0.482	0.308	0.204	0.139	0.099	0.072
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.912	2.834	4.092	5.737	7.810	10.356
22.	3.418	7.208	14.465	27.482	49.394	84.445
24.	5.787	16.773	45.349	113.502	262.611	565.755
26.	9.362	36.243	128.636	414.283	1207.952	3215.881
28.	14.570	73.553	335.233	1361.656	4913.535	15904.570
30.	21.935	141.467	812.449	4091.082	17989.120	69800.250
32.	32.089	259.733	1849.068	11372.550	60116.120	276138.200
34.	45.782	457.909	3983.398	29533.590	185463.900	997787.000
36.	63.892	779.002	8176.648	72243.810	533311.800	3328802.000
38.	87.432	1283.849	16080.040	167577.100	1440823.000	10344360.000
40.	117.579	2056.955	30434.970	370713.900	3681001.000	30167000.000

(b) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	0.003	0.000	0.000	0.000	0.000	0.000
12.	0.008	0.001	0.000	0.000	0.000	0.000
14.	0.020	0.003	0.000	0.000	0.000	0.000
16.	0.044	0.012	0.003	0.001	0.000	0.000
18.	0.089	0.037	0.012	0.003	0.001	0.000
20.	0.165	0.100	0.048	0.019	0.007	0.003
22.	0.288	0.247	0.164	0.089	0.045	0.025
24.	0.478	0.563	0.503	0.363	0.238	0.168
26.	0.762	1.196	1.407	1.314	1.093	0.956
28.	1.170	2.392	3.627	4.296	4.447	4.751
30.	1.742	4.548	8.721	12.881	16.344	21.016
32.	2.524	8.271	19.737	35.812	54.940	83.997
34.	3.572	14.470	42.360	93.182	170.813	307.169
36.	4.948	24.458	86.738	228.671	495.558	1038.026
38.	6.729	40.094	170.336	532.593	1351.687	3270.579
40.	8.998	63.954	322.245	1183.989	3489.194	9676.496
42.	11.853	99.538	589.516	2523.802	8571.109	27056.260
44.	15.401	151.506	1045.999	5178.852	20126.440	71862.560
46.	19.763	225.975	1805.359	10265.880	45368.920	182203.500
48.	25.077	330.901	3038.358	19717.040	98527.810	442642.300

Table 7.5. Load Equivalence Factors for SN=4, Subgrade Modulus=15000 psi. DRY FRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.002	0.000	0.000	0.000	0.000	0.000
8.	0.010	0.001	0.000	0.000	0.000	0.000
10.	0.036	0.005	0.001	0.000	0.000	0.000
12.	0.103	0.028	0.008	0.003	0.001	0.000
14.	0.245	0.110	0.052	0.026	0.014	0.008
16.	0.519	0.357	0.252	0.184	0.138	0.106
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.792	2.497	3.398	4.506	5.823	7.347
22.	3.027	5.679	10.191	17.424	28.370	44.154
24.	4.871	11.961	27.584	59.404	119.343	224.820
26.	7.530	23.629	68.530	182.300	444.064	996.544
28.	11.247	44.207	158.321	511.665	1488.714	3926.927
30.	16.310	78.939	343.641	1330.122	4563.711	13985.520
32.	23.056	135.375	706.635	3235.525	12946.160	45627.350
34.	31.870	224.095	1385.902	7425.742	34309.910	137840.300
36.	43.194	359.599	2607.282	16191.080	85635.370	389132.100
38.	57.522	561.258	4726.879	33730.890	202669.600	1034314.000
40.	75.417	854.646	8290.703	67469.680	457302.800	2604594.000

(b) Tandem Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.004	0.000	0.000	0.000	0.000	0.000
12.	0.011	0.001	0.000	0.000	0.000	0.000
14.	0.024	0.005	0.001	0.000	0.000	0.000
16.	0.048	0.015	0.004	0.001	0.000	0.000
18.	0.090	0.041	0.016	0.006	0.002	0.001
20.	0.157	0.099	0.053	0.025	0.012	0.006
22.	0.260	0.219	0.154	0.095	0.056	0.036
24.	0.411	0.452	0.408	0.317	0.231	0.180
26.	0.626	0.877	0.998	0.961	0.854	0.793
28.	0.923	1.619	2.277	2.673	2.847	3.116
30.	1.325	2.857	4.895	6.908	8.712	11.103
32.	1.856	4.852	9.991	16.742	24.715	36.327
34.	2.546	7.967	19.486	38.351	65.628	110.271
36.	3.427	12.697	36.497	83.570	164.334	313.148
38.	4.536	19.702	65.943	174.158	390.509	838.051
40.	5.915	29.851	115.379	348.785	885.529	2127.072
42.	7.610	44.271	196.122	673.881	1925.144	5146.023
44.	9.670	64.388	324.688	1260.193	4027.687	11919.580
46.	12.152	91.998	524.856	2287.864	8138.141	26541.130
48.	15.117	129.347	830.123	4042.831	15929.810	56999.630

Table 7.6. Load Equivalence Factors for SN=5, Subgrade Modulus=15000 psi. DRY FRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.003	0.000	0.000	0.000	0.000	0.000
8.	0.014	0.001	0.000	0.000	0.000	0.000
10.	0.046	0.009	0.002	0.000	0.000	0.001
12.	0.121	0.038	0.013	0.005	0.002	0.014
14.	0.270	0.133	0.069	0.038	0.022	0.134
16.	0.543	0.389	0.286	0.217	0.168	1.000
18.	1.000	1.000	1.000	1.000	1.000	5.985
20.	1.724	2.315	3.041	3.900	4.885	29.964
22.	2.814	4.925	8.266	13.270	20.363	129.491
24.	4.395	9.772	20.492	40.338	74.473	494.667
26.	6.611	18.297	47.032	111.598	244.107	1701.774
28.	9.635	32.607	101.103	285.008	729.046	5350.004
30.	13.663	55.697	205.450	679.478	2009.884	15552.420
32.	18.921	91.698	397.605	1526.125	5169.395	42213.050
34.	25.665	146.185	737.265	3253.027	12509.850	107850.900
36.	34.181	226.526	1316.556	6621.699	28690.900	261098.100
38.	44.785	342.242	2273.560	12936.770	62735.750	602318.500
40.	57.833	505.537	3810.236	24364.760	131423.100	

(b) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	0.005	0.000	0.000	0.000	0.000	0.000
12.	0.012	0.002	0.000	0.000	0.000	0.000
14.	0.026	0.006	0.001	0.000	0.000	0.000
16.	0.051	0.018	0.006	0.002	0.001	0.000
18.	0.091	0.044	0.019	0.008	0.003	0.002
20.	0.153	0.098	0.056	0.030	0.016	0.009
22.	0.244	0.204	0.148	0.098	0.063	0.044
24.	0.375	0.396	0.360	0.292	0.227	0.188
26.	0.556	0.729	0.813	0.797	0.737	0.709
28.	0.802	1.281	1.724	2.013	2.181	2.421
30.	1.125	2.163	3.466	4.760	5.980	7.582
32.	1.545	3.527	6.651	10.627	15.329	22.010
34.	2.080	5.577	12.249	22.557	37.042	59.771
36.	2.751	8.580	21.752	45.783	84.940	152.970
38.	3.583	12.884	37.393	89.275	185.879	371.378
40.	4.603	18.930	62.440	167.972	390.070	859.899
42.	5.838	27.275	101.575	306.012	788.306	1907.990
44.	7.321	38.604	161.337	541.369	1539.215	4072.465
46.	9.086	53.760	250.781	932.551	2913.237	8390.352
48.	11.170	73.770	382.185	1567.774	5358.988	16739.430

Table 7.7. Load Equivalence Factors for SN=3, Subgrade Modulus=25000 psi. DRY FRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.000	0.000	0.000	0.000	0.000	0.000
8.	0.001	0.000	0.000	0.000	0.000	0.000
10.	0.003	0.000	0.000	0.000	0.000	0.000
12.	0.010	0.002	0.000	0.000	0.000	0.000
14.	0.028	0.009	0.003	0.001	0.000	0.000
16.	0.067	0.036	0.020	0.011	0.006	0.003
18.	0.144	0.122	0.100	0.081	0.064	0.051
20.	0.286	0.359	0.428	0.485	0.525	0.548
22.	0.527	0.944	1.569	2.413	3.454	4.659
24.	0.919	2.267	5.085	10.325	19.056	32.430
26.	1.526	5.041	14.874	38.928	90.669	190.933
28.	2.433	10.505	39.882	131.870	380.636	975.725
30.	3.747	20.710	99.252	407.468	1435.001	4413.688
32.	5.599	38.914	231.569	1162.760	4928.793	17967.190
34.	8.150	70.112	510.606	3094.990	15603.190	66683.250
36.	11.590	121.745	1071.405	7749.215	45970.010	228110.800
38.	16.145	204.561	2151.125	18372.400	127078.900	725985.500
40.	22.083	333.832	4152.523	41500.070	331836.700	2166017.000

(b) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.001	0.000	0.000	0.000	0.000	0.000
14.	0.002	0.000	0.000	0.000	0.000	0.000
16.	0.004	0.001	0.000	0.000	0.000	0.000
18.	0.009	0.003	0.001	0.000	0.000	0.000
20.	0.016	0.008	0.003	0.001	0.000	0.000
22.	0.030	0.019	0.009	0.004	0.001	0.000
24.	0.051	0.046	0.030	0.015	0.007	0.003
26.	0.083	0.100	0.087	0.057	0.033	0.019
28.	0.130	0.207	0.232	0.195	0.139	0.101
30.	0.198	0.404	0.575	0.604	0.529	0.464
32.	0.294	0.754	1.339	1.735	1.842	1.922
34.	0.425	1.351	2.953	4.650	5.915	7.275
36.	0.600	2.335	6.203	11.736	17.691	25.401
38.	0.831	3.910	12.478	28.067	49.665	82.527
40.	1.131	6.365	24.151	63.985	131.740	251.402
42.	1.515	10.098	45.148	139.682	332.099	722.765
44.	2.000	15.654	81.773	293.229	799.343	1970.863
46.	2.607	23.763	143.953	594.033	1844.853	5124.844
48.	3.356	35.383	246.865	1164.851	4097.590	12754.180

Table 7.8. Load Equivalence Factors for SN=4, Subgrade Modulus=25000 psi. DRY FRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.000	0.000	0.000	0.000	0.000	0.000
8.	0.001	0.000	0.000	0.000	0.000	0.000
10.	0.005	0.001	0.000	0.000	0.000	0.000
12.	0.014	0.003	0.001	0.000	0.001	0.001
14.	0.034	0.013	0.005	0.002	0.011	0.007
16.	0.075	0.045	0.028	0.017	0.082	0.068
18.	0.150	0.132	0.114	0.097	0.496	0.524
20.	0.278	0.342	0.403	0.456	2.510	3.273
22.	0.484	0.803	1.252	1.828	10.926	17.260
24.	0.800	1.743	3.496	6.439	41.946	79.008
26.	1.269	3.538	8.939	20.367	144.777	320.818
28.	1.941	6.789	21.213	58.789	456.007	1174.889
30.	2.878	12.414	47.208	156.872	1326.752	3934.512
32.	4.154	21.765	99.373	391.046	3600.938	12180.230
34.	5.855	36.787	199.227	918.322	9192.090	35191.820
36.	8.083	60.201	382.653	2046.211	22221.070	95609.000
38.	10.953	95.718	707.437	4350.961	51162.300	245853.500
40.	14.600	148.347	1264.124	8874.105		

(b) Tandem Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.001	0.000	0.000	0.000	0.000	0.000
14.	0.002	0.000	0.000	0.000	0.000	0.000
16.	0.005	0.001	0.000	0.000	0.000	0.000
18.	0.009	0.003	0.001	0.000	0.000	0.000
20.	0.016	0.008	0.004	0.001	0.002	0.001
22.	0.028	0.019	0.011	0.005	0.010	0.006
24.	0.046	0.041	0.030	0.018	0.037	0.026
26.	0.072	0.083	0.075	0.056	0.129	0.106
28.	0.108	0.157	0.176	0.160	0.408	0.390
30.	0.159	0.284	0.390	0.427	1.193	1.319
32.	0.227	0.494	0.817	1.064	3.261	4.125
34.	0.318	0.830	1.633	2.503	8.388	12.055
36.	0.436	1.351	3.130	5.594	20.446	33.143
38.	0.587	2.139	5.781	11.939	47.499	86.295
40.	0.779	3.303	10.328	24.455	105.659	213.934
42.	1.019	4.987	17.906	48.273	225.944	507.104
44.	1.315	7.378	30.208	92.135	466.204	1154.514
46.	1.677	10.717	49.722	170.580	930.968	2532.489
48.	2.115	15.305	80.005	307.103		

Table 7.9. Load Equivalence Factors for SN=5, Subgrade Modulus=25000 psi. DRY FRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000
6.	0.000	0.000	0.000	0.000	0.000	0.000
8.	0.002	0.000	0.000	0.000	0.000	0.000
10.	0.006	0.001	0.000	0.000	0.000	0.000
12.	0.016	0.005	0.001	0.000	0.000	0.000
14.	0.038	0.017	0.008	0.004	0.002	0.001
16.	0.080	0.052	0.034	0.023	0.015	0.011
18.	0.153	0.139	0.123	0.109	0.095	0.082
20.	0.273	0.332	0.389	0.440	0 480	0.510
22.	0.459	0.729	1.093	1.548	2.074	2.650
24.	0.737	1.489	2 794	4.855	7.834	11.838
26.	1.137	2.863	6.593	13.827	26.456	46.621
28.	1.696	5.230	14.544	36.270	81.222	164.998
30.	2.458	9.142	30 275	88 658	229.763	532.556
32.	3.475	15.379	59.928	203.844	605.379	1587.103
34.	4.805	25.018	113.500	444.160	1498.561	4408.809
36.	6.516	39.515	206.773	923.056	3511.227	11513.750
38.	8.685	60.787	363.875	1839.040	7834.199	28455.390
40.	11.400	91.348	620.873	3528.828	16730.390	66950.930

(b) Tandem Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.000	0.000	0.000	0.000	0.000	0.000
12.	0.001	0.000	0.000	0.000	0.000	0.000
14.	0.003	0.001	0.000	0.000	0.000	0.000
16.	0.005	0.002	0.000	0.000	0.000	0.000
18.	0.010	0.004	0.001	0.000	0.000	0.000
20.	0.017	0.009	0.004	0.002	0.001	0.000
22.	0.027	0.019	0.012	0.006	0.003	0.002
24.	0.043	0.039	0.029	0.019	0.012	0.008
26.	0.066	0.074	0.069	0.055	0.040	0.031
28.	0.097	0.133	0.150	0.142	0.124	0.109
30.	0.139	0.230	0.309	0.347	0.349	0.352
32.	0.195	0.384	0.608	0.795	0.921	1.053
34.	0.267	0.621	1.146	1.729	2.284	2.939
36.	0.360	0.974	2.080	3.592	5.369	7.721
38.	0.477	1.491	3.650	7.162	12.028	19.211
40.	0.623	2.231	6.216	13.761	25.810	45.539
42.	0.803	3.271	10.302	25.576	53.277	103.326
44.	1.023	4.706	16.656	46.117	106.150	225.247
46.	1.288	6.657	26.336	80.906	204.838	473.645
48.	1.605	9.274	40.793	138.405	383.826	963.488

Table 8.1. Load Equivalence Factors for SN=3, Subgrade Modulus=5000 psi.
DRY NFRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
2.	56010.870	54.004	0.045	0.000	0.000	0.000
4.	264231.000	2065.687	12.911	0.158	0.004	0.000
6.	731584.200	22567.920	511.152	18.885	1.329	0.178
8.	1562869.000	134063.800	7758.098	631.358	84.202	18.605
10.	2861640.000	554435.000	66930.310	10021.910	2176.312	702.239
12.	4732017.000	1804686.000	398065.900	97674.620	31365.830	13681.350
14.	7275700.000	4952719.000	1818794.000	674837.600	299850.800	167715.200
16.	10595760.000	11964400.000	6827526.000	3611983.000	2116408.000	1461162.000
18.	14792880.000	26177320.000	22020680.000	15879790.000	11828780.000	9795038.000
20.	19967760.000	52920140.000	62932970.000	59712120.000	54949360.000	53379600.000
22.	26226400.000	100307300.000	162972700.000	197756700.000	219776400.000	245960000.000
24.	33664330.000	180173400.000	388877000.000	589507800.000	776399800.000	986951400.000
26.	42373310.000	309126300.000	865859000.000	1608225000.000	2471518000.000	3524972000.000
28.	52465050.000	510288800.000	1817620000.000	4068202000.000	7200055000.000	11408100000.000
30.	64031950.000	814449900.000	3625723000.000	9641316000.000	19433210000.000	33908220000.000
32.	77180330.000	1262043000.000	6917459000.000	21588840000.000	49076670000.000	93611290000.000
34.	92005950.000	1905482000.000	12692520000.000	45989380000.000	116910700000.000	242229700000.000
36.	108594300.000	2811263000.000	22486680000.000	93705070000.000	264481200000.000	591783400000.000
38.	127057800.000	4063523000.000	38627820000.000	183607300000.000	571456300000.000	1374244000000.000
40.	147476300.000	5764157000.000	64520470000.000	347169300000.000	1184884000000.000	3048420000000.000

(b) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	475649000.000	11037710.000	156545.800	4092.829	252.915	38.283
12.	770433500.000	32116270.000	786415.900	32713.250	2946.137	597.296
14.	1169684000.000	80944200.000	3162379.000	195099.300	24128.870	6247.387
16.	1689819000.000	182726100.000	10739170.000	932033.000	151456.600	48343.910
18.	2347760000.000	378349500.000	31929900.000	3742485.000	772239.600	295844.800
20.	3160603000.000	730593500.000	85307230.000	13069540.000	3333396.000	1500185.000
22.	4145144000.000	1331433000.000	208647800.000	40693980.000	12552220.000	6524060.000
24.	5319176000.000	2311596000.000	474030000.000	115147300.000	42181930.000	24962570.000
26.	6700408000.000	3852256000.000	1011588000.000	300430800.000	128747600.000	85732720.000
28.	8304635000.000	6194061000.000	2045253000.000	731008500.000	361747400.000	268395100.000
30.	10149370000.000	9656680000.000	3946087000.000	1674482000.000	946471900.000	775689700.000
32.	12254990000.000	14652600000.000	7307321000.000	3637671000.000	2326434000.000	2090582000.000
34.	14638560000.000	21709480000.000	13050330000.000	7543492000.000	5412048000.000	5298880000.000
36.	17316470000.000	31477560000.000	22564290000.000	15005320000.000	11989090000.000	12715720000.000
38.	20305920000.000	44772880000.000	37902630000.000	28760900000.000	25423850000.000	29062930000.000
40.	23626590000.000	62586380000.000	62015990000.000	53310130000.000	51839170000.000	63584220000.000
42.	27294200000.000	86139460000.000	99130530000.000	95890500000.000	102015400000.000	133746700000.000
44.	31333330000.000	116849500000.000	155073300000.000	167815900000.000	194419300000.000	271378200000.000
46.	35749360000.000	156466300000.000	237888400000.000	286386000000.000	359760200000.000	533045300000.000
48.	40578780000.000	207019300000.000	358406400000.000	477708400000.000	648090400000.000	1016117000000.000

Table 8.2. Load Equivalence Factors for SN=4, Subgrade Modulus=5000 psi.
DRY NFRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	17009.380	25.659	0.035	0.000	0.000	0.000
4.	84426.310	897.423	7.967	0.133	0.005	0.000
6.	241808.200	9251.422	272.218	12.670	1.073	0.165
8.	529868.100	52643.670	3710.865	360.366	55.360	13.587
10.	990179.200	210435.600	29431.380	5046.301	1221.481	426.695
12.	1665531.000	665925.000	163375.500	44410.580	15490.510	7170.410
14.	2598692.000	1784191.000	704187.900	281646.600	133081.600	77724.750
16.	3833529.000	4220957.000	2513456.000	1400433.000	857198.000	609637.000
18.	5413542.000	9066045.000	7754970.000	5771868.000	4423354.000	3730200.000
20.	7383421.000	18026730.000	21302960.000	20495310.000	19147500.000	18754590.000
22.	9789174.000	33659530.000	53236330.000	64474300.000	71893120.000	80423120.000
24.	12674810.000	59634410.000	122966000.000	183429900.000	239876400.000	302428400.000
26.	16082280.000	101036600.000	265777700.000	479543200.000	724866800.000	1018319000.000
28.	20061470.000	164845100.000	542733500.000	1166403000.000	2013164000.000	3122366000.000
30.	24655230.000	260246200.000	1055435000.000	2665860000.000	5199323000.000	8829755000.000
32.	29912110.000	399182000.000	1966316000.000	5771165000.000	12604240000.000	23278370000.000
34.	35876330.000	596978400.000	3528422000.000	11912650000.000	28901360000.000	57705270000.000
36.	42592800.000	872813300.000	6121971000.000	23566340000.000	63089760000.000	135442700000.000
38.	50111640.000	1250913000.000	10310800000.000	44908290000.000	131824800000.000	302915800000.000
40.	58469240.000	1760077000.000	16904480000.000	82714490000.000	264841000000.000	648582200000.000

