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Evaluation of each procedure is based on the backcalculated moduli and the sum of absolute error between measured and calculated deflection basins. Also, normalized surface deflections are used to evaluate the stress sensitivity of each pavement structure. Comparison of backcalculated moduli to laboratory tests is not made because test equipment was not available during the project.

The most influential variables for backcalculated moduli are location of the rigid bottom and AC layer thickness. Establishing a statewide database on the characteristics of pavement materials in California highways is strongly recommended for successful future operation.

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DEPARTMENT OF TRANSPORTATION
DIVISION OF NEW TECHNOLOGY,
MATERIALS AND RESEARCH

EVALUATION OF BACKCALCULATION METHODS TO PREDICT PAVEMENT LAYER MODULI

FINAL REPORT # FHWA/CA/TL-94/11
CALTRANS STUDY # F91TL03

Performed by .... Office of Pavement,
Pavement Analysis and Research Support Branch

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CONVERSION FACTORS

English to Metric System (SI) of Measurement

Quality	English Unit	Multiply By	To Get Metric Equivalent
Length	inches (in) or (")	25.40	millimetres (mm)
		.02540	metres (m)
	feet (ft) or (')	.3048	metres (m)
	miles (mi)	1.609	kilometres (km)
Area	square inches (in ^{2})	6.432 x 10 $^{-4}$	square metres (m ^{2})
	square feet (ft ^{2})	.09290	square metres m ^{2})
	acres	.4047	hectares (ha)
Volume	gallons (gal)	3.785	litre (l)
	cubic feet (ft ^{3})	.02832	cubic metres (m ^{3})
	cubic yards (yd ^{3})	.7646	cubic metres (m ^{3})
Volume/Time	cubic feet per		
(Flow)	second (ft ^{3}/s)	28.317	litres per second (l/s)
	gallons per minute (gal/min)	.06309	litres per second (l/s)
Mass	pounds (lb)	.4536	kilograms (kg)
Velocity	miles per hour (mph)	.4470	metres per second (m/s)
	feet per second (fps)	.3048	metres per second (m/s)
Acceleration	feet per second squared (ft/s ^{2})	.3048	metres per second squared (m/s ^{2})
	acceleration due to force of gravity (G)	9.807	metres per second squared (m/s ^{2})
Density	(lb/ft ^{3})	16.02	kilograms per cubic metre (kg/m ^{3})
Force	pounds (lb)	4.448	newtons (N)
	kips (1000 lb)	4448	newtons (N)
Thermal Energy	British thermal unit (Btu)	1055	joules (J)
Mechanical Energy	foot-pounds (ft-lb)	1.356	joules (J)
	foot-kips (ft-k)	1356	joules (J)
Bending Moment or Torque	inch-pounds (in-lb)	.1130	newton metres (Nm)
	foot-pounds (ft-lb)	1.356	newton-metres (Nm)
Pressure	pounds per square inch (psi)	6895	pascals (Pa)
	pounds per square foot (psf)	47.88	pascals (Pa)
Plane Angle	degrees (°)	0.0175	radians (rad)
Temperature	degrees fahrenheit (°)	$\frac{°F - 32}{1.8} = °C$	degrees celsius (° C)
Concentration	parts per million (ppm)	1	milligrams per kilogram (mg/kg)

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Mr. D.R. Alexander Dr. M.S. Mamlouk Dr. R.L. Lytton Dr. J.P. Mahoney Dr. H. Zhou	Allowed use of backcalculation computer programs.
Mr. D. Frith	Provided FWD data files of SHRP LTPP test sites.

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1.0 INTRODUCTION

1.1 Problem Statement

The California Department of Transportation (Caltrans) has relied on maximum surface deflection as the indicator of flexible pavement structural capacity for more than twenty-five years. Caltrans' pavement evaluation procedure and empirical design curves have proven to be an effective, reliable overlay design tool [1,2,3]. However, relying only on maximum surface deflection cannot provide information for evaluating in situ pavement conditions.

Newly evolving pavement analysis and evaluation procedures use mechanistic theory-based methods based on measured surface deflection basins and computerized backcalculation procedures to determine in situ pavement properties [4,5]. However, some researchers [6] recommend a sensitivity analysis of backcalculation procedures before adopting any backcalculation programs for routine use. Benefits, disadvantages and sensitivity in using backcalculation procedures have not been studied previously for California pavements.

1.2 Objectives

The main objective of this research is to evaluate backcalculation procedures that are currently available for determining the moduli of flexible pavement layers and the subgrade. More specific objectives of this study are to:

(1) Provide a single convenient reference describing backcalculation programs for Caltrans,

(2) Determine the sensitivity of backcalculation computer procedures to input parameters,

(3) Verify the accuracy of backcalculation computer procedures,

(4) Recommend computer procedure(s) for future use, and

(5) Provide recommendations for successful applications of the procedure(s) to evaluate pavement structural capacity.

It should be noted that the purpose of this research is not to promote nor to compare overlay design methods.

1.3 Scope

All objectives were achieved except for verification of computer procedures. Laboratory testing of resilient modulus was not completed during this project because testing equipment was not available.

The surface deflection basin data at six different pavement structures in California were obtained from Western Regional contractor of Strategic Highway Research Program (SHRP) for the Long-Term Pavement Performance (LTPP) studies.

Chapter 2 reviews characteristics of typical pavement materials including subgrade soils. After introducing several analytical methods for predicting the primary response (stress, strain and deflection) of pavement structures, a general background of backcalculation procedures is described. Chapter 3 describes various input variables for backcalculation and fifteen computerized backcalculation procedures. Chapter 4 presents results from sensitivity studies of five backcalculation procedures (BKCHEV, BOUSDEF 2.0, EVERCALC 3.3, MODULUS 4.0 and WESDEF). Chapter 5 discusses detailed features and the sensitivity of each procedure to input variables based on the coefficient of variance (COV) of backcalculated moduli. Chapter 6 presents conclusions, recommendations and implementation of the findings from this study. A comprehensive output summary for each program and for all six sites is presented in the Appendix.

1.4 Significance of This Study

One of the SHRP LTPP activities in Caltrans is to evaluate the pavement properties of General Pavement Study (GPS) and Special Pavement Study (SPS) test sites using deflection basin and backcalculation programs. The goals and objectives for SHRP deflection testing are described in Reference 7. Thus, the findings of this research can and should be applied to related SHRP studies as well as other pavement analysis and evaluation studies in Caltrans.

2.0 BACKGROUND

2.1 Introduction

The purpose of materials testing for pavement structures is to determine properties for use in design, analysis and evaluation procedures. Mechanistic or mechanistic-empirical design, analysis and evaluation of pavement systems require the elastic properties and permissible levels of primary response (stress, strain and deflection) of pavement. The elastic properties are usually the modulus of elasticity (or resilient modulus, referred to hereafter as modulus) and Poisson's ratio. Permissible levels are derived from observing field pavement performance.

The modulus of pavement materials in service is affected by several variables including loading (rate and level), moisture, temperature, density, stress state and type of materials. The moduli of pavement materials can be determined by several repeated load laboratory tests (i.e., ASTM D4123, ASTM D3497, AASHTO T292-91 I and AASHTO T294-92 I). However, these laboratory tests have some critical difficulties such as an inability to reproduce in situ loading and representative specimens of material and poor correlation with in-service behavior. In addition, field sampling for laboratory tests causes safety hazards to field personnel and traffic delays due to lane closure.

In order to resolve these difficulties, several non-destructive test methods have been suggested and used. One of these methods is to estimate the moduli of pavement materials using backcalculation procedures and pavement surface deflections. The basic concept or assumption of the backcalculation method is that there is a unique deflection basin of each pavement section with same thickness, modulus and Poisson's ratio of each layer. For proper operation of backcalculation computer programs it is necessary to understand the characteristics of pavement materials including subgrade soils and forward calculation methods. Forward calculation is the opposite of backcalculation by calculating the primary response of a pavement system based on known or assumed elastic properties of materials and layer thickness.

2.2 Characteristics of Pavement Materials

Predicting the primary response (stress, strain and deflection) of pavement structures under traffic wheel loading and environmental conditions requires an understanding of the stress-strain behavior of pavement materials. The stress-strain behavior can be expressed in terms of modulus and Poisson's ratio. In general, the moduli of pavement materials have been measured through laboratory test and assumed Poisson's ratios have been used.

Numerous materials have been used for pavement structural sections. However, the scope of review in the present section is limited to typical materials for pavement structures such as dense graded asphalt concrete (DGAC), unbound granular material, cement treated mixtures and fine subgrade soils.

2.2.1 Dense Graded Asphalt Concrete (DGAC)

The modulus of DGAC mix can be measured directly using repeated load tests such as ASTM D4123 and D3497. According to ASTM D4123 (Indirect Tension Test for Resilient Modulus of Bituminous Mixtures), the resilient modulus of DGAC mix is calculated using the following equation:

$$E_{RI} = P(\nu_{RI} + 0.27)/t\Delta H_I \qquad (2\text{-}1)$$

or

$$E_{RT} = P(\nu_{RT} + 0.27)/t\Delta H_T \qquad (2\text{-}2)$$

where E_{RI} = instantaneous resilient modulus of elasticity, psi,

E_{RT} = total resilient modulus of elasticity, psi,

ν_{RI} = instantaneous Poisson's ratio,

ν_{RT} = total Poisson's ratio,

ΔH_I = instantaneous recoverable horizontal deformation, in.,

ΔH_T = total recoverable horizontal deformation, in., P = repeated load, pounds,

t = thickness of specimen, in.

Usually the Poisson's ratio of 0.35 is assumed in the above equations.

According to ASTM D3497 (Dynamic Modulus of Asphalt Mixtures), the dynamic modulus of DGAC is calculated using the following equation:

$$|E^*| = \sigma_o/\varepsilon_o \tag{2-3}$$

where $|E^*|$ = dynamic modulus, psi

σ_o = repeated load/cross sectional area of the test specimen, psi

ε_o = recoverable axial strain, in/in.

It should be noted that both test methods require a strict temperature control during testing.

In addition to conducting a laboratory test, the modulus of DGAC mix can be estimated from a nomographic solution for the modulus of the bitumen (S_b, referred to as "stiffness modulus" in Figure 2-1) which is then used in equations to estimate the stiffness modulus of the DGAC mix. The modulus of bitumen can be found from the nomograph shown in Figure 2-1. This nomograph was originally developed by Van der Poel [8], and later it was slightly revised by Heukelom [9] as shown in Figure 2-1. The penetration index (PI) in Figure 2-1 is obtained using the following equation:

$$(20\text{-}PI)/(10+PI) = 50*(\log Pen_1 - \log Pen_2)/(T_1-T_2) \tag{2-4}$$

where Pen_1 = penetration value at temperature T_1 (°C) and

Pen_2 = penetration value at temperature T_2 (°C).

For a given asphalt concrete (AC) mix, the stiffness modulus of AC mix (S_m) is obtained from equation (2-5) with S_b being found from the Figure 2-1. The "stiffness modulus" is used in lieu of the dynamic modulus [10].

$$S_m = S_b[1 + (2.5/n)*(C_v/(1 - C_v))]^n \qquad (2\text{-}5)$$

where S_m = AC mix stiffness modulus (N/m^2),

S_b = bitumen stiffness modulus (N/m^2),

$n = 0.83*\log_{10}[(4*10^5)/S_b]$,

$C_v = (V_g)/(V_g + V_a)$

where V_g = volume of aggregate and

V_a = volume of asphalt.

Equation (2-5) is applicable for an air void of about 3 percent and a C_v value between 0.7 and 0.9. For mixes having air voids greater than 3 percent, Van Draat and Sommer [11] have recommended a correction term, C_v', defined as follows:

$$C_v' = C_v/(1 - (V_V - 0.03)) \qquad (2\text{-}6)$$

where V_V is the volume of air void. This correction is applicable only to mixes having an asphalt volume concentration factor C_B satisfying equation (2-7):

$$C_B \geq 2*(1 - C_v')/3 \qquad (2\text{-}7)$$

where: $C_B = V_a/(V_g + V_a)$

As shown in the above equations and in Figure 2-1, the modulus of an AC mix is a function of the volume of ingredients, density, asphalt cement properties, temperature and time of loading (or frequency).

According to the study by Bonaquist et al. [13], the dynamic modulus (ASTM D 3497) is higher than the resilient modulus (ASTM D 4123). The reason for a higher dynamic modulus is that asphalt concrete is in compression in D3497 so that shearing stresses are resisted by both the aggregate interlock and the stiffness of the asphalt cement. However, in D4123 the asphalt concrete is in tension so that aggregate interlock affects the resilient modulus much less.

The results in Reference 13 also show that, even though the stiffness modulus from the nomograph method is slightly less than the dynamic modulus, the agreement between these two methods is good.

Another method to predict AC modulus is to use the curves in Figures 2-2 and 2-3 developed by the Asphalt Institute [12]. The mean pavement temperature in Figure 2-2 is obtained by adding the measured pavement surface temperature at the time of test to the mean air temperature for the five-day period prior to the day of testing as shown in Figure 2-3. Because the effect of temperature on modulus of AC mix is significant, as shown in Figure 2-2, it is very important to record the surface temperature when deflections are measured.

The measured modulus of cores, the estimated modulus from Equation (2-5) or an estimate from Figure 2-2 can be used as an input for AC layer modulus in backcalculation procedures. Consequently, an engineer reduces the number of layers having an unknown modulus, reduces error and improves operation time.

2.2.2 Unbound Granular Aggregate

A function of granular base and subbase layers is to reduce the stress state in underlying layers from repeated wheel loading and to minimize rutting within granular layers [14].

The modulus of unbound granular materials can be measured directly according to AASHTO T292-91 I (Resilient Modulus of Subgrade Soils and Untreated Base/Subbase Materials) or AASHTO T294-92 I (Resilient Modulus of Unbound Granular Base/Subbase Materials and Subgrade Soils - SHRP Protocol P46). The modulus of unbound granular materials is a function of type and gradation of the aggregate, void ratio (or dry density) and degree of saturation [14].

The modulus of granular materials is highly dependent upon the stress state imposed on the material. A method to address the stress state dependency of resilient modulus (M_R) of granular materials can be represented by the following equation:

$$M_R = K_1 * \theta^{K_2} \qquad (2\text{-}8)$$

or

$$M_R = K_1 * \sigma_3^{K_2} \qquad (2\text{-}9)$$

where K_1 and K_2 = constants which depend on the material characteristics,

θ = bulk stress or $\sigma_1 + \sigma_2 + \sigma_3$, psi, and

σ_3 = confining stress, psi.

A typical plot of M_R versus stress state is shown in Figure 2-4. Extensive testing of granular materials has shown that the number of stress repetitions and the sequence of the applied stresses has little, if any, effect upon the M_R value [14]. Table 2-1 is a summary of typical resilient moduli obtained for granular materials. Moduli of granular materials may vary from about 15,000 to over 100,000 psi. In general, the modulus increases as the degree of particle angularity increases, density increases and degree of saturation decreases. Poisson's ratio of granular material is usually assumed in the range of 0.30 to 0.45.

2.2.3 Cement Treated Materials

Moduli values for cement treated materials are extremely dependent upon the soil type and properties, cement content and type of test [14]. Both soil cement and cement treated base usually exhibit linear, stress-independent elastic properties. Table 2-2 is a summary of typical moduli obtained from various tests on cement treated material. Usually the modulus increases with time due to pozzolanic action. From a practical point of view the modulus becomes relatively constant after 2 to 3 months.

As presented in the Table 2-2, moduli for soil cement (cohesive soil) may be in the range of 10,000 to 900,000 psi, while for cement treated granular bases, the values may be as high as 1,000,000 to 3,000,000 psi. The latter value approaches that normally used for a portland cement concrete (PCC) pavement (3,000,000 to 5,000,000 psi).

In general, the stress dependency of the modulus for cement treated materials is much less as the stabilized material becomes more rigid like a DGAC mix.

Poisson's ratio of the cement treated material is usually assumed in the range of 0.15 to 0.25 similar to that of PCC.

2.2.4 Fine Subgrade Soils

The subgrade condition significantly influences pavement structural response. Much of the pavement surface deflection accumulates in the subgrade [4].

The modulus of subgrade soils can be measured using AASHTO T-292 or T-294. Moduli of typical fine-grained soils are extremely dependent upon soil type, density, moisture conditions and stress state. Typical values of moduli vary from 3,000 to 40,000 psi for cohesive clay soils to 25,000 or 30,000 psi for fine-grained sandy soils [14].

For fine grained soils the most significant stress effect is from the axial deviator stress (s_d) applied to the specimen during the test. However, unlike granular materials, the M_R of fine grained soils rapidly decreases and then rises slightly as the deviator stress increases as illustrated in Figure 2-5. The characteristic shape of the curve has suggested the use of the following equations to define the modulus:

$$M_R = K_2 + K_3(K_1 - \sigma_d) \text{ for } K_1 > \sigma_d \quad (2\text{-}10)$$

$$M_R = K_2 + K_4(\sigma_d - K_1) \text{ for } K_1 < \sigma_d \quad (2\text{-}11)$$

where K_1, K_2, K_3 and K_4 = experimental constants and

σ_d = axial deviator stress or $\sigma_1 - \sigma_3$, psi.

The Poisson's ratio of fine-grained soil ranges from 0.40 to 0.50.

2.3 Non-destructive Testing Equipment

Surface deflection is the easiest and simplest pavement primary response parameter to measure and does not cause any destructive effects on the pavement structure. Several devices have been used to measure surface deflection.

Current non-destructive testing (NDT) devices are described briefly in this section and are categorized by the following loading modes: (1) quasi-static load, (2) vibratory load and (3) impulse load. Each device is described in detail in Reference 15.

2.3.1 Quasi-Static Loading

The quasi-static loading mode refers to measuring deflection under a slowly moving wheel load. The most common device of this type is the Benkelman beam, which is a relatively simple device for measuring surface deflections. The probe of the beam is placed between the dual wheels of a single axle and measures the pavement rebound deflection as the wheels move away at less than 5 miles per hour. The California Traveling Deflectometer and La Croix Deflectograph are included in this category. Though used extensively in the past, quasi-static testing has been superseded by dynamic testing from vibratory and impact loads.

2.3.2 Vibratory Loading

The two most common types of steady-state vibrator force generators are counter-rotating masses and electrohydraulic systems. In the first case, the harmonic loading function is generated by the rotation of an eccentric mass or masses. The typical device of this type is the commercially available "Dynaflect."

The Dynaflect generates a peak-to-peak fixed load of 1000 pounds at a driving frequency of 8 Hz through two steel wheels which are 20 inches apart. Caltrans has used the Dynaflect for twenty-five years successfully for pavement evaluation and overlay design. The Dynaflect uses a maximum of five geophones spaced at 12 inches apart, with the first geophone located midway between the loading wheels, to measure the pavement surface deflection.

In electrohydraulic vibrators the amplitude of the loading function is independent of the driving frequency. One device of this type is the Road Rater, which can produce various magnitudes of dynamic force in the frequency range 5 to 100 Hz. Pavement deflections are measured by at least two sensors, one at the center of loading and the others at some distance.

2.3.3 Impulse Loading

Most impulse loading NDT devices deliver a transient force to the pavement surface and measure the transient pavement response. The most widely used impulse loading device is the falling weight deflectometer (FWD). Force impulses are normally generated by dropping a mass onto a circular plate placed in contact with the pavement surface. With various dropping heights, the FWD can apply impulse forces in the legal and overload ranges.

In most FWD devices the duration of the pulse load is fixed and controlled by a damping system (specific combination of springs and pads, etc.) between the falling weight and the contact plate. Three typical impulse loading plate systems commercially available are Dynatest, KUAB and Phonix. However, Caltrans' experience using FWD's is limited. On many occasions, pavement primary response from an FWD loading has been compared favorably to the response from a moving wheel load despite the fact that an FWD's impulse load differs from a moving wheel [16].

2.4 Application of Deflection Data

The deflection basin data collected by using various NDT devices have been used to estimate moduli for pavement analysis, evaluation and overlay design by several agencies. Backcalculated moduli subsequently are input to structural response models and pavement performance models to estimate the load carrying capacity of existing pavement structures and to design an overlay thickness needed to carry future traffic. Deflection basin data also are used to determine the load transfer capability of cracks, the presence of voids between layers, the depth to bedrock and water tables and other important site-specific conditions [17]. Deflection data also can be used to monitor the variability of pavement materials and to determine seasonal changes in material properties.

For several years Caltrans has used the maximum deflection, measured by a Dynaflect, for AC pavement overlay design [3]. Also, Caltrans developed a computer program called "SHOES" (Super-Heavy Overload Evaluation System) for backcalculating layer moduli and for predicting pavement response to super-heavy vehicles in California [18]. The SHOES program uses WESDEF for backcalculation and ELSYM5 for the calculation of pavement response.

2.5 Analysis Methods

In order to understand backcalculation procedures it is necessary to understand forward calculation methods first. This section describes several forward calculation methods and then presents an overview of backcalculation.

2.5.1 Forward Calculation

Forward calculation requires essential inputs such as layer modulus, Poisson's ratio and thickness of pavement layers in order to calculate primary response. Some computer programs require users to input the interface friction between adjacent layers.

Most forward calculation methods fit into one of the following three groups; (1) multi-layered linear elastic theory, (2) method of equivalent thickness (MET) and (3) finite element method (FEM). The present section briefly describe these methods and some computer programs.

2.5.1.1 Multi-Layer Linear Elastic Theory

Because pavements commonly are built using several layers of material, numerous procedures based on layered theory have been developed to predict the response of pavement systems to traffic wheel loadings. These procedures rely on material properties characterized by two parameters, modulus and Poisson's ratio. Layered theory assumes axisymmetric conditions and uses the principle of superposition to determine the effect of multiple loads.

Most of the procedures using layered theory include several basic assumptions as follows:

1. The material in each layer is linear elastic, homogeneous, isotropic and weightless.
2. Each layer has a finite thickness except for the lower layer, and all layers are infinite in the horizontal direction.
3. A uniform static load is applied over a circular area at the surface.
4. Inertia of pavement structure is neglected.
5. The boundary conditions are as follows:
   a) Layers are in continuous contact. There is no normal stress outside the loaded area at the top of the surface layer, and it is free from shearing stress.
   b) For the lowest layer, stresses and displacement are assumed to approach zero at a very large depth.
   c) Full friction is generally assumed at each interface (unless specified otherwise),
6. Temperature effects are neglected.

These assumptions could cause systematic errors which can be mitigated by more realistic models and constitutive relations.

Examples of popular computer programs (BISAR, CIRCLY, ELSYM5 and WES5) are described briefly below.

a. BISAR

BISAR (Bitumen Structures Analysis in Roads) is a general purpose program for computing stresses, strains and displacements in elastic layered systems subjected to one or more vertical uniform circular loads [19]. These surface loads can be combinations of a vertical normal stress and a unidirectional horizontal stress (e.g. from braking). All interfaces between layers have an interface friction factor which can vary from zero (full continuity) to one (frictionless slip) between the layers.

Stresses, strains and displacements are calculated in a cylindrical coordinate system for each vertical load. For more than one load, the cylindrical components are transformed to a Cartesian coordinate system and the effect of the multiple load are found by summarizing the stresses, strains and displacements of each wheel.

BISAR requires the following information:

1. The number of layers;
2. Modulus and Poisson's ratio of each layer;
3. The thickness of each layer, except for the bottom one;
4. The friction at each interface;
5. The number and position of loads as well as the vertical and tangential component of each load;
6. The stress, strain and displacement components to be calculated; and
7. The number of places where calculations are required along with their position (in Cartesian coordinates).

The following are limitations of the BISAR:

1. The number of layers in the system is limited to a maximum of ten, although the program code can be changed for more.
2. The number of pavement systems analyzed in one run and the number of points in the system where stresses and strains can be calculated are limited to a maximum of 99.
3. Nonlinear behavior of granular bases and subgrade soils cannot be accounted for.

b. CIRCLY

CIRCLY [20] analyzes a multi-layered anisotropic medium subject to multiple circular loads. Load types (see Figure 2-6) include horizontal and vertical forces, moments and shear stress. For multiple loads, the principle of superposition is applied. Interfaces between the layers can be varied from fully continuous to fully frictionless. The bottom layer extends to a finite depth or to an infinite depth. If the bottom layer is finite, it is assumed to rest on a rigid base, and the contact can be either fully continuous (rough) or fully frictionless (smooth).

The program considers the homogeneous and isotropic properties as well as cross-anisotropic material properties. The cross-anisotropic material is assumed to have an axis of symmetry of rotation, i.e., the elastic properties are equivalent in all directions perpendicular to the axis of symmetry.

CIRCLY uses two coordinate systems to describe the locations of loads and calculation points: (1) global coordinate and (2) local coordinate (Figure 2-6). A 'global' coordinate system is used to describe the locations of the individual loads while 'local' coordinate systems are used to describe each load. The 'global' system is Cartesian with axes X, Y and Z also used to define the points where results are required. Each 'local' coordinate system may be Cartesian (x, y, z) or cylindrical (r, θ, z) and has its origin at the center of the load.

The input for the program consists of the following three groups: (1) applied loads, (2) layered system and (3) coordinate points at which results are required. The output consists of all the input parameters together with the results of strains, stresses and displacements in a rectangular coordinate system. The principal strains and stresses are also calculated if a user requires.

CIRCLY has the following capacities:

1. The number of layers in system must not exceed 14.
2. The number of points in system where stresses and strains are to be determined is more than 260 calculation points.
3. More than 100 distinct loaded areas are allowable.

c. ELSYM5

The ELSYM5 (Elastic Layered System) computer program [19] determines the stresses, strains and displacements along with principal values in a three dimensional elastic layered system. One or more uniform circular loads are applied normal to the surface of the system.

Each layer of the system is described by modulus of elasticity, Poisson's ratio and thickness. The bottom layer may be semi-infinite or given a finite thickness, in which case the program assumes the bottom elastic layer is supported by a rigid base. If the bottom layer is semi-infinite, a thickness of zero is assigned. Each layer is numbered with the top layer as one and each layer numbered consecutively downward. All elastic layer interfaces are continuous.

All locations within the system are described by using the Cartesian coordinate system (X, Y, Z). The positive Z axis extends vertically down from the surface into the system.

The applied loads are described by any two of the three following parameters: load, contact pressure, radius of loaded area. The program determines the missing value. The following equation shows the relationship among three parameters:

$$r = (P/(p^{*}\pi))^{0.5} \tag{2-12}$$

where r = radius of loaded area, inches,

P = load, pounds, and

p = contact pressure, psi.

Listed below are the limitations of the ELSYM5.

1. The number of different systems and elastic layers is from a minimum of one to a maximum of five.
2. The number of identical uniform circular loads ranges from a minimum of one to a maximum of ten.
3. Nonlinear behavior of granular bases and subgrade soils cannot be accounted for.

4. The number of points in the system where results are desired ranges from a minimum of one (one XY and one Z) to a maximum of 100 (ten XY and ten Z).

d. WESLEA (WES5)

WESLEA (Waterways Experiment Stations Linear Elastic Analysis) was developed for flexible and rigid airport pavements by Van Cauwelaert [21]. The current version of the program, called WES5, models an elastic layered system with up to five layers. The fifth layer is semi-infinite and can be characterized as rigid if needed. The program can handle pavement systems having a high modulus ratio (the ratio of modulus for adjacent layers in the system), multiple wheel loads(up to twenty wheel loads) and varying interface friction conditions.

The interface conditions in WESLEA are modeled differently than BISAR. BISAR assumes a linear transition from full to zero friction, whereas WESLEA considers the friction phenomenon (partial friction) by Coulomb's Law. That is, some friction will occur if a vertical stress exists. The "partial friction" approach enables WESLEA to better represent in situ interface conditions.

According to a direct comparison between WESLEA and BISAR made by Van Cauwelaert et al. [21], a very good comparison was obtained for stresses, strains and displacements. However, WES5 operation time is much faster than BISAR's. One example of surface deflection basins and operation times is shown in Table 2-3.

2.5.1.2 Method of Equivalent Thickness (MET)

The method of equivalent thickness to use Odemark's method is an analytical-empirical approach. Odemark's method is used to transform the multilayer pavement into a single equivalent uniform, semi-infinite layer of one modulus on which Boussinesq's equations can be applied. For example, a two-layer system may be transformed to a semi-infinite space, as shown in Figure 2-7, provided that layer 1 is replaced by a thickness, h_e, of material having the properties of the semi-infinite space.

Boussinesq's equations are used to calculate the stresses and strains at the underside of the interface. The equations for vertical normal stress, strain and deflections for both a point loading and a circular uniformly distributed load are presented in Reference 22.

The vertical stresses and horizontal strains are equal on both sides of the interface, which satisfy the equilibrium and compatibility of the adjacent layers. These values can be used with Hooke's law to calculate the remaining stresses and strains above the interface. Because of the approximation of this method, a correction factor is introduced for better agreement with the values from analytical equations. The equivalent thickness of the (n-1) layers above n-th layer may be calculated from Eqn. (2-13):

$$h_{e,n} = f * \Sigma [h_i * \{(E_i/E_n)*((1-\nu_n^2)/(1-\nu_i^2))\}^{1/3}] \qquad (2\text{-}13)$$

where E = elastic modulus,

h = layer thickness,

f = correction factor,

ν = Poisson's ratio, and

i = 1 to n, number of layers.

The correction factor, f, is 0.8 except for the first interface where it is 1.0. For a two layer system, a factor of 0.9 is often used.

The advantage of MET is that calculation may be carried out very quickly and easily. However, the method is approximate, so that the results obtained may deviate from exact values. Ullidtz and Piette [22] recommended that MET should not be used if the thickness of a layer is less than half the radius of the loaded area or if E_i/E_{i+1} is less than two.

2.5.1.3 Finite Element Method

The linear elastic layered method can be improved by including nonlinear properties of pavement materials. However, the use of the stresses at a single point in each nonlinear layer to compute layer modulus is not correct. As the stresses vary with the radial distance from the load, the modulus also changes and is not uniform throughout the layer [10]. The finite element method is used in programs such as ILLI-PAVE developed by the University of Illinois [23] and the MICH-PAVE program developed at the Michigan State University [24] to solve the problem of nonlinear elastic layers.

a. ILLI-PAVE

ILLI-PAVE models the pavement as an axisymmetric solid of revolution and divides it into a number of finite elements. The program takes into account the nonlinear properties of materials in their response to traffic loads. This program also includes a failure model for granular and subgrade soils where the principal stresses in these materials are modified at the end of each iteration so that they do not exceed their strength limits as defined by the Mohr-Coulomb theory of failure [23].

Material characterizations for the ILLI-PAVE model are shown in Table 2-4. The asphalt concrete material is assumed to be linear elastic with a modulus range from 100 to 1400 ksi. Eqn. (2-8) is used to characterize the granular base materials.

In ILLI-PAVE, four different fine-grained subgrade soil models are used. These models are given in Figure 2-8. The "break point" of the curves at a deviator stress (σ_{di}) of about 6 psi corresponds to a resilient modulus denoted E_{ri}. For each subgrade, E_{ri} is the main parameter characterizing the nonlinear subgrade soil.

From a practical point of view the operation of ILLI-PAVE is too costly, complex and cumbersome for routine use [10].

b. MICH-PAVE

In the MICH-PAVE program, which is very similar to ILLI-PAVE, the pavement is represented by an axisymmetric finite element model. The Mohr-Coulomb failure criterion and the nonlinear material response of granular and cohesive soils are used in MICH-PAVE. MICH-

PAVE's main improvement over ILLI-PAVE is a flexible boundary at a limited depth beneath the top of the subgrade, instead of a rigid boundary deep below the surface [10]. The subgrade below the flexible boundary is considered as a homogeneous half-space. The use of a flexible boundary substantially reduces the number of finite elements so that less computer storage is needed (than required by ILLI-PAVE) and MICH-PAVE is easily run on personal computers. In addition, extrapolation and interpolation techniques are used in MICH-PAVE to improve the accuracy of stresses and strains at layer boundaries [24].

Huang [10] points out several possibilities that may cause inaccurate results in the finite element method after his analysis of MICH-PAVE and ILLI-PAVE:

1. The shape of finite elements significantly effects the accuracy of results.
2. The stresses and strains can be evaluated most accurately at the center of elements. Calculations for element boundaries, particularly at element corners, are more prone to error.
3. The stresses at layer interfaces are obtained by linear extrapolation from those at the center of the two elements below or above the interface. This procedure can cause error if the mesh is not fine enough.

2.5.2 Backcalculation

A number of computer programs have been developed and used to backcalculate pavement moduli from surface deflection measurements. The same methods used in forward calculation (multi-layered linear elastic theory, MET and finite element method) are common in backcalculation procedures.

Figure 2-9 is a simplified illustration of how the deflection basins are matched in backcalculation procedures. This illustration is for one deflection and one layer in BISDEF [27]. For multiple deflections and layers, the solution is obtained by developing a set of equations that define the slope and intercept for each deflection and each variable layer modulus as follows:

$$\log(Def_j) = A_{ji} + S_{ji} * (\log E_i) \quad (2\text{-}14)$$

where A = intercept,

S = slope,

j = 1 to the number of deflection measurements, and

i = 1 to the number of pavement layers.

Generally there are two approaches used in backcalculation procedures. The first approach uses the iterative procedures in which a forward calculation scheme is employed in an iterative process to match the calculated deflections to measured ones. The other approach uses a deflection database generated from a forward calculation using a range of assumed input parameters for a given pavement structure. Regression equations formulated from database and interpolation techniques are used to determine layer moduli.

2.5.2.1 Iterative Procedure

Iterative procedures start by computing a set of surface deflections based on layer seed (or initial) moduli, which are supplied by the user or are generated internally. The calculated surface deflections are compared with measured surface deflections and a new set of moduli is then interpolated based upon the magnitude of difference in deflections. This process is repeated iteratively until the calculated deflections match the measured ones within a user specified tolerance. When the discrepancies finally fall within tolerances, the adjusted moduli are assumed to be representative of in situ moduli and are printed out either on screen or paper. Figure 2-10 shows the general process of an iterative procedure.

Three convergence criteria are commonly used to terminate iterative operation: (1) a percent difference between the last modulus and the new trial modulus of each layer, (2) permissible number of iterations and (3) a percent of error between calculated versus measured deflections. Typical default values are (1) a difference of ten percent between the last backcalculated modulus and the new trial modulus of each layer and (2) three iterations.

Because of advanced computer technology and improved backcalculation procedures, users can run ten or more iterations. Several formulae characterizing the error between calculated and measured deflections are described in Chapter 3.

2.5.2.2 Database - Regression Method

This method uses a deflection database generated from forward calculation. The first step is to make several computer runs to develop a deflection database with the assumed layer thicknesses, moduli and Poisson's ratios for the pavement structure of interest. The procedure then uses a search algorithm to determine the set of moduli which best fits the measured basin. The MODULUS 4.0 and LOADRATE programs are examples of this method. MODULUS 4.0 uses WES5 and LOADRATE uses ILLI-PAVE for forward calculation of pavement surface deflections.

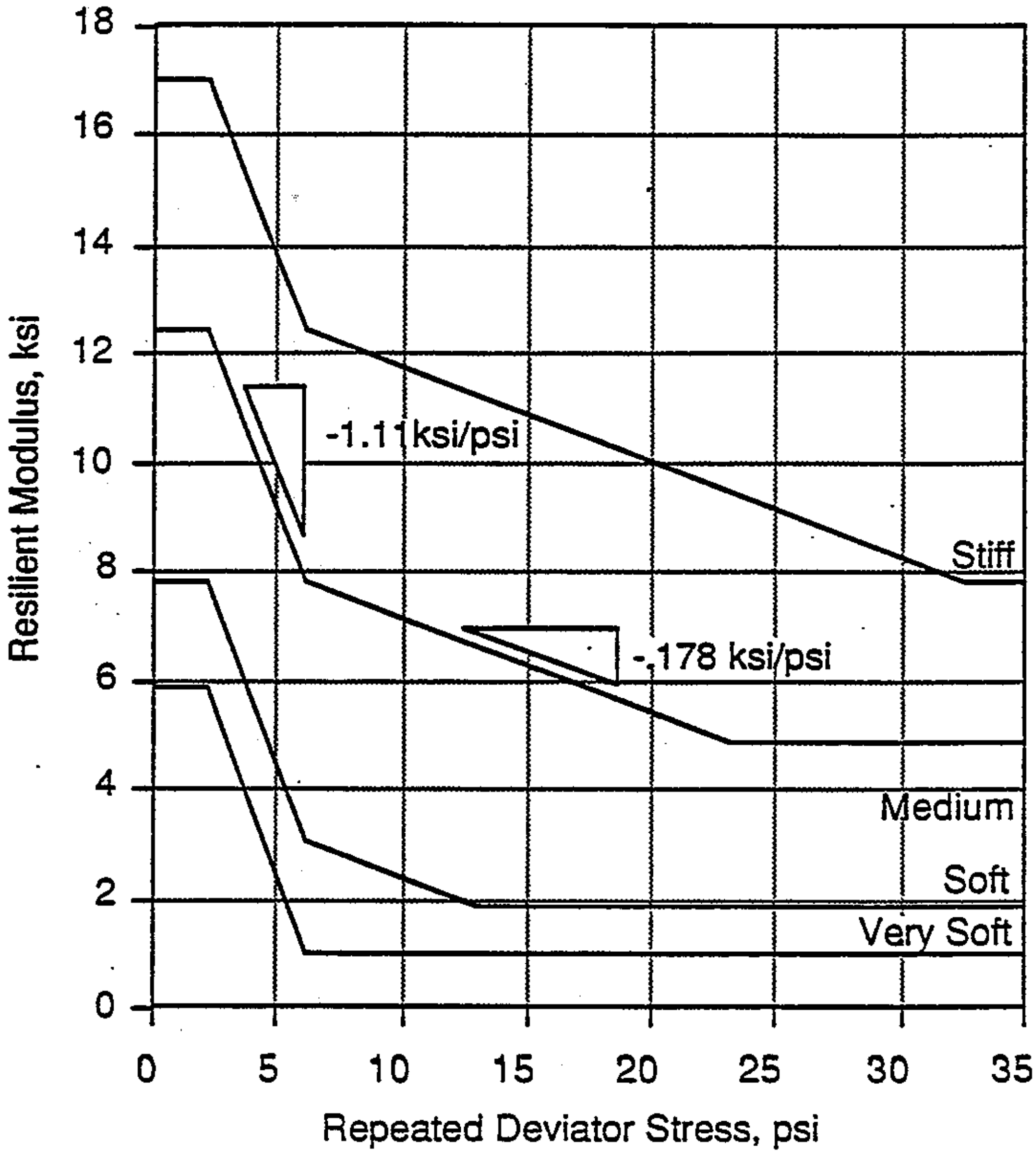
The database method is faster than iterative procedures based on multi-layered elastic theory for the cases where many deflection basins in an identical pavement structural section are evaluated. Where pavement structural sections change, however, the time consuming task of generating a database of deflection basins must be repeated for each new pavement section.

The following chapter describes prevalent input parameters required for most backcalculation procedures.

2.6 Problems with Backcalculation Procedures

As mentioned earlier, the basic concept or assumption of the backcalculation method is that there is a unique deflection basin for a pavement section of given thickness and moduli. However, it is possible that more than one combination of moduli can produce a deflection bowl equal to field measurements. Even though the calculated deflections are identical to field measurements, the calculated moduli may not actually represent the in situ moduli. Therefore, experience and engineering judgment are essential to determine the reasonable moduli of pavement layers.

Figure 2-8. Subgrade Soil Material Models for ILLI-PAVE Analysis (After Ref. 25)



For correct and meaningful analyses of the deflection data, Uddin and McCullough [29] recommend that users should (1) consider sources of variations or errors, (2) understand material characteristics at test sites, (3) obtain accurate information of test sites and (4) have experience.

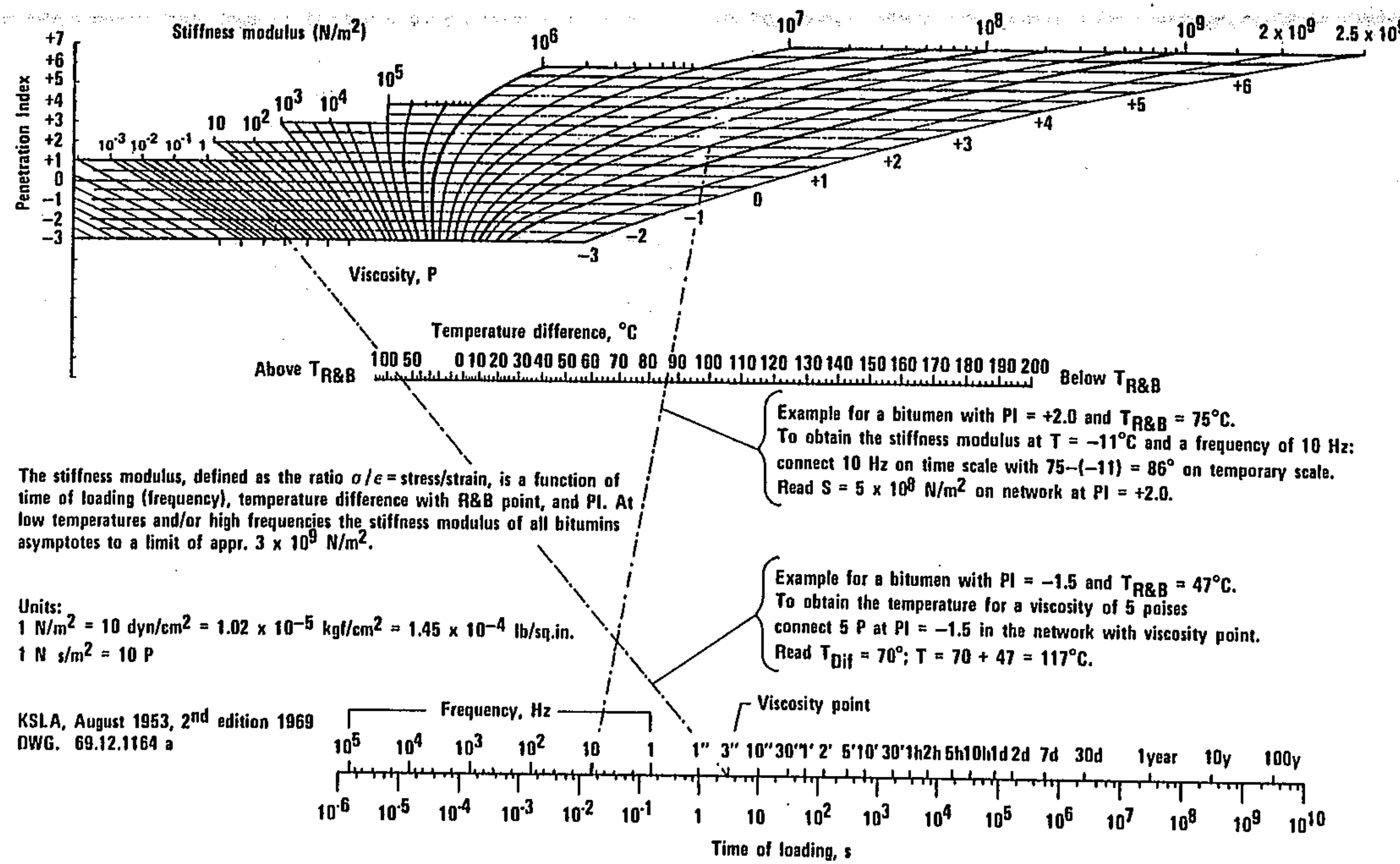


Figure 2-1. KSLA Nomograph for Bitumen Stiffness (After Ref. 14)

Figure 2-2. Prediction of AC Modulus for Bituminous Layers (After Ref. 12)

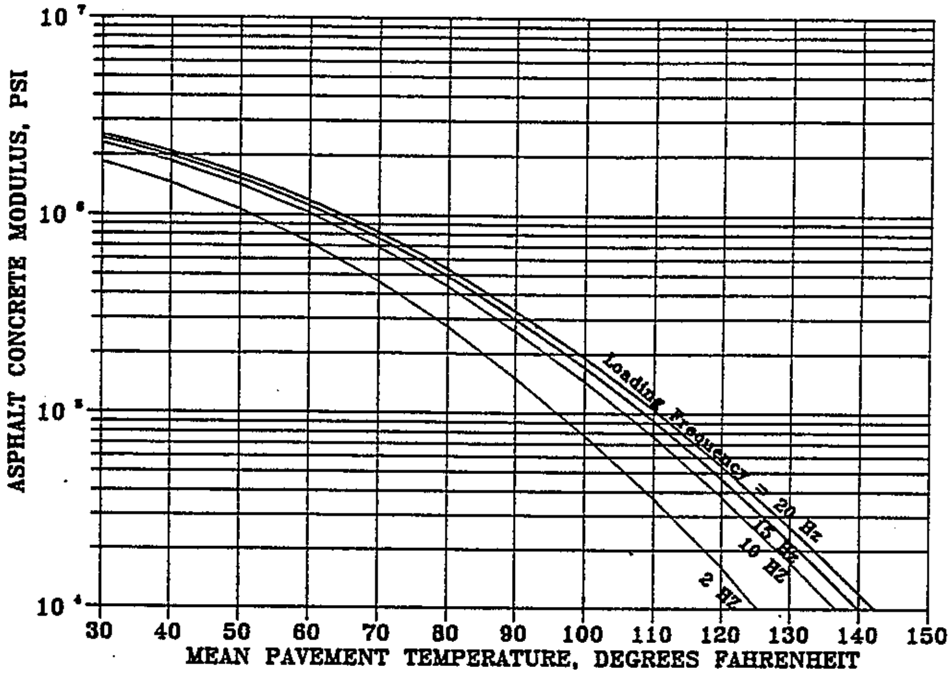


Figure 2-3. Prediction of Pavement Temperature for Bituminous Layers (After Ref. 12)

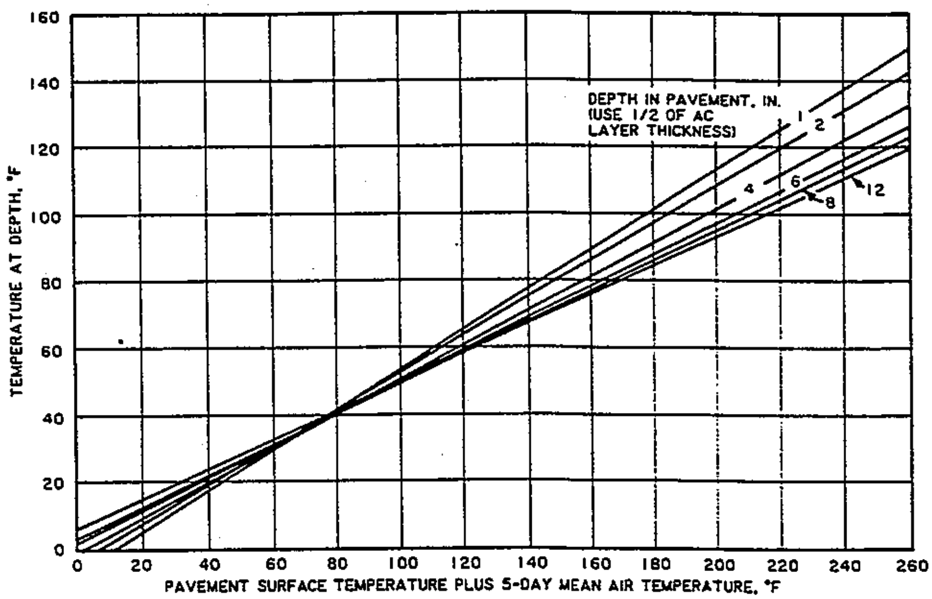


Figure 2-4. Typical M_R Response for Granular Materials (After Ref. 14)

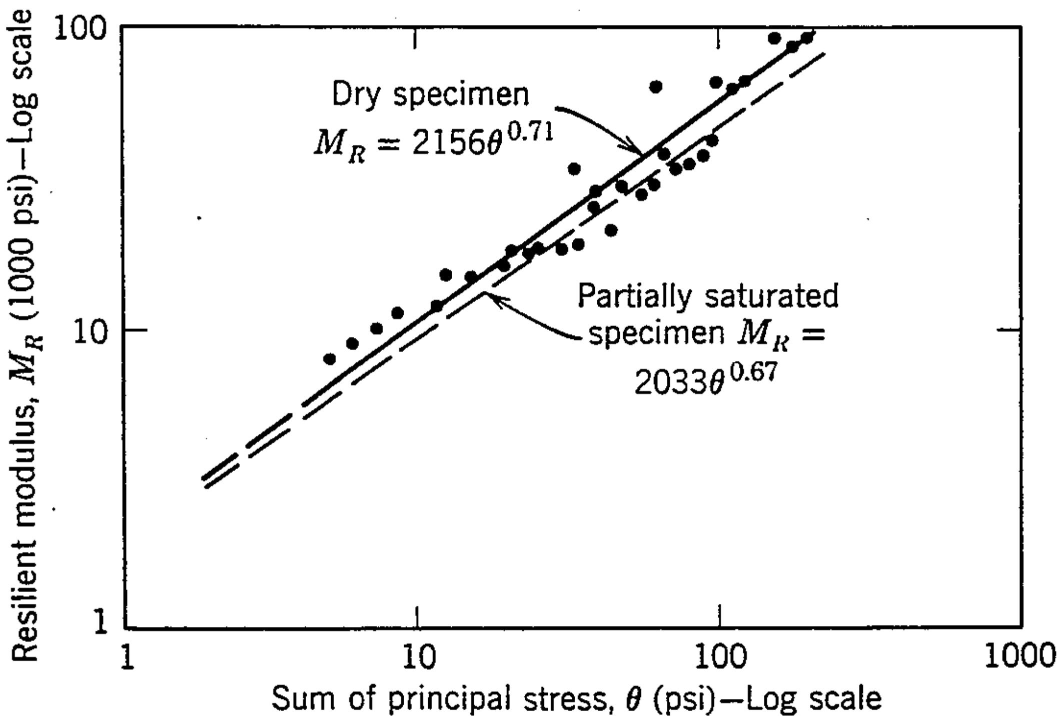


Figure 2-5. Typical M_R Response for Fine-Grained Soil (After Ref. 14)

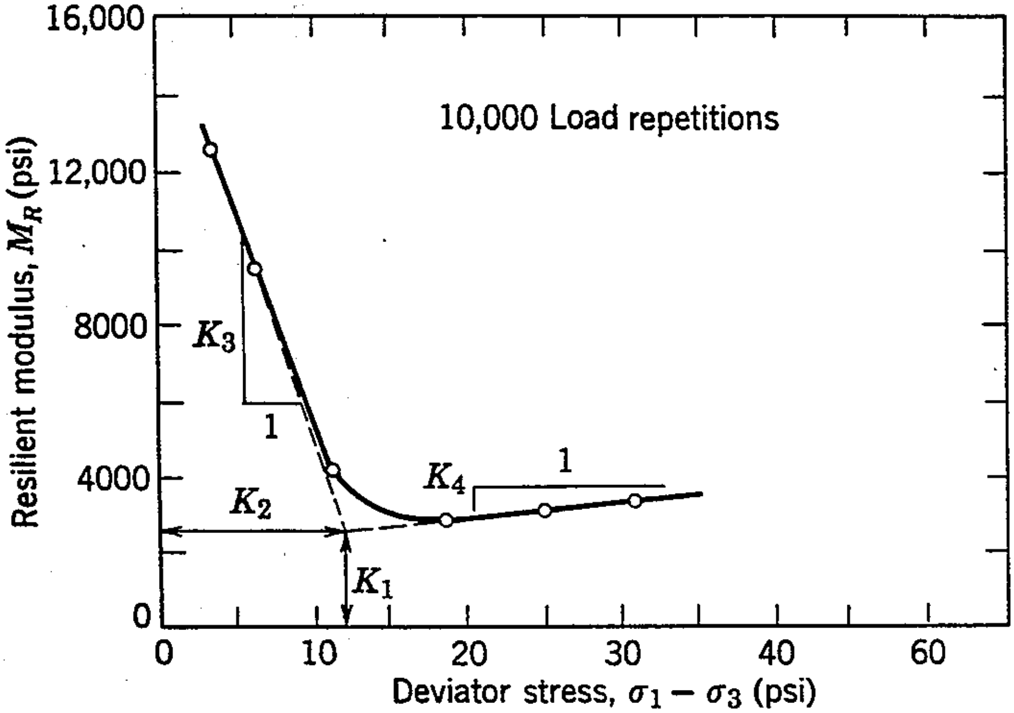


Figure 2-6. Load Types and Coordinate Systems in CIRCLY (After Ref. 20)

a. Load Types

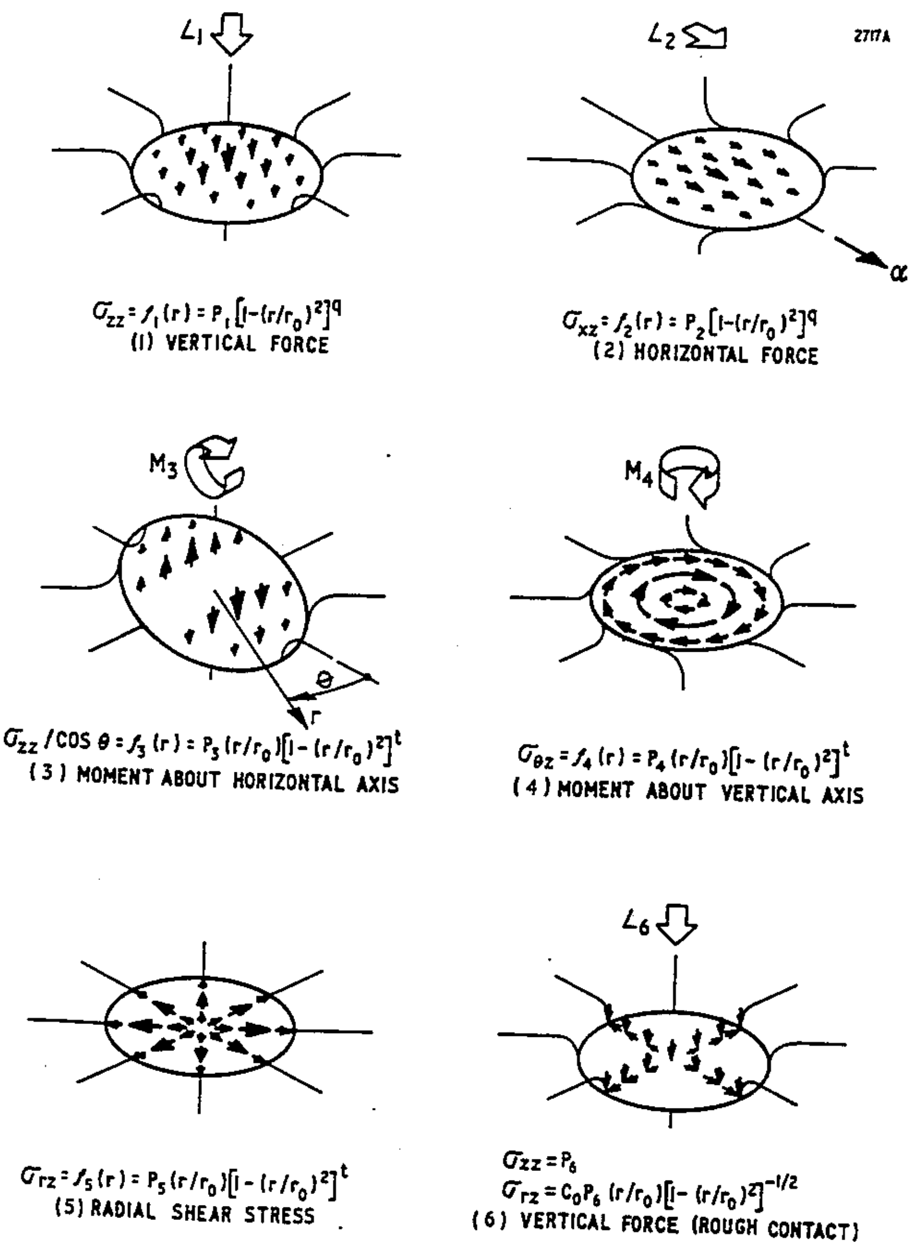


Figure 2-6. Load Types and Coordinate Systems in CIRCLY (After Ref. 20, Continued)

b. Global and Local Coordinate Systems

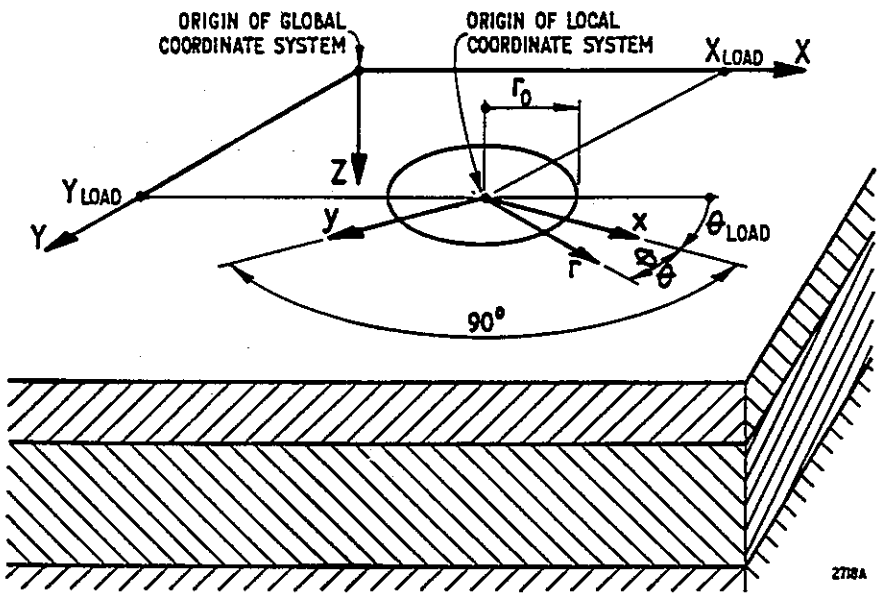


Figure 2-7. Transformation of Two-Layer System According to MET

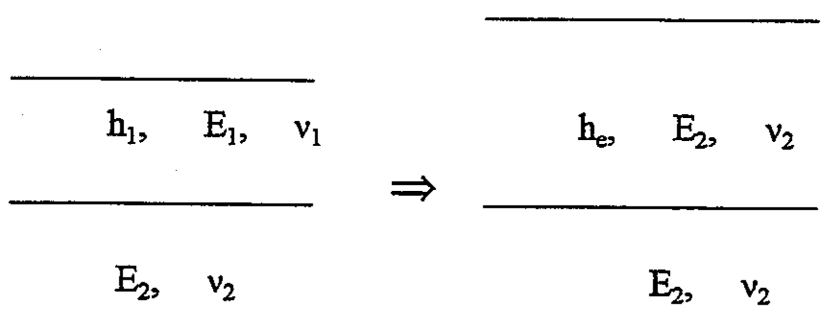


Figure 2-8. Subgrade Soil Material Models for ILLI-PAVE Analysis (After Ref. 25)

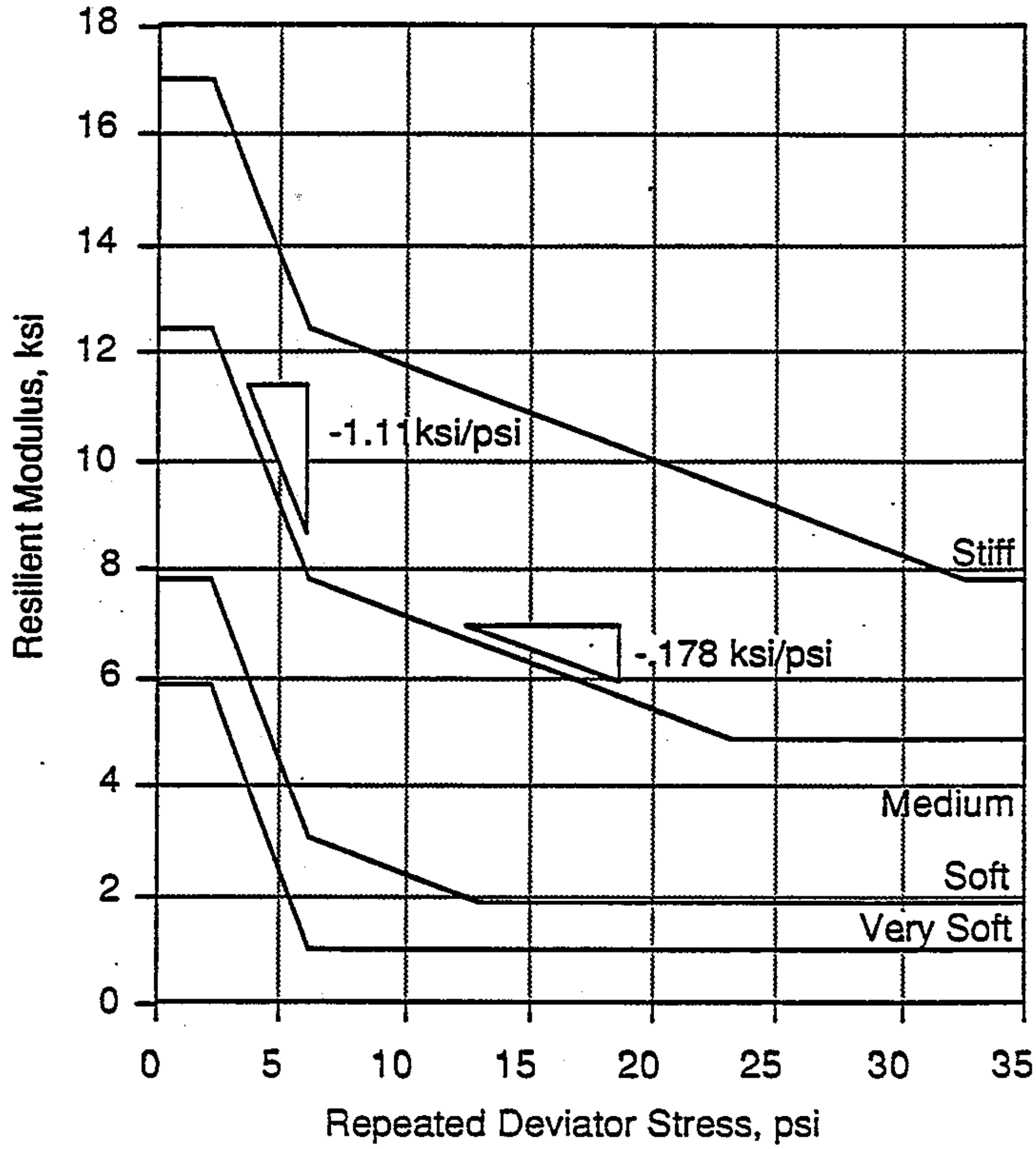


Figure 2-9. Simplified Description of How Deflection Basins Are Matched in BISDEF (One Deflection and One Layer) (After Ref. 27)

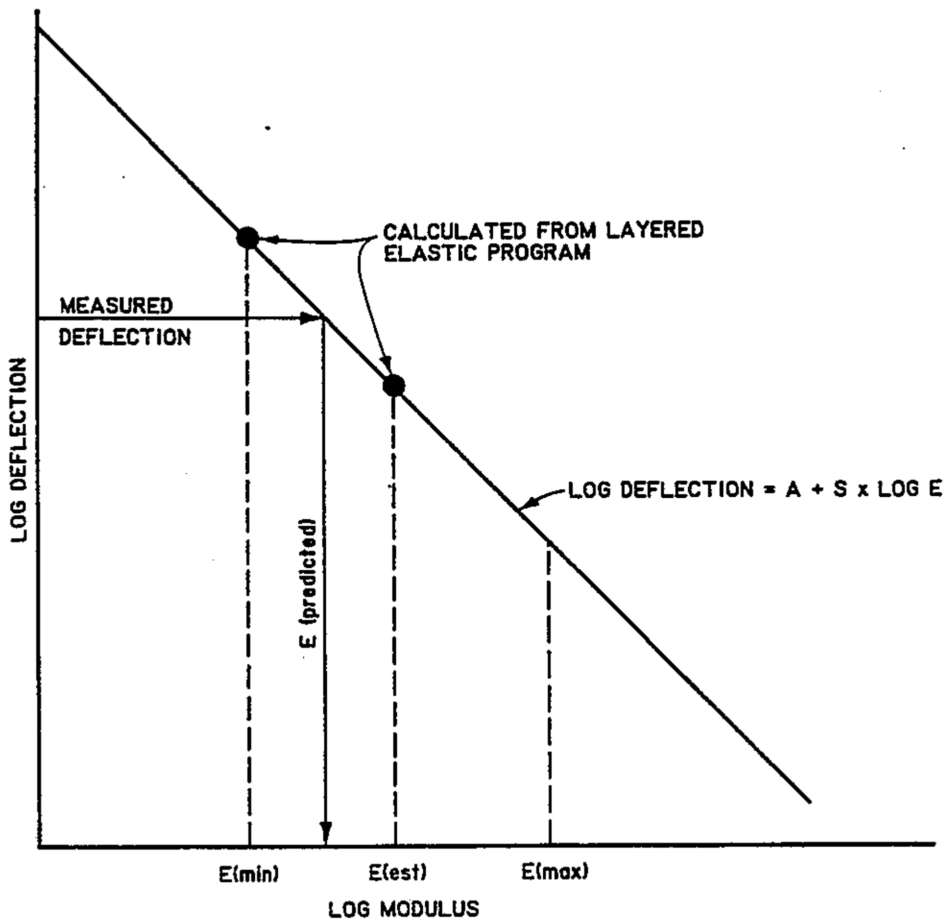


Figure 2-10. General Description of Iterative Procedure (After Ref. 28)

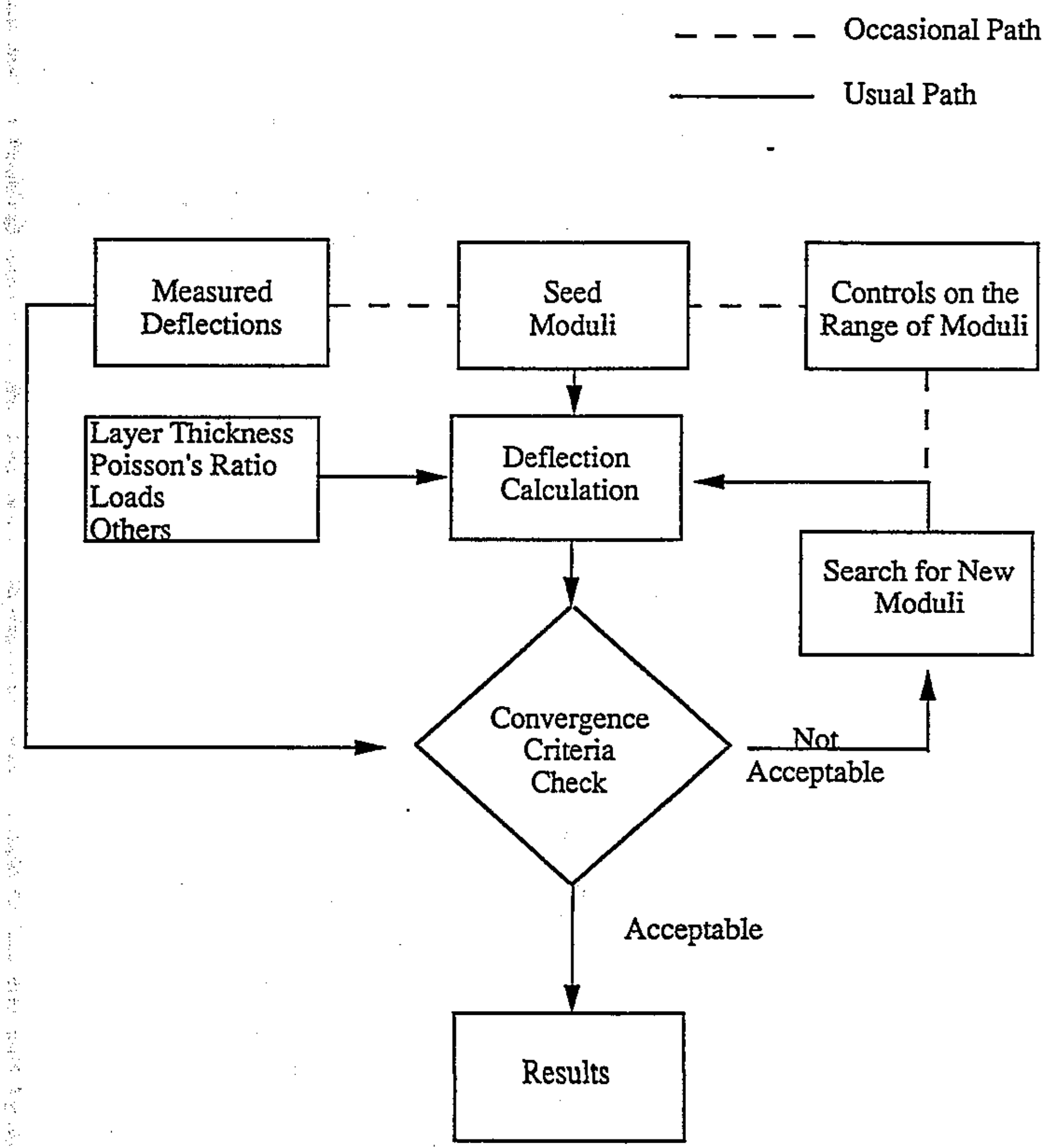


Table 2-1. Typical M_R of Granular Materials (After Ref. 14)

$$M_R = K_1 * \sigma_3^{K_2}$$

	K_1	K_2	M_R, ksi σ_3 = 5 psi	σ_3 = 50 psi
Average	9600	0.55	22.5	80
Range	5000 - 15000	0.45 - 0.60	15 - 35	60 - 110

Table 2-2. Summary of Cement-Treated Material Moduli (After Ref. 14)

Material	Cement Content	Modulus (10^5 psi)	Remarks
1. Silty Clay	3%	0.4–1.5	Res. Mod. (Lab-Comp)
	6%	1.6–3.2	Res. Mod. (Lab-Comp)
	3%	0.1–1.0	Res. Mod. (Undist-Comp)
	6%	0.2–1.7	Res. Mod. (Undist-Comp)
	3%	0.6–1.8	Res. Mod. (Lab Tensile)
	6%	1.3–4.4	Res. Mod. (Lab-Tensile)
	3%	—	Res. Mod. (Undist-Tensile)
	6%	2.5	Res. Mod. (Undist-Tensile)
2. Silty Clay	13%	2.0–9.0	Res. Mod. (Comp)
		3.4–4.4	Res. Mod. (Flex)
3. Sand	7%	15.0–27.0	Res. Mod. (Flex)
4. Sand	—	0.5–2.0	Dynamic Mod.
Sand/Slag	—	1.5–3.0	Dynamic Mod.
Lean Cement	3 pcf	21.0	Dynamic Mod.
	4.7 pcf	28.0	Dynamic Mod.
	6.2 pcf	35.0	Dynamic Mod.
	7.8 pcf	43.0	Dynamic Mod.
5. Well-Graded Gravel ($\frac{3}{4}$-in. max)	5.5%	10.0–30.0	Res. Mod.
6. Granular Base	1%	1.2–1.9	Res. Mod. (σ_3 = 10 psi and
	3%	8.0–28.5	σ_d = 30 psi) 1- to 7-day cure
7. Granular Base	—	5.0–60.0	Dynamic Mod.