(b) Tandem Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	99290650.000	2870019.000	54401.590	1833.760	137.568	23.725
12.	163091400.000	8153084.000	257220.000	13368.970	1425.001	322.706
14.	250624400.000	20127440.000	982072.700	73734.680	10567.070	3006.567
16.	365992700.000	44620570.000	3187021.000	329109.500	60869.470	21058.580
18.	513409200.000	90907920.000	9102962.000	1244658.000	287801.300	118086.300
20.	697228700.000	173000400.000	23460170.000	4120146.000	1161546.000	554115.600
22.	921745900.000	311120800.000	55538670.000	12223760.000	4117196.000	2247751.000
24.	1191541000.000	533623500.000	122478600.000	33099720.000	13097110.000	8074645.000
26.	1511244000.000	879312800.000	254293200.000	82946650.000	38017020.000	26181000.000
28.	1885041000.000	1399166000.000	501275100.000	194458600.000	101997600.000	77743950.000
30.	2317596000.000	2160230000.000	944569000.000	430328500.000	255693900.000	213975200.000
32.	2814062000.000	3248039000.000	1711062000.000	905259000.000	603978200.000	551122900.000
34.	3379349000.000	4770975000.000	2993171000.000	1821582000.000	1353838000.000	1339005000.000
36.	4017580000.000	6862069000.000	5075505000.000	3522360000.000	2896486000.000	3088492000.000
38.	4733739000.000	9685512000.000	8370274000.000	6574153000.000	5944369000.000	6801342000.000
40.	5532897000.000	13440990000.000	13458870000.000	11882250000.000	11751450000.000	14367150000.000
42.	6419644000.000	18370540000.000	21159890000.000	20868800000.000	22459260000.000	29235800000.000
44.	7400153000.000	24755730000.000	32584090000.000	35703000000.000	41630040000.000	57488720000.000
46.	8476807000.000	32940100000.000	49239860000.000	59626820000.000	75029740000.000	109601700000.000
48.	9658548000.000	43318250000.000	73127810000.000	97431320000.000	131807200000.000	203083000000.000

Table 8.3. Load Equivalence Factor for SN=5, Subgrade Modulus=5000 psi. DRY NFRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
2.	7309.777	15.144	0.029	0.000	0.000	0.000
4.	37614.740	497.087	5.659	0.117	0.005	0.000
6.	110344.700	4917.668	174.176	9.549	0.922	0.157
8.	246189.800	27143.850	2200.425	242.202	41.130	10.874
10.	466767.300	105917.200	16440.480	3103.019	811.245	299.804
12.	794663.800	328552.000	86908.430	25405.200	9396.617	4536.652
14.	1252866.000	865438.100	359427.900	151618.800	74838.180	45067.800
16.	1865159.000	2017319.000	1237911.000	715537.300	451769.600	328147.800
18.	2655404.000	4276493.000	3701080.000	2817283.000	2203045.000	1882020.000
20.	3648289.000	8404020.000	9885897.000	9605443.000	9071203.000	8937565.000
22.	4869379.000	15526180.000	24087740.000	29134350.000	32566910.000	36420640.000
24.	6343489.000	27239820.000	54373840.000	80193370.000	104352500.000	130803700.000
26.	8094707.000	45741240.000	115067400.000	203412700.000	303908000.000	422408100.000
28.	10150740.000	74011680.000	230470900.000	481211900.000	815969700.000	1246518000.000
30.	12536740.000	115948100.000	440161000.000	1071878000.000	2042473000.000	3402964000.000
32.	15280430.000	176568900.000	806349500.000	2265684000.000	4809887000.000	8682975000.000
34.	18407360.000	262269300.000	1424316000.000	4573376000.000	10735210000.000	20880010000.000
36.	21943760.000	381019100.000	2434845000.000	8859914000.000	22849050000.000	47635930000.000
38.	25918040.000	542773200.000	4044018000.000	16554410000.000	46622220000.000	103733700000.000
40.	30354170.000	759357100.000	6542979000.000	29929180000.000	91591530000.000	216610900000.000

(b) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	32716010.000	1104856.000	25721.020	1038.067	89.358	16.903
12.	54273340.000	3085833.000	116497.800	7090.727	851.739	208.620
14.	84124080.000	7507296.000	428726.800	36997.810	5886.512	1790.672
16.	123784600.000	16429750.000	1347459.000	157373.800	31904.760	11686.500
18.	174832000.000	33092350.000	3740810.000	570440.900	142988.800	61599.010
20.	238901900.000	62327360.000	9397855.000	1818000.000	550272.400	273591.900
22.	317627900.000	111036000.000	21739400.000	5212279.000	1868611.000	1056343.000
24.	412747700.000	188813100.000	46939690.000	13680790.000	5717495.000	3628955.000
26.	526027000.000	308655600.000	95584170.000	33317640.000	16015760.000	11296420.000
28.	659098800.000	487527900.000	185060700.000	76075480.000	41586680.000	32309690.000
30.	813794800.000	747532700.000	342939600.000	164284300.000	101137800.000	85902110.000
32.	992066300.000	1116614000.000	611577000.000	337803500.000	232268700.000	214251300.000
34.	1195804000.000	1630219000.000	1054304000.000	665402600.000	507094700.000	505182200.000
36.	1426737000.000	2331293000.000	1763278000.000	1261139000.000	1058497000.000	1132986000.000
38.	1686702000.000	3272648000.000	2870175000.000	2309749000.000	2122436000.000	2430068000.000
40.	1977841000.000	4518092000.000	4558446000.000	4100990000.000	4104934000.000	5007409000.000
42.	2301836000.000	6144745000.000	7083220000.000	7081607000.000	7684329000.000	9952960000.000
44.	2661217000.000	8242044000.000	10786440000.000	11921910000.000	13966370000.000	19140600000.000
46.	3057053000.000	10917620000.000	16127190000.000	19608390000.000	24704890000.000	35728120000.000
48.	3492653000.000	14295890000.000	23708340000.000	31576710000.000	42633230000.000	64884870000.000

Table 8.4. Load Equivalence Factors for SN=3, Subgrade Modulus=15000 psi. DRY NFRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
2.	9.716	0.005	0.000	0.000	0.000	0.000
4.	5.955	0.022	0.000	0.000	0.000	0.000
6.	4.075	0.058	0.001	0.000	0.000	0.000
8.	2.979	0.120	0.006	0.000	0.000	0.000
10.	2.275	0.212	0.023	0.004	0.001	0.000
12.	1.794	0.341	0.073	0.021	0.008	0.004
14.	1.450	0.513	0.196	0.090	0.049	0.031
16.	1.195	0.730	0.465	0.322	0.242	0.195
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	0.848	1.326	1.992	2.766	3.565	4.311
22.	0.727	1.712	3.725	6.961	11.272	16.157
24.	0.629	2.164	6.611	16.194	32.254	53.930
26.	0.549	2.684	11.226	35.267	84.888	163.281
28.	0.483	3.279	18.351	72.560	207.914	454.899
30.	0.427	3.950	29.026	142.119	478.636	1179.269
32.	0.380	4.703	44.608	266.716	1043.930	2871.776
34.	0.340	5.541	66.861	482.079	2171.355	6619.867
36.	0.306	6.467	97.945	842.351	4328.836	14529.750
38.	0.276	7.486	140.610	1428.563	8311.215	30538.050
40.	0.250	8.602	198.273	2358.618	15427.950	61724.380

(a) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	285.442	2.252	0.021	0.000	0.000	0.000
12.	246.667	3.555	0.061	0.002	0.000	0.000
14.	215.754	5.275	0.153	0.009	0.001	0.000
16.	190.626	7.463	0.343	0.030	0.005	0.002
18.	169.801	10.173	0.706	0.087	0.020	0.008
20.	152.342	13.458	1.356	0.229	0.068	0.034
22.	137.515	17.365	2.461	0.553	0.205	0.122
24.	124.849	21.947	4.258	1.243	0.565	0.393
26.	113.870	27.253	7.072	2.626	1.444	1.158
28.	104.313	33.331	11.342	5.267	3.449	3.151
30.	95.905	40.222	17.639	10.090	7.769	8.015
32.	88.497	47.984	26.707	18.563	16.632	19.206
34.	81.925	56.662	39.487	32.965	34.035	43.670
36.	76.058	66.292	57.157	56.710	66.905	94.762
38.	70.809	76.940	81.193	94.856	126.896	197.207
40.	66.071	88.611	113.324	154.590	232.958	395.264
42.	61.787	101.400	155.773	246.233	415.310	765.659
44.	57.905	115.286	211.066	383.997	720.976	1438.188
46.	54.375	130.409	282.406	587.430	1221.717	2626.504
48.	51.152	146.703	373.210	882.761	2024.040	4673.262

Table 8.5. Load Equivalence Factors for SN=4, Subgrade Modulus=15000 psi. DRY NFRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	4.209	0.004	0.000	0.000	0.000	0.000
4.	3.208	0.017	0.000	0.000	0.000	0.000
6.	2.549	0.049	0.001	0.000	0.000	0.000
8.	2.088	0.104	0.006	0.001	0.000	0.000
10.	1.751	0.192	0.025	0.004	0.001	0.000
12.	1.494	0.319	0.076	0.024	0.009	0.005
14.	1.293	0.491	0.201	0.097	0.055	0.036
16.	1.132	0.716	0.470	0.334	0.256	0.210
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	0.891	1.350	1.971	2.675	3.388	4.045
22.	0.799	1.773	3.651	6.531	10.232	14.315
24.	0.721	2.275	6.422	14.780	28.085	45.360
26.	0.655	2.863	10.818	31.382	71.146	130.958
28.	0.597	3.544	17.551	63.069	168.228	349.232
30.	0.546	4.322	27.569	120.865	374.843	869.420
32.	0.502	5.206	42.092	222.265	793.059	2038.975
34.	0.463	6.201	62.700	394.126	1603.184	4537.691
36.	0.428	7.313	91.319	676.432	3111.873	9636.785
38.	0.397	8.549	130.380	1127.887	5826.023	19634.410
40.	0.370	9.915	182.893	1832.561	10559.860	38539.110

(b) Tandem Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	131.631	1.436	0.019	0.001	0.000	0.000
12.	121.460	2.326	0.053	0.003	0.000	0.000
14.	112.533	3.530	0.132	0.009	0.001	0.000
16.	104.661	5.096	0.291	0.030	0.006	0.002
18.	97.653	7.073	0.593	0.085	0.022	0.010
20.	91.402	9.511	1.129	0.217	0.070	0.037
22.	85.782	12.457	2.031	0.508	0.202	0.124
24.	80.743	15.963	3.485	1.112	0.535	0.382
26.	76.161	20.077	5.744	2.293	1.316	1.072
28.	72.008	24.850	9.149	4.496	3.037	2.794
30.	68.199	30.326	14.135	8.433	6.626	6.826
32.	64.718	36.560	21.271	15.213	13.765	15.753
34.	61.524	43.604	31.267	26.522	27.388	34.582
36.	58.577	51.499	45.010	44.838	52.430	72.603
38.	55.864	60.308	63.607	73.771	96.989	146.457
40.	53.336	70.055	88.341	118.363	173.887	285.018
42.	50.989	80.818	120.863	185.754	303.137	536.916
44.	48.807	92.612	163.034	285.598	515.132	982.124
46.	46.771	105.541	217.196	431.042	855.276	1748.843
48.	44.867	119.590	285.871	639.443	1389.701	3037.616

Table 8.6. Load Equivalence Factors for SN=5, Subgrade Modulus=15000 psi. DRY NFRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
2.	2.327	0.003	0.000	0.000	0.000	0.000
4.	2.070	0.015	0.000	0.000	0.000	0.000
6.	1.828	0.043	0.001	0.000	0.000	0.000
8.	1.624	0.095	0.007	0.001	0.000	0.001
10.	1.454	0.179	0.026	0.005	0.001	0.006
12.	1.312	0.304	0.078	0.026	0.011	0.040
14.	1.192	0.476	0.205	0.103	0.060	0.221
16.	1.089	0.706	0.474	0.343	0.267	1.000
18.	1.000	1.000	1.000	1.000	1.000	3.866
20.	0.923	1.368	1.956	2.612	3.268	13.138
22.	0.855	1.818	3.599	6.242	9.555	40.126
24.	0.795	2.358	6.292	13.853	25.462	112.013
26.	0.741	2.997	10.538	28.888	62.778	289.593
28.	0.693	3.744	17.006	57.099	144.784	700.573
30.	0.650	4.607	26.580	107.754	315.237	1599.728
32.	0.611	5.595	40.395	195.309	652.718	3472.471
34.	0.576	6.716	59.910	341.689	1293.158	7204.266
36.	0.544	7.979	86.897	579.011	2462.988	14358.770
38.	0.515	9.393	123.588	953.922	4529.699	27604.580
40.	0.488	10.965	172.727	1532.295	8072.777	

(b) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	76.059	1.043	0.017	0.001	0.000	0.000
12.	73.525	1.722	0.048	0.003	0.000	0.000
14.	70.956	2.656	0.118	0.010	0.002	0.000
16.	68.436	3.889	0.260	0.030	0.007	0.002
18.	65.988	5.467	0.525	0.083	0.023	0.011
20.	63.645	7.436	0.992	0.208	0.071	0.039
22.	61.406	9.844	1.772	0.478	0.200	0.126
24.	59.294	12.738	3.024	1.027	0.514	0.374
26.	57.280	16.167	4.957	2.083	1.232	1.015
28.	55.377	20.181	7.856	4.019	2.775	2.566
30.	53.561	24.825	12.081	7.426	5.919	6.092
32.	51.848	30.154	18.101	13.211	12.038	13.691
34.	50.227	36.218	26.499	22.732	23.479	29.314
36.	48.683	43.063	37.999	37.958	44.112	60.118
38.	47.225	50.751	53.502	61.727	80.169	118.627
40.	45.831	59.312	74.047	97.954	141.353	226.089
42.	44.503	68.821	100.967	152.110	242.529	417.570
44.	43.239	79.301	135.768	231.538	405.945	749.569
46.	42.037	90.852	180.318	346.125	664.346	1311.051
48.	40.888	103.469	236.635	508.757	1064.683	2238.559

Table 8.7. Load Equivalence Factors for SN=3, Subgrade Modulus=25000 psi. DRY NFRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.212	0.000	0.000	0.000	0.000	0.000
4.	0.054	0.000	0.000	0.000	0.000	0.000
6.	0.020	0.000	0.000	0.000	0.000	0.000
8.	0.009	0.000	0.000	0.000	0.000	0.000
10.	0.005	0.000	0.000	0.000	0.000	0.000
12.	0.003	0.000	0.000	0.000	0.000	0.000
14.	0.002	0.000	0.000	0.000	0.000	0.000
16.	0.001	0.000	0.000	0.000	0.000	0.000
18.	0.001	0.000	0.001	0.001	0.001	0.001
20.	0.000	0.001	0.001	0.001	0.002	0.003
22.	0.000	0.001	0.001	0.003	0.006	0.009
24.	0.000	0.001	0.002	0.006	0.015	0.028
26.	0.000	0.001	0.003	0.012	0.036	0.079
28.	0.000	0.001	0.005	0.023	0.080	0.202
30.	0.000	0.001	0.006	0.040	0.170	0.484
32.	0.000	0.001	0.009	0.069	0.341	1.099
34.	0.000	0.001	0.012	0.114	0.659	2.370
36.	0.000	0.001	0.016	0.184	1.224	4.892
38.	0.000	0.001	0.020	0.289	2.199	9.704
40.	0.000	0.001	0.026	0.442	3.835	18.576

(b) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	0.737	0.004	0.000	0.000	0.000	0.000
12.	0.476	0.005	0.000	0.000	0.000	0.000
14.	0.322	0.005	0.000	0.000	0.000	0.000
16.	0.225	0.006	0.000	0.000	0.000	0.000
18.	0.163	0.007	0.000	0.000	0.000	0.000
20.	0.120	0.007	0.001	0.000	0.000	0.000
22.	0.091	0.008	0.001	0.000	0.000	0.000
24.	0.070	0.009	0.002	0.001	0.000	0.000
26.	0.054	0.009	0.002	0.001	0.001	0.001
28.	0.043	0.010	0.003	0.002	0.001	0.001
30.	0.034	0.010	0.005	0.003	0.003	0.003
32.	0.028	0.011	0.006	0.005	0.005	0.007
34.	0.023	0.012	0.009	0.008	0.010	0.014
36.	0.019	0.012	0.011	0.013	0.018	0.029
38.	0.016	0.013	0.015	0.020	0.032	0.057
40.	0.013	0.013	0.019	0.031	0.056	0.108
42.	0.011	0.014	0.024	0.046	0.093	0.198
44.	0.009	0.014	0.030	0.067	0.154	0.354
46.	0.008	0.015	0.037	0.096	0.247	0.618
48.	0.007	0.015	0.046	0.137	0.389	1.053

Table 8.8. Load Equivalence Factors for SN=4, Subgrade Modulus=25000 psi. DRY NFRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness$_3$ (in.) 1	2	3	4	5	6
2.	0.106	0.000	0.000	0.000	0.000	0.000
4.	0.035	0.000	0.000	0.000	0.000	0.000
6.	0.016	0.000	0.000	0.000	0.000	0.000
8.	0.008	0.000	0.000	0.000	0.000	0.000
10.	0.005	0.000	0.000	0.000	0.000	0.000
12.	0.003	0.000	0.000	0.000	0.000	0.000
14.	0.002	0.001	0.000	0.000	0.000	0.000
16.	0.001	0.001	0.000	0.000	0.000	0.000
18.	0.001	0.001	0.001	0.001	0.001	0.001
20.	0.001	0.001	0.001	0.002	0.003	0.004
22.	0.001	0.001	0.002	0.005	0.008	0.013
24.	0.000	0.001	0.003	0.009	0.020	0.037
26.	0.000	0.001	0.005	0.018	0.047	0.097
28.	0.000	0.001	0.007	0.032	0.102	0.241
30.	0.000	0.001	0.010	0.056	0.210	0.557
32.	0.000	0.001	0.014	0.094	0.413	1.224
34.	0.000	0.001	0.019	0.153	0.778	2.560
36.	0.000	0.002	0.025	0.244	1.415	5.132
38.	0.000	0.002	0.032	0.378	2.492	9.908
40.	0.000	0.002	0.042	0.573	4.261	18.483

(b) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	0.458	0.003	0.000	0.000	0.000	0.000
12.	0.323	0.004	0.000	0.000	0.000	0.000
14.	0.236	0.005	0.000	0.000	0.000	0.000
16.	0.177	0.006	0.000	0.000	0.000	0.000
18.	0.136	0.007	0.001	0.000	0.000	0.000
20.	0.107	0.008	0.001	0.000	0.000	0.000
22.	0.085	0.009	0.001	0.000	0.000	0.000
24.	0.069	0.010	0.002	0.001	0.000	0.000
26.	0.056	0.011	0.003	0.001	0.001	0.001
28.	0.046	0.012	0.004	0.002	0.002	0.002
30.	0.039	0.013	0.006	0.004	0.004	0.004
32.	0.032	0.014	0.008	0.007	0.007	0.009
34.	0.027	0.015	0.011	0.011	0.013	0.018
36.	0.023	0.016	0.015	0.017	0.023	0.035
38.	0.020	0.017	0.019	0.026	0.040	0.067
40.	0.017	0.018	0.025	0.039	0.067	0.125
42.	0.015	0.019	0.031	0.058	0.111	0.224
44.	0.013	0.020	0.039	0.083	0.180	0.391
46.	0.012	0.021	0.049	0.119	0.284	0.667
48.	0.010	0.022	0.060	0.167	0.440	1.112

Table 8.9. Load Equivalence Factors for SN=5, Subgrade Modulus= 25000 psi. DRY NFRZ Zone, based on Rutting.