Table 2-3. Surface Deflections for a Two-Layer System (After Ref. 21)

	Distance from Center of Loaded Area, inches						
	0	5	10	20	30	40	Times, s
BISAR	55.5	55.3	54.7	53.1	51.0	48.6	55
WESLEA	55.5	55.3	54.8	53.1	51.0	48.6	9

Table 2-4. Material Characterization for ILLI-PAVE (After Ref. 26)

a. Summary of Material Properties

Property	Asphalt Concrete 40°F	Asphalt Concrete 70°F	Asphalt Concrete 100°F	Crushed Stone	Gravel	Subgrade Stiff	Subgrade Medium	Subgrade Soft	Subgrade Very Soft
Unit weight (pcf)	145.00	145.00	145.00	135.00	135.00	125.00	120.00	115.00	110.00
Lateral pressure coefficient at rest	0.37	0.67	0.85	0.60	0.60	0.82	0.82	0.82	0.82
Poisson's ratio	0.27	0.40	0.46	0.38	0.38	0.45	0.45	0.45	0.45
Unconfined compressive strength (psi)	-	-	-	-	-	32.80	22.85	12.90	6.21
Deviator stress (psi)									
Upper limit	-	-	-	-	-	32.80	22.85	12.90	6.21
Lower limit	-	-	-	-	-	2.00	2.00	2.00	2.00
σ_{di} (psi)	-	-	-	-	-	6.20	6.20	6.20	6.20
Eri (ksi)	-	-	-	-	-	12.34	7.68	3.02	1.00
E-failure (ksi)	-	-	-	4.00	4.00	7.605	4.716	1.827	1.00
E-constant modulus (ksi)	400.00	500.00	100.00	-	-				
Er model (psi)	-	-	-	$9000\theta^{0.33}$	$6500\theta^{0.30}$	-	-	-	-
Friction angle (°)	-	-	-	40.0	40.0	0.0	0.0	0.0	0.0
Cohesion (psi)	-	-	-	0.0	0.0	16.4	11.425	6.45	3.105

b. Layer Thickness (inches)

Asphalt Concrete Layer	Granular Base
0.0	4.0
1.5	6.0
3.0	9.0
5.0	12.0
8.0	18.0
	24.0

3.0 BACKCALCULATION PROCEDURES

3.1 Introduction

Numerous backcalculation computer codes have been developed over the years. The need for non-destructive pavement evaluation and analysis combined with advances in personal computer technology has accelerated the development and expanded the use of backcalculation procedures.

Computerized backcalculation procedures require various input parameters and convergence criteria for proper operation as described in Section 2.5.2. Following the description of various input parameters for backcalculation procedures, features of fifteen backcalculation computer programs are presented in this chapter based on available literature.

3.2 Input Parameters

3.2.1 Surface Deflection

As discussed in Section 2.3, a variety of loading modes are used for measuring pavement deflections. Deflections are measured on the surface or sometimes at various depths within the pavement structure [30]. Surface deflections are measured with: (a) geophones that sense the velocity of pavement motion; (b) accelerometers to measure acceleration; and (c) linear voltage differential transformers (LVDT) to measure pavement displacement directly. Velocity and acceleration are integrated to compute deflection. Surface deflections generally are measured in the outside wheel path of the outside lane to provide information for the evaluation of existing pavement structure.

Input data required regarding surface deflection include the number and magnitude of surface deflections, the distances from the load at which they are measured, type of loading device, load magnitude and the radius of the loaded area.

The surface deflection of pavement structure is influenced by various factors. These factors include layer thickness, type and properties of material, subgrade condition, temperature, moisture, surface/subsurface discontinuities (cracks or voids) and placement of load/sensor seatings [31]. According to Chou [32], if the last sensor is too close to the load point for a pavement section having a thick and stiff base course layer, the deflection measured at the last sensor cannot be attributed solely to the properties of the subgrade material. Of course, proper operation and accurate calibration of load cells and sensors are essential for accurate deflections.

3.2.2 Depth to Rigid Bottom

In backcalculating layer moduli there is a concern with the location of bedrock, or the rigid bottom layer. Some researchers contend that it is important to determine the depth to bedrock and to use this value in order to obtain reasonable moduli. WESDEF and BISDEF require an input depth to bedrock unless a default value of 20 feet is used. EVERCALC 3.3 and MODULUS 4.0 can calculate the depth to bedrock.

According to the theoretical evaluation by Briggs and Nazarian [33], moduli calculated by BISDEF are more sensitive to depth of rigid layer than to the magnitude of modulus of the rigid layer. Uddin et al. [34] indicate that the assumption of a semi-infinite subgrade results in overestimating the subgrade modulus when a rigid layer exists at a shallow depth. Also, the location of the water table can affect backcalculation results and needs to be considered though specific effects and resulting adjustments still are being studied.

3.2.3 Seed Moduli

Seed moduli are starting values of pavement layer moduli. These are either assumed values or generated from measured deflections and regression equations. Seed moduli must be within the limits when a range of modulus is specified. The default seed moduli of various pavement materials in BISDEF are presented in Table 3-1. The range of modulus in Table 3-1 is described later in this section.

Some programs do not require seed moduli input. For example, the FPEDD1 generates the seed moduli internally from the surface deflections. Seed moduli values are assumed based on the type, temperature, condition or properties of the materials at the time when deflections are measured. When moduli of pavement materials are measured, users input the known values as fixed seed moduli, thereby reducing the number of layers to be calculated. The reduction of number of layers results in faster backcalculation and more reasonable output.

If a database of resilient moduli is available, users can set a reasonable seed modulus for each layer. If recovered binder properties and mix components are known, a computerized version of Figure 2-1 and Eqn. (2-5) can be used to estimate the AC modulus. However, it should be noted that this method can not be used for distressed AC layer.

Some programs allow input of material type instead of seed moduli. For example, MODULUS 4.0 has an option to select a material type instead of an input of seed moduli. EVERCALC 3.3 and MODULUS 4.0 requires temperature information for AC modulus.

3.2.4 Range of Modulus

Setting the range of modulus for each layer guides the backcalculation procedure toward a set of acceptable moduli. The range of modulus is defined by assumed minimum and maximum modulus values. Minimum modulus is the lowest limit that the program will use and maximum modulus is the highest one. If the modulus of a layer is known, the maximum and minimum modulus of that layer should be the same as the known modulus. Default values for range of modulus used in BISDEF are presented in Table 3-1.

The range of modulus is set taking into account the condition and temperature of the pavement. Like seed moduli, an existing database of moduli for pavement materials can be useful when setting the range.

3.2.5 Layer Thickness

The thickness of each layer in the pavement structure can be obtained from either construction or drilling records. Despite the design thickness of each layer, it may differ from actual thickness of each layer as built. This difference may result in substantial errors in backcalculated moduli. Thickness data from drilling are accurate but costly. Recently, non-destructive radar techniques have been used to determine the layer thickness [35]. The reliability of this technology, however, requires further study and the accuracy and precision of this method must be improved.

3.2.6 Poisson's Ratio

Most backcalculation procedures allow the user to assume a typical value for Poisson's ratio because values lie within narrow ranges and variations in Poisson's ratio do not have any significant effect on pavement response.

A typical range of Poisson's ratio of various pavement materials are presented in Table 3-2.

3.2.7 Convergence Criteria

Backcalculated moduli from different procedures are often unequal even when the same forward calculation procedure is used because convergence criteria vary from one backcalculation procedure to another.

In general, convergence criteria provided by users include a percent difference between the last computed modulus and the new trial modulus of each layer, a percent of basin deflection errors and the permissible number of iterations.

The modulus difference criterion checks the moduli changes from one iteration to the next. If the change of each layer modulus is below some preselected limit, the deflection matching process is overridden and the process is stopped. This modulus change criterion takes the following form:

$$\text{Modulus change tolerance} > |(E_i^{(k+1)} - E_i^{(k)})/E_i^{(k)}|*100 \qquad (3\text{-}1)$$

where Modulus Change Tolerance = difference in layer moduli from one iteration (k) to the next (k+1),

$E_i^{(k)}$ = a specific layer modulus for the i-th layer at the k-th iteration, and

$E_i^{(k+1)}$ = a specific layer modulus for the i-th layer at the (k+1)-th iteration.

This criterion can be particularly helpful if the iteration process cannot be terminated by other deflection basin convergence criteria (such as number of iterations or error tolerance). In this manner, the procedure will terminate before the maximum number of allowable iterations is achieved [28].

Several types of deflection error criteria have been used. The most common criteria [36] include (1) the sum of absolute differences between the measured and the calculated deflections (Eqn. 3-2), (2) the sum of the absolute relative differences (Eqn. 3-3), (3) the sum of the squared differences (Eqn. 3-4), (4) the sum of squared relative differences (Eqn. 3-5) and (5) the RMS (root mean square) in Eqn. (3-6).

$$\text{Sum of absolute differences} = \Sigma|d_c - d_m| \qquad (3\text{-}2)$$

$$\text{Sum of absolute relative differences} = \Sigma|D_i| \qquad (3\text{-}3)$$

$$\text{Sum of squared differences} = \Sigma|d_c - d_m|^2 \qquad (3\text{-}4)$$

$$\text{Sum of squared relative differences} = \Sigma D_i^2 \qquad (3\text{-}5)$$

$$\text{RMS Error} = [(1/n)\Sigma D_i^2]^{1/2} \qquad (3\text{-}6)$$

where n = number of measured deflections,

$D_i = (d_c - d_m)/d_m$

= error of the calculated defection at radius i,

d_c = calculated deflection at radius i,

d_m = measured deflection at radius i, and

i = 1 to number of sensors.

The absolute error criterion is used to minimize the difference in the cross-sectional area between the measured and the computed basin. The relative error criterion assumes that the deflection sensor error is a major consideration and thus uses the relative difference as a convergence objective [32]. Advantages and disadvantages of each criterion function is described further in Reference 35.

If the error check indicates convergence within tolerance limits then calculation stops and results are printed out or stored. If no convergence is evident, then a new iteration starts.

3.2.8 Other Input Parameters

Some backcalculation procedures require additional information along with the common input data mentioned above. Special program inputs for some procedures are described below.

WESDEF and BISDEF require the information on interface friction between layers. For BISDEF, the interface value can be varied from zero for full continuity between layers to 1000 for almost frictionless slip between layers. Frictionless slip usually is assumed at the bottom of a PCC slab and full continuity generally is assumed for most other pavement materials [37].

Several backcalculation procedures, such as MODULUS 4.0 and EVERCALC 3.3, require temperature information. If the pavement temperature differs from a specified temperature then the backcalculated AC modulus is corrected for the specified temperature based on a temperature-modulus relationship derived from laboratory testing. For example, EVERCALC 3.3 can convert the backcalculated AC modulus to the modulus at 77° F. Pavement temperature is measured directly or can be estimated by the method developed by the Asphalt Institute (TAI) method or Southgate method [12]. TAI method uses pavement surface temperature and 5-day mean air temperature to predict the AC temperature at a certain depth as shown in Figure 2-3.

Some procedures, like BOUSDEF, require the density data of pavement structural materials to calculate the stress-sensitivity constants for the base, subbase and subgrade.

3.3 Backcalculation Computer Programs

The previous section presented general input parameters which most backcalculation procedures require. However, these input parameters are not necessary for all backcalculation procedures. Current section describes features of 15 backcalculation programs based on published literature.

3.3.1 BKCHEV

The original version of this program (i.e., CHEVDEF) was written by Barker and Bush, U.S. Corps of Engineers, Waterways Experiment Station (WES). BKCHEV was later made interactive by Mamlouk at Arizona State University.

The program can model up to five layers (including the subgrade). The program uses the CHEVRON program for forward calculation. BKCHEV uses a constrained search where the moduli of each layer are bounded within reasonable limits [38]. Program iteration is controlled by a pre-designated number of iterations and the absolute sum of error in percent (see Eqn. (3-3)) between calculated and measured deflections.

BKCHEV works with both FWD and Dynaflect data. Figure 3-1 presents an explanation of input data file (line by line) for an FWD and a Dynaflect. Input data files can be created and modified with any word processor program. The user also can create an input data file by answering questions interactively when running BKCHEV.

For an FWD, the user provides information about the radius of loading plate, magnitude of loading, number of sensors (up to seven sensors) and location of each sensor from the center of the loading plate. For a Dynaflect, a radius of 1.6 inch, load of 1000 pounds and five sensors (located 10.0, 15.6, 26.0, 37.4 and 49.0 inches from the center of the loading plate) are assigned internally. BKCHEV requires only the magnitude of surface deflections when using a Dynaflect.

The sensitivity of the program to variations of input values was evaluated and is presented in the next Chapter.

3.3.2 BISDEF

BISDEF was developed by WES [39]. The program uses the BISAR program as a subroutine for forward calculation. BISDEF models multiple loads and various interface conditions. A range of modulus is input with an assumed seed modulus value for each layer when the modulus is to be computed. The number of layers with unknown modulus cannot exceed the number of measured deflections. According to Reference 37, best results are obtained when not more than three layers are allowed to compute. A rigid bottom layer is assumed to exist 20 feet beneath the pavement surface having a default modulus of 1,000,000 psi and Poisson's ratio of 0.5.

Users can use the program BINPUT to interactively create input data files for BISDEF. Because the default modulus range and seed moduli of pavement materials are provided in BINPUT, users have the option of selecting default values or entering values. Default values seed modulus and modulus range in BINPUT are tabulated in Table 3-1.

In BISDEF, errors are minimized by weighting deflections so that the smaller deflections away from the applied load contribute as much as those near the load. BISDEF performs three iterations unless (1) the absolute sum of the percent differences between computed and measured deflections or (2) the predicted change in modulus values is less than ten percent. Normally three iterations within the program produce a set of modulus values that yield a deflection basin that is within an average of 3 percent of each of the measured deflections [37].

Alexander et al. [37] recommended the following guidelines in determining layer modulus values using BISDEF:

1. Do not attempt to compute the modulus values for more than three layers in a single BISDEF run. Limit the number of computed layer moduli to two, if possible.
2. Do not attempt to compute the modulus of layers less than 3 inch thick. The modulus of a thin layer should be fixed based on material type or temperature. Alternatively, a thin layer can be combined with an adjacent layer and a composite modulus can be determined.
3. Exercise caution when using modulus values outside the default ranges provided in BINPUT. Values outside these limits may be unrealistic and should be justified for special cases.
4. For NDT devices that have circularly loaded areas, the deflection directly under the load should be input to BISDEF as occurring at half of the radius of the load plate.

3.3.3 BOUSDEF

BOUSDEF was developed by Zhou et al. [40] at Oregon State University. The program uses the method of equivalent thicknesses (MET) and modified Boussinesq equations. In addition, the program considers overburden pressure and non-linearity of pavement materials.

The program requires the following inputs: load force, radius of the loading plate, layer thickness, Poisson's ratio, seed modulus, range of modulus, density of pavement materials, deflection data (up to seven sensors), percent of tolerance to stop the deflection matching process and maximum number of iterations (up to nine iterations).

Output from the program includes the modulus of each layer, constants for stress-dependent aggregate base and subgrade soil, and bulk stress and deviator stress induced by both live load and dead load of upper layer materials. For the stress dependency of aggregate base Eqn. (2-8) is used and for the subgrade soil the following model is used:

$$M_R = K_3 \sigma_d^{K4} \qquad (3\text{-}7)$$

where K_3 and K_4 = constants which depend on the material characteristics and

σ_d = deviator stress.

For the total vertical stress (σ_{vt} or σ_1) and the total horizontal stress (σ_{ht} or σ_3), the following equations are used;

$$\sigma_{vt} = \sigma_{vl} + \Sigma(h_i * \gamma_i) \quad (3\text{-}8)$$

$$\sigma_{ht} = \sigma_{hl} + K_o * \Sigma(h_i * \gamma_i) \quad (3\text{-}9)$$

where σ_{vl} = load induced vertical stress,

σ_{hl} = load induced horizontal stress,

h_i = thickness of layer i,

γ_i = density of layer i,

K_o = coefficient of at-rest earth pressure, and

i = 1 to the number of layers.

Boussinesq equations are used to calculate vertical and horizontal stresses caused by loading. A value of K_o is assumed as 0.5. For the stress calculation, it is assumed that the ground water table is below the top of the subgrade and, therefore, does not affect the results. The bulk stress is assumed to represent the stress state at the middle of the base layer and the deviator stress is expected to characterize stresses at the top of the subgrade.

The sensitivity of the program was evaluated in this study and is presented in the next chapter.

3.3.4 COMDEF

COMDEF is an interactive, user friendly program for computing layer moduli of composite pavements based on FWD deflections [41]. Composite pavement is a general term which is defined as PCC pavement overlaid with one or more courses of AC. A simplified flow chart of COMDEF program is presented in Figure 3-2.

COMDEF uses database files to containing calculated deflection basins which are compared with measured deflections. Deflections in database files are calculated using multi-layer elastic theory. COMDEF, like BISDEF, assumes that a rigid layer exists at a depth of 20 feet. It further assumes that the composite pavement system can be modeled by a three layer system of AC surface, PCC base and subgrade. COMDEF does not require seed moduli.

The solution is output to the screen and to an output file. If the temperature option is used then AC modulus adjusted to 70° F and one hertz is calculated.

3.3.5 EFROMD-II

EFROMD-II (Elastic properties FROM Deflections, [40]) uses CIRCLY [20] for forward calculation. The program has a stage algorithm to backcalculate elastic moduli and Poisson's ratio for all the layers in pavement analyzed. In the first stage of the algorithm, the estimated seed moduli and Poisson's ratios are input by the user. Moduli are then updated after each iteration until equilibrium is reached. In the second stage, differences between the measured response and the response calculated in the first stage are used to correct the Poisson's ratios in each layer. The two stages are then repeated until the differences between the calculated and the measured responses reach an acceptable level. Figure 3-3 shows the iteration process used in the EFROMD-II model.

3.3.7 ELMOD (Evaluation of Layer Moduli and Overlay Design)

The ELMOD program is based on the method of equivalent thickness (MET) and operates extremely fast. The input required for ELMOD includes layer thickness, pavement surface temperature, and the deflection measurements at 0, 9, 12, 18, 24, 35 and 47 inches from the center of loading plate. The program computes moduli by using the outer deflections to first estimate the subgrade modulus. The moduli of the asphalt concrete and base courses are determined by an iterative process which uses the center deflection and the shape of the deflection basin. The subgrade modulus at the center of the loading plate is adjusted for stress level and the outer deflections are then checked. At this point a new iteration is made if needed.

ELMOD can analyze up to a four layer system and will account for nonlinearity in subgrade behavior. The program contains algorithms to predict seasonal variations, remaining life, and overlay thickness.

The program is supplied by Dynatest as part of the package offered to customers who purchase a Dynatest FWD [43].

3.3.7 ELSDEF

ELSDEF is identical to BISDEF, except that ELSDEF uses ELSYM5 for the elastic layer analysis rather than BISAR [44]. An iterative procedure is used to determine the best fit between measured deflections and computed deflections. The procedure involves determining the relationship between the log modulus versus log deflection (see Figure 2-9) for each unknown modulus by varying the unknown moduli. This relationship is then used iteratively to find moduli that minimize errors.

Inputs to the program are load, deflection basin data, error tolerances, layer thickness, Poisson's ratio, seed modulus, and allowable range of modulus. Small deflections away from the load are weighted so that they contribute equally to those near the load in the solution process. The number of layers having an unknown modulus cannot exceed the number of measured deflections. No provision is available for nonlinear material behavior. ELSDEF can be run with or without a rigid bottom. The procedure is sensitive to the choice of seed moduli [45].

3.3.8 EVERCALC 3.3

EVERCALC 3.3 [44] was developed at the University of Washington for the Washington State DOT. The program uses the CHEVRON forward calculation program and an iterative procedure to match surface deflections from measurements with those calculated from assumed elastic moduli. This user-friendly program can evaluate a flexible pavement structure containing up to five layers. The program can be run with or without a rigid bottom.

EVERCALC 3.3 has a main menu which provides seven options: (1) Edit General Data File, (2) Edit Deflection Data File, (3) Perform Backcalculation, (4) Convert FWD Data File, (5) Plot Bar Chart, (6) Execute DOS Commands and (7) Exit to DOS.

Inputs required for this program are surface deflection measurements (up to ten) at various distances from the load center, seed modulus, range of modulus, layer thickness, Poisson's ratio and temperature information. Two input files (general data and deflection data) are created using options in the main menu. English or metric units can be used in the input data files by setting the unit switch in the general data file.

EVERCALC 3.3 produces a solution when at least one of three convergent criteria is satisfied. That is, (1) RMS (see Eqn. (3-6)) falls within a preset tolerance (at least 1 percent generally is recommended), (2) the change of modulus (see Eqn. (3-1)) is less than a predetermined value or (3) the designated number of iterations is complete.

EVERCALC 3.3 determines the constants for stress sensitive base materials and subgrade soil when at least two load levels are available at a site. Furthermore, the asphalt concrete modulus is adjusted to a temperature of 77° F and a load duration of 0.1 second.

The sensitivity of the program was evaluated in this study and is presented in the next chapter.

3.3.9 FPEDD1 (Flexible Pavement Structural Evaluation System based on Dynamic Deflections - version 1.0)

FPEDD1 was developed by Uddin et al. [46] at the University of Texas. It uses ELSYM5 for forward calculation of three or four layers of flexible and composite pavements. The program works with both Dynaflect and FWD data. For the Dynaflect, the peak-to-peak dynamic force is modeled as two pseudostatic loads of 500 pounds each uniformly loading a circular area of 3 in^2.

The program models nonlinear stress-strain response in granular materials and subgrade soil. A unique feature of FPEDD1 is the assumption of a rigid layer at a fixed depth in the subgrade. If the user specifies a known thickness of subgrade above the rigid bottom, the program will activate a procedure to correct the seed modulus predicted for the semi-infinite subgrade. In addition, the program has a built-in procedure to create an artificial rigid bottom. The depth to the rigid bottom is calculated using the theory of stress wave propagation in elastic media.

Input data include the number of sensors, magnitude of loading, radius of loading plate, measured deflections, location of sensors and number of layers. Temperature data are needed for temperature correction of the AC modulus. Layer data such as thickness, Poisson's ratio, and the range of modulus are also required. However, the program does not require seed moduli. Seed moduli are generated internally as functions of measured deflections, radial distances of deflection sensors from the NDT load and layer thickness.

In addition to the layer moduli, FPEDD1 calculates fatigue life and remaining life of the pavement structure. The user-specified design load data are required in addition to accumulated traffic loading (in 18-kip equivalent single axle load (ESAL)). A simplified flow chart of the program is presented in Figure 3-4.

3.3.10 ISSEM4

ISSEM4 [47] is a mechanistic-based pavement analysis program. The program uses an iterative procedure to match calculated surface deflections to measured deflections.

This program uses a modification of ELMOD. Odemark's assumption and the Boussinesq equation are used to determine a location where the deflection is assumed to be solely a function of the subgrade. ELSYM5 then is used in an iterative process to backcalculate the modulus of the layer. This process is repeated for each layer [32].

The program can estimate nonlinear elastic parameters for aggregates and fine soils. A "finite cylinder" concept is used to estimate the stress sensitivity of the unbound materials from a single FWD load level.

3.3.11 LOADRATE

The LOADRATE program is a regression-type program based on results generated using ILLI-PAVE [32]. The program considers only surface-treated types of pavements. Regression equations are developed to relate the nonlinear elastic parameters of the bulk stress model (for the base material) and the deviator stress model (for the subgrade material) with the deflections at the point of loading and at some distance away from the load. Layer moduli are calculated from these parameters. This method was developed for determining load zoning requirements on a network (district or county) level.

The LOADRATE program does not require tolerance inputs.

3.3.12 MODCOMP2

MODCOMP2 was developed Irwin and Speck for the U.S. Army Cold Regions Research and Engineering Laboratory [45]. MODCOMP2 uses CHEVRON for forward calculation and an iterative process. The program obtains convergence (which is the absolute deflection error at a point) starting with the deepest layer and works upwards.

The program can model from two to fifteen layers in a pavement system (including the bottom layer, which is assumed to be a semi-infinite half space). However, no more than four or five layers should be unknown. The program accepts data for up to six different load levels and it can model up to eight surface deflections (for each load level) measured at various radial distances from the center of the load.

3.3.13 MODULUS 4.0

MODULUS 4.0 was developed by the Texas Transportation Institute (TTI) for the Texas Department of Highways and Public Transportation [48]. The backcalculation scheme within MODULUS is a two step process [49]. First, a linear elastic layer program is run several times and a deflection database is built covering a range of layer moduli. MODULUS 4.0 uses WES5 for forward deflection calculation. The second step is to use the Hooke-Jeeves' pattern search algorithm to match measured and calculated deflection bowls. This algorithm always converges [50].

The main menu in MODULUS 4.0 provides five options; (1) Input Data Conversion Options, (2) Run Modulus Backcalculation Program, (3) Plot Deflection and/or Moduli Values, (4) Print Results of Latest Analysis and (5) Exit to DOS. The user can manually input basin deflections or an input file containing them can be automatically read from a diskette. The Backcalculation Program option reads the input file (.OUT extension), performs the backcalculation and creates an output file (.DAT extension) containing the backcalculated moduli. Three options ("use an existing fixed design", "input material types" and "run a full analysis") are available depending on the user's familiarity with backcalculation schemes. The Plot Deflection option allows the user to analyze deflection readings, calculated moduli, depth to bedrock and average errors graphically along the entire project length. This option also performs a unit delineation analysis to identify units of sections having similar characteristics.

The program is intended to be used with deflections collected only by an FWD. One minor restriction in MODULUS 4.0 is that four of the deflection sensors must be located at offsets of 0, 12, 24, 36 inches from the center of the load plate.

To improve matching deflection basins, MODULUS 4.0 uses a weighting factor which is proportional to the magnitude of the measured deflection. The weighting factors at each sensor are:

$$W_i = d_i/d_1 \qquad (3\text{-}10)$$

where W_i = The weighting factor for sensor i,

d_i = The measured deflection of sensor i, and

d_1 = The measured deflection beneath the load plate.

MODULUS 4.0 also uses the sensor selection procedure to improve backcalculation results [49]. This procedure prevents overpredicting the subgrade modulus using only selected sensors. Boussinesq's equation for deflection under a point load is used to select the number of sensors. At each sensor the apparent modulus (E_r) of the infinite half-space is calculated:

$$E_r = P(1-\mu^2)/(\pi r D_r) \quad (3\text{-}11)$$

where E_r = Young's modulus of the infinite half-space;

D_r = Surface deflection at offset r due to load P;

P = Point load;

μ = Poisson's ratio;

r = Horizontal offset from the load.

By plotting the E_r at the various sensors, it is possible to determine the approximate offset at which the measured deflection is originating only from subgrade conditions. The technique is illustrated in Figure 3-5 where position C shows the minimum apparent modulus associated with the weakest modulus normally found near the top of the subgrade. The sensors up to and one beyond position C are used for deflection analysis. Removing a sensor is achieved by setting its weighting factor equal to zero. However, after selecting sensors, the number of sensors must equal the number of unknown layer moduli plus one. Unlike many other backcalculation procedures where subgrade conditions are characterized by deflections at the outer sensors, the importance of these measurements is reduced in MODULUS 4.0.

MODULUS 4.0 can estimate the depth to bedrock. It will also perform a unit delineation analysis (using the cumulative difference approach) in order to identify sections having similar characteristics. MODULUS 4.0 does not require tolerance inputs for convergence criteria.

The sensitivity of the program was evaluated in this study and is presented in the next chapter.

3.3.14 PADAL (PAvement Deflection AnaLysis)

The PADAL program based on finite element method was developed to incorporate an iterative procedure and two convergence criteria (modulus criterion and deflection criterion) based on deflections measured by an FWD. The background development of the PADAL computer program and some typical applications have been described in References 43 and 50. Figure 3-6 summarizes the main steps of the program. Note that data regarding unit weight of layer materials and position of water table are required (see Figure 3-6). In recognizing the significant influence of subgrade stiffness (or modulus) on surface deflection, subgrade modulus is modeled using a nonlinear, stress-dependent elastic relationship as follows:

$$E_s = A\,(p_o'/q_r)^B \tag{3-12}$$

where E_s = modulus of the soil,

p_o' = mean normal effective stress due to weight of the pavement above the point concerned,

q_r = deviator stress due to wheel loading, and

A and B = soil constants.

Iteration in PADAL is carried out using a procedure which relates surface deflection at a particular radial location to the modulus of a particular pavement layer. The process involves successive improvement from initially assumed moduli until a satisfactory match is achieved between the computed and measured deflection bowls. Convergence is reached when the following criteria are satisfied:

(i) Modulus criterion;

$$|E_n - E_{n-10}| < \pm 10 \text{ MPa asphalt layer(s)} \tag{3-13}$$

$$< \pm 1 \text{ MPa subbase and subgrade} \tag{3-14}$$

where E = modulus of layers and

n = the number of iterations and is greater than 15.

(ii) Deflection criterion;

$$(d_c-d_m)*100\%/d_m < \pm 1 \% \quad (3\text{-}15)$$

where d_c = calculated deflection, and

d_m = measured deflection.

Extensive tests based on theoretical deflection basins produced from three- and four-layered structures showed that PADAL converged from a large range of different assumed initial modulus to a solution within 2% of the correct values. However, the accuracy of predictions for thin layers (for example, a 40-mm asphalt wearing course) was found to be less satisfactory showing errors of up to 50 %.

3.3.15 WESDEF

WESDEF program was developed jointly by the Pavement Systems Division of WES, ISICH (l'Institut Superieur Industriel Catholique du Hainaut, Belgium) and Purdue University. Except for replacing BISAR with WES5, WESDEF is almost identical to BISDEF. WES5 can handle multiple loads (a maximum of 20 loads) and varying interface conditions as described in Chapter 2.

Van Cauwelaert et al. [21] compared backcalculated moduli for FWD data from an AC, a PCC and a composite airfield pavement using both WESDEF and BISDEF. The summary of WESDEF and BISDEF results is shown in Table 3-3. Structure information and NDT data for these three test cases also are presented in Table 3-3. Results show good agreement though WESDEF operation time averaged 4.5 times faster than BISDEF. Iteration criteria limits the absolute sum of the percent differences between computed and measured deflections or the predicted change in modulus values to less than 10%.

The sensitivity of the program was evaluated in this study and is presented in the next chapter.

Figure 3-1. Line Description of BKCHEV Input Data File

<u>Data file for FWD</u>

Line 1:	Description
Line 2:	F (for FWD)
Line 3:	Radius of FWD plate in inches
Line 4:	Load applied by FWD (lbs)
Line 5:	Number of radial points at which deflections were measured
Line 6:	Distances to radial points form load. Keep a space between distances.
Line 7:	Deflections at radial points in mils. Keep a space between each two deflections.
Line 8:	Number of layers in the pavement system
Line 9:	Thickness of layers. Keep a space between each two thicknesses.
Line 10:	Seed moduli of all layers (ksi)
Line 11:	Poisson's ratio of all layers
Line 12:	Minimum and maximum moduli of layer 1 (ksi)
	Minimum and maximum moduli of layer 2 (ksi)
	" " " " "
	" " " " "
	" " " " "
	Allowable tolerance (%)
	Maximum number of iterations

<u>Data file for Dynaflect</u>

Line 1:	Description
Line 2:	D (for Dynaflect)
Line 3:	Deflections at sensors in mils
Line 4:	Number of layers in the pavement system
Line 5:	Thicknesses of layers (in.)
Line 6:	Seed moduli of layers (ksi)
Line 7:	Poisson's ratio of layers
Line 8:	Minimum and maximum moduli of layer 1 (ksi)
	Minimum and maximum moduli of layer 2 (ksi)
	" " " " "
	" " " " "
	" " " " "
	Tolerance (%)
	Maximum number of iterations

Figure 3-2. A Simplified Flow Chart of COMDEF (After Ref. 41)

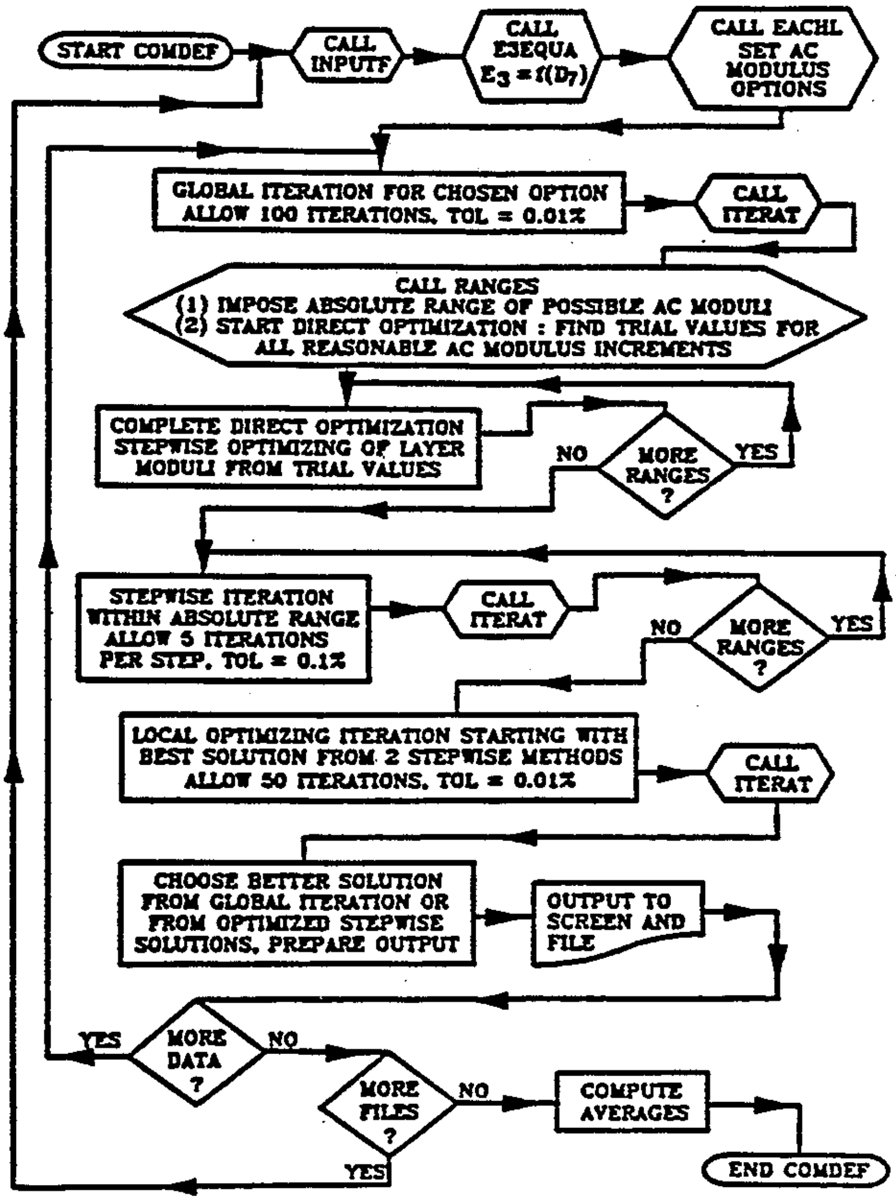
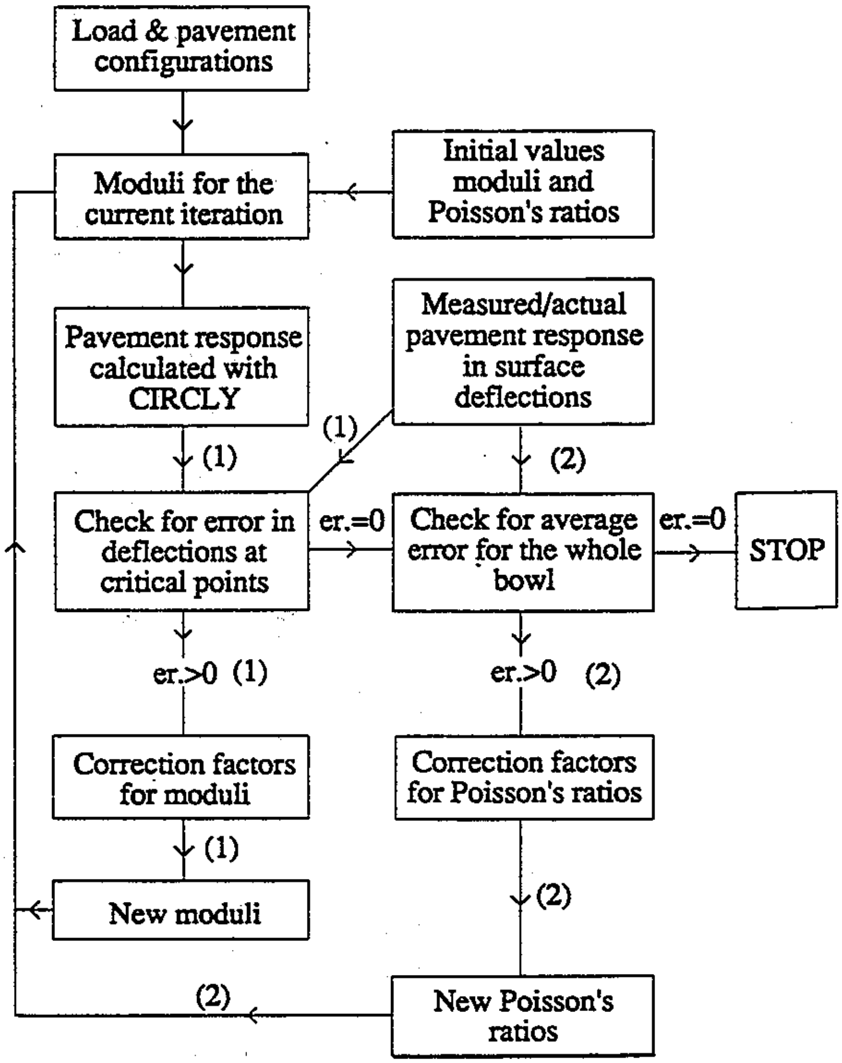


Figure 3-3. Iteration Process Used in the EFROMD-II Model (After Ref. 42)



(1) Stage I of the algorithm
(2) Stage II of the algorithm

Figure 3-4. A Flow Chart of FPEDD1 (After Ref. 46)

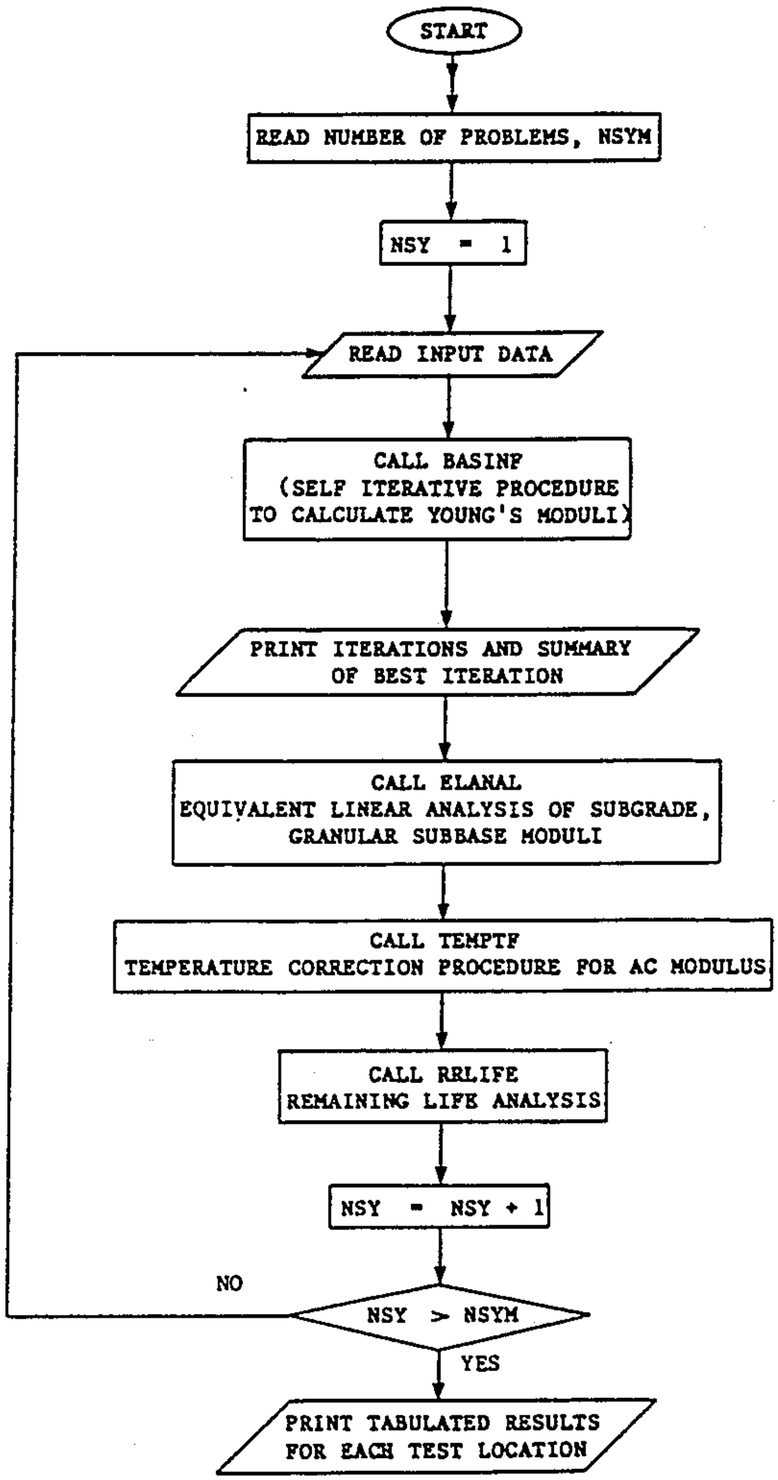


Figure 3-5. A Schematic Illustrating the Procedure to Select the Number of Sensors to Use during Deflection Analysis of MODULUS 4.0 (After Ref. 49)

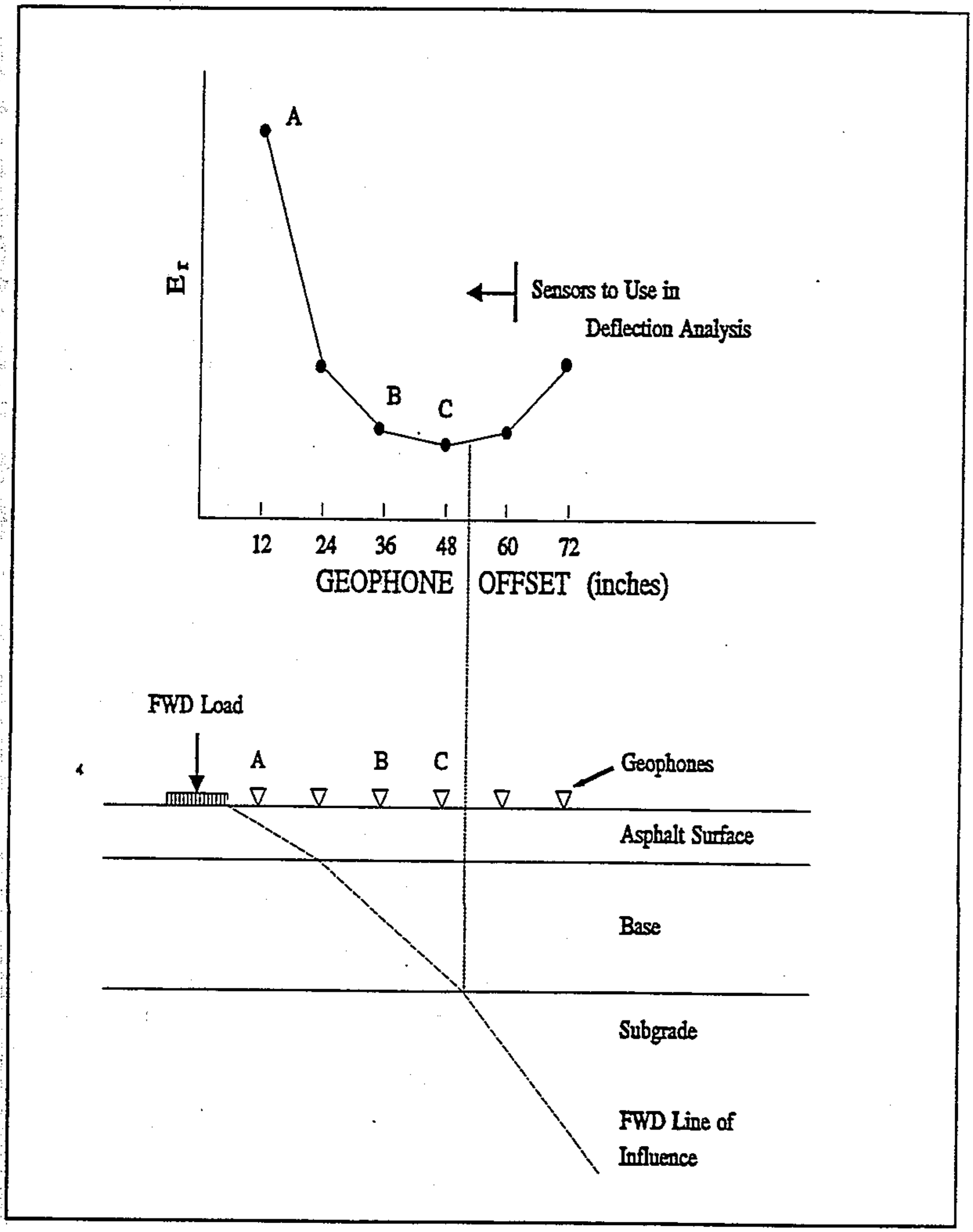


Figure 3-6. Main Steps of PADAL (After Ref. 50)

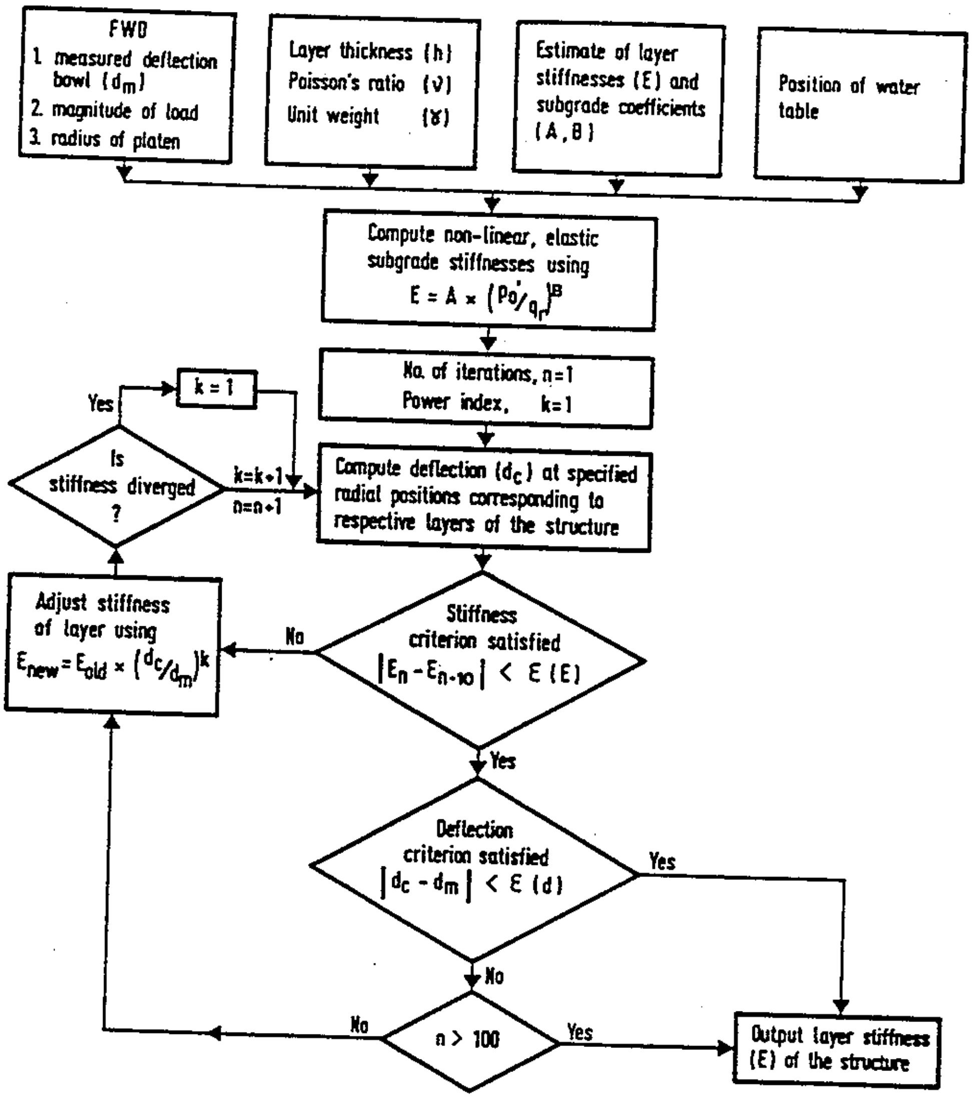


Table 3-1. The Default Values of Seed Modulus and Range of Modulus in BISDEF (BINPUT)

Materials	Seed Modulus psi	Range of Modulus psi
Asphalt Concrete	350,000	200,000 - 1,000,000
Portland Cement Concrete	3,500,000	2,500,000 - 7,000,000
High-Quality Stabilized Base	300,000	100,000 - 1,000,000
Base-Subbase Stabilized	300,000	100,000 - 1,000,000
Base-Subbase Unstabilized	30,000	5,000 - 150,000
Subgrade	15,000	1,000 - 50,000

Table 3-2. Typical Poisson's Ratio of Pavement Materials

Material	Poisson's Ratio
DGAC	0.35
PCC, Cement Treated Materials	0.2 - 0.3
Aggregate Base and Subbase	0.3 - 0.4
Subgrade Soil	0.4 - 0.5

Table 3-3. WESDEF and BISDEF Comparison (After Ref. 21)

a. Comparison of Output

Case	Pavement Type	Number of Iterations	Modulus, psi[a]		Average % Difference[b]		Time, s	
			BISDEF	WESDEF	BISDEF	WESDEF	BISDEF	WESDEF
1	AC	2	280 000[c]	280 000[c]	0.2	0.5	627	137
	base		44 759	44 796				
	subgrade		11 887	10 493				
2	PCC	2	4 188 867	4 258 500	0.3	0.4	583	187
	subgrade		10 425	10 493				
3	AC	2	393 648	344 406	2.2	2.2	860	146
	PCC		514 990	586 335				
	subgrade		19 790	20 066				

[a] 1 psi = 6894.757 Pa.
[b] Average percent difference between measured and computed deflections.
[c] AC modulus was fixed at 280 000 psi and only the base and subgrade moduli were computed.

b. Pavement Structure and NDT Data

Case	Pavement		NDT, Falling Weight Deflectometer							
	Type	Thickness, in.[b]	Load, lb[c]	Deflection, mils[a] D0	D12	D24	D36	D48	D60	D72
1	AC	5.0	24 800	46.8	30.4	19.1	12.9	9.1	6.5	4.8
	Base	12.0								
	Subgrade	223.0								
2	PCC	10.0	25 200	16.2	15.0	13.2	11.3	9.6	7.9	6.5
	Subgrade	239.0								
3	AC	6.0	26 856	16.4	12.0	9.3	7.4	5.9	4.7	3.7
	PCC	13.0								
	Subgrade	221.0								

[a] 1 mil = 0.0254 mm.
[b] 1 in. = 2.54 cm.
[c] 1 lb = 4.448222 N.

4.0 SENSITIVITY ANALYSIS OF BACKCALCULATION PROCEDURES

4.1 Introduction

The sensitivity of five computer programs was evaluated by systematically varying several inputs. Inputs studied in the sensitivity analysis include the depth to rigid bottom, seed modulus, range of modulus (minimum and maximum), layer thickness, Poisson's ratio and convergence criteria (number of iterations and tolerance limit of sum of absolute error in percent). Initially, all backcalculation programs were run using an IBM compatible personal computer 80286 (PC 286) equipped with a math coprocessor. Later, an 80486 DX with 33 MHz (PC 486) computer was purchased and used for the study.

4.2 Field Surface Deflection Measurement

For this study, FWD deflection measurements from six different SHRP LTPP sites in California were used. The Western Regional contractor for SHRP LTPP study used a Dynatest FWD and operational field guidelines [31] prepared for SHRP LTPP FWD testing were followed.

Four different levels of loading (6000, 9000, 12000 and 16000 pounds with a target tolerance ± 10%) were applied and seven sensors measured surface deflection. The drop sequence of FWD shown in Table 4-1 was applied. The loading plate radius was 5.9 inches. The seven sensors were spaced 0, 8, 12, 18, 24, 36, and 60 inches from the center of the loading plate. Load and surface deflection (at each sensor) for each target loading level was averaged from three repeated measurements and then subsequently input to backcalculation procedures.

The sites used for this study include four GPS sites and two sections from an SPS-5 site in California. The location of each site is shown in Figure 4-1. The layer material and thickness of each pavement structural section are summarized in Table 4-2. Density of structural materials is shown in parentheses. Layer material, thickness and density data were obtained from the SHRP LTPP database.

Table 4-3 presents the averaged surface deflections and load at each site. In addition, Table 4-3 shows station, time and temperature (air and pavement) when surface deflections were measured. It should be noted that the pavement temperature at sites 0517, 2647, 7452 and 7454 is extremely low (7 to 36° F). Deflections were measured at each site despite low temperatures because of the SHRP FWD operation schedule.

The road surface at sites 0512 and 0517 showed alligator cracking, bleeding and rutting. No surface distress was noted at the other sites when deflections were measured.

4.3 Backcalculation Procedures Available

Six different pavement structures were used to evaluate the following backcalculation programs: BKCHEV, BOUSDEF 2.0, EVERCALC 3.3, MODULUS 4.0, and WESDEF. The forward calculation and backcalculation methods used in these programs are summarized in Table 4-4. Procedures based on the finite element method were not available for this study. A comparison of output is possible between BKCHEV and EVERCALC 3.3 because these two programs use the CHEVRON for forward calculation.

Input data required for each backcalculation procedure available for this study are summarized in Table 4-5.

4.4 Input Variables Considered

The input variables considered in the sensitivity study include depth to rigid bottom, seed modulus, minimum and maximum range of modulus, layer thickness, Poisson's ratio and convergence criteria (the number of iterations and the tolerable sum of absolute error in percent). The effect of various interface friction conditions is evaluated for WESDEF. For MODULUS 4.0, the effect of a range of reasonable subgrade modulus is evaluated. MODULUS 4.0 requires only a "reasonable subgrade modulus," which is similar to the seed modulus in other procedures. All other layers in MODULUS 4.0 require the seed modulus input as well as the range of modulus.

4.4.1 Depth to Rigid Bottom

The effect of the rigid bottom below subgrade soil is evaluated for all five procedures. The location of the rigid bottom is varied using the following values for subgrade thickness: 20, 50, 100, 200 and 500 inches. In all procedures, the fifth layer at all sites (the fourth layer at site 7454) is the rigid bottom having infinite thickness. The modulus and Poisson's ratio of the rigid bottom are assumed equal to 1,000,000 psi and 0.5, respectively.

Even though EVERCALC 3.3 and MODULUS 4.0 can calculate the depth to a rigid bottom from the input information, infinite subgrade thickness is used as a reference value for all procedures except WESDEF. WESDEF uses a default depth of 240 inches (from the pavement surface) as a reference value.

Table 4-6 presents the various subgrade thickness input values and their corresponding numbers shown in the first column of the backcalculation output summary attached in the Appendix.

4.4.2 Seed Modulus

Because of the lack of modulus data for pavement materials in California, the seed modulus of DGAC was selected based on a limited database. The seed modulus of all other materials, including subgrade soil, was selected based on judgment and recommendations either in the program or in available literature. The following three levels of seed modulus were used for each layer material: arbitrary reference, low modulus and high modulus. The low seed modulus is one-half of the arbitrary reference value and the high seed modulus is twice the reference value. The numerical values for seed modulus are shown in Table 4-7. The number in parentheses in Table 4-7 corresponds to the number in the first column of the output summary in the Appendix.

4.4.3 Range of Modulus

Like the seed modulus of pavement materials, the minimum and maximum modulus of pavement materials were selected using judgment and available information. Because

MODULUS 4.0 requires a reasonable subgrade modulus of 1000 psi or higher, the minimum reference modulus of subgrade was established at 1000 psi. Low pavement temperatures during field measurements resulted in a maximum reference modulus of 3,500,000 psi for DGAC.

Like the seed modulus, three different levels of both the minimum and maximum modulus were tried: the arbitrary reference value as well as 50% and 200% of the reference value. Table 4-8 shows the numerical values used in the study. The number in parentheses in Table 4-8 corresponds to the number in the first column of the output summary in the Appendix.

4.4.4 Layer Thickness

The thickness of each layer was obtained from the SHRP LTPP database. The DGAC thickness used for backcalculation combines the chip seal and actual DGAC layer thickness because the chip seal layer is too thin to analyze separately. As a result, the number of layers (including the subgrade) is reduced to no more than four.

Again, three different values were tried for the sensitivity analysis. These values were the measured (or reference) thickness (100%) and ± 5% deviation from this reference value as shown in Table 4-9. The thin layer is 95% and the thick layer is 105% of the measured thickness. The number in parentheses in Table 4-9 corresponds to the number in the first column of the output summary in the Appendix.

4.4.5 Poisson's Ratio

The current analysis is consistent with previous studies where Poisson's ratio for each pavement material is assumed (instead of measured) for both forward calculation and backcalculation. However, three different Poisson's ratios of pavement materials were studied to evaluate model sensitivity. The levels of Poisson's ratio of materials varied ± 20% from a reference value (100%) and are presented in Table 4-10. The number in parentheses in Table 4-10 corresponds to the number in the first column of the output summary in the Appendix.

4.4.6 Convergence Criteria

For the sensitivity analysis two input variables of convergence criteria were examined. These two variables are the number of iterations and the tolerance for the sum of absolute error in percent (see Eqn. (3-2)). Trial numbers of iterations are 3, 6 and 9 and the predetermined tolerable levels of sum of absolute error are 3, 5, 10 and 15%. The maximum number of iterations was limited to nine because it is the maximum number for BOUSDEF. The reference values were 3 for the number of iterations and 10% for the sum of absolute error. The sensitivity of EVERCALC 3.3 to changes in the predetermined sum of absolute error (%) was not studied because EVERCALC 3.3 uses the RMS (root mean square, see Eqn. (3-6)).

Table 4-11 presents the number in the first column of the Appendix which corresponds to the input variables of convergence criteria.

4.4.7 Other Input Variables

For WESDEF, the following levels of varying interface friction were evaluated: full (1.0), partial (0.5) and slip (0.0) conditions. Table 4-12 summarizes the various input conditions and their corresponding numbers in the output summary of WESDEF in the Appendix.

Because MODULUS 4.0 uses a "reasonable subgrade modulus" input, the effect of varying reasonable subgrade modulus is evaluated. Table 4-13 summarizes the various reasonable subgrade modulus values and their corresponding numbers shown in the first column of the output summary in the Appendix.

It should be noted that, through the sensitivity study, only one variable was examined at a time while other variables were fixed. For example, when the sensitivity of DGAC layer thickness on the backcalculated modulus was examined, other input variables were assigned the reference values and only DGAC layer thickness varied to either 95% or 105% of the measured thickness. The reference values of each input variable are summarized in Table 4-14.

4.5 Output of Backcalculation Procedures

4.5.1 Backcalculated Moduli

The purpose of backcalculation is to estimate the unknown layer moduli within a reasonable tolerance. Backcalculated moduli based on reference values from each computer program are presented in Table 4-15. In addition to backcalculated moduli of each layer and the subgrade, Table 4-15 also presents the sum of absolute error in percentage (Eqn. (3-3)) between measured and calculated deflections as well as the number of iterations performed. A comprehensive output summary of each program at all six sites is presented in the Appendix. In some cases, because the change of modulus is within the limit (generally ± 10 percent), the backcalculation process was terminated even though the number of iterations is less than three or the sum of absolute error is more than 10 percent.

The magnitude of the DGAC modulus at each site shows the dramatic effect of temperature and pavement condition. For example, the pavement temperature at sites 2647 and 7454 was so low (21 and 7° F) that the backcalculated DGAC modulus reached the maximum modulus of 3,500,000 psi. Pavement distress at site 0517 is believed to have resulted in the lowest DGAC modulus of all sites, even though the pavement temperature was only relatively low (36° F).

Backcalculation results also show a sensitivity of the subgrade modulus to ambient temperature. When the temperature was far below the freezing (7° F) at site 7454, results from all procedures except BOUSDEF show a very high subgrade modulus (higher than 75,000 psi). Results from BKCHEV and EVERCALC 3.3 (with the load of 8550, 11154 and 15020 pounds) at site 2647 (21° F) show the subgrade modulus of higher than 100,000 psi with about a 10% sum of absolute error. Backcalculated subgrade moduli at sites 2647 and 7454 are much higher than the range of values (20,000 to 50,000 psi) recommended in the 1986 AASHTO Design Guide [4] for frozen subgrade soil.

For some cases, backcalculated moduli of aggregate subbase (AS) layers are smaller than those of the subgrade. This result contradicts the traditional pavement structure design philosophy where the upper layer is stronger than underlying layer.

Backcalculation results show that the sum of absolute error between measured and calculated deflection is relatively small at most sites (0512, 2647, 7454 and 8153). However, the error is extremely high at sites 0517 and 7452. Reasons for these differences are discussed in the following chapter.

4.5.2 Depth to Rigid Bottom

EVERCALC 3.3 and MODULUS 4.0 can estimate the depth from the surface to the rigid bottom. Calculated depths are presented in Table 4-16.

Even though the calculated depth to the rigid bottom is comparable at most sites (0517, 2647, 7452, and 7454), there is significant disagreement between results at sites 0512 and 8153. It is unknown, however, which procedure produces more accurate results. It is noted that, for MODULUS 4.0, the calculated depth to the rigid bottom changes with the loading magnitude at the same site. This suggests that MODULUS 4.0 needs additional study and changes to reduce or eliminate sensitivity to load magnitude.

According to the SHRP LTPP database, the depth to the rigid bottom or bedrock for all sites is unknown. However, the SHRP LTPP file indicated that cobble or boulder sized aggregate prevented the augering process from continuing at about 3 and 2.5 feet deep at sites 7454 and 2647, respectively. For the other sites, there was no difficulty for augering process up to 20 feet deep from the pavement surface.

4.6 Backcalculation Operation Time

The computer operation time of each backcalculation procedure (with one deflection data set from each site) was measured using a personal computer 80486 (PC 486) equipped with a math coprocessor. Table 4-17 presents the results. The reference input data in Table 4-14 were used for this comparison. Operation time ranges from 0.3 to about 37 seconds depending on procedure and pavement structure.

A comparison of operation time with a PC 286 and a PC 486 is presented in Table 4-18 using MODULUS 4.0. The operation time of MODULUS 4.0 shown in Table 4-18 includes the time for both generating a database and backcalculation using four deflection data sets at four different load levels. For backcalculation only, a PC 286 takes twenty seconds to four minutes for four deflection data sets at one site depending upon the number of layers. However, a PC 486 takes about fifteen seconds for the backcalculation process for a pavement structure with four layers. Comparing operation time shows that the PC 486 is eight to twenty times faster than a PC 286.

Figure 4-1. Location of Test Sites

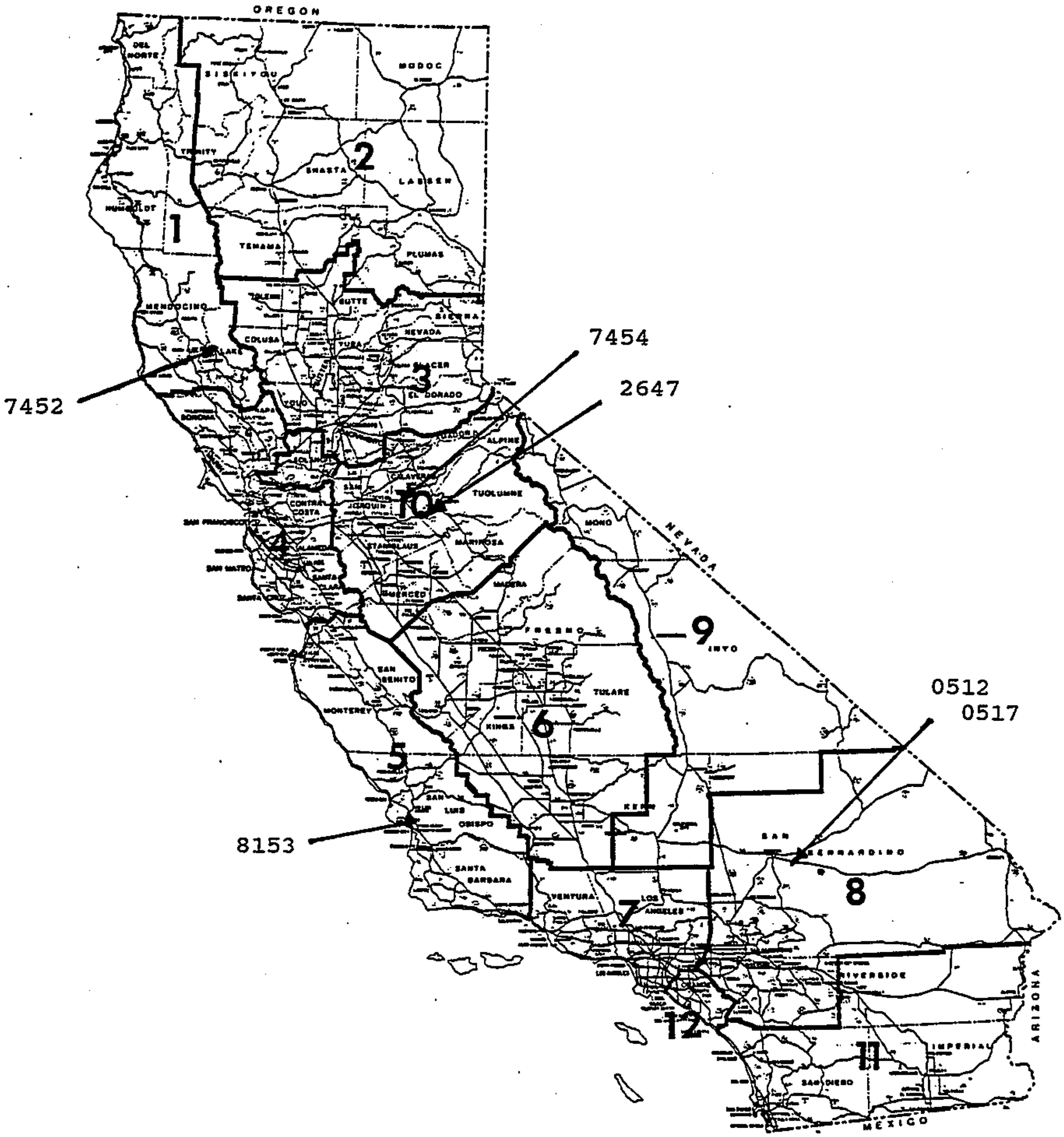


Table 4-1. Drop Sequence of FWD Used for SHRP LTPP Study (After Ref. 31)

No. of Drops	Sequence No.	Drop Height	Target Load (Pounds)
3	1[1]	h3	12,000
4	2[2]	h1	6,000
4	3[2]	h2	9,000
4	4[2]	h3	12,000
4	5[2]	h4	15,000

1[1]: Drops used for seating only, no data recorded.