(a) Single Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
2.	0.064	0.000	0.000	0.000	0.000	0.000
4.	0.027	0.000	0.000	0.000	0.000	0.000
6.	0.014	0.000	0.000	0.000	0.000	0.000
8.	0.008	0.000	0.000	0.000	0.000	0.000
10.	0.005	0.000	0.000	0.000	0.000	0.000
12.	0.003	0.001	0.000	0.000	0.000	0.000
14.	0.002	0.001	0.000	0.000	0.000	0.000
16.	0.002	0.001	0.001	0.000	0.000	0.000
18.	0.001	0.001	0.001	0.001	0.001	0.001
20.	0.001	0.001	0.002	0.003	0.004	0.005
22.	0.001	0.001	0.003	0.006	0.010	0.016
24.	0.001	0.002	0.005	0.012	0.025	0.044
26.	0.000	0.002	0.007	0.022	0.057	0.113
28.	0.000	0.002	0.010	0.040	0.121	0.272
30.	0.000	0.002	0.014	0.070	0.245	0.616
32.	0.000	0.002	0.019	0.116	0.473	1.321
34.	0.000	0.002	0.026	0.189	0.876	2.703
36.	0.000	0.003	0.034	0.297	1.569	5.310
38.	0.000	0.003	0.045	0.458	2.722	10.055
40.	0.000	0.003	0.058	0.689	4.592	18.418

(b) Tandem Axle

Axle Load	Surface Thickness (in.) 1	2	3	4	5	6
10.	0.326	0.003	0.000	0.000	0.000	0.000
12.	0.245	0.004	0.000	0.000	0.000	0.000
14.	0.189	0.005	0.000	0.000	0.000	0.000
16.	0.149	0.006	0.000	0.000	0.000	0.000
18.	0.120	0.007	0.001	0.000	0.000	0.000
20.	0.098	0.008	0.001	0.000	0.000	0.000
22.	0.081	0.010	0.002	0.000	0.000	0.000
24.	0.068	0.011	0.003	0.001	0.000	0.000
26.	0.057	0.012	0.004	0.002	0.001	0.001
28.	0.049	0.013	0.005	0.003	0.002	0.002
30.	0.042	0.015	0.007	0.005	0.004	0.005
32.	0.036	0.016	0.010	0.008	0.008	0.010
34.	0.031	0.018	0.013	0.013	0.015	0.021
36.	0.027	0.019	0.018	0.020	0.027	0.041
38.	0.024	0.020	0.023	0.031	0.046	0.076
40.	0.021	0.022	0.030	0.046	0.077	0.138
42.	0.019	0.023	0.038	0.068	0.126	0.244
44.	0.017	0.025	0.048	0.097	0.201	0.419
46.	0.015	0.027	0.059	0.138	0.314	0.704
48.	0.014	0.028	0.073	0.192	0.481	1.155

APPENDIX 4

Tables of Load Equivalence Factors Based on Cracking

Table 9.1. Load Equivalence Factors for SN=3, Subgrade Modulus=5000 psi. WET FRZ Zone, based on Cracking.

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.001	0.001	0.001	0.001	0.001	0.001
4.	0.010	0.009	0.008	0.008	0.007	0.007
6.	0.042	0.040	0.038	0.036	0.034	0.032
8.	0.128	0.123	0.118	0.113	0.109	0.104
10.	0.311	0.300	0.291	0.282	0.273	0.265
12.	0.648	0.631	0.616	0.602	0.589	0.576
14.	1.215	1.191	1.172	1.155	1.137	1.120
16.	2.105	2.077	2.057	2.039	2.021	2.003
18.	3.429	3.402	3.390	3.380	3.369	3.357
20.	5.317	5.303	5.312	5.325	5.335	5.341
22.	7.922	7.938	7.990	8.047	8.100	8.145
24.	11.414	11.486	11.615	11.749	11.876	11.991
26.	15.987	16.154	16.402	16.660	16.906	17.134
28.	21.858	22.169	22.598	23.039	23.465	23.864
30.	29.265	29.786	30.472	31.178	31.862	32.510
32.	38.469	39.286	40.328	41.398	42.443	43.438
34.	49.758	50.975	52.495	54.058	55.589	57.055
36.	63.443	65.188	67.337	69.548	71.721	73.813
38.	79.858	82.289	85.248	88.294	91.299	94.204
40.	99.365	102.668	106.652	110.759	114.823	118.766

(b) Tandem Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.034	0.031	0.028	0.026	0.023	0.021
12.	0.067	0.062	0.057	0.052	0.048	0.044
14.	0.121	0.113	0.104	0.096	0.089	0.081
16.	0.204	0.191	0.178	0.165	0.153	0.141
18.	0.325	0.306	0.286	0.267	0.248	0.231
20.	0.496	0.468	0.440	0.413	0.386	0.360
22.	0.729	0.691	0.652	0.614	0.576	0.539
24.	1.039	0.987	0.935	0.884	0.833	0.783
26.	1.442	1.374	1.306	1.239	1.172	1.106
28.	1.956	1.869	1.783	1.697	1.610	1.524
30.	2.601	2.492	2.385	2.276	2.167	2.058
32.	3.399	3.265	3.133	3.000	2.865	2.729
34.	4.374	4.211	4.053	3.892	3.727	3.560
36.	5.552	5.358	5.170	4.978	4.780	4.578
38.	6.961	6.732	6.513	6.287	6.052	5.811
40.	8.630	8.364	8.112	7.850	7.575	7.290
42.	10.593	10.288	10.000	9.700	9.383	9.050
44.	12.883	12.537	12.214	11.874	11.511	11.126
46.	15.538	15.149	14.790	14.410	13.999	13.560
48.	18.596	18.164	17.770	17.350	16.889	16.391

Table 9.2. Load Equivelance Factors for SN=4, Subgrade Modulus=5000 psi. WET FRZ Zone, based on Cracking.

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.001	0.001	0.001	0.001	0.001	0.001
4.	0.009	0.009	0.008	0.008	0.007	0.007
6.	0.042	0.040	0.038	0.036	0.034	0.032
8.	0.129	0.124	0.118	0.114	0.109	0.105
10.	0.313	0.303	0.293	0.284	0.275	0.267
12.	0.655	0.637	0.622	0.608	0.594	0.581
14.	1.231	1.206	1.186	1.168	1.149	1.131
16.	2.137	2.105	2.084	2.065	2.045	2.025
18.	3.487	3.454	3.438	3.426	3.412	3.396
20.	5.416	5.390	5.394	5.402	5.407	5.408
22.	8.079	8.076	8.120	8.171	8.217	8.254
24.	11.653	11.697	11.813	11.938	12.056	12.160
26.	16.339	16.464	16.695	16.939	17.173	17.385
28.	22.359	22.611	23.016	23.440	23.849	24.228
30.	29.960	30.400	31.055	31.739	32.401	33.021
32.	39.412	40.121	41.122	42.165	43.181	44.141
34.	51.012	52.088	53.556	55.085	56.581	58.004
36.	65.083	66.646	68.731	70.900	73.031	75.069
38.	81.970	84.171	87.050	90.047	93.002	95.841
40.	102.049	105.064	108.952	113.002	117.006	120.870

(b) Tandem Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.033	0.031	0.028	0.026	0.023	0.021
12.	0.066	0.062	0.057	0.052	0.048	0.044
14.	0.120	0.113	0.105	0.097	0.089	0.082
16.	0.204	0.191	0.179	0.166	0.154	0.142
18.	0.325	0.307	0.288	0.269	0.250	0.232
20.	0.497	0.471	0.443	0.415	0.388	0.362
22.	0.732	0.695	0.657	0.618	0.580	0.543
24.	1.045	0.995	0.943	0.892	0.840	0.789
26.	1.452	1.386	1.319	1.251	1.183	1.115
28.	1.972	1.887	1.801	1.714	1.626	1.538
30.	2.625	2.517	2.411	2.301	2.190	2.078
32.	3.434	3.301	3.169	3.035	2.897	2.756
34.	4.423	4.261	4.102	3.939	3.770	3.597
36.	5.619	5.424	5.236	5.041	4.838	4.628
38.	7.050	6.819	6.599	6.369	6.128	5.877
40.	8.747	8.478	8.223	7.956	7.673	7.376
42.	10.744	10.433	10.142	9.836	9.507	9.160
44.	13.075	12.720	12.392	12.045	11.668	11.265
46.	15.779	15.377	15.013	14.623	14.195	13.733
48.	18.895	18.446	18.045	17.612	17.131	16.606

Table 9.3. Load Equivalence Factors for SN=5, Subgrade Modulus=5000 psi. WET FRZ Zone, based on Cracking.

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.001	0.001	0.001	0.001	0.001	0.001
4.	0.009	0.009	0.008	0.008	0.007	0.007
6.	0.042	0.040	0.038	0.036	0.034	0.032
8.	0.130	0.124	0.119	0.114	0.110	0.105
10.	0.316	0.305	0.295	0.286	0.277	0.269
12.	0.662	0.644	0.628	0.614	0.600	0.586
14.	1.247	1.220	1.199	1.180	1.161	1.141
16.	2.168	2.133	2.110	2.089	2.068	2.045
18.	3.543	3.503	3.484	3.469	3.453	3.434
20.	5.511	5.473	5.471	5.475	5.477	5.473
22.	8.230	8.208	8.245	8.289	8.328	8.359
24.	11.884	11.899	12.003	12.120	12.228	12.321
26.	16.678	16.761	16.975	17.208	17.428	17.626
28.	22.842	23.036	23.417	23.826	24.217	24.576
30.	30.630	30.992	31.615	32.277	32.917	33.511
32.	40.323	40.925	41.885	42.901	43.889	44.816
34.	52.225	53.160	54.577	56.072	57.533	58.913
36.	66.669	68.052	70.072	72.200	74.288	76.273
38.	84.014	85.986	88.786	91.734	94.637	97.411
40.	104.647	107.376	111.168	115.159	119.103	122.890

(b) Tandem Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.034	0.031	0.028	0.026	0.023	0.021
12.	0.067	0.062	0.057	0.052	0.048	0.044
14.	0.121	0.113	0.104	0.096	0.088	0.081
16.	0.204	0.191	0.177	0.164	0.152	0.141
18.	0.325	0.305	0.285	0.265	0.247	0.229
20.	0.495	0.466	0.437	0.410	0.383	0.357
22.	0.726	0.686	0.647	0.608	0.571	0.536
24.	1.033	0.980	0.927	0.876	0.825	0.777
26.	1.432	1.362	1.294	1.226	1.160	1.096
28.	1.940	1.851	1.764	1.678	1.593	1.510
30.	2.576	2.465	2.358	2.250	2.143	2.038
32.	3.363	3.227	3.096	2.964	2.832	2.700
34.	4.323	4.160	4.002	3.843	3.682	3.521
36.	5.482	5.288	5.101	4.912	4.720	4.525
38.	6.868	6.640	6.423	6.201	5.973	5.742
40.	8.508	8.246	7.995	7.739	7.473	7.200
42.	10.436	10.136	9.852	9.559	9.252	8.935
44.	12.683	12.345	12.027	11.696	11.347	10.981
46.	15.287	14.910	14.558	14.188	13.794	13.378
48.	18.285	17.869	17.484	17.076	16.637	16.167

Table 9.4. Load Equivalence Factors for SN=3, Subgrade Modulus=15000 psi. WET FRZ Zone, based on Cracking.

(a) Single Axle

Axle Load	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.003	0.003	0.003	0.003	0.002	0.002
6.	0.013	0.013	0.012	0.011	0.011	0.010
8.	0.039	0.038	0.036	0.035	0.034	0.032
10.	0.094	0.091	0.089	0.086	0.084	0.082
12.	0.193	0.190	0.186	0.182	0.179	0.175
14.	0.359	0.355	0.351	0.346	0.342	0.338
16.	0.618	0.614	0.611	0.607	0.604	0.600
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.542	1.550	1.558	1.566	1.574	1.582
22.	2.285	2.308	2.331	2.355	2.378	2.401
24.	3.278	3.324	3.373	3.423	3.471	3.519
26.	4.572	4.656	4.744	4.833	4.921	5.009
28.	6.228	6.365	6.510	6.657	6.804	6.950
30.	8.309	8.522	8.748	8.977	9.207	9.435
32.	10.888	11.203	11.539	11.880	12.224	12.567
34.	14.042	14.493	14.974	15.466	15.962	16.458
36.	17.854	18.482	19.153	19.840	20.535	21.232
38.	22.416	23.268	24.182	25.119	26.070	27.026
40.	27.824	28.958	30.177	31.430	32.705	33.989

(b) Tandem Axle

Axle Load	Surface Thickenss (in.)					
	1	2	3	4	5	6
10.	0.020	0.018	0.016	0.015	0.013	0.012
12.	0.038	0.035	0.032	0.029	0.027	0.024
14.	0.068	0.063	0.058	0.053	0.049	0.045
16.	0.114	0.105	0.098	0.090	0.083	0.077
18.	0.179	0.167	0.156	0.145	0.135	0.125
20.	0.271	0.254	0.238	0.222	0.207	0.193
22.	0.395	0.371	0.349	0.328	0.307	0.287
24.	0.558	0.527	0.498	0.469	0.442	0.415
26.	0.769	0.729	0.691	0.654	0.618	0.582
28.	1.036	0.985	0.938	0.891	0.845	0.799
30.	1.369	1.307	1.248	1.190	1.132	1.074
32.	1.780	1.704	1.632	1.561	1.490	1.418
34.	2.278	2.188	2.102	2.017	1.930	1.842
36.	2.878	2.771	2.671	2.570	2.466	2.360
38.	3.593	3.468	3.352	3.233	3.111	2.985
40.	4.436	4.292	4.160	4.023	3.881	3.733
42.	5.424	5.261	5.111	4.955	4.791	4.620
44.	6.572	6.389	6.222	6.047	5.860	5.663
46.	7.899	7.696	7.511	7.317	7.107	6.882
48.	9.423	9.200	8.999	8.784	8.550	8.297

Table 9.5. Load Equivalence Factors for SN=4, SubgradeModulus=15000 psi. WET FRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.003	0.003	0.003	0.002	0.002	0.002
6.	0.013	0.012	0.012	0.011	0.011	0.010
8.	0.039	0.038	0.036	0.035	0.034	0.032
10.	0.093	0.091	0.088	0.086	0.084	0.081
12.	0.193	0.189	0.186	0.182	0.178	0.175
14.	0.359	0.355	0.350	0.346	0.342	0.338
16.	0.617	0.614	0.610	0.607	0.604	0.600
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.543	1.551	1.559	1.567	1.575	1.583
22.	2.290	2.311	2.334	2.357	2.381	2.404
24.	3.287	3.331	3.379	3.427	3.476	3.524
26.	4.588	4.668	4.754	4.841	4.929	5.017
28.	6.253	6.385	6.527	6.672	6.818	6.964
30.	8.349	8.552	8.773	9.000	9.228	9.457
32.	10.946	11.248	11.577	11.914	12.256	12.599
34.	14.123	14.556	15.028	15.514	16.008	16.504
36.	17.967	18.569	19.228	19.907	20.600	21.298
38.	22.568	23.387	24.283	25.211	26.159	27.116
40.	28.025	29.116	30.312	31.553	32.823	34.109

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.020	0.018	0.016	0.015	0.013	0.012
12.	0.039	0.035	0.032	0.030	0.027	0.025
14.	0.069	0.064	0.059	0.054	0.049	0.045
16.	0.115	0.107	0.099	0.091	0.084	0.078
18.	0.181	0.169	0.158	0.147	0.136	0.126
20.	0.274	0.257	0.241	0.225	0.210	0.195
22.	0.399	0.376	0.354	0.332	0.311	0.291
24.	0.565	0.534	0.504	0.476	0.447	0.420
26.	0.778	0.738	0.701	0.663	0.626	0.589
28.	1.049	0.999	0.951	0.904	0.856	0.809
30.	1.388	1.325	1.266	1.207	1.147	1.087
32.	1.805	1.728	1.656	1.584	1.510	1.435
34.	2.311	2.219	2.133	2.046	1.957	1.865
36.	2.921	2.812	2.711	2.607	2.500	2.390
38.	3.647	3.520	3.402	3.281	3.155	3.023
40.	4.505	4.358	4.223	4.083	3.936	3.781
42.	5.509	5.342	5.189	5.030	4.860	4.680
44.	6.678	6.489	6.319	6.139	5.945	5.738
46.	8.028	7.818	7.629	7.429	7.210	6.974
48.	9.579	9.347	9.142	8.921	8.676	8.409

Table 9.6. Load Equivalence Factors for SN=5, Subgrade Modulus=15000 psi. WET FRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.003	0.003	0.003	0.002	0.002	0.002
6.	0.013	0.012	0.012	0.011	0.011	0.010
8.	0.039	0.037	0.036	0.035	0.033	0.032
10.	0.093	0.091	0.088	0.086	0.083	0.081
12.	0.192	0.189	0.185	0.182	0.178	0.175
14.	0.358	0.354	0.350	0.346	0.341	0.337
16.	0.617	0.613	0.610	0.607	0.603	0.600
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.545	1.552	1.560	1.568	1.576	1.584
22.	2.294	2.314	2.337	2.360	2.383	2.406
24.	3.295	3.337	3.384	3.432	3.480	3.528
26.	4.603	4.679	4.763	4.850	4.937	5.025
28.	6.278	6.403	6.542	6.686	6.831	6.977
30.	8.386	8.581	8.797	9.021	9.249	9.477
32.	11.000	11.290	11.612	11.946	12.287	12.630
34.	14.201	14.616	15.079	15.560	16.052	16.548
36.	18.074	18.653	19.299	19.972	20.661	21.359
38.	22.712	23.500	24.380	25.299	26.243	27.201
40.	28.216	29.266	30.440	31.670	32.935	34.223

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.020	0.018	0.016	0.015	0.013	0.012
12.	0.038	0.035	0.032	0.029	0.026	0.024
14.	0.068	0.062	0.057	0.053	0.048	0.044
16.	0.113	0.104	0.096	0.089	0.082	0.076
18.	0.177	0.165	0.154	0.143	0.133	0.123
20.	0.268	0.251	0.234	0.219	0.205	0.191
22.	0.390	0.366	0.345	0.323	0.303	0.284
24.	0.551	0.520	0.491	0.463	0.436	0.410
26.	0.759	0.719	0.681	0.645	0.610	0.575
28.	1.022	0.972	0.924	0.878	0.833	0.789
30.	1.350	1.288	1.230	1.173	1.116	1.060
32.	1.754	1.678	1.608	1.538	1.469	1.400
34.	2.244	2.155	2.070	1.987	1.902	1.818
36.	2.834	2.729	2.630	2.531	2.430	2.329
38.	3.536	3.414	3.299	3.184	3.065	2.945
40.	4.365	4.225	4.094	3.961	3.823	3.682
42.	5.335	5.176	5.029	4.877	4.720	4.556
44.	6.462	6.285	6.121	5.951	5.772	5.585
46.	7.765	7.569	7.388	7.199	6.998	6.786
48.	9.260	9.047	8.850	8.643	8.419	8.181

Table 9.7. Load Equivalence Factors for SN=3, SubgradeModulus=25000 psi. WET FRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.002	0.002	0.001	0.001	0.001	0.001
6.	0.007	0.007	0.006	0.006	0.006	0.005
8.	0.020	0.019	0.019	0.018	0.018	0.017
10.	0.047	0.046	0.045	0.044	0.043	0.042
12.	0.095	0.094	0.093	0.092	0.091	0.089
14.	0.174	0.174	0.173	0.172	0.171	0.170
16.	0.295	0.298	0.299	0.299	0.299	0.300
18.	0.473	0.481	0.484	0.487	0.491	0.495
20.	0.723	0.738	0.748	0.757	0.766	0.776
22.	1.062	1.091	1.111	1.129	1.148	1.169
24.	1.513	1.560	1.595	1.629	1.664	1.703
26.	2.096	2.170	2.228	2.285	2.344	2.408
28.	2.837	2.949	3.039	3.128	3.222	3.323
30.	3.763	3.926	4.060	4.194	4.336	4.487
32.	4.905	5.133	5.326	5.521	5.726	5.946
34.	6.294	6.607	6.877	7.150	7.440	7.751
36.	7.965	8.385	8.753	9.129	9.528	9.956
38.	9.955	10.509	11.002	11.505	12.042	12.620
40.	12.305	13.023	13.670	14.334	15.044	15.808

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.019	0.017	0.016	0.014	0.013	0.011
12.	0.037	0.034	0.031	0.028	0.025	0.023
14.	0.065	0.060	0.055	0.050	0.046	0.042
16.	0.107	0.099	0.091	0.084	0.078	0.072
18.	0.167	0.155	0.145	0.134	0.125	0.115
20.	0.250	0.234	0.219	0.205	0.191	0.178
22.	0.362	0.340	0.320	0.300	0.281	0.263
24.	0.509	0.480	0.453	0.428	0.402	0.378
26.	0.697	0.660	0.626	0.593	0.560	0.528
28.	0.933	0.888	0.846	0.804	0.762	0.720
30.	1.227	1.172	1.120	1.068	1.016	0.964
32.	1.587	1.521	1.458	1.395	1.332	1.268
34.	2.023	1.945	1.871	1.795	1.719	1.641
36.	2.544	2.454	2.367	2.279	2.188	2.095
38.	3.162	3.059	2.960	2.857	2.751	2.641
40.	3.889	3.773	3.660	3.543	3.420	3.292
42.	4.738	4.608	4.482	4.350	4.209	4.062
44.	5.721	5.578	5.439	5.292	5.133	4.964
46.	6.853	6.698	6.547	6.384	6.207	6.016
48.	8.148	7.982	7.821	7.643	7.447	7.234

Table 9.8. Load Equivalence Factors for SN=4, Subgrade Modulus=25000 psi. WET FRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.002	0.002	0.001	0.001	0.001	0.001
6.	0.007	0.006	0.006	0.006	0.006	0.005
8.	0.019	0.019	0.018	0.018	0.017	0.017
10.	0.045	0.045	0.044	0.043	0.042	0.041
12.	0.091	0.092	0.091	0.089	0.088	0.087
14.	0.168	0.169	0.169	0.168	0.167	0.166
16.	0.285	0.289	0.290	0.291	0.291	0.292
18.	0.456	0.466	0.470	0.474	0.478	0.482
20.	0.697	0.715	0.726	0.735	0.745	0.757
22.	1.024	1.056	1.077	1.096	1.117	1.140
24.	1.458	1.509	1.546	1.581	1.618	1.659
26.	2.020	2.099	2.158	2.216	2.278	2.345
28.	2.734	2.851	2.942	3.032	3.129	3.234
30.	3.627	3.794	3.929	4.064	4.208	4.366
32.	4.726	4.960	5.152	5.347	5.556	5.784
34.	6.063	6.382	6.650	6.923	7.217	7.537
36.	7.672	8.098	8.462	8.835	9.238	9.678
38.	9.588	10.147	10.632	11.132	11.673	12.264
40.	11.850	12.572	13.207	13.864	14.577	15.358

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.019	0.018	0.016	0.014	0.013	0.012
12.	0.037	0.034	0.031	0.028	0.026	0.023
14.	0.066	0.060	0.056	0.051	0.047	0.043
16.	0.108	0.100	0.093	0.086	0.079	0.073
18.	0.169	0.158	0.147	0.136	0.126	0.117
20.	0.254	0.237	0.222	0.208	0.193	0.180
22.	0.367	0.345	0.325	0.305	0.285	0.266
24.	0.515	0.487	0.460	0.433	0.408	0.382
26.	0.706	0.669	0.635	0.601	0.567	0.534
28.	0.945	0.900	0.857	0.814	0.772	0.729
30.	1.243	1.188	1.135	1.083	1.029	0.975
32.	1.607	1.541	1.478	1.414	1.349	1.282
34.	2.048	1.970	1.896	1.819	1.740	1.660
36.	2.576	2.485	2.398	2.309	2.215	2.119
38.	3.202	3.098	2.998	2.894	2.785	2.671
40.	3.938	3.821	3.708	3.589	3.462	3.329
42.	4.797	4.666	4.540	4.405	4.260	4.106
44.	5.792	5.648	5.509	5.359	5.195	5.019
46.	6.937	6.781	6.630	6.464	6.281	6.082
48.	8.248	8.081	7.919	7.738	7.535	7.312

Table 9.9. Load Equivalence Factors for SN=5, Subgrade Modulus=25000 psi. WET FRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.002	0.001	0.001	0.001	0.001	0.001
6.	0.006	0.006	0.006	0.006	0.006	0.005
8.	0.019	0.018	0.018	0.017	0.017	0.016
10.	0.044	0.044	0.043	0.042	0.041	0.040
12.	0.088	0.089	0.088	0.087	0.086	0.086
14.	0.162	0.164	0.164	0.164	0.163	0.163
16.	0.275	0.281	0.282	0.283	0.284	0.286
18.	0.441	0.452	0.457	0.461	0.466	0.471
20.	0.674	0.694	0.705	0.715	0.726	0.739
22.	0.990	1.024	1.045	1.066	1.088	1.112
24.	1.409	1.463	1.500	1.536	1.575	1.618
26.	1.951	2.034	2.094	2.153	2.216	2.287
28	2.641	2.762	2.854	2.945	3.044	3 153
30.	3.502	3.674	3.809	3.945	4.092	4.255
32.	4.563	4.802	4.994	5.188	5.400	5.635
34.	5.853	6.177	6.443	6.715	7.012	7.340
36.	7.406	7.836	8.196	8.567	8.973	9.422
38.	9.254	9.817	10.295	10.790	11.334	11.937
40.	11.436	12.160	12.784	13.434	14.150	14.945

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.019	0.017	0.015	0.014	0.013	0.011
12.	0.036	0.033	0.030	0.027	0.025	0.023
14.	0.064	0.059	0.054	0.049	0.045	0.042
16.	0.105	0.097	0.090	0.083	0.077	0.071
18.	0.165	0.153	0.142	0.132	0.123	0.114
20.	0.247	0.231	0.216	0.202	0.188	0.175
22.	0.357	0.336	0.315	0.296	0.277	0.260
24.	0.502	0.473	0.447	0.421	0.397	0.373
26.	0.687	0.651	0.617	0.584	0.552	0.521
28.	0.921	0.876	0.834	0.792	0.751	0.712
30.	1.211	1.156	1.104	1.053	1.002	0.952
32.	1.566	1.500	1.438	1.376	1.314	1.253
34.	1.996	1.919	1.845	1.771	1.696	1.622
36.	2.511	2.421	2.335	2.248	2.159	2.070
38.	3.121	3.018	2.919	2.819	2.715	2.610
40.	3.839	3.723	3.611	3.496	3.376	3.254
42.	4.676	4.547	4.422	4.292	4.156	4.015
44.	5.646	5.505	5.367	5.222	5.069	4.907
46.	6.764	6.610	6.460	6.301	6.129	5.948
48.	8.043	7.879	7.718	7.544	7.355	7.152

Table 10.1. Load Equivalence Factors for SN=3, Subgrade Modulus=5000 psi. WET NFRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.001	0.001	0.001	0.001	0.001	0.001
4.	0.010	0.009	0.008	0.007	0.006	0.006
6.	0.039	0.036	0.032	0.030	0.028	0.026
8.	0.107	0.100	0.093	0.087	0.082	0.078
10.	0.238	0.227	0.216	0.206	0.197	0.190
12.	0.466	0.450	0.435	0.421	0.409	0.398
14.	0.826	0.809	0.793	0.777	0.762	0.749
16.	1.363	1.351	1.339	1.326	1.315	1.304
18.	2.128	2.131	2.133	2.133	2.134	2.135
20.	3.176	3.210	3.242	3.272	3.300	3.325
22.	4.569	4.659	4.745	4.826	4.903	4.975
24.	6.377	6.553	6.726	6.891	7.048	7.196
26.	8.674	8.979	9.281	9.573	9.852	10.117
28.	11.542	12.027	12.514	12.989	13.446	13.881
30.	15.066	15.799	16.541	17.269	17.974	18.647
32.	19.340	20.402	21.485	22.554	23.593	24.591
34.	24.463	25.952	27.479	28.995	30.477	31.906
36.	30.541	32.573	34.668	36.759	38.812	40.801
38.	37.685	40.395	43.204	46.022	48.802	51.505
40.	46.013	49.558	53.252	56.974	60.662	64.261

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.035	0.030	0.025	0.022	0.019	0.017
12.	0.066	0.056	0.049	0.043	0.038	0.034
14.	0.113	0.097	0.085	0.076	0.068	0.062
16.	0.181	0.158	0.140	0.125	0.114	0.104
18.	0.276	0.243	0.217	0.197	0.180	0.167
20.	0.404	0.360	0.324	0.296	0.273	0.254
22.	0.573	0.515	0.468	0.430	0.399	0.375
24.	0.790	0.715	0.654	0.605	0.566	0.534
26.	1.064	0.969	0.893	0.832	0.782	0.743
28.	1.402	1.286	1.193	1.118	1.057	1.009
30.	1.816	1.676	1.564	1.474	1.401	1.343
32.	2.315	2.149	2.017	1.911	1.825	1.758
34.	2.911	2.716	2.563	2.440	2.342	2.266
36.	3.614	3.390	3.216	3.076	2.965	2.881
38.	4.438	4.184	3.988	3.832	3.709	3.617
40.	5.395	5.110	4.893	4.722	4.589	4.491
42.	6.500	6.183	5.947	5.762	5.622	5.521
44.	7.765	7.419	7.165	6.970	6.824	6.724
46.	9.206	8.832	8.564	8.363	8.216	8.121
48.	10.839	10.440	10.163	9.959	9.818	9.734

Table 10.2. Load Equivalence Factors for SN=4, Subgrade Modulus=5000 psi. WET NFRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.001	0.001	0.001	0.001	0.001	0.001
4.	0.010	0.009	0.008	0.007	0.006	0.006
6.	0.038	0.035	0.032	0.030	0.027	0.025
8.	0.105	0.099	0.092	0.087	0.082	0.077
10.	0.236	0.225	0.215	0.205	0.196	0.189
12.	0.463	0.448	0.433	0.420	0.407	0.396
14.	0.822	0.806	0.790	0.774	0.760	0.747
16.	1.359	1.348	1.335	1.323	1.312	1.302
18.	2.124	2.128	2.129	2.130	2.131	2.132
20.	3.173	3.208	3.240	3.270	3.297	3.323
22.	4.570	4.659	4.744	4.825	4.902	4.974
24.	6.384	6.558	6.729	6.894	7.050	7.198
26.	8.691	8.991	9.290	9.581	9.860	10.123
28.	11.572	12.050	12.533	13.006	13.461	13.895
30.	15.116	15.838	16.574	17.298	18.001	18.673
32.	19.417	20.462	21.536	22.600	23.636	24.633
34.	24.575	26.040	27.555	29.065	30.542	31.969
36.	30.697	32.696	34.776	36.859	38.907	40.893
38.	37.897	40.564	43.354	46.161	48.934	51.633
40.	46.293	49.784	53.454	57.162	60.842	64.437

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.035	0.030	0.025	0.022	0.019	0.017
12.	0.065	0.056	0.048	0.042	0.037	0.034
14.	0.112	0.097	0.084	0.075	0.067	0.061
16.	0.180	0.157	0.139	0.124	0.113	0.103
18.	0.275	0.242	0.216	0.195	0.178	0.165
20.	0.404	0.359	0.323	0.294	0.271	0.253
22.	0.573	0.513	0.465	0.427	0.396	0.372
24.	0.791	0.713	0.652	0.602	0.562	0.531
26.	1.065	0.967	0.890	0.828	0.778	0.738
28.	1.405	1.284	1.189	1.113	1.051	1.003
30.	1.821	1.675	1.560	1.468	1.394	1.336
32.	2.323	2.148	2.013	1.904	1.817	1.750
34.	2.922	2.717	2.559	2.432	2.332	2.256
36.	3.630	3.393	3.212	3.067	2.954	2.868
38.	4.459	4.189	3.984	3.822	3.696	3.603
40.	5.423	5.118	4.890	4.711	4.574	4.475
42.	6.536	6.195	5.945	5.751	5.605	5.502
44.	7.811	7.436	7.165	6.958	6.806	6.703
46.	9.264	8.855	8.566	8.351	8.197	8.098
48.	10.911	10.470	10.168	9.948	9.796	9.708

Table 10.3. Load Equivalence Factors for SN=5, Subgrade Modulus=5000 psi. WET NFRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.001	0.001	0.001	0.001	0.001	0.001
4.	0.010	0.009	0.008	0.007	0.006	0.006
6.	0.038	0.035	0.032	0.029	0.027	0.025
8.	0.104	0.098	0.092	0.086	0.081	0.077
10.	0.234	0.224	0.214	0.204	0.196	0.188
12.	0.460	0.446	0.431	0.418	0.406	0.395
14.	0.818	0.803	0.787	0.772	0.758	0.746
16.	1.355	1.344	1.333	1.321	1.310	1.300
18.	2.120	2.124	2.126	2.128	2.129	2.130
20.	3.170	3.205	3.237	3.267	3.295	3.321
22.	4.571	4.659	4.744	4.825	4.901	4.973
24.	6.391	6.562	6.732	6.896	7.052	7.199
26.	8.706	9.002	9.299	9.589	9.866	10.130
28.	11.601	12.072	12.551	13.022	13.476	13.908
30.	15.163	15.874	16.605	17.326	18.026	18.696
32.	19.489	20.518	21.585	22.644	23.677	24.671
34.	24.680	26.123	27.627	29.130	30.604	32.028
36.	30.845	32.813	34.879	36.953	38.996	40.979
38.	38.097	40.724	43.496	46.292	49.058	51.755
40.	46.558	49.997	53.644	57.340	61.011	64.603

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.036	0.030	0.026	0.022	0.020	0.017
12.	0.066	0.057	0.049	0.043	0.038	0.035
14.	0.113	0.098	0.086	0.076	0.069	0.062
16.	0.181	0.159	0.141	0.126	0.115	0.105
18.	0.277	0.245	0.219	0.198	0.181	0.168
20.	0.405	0.361	0.326	0.298	0.275	0.257
22.	0.573	0.516	0.470	0.432	0.402	0.377
24.	0.790	0.716	0.657	0.609	0.570	0.538
26.	1.062	0.971	0.897	0.836	0.787	0.747
28.	1.399	1.287	1.197	1.123	1.063	1.015
30.	1.811	1.677	1.568	1.480	1.408	1.351
32.	2.308	2.149	2.022	1.918	1.834	1.768
34.	2.899	2.715	2.568	2.449	2.353	2.277
36.	3.598	3.387	3.221	3.086	2.978	2.894
38.	4.416	4.178	3.992	3.842	3.723	3.632
40.	5.366	5.101	4.897	4.733	4.605	4.509
42.	6.461	6.171	5.949	5.774	5.639	5.541
44.	7.716	7.401	7.165	6.982	6.844	6.747
46.	9.144	8.808	8.562	8.375	8.238	8.147
48.	10.762	10.408	10.157	9.971	9.840	9.761

Table 10.4. Load Equivalence Factors for SN=3, Subgrade Modulus=15000 psi. WET NFRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.003	0.003	0.003	0.002	0.002	0.002
6.	0.014	0.013	0.011	0.011	0.010	0.009
8.	0.040	0.038	0.035	0.033	0.031	0.029
10.	0.096	0.091	0.087	0.083	0.079	0.076
12.	0.196	0.190	0.183	0.177	0.172	0.167
14.	0.363	0.355	0.347	0.340	0.334	0.328
16.	0.621	0.614	0.608	0.602	0.597	0.592
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.536	1.550	1.564	1.578	1.591	1.603
22.	2.268	2.308	2.349	2.388	2.426	2.460
24.	3.241	3.325	3.410	3.492	3.570	3.644
26.	4.506	4.656	4.809	4.958	5.101	5.236
28.	6.118	6.365	6.618	6.865	7.104	7.331
30.	8.139	8.521	8.914	9.302	9.678	10.037
32.	10.636	11.200	11.785	12.365	12.930	13.472
34.	13.680	14.486	15.327	16.164	16.984	17.774
36.	17.350	18.470	19.643	20.818	21.972	23.089
38.	21.730	23.250	24.848	26.455	28.042	29.584
40.	26.910	28.931	31.063	33.218	35.353	37.437

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.021	0.018	0.015	0.013	0.011	0.010
12.	0.042	0.035	0.030	0.026	0.023	0.021
14.	0.074	0.063	0.055	0.049	0.044	0.040
16.	0.122	0.106	0.093	0.083	0.075	0.069
18.	0.191	0.167	0.149	0.135	0.123	0.114
20.	0.288	0.254	0.228	0.208	0.191	0.178
22.	0.417	0.371	0.337	0.309	0.287	0.268
24.	0.587	0.527	0.481	0.445	0.415	0.391
26.	0.806	0.729	0.670	0.624	0.586	0.555
28.	1.083	0.985	0.912	0.854	0.806	0.768
30.	1.426	1.306	1.217	1.145	1.087	1.041
32.	1.848	1.702	1.595	1.510	1.440	1.385
34.	2.359	2.185	2.059	1.958	1.877	1.813
36.	2.971	2.767	2.621	2.505	2.412	2.338
38.	3.698	3.462	3.295	3.163	3.059	2.977
40.	4.554	4.284	4.096	3.950	3.835	3.746
42.	5.555	5.249	5.041	4.882	4.758	4.663
44.	6.715	6.374	6.147	5.976	5.846	5.749
46.	8.052	7.675	7.432	7.253	7.120	7.025
48.	9.583	9.173	8.917	8.734	8.602	8.513

Table 10.5. Load Equivalence Factors for SN=4, Subgrade Modulus=15000 psi. WET NFRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.003	0.003	0.002	0.002	0.002	0.002
6.	0.013	0.012	0.011	0.010	0.010	0.009
8.	0.040	0.037	0.035	0.033	0.031	0.029
10.	0.095	0.091	0.086	0.082	0.079	0.076
12.	0.195	0.189	0.183	0.177	0.171	0.167
14.	0.362	0.354	0.347	0.340	0.333	0.328
16.	0.620	0.614	0.608	0.602	0.596	0.592
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.538	1.551	1.566	1.579	1.592	1.604
22.	2.273	2.312	2.353	2.392	2.429	2.463
24.	3.252	3.333	3.417	3.499	3.577	3.650
26.	4.525	4.671	4.823	4.971	5.113	5.247
28.	6.149	6.390	6.640	6.886	7.124	7.350
30.	8.187	8.559	8.948	9.334	9.708	10.066
32.	10.705	11.256	11.836	12.413	12.976	13.517
34.	13.777	14.566	15.399	16.233	17.050	17.838
36.	17.484	18.581	19.744	20.913	22.064	23.180
38.	21.910	23.399	24.984	26.585	28.168	29.708
40.	27.147	29.127	31.244	33.391	35.523	37.604

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.022	0.018	0.015	0.013	0.012	0.010
12.	0.042	0.035	0.030	0.027	0.024	0.021
14.	0.074	0.063	0.055	0.049	0.044	0.040
16.	0.123	0.106	0.094	0.084	0.076	0.069
18.	0.194	0.169	0.150	0.135	0.124	0.114
20.	0.292	0.256	0.230	0.209	0.192	0.179
22.	0.423	0.375	0.339	0.311	0.288	0.270
24.	0.596	0.533	0.485	0.448	0.418	0.393
26.	0.819	0.737	0.676	0.628	0.589	0.558
28.	1.100	0.996	0.920	0.860	0.811	0.772
30.	1.450	1.321	1.228	1.154	1.095	1.047
32.	1.879	1.723	1.610	1.522	1.450	1.393
34.	2.399	2.212	2.079	1.974	1.891	1.824
36.	3.023	2.802	2.647	2.526	2.430	2.354
38.	3.764	3.507	3.329	3.191	3.082	2.997
40.	4.637	4.341	4.140	3.986	3.865	3.772
42.	5.657	5.320	5.096	4.927	4.796	4.697
44.	6.840	6.462	6.216	6.033	5.894	5.792
46.	8.205	7.783	7.517	7.323	7.180	7.078
48.	9.768	9.303	9.020	8.820	8.676	8.579

Table 10.6. Load Equivalence Factors for SN=5, Subgrade Modulus=15000 psi. WET NFRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.003	0.003	0.002	0.002	0.002	0.002
6.	0.013	0.012	0.011	0.010	0.010	0.009
8.	0.040	0.037	0.035	0.033	0.031	0.029
10.	0.094	0.090	0.086	0.082	0.079	0.075
12.	0.194	0.188	0.182	0.176	0.171	0.166
14.	0.361	0.353	0.346	0.339	0.333	0.327
16.	0.619	0.613	0.607	0.601	0.596	0.591
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.539	1.553	1.567	1.580	1.593	1.605
22.	2.278	2.316	2.356	2.395	2.432	2.466
24.	3.262	3.342	3.424	3.506	3.583	3.656
26.	4.543	4.686	4.835	4.982	5.124	5.258
28.	6.179	6.413	6.661	6.906	7.142	7.368
30.	8.232	8.595	8.981	9.364	9.737	10.094
32.	10.770	11.310	11.884	12.458	13.019	13.559
34.	13.870	14.642	15.468	16.297	17.112	17.898
36.	17.611	18.685	19.839	21.003	22.151	23.265
38.	22.080	23.540	25.113	26.708	28.287	29.825
40.	27.371	29.313	31.416	33.555	35.683	37.762

(b) Tandem Axle

Axle Load (kips)	Surfcae Thickness (in.)					
	1	2	3	4	5	6
10.	0.021	0.018	0.015	0.013	0.011	0.010
12.	0.041	0.035	0.030	0.026	0.023	0.021
14.	0.073	0.063	0.055	0.048	0.044	0.040
16.	0.120	0.105	0.093	0.083	0.075	0.069
18.	0.189	0.166	0.148	0.134	0.122	0.113
20.	0.284	0.251	0.227	0.207	0.190	0.177
22.	0.411	0.367	0.334	0.307	0.285	0.267
24.	0.578	0.521	0.477	0.442	0.413	0.389
26.	0.793	0.720	0.664	0.619	0.582	0.552
28.	1.065	0.973	0.903	0.847	0.801	0.763
30.	1.402	1.290	1.205	1.136	1.080	1.034
32.	1.815	1.680	1.579	1.497	1.430	1.376
34.	2.316	2.156	2.037	1.941	1.863	1.800
36.	2.917	2.730	2.592	2.482	2.393	2.322
38.	3.629	3.415	3.258	3.134	3.034	2.956
10.	4.468	4.224	4.050	3.912	3.803	3.718
12.	5.448	5.175	4.983	4.834	4.717	4.628
14.	6.583	6.282	6.075	5.917	5.795	5.704
16.	7.892	7.563	7.343	7.180	7.057	6.968
18.	9.391	9.036	8.809	8.644	8.524	8.443