2[2], 3[2], 4[2], 5[2]: Store only deflection peaks for first three drops at each drop height; for fourth drop at each drop height a complete deflection-time history will be stored.

Table 4-2. Materials and Layer Thickness of Each Pavement Structural Section (inches)

Layers	SHRP No.					
	0512	0517	2647	7452	7454	8153
Chip Seal	0.50	0.50	0.25	0.25	0.25	0.25
DGAC	4.0 (N/A)[1]	4.5 (N/A)	4.0 (141.6)	3.8 (145.4)	4.3 (145.4)	4.0 (145.4)
AB	---	---	---	---	16.8 (N/A)	6.5 (136.3)
CTB*	7.5 (N/A)	6.0 (N/A)	9.7 (N/A)	---	---	---
LCB**	---	---	---	7.2 (N/A)	---	---
AS	20.0 (135.3)[2]	20.0 (140.4)	11.8 (136.2)	10.5 (145.8)	---	11.9 (126.7)
Subgrade	(127.8)	(120.5)	(148.0)	(126.5)	(147.9)	(119.3)
Route	08-SBD-40	08-SBD-40	10-TUO-120	01-LAK-29	10-CAL-4	05-SLO-227

CTB*: Cement Treated Base.

LCB**: Lean Concrete Base.

(N/A)[1] : not available.

( )[2] : density, pcf.

Table 4-3. Averaged Surface Deflection of Each Site, mils

SHRP No.	Date/ Time	Temp (°F) Air	Temp (°F) Pavt	Sta	Load (lb)	Offset of Sensors, inches 0	8	12	18	24	36	60
0512*	01 - 26	63	74	200	6400	9.81	7.36	5.22	3.91	2.99	2.06	1.30
	11:05				9328	13.22	10.10	7.49	5.71	4.41	3.09	1.92
					12059	16.33	12.66	9.66	7.44	5.87	4.26	2.66
					15419	19.20	14.97	11.60	9.02	7.21	5.23	3.29
0517*	01 - 27	45	36	400	6379	20.09	15.08	12.97	6.45	4.79	2.93	1.70
	08:57				9437	25.39	19.16	16.73	8.85	6.60	4.14	2.39
					12237	29.53	22.57	19.89	11.14	8.44	5.59	3.28
					15923	33.17	25.45	22.61	13.31	10.14	6.93	4.17
2647	12 - 15	45	21	250	5658	1.64	1.48	1.40	1.23	1.05	0.75	0.45
	08:36				8550	2.48	2.21	2.08	1.83	1.51	1.09	0.58
					11154	3.31	2.93	2.78	2.41	2.03	1.45	0.80
					15020	4.48	3.96	3.76	3.27	2.79	1.99	1.06
7452	12 - 11	46	22	475	5566	7.61	6.53	6.20	5.37	3.11	1.23	0.86
	09:26				8330	10.47	9.00	8.56	7.44	4.37	1.90	1.25
					10934	12.93	11.07	10.53	9.19	5.58	2.68	1.67
					14578	16.43	14.04	13.54	11.68	7.33	3.82	2.32
7454	12 - 14	36	7	250	6266	3.57	2.88	2.41	1.71	1.19	0.55	0.21
	08:25				8974	5.17	4.21	3.56	2.56	1.77	0.84	0.31
					11542	6.79	5.46	4.64	3.34	2.34	1.09	0.40
					15158	9.04	7.19	6.10	4.35	3.06	1.42	0.48
8153	12 - 19	56	51	375	5532	11.56	9.46	8.01	6.06	4.64	3.16	1.91
	09:59				8062	16.69	13.71	11.56	8.92	6.93	4.67	2.84
					10602	20.88	17.28	14.66	11.48	9.03	6.17	3.77
					14162	25.90	21.47	18.40	14.58	11.61	8.06	4.97

*: alligator cracking, bleeding and rutting.

Table 4-4. Backcalculation Procedures Available for This Study

	MET	Elastic Layer System	Finite Element Method
Iteration	BOUSDEF	BKCHEV EVERCALC 3.3 WESDEF	----
Database	----	MODULUS 4.0	----

Table 4-5. Input Data Required for Backcalculation Procedures Available for This Study

	BKCHEV	BOUSDEF	EVERCALC	MODULUS	WESDEF
A. Layer Data					
Max. No. of Layer[1]	5	5	5	5	5
Layer Thickness	Yes	Yes	Yes	Yes	Yes
Poisson's Ratio	Yes	Yes	Yes	Yes	Yes
Density	No	Yes	No	No	No
Minimum Modulus	Yes	Yes	Yes	Yes/No*	Yes
Maximum Modulus	Yes	Yes	Yes	Yes/No*	Yes
Seed Modulus	Yes	Yes	Yes	Yes/No*	Yes
B. Load Data					
Radius of Plate	Yes/No[2]	Yes	Yes	Yes	Yes
Magnitude	Yes/No[2]	Yes	Yes	Yes	Yes
C. Deflection Data					
Deflection	Yes	Yes	Yes	Yes	Yes
No. of Sensors	Yes/No[2]	Yes	Yes	No[3]	Yes
Sensor Spacing	Yes/No[2]	Yes	Yes	Yes	Yes
D. Conversion Criteria					
Deflection Error	SOA[4]	SOA	RMS[5]	No	SOA
No. of Iteration	Yes	Yes	Yes	No	No
Change of Modulus	No	No	Yes	No	No
F. Miscelleneous					
Temperature	No	No	Yes	Yes	No
Rigid Bottom	No	No	Yes	Yes	Yes

1: includes subgrade.

2: for Dynaflect.

3: with default value of sensor spacing.

4: Sum of Absolute Error, %.

5: Root Mean Square.

*: not required with an option of material type.

Table 4-6. Assumed Various Subgrade Thickness Used for Sensitivity Study

Subgrade Thickness (in.)	No. in the First Column of Output Summary in the Appendix
20	0
50	1
100	2
200	3
500	4
Various*	R
Various**	5 (Reference)

Various* : The depth of rigid bottom calculated by EVERCALC 3.3.

Various** : The reference value of subgrade thickness varies with backcalculation procedures;

1) For BKCHEV, BOUSDEF, EVERCALC 3.3 and MODULUS 4.0, the thickness of subgrade is infinite.

2) For WESDEF, the top of rigid layer is located at 240 inches from the surface of pavement.

BOUSDEF (2647)

No.	K1	K2	K3	K4	R1^2	R2^2	Rigid Bottom
0	-----	-----	3373	0.338	-----	0.39	20
1	-----	-----	6705	0.372	-----	0.21	50
2	-----	-----	1547	1.000	-----	0.11	100
3	-----	-----	1166	1.000	-----	0.02	200
4	-----	-----	500	1.000	-----	0.00	500
5	7486225	-1.733	60761	0.045	0.43	0.21	
6	268210288	-3.146	58072	0.082	0.76	0.76	
7	355020	-1.044	33444	0.262	0.24	0.37	
8	499622624	-3.446	65171	0.054	0.78	0.24	
9	10373	0.204	16839	0.532	0.03	0.38	
10	977686	-1.251	21398	0.402	0.60	0.80	
11	97515	-0.644	33063	0.254	0.77	0.80	
14	213409	-1.074	16117	0.540	0.57	0.78	
15	2091	1.295	81178	-0.069	0.14	0.29	
16	7486225	-1.733	60761	0.045	0.43	0.21	
17	7486225	-1.733	60761	0.045	0.43	0.21	
18	331	2.234	106254	-0.131	0.58	0.12	
19	1995	1.250	15884	0.550	0.86	0.62	
20	11	3.788	142676	-0.451	0.72	0.98	
21	20001	0.000	56517	0.124	1.00	0.37	
24	7486225	-1.733	60761	0.045	0.43	0.21	
25	7486225	-1.733	60761	0.045	0.43	0.21	
26	55.08	0.502	42522	0.163	0.08	0.39	
27	5211614	-1.609	24888	0.397	0.57	0.81	
28	754137	-1.242	20044	0.416	0.50	0.80	
29	92	2.403	7996	0.757	0.83	0.90	
30	93366	-0.509	20624	0.416	0.02	0.71	
31	13795661824	-4.562	36651	0.259	0.34	0.89	
34	108593	-0.401	50593	0.123	0.09	0.57	
35	109501	-0.737	15733	0.509	0.25	0.71	
36	11515284	-1.858	90951	-0.111	0.55	0.67	
37	68384392	-3.029	40517	0.218	0.34	0.08	
38	1071106304	-3.735	73392	0.021	0.79	0.03	
39	494	1.714	105203	-0.189	0.40	0.22	
40	14075384	-1.919	69082	-0.002	0.65	0.01	
41	1151611	-1.072	69272	-0.010	0.12	0.01	
45	8282079	-1.769	64955	0.021	0.45	0.06	
46	148699792	-2.878	49635	0.136	0.71	0.69	
47	7486225	-1.733	67463	0.004	0.43	0.00	
48	7486225	-1.733	56657	0.073	0.43	0.37	
49	128276512	-2.967	37572	0.246	0.56	0.87	
50	7300577	-1.656	97148	-0.157	0.48	0.72	
53	7486225	-1.733	80018	-0.062	0.43	0.43	
54	30960	0.225	95321	-0.160	0.01	0.04	
65	83	2.607	19942	0.504	0.60	0.78	
66	26449	-0.071	63440	0.058	0.69	0.19	
77	7486225	-1.733	60761	0.045	0.43	0.21	
78	7486225	-1.733	60761	0.045	0.43	0.21	
79	7486225	-1.733	60761	0.045	0.43	0.21	

Table 4-8. Minimum and Maximum Range of Layer Modulus

a. Minimum Range, psi

Material	Low (50%)	Arbitrary Reference	High (200%)
DGAC	50,000(16)*	100,000(5)	200,000(17)
CTB, LCB	10,000(18)	20,000(5)	40,000(19)
AB	5,000(18)	10,000(5)	20,000(19)
AS	5,000(20)	10,000(5)	20,000(21)
Subgrade	500(24)	1,000(5)	2,000(25)

b. Maximum Range

Material	Low (50%)	Arbitrary Reference (100%)	High (200%)
DGAC	1,750,000(26)*	3,500,000(5)	7,000,000(27)
CTB, LCB	1,000,000(28)	2,000,000(5)	4,000,000(29)
AB	125,000(28)	250,000(5)	500,000(29)
AS	125,000(30)	250,000(5)	500,000(31)
Subgrade	75,000(34)	150,000(5)	300,000(35)

*: The number in the parentheses corresponds to the number of the first column in the Appendix.

Table 4-9. Layer Thickness, inches

SHRP No.	Layer	Thin (95%)	Reference Measurement (100%)	Thick (105%)
0512	DGAC*	4.28(36)	4.5 (5)	4.72(37)
	CTB	7.12(38)	7.5 (5)	7.88(39)
	AS	19.0 (40)	20.0 (5)	21.0 (41)
0517	DGAC*	4.75(36)	5.0 (5)	5.25(37)
	CTB	5.70(38)	6.0 (5)	6.30(39)
	AS	19.0 (40)	20.0 (5)	21.0 (41)
2647	DGAC*	4.04(36)	4.25(5)	4.46(37)
	CTB	9.22(38)	9.7 (5)	10.18(39)
	AS	11.21(40)	11.8 (5)	12.39(41)
7452	DGAC*	3.85(36)	4.05(5)	4.25(37)
	LCB	6.84(38)	7.2 (5)	7.56(39)
	AS	9.98(40)	10.5 (5)	11.02(41)
7454	DGAC*	4.32(36)	4.55(5)	4.78(37)
	AB	15.96(38)	16.8 (5)	17.64(39)
8153	DGAC*	4.04(36)	4.25(5)	4.46(37)
	AB	6.18(38)	6.5 (5)	6.82(39)
	AS	11.30(40)	11.9 (5)	12.50(41)

DGAC* : Combined thickness of surface friction course and asphalt concrete layer.

( ): The number in the parentheses corresponds to the number of the first column in the Appendix.

Table 4-10. Poisson's Ratio of Each Layer

Material	Low (80%)	Arbitrary Reference (100%)	High (120%)
DGAC	0.28(45)*	0.35(5)	0.42(46)
CTB, LCB	0.20(47)	0.25(5)	0.30(48)
AB	0.24(47)	0.30(5)	0.36(48)
AS	0.24(49)	0.30(5)	0.36(50)
Subgrade	0.32(53)	0.40(5)	0.48(54)

*: The number in the parentheses corresponds to the number of the first column in the Appendix.

Table 4-11. Convergence Criteria Used for This Study

Convergence Criteria	No. in the First Column of Output Summary in the Appendix
1. Number of Iterations	
3	5
6	65
9	66
2. Tolerance Level of Sum of Absolute Error	
3 %	77
5 %	78
10 %	5
15 %	79

Table 4-12. Various Interface Friction in WESDEF

Interface Friction Condition	Layer Interface			
	DGAC - Base	Base - AS	AS - Subgrade	Subgrade - Rigid Bottom
Full (1.0)	5*	5	5	5
Partial (0.5)	56	58	61	63
Slip (0.0)	55	57	60	64

*: The number in the parentheses corresponds to the number of the first column in the Appendix.

Table 4-13. Assumed Reasonable Subgrade Modulus in MODULUS 4.0

Reasonable Subgrade Modulus, psi	No. in the First Column of Output Summary in the Appendix
20,000	5
1,000	91
10,000	92
2,000	93
40,000	94
300,000	95
75,000	96

Table 4-14. Reference Values of Input Variables for Backcalculation Procedures

Variables	DGAC	CTB & LCB	AB	AS	Subgrade
Seed Modulus, psi	450000	1000000	50000	50000	20000
Minimum Modulus, psi	100000	20000	10000	10000	1000
Maximum Modulus, psi	3500000	2000000	250000	250000	150000
Poisson's Ratio	0.35	0.25	0.30	0.30	0.40
Interface Friction	1.0	1.0	1.0	1.0	1.0
Layer Thickness		Measured Thickness			
No. of Iteration		3			
Sum of Absolute Error		10%			
Rigid Depth		240 in.* or No rigid bottom**			

240 in.* : for WESDEF only.

No rigid bottom**: The subgrade thickness is infinite for BKCEHV, BOUSDEF, EVERCALC 3.3 and MODULUS 4.0.

Table 4-15. Output of Each Backcalculation Procedure

a. 0512 (Pavement Temperature = 74° F)

1. 6400 lbf

Procedure	DGAC	CTB	AS	Subgrade	Itr.	% Error
BKCHEV	445445	26976	42551	22588	3	12.7
BOUSDEF	439173	20000[L]	59359	23306	3	14.2
EVERCALC	413659	30850	37637	22846	3	12.2
MODULUS	417700	20000[L]	130900	18500	–	16.9
WESDEF	496277	20000[L]	85961	14681	3	14.8

2. 9328 lbf

Procedure	DGAC	CTB	AS	Subgrade	Itr.	% Error
BKCHEV	529308	33104	38977	22259	3	10.4
BOUSDEF	596827	20594	57242	23224	3	10.3
EVERCALC	486028	37216	35869	22479	2	9.1
MODULUS	499200	28400	53700	21900	–	21.9
WESDEF	589179	23791	72827	14462	3	11.0

3. 12059 lbf

Procedure	DGAC	CTB	AS	Subgrade	Itr.	% Error
BKCHEV	587902	37143	40924	20658	3	9.5
BOUSDEF	662355	24749	55926	21861	3	8.0
EVERCALC	538212	41910	37431	20892	2	8.8
MODULUS	557000	32100	53900	20400	–	20.4
WESDEF	634074	27397	73661	13258	3	8.0

4. 15419 lbf

Procedure	DGAC	CTB	AS	Subgrade	Itr.	% Error
BKCHEV	637471	45809	41135	21481	3	7.8
BOUSDEF	700598	39065	47215	22810	3	7.2
EVERCALC	606181	48643	39165	21630	2	7.1
MODULUS	616500	38200	53900	21200	–	18.7
WESDEF	731245	29880	79197	13550	3	8.1

L: minimum value of modulus range in Table 4-14.

Table 4-15. Output of Each Backcalculation Procedure (Continued)

b. 0517 (Pavement Temperature = 36° F)

1. 6379 lbf

Procedure	DGAC	CTB	AS	Subgrade	Itr.	% Error
BKCHEV	N/A					
BOUSDEF	158644	20000L	10000L	20000	3	58.5
EVERCALC	104042	20000L	11489	18058	3	58.0
MODULUS	120300	20000L	10700	20000	--	59.8
WESDEF	126933	20000L	11943	12753	3	74.7

2. 9437 lbf

Procedure	DGAC	CTB	AS	Subgrade	Itr.	% Error
BKCHEV	193494	20000L	11757	20018	3	50.7
BOUSDEF	340677	20000L	10000L	20000	3	60.8
EVERCALC	155751	20000L	13806	18738	2	43.2
MODULUS	153600	26800	10000L	26700	--	47.7
WESDEF	187140	20000L	15745	12864	3	57.7

3. 12237 lbf

Procedure	DGAC	CTB	AS	Subgrade	Itr.	% Error
BKCHEV	250392	20000L	14305	18518	3	43.5
BOUSDEF	300051	20000L	13477	20000	3	42.2
EVERCALC	207608	20000L	16588	17586	2	35.8
MODULUS	209500	29100	10000L	29100	--	43.0
WESDEF	256247	20000L	19557	12025	3	47.8

4. 15923 lbf

Procedure	DGAC	CTB	AS	Subgrade	Itr.	% Error
BKCHEV	325461	20000L	19004	18657	3	35.9
BOUSDEF	386068	20000L	17899	20000	3	34.5
EVERCALC	282383	20000L	21386	17918	2	30.0
MODULUS	287400	33600	10400	33600	--	37.6
WESDEF	352731	20000L	27933	12088	3	37.5

L: minimum value of modulus range in Table 4-14.

Table 4-15. Output of Each Backcalculation Procedure (Continued)

c. 2647 (Pavement Temperature = 21° F)

1. 5658 lbf

Procedure	DGAC	CTB	AS	Subgrade	Itr.	% Error
BKCHEV	3499999	938222	12808	89800	3	14.8
BOUSDEF	3499999	20000^{L}	250000^{H}	64839	3	314.0
EVERCALC	590796	2000001^{H}	250000^{H}	46459	3	76.6
MODULUS	3500000^{H}	620100	55600	58500	--	27.1
WESDEF	3500000^{H}	903206	27434	48246	3	19.4

2. 8550 lbf

Procedure	DGAC	CTB	AS	Subgrade	Itr.	% Error
BKCHEV	3499999	867068	10763	122253	3	12.6
BOUSDEF	2549190	77024	81138	70727	3	188.2
EVERCALC	3499999	844377	11943	110740	3	11.3
MODULUS	3500000^{H}	664800	28500	75000	--	21.3
WESDEF	3500000^{H}	926883	13325	74630	3	16.5

3. 11154 lbf

Procedure	DGAC	CTB	AS	Subgrade	Itr.	% Error
BKCHEV	3499999	839701	11835	105514	3	12.6
BOUSDEF	2424327	117491	55523	65522	3	190.8
EVERCALC	3499999	811817	13510	96250	2	11.9
MODULUS	3500000^{H}	661600	28100	72400	--	18.6
WESDEF	3500000^{H}	830673	19537	58844	3	16.4

4. 15020 lbf

Procedure	DGAC	CTB	AS	Subgrade	Itr.	% Error
BKCHEV	3362024	873284	10224	117467	3	9.0
BOUSDEF	2382703	76456	70192	69109	3	201.3
EVERCALC	3499999	845479	11013	110579	2	9.3
MODULUS	3500000^{H}	610100	35300	67600	--	27.0
WESDEF	3500000^{H}	933339	12062	72225	3	15.6

H: maximum value of modulus range in Table 4-14.
L: minimum value of modulus range in Table 4-14.

Table 4-15. Output of Each Backcalculation Procedure (Continued)

d. 7452 (Pavement Temperature = 22° F)

1. 5566 lbf

Procedure	DGAC	LCB	AS	Subgrade	Itr.	% Error
BKCHEV	3499999	20000L	10000L	28734	3	132.4
BOUSDEF	100000L	125003	10000L	24978	3	169.4
EVERCALC	1213820	20000L	14362	31454	3	86.6
MODULUS	2056400	20000L	23200	20000	--	35.5
WESDEF	3500000H	20000L	10000L	23720	3	133.5

2. 8330 lbf

Procedure	DGAC	LCB	AS	Subgrade	Itr.	% Error
BKCHEV	3499999	20000L	10000L	31969	3	98.8
BOUSDEF	100000L	133074	10000L	28001	3	159.4
EVERCALC	1592209	20000L	15864	32714	2	85.0
MODULUS	2337600	22200	21300	22200	--	33.8
WESDEF	3500000H	20000L	11705	24155	3	108.4

3. 10934 lbf

Procedure	DGAC	LCB	AS	Subgrade	Itr.	% Error
BKCHEV	3499999	20000L	10000L	34045	3	74.8
BOUSDEF	10000	20000L	10000L	33315	3	313.1
EVERCALC	1971953	20000L	17942	31398	2	68.8
MODULUS	2682300	23800	20000	23800	--	29.8
WESDEF	3500000H	20000L	15364	22945	3	82.9

4. 14578 lbf

Procedure	DGAC	LCB	AS	Subgrade	Itr.	% Error
BKCHEV	3499999	20000L	10595	33909	3	67.7
BOUSDEF	812645	225341	10000L	31890	3	66.0
EVERCALC	2351919	20000L	20281	29896	2	57.9
MODULUS	3019600	25000	19100	25000	--	25.9
WESDEF	3500000H	20000L	20416	21558	3	66.2

H: maximum value of modulus range in Table 4-14.
L: minimum value of modulus range in Table 4-14.

Table 4-15. Output of Each Backcalculation Procedure (Continued)

e. 7454 (Pavement Temperature = 7° F)

1. 6266 lbf

Procedure	DGAC	AB	Subgrade	Itr.	% Error
BKCHEV	3307471	28584	121580	2	4.9
BOUSDEF	536758	33128	1000[L]	3	28724.2
EVERCALC	3499999	32532	75592	3	140.4
MODULUS	2435500	35400	117800	--	13.0
WESDEF	2831667	35649	85038	3	11.0

2. 8974 lbf

Procedure	DGAC	AB	Subgrade	Itr.	% Error
BKCHEV	3499999	26606	121012	1	7.7
BOUSDEF	531965	31808	1000[L]	3	28011.6
EVERCALC	3362250	27395	116459	2	4.8
MODULUS	2630700	33300	111100	--	12.4
WESDEF	2979840	33703	82095	3	9.9

3. 11542 lbf

Procedure	DGAC	AB	Subgrade	Itr.	% Error
BKCHEV	3423664	26188	118040	2	6.8
BOUSDEF	521264	30979	1000[L]	3	27879.2
EVERCALC	3335756	26670	116264	1	5.5
MODULUS	2518600	33200	110600	--	11.1
WESDEF	2961950	32770	81578	3	11.1

4. 15158 lbf

Procedure	DGAC	AB	Subgrade	Itr.	% Error
BKCHEV	3499999	25038	123435	1	8.2
BOUSDEF	515136	31010	1000[L]	3	29157.0
EVERCALC	3409053	25236	124371	1	4.4
MODULUS	2393200	33600	111900	--	11.0
WESDEF	3117760	29388	87821	2	9.4

L: minimum value of modulus range in Table 4-14.

Table 4-15. Output of Each Backcalculation Procedure (Continued)

f. 8153 (Pavement Temperature = 51° F)

1. 5532 lbf

Procedure	DGAC	AB	AS	Subgrade	Itr.	% Error
BKCHEV	766660	20000	20448	13678	3	8.0
BOUSDEF	1037012	12200	26669	13656	3	6.2
EVERCALC	917583	10000L	39299	13246	3	11.7
MODULUS	735500	11400	57600	13200	--	14.5
WESDEF	587025	20000	42547	9362	3	20.1

2. 8062 lbf

Procedure	DGAC	AB	AS	Subgrade	Itr.	% Error
BKCHEV	815006	20000	21016	13405	3	6.2
BOUSDEF	872160	25976	16197	14267	3	6.4
EVERCALC	961054	10000L	49769	13017	1	1.9
MODULUS	705300	16800	32700	13100	--	12.9
WESDEF	764350	20000	37100	9336	3	17.6

3. 10602 lbf

Procedure	DGAC	AB	AS	Subgrade	Itr.	% Error
BKCHEV	922046	20000	24210	13318	3	6.6
BOUSDEF	910514	31716	16925	14128	3	6.4
EVERCALC	1085588	10000L	62453	12901	1	1.5
MODULUS	794600	17000	38400	12900	--	12.4
WESDEF	716094	20000	54851	8941	3	15.7

4. 14162 lbf

Procedure	DGAC	AB	AS	Subgrade	Itr.	% Error
BKCHEV	1068708	20000	30639	13473	3	7.2
BOUSDEF	920405	41203	18748	14318	3	6.0
EVERCALC	1212374	11575	64233	13094	1	1.9
MODULUS	897800	18700	44300	13100	--	11.5
WESDEF	824442	20000	75921	8891	3	12.8

L: minimum value of modulus range in Table 4-14.

Table 4-16. Depth of the Rigid Bottom Calculated by EVERCALC 3.3 and MODULUS 4.0 (inches)

Site/Load Level (lbf)	EVERCALC 3.3	MODULUS 4.0
0512	600	
6400		250.83
9328		300.00
12059		300.00
15419		300.00
0517	36.6	
6379		21.13
9437		22.69
12237		24.54
15923		26.82
2647	104.9	
5658		173.00
8550		99.84
11154		113.30
15020		300.00
7452	42.0	
5566		61.73
8330		68.36
10934		80.66
14578		100.23
7454	50.3	
6266		62.69
8974		73.99
11542		75.80
15158		67.01
8153	600	
5532		300.00
8062		300.00
10602		300.00
14162		300.00

Table 4-17. Operation Time of Each Program with a PC 486 with One Deflection Data Set (seconds)

Site	BKCHEV	BOUSDEF	EVERCALC	MODULUS	WESDEF
0512	21	0.7	34.5	---	12
0517	21	N/A	35	---	20.3
2647	21	0.7	36.5	---	19
7452	21	0.7	36.5	---	25
7454	5	0.3	21	---	17.7
8153	21	0.7	35	---	18.3

4-18. Comparison of Operation Time between 80286 and 80486 with MODULUS 4.0 Using Four Deflection Data Sets

Site	80286	80486
0512	25' 43"	1' 18"
0517	25' 23"	1' 12"
2647	24' 23"	1' 09"
7452	25' 39"	1' 14"
7454	5' 08"	0' 46"
8153	----	1' 57"

5.0 DISCUSSION OF RESULTS

5.1 Introduction

There are several ways to determine the accuracy of backcalculation procedures. Two common methods include (1) comparing theoretical value of primary response of pavement structure such as stress, strain and deflection with in situ measurements and (2) comparing backcalculated moduli with measured moduli in the laboratory.

In situ measurements have been studied in previous research. For example, Lenngren [52] compared strains measured in an instrumented road section with strains from backcalculation (based on FWD data). The results showed good agreement between the two methods. However, in situ measurements of stresses and strains require costly field instrumentation and previous studies show poor reproducibility between different sensors. Evaluation of backcalculation programs based on either deflections or moduli can be done faster, cheaper and easier than comparisons of stresses and strains.

The second method listed above, using laboratory measurements, was originally planned for this project. However, delayed delivery of laboratory modulus testing equipment prevented completing this task. Therefore, the scope of this study focuses on the sensitivity of backcalculated layer moduli to changes in program inputs and the accuracy of calculated deflections.

In this chapter, the sensitivity of output to varied input values is discussed along with nonlinear responses of the pavement structure. Some features of each backcalculation procedure which were not mentioned in Chapter 3 also are described.

It should be noted that some findings and recommendations presented in this Chapter are subject to the results of future laboratory modulus testing.

5.2 Nonlinearity of Pavement Structures

The use of four loading levels at each site made it possible to evaluate the stress sensitivity of each pavement structure as a whole. Because of the various loading magnitudes applied, normalized surface deflection is the main primary response parameter studied and is defined by Equation (5-1) as follows:

$$\Delta = \delta / P \tag{5-1}$$

where Δ = Normalized deflection in mils/kip,

δ = Measured surface deflection in mils,

P = Applied load in kips.

As illustrated in Figure 5-1, two sites (2647 and 7454) show a very strong linear characteristic where the normalized deflections of sensors do not vary substantially under different load levels. Overall, these two sites also show lower normalized deflections than other sites. Lower deflections and the linear pattern at these two sites probably result from the extremely low pavement temperature (21° F and 7° F, respectively) during FWD testing.

In general, results in Figure 5-1 show that the normalized deflection decreases at higher loading levels, which means that the pavement structures stiffen. Stiffening results mainly from increasing DGAC modulus and slightly from high moduli in the aggregate base (AB) and aggregate subbase (AS). As an example, Figure 5-2 shows results from EVERCALC 3.3 for sites 0512 and 8153, where FWD deflections were measured at moderate temperature. Stiffening of the DGAC is unexpected and is not evident in laboratory testing.

Sites 0517 and 7452 show significant nonlinearity of the pavement structure, which contributes to the high error in calculated deflections presented in Tables 4-15-b and 4-15-d. According to the Dynaflect operator who surveyed the road condition at site 0517, the surface showed alligator cracking, bleeding and rutting. When pavement materials were sampled, shortly after measuring deflections, the cement treated base (CTB) exhibited poor structural integrity. Even though the backcalculated moduli of the DGAC and CTB seem reasonable, the stress sensitivity shown in Figure 5-1 suggests that a distressed pavement like site 0517 may not be suitable for linear elastic backcalculation and that high error in predicted deflections and moduli may result. For example, site 0512 has a similar structural section and surface condition to site 0517 but the results of backcalculation quite different. Laboratory modulus testing could explain these differences.

High errors shown in Table 4-15 for site 7452, which has a lean concrete base (LCB) under the DGAC, are similar to site 0517. The results suggest that backcalculation using MET or multi-layer linear elastic theory does not work well when a very stiff layer is sandwiched between relatively soft layers.

5.3 Effect of Input Variables on Backcalculated Moduli

The sensitivity of output to the input variables is evaluated by using the coefficient of variations (COV) as a measure of program performance. High COV values correlate with a wide variation in backcalculated moduli and indicate that a program is sensitive to changes in the varied input variable.

The coefficient of variation for a sample is based on its mean (average) and standard deviation as defined in the following equation:

$$\text{COV, \%} = 100 \times \text{one standard deviation/average} \quad (5\text{-}2)$$

The COV of backcalculated moduli based on 9000± pounds loading and varied input variables are discussed below.

5.3.1 Depth to Rigid Bottom

The influence of the rigid bottom below the subgrade soil was evaluated by varying the subgrade thickness as follows: 20, 50, 100, 200 and 500 inches.

In general, as shown with high COV in Table 5-1, the moduli of the subgrade and aggregate subbase at each site is affected substantially by the depth of the rigid bottom. For example, the results from EVERCALC 3.3 shown in Figure 5-3 indicate that the subgrade modulus increases with the depth of rigid bottom at all sites. In contrast, the sum of absolute error in predicted deflections without the rigid bottom (that is, with an infinitely deep subgrade) is the smallest at all sites. These findings warrant further research.

The assumed modulus of 1,000,000 psi and Poisson's ratio of 0.5 for the rigid bottom was used in this study. However, those values should be verified or more reasonable values have to be used to enhance the accuracy of procedures. The effect of change in modulus and Poisson's ratio of the rigid bottom was not performed in this study.

It is recommended that the existence and depth of a rigid bottom be determined before using any backcalculation procedure. A study on the effect of various moduli of the rigid bottom is also recommended.

5.3.2 Seed Modulus

The sensitivity of the backcalculated modulus to seed modulus was performed using the three levels of seed modulus shown in Table 4-7. The sensitivity of calculated moduli to the layer seed modulus depends on the backcalculation procedure and site inputs. Of the programs studied, BOUSDEF is the most sensitive to changes in seed modulus as shown by high coefficients of variation in Table 5-2. BKCHEV, EVERCALC 3.3 and WESDEF are less sensitive. Because MODULUS 4.0 generates its own seed modulus values, its sensitivity to the seed modulus can not be studied.

5.3.3 Range of Modulus

Program sensitivity to a range of modulus (minimum and maximum) was examined using limits of one-half and twice the reference range for each layer and for the subgrade (see Table 4-8). The effect of modulus range on backcalculated moduli is presented in Table 5-3 in terms of COV. The low COV values in Table 5-3 indicate that the backcalculated moduli are affected little by the various values of range as long as they are within the predefined range of modulus. It was found that the calculated layer modulus is more sensitive to the change of the minimum than the maximum of the range.

One important consideration when setting the range of modulus is that it should be wide enough to cover the expected in situ modulus of each layer so that backcalculated moduli do not equal the user's predefined maximum or minimum value. If the maximum of the range is less than the expected in situ modulus, then the underestimated maximum substantially affects the backcalculated modulus. Backcalculated layer moduli results and sum of absolute (SOA) error (with the maximum AC modulus value of 1,750,000, 3,500,000 and 7,000,000 psi) at site 7454 are presented in Table 5-4. Results are shown for EVERCALC 3.3, MODULUS 4.0 and WESDEF. The underestimated DGAC modulus affects the base layer modulus substantially and results in much higher error. For site 7454, the maximum range is more critical (see Table 5-3) because the pavement structure is very stiff because of the cold pavement temperature.

Users should set the maximum range high enough to cover the expected layer modulus. Also, the predefined minimum range of modulus should not be greater than the in situ layer modulus. Experience and a database on characteristics of pavement materials are useful in setting the range of layer modulus.

5.3.4 Layer Thickness

The sensitivity of the backcalculated modulus to layer thickness was performed using a ± 5 percent difference from the verified layer thickness. The COV summary presented in Table 5-5 indicates that the backcalculated moduli from BOUSDEF and MODULUS 4.0 are more sensitive than other programs to variations in layer thickness.

High COV values of DGAC moduli in Table 5-5 result from variations in DGAC layer thickness. Changing the DGAC layer thickness by ± 5 percent results in disproportionate variation in backcalculated DGAC moduli, which are shown in Table 5-6. As expected, an overestimated DGAC layer thickness leads to underestimating the DGAC layer modulus. The underestimated AC modulus subsequently affects the moduli of underlying layers.

A five percent deviation from the measured thickness causes more than around a ten percent error in backcalculated moduli for most cases (Table 5-6). Therefore, accurate AC layer thickness data are required by all backcalculation procedures though, in practice, they are difficult to obtain. Coring and augering provide accurate data but are laborious and expensive. Recently, non-destructive ground penetration radar (GPR) technology has been evaluated for layer thickness measurement. For example, Roddis et al. [53] found that GPR measures layer thickness with an accuracy of ± 5 to 10 percent depending on the treatment of data. Sensitivity analysis of backcalculation programs suggest that the tolerable error in the layer thickness input should be less than ± 5 percent regardless of the method used to determine thickness.

Changing the thickness of other layers by ± 5 percent has little effect on backcalculation results as shown in Table 5-5. Subgrade modulus is the least sensitive one to the layer thickness variation.

5.3.5 Poisson's Ratio

Varying Poisson's ratio by ± 20 percent affects backcalculated moduli little for most cases, as shown by low COV in Table 5-7. Changing the AC Poisson's ratio has the most influence on backcalculation results as shown in Table 5-8. Backcalculated AC moduli decrease when Poisson's ratio increases. The amount of underestimation due to a ± 20 percent Poisson's ratio, however, is less than eight percent except in a few cases. Therefore, typical Poisson's ratio values are adequate for backcalculation procedure.

5.3.6 Convergence Criteria

Two convergence criteria considered in this study are (1) the number of iterations and (2) the sum of absolute error (in percent). The accuracy of backcalculation procedures usually can be improved by using a smaller error tolerance and/or higher number of iterations. Experience shows that this approach is not always true. Even though the required iterations were not completed, for example, the operation sometimes stopped because the difference between calculated and measured deflections was within the preset error tolerance. Also, program operation stopped when the actual number of iterations reached the given number of iterations, even though the sum of absolute error was still greater than the preset value. These phenomena resulted because of another criterion, the change of modulus. In some cases the change of modulus controlled the iteration process (instead of the other convergence criteria).

Of the procedures evaluated in this study, only EVERCALC 3.3 enables the user to control the modulus change tolerance as well as the other two convergence criteria. Controlling the input of all three convergence criteria (with high number of iterations, small value of tolerable error and change of modulus) in EVERCALC 3.3 contrasts with most other procedures, where the change of modulus criterion is assigned a fixed value of 10%. MODULUS 4.0 uses a database which does not require any termination criteria mentioned above.

In general, three to six iterations using the given reference input values used in this study yield reasonable results. More iterations will slightly improve accuracy but operation time is disproportionately longer.

5.4 <u>Unique Features of Each Backcalculation</u>

5.4.1 BKCHEV

The output from BKCHEV includes the results of each iteration. One example of BKCHEV output is presented in Figure 5-4. Output can be stored either on a floppy diskette or hard disk. Stored results then can be printed by using other software (e.g. word processing program) or the DOS (Disk Operation System) PRINT command.

As expected, the results from BKCHEV are similar to those from EVERCALC 3.3 because both programs use the same forward calculation subroutine (CHEVRON). Units for input modulus are ksi (kilo-pounds per square inch) instead of psi. BKCHEV can backcalculate layer moduli using either Dynaflect or FWD deflections. For the Dynaflect, the following predetermined values are used: (1) 1000 pounds of single load; (2) 1.6 inch radius of loading plate; (3) offset distance of sensors from the center of loading plate equal to 10.0, 15.6, 26.0, 37.4 and 49.0 inches. All the other backcalculation procedures evaluated in this study (except MODULUS 4.0) can work with Dynaflect deflection data as described above. Input data are saved in a text file in ASCII (American Standard Code for Information Interchange) form and can be edited by the program or by using word processing software.

BKCHEV requires the user to input the number of iterations and the sum of absolute error. However, BKCHEV is controlled by three convergence criteria (error tolerance, number of iterations and modulus change). The program internally sets the change of modulus to 10 percent.

5.4.2 BOUSDEF (Version 2.0)

The main menu of the program consists of three submenus: (1) Edit a Data File, (2) Create a Data File and (3) Analyze a Data File. The following keys are used during editing and/or creating a data file; F1 = Help, F8 = Run, F10 = Save and Esc = Exit without saving. With the Help key (F1) users get information regarding each input item. The input data are saved in a text file (in ASCII form) which can be edited by the program or by word processing software.

An example of Edit screen is illustrated in Figure 5-5. "Layer for M", which represents the layers where moduli will be calculated, has two optional of one (1) and zero (0). A value of one (1) indicates that the layer is treated as a variable so that the user must input the minimum, maximum and initial (seed) moduli. Zero (0) indicates that the layer has a fixed modulus (known or assumed) so that the minimum, maximum, and seed moduli are not required. The recommended modulus and Poisson's ratio of materials in the program are presented in Table 5-9. BOUSDEF assumes that the subgrade is infinitely deep.

Density data for all structural layers are required in order to calculate stress states in the base (or subbase) and subgrade. The bulk and deviator stresses shown in the output summary represent the stress state in the middle depth of the base (or subbase) and at the top of subgrade, respectively. BOUSDEF calculates and displays the nonlinearity constants of Eqns. (2-8) and (3-

5) along with the coefficient of the determination (R^2) for each equation. If a pavement structural section consists of four layers including the subgrade, then the constants for bulk stress, K_1 and K_2 in Eqn. (2-8), represent the subbase and those for deviator stress, K_3 and K_4 in Eqn. (3-5), apply to the subgrade.

A user must input two convergence criteria: tolerance in the sum of absolute error and number of iterations. However, the program is controlled by three convergence criteria (error tolerance, number of iterations and modulus change). The program internally sets the change of modulus to 10 percent. A color monitor is required in order to operate the program properly.

The operating time for BOUSDEF is the shortest of all procedures given the same data set. Even though the sum of absolute error is the highest, the subgrade modulus produced by BOUSDEF is comparable to values from other backcalculation procedures. Thus, the program can be used as a tool to initially estimate the subgrade modulus, as suggested by the program's developers in Reference 40.

Output from BOUSDEF is presented on the screen and can be printed on paper using the Shift and Print Scrn key simultaneously. Unfortunately, output cannot be saved on disk. One example of output is presented in Figure 5-6.

5.4.3 EVERCALC 3.3

EVERCALC 3.3 is a user-friendly program with a main menu which has seven options as shown in Figure 5-7. EVERCALC 3.3 needs two input data files: a general data file and a deflection data file. An example of the general data file screen and deflection data file screen is shown in Figures 5-8 and 5-9, respectively.

In the general data screen (Figure 5-8), EVERCALC 3.3 displays the following three user-supplied convergence criteria: number of iterations; RMS; and modulus change tolerance. Two options for the temperature measurement provided by the program are direct field measurement and the Southgate method. For the Southgate method, users must provide surface temperature and 5 day mean air temperature in the Deflection Data Screen (see Figure 5-9). EVERCALC 3.3 calculates an estimated depth to the rigid bottom if user chooses the "stiff layer option."

The TAB, ENTER, and arrow keys (↑ and ↓) enable movement of the cursor back and forth from cell to cell in the General Data and Deflection Data screens. The arrow keys → and ← can be used to move the cursor back and forth within a cell.

There are two options for seed modulus: internal equation and engineering judgment. With more than three layers in a pavement system, the user must select engineering judgment and provide seed moduli. If there are more than three layers and the user chooses the internal equation, the following error message appears: "Number of Layers more than three, wrong seed option." For three layer pavement systems, if the calculated seed modulus is out of range then the minimum or maximum value is used as the seed modulus. For example, if the calculated seed modulus for the top layer is greater than 1,000,000 psi then 1,000,000 psi is the seed modulus of the top layer. The range of seed moduli assigned internally are:

$$100{,}000 \le E_{surface} < 1{,}000{,}000$$

$$10{,}000 \le E_{base} < 50{,}000$$

$$3{,}000 \le E_{subgrade} < 50{,}000$$

Input data from the general and deflection data files are saved in a text file (in ASCII form) and can be edited by the program or other software.

An example of EVERCALC 3.3 output is shown in Figure 5-10. Stress and strain in vertical, tangential and radial directions are calculated on the basis of the backcalculated moduli. Also, bulk stresses are calculated at the following depths: (1) 0.05 inch higher than the bottom of the AC layer, (2) 0.05 inch higher than the top of subgrade and (3) mid-depth of the base and/or subbase. The bulk stress is calculated only from the applied load and no input for density is required.

Each layer's backcalculated modulus from the first deflection data set automatically becomes the seed modulus for the next deflection data set. For example, the backcalculated layer moduli of 413659, 30850, 37637 and 22846 psi from the loading of 6400 pound became the seed moduli for the next calculation with the loading of 9328 pound as can be seen in Figure 5-10.

In general, lower error resulted for the subsequent deflection data set but this method does not always guarantee lower RMS, faster convergence or fewer iterations. A trial was made to see how this method affects backcalculated moduli. Deflection data from a 9000± pound loading followed deflections from a 6000± pound loading first and then were used as the first data set in a separate operation. Results are presented in Table 5-10. For some sites, especially where AC modulus high, the moving-on effect on layer moduli is substantial.

A graphical presentation of both the measured and on-going theoretical deflection bowls during the backcalculation process is unique. However, by eliminating this presentation, the operating time of the program can be reduced. EVERCALC 3.3 requires a color monitor for a proper operation.

Recently, an advanced version of EVERCALC (version 4.0) was introduced by Sivaneswaran et al. [36] using a convergence method based on the use of nonlinear least square optimization. The new version can backcalculate not only layer moduli but also layer thicknesses. Further research should include an evaluation of EVERCALC 4.0.

5.4.4 MODULUS 4.0

Backcalculation results from MODULUS 4.0 are stored on hard disk and are presented in summary and section reports. The summary report includes input information, backcalculated moduli, absolute error per sensor and the depth to rigid bottom (or bedrock). The section report shows input information, backcalculated moduli, weighting factor of each sensor, absolute sum of percent error and other information. An example of summary and section reports is presented in Figure 5-11.

The assumed maximum depth of bedrock in MODULUS 4.0 is 300 inches. The depth to bedrock is not affected by seed modulus, range of modulus or thickness of structural layers. The estimated bedrock depth varied with applied load levels at sites 2647 and 7452 but not at sites of 0517 and 7454.

There are two ways to backcalculate the layer moduli with MODULUS 4.0 depending on how the user provides input. The first method is to use the material type information and the second method is similar to the other backcalculation procedures which require seed moduli, range of modulus, Poisson's ratio and layer thickness. The subgrade does not require range of modulus but a user must provide a "reasonable subgrade modulus" which is similar to the seed modulus. The effect of reasonable subgrade modulus values on backcalculation results is substantial (up to 109% COV) as shown in Table 5-11.

MODULUS 4.0 assumes default values for the location of seven sensors as 0, 12, 24, 36, 48 and 60 inches from the center of loading plate. However, a user can change sensor locations manually.

Table 5-12 presents the weighting factors assigned to each deflection for moduli backcalculation and Figure 5-11 shows how these factors appear in the section report. Sites 0517, 7452 and 7454 have a zero weighting factor for sensors No. 6 and 7. The weighting factors are calculated according to the Eqn. (3-6) and the technique illustrated in Figure 3-5. For example, the weighting factors for sensors 6 and 7 at site 0517 ranged from 0.14 to 0.21 and 0.08 to 0.12 respectively, but the weighting factor assigned to them equals zero. Consequently, bedrock is assumed to exist at a very shallow depth. At site 7454, the first four sensors were selected for backcalculation. The offset distance to the fourth sensor from the center of the loading plate is 18 inches. However, the structural thickness above the subgrade at site 7454 is 21.4 inches (as shown in Table 4-16), which is greater than the offset distance to the fourth sensor.

The followings limitations on inputs apply to MODULUS 4.0:

(1) A reasonable subgrade modulus should not be less than 1000 psi.

(2) When the temperature data at site 7452 (22° F) was entered the program showed the following statement on the screen: "out of range." However, the pavement temperature of

36° F is acceptable. The lowest acceptable temperature is not known nor cited by the program.

(3) An input value of 1000 inches for subgrade thickness is "out of range" but 999 inches of the subgrade thickness is acceptable.

(4) When a reasonable subgrade modulus value of 300000 psi was input, "floating point error" message appeared on the screen and operation terminated.

5.4.5 WESDEF

WESDEF is one of the subprograms in LEEP (Layered Elastic Airfield Pavement Evaluation Programs), which has a program selection menu with options [A] through [X] as shown in Figure 5-12. Users can run a program called INDEF to create or to modify an input data file for WESDEF. INDEF runs in the following three input modes: (1) Get deflections from an existing file, (2) Manually enter deflections and (3) Modify an existing WESDEF data file. An example of WESDEF output is presented in Figure 5-13. The output includes the summary of input data, final modulus values and the sum of absolute error. The input data are saved in a text file in ASCII form and can be accessed and edited by the program or by other software.

WESDEF specifies six pavement material types and includes default values for initial (seed) modulus, range of modulus and Poisson's ratio. Table 5-13 presents the pavement material types and their default values in WESDEF.

To study how sensitive backcalculated moduli are to interface friction, three different conditions (full adhesion, partial adhesion and full slip) were assumed. The COV of backcalculated layer moduli under these conditions can be extreme (as high as 147%) as shown in Table 5-14. The moduli of the base and AS layers are most affected and the subgrade modulus is least sensitive to friction condition. Experience and judgment are needed in order to input a reasonable value of interface friction condition.

Convergence criteria are set internally and cannot be adjusted. The maximum number of iterations is set equal to three and the tolerance level of the sum of absolute error is 10 percent.

5.5 Summary

Based on the sensitivity and error of backcalculation results as well as ease of operation (including input file preparation), EVERCALC 3.3 is best suited to backcalculation at Caltrans. Users can obtain better results with EVERCALC 3.3 by assigning the predefined values of all three convergence criteria (change of modulus, number of iteration and deflection error). Other procedures, except MODULUS 4.0, require two convergence criteria (number of iterations and absolute sum of error). The change of modulus criterion of 10% is set internally in other procedures. However, it is recommended strongly that moduli from EVERCALC 3.3 be correlated with results from laboratory testing.

Only EVERCALC 3.3 produced solutions with all input values for all sites used in this study. Other programs displayed error statements such as "run time error" or "floating point error" in response to some input values. Those cases are indicated by "No solution" in the tables presented in the Appendix.

More experience with various pavement structures and knowledge of material properties are needed in order to use backcalculation to reliably evaluate pavement structural capacity. Extensive resilient laboratory testing of materials used in California highways and non-destructive (especially FWD) pavement testing also are required. Especially important are the modulus-temperature relationship of AC mixes and the nonlinear properties of granular and fine-grained soils. In addition, the use of waste materials, such as scrap tires and glass, in highway construction is growing so it is important to establish the characteristics of conventional as well as waste materials.

Figure 5-1. Stress Sensitivity of Pavement Structure with Normalized Surface Deflection

a. 0512

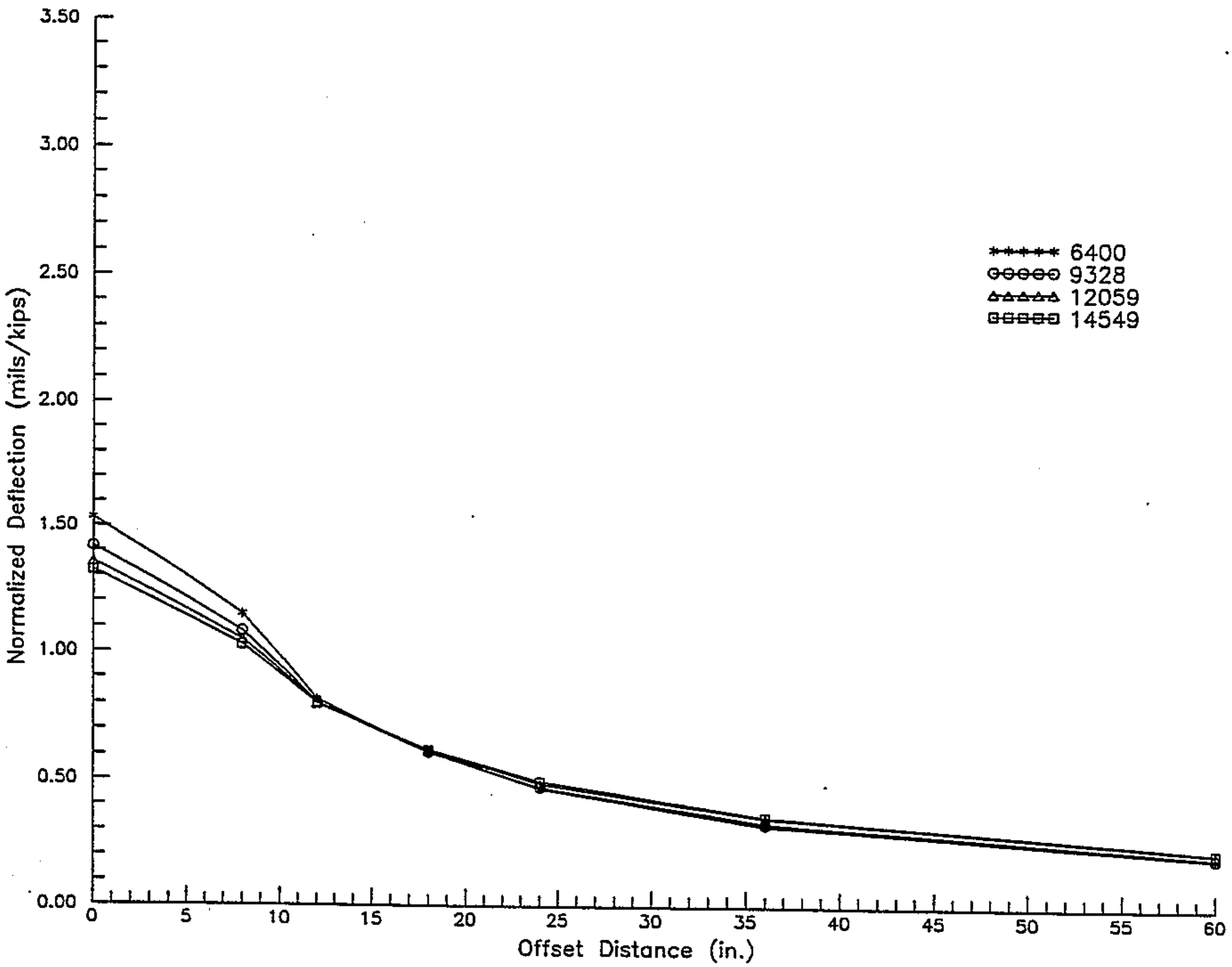


Figure 5-1. Stress Sensitivity of Pavement Structure with Normalized Surface Deflection (Continued)

b. 0517

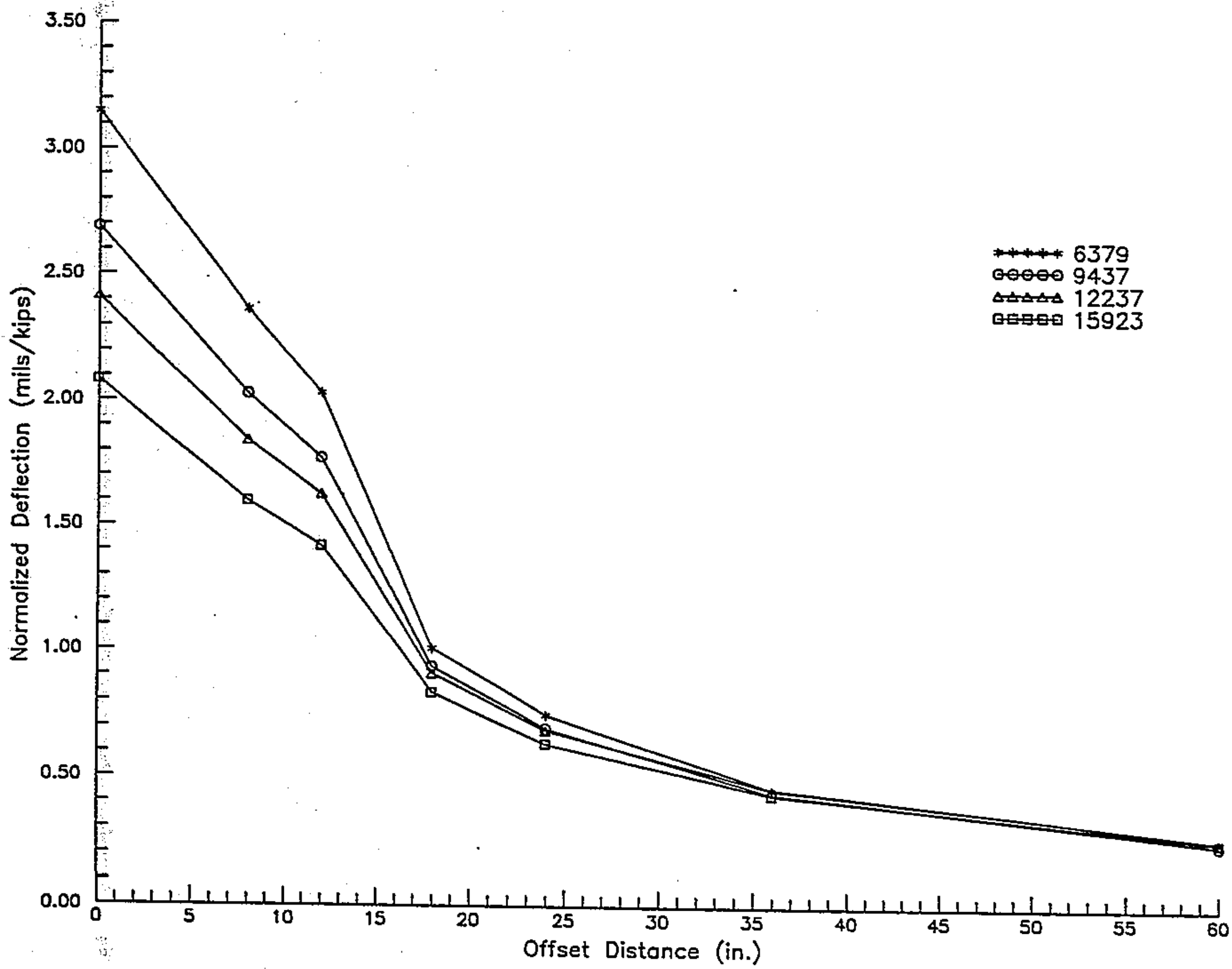


Figure 5-1. Stress Sensitivity of Pavement Structure with Normalized Surface Deflection (Continued)

c. 2647

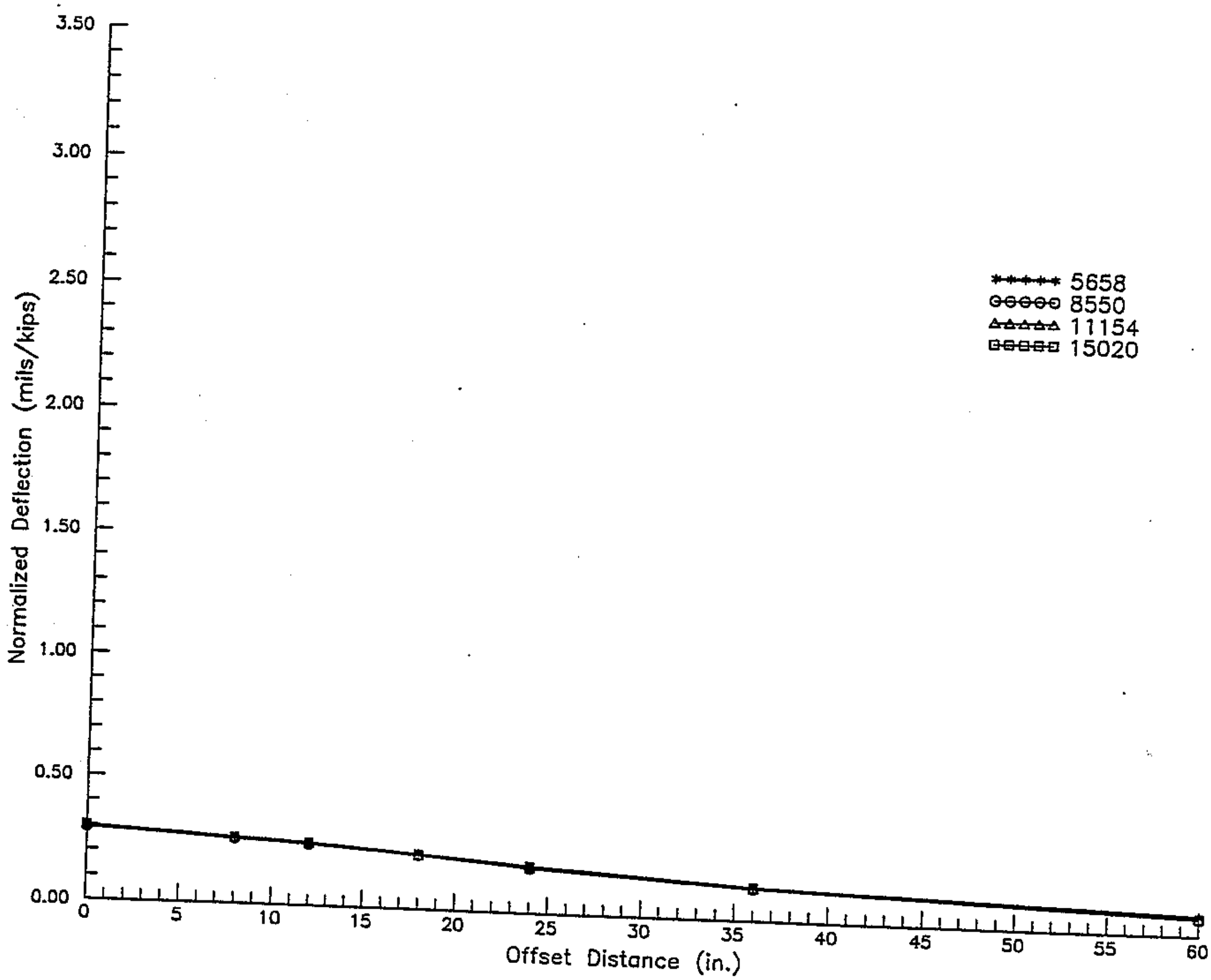


Figure 5-1. Stress Sensitivity of Pavement Structure with Normalized Surface Deflection (Continued)

d. 7452

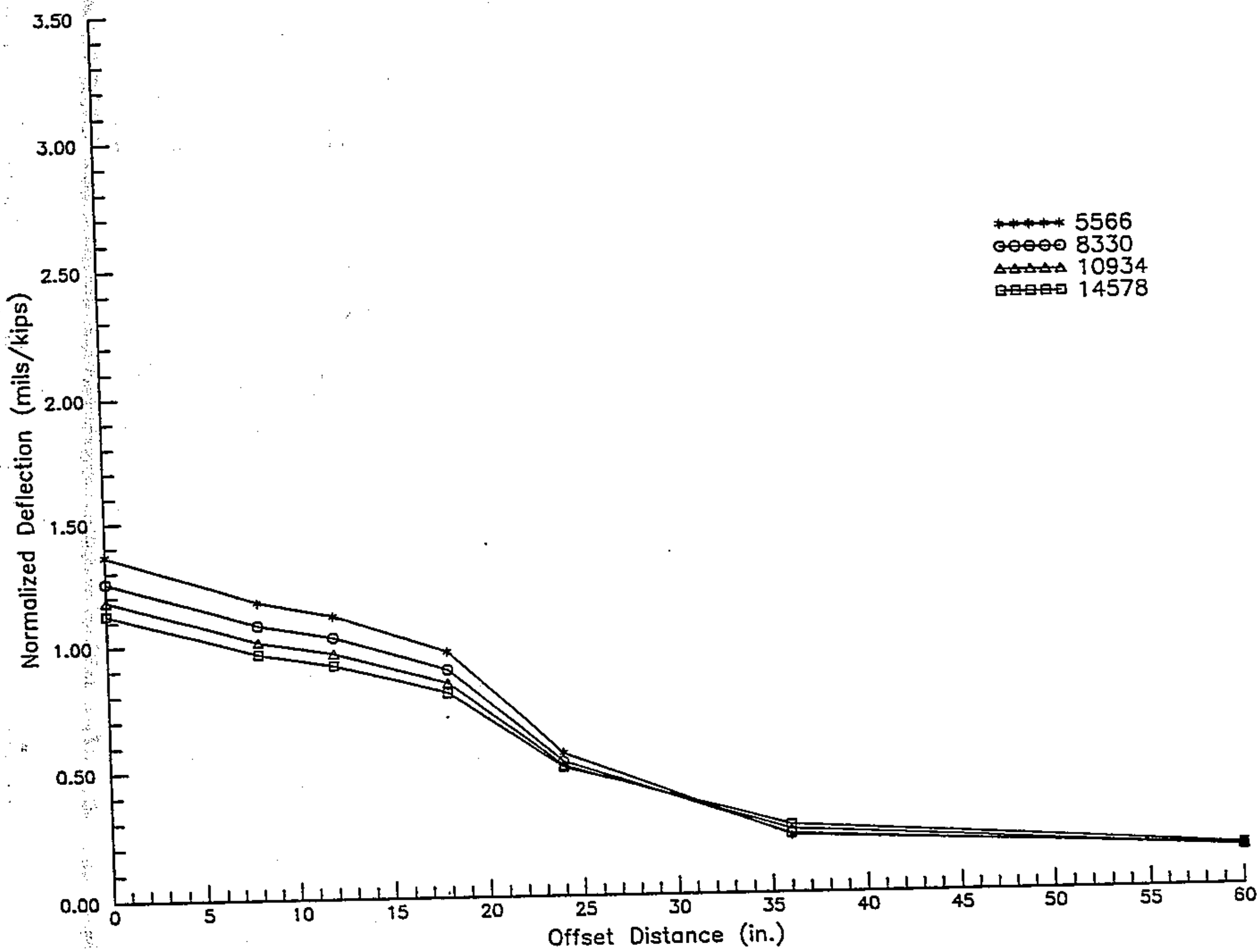


Figure 5-1. Stress Sensitivity of Pavement Structure with Normalized Surface Deflection (Continued)

e. 7454

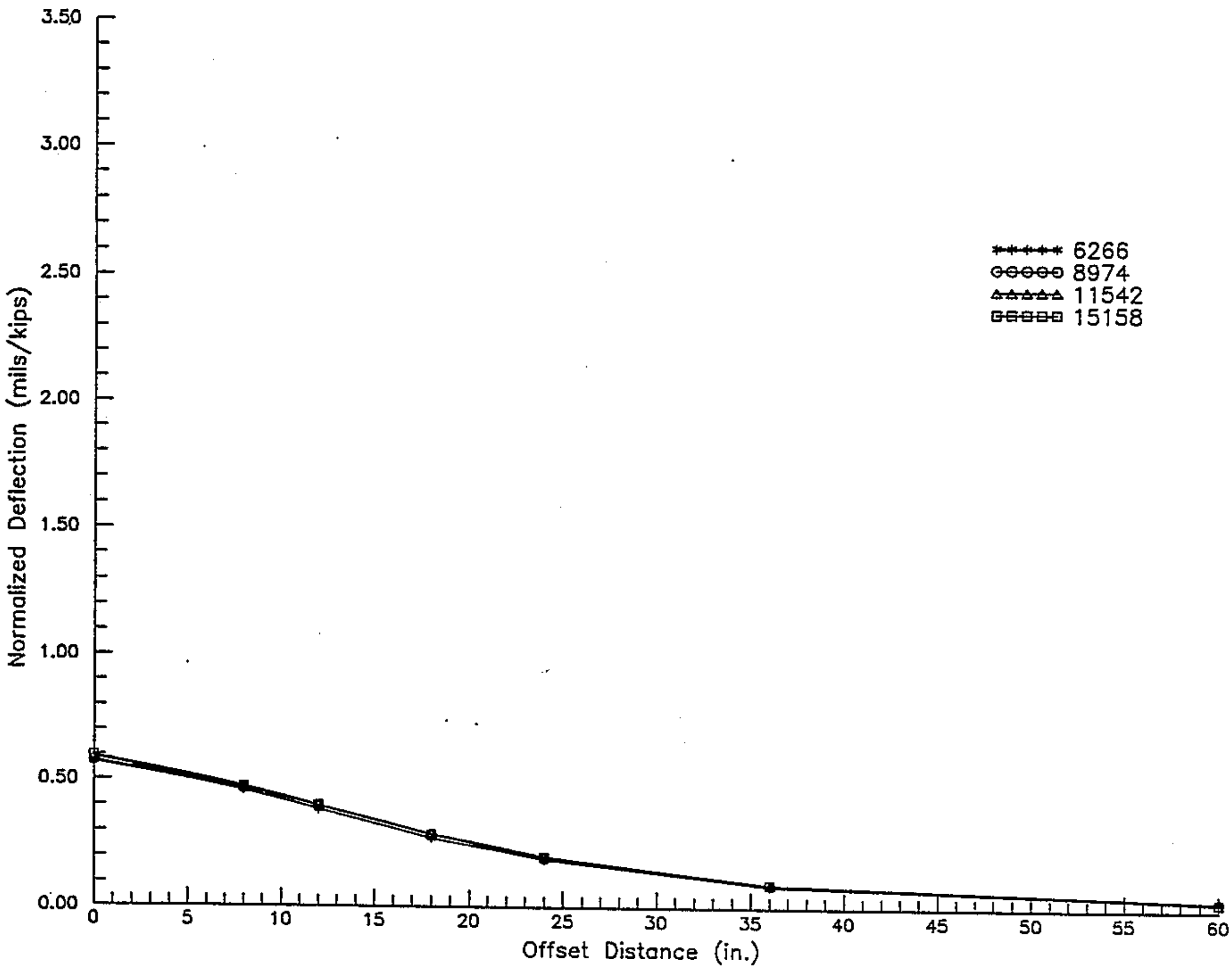


Figure 5-1. Stress Sensitivity of Pavement Structure with Normalized Surface Deflection (Continued)

f. 8153

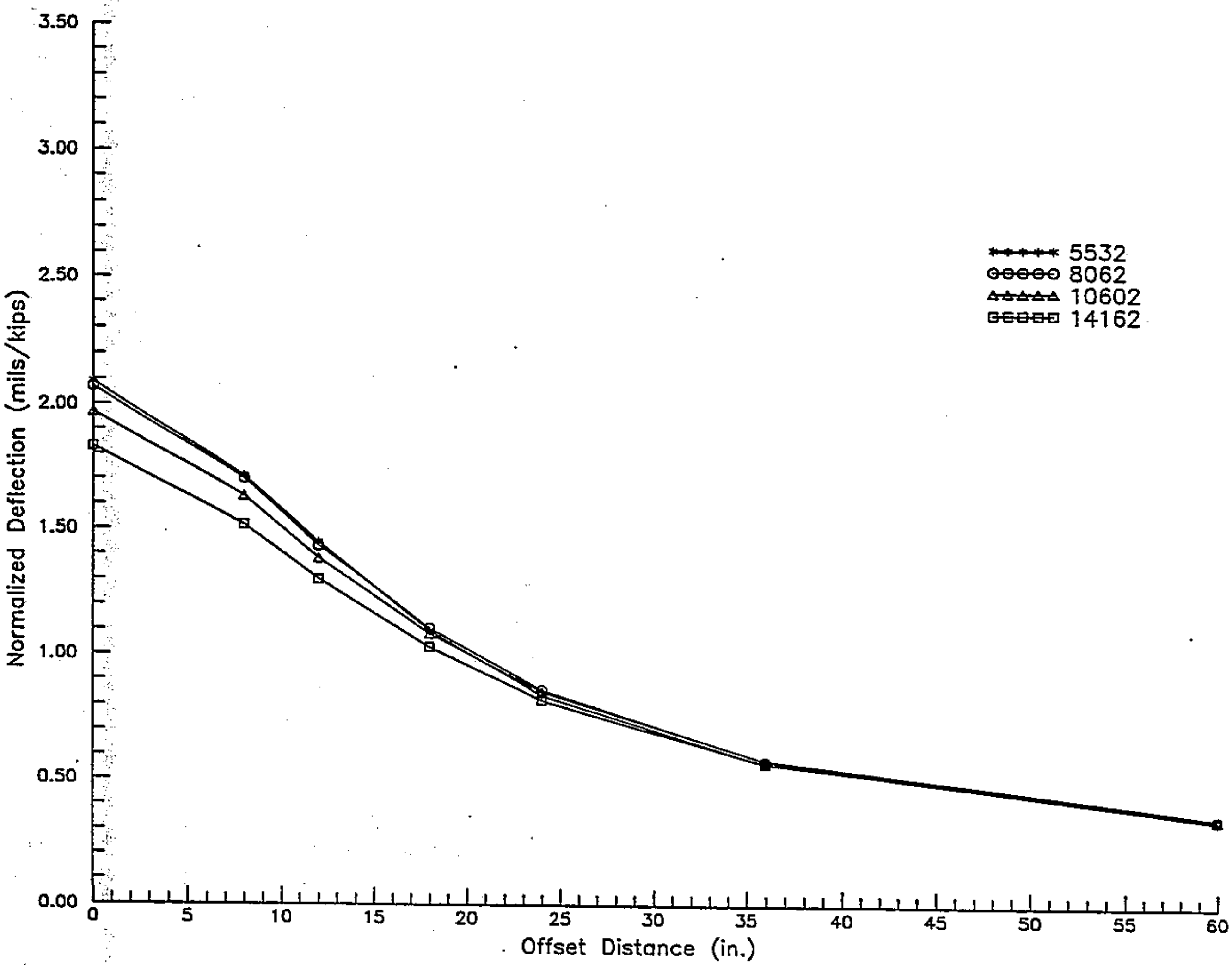


Figure 5-2. Stiffening of Pavement Structure with Load Levels at Site of 8153
(Results of EVERCALC 3.3)