Table 10.7. LoadEquivalence Factors for SN=3, Subgrade Modulus=25000 psi. WET NFRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.002	0.002	0.002	0.002	0.002	0.001
6.	0.011	0.010	0.010	0.009	0.008	0.007
8.	0.036	0.034	0.032	0.030	0.028	0.026
10.	0.091	0.086	0.082	0.078	0.075	0.072
12.	0.195	0.188	0.181	0.175	0.170	0.165
14.	0.376	0.367	0.358	0.351	0.344	0.338
16.	0.666	0.657	0.650	0.643	0.637	0.632
18.	1.107	1.104	1.103	1.102	1.102	1.101
20.	1.749	1.761	1.775	1.789	1.803	1.815
22.	2.650	2.691	2.735	2.779	2.820	2.859
24.	3.877	3.968	4.065	4.160	4.251	4.336
26.	5.509	5.678	5.858	6.036	6.206	6.367
28.	7.633	7.920	8.226	8.528	8.820	9.097
30.	10.346	10.804	11.290	11.774	12.242	12.690
32.	13.760	14.454	15.192	15.929	16.648	17.337
34.	17.993	19.007	20.088	21.171	22.232	23.254
36.	23.180	24.616	26.151	27.696	29.216	30.685
38.	29.465	31.449	33.574	35.722	37.844	39.904
40.	37.005	39.687	42.567	45.489	48.388	51.213

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.030	0.024	0.021	0.018	0.016	0.014
12.	0.060	0.050	0.043	0.038	0.033	0.030
14.	0.110	0.093	0.081	0.072	0.064	0.058
16.	0.187	0.161	0.142	0.127	0.115	0.105
18.	0.302	0.263	0.234	0.211	0.192	0.177
20.	0.466	0.409	0.367	0.334	0.307	0.285
22.	0.692	0.612	0.554	0.508	0.471	0.440
24.	0.995	0.888	0.810	0.748	0.698	0.656
26.	1.393	1.253	1.151	1.070	1.004	0.950
28.	1.906	1.725	1.596	1.492	1.408	1.340
30.	2.555	2.328	2.166	2.038	1.933	1.848
32.	3.364	3.084	2.886	2.730	2.603	2.499
34.	4.360	4.020	3.784	3.597	3.446	3.323
36.	5.572	5.166	4.888	4.669	4.493	4.351
38.	7.032	6.554	6.231	5.980	5.779	5.617
40.	8.775	8.219	7.850	7.567	7.342	7.163
42.	10.837	10.198	9.785	9.471	9.225	9.032
44.	13.257	12.533	12.076	11.736	11.473	11.270
46.	16.080	15.267	14.772	14.411	14.137	13.932
48.	19.351	18.449	17.920	17.547	17.272	17.074

Table 10.8. Load Equivalence Factors for SN=4, Subgrade Modulus=25000 psi. WET NFRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.002	0.002	0.002	0.002	0.002	0.001
6.	0.011	0.010	0.009	0.009	0.008	0.007
8.	0.036	0.034	0.031	0.029	0.028	0.026
10.	0.090	0.086	0.082	0.078	0.075	0.072
12.	0.195	0.188	0.181	0.175	0.170	0.165
14.	0.376	0.367	0.359	0.351	0.344	0.338
16.	0.667	0.659	0.651	0.644	0.638	0.633
18.	1.111	1.108	1.106	1.105	1.104	1.104
20.	1.757	1.768	1.781	1.795	1.808	1.820
22.	2.666	2.703	2.747	2.790	2.831	2.869
24.	3.904	3.990	4.084	4.178	4.268	4.353
26.	5.552	5.714	5.891	6.066	6.235	6.395
28.	7.699	7.975	8.275	8.575	8.865	9.140
30.	10.444	10.885	11.364	11.844	12.310	12.756
32.	13.899	14.570	15.299	16.031	16.747	17.434
34.	18.186	19.169	20.238	21.315	22.372	23.392
36.	23.443	24.837	26.357	27.894	29.410	30.876
38.	29.815	31.745	33.850	35.990	38.107	40.164
40.	37.464	40.076	42.932	45.845	48.738	51.561

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.030	0.025	0.021	0.018	0.016	0.014
12.	0.061	0.051	0.044	0.038	0.034	0.030
14.	0.112	0.095	0.082	0.073	0.065	0.059
16.	0.191	0.164	0.144	0.128	0.116	0.106
18.	0.309	0.267	0.237	0.214	0.195	0.180
20.	0.477	0.416	0.373	0.339	0.311	0.289
22.	0.708	0.624	0.563	0.516	0.477	0.446
24.	1.019	0.905	0.823	0.759	0.707	0.665
26.	1.428	1.277	1.170	1.086	1.017	0.962
28.	1.953	1.759	1.622	1.515	1.428	1.357
30.	2.619	2.374	2.203	2.069	1.960	1.872
32.	3.450	3.146	2.936	2.773	2.640	2.533
34.	4.472	4.102	3.850	3.654	3.496	3.368
36.	5.717	5.272	4.974	4.744	4.559	4.410
38.	7.217	6.689	6.342	6.076	5.864	5.694
40.	9.007	8.389	7.992	7.690	7.452	7.262
42.	11.125	10.411	9.962	9.626	9.363	9.158
44.	13.613	12.797	12.297	11.930	11.647	11.429
46.	16.515	15.591	15.044	14.650	14.353	14.130
48.	19.877	18.843	18.253	17.840	17.538	17.319

Table 10.9. Load Equivalence Factors for SN=5, Subgrade Modulus=25000 psi. WET NFRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.002	0.002	0.002	0.002	0.002	0.001
6.	0.011	0.010	0.009	0.009	0.008	0.007
8.	0.036	0.033	0.031	0.029	0.028	0.026
10.	0.090	0.086	0.081	0.078	0.074	0.071
12.	0.194	0.188	0.181	0.175	0.170	0.165
14.	0.376	0.367	0.359	0.351	0.344	0.338
16.	0.668	0.660	0.652	0.645	0.639	0.633
18.	1.115	1.110	1.109	1.107	1.107	1.106
20.	1.765	1.774	1.787	1.800	1.813	1.825
22.	2.680	2.715	2.757	2.800	2.840	2.878
24.	3.930	4.010	4.103	4.196	4.285	4.369
26.	5.593	5.747	5.921	6.095	6.263	6.422
28.	7.762	8.026	8.322	8.619	8.908	9.182
30.	10.536	10.961	11.435	11.911	12.375	12.818
32.	14.031	14.679	15.400	16.128	16.840	17.525
34.	18.370	19.322	20.380	21.451	22.505	23.522
36.	23.692	25.047	26.551	28.082	29.593	31.057
38.	30.148	32.025	34.112	36.243	38.356	40.410
40.	37.901	40.445	43.279	46.181	49.070	51.890

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.029	0.024	0.020	0.018	0.015	0.014
12.	0.058	0.049	0.042	0.037	0.033	0.030
14.	0.107	0.092	0.080	0.071	0.064	0.058
16.	0.183	0.158	0.140	0.125	0.113	0.104
18.	0.295	0.258	0.230	0.208	0.190	0.175
20.	0.455	0.401	0.361	0.329	0.303	0.282
22.	0.675	0.601	0.545	0.501	0.464	0.435
24.	0.970	0.870	0.796	0.737	0.688	0.648
26.	1.358	1.227	1.131	1.053	0.989	0.937
28.	1.856	1.690	1.567	1.469	1.388	1.321
30.	2.488	2.280	2.127	2.005	1.905	1.822
32.	3.275	3.020	2.834	2.686	2.564	2.465
34.	4.243	3.936	3.714	3.538	3.394	3.276
36.	5.422	5.057	4.797	4.592	4.424	4.289
38.	6.841	6.414	6.115	5.880	5.690	5.536
40.	8.534	8.041	7.703	7.439	7.228	7.059
42.	10.537	9.976	9.599	9.309	9.080	8.899
44.	12.889	12.257	11.845	11.534	11.291	11.103
46.	15.631	14.930	14.487	14.160	13.911	13.724
48.	18.807	18.039	17.573	17.239	16.993	16.817

Table 11.1. Load Equivalence Factors for SN=3, Subgrade Modulus=5000 psi. DRY FRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.002	0.002	0.002	0.002	0.001	0.001
4.	0.021	0.018	0.016	0.015	0.014	0.013
6.	0.087	0.078	0.072	0.067	0.063	0.060
8.	0.252	0.231	0.215	0.203	0.194	0.187
10.	0.586	0.546	0.518	0.495	0.478	0.464
12.	1.185	1.120	1.075	1.040	1.013	0.991
14.	2.166	2.073	2.010	1.963	1.926	1.898
16.	3.671	3.550	3.476	3.422	3.381	3.350
18.	5.866	5.726	5.653	5.606	5.574	5.551
20.	8.943	8.804	8.757	8.741	8.739	8.742
22.	13.120	13.016	13.035	13.089	13.151	13.210
24.	18.642	18.624	18.770	18.950	19.128	19.285
26.	25.781	25.924	26.278	26.664	27.028	27.346
28.	34.837	35.242	35.915	36.612	37.259	37.818
30.	46.136	46.936	48.073	49.220	50.274	51.181
32.	60.036	61.399	63.182	64.954	66.573	67.966
34.	76.922	79.059	81.714	84.328	86.712	88.760
36.	97.207	100.376	104.182	107.904	111.294	114.208
38.	121.337	125.850	131.137	136.290	140.979	145.014
40.	149.784	156.010	163.176	170.141	176.480	181.940

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.077	0.061	0.051	0.044	0.040	0.038
12.	0.147	0.118	0.100	0.088	0.080	0.076
14.	0.257	0.210	0.180	0.160	0.147	0.139
16.	0.422	0.348	0.301	0.270	0.249	0.237
18.	0.658	0.548	0.477	0.430	0.400	0.383
20.	0.983	0.825	0.724	0.657	0.614	0.591
22.	1.417	1.199	1.059	0.967	0.909	0.877
24.	1.985	1.690	1.504	1.380	1.303	1.262
26.	2.711	2.324	2.079	1.918	1.818	1.767
28.	3.625	3.126	2.812	2.606	2.479	2.417
30.	4.756	4.125	3.729	3.471	3.314	3.241
32.	6.138	5.352	4.860	4.543	4.353	4.268
34.	7.807	6.841	6.241	5.855	5.628	5.533
36.	9.801	8.629	7.905	7.443	7.177	7.074
38.	12.163	10.756	9.892	9.347	9.038	8.929
40.	14.935	13.263	12.245	11.607	11.255	11.144
42.	18.164	16.197	15.006	14.270	13.873	13.765
44.	21.899	19.603	18.225	17.382	16.941	16.844
46.	26.194	23.535	21.953	20.997	20.513	20.434
48.	31.102	28.044	26.242	25.167	24.644	24.596

Table 11.2. Load Equivalence Factors for SN=4, Subgrade Modulus=5000 psi. DRY FRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.002	0.002	0.002	0.002	0.001	0.001
4.	0.021	0.019	0.017	0.015	0.014	0.013
6.	0.088	0.079	0.072	0.067	0.063	0.060
8.	0.255	0.233	0.217	0.205	0.195	0.188
10.	0.594	0.552	0.522	0.499	0.481	0.467
12.	1.202	1.132	1.085	1.048	1.020	0.998
14.	2.197	2.096	2.029	1.980	1.941	1.912
16.	3.725	3.591	3.510	3.452	3.408	3.375
18.	5.955	5.795	5.711	5.657	5.620	5.594
20.	9.081	8.912	8.849	8.824	8.814	8.813
22.	13.327	13.179	13.176	13.216	13.268	13.320
24.	18.942	18.863	18.977	19.138	19.303	19.451
26.	26.202	26.262	26.575	26.935	27.281	27.586
28.	35.414	35.709	36.328	36.992	37.615	38.157
30.	46.911	47.567	48.635	49.739	50.763	51.649
32.	61.056	62.237	63.932	65.650	67.232	68.599
34.	78.242	80.151	82.698	85.246	87.584	89.600
36.	98.893	101.779	105.452	109.094	112.429	115.305
38.	123.462	127.628	132.756	137.812	142.437	146.426
40.	152.431	158.237	165.212	172.064	178.327	183.734

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.078	0.062	0.051	0.045	0.040	0.038
12.	0.149	0.120	0.101	0.089	0.081	0.076
14.	0.262	0.212	0.181	0.161	0.147	0.139
16.	0.431	0.353	0.304	0.271	0.250	0.238
18.	0.671	0.555	0.481	0.433	0.402	0.384
20.	1.003	0.836	0.731	0.662	0.617	0.593
22.	1.446	1.215	1.070	0.974	0.913	0.881
24.	2.026	1.714	1.518	1.390	1.310	1.267
26.	2.769	2.357	2.100	1.932	1.828	1.775
28.	3.702	3.170	2.840	2.625	2.494	2.429
30.	4.858	4.184	3.767	3.497	3.334	3.257
32.	6.271	5.430	4.912	4.579	4.380	4.291
34.	7.978	6.942	6.307	5.902	5.664	5.564
36.	10.017	8.758	7.991	7.505	7.224	7.114
38.	12.432	10.918	10.001	9.426	9.100	8.981
40.	15.267	13.465	12.381	11.707	11.333	11.210
42.	18.571	16.444	15.176	14.394	13.971	13.849
44.	22.392	19.906	18.434	17.536	17.064	16.949
46.	26.787	23.901	22.206	21.186	20.664	20.565
48.	31.809	28.483	26.548	25.397	24.829	24.756

Table 11.3. Load Equivalence Factors for SN=5, Subgrade Modulus=5000 psi. DRY FRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.002	0.002	0.002	0.002	0.001	0.001
4.	0.021	0.019	0.017	0.015	0.014	0.013
6.	0.089	0.079	0.073	0.067	0.063	0.060
8.	0.257	0.235	0.218	0.206	0.196	0.189
10.	0.601	0.557	0.526	0.502	0.484	0.470
12.	1.216	1.143	1.093	1.055	1.026	1.004
14.	2.225	2.116	2.046	1.994	1.954	1.923
16.	3.773	3.627	3.540	3.478	3.432	3.397
18.	6.033	5.854	5.761	5.702	5.661	5.632
20.	9.203	9.006	8.930	8.896	8.880	8.874
22.	13.509	13.322	13.299	13.327	13.371	13.416
24.	19.205	19.071	19.159	19.303	19.455	19.595
26.	26.572	26.558	26.834	27.171	27.502	27.795
28.	35.921	36.118	36.689	37.323	37.926	38.453
30.	47.591	48.120	49.126	50.192	51.190	52.058
32.	61.952	62.970	64.588	66.258	67.808	69.151
34.	79.403	81.108	83.558	86.047	88.345	90.333
36.	100.376	103.009	106.563	110.134	113.421	116.262
38.	125.331	129.187	134.172	139.143	143.711	147.658
40.	154.759	160.189	166.994	173.745	179.942	185.300

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.079	0.062	0.052	0.045	0.040	0.038
12.	0.152	0.121	0.102	0.089	0.081	0.076
14.	0.267	0.215	0.183	0.161	0.148	0.140
16.	0.438	0.356	0.306	0.272	0.251	0.239
18.	0.683	0.561	0.485	0.435	0.404	0.386
20.	1.020	0.845	0.737	0.665	0.620	0.595
22.	1.472	1.229	1.078	0.980	0.917	0.884
24.	2.063	1.734	1.531	1.398	1.316	1.272
26.	2.819	2.385	2.118	1.944	1.837	1.782
28.	3.770	3.209	2.865	2.643	2.506	2.439
30.	4.949	4.236	3.801	3.521	3.352	3.272
32.	6.389	5.498	4.956	4.610	4.404	4.311
34.	8.128	7.030	6.366	5.944	5.696	5.590
36.	10.208	8.870	8.066	7.559	7.266	7.149
38.	12.670	11.059	10.097	9.495	9.153	9.026
40.	15.561	13.641	12.501	11.794	11.401	11.269
42.	18.930	16.662	15.324	14.503	14.057	13.923
44.	22.828	20.171	18.616	17.671	17.171	17.041
46.	27.311	24.222	22.428	21.351	20.796	20.679
48.	32.434	28.869	26.816	25.598	24.990	24.896

Table 11.4. Load Equivalence Factors for SN=3, Subgrade Modulus=15000 psi. DRY FRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.001	0.001	0.001	0.000	0.000	0.000
4.	0.005	0.005	0.004	0.004	0.004	0.003
6.	0.020	0.018	0.017	0.016	0.015	0.014
8.	0.054	0.050	0.047	0.045	0.043	0.042
10.	0.118	0.112	0.107	0.103	0.100	0.098
12.	0.227	0.219	0.213	0.207	0.202	0.199
14.	0.398	0.389	0.381	0.375	0.370	0.366
16.	0.648	0.641	0.635	0.630	0.626	0.623
18.	1.000	/1.000	1.000	1.000	1.000	1.000
20.	1.478	1.492	1.504	1.515	1.524	1.531
22.	2.108	2.147	2.181	2.210	2.235	2.255
24.	2.918	2.997	3.065	3.124	3.174	3.215
26.	3.940	4.077	4.195	4.299	4.388	4.461
28.	5.207	5.425	5.616	5.784	5.927	6.046
30.	6.755	7.083	7.373	7.628	7.848	8.030
32.	8.621	9.095	9.515	9.888	10.210	10.478
34.	10.846	11.507	12.098	12.623	13.078	13.459
36.	13.472	14.371	15.177	15.897	16.524	17.049
38.	16.543	17.738	18.814	19.779	20.622	21.330
40.	20.108	21.664	23.074	24.342	25.453	26.389

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.046	0.037	0.030	0.026	0.024	0.022
12.	0.085	0.068	0.057	0.050	0.045	0.043
14.	0.143	0.116	0.098	0.087	0.080	0.075
16.	0.227	0.185	0.159	0.142	0.131	0.124
18.	0.343	0.282	0.245	0.220	0.204	0.195
20.	0.498	0.414	0.361	0.327	0.305	0.292
22.	0.700	0.586	0.515	0.469	0.439	0.423
24.	0.958	0.807	0.714	0.654	0.615	0.595
26.	1.280	1.086	0.967	0.889	0.841	0.816
28.	1.676	1.432	1.282	1.184	1.124	1.094
30.	2.158	1.854	1.668	1.548	1.475	1.440
32.	2.736	2.364	2.137	1.991	1.903	1.864
34.	3.422	2.972	2.698	2.524	2.421	2.377
36.	4.228	3.690	3.365	3.159	3.039	2.991
38.	5.168	4.532	4.149	3.908	3.772	3.721
40.	6.255	5.509	5.063	4.786	4.631	4.580
42.	7.504	6.637	6.122	5.805	5.633	5.582
44.	8.929	7.930	7.341	6.982	6.792	6.745
46.	10.547	9.404	8.734	8.331	8.124	8.084
48.	12.374	11.073	10.318	9.869	9.647	9.617

Table 11.5. Load Equivalence Factors for SN=4, Subgrade Modulus=15000 psi. DRY FRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.001	0.001	0.001	0.000	0.000	0.000
4.	0.005	0.005	0.004	0.004	0.004	0.003
6.	0.020	0.018	0.017	0.016	0.015	0.014
8.	0.054	0.050	0.047	0.045	0.043	0.042
10.	0.119	0.112	0.108	0.104	0.100	0.098
12.	0.228	0.219	0.213	0.207	0.203	0.199
14.	0.398	0.389	0.381	0.375	0.370	0.366
16.	0.648	0.641	0.635	0.630	0.626	0.623
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.477	1.492	1.504	1.515	1.524	1.531
22.	2.106	2.146	2.180	2.210	2.234	2.255
24.	2.916	2.995	3.064	3.123	3.174	3.215
26.	3.936	4.074	4.194	4.299	4.388	4.461
28.	5.200	5.421	5.614	5.782	5.927	6.046
30.	6.745	7.077	7.369	7.626	7.847	8.030
32.	8.606	9.086	9.511	9.885	10.209	10.478
34.	10.825	11.495	12.091	12.619	13.077	13.459
36.	13.444	14.354	15.168	15.892	16.522	17.050
38.	16.506	17.716	18.802	19.773	20.620	21.331
40.	20.059	21.636	23.057	24.333	25.450	26.390

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.047	0.037	0.031	0.027	0.024	0.022
12.	0.087	0.069	0.058	0.050	0.046	0.043
14.	0.146	0.117	0.099	0.088	0.080	0.076
16.	0.232	0.188	0.161	0.143	0.132	0.125
18.	0.350	0.287	0.247	0.222	0.205	0.196
20.	0.509	0.420	0.365	0.329	0.307	0.294
22.	0.715	0.595	0.521	0.473	0.442	0.426
24.	0.978	0.819	0.722	0.659	0.620	0.599
26.	1.307	1.102	0.977	0.897	0.846	0.821
28.	1.711	1.453	1.295	1.194	1.132	1.101
30.	2.203	1.881	1.686	1.561	1.485	1.448
32.	2.792	2.398	2.159	2.007	1.916	1.875
34.	3.492	3.014	2.727	2.545	2.438	2.391
36.	4.315	3.743	3.401	3.185	3.060	3.009
38.	5.273	4.596	4.193	3.941	3.798	3.744
40.	6.382	5.587	5.117	4.826	4.663	4.607
42.	7.656	6.731	6.187	5.854	5.672	5.616
44.	9.110	8.042	7.418	7.040	6.839	6.785
46.	10.760	9.536	8.826	8.400	8.180	8.133
48.	12.624	11.228	10.427	9.951	9.713	9.675