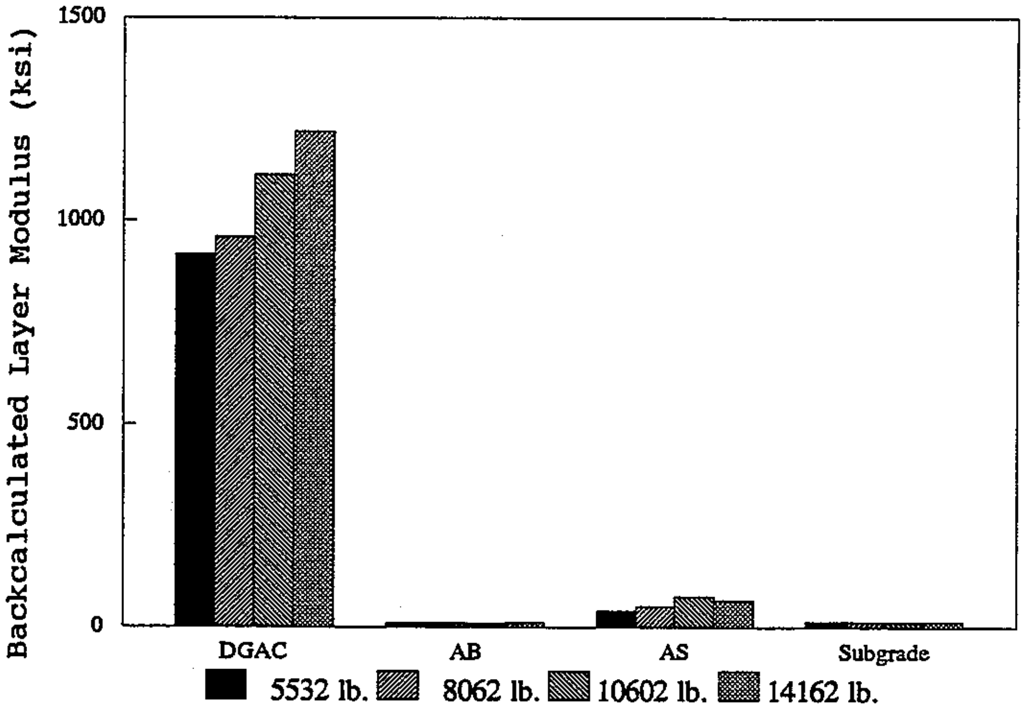


Figure 5-3. Effect of Depth to the Rigid Bottom on the Subgrade Modulus with EVERCALC 3.3

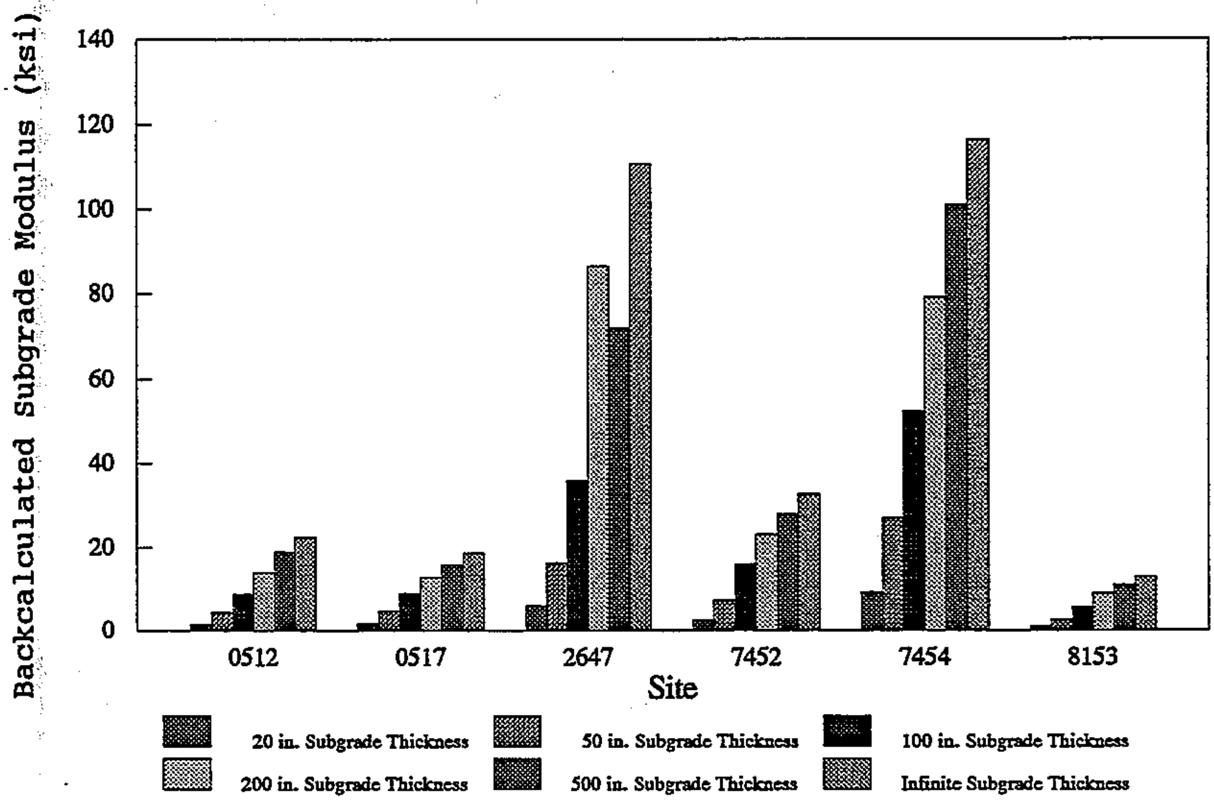


Figure 5-4. Example of BKCHEV Output

DEFLECTIONS WERE OBTAINED USING THE FALLING WEIGHT DEFLECTOMETER

RADIUS(IN) =5.910 LOAD(PSI) = 9328.

LAYER	THICKNESS(IN.)	MODULUS(PSI)	POISSONS RATIO
1	4.5	450000.	.35
2	7.5	1000000.	.25
3	20.0	50000.	.30
4	SEMI-INFINITE	20000.	.40

NUMBER OF VARIABLE LAYERS = 4

POSITION :	1	2	3	4	5	6	7
DIST.(IN):	.000E+00	.800E+01	.120E+02	.180E+02	.240E+02	.360E+02	.600E+02
DEF.(MIL):	.132E+02	.101E+02	.749E+01	.571E+01	.441E+01	.309E+01	.192E+01

VARIABLE LAYER NO	SYSTEM LAYER NO	VALUE OF MIN MODULUS	VALUE OF MAX MODULUS
1	1	100000.	3500000.
2	2	20000.	2000000.
3	3	10000.	250000.
4	4	1000.	150000.

POSITION	COMP.DEFL.	MEASURED(MILS)	DIFFERENCE	%DIFF.
1	.6482E+01	.1322E+02	.6738E+01	51.0
2	.5339E+01	.1010E+02	.4761E+01	47.1
3	.4972E+01	.7490E+01	.2518E+01	33.6
4	.4496E+01	.5710E+01	.1214E+01	21.3
5	.4044E+01	.4410E+01	.3658E+00	8.3
6	.3273E+01	.3090E+01	-.1826E+00	-5.9
7	.2216E+01	.1920E+01	-.2960E+00	-15.4
		ABSOLUTE SUM:	16.1	182.6
		ARITHMATIC SUM:		139.9

DATA FOR DEVELOPING EQUATIONS FOR ITERATION NO. 1

PREDICTED MODULI: 597377. 45138. 42652. 20643.

POSITION	COMP.DEFL.	MEASURED(MILS)	DIFFERENCE	%DIFF.
1	.1191E+02	.1322E+02	.1312E+01	9.9
2	.8930E+01	.1010E+02	.1170E+01	11.6
3	.7253E+01	.7490E+01	.2369E+00	3.2
4	.5519E+01	.5710E+01	.1915E+00	3.4
5	.4434E+01	.4410E+01	-.2400E-01	-.5
6	.3227E+01	.3090E+01	-.1367E+00	-4.4
7	.2090E+01	.1920E+01	-.1699E+00	-8.8
		ABSOLUTE SUM:	3.2	41.8
		ARITHMATIC SUM:		14.2
		AVERAGE:	6.0	6.0

Figure 5-4. Example of BKCHEV Output (Continued)

```
    DATA FOR DEVELOPING EQUATIONS FOR ITERATION       NO.  2

PREDICTED MODULI:    528653.    31744.    39835.    22220.

    POSITION   COMP.DEFL.    MEASURED(MILS)   DIFFERENCE      %DIFF.
        1      .1340E+02      .1322E+02      -.1840E+00       -1.4
        2      .9840E+01      .1010E+02       .2599E+00        2.6
        3      .7788E+01      .7490E+01      -.2977E+00       -4.0
        4      .5667E+01      .5710E+01       .4315E-01         .8
        5      .4384E+01      .4410E+01       .2604E-01         .6
        6      .3062E+01      .3090E+01       .2790E-01         .9
        7      .1941E+01      .1920E+01      -.2056E-01       -1.1

                            ABSOLUTE SUM:          .9         11.3
                            ARITHMATIC SUM:                   -1.6
                            AVERAGE:              1.6          1.6

    DATA FOR DEVELOPING EQUATIONS FOR ITERATION       NO.  3

PREDICTED MODULI:    529308.    33104.    38977.    22259.

    POSITION   COMP.DEFL.    MEASURED(MILS)   DIFFERENCE      %DIFF.
        1      .1330E+02      .1322E+02      -.7727E-01        -.6
        2      .9774E+01      .1010E+02       .3258E+00        3.2
        3      .7751E+01      .7490E+01      -.2608E+00       -3.5
        4      .5659E+01      .5710E+01       .5088E-01         .9
        5      .4388E+01      .4410E+01       .2187E-01         .5
        6      .3066E+01      .3090E+01       .2394E-01         .8
        7      .1938E+01      .1920E+01      -.1815E-01        -.9

                            ABSOLUTE SUM:          .8         10.4
                            ARITHMATIC SUM:                     .4
                            AVERAGE:              1.5          1.5

  THE FINAL MODULUS VALUES ARE
  529308.      33104.      38977.      22259.
CHANGE IN MODULUS VALUES IS IN TOLERANCE

***** END OF PROGRAM *****
```

Figure 5-5. Editing Screen of BOUSDEF

Pavement Structure Data
Number of Layers: 4 File Name: B:0512-5

Layer No.	Layer for M	Thickness (inch.)	Poisson Ratio	Minimum Modulus	Maximum Modulus	Initial Modulus	Density (pcf)
1.	1	4.50	0.35	100000	3500000	450000	145.0
2.	1	7.50	0.25	20000	2000000	1000000	132.4
3.	1	20.00	0.30	10000	250000	50000	135.3
4.	1	0.00	0.40	1000	150000	20000	127.8
5.	0	0.00	0.00	0	0	0	0.0

Deflection Measurement Data
Load Plate Radius: 5.90
Number of Sensors: 7

Sensor Locations :		0.0	8.0	12.0	18.0	24.0	36.0	60.0
	Load (lb)	Deflection Readings at Corresponding Sensor Locations						
Test 1:	6400	9.81	7.36	5.22	3.91	2.99	2.06	1.30
Test 2:	9328	13.22	10.10	7.49	5.71	4.41	3.09	1.92
Test 3:	12059	16.33	12.66	9.66	7.44	5.87	4.26	2.66
Test 4:	15419	19.20	14.97	11.60	9.02	7.21	5.23	3.29

Tolerance (%): 10 Number of Iterations: 3

F1=Help F8=Run F10=Save Esc=Exit (No save)

Figure 5-6. Example of BOUSDEF Output

```
                    Summary of Backcalculated Results

Test Number:  1
The Final Modulus Values, after  3 iterations, are (psi):
  439,173     20,000     59,359     23,306
Modulus changes are IN tolerence

─────────────────────────── Table of Deflections ──────────────────────────
Radial Position   Calcu Defle   Measured Defle   Difference   %Difference
       1              9.89           9.81           -0.08         -0.79
       2              7.01           7.36            0.35          4.72
       3              5.46           5.22           -0.24         -4.52
       4              3.89           3.91            0.02          0.58
       5              3.00           2.99           -0.01         -0.30
       6              2.07           2.06           -0.01         -0.69
       7              1.27           1.30            0.03          2.65
                         Abs. Sum of Diff :          0.74
                         Abs. Sum of %Diff:                       14.25
                         Mth. Sum of %Diff:                        1.65



                       Press any key to continue


                    Summary of Backcalculated Results

Test number:  2
Abs. sum of % difference is NOT within 10 % tolerance
Modulus Change is NOT within 10 % tolerance
Reached SPECIFIED number of iterations
The Final Modulus Values, after  3 iterations, are (psi):
    596,827       20,594      57,242      23,224
─────────────────────────── Table of Deflections ──────────────────────────
Radial Position   Calcu Defle   Measured Defle   Difference   %Difference
       1             13.31          13.22           -0.09         -0.71
       2              9.83          10.10            0.27          2.63
       3              7.80           7.49           -0.31         -4.09
       4              5.65           5.71            0.06          0.97
       5              4.41           4.41            0.00          0.00
       6              3.11           3.09           -0.02         -0.54
       7              1.95           1.92           -0.03         -1.34
                         Abs. Sum of Diff :          0.76
                         Abs. Sum of %Diff:                       10.29
                         Mth. Sum of %Diff:                       -3.07



                       Press any key to continue
```

Figure 5-6. Example of BOUSDEF Output (Continued)

Summary of Backcalculated Results

Test Number: 3
Abs. sum of % difference is WITHIN 10 % tolerence
The Final Modulus Values, after 3 iterations, are (psi):
662,355 24,749 55,926 21,861

Table of Deflections

Radial Position	Calcu Defle	Measured Defle	Difference	%Difference
1	16.40	16.33	-0.07	-0.45
2	12.34	12.66	0.32	2.53
3	9.94	9.66	-0.28	-2.94
4	7.40	7.44	0.04	0.60
5	5.88	5.87	-0.01	-0.15
6	4.22	4.26	0.04	0.84
7	2.67	2.66	-0.01	-0.50
		Abs. Sum of Diff :	0.78	
		Abs. Sum of %Diff:		8.01
		Mth. Sum of %Diff:		-0.05

Press any key to continue

Summary of Backcalculated Results

Test Number: 4
Abs. sum of % difference is WITHIN 10 % tolerence
The Final Modulus Values, after 3 iterations, are (psi):
700,598 39,065 47,215 22,810

Table of Deflections

Radial Position	Calcu Defle	Measured Defle	Difference	%Difference
1	19.20	19.20	-0.00	-0.01
2	14.60	14.97	0.37	2.45
3	11.95	11.60	-0.35	-3.00
4	9.07	9.02	-0.05	-0.57
5	7.28	7.21	-0.07	-1.00
6	5.23	5.23	-0.00	-0.05
7	3.29	3.29	0.00	0.11
		Abs. Sum of Diff :	0.85	
		Abs. Sum of %Diff:		7.19
		Mth. Sum of %Diff:		-2.06

Press any key to continue

Figure 5-6. Example of BOUSDEF Output (Continued)

Summary of Backcalculated Results

Summary of Non-linear Characteristics of Lower layers

For base layer:	K1=	144285	K2=	-0.388	R^2=	0.76
For subgrade:	K1=	27156	K2=	-0.083	R^2=	0.20

Summary of Moduli and Stresses

Load(lb)	E(1)	E(2)	E(3)	E(4)	BSTRS	DSTRS
6,400	439,173	20,000	59,359	23,306	9.19	6.92
9,328	596,827	20,594	57,242	23,224	11.35	7.78
12,059	662,355	24,749	55,926	21,861	13.46	8.51
15,419	700,598	39,065	47,215	22,810	15.65	10.05
Averag	599,738	26,102	54,935	22,800		

Press any key to continue

Figure 5-7. Main Menu Screen of EVERCALC 3.3

```
                    EVERCALC VERSION 3.3 - February 1992
  Washington State Department of Transportation - University of Washington

                                 THE MENU
                    Use <ARROWS> to select <ENTER> to Choose

                   1  Edit General Data File
                   2  Enter Deflection Data Interactively
                   3  Perform Backcalculataion
                   4  Convert FWD Raw Data File
                   5  Plot Bar Chart of Normalized Modulus
                   6  Execute DOS Commands
                   7  Exit to DOS

 Edit file containing information such as # of layers, # of sensors etc..
```

Figure 5-8. General Data File Screen of EVERCALC 3.3

```
                         GENERAL DATA                     INSERT OFF

Route: 08-SBD-40                        File Name: B:0512.GEN

No of Layers: 4                         Units: E

Load Plate Radius:   5.9                No of Sensors:   7

Sensor No:          1    2    3    4    5    6    7    8    9   10
Radial Offsets:       0    8   12   18   24   36   60

Temp Correction: Y                      Temp Measurement: S

Seed Modulus Option: E                  Stiff Layer Option: Y

Maximum Iteration:  3  RMS Tolerance(%):  1    Modulus Tolerance(%):  1

Please Enter Route Name or Title of Analysis, 25 Characters Max

Use Arrows,TAB Or ENTER To Move Highlight Bar, <F1> When Done Editing Screen
```

Figure 5-9. Deflection Data File Screen of EVERCALC 3.3

```
                         DEFLECTION DATA                      INSERT OFF

Route: 08-SBD-40                                   File Name: B:0512-5.DEF
Layer No  Known/Unknown  Poisson's Ratio  Seed Moduli  Min Moduli  Max Moduli
   1            1             0.35          450000      100000     3500000
   2            1             0.25         1000000       20000     2000000
   3            1             0.30           50000       10000      250000
   4            1             0.40           20000        1000      150000

Station:            200       Thickness:       4.5      7.5       20
No of Data Sets:     4        Temperature:      74    63
                                             Sensor No
                Load       1       2       3       4       5       6       7
Data Set 1      6400    9.81    7.36    5.22    3.91    2.99    2.06    1.30
Data Set 2      9328   13.22   10.10    7.49    5.71    4.41    3.09    1.92
Data Set 3     12059   16.33   12.66    9.66    7.44    5.87    4.26    2.66
Data Set 4     15419   19.20   14.97   11.60    9.02    7.21    5.23    3.29

Five Day Mean Temperature (C or F)

Use Arrows,TAB Or ENTER To Move Highlight Bar, <F1> When Done Editing Screen
```

Figure 5-10. Example of EVERCALC 3.3 Output

```
BACKCALCULATION BY EVERCALC VERSION 3.3
=======================================

Route                      :                          08-SBD-40

Milepost                   :     200.000
Number of Layers           :           4
Thicknesses(in)            :         4.5       7.5       20.0

Load (lbs)                 :       6400.
Seed Moduli Used (psi)     :     450000.  1000000.     50000.     20000.
Moduli Calculated (psi)    :     413659.    30850.     37637.     22846.

Deflections (mils)    After Iteration  3

NO    OFFSET(in)  CALCULATED    MEASURED  DIFFERENCE    DIFF(%)

 1          .0       9.827        9.810       -.017        -.2
 2         8.0       7.303        7.360        .057         .8
 3        12.0       5.238        5.220       -.018        -.4
 4        18.0       3.911        3.910       -.001         .0
 5        24.0       3.102        2.990       -.112       -3.7
 6        36.0       2.150        2.060       -.090       -4.4
 7        60.0       1.336        1.300       -.036       -2.8

                          ABSOL. SUM:          .3312      12.2
                          ARITH. SUM:                    -10.7
                          RMS ERROR:                       2.4

Stresses (psi)  &  Strains (10^-6 in/in)

  R        Z              VERTICAL TANGENTIAL   RADIAL      BULK

 .00    4.50   STRESS:   -22.4848  101.6062  101.6062  180.7276
               STRAIN:  -226.2955  178.6828  178.6828

 .00    8.25   STRESS:   -14.2423     .4159     .4159  -13.4105
               STRAIN:  -468.3943  125.5238  125.5238

 .00   22.00   STRESS:    -3.9020     .5075     .5075   -2.8869
               STRAIN:  -111.7642   40.5414   40.5414

 .00   32.00   STRESS:    -1.9338     .0157     .0157   -1.9025
               STRAIN:   -85.1937   34.2694   34.2694

Number of Iteration reached the limit.
```

Figure 5-10. Example of EVERCALC 3.3 Output (Continued)

```
Load (lbs)               :       9328.

Seed Moduli Used (psi)    :     413659.     30850.     37637.     22846.

Moduli Calculated (psi)   :     485725.     37247.     35852.     22480.

Deflections (mils)   After Iteration  3

NO    OFFSET(in)  CALCULATED    MEASURED  DIFFERENCE     DIFF(%)

 1         .0        13.347      13.220       -.127        -1.0
 2        8.0         9.745      10.100        .355         3.5
 3       12.0         7.727       7.490       -.237        -3.2
 4       18.0         5.667       5.710        .043          .7
 5       24.0         4.412       4.410       -.002          .0
 6       36.0         3.078       3.090        .012          .4
 7       60.0         1.925       1.920       -.005         -.2

                          ABSOL. SUM:          .7813         9.1
                          ARITH. SUM:                         .2
                          RMS ERROR:                         1.9

Stresses (psi)  &  Strains (10^-6 in/in)

  R        Z               VERTICAL TANGENTIAL   RADIAL       BULK

.00     4.50    STRESS:   -32.5504  149.0195  149.0195  265.4887
                STRAIN:  -281.7725  222.8735  222.8735

.00     8.25    STRESS:   -20.0654    1.3166    1.3166  -17.4322
                STRAIN:  -556.3934  161.1909  161.1909

.00    22.00    STRESS:    -5.3524     .7646     .7646   -3.8231
                STRAIN:  -162.0864   59.7162   59.7162

.00    32.00    STRESS:    -2.6885     .0393     .0393   -2.6099
                STRAIN:  -120.9938   48.8869   48.8869

Modulus tolerance criteria is satisfied.
```

Figure 5-10. Example of EVERCALC 3.3 Output (Continued)

```
Load (lbs)               :     12059.

Seed Moduli Used (psi)   :     485725.     37247.     35852.     22480.

Moduli Calculated (psi)  :     539577.     41801.     37483.     20889.

Deflections (mils)    After Iteration  3

NO   OFFSET(in)   CALCULATED    MEASURED   DIFFERENCE    DIFF(%)

 1        .0        16.489       16.330       -.159        -1.0
 2       8.0        12.263       12.660        .397         3.1
 3      12.0         9.886        9.660       -.226        -2.3
 4      18.0         7.428        7.440        .012          .2
 5      24.0         5.896        5.870       -.026         -.4
 6      36.0         4.208        4.260        .052         1.2
 7      60.0         2.675        2.660       -.015         -.6

                         ABSOL. SUM:          .8870         8.8
                         ARITH. SUM:                         .2
                         RMS ERROR:                         1.6

Stresses (psi)  &  Strains (10^-6 in/in)

  R      Z               VERTICAL TANGENTIAL    RADIAL       BULK

.00    4.50   STRESS:   -41.9904  192.8613  192.8613  343.7323
              STRAIN:  -328.0225  259.5673  259.5673

.00    8.25   STRESS:   -25.6149    2.0287    2.0287  -21.5575
              STRAIN:  -637.0486  189.5948  189.5948

.00   22.00   STRESS:    -6.6310    1.1190    1.1190   -4.3930
              STRAIN:  -194.8218   73.9708   73.9708

.00   32.00   STRESS:    -3.2553     .0715     .0715   -3.1123
              STRAIN:  -158.5726   64.3872   64.3872

Modulus tolerance criteria is satisfied.
```

Figure 5-10. Example of EVERCALC 3.3 Output (Continued)

```
Load (lbs)                  :      15419.

Seed Moduli Used (psi)      :     539577.     41801.     37483.     20889.

Moduli Calculated (psi)     :     606642.     48606.     39180.     21629.

Deflections (mils)    After Iteration  2

NO    OFFSET(in)   CALCULATED      MEASURED   DIFFERENCE       DIFF(%)

 1          .0        19.359        19.200         -.159          -.8
 2         8.0        14.557        14.970          .413          2.8
 3        12.0        11.848        11.600         -.248         -2.1
 4        18.0         9.016         9.020          .004           .0
 5        24.0         7.218         7.210         -.008          -.1
 6        36.0         5.187         5.230          .043           .8
 7        60.0         3.304         3.290         -.014          -.4

                                ABSOL. SUM:        .8885          7.1
                                ARITH. SUM:                        .1
                                RMS ERROR:                        1.4

Stresses (psi)  &  Strains (10^-6 in/in)

  R        Z              VERTICAL  TANGENTIAL     RADIAL        BULK

 .00     4.50    STRESS:   -53.9765   244.0776   244.0776   434.1786
                 STRAIN:  -370.6155   292.6640   292.6640

 .00     8.25    STRESS:   -32.4231     3.2453     3.2453   -25.9324
                 STRAIN:  -700.4457   216.8415   216.8415

 .00    22.00    STRESS:    -8.2282     1.4693     1.4693    -5.2896
                 STRAIN:  -232.5126    89.2545    89.2545

 .00    32.00    STRESS:    -4.0421      .1027      .1027    -3.8366
                 STRAIN:  -190.6811    77.6024    77.6024

Modulus tolerance criteria is satisfied.
```

Summary of Backcalculation at Station 200.000

LOAD	E(1)	E(2)	BSTR	CSTR	E(3)	BSTR	CSTR	E(4)	DSTR	CSTR
6400.	413659.	30850.	14.51	-.20	37637.	5.98	.21	22846.	2.75	1.58
9328.	485725.	37247.	18.53	-1.10	35852.	6.91	-.05	22480.	3.52	1.55
12059.	539577.	41801.	22.66	-1.81	37483.	7.48	-.41	20889.	4.12	1.52
15419.	606642.	48606.	27.03	-3.03	39180.	8.38	-.76	21629.	4.94	1.49
MEAN =	511401.	39626.	20.68	-1.53	37538.	7.19	-.25	21961.	3.83	1.53
NORM.= to 9000 lbs	477652.	36530.	18.08	-1.00	36052.	6.81	-.02	22521.	3.44	1.56
K1, K2 & RSQ =		4567.	.7149	1.00	29122.	.1289	.25	25788.	-.1221	.57

Subgrade is a Fine-Grained Soil

Note: E(i) = Modulus of i-th layer (psi)
EAD = Adj. moduli of asphalt layer for 77 deg F (psi)
BSTR = Bulk stress (psi)
CSTR = Confining stress (psi)
DSTR = Deviator stress (psi)
K1,K2 = Stress sensitivity coefficients
RSQ = Coefficient of determination

Figure 5-10. Example of EVERCALC 3.3 Output (Continued)

Figure 5-11. Example of MODULUS 4.0 Output

a. Summary Report

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 4.0)

District: 5
County: 12
Highway/Road: 05

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum
Pavement:	4.50	100,000	3,500,001
Base:	7.50	20,000	2,000,000
Subbase:	20.00	10,000	250,000
Subgrade:	INFINITY	20,000	

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERROR/Sens.	Depth to Bedrock
200.000	6,399	9.81	7.36	5.22	3.91	2.99	2.06	1.30	418.	20.0	130.9	18.5	3.37	250.83 *
200.000	9,327	13.22	10.10	7.49	5.71	4.41	3.09	1.92	499.	28.4	53.7	21.9	3.13	300.00
200.000	12,058	16.33	12.66	9.66	7.44	5.87	4.26	2.66	557.	32.1	53.9	20.4	2.92	300.00
200.000	15,418	19.20	14.97	11.60	9.02	7.21	5.23	3.29	617.	38.2	53.9	21.2	2.67	300.00
Mean:		14.64	11.27	8.49	6.52	5.12	3.66	2.29	523.	29.7	73.1	20.5	3.02	285.99
Std. Dev:		4.04	3.28	2.75	2.20	1.82	1.38	0.87	85.	7.6	38.5	1.5	0.30	23.14
Var Coeff(%):		27.60	29.10	32.41	33.79	35.61	37.69	37.81	16.	25.6	52.7	7.2	9.92	8.09

Figure 5-11. Example of MODULUS 4.0 Output (Continued)

b. Section Report

```
                                                                                          Page:  1
---------------------------------------------------------------------------------------------------
                         TTI  MODULUS  ANALYSIS  SYSTEM  (SECTION REPORT)                (Version 4.0)
---------------------------------------------------------------------------------------------------
District: 5   County:  12                  Distance (in) from center of loading plate to sensor: R1 =   0.000
Highway/Road:    05                                                                         R2 =   8.000
Radius of loading plate(in):      5.910             POISSON RATIO VALUES                   R3 =  12.000
Surface thickness(in):            4.500                 H1: l = 0.35                       R4 =  16.000
Base thickness(in):               7.500                 H2: l = 0.25                       R5 =  24.000
Subbase thickness(in):           20.000                 H3: l = 0.30                       R6 =  36.000
Subgrade thickness(in):        INFINITY                 H4: l = 0.40                       R7 =  60.000
---------------------------------------------------------------------------------------------------
Station: 200.000          R1      R2      R3      R4      R5      R6      R7     Plate Load =       6,401 lbs
Measured Deflection:     9.81    7.36    5.22    3.91    2.99    2.06    1.30   Plate Pressure =  58.330 psi
Calculated Deflection:   9.98    6.95    5.28    4.13    2.90    2.24    1.60
Weight Factor:           1.00    0.75    0.53    0.40    0.30    0.00    0.00
     % ERROR            -1.74    5.60   -1.14   -5.50    2.88    0.00    0.00   Absolute Sum of % ERROR =  16.900
Layer:                SURFACE(E1)   BASE(E2)   SUBBASE(E3)   SUBGRADE(E4)       Square Error =            0.007
Moduli Values (ksi):     417.7        20.0       130.9          18.5
Close to limits?          NO          YES         NO             -              Failed Convexity Test? YES
---------------------------------------------------------------------------------------------------
Station: 200.000          R1      R2      R3      R4      R5      R6      R7     Plate Load =       9,328 lbs
Measured Deflection:    13.22   10.10    7.49    5.71    4.41    3.09    1.92   Plate Pressure =  85.010 psi
Calculated Deflection:  13.38    9.67    7.57    6.04    4.23    3.02    1.98
Weight Factor:           1.00    0.76    0.57    0.43    0.33    0.23    0.15
     % ERROR            -1.22    4.29   -1.04   -5.81    4.07    2.26   -3.19   Absolute Sum of % ERROR =  21.900
Layer:                SURFACE(E1)   BASE(E2)   SUBBASE(E3)   SUBGRADE(E4)       Square Error =            0.009
Moduli Values (ksi):     499.2        28.4        53.7          21.9
Close to limits?          NO           NO          NO            -              Failed Convexity Test?  NO
---------------------------------------------------------------------------------------------------
Station: 200.000          R1      R2      R3      R4      R5      R6      R7     Plate Load =      12,059 lbs
Measured Deflection:    16.33   12.66    9.66    7.44    5.87    4.26    2.66   Plate Pressure = 109.900 psi
Calculated Deflection:  16.51   12.17    9.70    7.88    5.68    4.14    2.74
Weight Factor:           1.00    0.78    0.59    0.46    0.36    0.26    0.16
     % ERROR            -1.08    3.87   -0.38   -5.93    3.18    2.82   -3.16   Absolute Sum of % ERROR =  20.400
Layer:                SURFACE(E1)   BASE(E2)   SUBBASE(E3)   SUBGRADE(E4)       Square Error =            0.008
Moduli Values (ksi):     557.0        32.1        53.9          20.4
Close to limits?          NO           NO          NO            -              Failed Convexity Test?  NO
---------------------------------------------------------------------------------------------------
Station: 200.000          R1      R2      R3      R4      R5      R6      R7     Plate Load =      15,419 lbs
Measured Deflection:    19.20   14.97   11.60    9.02    7.21    5.23    3.29   Plate Pressure = 140.520 psi
Calculated Deflection:  19.39   14.44   11.62    9.54    6.98    5.11    3.38
Weight Factor:           1.00    0.78    0.60    0.47    0.38    0.27    0.17
     % ERROR            -1.00    3.52   -0.17   -5.73    3.24    2.29   -2.72   Absolute Sum of % ERROR =  18.700
Layer:                SURFACE(E1)   BASE(E2)   SUBBASE(E3)   SUBGRADE(E4)       Square Error =            0.007
Moduli Values (ksi):     616.5        38.2        53.9          21.2
Close to limits?          NO           NO          NO            -              Failed Convexity Test?  NO
---------------------------------------------------------------------------------------------------
```

Figure 5-12. Programs Selection Menu of LEEP

[A] CONVERT - DynaTest FWD File Conversion
[B] MKFILE - Interactive File Creation for BASIN
[C] BASIN - Find Representative Basin

[D] INDEF - Create WESDEF Data File
[E] WESDEF - Back-calculate Modulus Values

[F] TRAFFIC - Compute Equivalent Traffic

[G] INPAVE - Create WESPAVE Data File
[H] WESPAVE - Pavement Evaluation Program

[I] INLEA - Create WESLEA Data File
[J] WESLEA - 5-Layer, Linear, Elastic Program

[K] DOS - Run DOS, Type Exit to Return LEEP

[X] Exit to DOS

Figure 5-13. Example of WESDEF Output

```
****************WESDEF DRA-07.90.23****************
          P R O B L E M   N U M B E R  =   2
**********EXECUTED:  1-13-1993 @ 14:57*************

0512-9328

    NUMBER OF VARIABLE LAYERS AND TARGET DEFLECTIONS =   4
```

VARIABLE LAYER NO.	SYSTEM LAYER NO.	ESTIMATED INITIAL MODULUS PSI	ASSIGNED RANGE FOR LAYER MODULUS: MINIMUM MODULUS PSI	MAXIMUM MODULUS PSI
1	1	450000.	100000.	3500000.
2	2	1000000.	20000.	2000000.
3	3	50000.	10000.	250000.
4	4	20000.	1000.	150000.