Table 11.6. Load Equivalence Factors for SN=5, Subgrade Modulus=15000 psi. DRY FRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.001	0.001	0.001	0.000	0.000	0.000
4.	0.005	0.005	0.004	0.004	0.004	0.003
6.	0.020	0.018	0.017	0.016	0.015	0.014
8.	0.054	0.050	0.047	0.045	0.043	0.042
10.	0.119	0.113	0.108	0.104	0.100	0.098
12.	0.228	0.219	0.213	0.207	0.203	0.199
14.	0.398	0.389	0.381	0.375	0.370	0.366
16.	0.648	0.641	0.635	0.630	0.626	0.623
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.477	1.492	1.504	1.515	1.524	1.531
22.	2.105	2.146	2.180	2.210	2.234	2.255
24.	2.913	2.994	3.063	3.123	3.174	3.215
26.	3.932	4.072	4.193	4.298	4.387	4.461
28.	5.195	5.418	5.612	5.781	5.927	6.046
30.	6.736	7.072	7.366	7.625	7.847	8.030
32.	8.593	9.079	9.506	9.883	10.208	10.478
34.	10.807	11.485	12.085	12.616	13.076	13.459
36.	13.419	14.340	15.159	15.888	16.521	17.050
38.	16.473	17.697	18.791	19.767	20.618	21.331
40.	20.016	21.611	23.043	24.326	25.447	26.390

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.045	0.036	0.030	0.026	0.024	0.022
12.	0.083	0.067	0.056	0.050	0.045	0.042
14.	0.140	0.114	0.097	0.086	0.079	0.075
16.	0.222	0.182	0.157	0.141	0.130	0.124
18.	0.335	0.278	0.242	0.218	0.202	0.193
20.	0.486	0.407	0.357	0.324	0.302	0.290
22.	0.683	0.576	0.509	0.464	0.436	0.420
24.	0.935	0.794	0.706	0.647	0.610	0.591
26.	1.249	1.069	0.955	0.880	0.834	0.810
28.	1.637	1.409	1.266	1.172	1.115	1.086
30.	2.107	1.824	1.648	1.533	1.463	1.430
32.	2.672	2.325	2.110	1.971	1.888	1.851
34.	3.342	2.924	2.665	2.499	2.402	2.360
36.	4.130	3.631	3.324	3.128	3.015	2.971
38.	5.048	4.459	4.098	3.871	3.742	3.695
40.	6.110	5.421	5.002	4.740	4.595	4.548
42.	7.331	6.531	6.048	5.750	5.588	5.544
44.	8.724	7.803	7.252	6.915	6.738	6.698
46.	10.306	9.254	8.629	8.251	8.060	8.028
48.	12.092	10.897	10.194	9.775	9.571	9.551

Table 11.7. Load Equivalence Factors for SN=3, Subgrade Modulus=25000psi. DRY FRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.002	0.002	0.002	0.002	0.002	0.001
6.	0.007	0.007	0.006	0.006	0.006	0.005
8.	0.018	0.017	0.016	0.015	0.015	0.014
10.	0.036	0.035	0.034	0.033	0.033	0.032
12.	0.065	0.065	0.064	0.063	0.062	0.062
14.	0.108	0.110	0.110	0.110	0.109	0.108
16.	0.168	0.174	0.176	0.177	0.177	0.178
18.	0.249	0.261	0.267	0.271	0.274	0.276
20.	0.355	0.375	0.388	0.397	0.404	0.409
22.	0.489	0.523	0.546	0.562	0.575	0.585
24.	0.656	0.709	0.745	0.773	0.796	0.813
26.	0.860	0.939	0.994	1.038	1.073	1.101
28.	1.106	1.218	1.299	1.364	1.417	1.459
30.	1.398	1.553	1.667	1.760	1.836	1.897
32.	1.740	1.949	2.106	2.234	2.340	2.426
34.	2.139	2.415	2.624	2.797	2.942	3.059
36.	2.599	2.956	3.230	3.459	3.650	3.807
38.	3.126	3.579	3.932	4.229	4.478	4.683
40.	3.724	4.292	4.740	5.118	5.438	5.702

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.043	0.034	0.028	0.025	0.022	0.021
12.	0.076	0.060	0.051	0.044	0.040	0.038
14.	0.123	0.099	0.084	0.075	0.068	0.064
16.	0.189	0.154	0.132	0.118	0.108	0.103
18.	0.276	0.227	0.197	0.177	0.164	0.156
20.	0.390	0.324	0.282	0.255	0.238	0.228
22.	0.535	0.447	0.393	0.357	0.335	0.322
24.	0.715	0.602	0.533	0.487	0.458	0.443
26.	0.935	0.793	0.706	0.649	0.613	0.595
28.	1.201	1.025	0.917	0.847	0.803	0.782
30.	1.517	1.302	1.171	1.086	1.035	1.010
32.	1.889	1.631	1.474	1.373	1.313	1.285
34.	2.323	2.017	1.831	1.712	1.642	1.612
36.	2.825	2.465	2.248	2.110	2.030	1.998
38.	3.401	2.983	2.730	2.572	2.482	2.449
40.	4.058	3.575	3.285	3.106	3.006	2.972
42.	4.801	4.248	3.919	3.717	3.607	3.575
44.	5.638	5.010	4.639	4.413	4.293	4.264
46.	6.576	5.867	5.451	5.201	5.073	5.048
48.	7.621	6.827	6.364	6.088	5.953	5.936

Table 11.8. Load Eqivalence Factors for SN=4, Subgrade Modulus=25000 psi. DRY FRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.002	0.002	0.002	0.002	0.001	0.001
6.	0.007	0.007	0.006	0.006	0.006	0.005
8.	0.017	0.017	0.016	0.015	0.015	0.014
10.	0.035	0.035	0.034	0.033	0.032	0.032
12.	0.064	0.064	0.063	0.062	0.062	0.061
14.	0.106	0.108	0.108	0.108	0.108	0.107
16.	0.164	0.170	0.173	0.174	0.175	0.175
18.	0.243	0.255	0.262	0.266	0.269	0.272
20.	0.345	0.367	0.381	0.390	0.397	0.403
22.	0.475	0.511	0.535	0.552	0.566	0.576
24.	0.635	0.692	0.730	0.759	0.782	0.800
26.	0.832	0.915	0.973	1.018	1.054	1.083
28.	1.068	1.185	1.270	1.337	1.391	1.434
30.	1.348	1.510	1.628	1.724	1.802	1.864
32.	1.676	1.894	2.056	2.187	2.296	2.383
34.	2.058	2.344	2.559	2.737	2.884	3.003
36.	2.497	2.866	3.148	3.382	3.577	3.736
38.	3.000	3.468	3.830	4.133	4.387	4.595
40.	3.570	4.156	4.614	4.999	5.324	5.592

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.044	0.035	0.029	0.025	0.022	0.021
12.	0.078	0.061	0.051	0.045	0.041	0.038
14.	0.126	0.101	0.085	0.075	0.069	0.065
16.	0.193	0.156	0.134	0.119	0.109	0.104
18.	0.283	0.231	0.199	0.179	0.165	0.158
20.	0.400	0.329	0.286	0.258	0.240	0.230
22.	0.547	0.455	0.398	0.361	0.338	0.325
24.	0.731	0.612	0.539	0.492	0.462	0.446
26.	0.956	0.805	0.714	0.655	0.618	0.599
28.	1.227	1.041	0.927	0.854	0.810	0.787
30.	1.550	1.322	1.184	1.096	1.043	1.017
32.	1.929	1.655	1.491	1.385	1.322	1.293
34.	2.372	2.046	1.851	1.727	1.654	1.622
36.	2.884	2.501	2.272	2.128	2.044	2.010
38.	3.471	3.025	2.760	2.594	2.499	2.464
40.	4.140	3.625	3.320	3.131	3.026	2.990
42.	4.897	4.307	3.960	3.747	3.631	3.595
44.	5.749	5.078	4.686	4.448	4.321	4.288
46.	6.704	5.946	5.506	5.241	5.105	5.076
48.	7.769	6.917	6.426	6.135	5.990	5.968

Table 11.9. Load Equivalence Factors for SN=5, Subgrade Modulus=25000 psi. DRY FRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.002	0.002	0.002	0.002	0.001	0.001
6.	0.007	0.007	0.006	0.006	0.006	0.005
8.	0.017	0.017	0.016	0.015	0.015	0.014
10.	0.035	0.034	0.033	0.033	0.032	0.031
12.	0.063	0.063	0.063	0.062	0.061	0.060
14.	0.104	0.106	0.107	0.107	0.106	0.106
16.	0.161	0.167	0.170	0.172	0.173	0.173
18.	0.237	0.250	0.258	0.263	0.266	0.268
20.	0.336	0.360	0.374	0.384	0.392	0.398
22.	0.462	0.500	0.525	0.544	0.558	0.569
24.	0.618	0.677	0.717	0.747	0.771	0.789
26.	0.808	0.894	0.954	1.001	1.038	1.068
28.	1.036	1.158	1.245	1.314	1.369	1.413
30.	1.306	1.474	1.595	1.693	1.772	1.836
32.	1.622	1.847	2.013	2.147	2.258	2.347
34.	1.990	2.284	2.505	2.685	2.835	2.956
36.	2.412	2.791	3.079	3.317	3.515	3.676
38.	2.895	3.375	3.744	4.051	4.309	4.519
40.	3.442	4.042	4.508	4.899	5.228	5.498

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.042	0.033	0.028	0.024	0.022	0.020
12.	0.074	0.059	0.050	0.044	0.040	0.038
14.	0.120	0.097	0.083	0.074	0.068	0.064
16.	0.184	0.151	0.130	0.116	0.107	0.102
18.	0.269	0.223	0.194	0.175	0.162	0.155
20.	0.380	0.318	0.278	0.252	0.236	0.226
22.	0.521	0.439	0.388	0.353	0.332	0.320
24.	0.697	0.591	0.525	0.482	0.454	0.439
26.	0.912	0.779	0.696	0.642	0.608	0.590
28.	1.171	1.007	0.905	0.838	0.796	0.776
30.	1.480	1.280	1.156	1.075	1.026	1.003
32.	1.844	1.604	1.455	1.359	1.302	1.276
34.	2.268	1.984	1.808	1.695	1.629	1.601
36.	2.759	2.425	2.220	2.089	2.014	1.984
38.	3.322	2.934	2.697	2.548	2.463	2.432
40.	3.965	3.518	3.246	3.076	2.982	2.952
42.	4.692	4.182	3.873	3.682	3.579	3.551
44.	5.512	4.932	4.585	4.372	4.261	4.236
46.	6.430	5.777	5.389	5.154	5.035	5.016
48.	7.454	6.723	6.292	6.035	5.910	5.899

Table 12.1. Load Equivalence Factors for SN=3, Subgrade Modulus=5000 psi. DRY NFRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.006	0.003	0.002	0.001	0.001	0.001
4.	0.026	0.018	0.013	0.010	0.007	0.006
6.	0.073	0.055	0.043	0.034	0.029	0.025
8.	0.158	0.127	0.105	0.089	0.078	0.070
10.	0.290	0.247	0.216	0.192	0.174	0.161
12.	0.482	0.432	0.393	0.362	0.339	0.321
14.	0.744	0.695	0.656	0.625	0.600	0.580
16.	1.088	1.054	1.028	1.007	0.989	0.975
18.	1.524	1.526	1.532	1.538	1.542	1.545
20.	2.064	2.129	2.193	2.251	2.300	2.339
22.	2.719	2.880	3.039	3.183	3.307	3.410
24.	3.500	3.800	4.097	4.372	4.614	4.817
26.	4.418	4.907	5.398	5.860	6.274	6.625
28.	5.483	6.222	6.973	7.692	8.345	8.907
30.	6.708	7.764	8.855	9.914	10.892	11.741
32.	8.103	9.555	11.078	12.578	13.980	15.212
34.	9.679	11.616	13.677	15.735	17.682	19.410
36.	11.447	13.969	16.689	19.442	22.074	24.434
38.	13.418	16.635	20.152	23.755	27.237	30.388
40.	15.604	19.636	24.104	28.734	33.256	37.382

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.091	0.052	0.033	0.023	0.018	0.015
12.	0.146	0.087	0.058	0.042	0.033	0.028
14.	0.218	0.136	0.093	0.069	0.056	0.049
16.	0.312	0.202	0.142	0.108	0.089	0.080
18.	0.430	0.287	0.207	0.161	0.136	0.124
20.	0.574	0.393	0.291	0.232	0.199	0.184
22.	0.748	0.525	0.397	0.323	0.282	0.264
24.	0.953	0.685	0.529	0.438	0.388	0.368
26.	1.193	0.876	0.689	0.580	0.521	0.500
28.	1.470	1.102	0.882	0.754	0.686	0.665
30.	1.788	1.365	1.111	0.963	0.888	0.868
32.	2.148	1.669	1.380	1.213	1.130	1.116
34.	2.553	2.017	1.694	1.507	1.420	1.414
36.	3.007	2.413	2.055	1.851	1.762	1.769
38.	3.511	2.860	2.468	2.250	2.162	2.187
40.	4.069	3.362	2.939	2.708	2.626	2.676
42.	4.684	3.923	3.471	3.232	3.161	3.245
44.	5.356	4.545	4.069	3.827	3.774	3.900
46.	6.091	5.234	4.737	4.498	4.473	4.651
48.	6.890	5.992	5.481	5.253	5.263	5.508

Table 12.2. Load Equivalence Factors for SN=4, Subgrade Modulus=5000 psi. DRY NFRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.006	0.003	0.002	0.001	0.001	0.001
4.	0.026	0.018	0.013	0.009	0.007	0.006
6.	0.073	0.055	0.042	0.034	0.028	0.025
8.	0.157	0.126	0.104	0.089	0.077	0.069
10.	0.288	0.245	0.214	0.190	0.172	0.159
12.	0.478	0.428	0.389	0.359	0.336	0.318
14.	0.736	0.688	0.650	0.619	0.594	0.575
16.	1.075	1.042	1.017	0.996	0.980	0.966
18.	1.505	1.507	1.514	1.521	1.527	1.531
20.	2.035	2.100	2.166	2.226	2.276	2.317
22.	2.678	2.839	3.000	3.146	3.273	3.377
24.	3.444	3.743	4.042	4.320	4.565	4.769
26.	4.342	4.830	5.323	5.788	6.205	6.559
28.	5.384	6.119	6.873	7.596	8.253	8.817
30.	6.581	7.631	8.724	9.788	10.768	11.621
32.	7.942	9.385	10.910	12.414	13.819	15.054
34.	9.479	11.402	13.464	15.526	17.476	19.206
36.	11.201	13.703	16.422	19.177	21.813	24.175
38.	13.120	16.309	19.822	23.426	26.911	30.062
40.	15.244	19.242	23.700	28.330	32.853	36.978

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.091	0.052	0.033	0.023	0.018	0.015
12.	0.145	0.087	0.057	0.041	0.032	0.028
14.	0.218	0.136	0.092	0.068	0.055	0.049
16.	0.311	0.201	0.140	0.107	0.088	0.079
18.	0.428	0.284	0.205	0.160	0.135	0.123
20.	0.572	0.390	0.288	0.229	0.197	0.182
22.	0.744	0.520	0.393	0.319	0.279	0.261
24.	0.947	0.679	0.523	0.432	0.383	0.364
26.	1.185	0.867	0.681	0.573	0.515	0.494
28.	1.459	1.090	0.872	0.744	0.678	0.657
30.	1.773	1.350	1.098	0.951	0.877	0.858
32.	2.129	1.649	1.363	1.197	1.116	1.103
34.	2.529	1.993	1.671	1.488	1.402	1.398
36.	2.977	2.383	2.027	1.827	1.739	1.748
38.	3.475	2.823	2.435	2.219	2.134	2.161
40.	4.025	3.318	2.898	2.671	2.592	2.645
42.	4.630	3.869	3.421	3.186	3.120	3.206
44.	5.292	4.481	4.009	3.772	3.724	3.854
46.	6.015	5.158	4.666	4.433	4.413	4.596
48.	6.801	5.902	5.398	5.176	5.192	5.441

Table. 12.3. Load Equivalence Factors for SN=5, Subgrade Modulus=5000 psi. DRY NFRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.006	0.003	0.002	0.001	0.001	0.001
4.	0.026	0.018	0.013	0.009	0.007	0.006
6.	0.073	0.054	0.042	0.034	0.028	0.024
8.	0.156	0.125	0.104	0.088	0.077	0.069
10.	0.286	0.244	0.212	0.189	0.171	0.158
12.	0.474	0.424	0.386	0.356	0.333	0.315
14.	0.729	0.681	0.643	0.613	0.589	0.570
16.	1.064	1.031	1.006	0.987	0.971	0.957
18.	1.487	1.489	1.498	1.506	1.513	1.917
20.	2.009	2.074	2.141	2.203	2.255	2.296
22.	2.640	2.801	2.964	3.112	3.241	3.346
24.	3.391	3.690	3.992	4.272	4.519	4.725
26.	4.272	4.758	5.254	5.722	6.142	6.497
28.	5.293	6.024	6.781	7.506	8.166	8.732
30.	6.463	7.508	8.603	9.670	10.654	11.508
32.	7.794	9.228	10.754	12.261	13.670	14.906
34.	9.294	11.205	13.266	15.331	17.284	19.016
36.	10.975	13.459	16.174	18.932	21.570	23.933
38.	12.845	16.009	19.516	23.121	26.607	29.759
40.	14.914	18.878	23.326	27.954	32.478	36.602

(a) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.091	0.053	0.033	0.023	0.018	0.015
12.	0.146	0.088	0.058	0.042	0.033	0.029
14.	0.219	0.137	0.094	0.070	0.057	0.050
16.	0.313	0.203	0.143	0.109	0.090	0.081
18.	0.432	0.289	0.209	0.163	0.138	0.125
20.	0.577	0.397	0.294	0.235	0.201	0.186
22.	0.752	0.530	0.401	0.327	0.285	0.267
24.	0.960	0.692	0.535	0.443	0.393	0.372
26.	1.202	0.885	0.698	0.587	0.528	0.505
28.	1.482	1.114	0.894	0.764	0.695	0.673
30.	1.804	1.381	1.126	0.977	0.899	0.879
32.	2.168	1.689	1.399	1.230	1.146	1.130
34.	2.579	2.043	1.717	1.529	1.439	1.431
36.	3.039	2.445	2.085	1.878	1.786	1.791
38.	3.551	2.900	2.505	2.283	2.192	2.214
40.	4.117	3.411	2.984	2.749	2.663	2.710
42.	4.741	3.981	3.525	3.281	3.206	3.286
44.	5.425	4.615	4.133	3.885	3.828	3.950
46.	6.173	5.316	4.813	4.568	4.537	4.712
48.	6.985	6.088	5.571	5.336	5.340	5.579

Table 12.4. Load Equivalence Factors for SN=3, Subgrade Modulus=15000 psi. DRY NFRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.001	0.001	0.000	0.000	0.000	0.000
4.	0.008	0.005	0.004	0.003	0.002	0.002
6.	0.027	0.020	0.016	0.013	0.010	0.009
8.	0.067	0.054	0.044	0.038	0.033	0.030
10.	0.138	0.118	0.103	0.091	0.082	0.076
12.	0.253	0.226	0.206	0.189	0.177	0.167
14.	0.425	0.397	0.374	0.355	0.340	0.328
16.	0.668	0.647	0.629	0.614	0.602	0.592
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.437	1.479	1.517	1.550	1.579	1.602
22.	1.998	2.112	2.216	2.310	2.391	2.459
24.	2.704	2.927	3.136	3.328	3.497	3.640
26.	3.573	3.955	4.321	4.662	4.968	5.229
28.	4.629	5.230	5.819	6.376	6.882	7.320
30.	5.895	6.790	7.681	8.538	9.328	10.018
32.	7.394	8.671	9.965	11.227	12.405	13.444
34.	9.151	10.915	12.731	14.527	16.222	17.732
36.	11.192	13.565	16.045	18.529	20.899	23.030
38.	13.544	16.667	19.976	23.332	26.567	29.501
40.	16.235	20.268	24.600	29.043	33.369	37.325

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.028	0.016	0.010	0.007	0.005	0.005
12.	0.049	0.030	0.019	0.014	0.011	0.010
14.	0.080	0.050	0.034	0.025	0.020	0.018
16.	0.123	0.079	0.056	0.042	0.035	0.032
18.	0.180	0.120	0.087	0.068	0.057	0.052
20.	0.255	0.174	0.129	0.103	0.088	0.082
22.	0.350	0.245	0.186	0.151	0.132	0.123
24.	0.468	0.336	0.259	0.215	0.190	0.180
26.	0.612	0.450	0.354	0.298	0.267	0.256
28.	0.786	0.589	0.472	0.403	0.367	0.355
30.	0.994	0.759	0.618	0.536	0.493	0.482
32.	1.238	0.963	0.797	0.700	0.651	0.642
34.	1.523	1.205	1.012	0.900	0.847	0.842
36.	1.854	1.490	1.268	1.142	1.085	1.087
38.	2.233	1.822	1.572	1.431	1.372	1.386
40.	2.665	2.207	1.927	1.773	1.716	1.745
42.	3.155	2.648	2.341	2.176	2.124	2.175
44.	3.707	3.153	2.819	2.646	2.603	2.683
46.	4.326	3.726	3.368	3.191	3.164	3.281
48.	5.017	4.373	3.995	3.818	3.814	3.979

Table 12.5. Load Equivalence Factors for SN=4, Subgrade Modulus=15000 psi. DRY NFRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.001	0.001	0.000	0.000	0.000	0.000
4.	0.008	0.005	0.004	0.003	0.002	0.002
6.	0.027	0.020	0.016	0.012	0.010	0.009
8.	0.067	0.054	0.044	0.038	0.033	0.029
10.	0.138	0.118	0.102	0.091	0.082	0.076
12.	0.253	0.226	0.205	0.189	0.177	0.167
14.	0.424	0.396	0.373	0.354	0.340	0.328
16.	0.668	0.647	0.629	0.614	0.602	0.592
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.437	1.480	1.518	1.551	1.580	1.603
22.	1.999	2.113	2.218	2.312	2.393	2.461
24.	2.705	2.929	3.140	3.332	3.502	3.645
26.	3.575	3.959	4.327	4.670	4.977	5.239
28.	4.633	5.237	5.829	6.388	6.896	7.335
30.	5.900	6.800	7.696	8.557	9.350	10.043
32.	7.401	8.686	9.987	11.255	12.438	13.481
34.	9.161	10.936	12.762	14.566	16.269	17.785
36.	11.205	13.593	16.087	18.583	20.964	23.105
38.	13.561	16.704	20.032	23.405	26.656	29.604
40.	16.257	20.316	24.673	29.140	33.488	37.462

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.028	0.016	0.010	0.007	0.005	0.005
12.	0.049	0.029	0.019	0.014	0.011	0.009
14.	0.080	0.049	0.033	0.025	0.020	0.018
16.	0.122	0.078	0.055	0.042	0.035	0.031
18.	0.179	0.119	0.085	0.067	0.056	0.051
20.	0.253	0.173	0.127	0.101	0.087	0.081
22.	0.347	0.243	0.183	0.149	0.130	0.122
24.	0.465	0.333	0.256	0.212	0.188	0.178
26.	0.608	0.445	0.350	0.294	0.264	0.254
28.	0.781	0.584	0.467	0.399	0.363	0.352
30.	0.988	0.753	0.612	0.530	0.488	0.478
32.	1.231	0.955	0.789	0.693	0.645	0.637
34.	1.515	1.196	1.003	0.891	0.839	0.835
36.	1.843	1.479	1.257	1.131	1.075	1.079
38.	2.221	1.809	1.559	1.418	1.361	1.376
40.	2.651	2.191	1.912	1.759	1.703	1.733
42.	3.139	2.630	2.323	2.159	2.108	2.160
44.	3.688	3.131	2.798	2.626	2.585	2.667
46.	4.305	3.701	3.343	3.167	3.142	3.262
48.	4.992	4.344	3.966	3.791	3.790	3.957

Table 12.6. Load Equivalence Factors for SN=5, Subgrade Modulus=15000 psi. DRY NFRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.001	0.001	0.000	0.000	0.000	0.000
4.	0.008	0.005	0.004	0.003	0.002	0.002
6.	0.027	0.020	0.015	0.012	0.010	0.009
8.	0.066	0.053	0.044	0.037	0.033	0.029
10.	0.138	0.117	0.102	0.091	0.082	0.076
12.	0.252	0.226	0.205	0.189	0.176	0.167
14.	0.424	0.396	0.373	0.354	0.339	0.328
16.	0.668	0.647	0.629	0.614	0.601	0.592
18.	1.000	1.000	1.000	1.000	1.000	1.000
20.	1.438	1.480	1.518	1.552	1.580	1.604
22.	2.000	2.114	2.220	2.314	2.395	2.463
24.	2.706	2.932	3.143	3.336	3.507	3.650
26.	3.577	3.963	4.333	4.677	4.985	5.248
28.	4.636	5.244	5.838	6.399	6.910	7.350
30.	5.905	6.810	7.710	8.575	9.371	10.066
32.	7.407	8.700	10.007	11.281	12.468	13.516
34.	9.170	10.955	12.791	14.603	16.313	17.836
36.	11.217	13.620	16.126	18.634	21.026	23.175
38.	13.577	16.739	20.085	23.474	26.740	29.700
40.	16.277	20.361	24.742	29.231	33.600	37.592

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.029	0.016	0.010	0.007	0.006	0.005
12.	0.050	0.030	0.020	0.014	0.011	0.010
14.	0.081	0.051	0.035	0.026	0.021	0.018
16.	0.124	0.080	0.056	0.043	0.036	0.032
18.	0.182	0.121	0.088	0.069	0.058	0.053
20.	0.257	0.176	0.131	0.104	0.090	0.083
22.	0.352	0.248	0.188	0.153	0.134	0.125
24.	0.471	0.339	0.262	0.217	0.193	0.182
26.	0.616	0.454	0.358	0.301	0.270	0.259
28.	0.791	0.595	0.477	0.408	0.371	0.359
30.	1.000	0.766	0.625	0.542	0.498	0.487
32.	1.246	0.972	0.805	0.707	0.658	0.648
34.	1.533	1.216	1.022	0.909	0.855	0.849
36.	1.865	1.502	1.280	1.152	1.095	1.096
38.	2.246	1.837	1.586	1.444	1.384	1.396
40.	2.680	2.224	1.944	1.789	1.730	1.758
42.	3.173	2.669	2.361	2.194	2.141	2.190
44.	3.728	3.176	2.842	2.668	2.623	2.701
46.	4.350	3.753	3.395	3.216	3.187	3.302
48.	5.044	4.403	4.025	3.847	3.841	4.003

Table 12.7. Load Equivalence Factors for Sn=3, Subgrade Modulus=25000 psi. DRY NFRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.001	0.001	0.000	0.000	0.000	0.000
4.	0.007	0.005	0.004	0.003	0.002	0.002
6.	0.030	0.023	0.018	0.014	0.012	0.010
8.	0.087	0.070	0.058	0.049	0.043	0.038
10.	0.201	0.171	0.149	0.132	0.119	0.110
12.	0.403	0.361	0.328	0.301	0.280	0.265
14.	0.733	0.684	0.643	0.609	0.582	0.561
16.	1.235	1.195	1.158	1.127	1.102	1.082
18.	1.964	1.962	1.955	1.948	1.942	1.939
20.	2.981	3.064	3.130	3.187	3.235	3.276
22.	4.357	4.595	4.801	4.984	5.143	5.277
24.	6.167	6.661	7.106	7.509	7.865	8.168
26.	8.500	9.384	10.204	10.961	11.640	12.224
28.	11.449	12.898	14.277	15.572	16.750	17.773
30.	15.116	17.356	19.532	21.609	23.524	25.202
32.	19.615	22.924	26.202	29.378	32.341	34.963
34.	25.064	29.786	34.545	39.223	43.636	47.577
36.	31.592	38.141	44.850	51.532	57.902	63.640
38.	39.339	48.208	57.433	66.735	75.695	83.832
40.	48.449	60.220	72.640	85.310	97.634	108.916

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.028	0.016	0.010	0.007	0.005	0.005
12.	0.053	0.032	0.021	0.015	0.012	0.010
14.	0.094	0.059	0.040	0.030	0.024	0.021
16.	0.154	0.100	0.070	0.053	0.044	0.040
18.	0.240	0.160	0.116	0.090	0.076	0.069
20.	0.358	0.246	0.182	0.145	0.125	0.115
22.	0.517	0.364	0.276	0.224	0.195	0.182
24.	0.723	0.522	0.404	0.334	0.295	0.279
26.	0.987	0.729	0.574	0.482	0.432	0.413
28.	1.319	0.994	0.796	0.679	0.616	0.594
30.	1.729	1.328	1.081	0.935	0.858	0.836
32.	2.230	1.743	1.442	1.263	1.172	1.152
34.	2.834	2.253	1.890	1.677	1.572	1.557
36.	3.556	2.871	2.442	2.192	2.075	2.071
38.	4.408	3.613	3.114	2.825	2.699	2.715
40.	5.409	4.496	3.923	3.597	3.467	3.511
42.	6.572	5.538	4.889	4.528	4.401	4.487
44.	7.918	6.759	6.033	5.641	5.527	5.671
46.	9.462	8.178	7.378	6.963	6.874	7.096
48.	11.226	9.818	8.949	8.520	8.472	8.798

Table 12.8. Load Equivalence Factors for SN=4, Subgrade Modulus=25000 psi. DRY NFRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.001	0.001	0.000	0.000	0.000	0.000
4.	0.007	0.005	0.004	0.003	0.002	0.002
6.	0.031	0.023	0.018	0.014	0.012	0.010
8.	0.087	0.071	0.058	0.049	0.043	0.039
10.	0.203	0.173	0.150	0.133	0.120	0.111
12.	0.407	0.365	0.330	0.303	0.282	0.267
14.	0.741	0.691	0.649	0.614	0.587	0.565
16.	1.249	1.209	1.170	1.138	1.111	1.091
18.	1.988	1.985	1.976	1.968	1.961	1.956
20.	3.019	3.102	3.166	3.220	3.267	3.307
22.	4.413	4.654	4.858	5.039	5.196	5.329
24.	6.249	6.748	7.193	7.594	7.949	8.251
26.	8.615	9.509	10.331	11.088	11.767	12.351
28.	11.606	13.074	14.459	15.756	16.937	17.962
30.	15.328	17.597	19.786	21.871	23.791	25.475
32.	19.893	23.247	26.548	29.740	32.715	35.349
34.	25.423	30.211	35.008	39.713	44.148	48.110
36.	32.051	38.693	45.459	52.183	58.591	64.364
38.	39.916	48.913	58.222	67.589	76.606	84.797
40.	49.166	61.110	73.648	86.414	98.822	110.183

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.028	0.016	0.010	0.007	0.005	0.004
12.	0.053	0.032	0.021	0.015	0.012	0.010
14.	0.094	0.058	0.040	0.029	0.024	0.021
16.	0.154	0.099	0.070	0.053	0.044	0.039
18.	0.240	0.160	0.115	0.090	0.076	0.069
20.	0.359	0.246	0.182	0.145	0.124	0.114
22.	0.518	0.364	0.275	0.223	0.195	0.182
24.	0.725	0.523	0.403	0.333	0.294	0.278
26.	0.991	0.730	0.574	0.481	0.431	0.412
28.	1.324	0.996	0.797	0.679	0.616	0.594
30.	1.737	1.331	1.083	0.935	0.858	0.836
32.	2.241	1.749	1.444	1.264	1.173	1.153
34.	2.849	2.261	1.895	1.679	1.574	1.560
36.	3.575	2.883	2.449	2.196	2.079	2.076
38.	4.434	3.630	3.124	2.833	2.706	2.722
40.	5.442	4.519	3.938	3.608	3.477	3.522
42.	6.615	5.568	4.910	4.544	4.415	4.502
44.	7.972	6.797	6.061	5.664	5.547	5.693
46.	9.530	8.227	7.415	6.993	6.902	7.126
48.	11.309	9.880	8.997	8.560	8.510	8.837

Table 12.9. Load Equivalence for SN=3, Subgrade Modulus=2500 DRY NFRZ Zone, based on Cracking.

(a) Single Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
2.	0.001	0.001	0.000	0.000	0.000	0.000
4.	0.007	0.005	0.004	0.003	0.002	0.002
6.	0.031	0.023	0.018	0.014	0.012	0.010
8.	0.088	0.071	0.059	0.050	0.043	0.039
10.	0.204	0.174	0.151	0.134	0.121	0.111
12.	0.411	0.368	0.333	0.306	0.284	0.268
14.	0.748	0.698	0.655	0.619	0.591	0.570
16.	1.263	1.222	1.182	1.148	1.121	1.100
18.	2.011	2.007	1.997	1.986	1.978	1.972
20.	3.054	3.138	3.200	3.252	3.297	3.336
22.	4.466	4.709	4.912	5.091	5.246	5.378
24.	6.327	6.831	7.275	7.675	8.028	8.329
26.	8.724	9.629	10.453	11.209	11.887	12.472
28.	11.756	13.242	14.632	15.932	17.114	18.141
30.	15.529	17.827	20.028	22.119	24.045	25.735
32.	20.158	23.555	26.878	30.084	33.070	35.716
34.	25.767	30.618	35.450	40.179	44.635	48.618
36.	32.489	39.219	46.040	52.804	59.246	65.052
38.	40.467	49.586	58.974	68.403	77.473	85.715
40.	49.851	61.959	74.610	87.466	99.954	111.389

(b) Tandem Axle

Axle Load (kips)	Surface Thickness (in.)					
	1	2	3	4	5	6
10.	0.028	0.016	0.010	0.007	0.005	0.005
12.	0.054	0.032	0.021	0.015	0.012	0.011
14.	0.094	0.059	0.040	0.030	0.024	0.021
16.	0.154	0.100	0.071	0.054	0.045	0.040
18.	0.240	0.161	0.116	0.091	0.077	0.070
20.	0.358	0.247	0.183	0.146	0.125	0.116
22.	0.516	0.365	0.276	0.225	0.196	0.183
24.	0.721	0.522	0.404	0.334	0.296	0.279
26.	0.984	0.728	0.574	0.483	0.433	0.413
28.	1.314	0.992	0.796	0.679	0.616	0.595
30.	1.722	1.324	1.080	0.935	0.858	0.836
32.	2.219	1.737	1.439	1.262	1.171	1.150
34.	2.819	2.244	1.885	1.674	1.570	1.555
36.	3.535	2.858	2.434	2.186	2.070	2.067
38.	4.381	3.596	3.102	2.817	2.692	2.707
40.	5.373	4.473	3.907	3.585	3.456	3.500
42.	6.527	5.507	4.867	4.511	4.385	4.471
44.	7.861	6.718	6.003	5.618	5.505	5.648
46.	9.392	8.126	7.339	6.931	6.844	7.065
48.	11.139	9.752	8.899	8.478	8.433	8.756

APPENDIX 5

List of Programs

```
1.      //BRCRCS JOB (W114,013C,7,999,HJ),'CRACKD'
2.      //*TAMU R=2304,PRTY=5
3.      //STEP EXEC WATFIV,REGION=2304K
4.      //FT02F001 DD DSN=USR.W114.HJ.REGCRC2,DISP=SHR
5.      //FT04F001  DD  DSN=USR.W114.HJ.DAMDATA,DISP=SHR
6.      //SYSIN  DD  DATA
7.      //$OPTIONS
8.      C      THIS PROG.TO FIND RHO2 AND B2 FOR CRACKING LEF
8.2     C      USING THE MAXIMUM LIKELIHOOD ESTIMATION PROCEDURE
8.3     C      DAMDATA IS THE OUTPUT OF VESYS PROGRAM BY BETER JORDAHL
8.4     C      FROM THE COST ALLOCATION STUDY FOR THE FEDERAL HIGHWAY A.
8.5     C      (FDA),WITH DR. R. LYTTON,AND BRENT RAUHUT 1984
8.6     C      THIS IS FOR PROJECT 2476 FOR THE SDHPT OF TEXAS
8.7     C      REGCRC2  IS THE OUTPUT FILE OF THIS PROGRAM
8.8     C      DEC.,1985
9.              INTEGER SIDNO
9.5       10    CONTINUE
10.             CHARACTER*6 TLD,TEST
11.             REAL * 8 ENVIR
12.             REAL NAX,L2
13.             DIMENSION NAX(10),DI(10),E(10),X(10),A1(10),A2(10),E1(10),
13.5           + E2(10)
14.             DATA TEST/'SINGLE'/
16.             NYR=10
18.             READ(4,100,END=1000) SIDNO,ENVIR,ES,SN,TAC,LOAD,TLD
19.       100   FORMAT(I6,1X,A8,4X,F6.0,4X,F4.1,10X,F4.1,8X,I2,5X,A6)
20.             IF(TLD.EQ.TEST)L2=1
21.             IF(TLD.NE.TEST)L2=2
22.             READ(4,101)(NAX(I),DI(I),I=1,NYR)
23.       101   FORMAT(5X,G15.5,F10.4)
23.2            DO 205 I=1,10
24.       205   E(I)=DI(I)/1000.0
25.             DO 600 L= 100,300,5
25.5            F=FLOAT(L)
26.             Z2=F/100.0
27.             SUMX=0.0
28.             SUMY=0.0
29.             XN=0.0
30.             DO 500 I=1,NYR
31.             A1(I)=-ALOG(E(I))
32.             A2(I)=(1.0/NAX(I))**(Z2)
32.3            IF (DI(I).GE.1000.0) GO TO 900
33.             SUMX=SUMX+A1(I)
34.             SUMY=SUMY+A2(I)
35.             XN=XN+1.0
36.       500   CONTINUE
37.             R2=(SUMX/SUMY)**(1.0/Z2)
38.             SUMC=0.0
39.             SUMD=0.0
40.             XL=0.0
41.             DO 550 I=1,NYR
42.             E1(I)=ALOG(R2/NAX(I))
43.             E2(I)=ALOG(E(I))*(ALOG(NAX(I))-ALOG(R2))
44.             SUMC=SUMC+E1(I)
45.             SUMD=SUMD+E2(I)
46.             XL=XL+1.0
47.       550   CONTINUE
48.             B2=-1.0*(NYR/(SUMC-SUMD))
49.             Z=ABS(B2-Z2)
50.             IF (Z.LE.0.05) GO TO 700
```

```
51.          600 CONTINUE
51.2             GO TO 900
51.4         700  T=TAC
51.6             L1=LOAD
52.              WRITE(2,750)SIDNO,ENVIR,ES,SN,T,L1,L2,F
53.          750 FORMAT(I6,1X,A8,4X,F6.0,4X,F4.1,10X,F4.1,8X,I2,5X,F3.1,F4.0)
54.              WRITE(2,800)(NAX(I),DI(I),E(I),I=1,NYR)
55.          800 FORMAT(5X,G15.5,5X,F10.4,F15.5)
56.              WRITE(2,850)Z2,R2,Z
57.          850 FORMAT(2X,G12.5,3X,G12.5,F10.7)
58.          900 GO TO 10
59.         1000 STOP
60.              END
61.        //$DATA
```

```
1.      //CREG JOB (W114,013C,S03,03,HJ),'CRCZ1R'
2.      //*TAMU R=1536,PRTY=5
3.      //      EXEC NEWSAS,REGION=1536K
4.      //DATAIN DD DSN=USR.W114.HJ.REGCRC2,DISP=SHR
5.      //SYSIN DD  *
5.2     C       THIS PROGRAM (SAS) IS USED TO FIND THE REGRESSION COEF.
5.3     C       FOR EQUATION 13 IN THE REPORT
5.4     C       THIS IS DONE FOR EACH Z
5.5     C       THIS CASE IS FOR WET-FREEZE (ZONE 1)
6.      DATA RDATA;
7.      INFILE DATAIN;
8.      INPUT SIDNO 1-2 ENVIR$ 8-15 ES 16-25 SN 26-33 T 40-47 L1 52-57
9.      L2 59-65////////// Z2 3-14 R2 18-29;
10.     IF SIDNO NE 1 THEN DELETE;
11.     X1=LOG10(L1+L2);X2=T*LOG10(L1+L2);X3=(T**2)*LOG10(L1+L2);
12.     X4=ES*LOG10(L1+L2);X5=(ES**2)*LOG10(L1+L2);X6=LOG10(L2);
13.     X7=T*LOG10(L2);X8=(T**2)*LOG10(L2);X9=ES*LOG10(L2);
14.     X10=(ES**2)*LOG10(L2);X11=LOG10(ES);X12=LOG10(SN);
15.     X13=LOG10(T);
16.     Y1=LOG10(R2);
17.     PROC GLM;
18.     MODEL Y1=X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12 X13;
19.     //*END
```

```
1.      //Z1CRC JOB (W114,013C,3,999,HJ),'LEFTAND'
2.      //*TAMU R=768,PRTY=5
3.      //STEP EXEC WATFIV,REGION=768K
5.      //SYSIN  DD  DATA
6.      //$OPTIONS
7.      C  THIS PROGRAM TO FIND LEF FOR Z1 BASED ON CRACKING TANDEM
7.2     C        THIS IS DONE FOR EACH ZONE SEPARATELY
7.3     C        THIS IS FOR THE WET-FRZ ZONE
8.            DIMENSION LE(48,6,5),Y1(48,6,5),Y2(48,6,5),DF(48,6,5)
8.1           DIMENSION Y3(48,6,5),RHO(48,6,5),RHO18(48,6,5),Y4(48,6,5)
8.2           DIMENSION Y5(48,6,5),B18(48,6,5),B(48,6,5)
9.            REAL LE,L2
10.           ES=5000
10.2       10 CONTINUE
11.           L2=2.0
12.           X1=ALOG10(19.0)
13.           X4=15000.0*ALOG10(19.0)
14.           X5=(15000.0**2)*ALOG10(19.0)
15.           X6=ALOG10(1.0)
16.           X9=15000.0*ALOG10(1.0)
17.           X10=(15000.0**2)*ALOG10(1.0)
18.           X11=ALOG10(15000.0)
19.           DO 300 K=3,5
20.           DO 200 I=10,48,2
21.           DO 100 J=1,6
36.           B0=3.54028542
37.           B1=-4.28245882
38.           B2=-0.06530508
39.           B3=.00134329
40.           B4=0.0000040
41.           B5=-0.0000000
42.           B6=3.88083586
43.           B7=0.11957105
44.           B8=-.00137183
45.           B9=-0.0000750
46.           B10=0.0000000
47.           B11=0.95209187
48.           B12=7.08526960
49.           B13=0.615592643
50.           A0=-0.58283352
51.           A1=0.54902124
52.           A2=-0.04392656
53.           A3=0.00462657
54.           A4=-0.0000214
55.           A5=0.0000000
56.           A6=-1.13682295
57.           A7=0.15110515
58.           A8=-0.01561340
59.           A9=0.0000873
60.           A10=-0.0000000
61.           A11=0.22520930
62.           A12=-0.77012976
63.           A13=.30153134
64.           X=I
65.           T=J
66.           SN=K
67.           Z1=ALOG10(X+L2)
68.           X2=T*ALOG10(19.0)
69.           Z2=T*ALOG10(X+L2)
70.           X3=(T**2)*ALOG10(19.0)
```

```
 71.            Z3=(T**2)*ALOG10(X+L2)
 72.            Z4=ES*ALOG10(X+L2)
 73.            Z5=(ES**2)*ALOG10(X+L2)
 74.            Z6=ALOG10(L2)
 75.            X7=T*ALOG10(1.0)
 76.            Z7=T*ALOG10(L2)
 77.            X8=(T**2)*ALOG10(1.0)
 78.            Z8=(T**2)*ALOG10(L2)
 79.            Z9=ES*ALOG10(L2)
 80.            Z10=(ES**2)*ALOG10(L2)
 81.            Z11=ALOG10(ES)
 82.            X12=ALOG10(SN)
 83.            Z12=ALOG10(SN)
 84.            X13=ALOG10(T)
 85.            Z13=ALOG10(T)
 89.            Y2(I,J,K)=B0+B1*X1+B2*X2+B3*X3+B4*X4+B5*X5+B6*X6+B7*X7
 90.           +          +B8*X8+B9*X9+B10*X10+B11*X11+B12*X12+B13*X13
 91.            Y3(I,J,K)=B0+B1*Z1+B2*Z2+B3*Z3+B4*Z4+B5*Z5+B6*Z6+B7*Z7
 92.           +          +B8*Z8+B9*Z9+B10*Z10+B11*Z11+B12*Z12+B13*Z13
 93.            RHO(I,J,K)=10**Y3(I,J,K)
 94.            RHO18(I,J,K)=10**Y2(I,J,K)
 95.            Y4(I,J,K)=A0+A1*X1+A2*X2+A3*X3+A4*X4+A5*X5+A6*X6+A7*X7
 96.           +          +A8*X8+A9*X9+A10*X10+A11*X11+A12*X12+A13*X13
 97.            Y5(I,J,K)=A0+A1*Z1+A2*Z2+A3*Z3+A4*Z4+A5*Z5+A6*Z6+A7*Z7
 98.           +          +A8*Z8+A9*Z9+A10*Z10+A11*Z11+A12*Z12+A13*Z13
 99.            B18(I,J,K)=(10**Y4(I,J,K))
100.            B(I,J,K)=(10**Y5(I,J,K))
100.4           DF(I,J,K)=((10**(-0.5095))*(19**3.0319)/((T**1.0444)*
100.6          +(SN**4.6460)))
101.            LE(I,J,K)=(RHO18(I,J,K)/RHO(I,J,K))*((-ALOG(.1/DF(I,J,K)))
102.           +          **((1.0/B(I,J,K))-(1.0/B18(I,J,K))))
103.       100  CONTINUE
104.       200  CONTINUE
105.       300  CONTINUE
106.            DO 400 K=3,5
107.            WRITE (6,600) SN,ES
107.5           SN=K
108.       600  FORMAT('1',T10,'SN=',F4.0,3X,'ES=',F7.0,3X,'TANDEM',3X,
108.5         +'WET-FRZ',3X,'CRACKING')
109.            WRITE (6,601)(L,L=1,6)
110.       601  FORMAT( 15X,I1,5(14X,I1))
111.            DO 400 I=10,48,2
111.2           X=I
112.       400  WRITE(6,500)X,(LE(I,J,K),J=1,6)
113.       500  FORMAT(F4.0, 6F15.3)
113.2           ES=ES+10000.0
113.4           IF(ES.LE.25000.0) GO TO 10
114.       800  STOP
115.            END
116.      //$DATA
```

```
      //$OPTIONS
      C  THIS PROGRAM TO FIND LEF FOR Z1 BASED ON PSI
 1          DIMENSION LE(40,6,5),Y1(40,6,5),Y2(40,6,5)
 2          DIMENSION Y3(40,6,5),RHO(40,6,5),RHO18(40,6,5),Y4(40,6,5)
 3          DIMENSION Y5(40,6,5),B18(40,6,5),B(40,6,5)
 4          REAL LE,L2
 5          ES=5000
 6       10 CONTINUE
 7          L2=1.0
 8          X1=ALOG10(19.0)
 9          X4=15000.0*ALOG10(19.0)
10          X5=(15000.0**2)*ALOG10(19.0)
11          X6=ALOG10(1.0)
12          X9=15000.0*ALOG10(1.0)
13          X10=(15000.0**2)*ALOG10(1.0)
14          X11=ALOG10(15000.0)
15          DO 300 K=3,5
16          DO 200 I=2,40,2
17          DO 100 J=1,6
18          CO=.5848723
19          C1=-.2263555
20          C2=.0473364
21          C3=-.0026169
22          C4= .0000015
23          C5=-.0000000
24          C6= .1607131
25          C7=-.0391811
26          C8=-.0021043
27          C9=.0000015
28          C10=.0000000
29          C11=-.0084751
30          C12=-.0023573
31          C13=-.1823595
32          B0=-5.78514876
33          B1=-1.89967660
34          B2=-0.72012773
35          B3=.03534285
36          B4=-2.1449E-05
37          B5=1.7826E-10
38          B6=-.20866606
39          B7=1.00533238
40          B8=-.06279118
41          B9=1.0709E-05
42          B10=7.515E-10
43          B11=2.85709359
44          B12=2.74651610
45          B13=6.28807783
46          A0=5.75402805
47          A1=-.27361528
48          A2=.10077234
49          A3=-.00155036
50          A4=4.3523E-05
51          A5=-5.8013E-10
52          A6=-1.27831176
53          A7=.55820096
54          A8=-.04702459
55          A9=-6.8417E-05
56          A10=1.4384E-09
57          A11=-1.45929552
58          A12=.49654038
```

```
      A13=-2.21563154
      X=I
      T=J
      SN=K
      Z1=ALOG10(X+L2)
      X2=T*ALOG10(19.0)
      Z2=T*ALOG10(X+L2)
      X3=(T**2)*ALOG10(19.0)
      Z3=(T**2)*ALOG10(X+L2)
      Z4=ES*ALOG10(X+L2)
      Z5=(ES**2)*ALOG10(X+L2)
      Z6=ALOG10(L2)
      X7=T*ALOG10(1.0)
      Z7=T*ALOG10(L2)
      X8=(T**2)*ALOG10(1.0)
      Z8=(T**2)*ALOG10(L2)
      Z9=ES*ALOG10(L2)
      Z10=(ES**2)*ALOG10(L2)
      Z11=ALOG10(ES)
      X12=ALOG10(SN)
      Z12=ALOG10(SN)
      X13=ALOG10(T)
      Z13=ALOG10(T)
      Y1(I,J,K)=C0+C1*Z1+C2*Z2+C3*Z3+C4*Z4+C5*Z5+C6*Z6+C7*Z7
     +         +C8*Z8+C9*Z9+C10*Z10+C11*Z11+C12*Z12+C13*Z13
      C=1.05
      Y2(I,J,K)=B0+B1*X1+B2*X2+B3*X3+B4*X4+B5*X5+B6*X6+B7*X7
     +         +B8*X8+B9*X9+B10*X10+B11*X11+B12*X12+B13*X13
      Y3(I,J,K)=B0+B1*Z1+B2*Z2+B3*Z3+B4*Z4+B5*Z5+B6*Z6+B7*Z7
     +         +B8*Z8+B9*Z9+B10*Z10+B11*Z11+B12*Z12+B13*Z13
      RH0(I,J,K)=10**Y3(I,J,K)
      RH018(I,J,K)=10**Y2(I,J,K)
      Y4(I,J,K)=A0+A1*X1+A2*X2+A3*X3+A4*X4+A5*X5+A6*X6+A7*X7
     +         +A8*X8+A9*X9+A10*X10+A11*X11+A12*X12+A13*X13
      Y5(I,J,K)=A0+A1*Z1+A2*Z2+A3*Z3+A4*Z4+A5*Z5+A6*Z6+A7*Z7
     +         +A8*Z8+A9*Z9+A10*Z10+A11*Z11+A12*Z12+A13*Z13
      B18(I,J,K)=(10**Y4(I,J,K))+.07
      B(I,J,K)=(10**Y5(I,J,K))+.07
      LE(I,J,K)=(RH018(I,J,K)/RH0(I,J,K))*((-ALOG(1.0/1.05))
     +          **((1.0/B(I,J,K))-(1.0/B18(I,J,K))))
  100 CONTINUE
  200 CONTINUE
  300 CONTINUE
      DO 400 K=3,5
      SN=K
      WRITE (6,600) SN,ES
  600 FORMAT('1',T10,'SN=',F4.0,3X,'ES=',F7.0,3X,'SINGLE',3X,'WET-FRZ
     +',3X,'PSI')
      WRITE (6,601)(L,L=1,6)
  601 FORMAT( 15X,I1,14X,I1,14X,I1,14X,I1,14X,I1,14X,I1)
      DO 400 I=2,40,02
      X=I
  400 WRITE(6,500)X,(LE(I,J,K),J=1,6)
  500 FORMAT(F4.0, 6F15.3)
      ES=ES+10000.0
      IF(ES.LE.25000.0) GO TO 10
  800 STOP
      END

//$DATA
```

```
      //$OPTIONS
      C  THIS PROGRAM TO FIND LEF FOR Z1 BASED ON PSI
 1          DIMENSION LE(48,6,5),Y1(48,6,5),Y2(48,6,5)
 2          DIMENSION Y3(48,6,5),RHO(48,6,5),RHO18(48,6,5),Y4(48,6,5)
 3          DIMENSION Y5(48,6,5),B18(48,6,5),B(48,6,5)
 4          REAL LE,L2
 5          ES=5000
 6       10 CONTINUE
 7          L2=2.0
 8          X1=ALOG10(19.0)
 9          X4=15000.0*ALOG10(19.0)
10          X5=(15000.0**2)*ALOG10(19.0)
11          X6=ALOG10(1.0)
12          X9=15000.0*ALOG10(1.0)
13          X10=(15000.0**2)*ALOG10(1.0)
14          X11=ALOG10(15000.0)
15          DO 300 K=3,5
16          DO 200 I=10,48,2
17          DO 100 J=1,6
18          CO=.5848723
19          C1=-.2263555
20          C2=.0473364
21          C3=-.0026169
22          C4= .0000015
23          C5= .0000000
24          C6= .1607131
25          C7=-.0391811
26          C8=-.0021043
27          C9= .0000015
28          C10=.0000000
29          C11=-.0084751
30          C12=-.0023573
31          C13=-.1823595
32          B0=-5.78514876
33          B1=-1.89967660
34          B2=-.72012773
35          B3=.03534285
36          B4=-2.1449E-05
37          B5=1.7826E-10
38          B6=-.20866606
39          B7=1.00533238
40          B8=-.06279118
41          B9=1.0709E-05
42          B10=7.515E-10
43          B11=2.85709359
44          B12=2.74651610
45          B13=6.28807783
46          A0=5.75402805
47          A1=-.27361528
48          A2=.10077234
49          A3=-.00155036
50          A4=4.3523E-05
51          A5=-5.8013E-10
52          A6=-1.27831176
53          A7=.55820096
54          A8=-.04702459
55          A9=-6.8417E-05
56          A10=1.4384E-09
57          A11=-1.45929552
58          A12=.49654038
```

```
      A13=-2.21563154
      X=I
      T=J
      SN=K
      Z1=ALOG10(X+L2)
      X2=T*ALOG10(19.0)
      Z2=T*ALOG10(X+L2)
      X3=(T**2)*ALOG10(19.0)
      Z3=(T**2)*ALOG10(X+L2)
      Z4=ES*ALOG10(X+L2)
      Z5=(ES**2)*ALOG10(X+L2)
      Z6=ALOG10(L2)
      X7=T*ALOG10(1.0)
      Z7=T*ALOG10(L2)
      X8=(T**2)*ALOG10(1.0)
      Z8=(T**2)*ALOG10(L2)
      Z9=ES*ALOG10(L2)
      Z10=(ES**2)*ALOG10(L2)
      Z11=ALOG10(ES)
      X12=ALOG10(SN)
      Z12=ALOG10(SN)
      X13=ALOG10(T)
      Z13=ALOG10(T)
      Y1(I,J,K)=CO+C1*Z1+C2*Z2+C3*Z3+C4*Z4+C5*Z5+C6*Z6+C7*Z7
     +         +C8*Z8+C9*Z9+C10*Z10+C11*Z11+C12*Z12+C13*Z13
      C=1.05
      Y2(I,J,K)=BO+B1*X1+B2*X2+B3*X3+B4*X4+B5*X5+B6*X6+B7*X7
     +         +B8*X8+B9*X9+B10*X10+B11*X11+B12*X12+B13*X13
      Y3(I,J,K)=BO+B1*Z1+B2*Z2+B3*Z3+B4*Z4+B5*Z5+B6*Z6+B7*Z7
     +         +B8*Z8+B9*Z9+B10*Z10+B11*Z11+B12*Z12+B13*Z13
      RHO(I,J,K)=10**Y3(I,J,K)
      RHO18(I,J,K)=10**Y2(I,J,K)
      Y4(I,J,K)=AO+A1*X1+A2*X2+A3*X3+A4*X4+A5*X5+A6*X6+A7*X7
     +         +A8*X8+A9*X9+A10*X10+A11*X11+A12*X12+A13*X13
      Y5(I,J,K)=AO+A1*Z1+A2*Z2+A3*Z3+A4*Z4+A5*Z5+A6*Z6+A7*Z7
     +         +A8*Z8+A9*Z9+A10*Z10+A11*Z11+A12*Z12+A13*Z13
      B18(I,J,K)=(10**Y4(I,J,K))+.07
      B(I,J,K)=(10**Y5(I,J,K))+.07
      LE(I,J,K)=(RHO18(I,J,K)/RHO(I,J,K))*((-ALOG(1.0/C))
     +          **((1.0/B(I,J,K))-(1.0/B18(I,J,K))))
  100 CONTINUE
  200 CONTINUE
  300 CONTINUE
      DO 400 K=3,5
      WRITE (6,600) SN,ES
      SN=K
  600 FORMAT('1',T10,'SN=',F4.0,3X,'ES=',F7.0,3X,'TANDEM',3X,
     +'WET-FRZ',3X,'PSI')
      WRITE (6,601)(L,L=1,6)
  601 FORMAT( 15X,I1,5(14X,I1))
      DO 400 I=10,48,2
      X=I
  400 WRITE(6,500)X,(LE(I,J,K),J=1,6)
  500 FORMAT(F4.0, 6F15.3)
      ES=ES+10000.0
      IF(ES.LE.25000.0) GO TO 10
  800 STOP
      END
//$DATA
```

```
1.      //DAMAGE JOB (W114,013C,3,999,HJ),'RUTTING'
2.      //*TAMU R=512,PRTY=5
3.      //STEP EXEC WATFIV,REGION=512K
3.1     //FT03F001 DD DUMMY
3.2     //FT02F001 DD DSN=USR.W114.HJ.RDATA1,DISP=SHR
4.      //FT04F001 DD  DSN=USR.W114.HJ.DAMDATA,DISP=SHR
5.      //SYSIN  DD  DATA
6.      //$OPTIONS
7.      C       THIS PROG.TO FIND B1,B2,RHO2,C2,DAMAGE,FOR RUTTING
7.2     C       THIS IS DONE FOR EACH ZONE SEPARATELY
7.3     C       PROJECT 2476 FOR SDHPS OF TEXAS
7.4     C       DAMDATA IS THE OUTPUT FILE FOR THIS PROGRAM
7.5     C       RDATA1 IS THE INPUT FILE
8.              INTEGER SIDNO
9.              CHARACTER*6 TLD,TEST
10.             REAL * 8 ENVIR
11.             REAL NAX
12.             DIMENSION NAX(10),RD(10),G(10)
12.1            DATA TEST/'SINGLE'/
12.2            L2=2
13.          10 CONTINUE
14.             NYR=10
15.             RT=0.5
17.             READ(4,100,END=1000) SIDNO,ENVIR,ES,SN,TAC,LOAD,TLD
18.         100 FORMAT(I6,1X,A8,4X,F6.0,4X,F4.1,10X,F4.1,8X,I2,5X,A6)
19.             READ(4,101)(NAX(I),RD(I),I=1,NYR)
20.         101 FORMAT(5X,G15.5,10X,F10.4)
20.1            IF (TLD.EQ.TEST) L2=1
20.2            IF (TLD.NE.TEST)L2=2
21.             SUMX=0.0
22.             SUMY=0.0
23.             SUMXY=0.0
24.             SMXSQ=0.0
25.             XN=0.0
26.             DO 200 I=1,NYR
27.             Y=ALOG10(RD(I)/RT)
28.             X=ALOG10(NAX(I))
29.             SUMX=SUMX+X
30.             SUMY=SUMY+Y
31.             SMXSQ=SMXSQ+(X*X)
32.             SUMXY=SUMXY+(X*Y)
33.             XN=XN+1.0
34.         200 CONTINUE
35.             SSY=SUMXY-(SUMX*SUMY)/XN
36.             SSX=SMXSQ-(SUMX*SUMX)/XN
37.             BETA1=SSY/SSX
38.             DO 500 K=21,1000
39.             C=FLOAT(K)/20.
40.             SUMB2=0.0
41.             D=0.0
42.             DO 300 J=1,NYR
43.             G(J)=RD(J)/RT
43.1            IF ((-ALOG(G(J))+ALOG(C)).EQ.0.0 )GO TO 900
43.2            IF (G(J).GT.1.00) GO TO 850
44.             B2=BETA1/(-ALOG(G(J))+ALOG(C))
45.             SUMB2=SUMB2+B2
46.             D=D+1.0
47.         300 CONTINUE
48.             AVB2=SUMB2/D
49.             SUMR2=0.0
```

```
50.             E=0.0
51.             DO 350 L=1,NYR
51.1            G(L)=RD(L)/RT
52.             IF (G(L).GT.1.0) GO TO 850
53.             RH02=((-ALOG(G(L))+ALOG(C))**(1.0/AVB2))*NAX(L)
54.             SUMR2=SUMR2+RH02
55.             E=E+1.0
56.          350 CONTINUE
57.             AVRH02=SUMR2/E
58.             SUMC2=0.0
59.             Q=0.0
60.             DO 400 M=1,NYR
60.1            IF ((-((AVRH02/NAX(M))**AVB2)).GT.173.0)GO TO 900
61.             C2=G(M)/EXP(-((AVRH02/NAX(M))**AVB2))
62.             SUMC2=SUMC2+C2
63.             Q=Q+1.0
64.          400 CONTINUE
65.             AVC2=SUMC2/Q
66.             Z=ABS(AVC2-C)
67.             IF(Z.LE.0.020) GO TO 580
68.          500 CONTINUE
69.             GO TO 800
69.5        580   PF=RT*AVC2
70.          600 WRITE(3,610)
71.          610 FORMAT('SIDNO   ENVIR    L1   L2   T1     ES     SN      PF')
73.             WRITE(2,650)SIDNO,ENVIR,LOAD,L2,TAC,ES,SN,PF
74.          650 FORMAT(I6,1X,A8,2X,I2,2X,I1,3X,F4.1,2X,F6.0,2X,F4.1,2X,F7.5)
75.              WRITE(3,670)
76.          670 FORMAT(5X,'       NAX                      RD           G'/)
77.             WRITE(2,700)(NAX(M),RD(M),G(M),M=1,NYR)
78.          700 FORMAT(5X,G15.5,5X,F10.3,5X,F10.7)
79.             WRITE(3,710)
80.          710 FORMAT('      BETA1               AVB2              AVRH02      ',
81.            +       '              AVC2              Z'/)
82.             WRITE(2,750) BETA1,AVB2,AVRH02,AVC2,Z
83.          750 FORMAT(2X,G12.5,3X,G12.5,3X,G12.5,3X,F10.5,2X,F7.5///)
84.             GO TO 900
85.          800 WRITE(3,810) SIDNO
86.          810 FORMAT(5X,I6,' ERROR Z IS NOT ACCEPTED'//)
87.             GO TO 900
88.         850   WRITE(3,851) SIDNO
89.         851   FORMAT(5X,I6,'  DAMAGE IS GT.  1.00'//)
90.        900   GO TO 10
91.         1000  STOP
92.             END
93.        //$DATA
94.        /*END
```