INITIAL PAVEMENT PARAMETERS

LAYER NO.	MATERIAL TYPE	MODULUS PSI	POISSON'S RATIO	THICK. IN.	INTERFACE VALUE
1	AC	450000.	.35	4.50	1.
2	HIGH QUAL. STAB. BASE	1000000.	.25	7.50	1.
3	BASE OR SUBBASE	50000.	.30	20.00	1.
4	SUBGRADE	20000.	.40	208.00	1.
5	RIGID BOUNDARY	1000000.	.50	SEMI-INF	

LOAD INFORMATION

LOAD NUMBER	LOAD POUNDS	RADIUS OF LOADED AREA, IN.	LOAD CO-ORDINATES X, IN.	Y, IN.
1	9328.	5.91	.00	.00

Figure 5-13. Example of WESDEF Output (Continued)

```
************************WESDEF OUTPUT SUMMARY************************

     NUMBER OF ITERATIONS PERFORMED:  3

          DEFLECTIONS COMPUTED FOR FINAL MODULUS VALUES
          *********************************************

          SENSOR  MEASURED   COMPUTED
          OFFSET DEFLECTION DEFLECTION
POSITION   IN.      MILS       MILS    DIFFERENCE % DIFF.
******** ****** ********** ********** ********** *******
    1        .0     13.2       13.3         -.1      -.7
    2       8.0     10.1        9.8          .3      2.6
    3      12.0      7.5        7.8         -.3     -3.8
    4      18.0      5.7        5.6          .1      1.2
    5      24.0      4.4        4.4          .0       .6
    6      36.0      3.1        3.1          .0     -1.2
    7      60.0      1.9        1.9          .0       .9

                         ABSOLUTE SUM:       .8     11.0
                       ARITHMETIC SUM:               -.5
                              AVERAGE:       .1      1.6

                        FINAL MODULUS VALUES
                        ********************

LAYER                            MODULUS  POISSON'S THICK. INTERFACE
 NO.        MATERIAL TYPE          PSI      RATIO     IN.     VALUE
***** ********************** ********* ********* ****** *********
  1            AC              587828.     .35      4.50       1.
  2    HIGH QUAL. STAB. BASE    23816.     .25      7.50       1.
  3      BASE OR SUBBASE        72772.     .30     20.00       1.
  4         SUBGRADE            14463.     .40    208.00       1.
  5      RIGID BOUNDARY       1000000.     .50   SEMI-INF

REACHED MAX NO OF ITERATIONS
ABSOLUTE SUM OF % DIFF. NOT WITHIN TOLERANCE
CHANGE IN MODULUS VALUES NOT WITHIN TOLERANCE
```

Table 5-1. Effect of the Depth of Rigid Bottom on the Backcalculated Moduli (Summary of COV, %)

Site/ Program	Layers			
	AC	BASE	AS	Subgrade
a. 0512				
BKCHEV	18.46	207.17	67.34	63.57
BOUSDEF	7.20	1.10	19.86	59.54
EVERCALC	24.40	34.66	55.46	58.51
MODULUS	11.29	22.80	41.24	61.22
WESDEF	7.04	15.72	40.01	66.83
b. 0517				
BKCHEV	—	—	—	—
BOUSDEF	46.69	0.00*	23.40	57.07
EVERCALC	23.30	58.66*	41.83	71.20
MODULUS	11.11	12.81	3.67	34.71
WESDEF	17.77	0.00*	28.01	60.30
c. 2647				
BKCHEV	0.00*	33.27	96.57	87.22
BOUSDEF	89.18	49.33	55.41	62.51
EVERCALC	40.01	35.95	92.14	71.88
MODULUS	0.00*	36.86	73.84	54.37
WESDEF	0.00*	5.81	79.57	74.71
d. 7452				
BKCHEV	21.49	16.20	43.52	51.87
BOUSDEF	154.24	74.80	15.77	47.22
EVERCALC	41.27	1.97*	92.07	71.26
MODULUS	11.16	4.03*	38.01	30.37
WESDEF	0.00*	0.00*	88.69	45.18
e. 7454				
BKCHEV	26.59	54.92	—	59.51
BOUSDEF	57.62	29.40	—	72.25
EVERCALC	54.25	59.69	—	69.38
MODULUS	4.06	7.23	—	28.60
WESDEF	14.63	40.39	—	42.47
f. 8153				
BKCHEV	77.85	0.00*	80.53	64.04
BOUSDEF	27.68	120.22	81.12	62.15
EVERCALC	21.51	16.89	69.10	56.00
MODULUS	11.76	6.49	50.48	58.65
WESDEF	12.58	0.00*	76.81	48.95

*: Hit the limit of the modulus range presented in Table 4-14.

Table 5-2. Effect of Seed Modulus on the Backcalculated Moduli (Summary of COV, %)

Site / Program	Layers			
	AC	BASE	AS	Subgrade
a. 0512				
BKCHEV	6.03	11.75	8.57	5.72
BOUSDEF	22.35	13.87	78.81	18.85
EVERCALC	0.05	0.08	0.05	0.01
MODULUS	--	--	--	--
WESDEF	27.35	18.81	28.77	32.82
b. 0517				
BKCHEV				
BOUSDEF	161.75	0.00*	9.16	34.91*
EVERCALC	0.05	0.00*	0.02	0.01
MODULUS	--	--	--	--
WESDEF	5.95	0.00*	1.80	0.47
c. 2647				
BKCHEV	0	0.17	0.69	0.42
BOUSDEF	74.38	101.10	64.78	26.78
EVERCALC	1.34	19.09	35.12	0.16
MODULUS	--	--	--	--
WESDEF	0	1.19	3.29	2.34
d. 7452				
BKCHEV	0.00*	0.00*	0.00*	0.56
BOUSDEF	201.98	68.42	205.70	6.43
EVERCALC	2.35	0.00*	2.70	0.68
MODULUS	--	--	--	--
WESDEF	0.00*	0.00*	6.73	0.50
e. 7454				
BKCHEV	0.44	0.55	--	1.50
BOUSDEF	40.28	14.82	--	87.00
EVERCALC	1.42	2.97	--	12.70
MODULUS	--	--	--	--
WESDEF	0.22	0.51	--	0.13
f. 8153				
BKCHEV	75.62	0.00*	17.36	0.97
BOUSDEF	16.53	9.74	9.72	1.42
EVERCALC	8.23	40.30	34.56	0.82
MODULUS	--	--	--	--
WESDEF	10.52	3.02*	79.37	6.83

*: Hit the limit of the modulus range presented in Table 4-14.

Table 5-3. Effect of Modulus Range on the Backcalculated Moduli (Summary of COV, %)

a. Minimum Range

Site / Program	Layers			
	AC	BASE	AS	Subgrade
a. 0512				
BKCHEV	5.29	10.36	5.49	0.64
BOUSDEF	7.64	31.93	17.64	1.43
EVERCALC	1.83	2.34	1.27	0.15
MODULUS	6.88	13.50	9.55	1.43
WESDEF	10.99	20.74	12.48	1.60
b. 0517				
BKCHEV	24.75	36.74*	24.44	9.08
BOUSDEF	38.19	52.61	26.20	0.00
EVERCALC	22.23	34.91	18.73	3.40
MODULUS	27.55	36.63	31.05	39.01
WESDEF	23.25	34.91	27.75	3.50
c. 2647				
BKCHEV	0.00*	4.84	25.44	10.48
BOUSDEF	15.39	155.69	79.05	7.59
EVERCALC	0.00*	5.37	19.72	7.60
MODULUS	0.00*	58.54	71.21	22.88
WESDEF	0.00*	0.72	18.46	13.48
d. 7452				
BKCHEV	0.00*	34.91*	33.43	17.84
BOUSDEF	34.91	62.45	32.36	15.28
EVERCALC	8.63	33.86*	28.13	1.66
MODULUS	10.81	34.10	35.04	19.58
WESDEF	0.00*	34.91*	38.58	3.51
e. 7454				
BKCHEV	0.00*	0.00*	—	0.00
BOUSDEF	25.50	15.28	—	225.67
EVERCALC	0.01	0.02	—	0.09
MODULUS	13.05	35.79	—	45.34
WESDEF	0.00	0.00	—	0.00
f. 8153				
BKCHEV	10.21	34.91*	41.05	2.24
BOUSDEF	3.83	10.57	7.33	0.60
EVERCALC	5.94	30.32*	34.41	0.35
MODULUS	3.13	10.01	12.13	0.27
WESDEF	18.18	34.91*	88.27	9.14

*: Hit the limit of the modulus range presented in Table 4-14.

Table 5-3. Effect of Range of Modulus on the Backcalculated Moduli (Continued)

b. Maximum Range

Site / Program	Layers			
	AC	BASE	AS	Subgrade
a. 0512				
BKCHEV	0.09	10.36	0.36	0.02
BOUSDEF	0.40	1.05	0.50	0.24
EVERCALC	0.01	0.01	0.00	0.00
MODULUS	0.00	0.00	0.00	0.00
WESDEF	0.74	0.70	0.78	0.10
b. 0517				
BKCHEV	1.27	0.00*	4.78	4.87
BOUSDEF	13.35	0.00	6.79	0.00
EVERCALC	0.01	0.00*	0.00	0.00
MODULUS	2.66	5.05	4.80	4.95
WESDEF	0.44	0.00*	0.67	0.15
c. 2647				
BKCHEV	36.74	23.21	8.92	14.52
BOUSDEF	90.17	68.17	84.36	17.70
EVERCALC	53.17*	39.10	51.93	14.59
MODULUS	38.87*	34.59	13.29	8.17*
WESDEF	36.74*	17.29	10.99	4.15
d. 7452				
BKCHEV	34.91*	17.02	0.00*	5.87
BOUSDEF	183.02	40.28	0.00	5.61
EVERCALC	0.03	0.00*	0.03	0.01
MODULUS	8.89	11.67	26.00	11.67
WESDEF				
e. 7454				
BKCHEV	18.66	20.28	--	15.05
BOUSDEF	81.63	17.68	--	156.05
EVERCALC	22.04	20.72	--	13.16
MODULUS	14.35	33.08	--	19.48
WESDEF	15.79	8.32	--	3.63
f. 8153				
BKCHEV	0.06	0.00*	0.23	0.28
BOUSDEF	0.00	0.00	0.00	0.00
EVERCALC	0.10	0.00*	1.12	0.01
MODULUS	5.43	15.90	30.39	0.56
WESDEF	7.83	0.00*	21.40	2.30

*:Hit the limit of the modulus range presented in Table 4-14.

Table 5-4. Effect of Various DGAC Maximum Range of Modulus on the Backcalculated Layer Modulus (Site 7454 with 8974 lb Loading)

	DGAC Maximum Modulus, psi		
	1750000	3500000	7000000
EVERCALC			
AC	1750001	3362250	3363431
Base	35182	27395	27379
Subgrade	107865	116459	116757
SOA Error, %	71.7	4.8	4.6
MODULUS			
AC	1750000	2435500	2435500
Base	64900	35400	35400
Subgrade	66300	117800	117800
SOA Error, %	17.4	13.0	13.0
WESDEF			
AC	1750000	2979840	3103594
Base	41554	33703	33106
Subgrade	76473	82095	82250
SOA Error, %	50.9	9.9	9.5

Table 5-5. Effect of Varied Layer Thickness on the Backcalculated Moduli (Summary of COV, %)

Site / Program	Layers			
	AC	BASE	AS	Subgrade
a. 0512				
BKCHEV	4.95	2.86	1.94	0.09
BOUSDEF	5.91	4.82	3.36	0.65
EVERCALC	4.99	2.45	1.56	0.04
MODULUS	5.13	2.95	3.98	0.29
WESDEF	4.59	4.91	7.03	0.53
b. 0517				
BKCHEV	4.04	0.00*	0.93	0.35
BOUSDEF	16.56	0.00	6.71	0.00
EVERCALC	6.13	0.00*	0.66	0.22
MODULUS	6.34	7.83	9.42	7.81
WESDEF	2.21	0.00*	2.83	0.98
c. 2647				
BKCHEV	0.00*	5.36	5.16	3.58
BOUSDEF	61.06	129.11	46.90	9.22
EVERCALC	14.72	8.91	27.07	11.91
MODULUS	0.00*	19.60	29.67	5.84
WESDEF	0.00*	5.35	9.69	6.18
d. 7452				
BKCHEV	0.00*	0.00*	0.00*	2.45
BOUSDEF	203.13	27.61	12.03	7.23
EVERCALC	8.05	0.00*	1.89	0.34
MODULUS	8.36	4.70	25.52	4.70
WESDEF	0.00	0.00	8.29	1.43
e. 7454				
BKCHEV	5.12	4.81	--	2.77
BOUSDEF	7.48	15.11	--	188.76
EVERCALC	5.96	2.95	--	0.75
MODULUS	10.01	1.16	--	1.16
WESDEF	9.11	1.75	--	0.33
f. 8153				
BKCHEV	7.05	0.00*	1.85	0.07
BOUSDEF	6.05	3.43	0.92	0.03
EVERCALC	7.50	0.00*	4.88	0.10
MODULUS	8.43	11.19	17.84	0.27
WESDEF	10.81	0.00*	8.88	0.68

*: Hit the limit of the range of modulus presented in Table 4-14.

Table 5-6. Effect of Varied AC Layer Thickness on the Backcalculated DGAC Modulus at 9000± Pounds Loading

	Modulus Ratio		
	Thin (95%)	Measured (100%)	Thick (105%)
a. 0512			
BKCHEV	1.099	1.000	0.914
BOUSDEF	1.115	1.000	0.895
EVERCALC	1.102	1.000	0.916
MODULUS	1.092	1.000	0.902
WESDEF	1.088	1.000	0.919
b. 0517			
BKCHEV	---	1.000	0.895
BOUSDEF	1.078	1.000	0.565
EVERCALC	1.127	1.000	0.898
MODULUS	1.097	1.000	0.902
WESDEF	1.043	1.000	1.039
c. 2647			
BKCHEV	1.000*	1.000*	1.000*
BOUSDEF	1.095	1.000	0.039
EVERCALC	1.000*	1.000*	1.000*
MODULUS	1.000*	1.000*	1.000*
WESDEF	1.000*	1.000*	1.000*
d. 7452			
BKCHEV	1.000*	1.000*	1.000*
BOUSDEF	35.000*	1.000*	1.000*
EVERCALC	1.182	1.000	0.884
MODULUS	1.193	1.000	0.886
WESDEF	1.000*	1.000*	1.000*
e. 7454			
BKCHEV	1.000*	1.000*	0.875
BOUSDEF	0.819	1.000	0.930
EVERCALC	1.041	1.000	0.870
MODULUS	1.200	1.000	0.885
WESDEF	1.161	1.000	0.872
f. 8153			
BKCHEV	1.145	1.000	0.881
BOUSDEF	1.123	1.000	0.898
EVERCALC	1.152	1.000	0.873
MODULUS	1.246	1.000	0.941
WESDEF	1.055	1.000	0.845

*: Hit the limit of the range of modulus presented in Table 4-14.

Table 5-7. Effect of Various Poisson's Ratio on the Backcalculated Moduli (Summary of COV, %)

Site / Program	AC	BASE	AS	Subgrade
a. 0512				
BKCHEV	2.76	2.21	3.57	0.93
BOUSDEF	3.18	3.91	3.20	1.45
EVERCALC	3.05	10.14	3.60	1.00
MODULUS	2.41	2.01	3.70	0.84
WESDEF	3.52	5.36	10.84	4.65
b. 0517				
BKCHEV	3.13	0.00*	1.29	1.86
BOUSDEF	2.85	0.00	0.00	0.00
EVERCALC	3.34	0.00*	1.63	1.64
MODULUS	5.79	8.06	10.88	8.04
WESDEF	2.21	0.00*	3.62	2.99
c. 2647				
BKCHEV	0.00*	2.38	4.19	3.98
BOUSDEF	52.14	135.13	39.02	8.57
EVERCALC	39.98	53.88	165.82	15.44
MODULUS	0.00*	10.63	24.39	5.09
WESDEF	0.00*	3.59	10.25	8.36
d. 7452				
BKCHEV	0.00*	0.00*	0.00*	2.09
BOUSDEF	0.00	1.31	0.00	1.65
EVERCALC	2.58	0.00*	2.41	1.61
MODULUS	2.85	3.82	19.45	3.82
WESDEF	0	0	5.81	3.93
e. 7454				
BKCHEV	2.39	3.19	--	3.04
BOUSDEF	7.99	11.04	--	225.29
EVERCALC	3.40	3.71	--	2.54
MODULUS	3.06	2.23	--	2.26
WESDEF	3.88	4.44	--	4.96
f. 8153				
BKCHEV	2.79	0.00*	3.88	0.84
BOUSDEF	3.60	1.14	0.96	1.58
EVERCALC	2.73	0.00*	7.20	0.20
MODULUS	3.79	15.15	37.94	1.32
WESDEF	12.90	0.00*	15.64	4.04

***: Hit the limit of the range of modulus presented in Table 4-14.**

Table 5-8. Effect of Varied AC Poisson's Ratio on the Backcalculated AC Modulus at 9000± Pounds Loading

	AC Poisson's Ratio		
	0.28 (80 %)	0.35 (100 %)	0.42 (120 %)
a. 0512			
BKCHEV	1.049	1.000	0.940
BOUSDEF	1.043	1.000	0.955
EVERCALC	1.052	1.000	0.937
MODULUS	1.047	1.000	0.948
WESDEF	1.047	1.000	0.929
b. 0517			
BKCHEV	1.056	1.000	0.932
BOUSDEF	0.987	1.000	0.921
EVERCALC	1.058	1.000	0.930
MODULUS	1.158	1.000	0.932
WESDEF	0.972	1.000	0.996
c. 2647			
BKCHEV	1.000*	1.000*	1.000*
BOUSDEF	1.046	1.000	0.039*
EVERCALC	1.000*	1.000*	0.180
MODULUS	1.000*	1.000*	1.000*
WESDEF	1.000*	1.000*	1.000*
d. 7452			
BKCHEV	1.000*	1.000*	1.000*
BOUSDEF	1.000*	1.000*	1.000*
EVERCALC	1.053	1.000	0.950
MODULUS	1.051	1.000	0.944
WESDEF	1.000*	1.000*	1.000*
e. 7454			
BKCHEV	1.000*	1.000*	1.000*
BOUSDEF	1.027	1.000	0.968
EVERCALC	1.041	1.000	0.939
MODULUS	1.047	1.000	0.941
WESDEF	1.048	1.000	0.942
f. 8153			
BKCHEV	1.050	1.000	0.939
BOUSDEF	1.041	1.000	0.951
EVERCALC	1.048	1.000	0.936
MODULUS	1.075	1.000	1.030
WESDEF	0.869	1.000	0.747

*: Hit the limit of the range of modulus presented in Table 4-14.

Table 5-9. Recommended Range of Poisson's Ratio and Modulus of Pavement Materials in BOUSDEF

Materials	Range of Poisson's Ratio	Range of Modulus (ksi)
Asphalt Concrete	0.30 - 0.40	100 - 2000
Aggregate	0.30 - 0.45	10 - 200
Soil	0.40 - 0.50	1 - 30
Portland Cement Concrete	0.15 - 0.25	----

Table 5-10. Effect of Moving-on in EVERCALC 3.3 on the Backcalculated Layer Moduli Based on the Deflection Measured at 9000± Pound Loading

	AC	Base	AS	Subgrade	Itr. No.	% Error
0512	486028*	37216	35869	22479	2	9.1
	490077@	*37113*	*35509*	*22477*	*3*	*9.5*
0517	155751	20000	13806	18738	2	43.2
	172724	*20000*	*13034*	*18704*	*3*	*48.0*
2647	3499999	844377	11943	110740	3	11.3
	1185472	*519825*	*250000*	*51248*	*3*	*82.4*
7452	1592209	20000	15864	32714	2	85.0
	1376842	*41014*	*11131*	*33185*	*3*	*86.1*
7454	3362250	27395	----	116459	2	4.8
	3499999	*30665*	----	*74899*	*3*	*129.0*
8153	961054	10000	49769	13017	1	1.9
	968664	*10000*	*39206*	*13003*	*3*	*10.5*

*: Deflection data for the moduli in normal style are used as the second deflection data set after the backcalculation with the deflection data of 6000± pound loading.

@: Deflection data for the moduli in italic style are used as the first deflection data set.

Table 5-11. Effect of Varied Reasonable Subgrade Modulus in MODULUS 4.0 on the Backcalculated Layer Modulus with 9000± Pound Loading (Summary of COV, %)

Site	COV, %			
	AC	BASE	AS	Subgrade
0512	0.00	0.00	0.00	0.00
0517	18.81	15.90	57.56	32.90
2647	19.56	25.65	101.97	30.56
7452	33.85	109.34	51.57	25.16
7454	14.66	45.79	---	42.05
8153	5.39	13.53	15.30	0.36

Table 5-12. Weighting Factors of Each Sensor in MODULUS 4.0

Site	Load	Sensor No.						
	(lb)	1	2	3	4	5	6	7
0512	6400	1.00	0.75	0.53	0.40	0.30	0.00	0.00
	9328	1.00	0.76	0.57	0.43	0.33	0.23	0.15
	12059	1.00	0.78	0.59	0.46	0.36	0.26	0.16
	15419	1.00	0.78	0.60	0.47	0.38	0.27	0.17
0517	6379	1.00	0.75	0.65	0.32	0.24	0.00	0.00
	9437	1.00	0.75	0.66	0.35	0.26	0.00	0.00
	12237	1.00	0.76	0.67	0.38	0.29	0.00	0.00
	15923	1.00	0.77	0.68	0.40	0.31	0.00	0.00
2647	5657	1.00	0.90	0.85	0.75	0.64	0.46	0.27
	8549	1.00	0.89	0.84	0.74	0.61	0.44	0.23
	11153	1.00	0.89	0.84	0.73	0.61	0.44	0.24
	15019	1.00	0.88	0.84	0.73	0.62	0.44	0.24
7452	5565	1.00	0.86	0.81	0.71	0.41	0.00	0.00
	8330	1.00	0.86	0.82	0.71	0.42	0.00	0.00
	10933	1.00	0.86	0.81	0.71	0.43	0.00	0.00
	14578	1.00	0.85	0.81	0.71	0.45	0.00	0.00
7454	6266	1.00	0.81	0.68	0.48	0.00	0.00	0.00
	8974	1.00	0.81	0.69	0.50	0.00	0.00	0.00
	11542	1.00	0.80	0.68	0.49	0.00	0.00	0.00
	15158	1.00	0.80	0.67	0.48	0.00	0.00	0.00
8153	5531	1.00	0.82	0.69	0.52	0.40	0.27	0.17
	8062	1.00	0.82	0.69	0.53	0.42	0.28	0.17
	10602	1.00	0.83	0.70	0.55	0.43	0.30	0.18
	14162	1.00	0.83	0.71	0.56	0.45	0.31	0.19

BKCHEV (7452; 14578 lbf)

No.	AC	LCB	AS	Subgrade	Itr.	%	Rigid Bottom
0	3499999	20000	111700	2811	3	95.9	20
1	3500002	20000	60491	8042	3	92.3	50
2	No Solution						100
3	862455	76130	18481	20629	3	83.3	200
4	3500002	20000	13629	28567	3	65.4	500
5	3499999	20000	10595	33909	3	67.7	
6	3499995	20000	11054	33066	3	66.3	
7	3499999	20000	10728	34149	3	66.6	
8	3500002	20000	10692	33780	3	67.3	
9	3500002	20000	10398	33967	3	68.7	
10	3500002	20000	10736	34446	2	66.2	
11	3500002	20000	10333	33923	3	69.1	
14	3499999	20000	10494	35008	3	66.8	
15	3499999	20000	10461	34680	3	67.4	
16	3499995	20000	10736	33655	3	67.2	
17	3499995	20000	10981	33175	3	66.6	
18	3499995	10000	16519	31358	3	78.8	
19	3499999	40000	10000	30720	3	63.5	
20	3499999	20000	10541	33289	3	68.8	
21	3499999	20000	20000	26999	3	67.6	
24	3499995	20000	10504	33936	3	68.1	
25	3500002	20000	10647	33802	3	67.5	
26	1750001	71593	10000	31713	3	63.8	
27	7000000	20000	10000	28489	3	121.2	
28	3499995	20000	10594	33917	3	67.7	
29	3499999	20000	10596	33903	3	67.7	
30	3499999	20000	10592	33907	3	67.7	
31	3499995	20000	10598	33911	3	67.6	
34	3500002	20000	10602	33803	3	67.8	
35	3500002	20000	10588	33999	3	67.6	
36	3499995	20000	13892	31332	3	62.0	
37	3499999	20000	10000	33141	3	67.0	
38	3499999	20000	10674	33616	3	67.4	
39	3499999	20000	10534	34069	3	68.0	
40	3499995	20000	10298	33802	3	67.5	
41	3500002	20000	10885	34003	3	67.8	
45	3499995	20000	11231	32935	3	65.9	
46	3499999	20000	10000	33681	3	67.2	
47	3499999	20000	10224	34120	3	67.9	
48	3499999	20000	10382	33512	3	67.1	
49	3499995	20000	10437	34571	3	68.0	
50	3500002	20000	10008	32856	3	66.8	
53	3499999	20000	10061	34463	3	67.1	
54	3499999	20000	10735	32452	3	68.1	
65	3499999	20000	10338	33818	3	67.5	
66	3499999	20000	10338	33818	3	67.5	
77	3499999	20000	10338	33818	3	67.5	
78	3499999	20000	10338	33818	3	67.5	
79	3499999	20000	10000	33818	3	67.5	

Table 5-14. Effect of Interface Friction on the Backcalculated Moduli in WESDEF (Summary of COV, %)

Site	Layers			
	AC	BASE	AS	Subgrade
0512	19.11	25.91	72.68	7.91
0517	13.54	0.00*	60.03	2.57
2647	0.00*	40.22	147.80	15.33
7452	0.00*	0.00*	5.44	2.21
7454	4.29	30.73	----	2.39
8153	24.58	0.00*	109.82	9.67

*: Hit the limit of the range of modulus presented in Table 4-14.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary

The main objective of this research is to evaluate backcalculation procedures that are currently available for determining the moduli of flexible pavement layers and the subgrade. All specific objectives were achieved except for verification of computer procedures. Laboratory testing for resilient modulus of pavement materials and subgrade soils was not completed because testing equipment was not available.

The sensitivity of five backcalculation computer procedures to input variables are evaluated using the coefficient of variance of backcalculated moduli for various ranges of common input parameters. The backcalculation programs evaluated in this study are BKCHEV, BOUSDEF 2.0, EVERCALC 3.3, MODULUS 4.0, and WESDEF. Normalized surface deflections were used to evaluate the stress sensitivity of each pavement structure. FWD surface deflection data from six sites in the SHRP LTPP database were used to study backcalculated layer moduli.

Backcalculation procedures use systematic techniques for calculating layer moduli of pavement structures. However, user judgment, knowledge and experience substantially affect success in backcalculation.

6.2 Conclusions

The following conclusions are drawn from this study:

1. Any backcalculation procedures using linear elastic layer theory may not work well with pavement sections showing nonlinearity. Pavement structures which are distressed or where a stiff layer is sandwiched between relatively soft layers may not be suitable for linear elastic backcalculation because of high error in predicted deflections.

2. The moduli of the subgrade and aggregate subbase is affected substantially by the location of the rigid bottom at each site studied. The subgrade modulus at all six sites increases when the depth to rigid bottom increases.

3. The backcalculated modulus from BOUSDEF is the most sensitive to variation in the seed modulus. BKCHEV, EVERCALC 3.3 and WESDEF are less sensitive.

4. All procedures are insensitive to the range of modulus as long as the backcalculated layer modulus is within the predefined range of modulus. The range of modulus value provided by the user should be wide enough to include the likely in situ layer moduli.

5. Backcalculated AC moduli are substantially affected by a ± 5% change in AC layer thickness. An overestimated AC layer thickness causes underestimation in AC modulus. The ± 5% deviation from the measured AC layer thickness results in more than a 10% difference in backcalculated AC modulus for most cases.

6. The backcalculated layer moduli change little when Poisson's ratio varies by ± 20%. Therefore, typical values assumed for Poisson's ratio are acceptable for backcalculation.

6.3 Recommendations

The following recommendations are suggested from the results and findings obtained in this study:

1. It is necessary to establish a database of pavement material properties for successful backcalculation. A modulus database of pavement materials including the AC modulus-temperature relationship is useful to provide a range of representative layer moduli.

2. The depth to a rigid bottom should be determined especially if there is a rigid layer near the surface. However, the modulus and Poisson's ratio of the rigid bottom must be reasonable values which may require testing, experience and judgment.

3. Accurate values of layer thickness must be provided especially the AC thickness.

4. Based on the sensitivity and error of backcalculation results as well as ease of operation and input file preparation, EVERCALC 3.3 is recommended for backcalculation work at Caltrans. However, validation of backcalculation is recommended by comparing backcalculated moduli with results from laboratory tests.

6.4 Implementation

EVERCALC 3.3 is recommended for future backcalculation. However, careful interpretation of output is required for pavements showing strong structural nonlinearity. Nonlinear output resulted when the pavement is distressed or a very stiff base layer is present. Use of EVERCALC 3.3 for composite pavement structures (AC over PCC) also is uncertain. Further evaluation and experience are needed.

When Dynaflect data are used with EVERCALC 3.3, the number of layers to be calculated should be less than five. For pavement structures having five layers, BOUSDEF may be used to reduce the number of layers to four by estimating the subgrade modulus. The estimated subgrade modulus then may be entered as a fixed value for EVERCALC 3.3 operation.

Further implementation will be expanded as experience is gained and material characteristics are obtained from laboratory and field testing.

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APPENDIX - COMPREHENSIVE OUTPUT SUMMARY OF EACH PROCEDURE

Comprehensive output summary for each backcalculation procedure and for all six sites is presented at four different loading levels.

It is found that only EVERCALC 3.3 produces solutions with any input values used in this study for all sites and for all load levels. Other programs show error statements such as "run time error" or "floating point error" during the execution with a certain input. "No solution" in the tables means that there is no solution for a given input corresponding to number in the first column.

BKCHEV (0512; 6400 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	428786	20000	140237	1685	3	26.2	20
1	No Solution						50
2	478472	20000	100084	9699	3	23.6	100
3	604045	20000	79059	14636	3	13.7	200
4	622931	20000	45350	17963	3	68.3	500
5	445445	26976	42551	22588	3	12.7	
6	441443	27272	42856	22610	3	13.2	
7	471487	24892	43681	22395	3	13.5	
8	440653	27497	41376	22627	3	12.1	
9	444696	27045	42573	22589	3	12.8	
10	408533	31401	38976	22812	3	11.9	
11	494371	23265	41674	22284	3	22.7	
14	497785	22192	52029	17184	3	119.7	
15	448257	26779	43008	22803	3	13.9	
16	445950	26970	42568	22595	3	12.7	
17	442451	27487	41088	22622	3	11.9	
18	391089	33762	37358	22807	3	12.3	
19	340627	40000	31078	23602	3	15.3	
20	446521	26859	42894	22574	3	12.9	
21	445909	26927	42647	22581	3	12.7	
24	439396	27591	41372	22634	3	12.1	
25	445123	27004	42537	22588	3	12.7	
26	446351	26927	42577	22589	3	12.7	
27	445654	26966	42554	22588	3	12.7	
28	444477	27074	42439	22596	3	12.7	
29	446133	26906	42620	22582	3	12.7	
30	446284	26886	42771	22577	3	12.8	
31	445941	26924	42656	22582	3	12.8	
34	445458	26975	42551	22590	3	12.7	
35	445697	26949	42592	22581	3	12.7	
36	484849	28816	40907	22651	3	12.3	
37	420778	24268	44589	22349	3	14.0	
38	442472	27039	41682	22638	3	12.1	
39	442714	27484	42189	22581	3	12.8	
40	447054	26600	44153	22624	3	12.6	
41	438605	27894	40162	22595	3	12.1	
45	467248	27159	42818	22623	3	12.7	
46	433175	25291	42751	22330	3	13.9	
47	443429	26386	43786	22638	3	12.7	
48	442479	28045	40076	22570	3	12.1	
49	459852	25537	41860	22496	3	13.6	
50	444556	27066	43714	22432	3	12.7	
53	453398	26377	40664	22519	3	13.7	
54	453508	25865	46094	21965	3	12.6	
65	445445	26976	42551	22588	3	12.7	
66	445445	26976	42551	22588	3	12.7	
77	445445	26976	42551	22588	3	12.7	
78	445445	26976	42551	22588	3	12.7	
79	433558	27407	41465	22610	2	12.6	

BKCHEV (512; 9328f)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	578193	20000	155373	1558	3	18.6	20
1	564418	20000	147495	4366	3	19.3	50
2	639836	20000	111880	9126	3	18.3	100
3	326180	2000001	10000	13989	3	185.7	200
4	532718	37449	41013	18909	3	8.2	500
5	529308	33104	38977	22259	3	10.4	
6	525013	33702	38815	22314	3	10.5	
7	531107	33052	38973	22289	3	10.4	
8	528136	33246	38711	22279	3	10.2	
9	528442	33199	38954	22267	3	10.4	
10	472643	41408	34680	22489	3	9.6	
11	455265	41782	33987	22756	2	9.4	
14	561108	28633	46473	18428	3	72.2	
15	538323	32314	39437	22498	3	11.7	
16	524448	33514	38703	22280	3	10.3	
17	533217	32715	39198	22232	3	10.4	
18	460610	43200	34131	22475	3	10.5	
19	467657	40000	33848	22679	3	9.4	
20	530327	32990	39022	22248	3	10.4	
21	529490	33086	38981	22260	3	10.4	
24	529854	33041	39027	22257	3	10.4	
25	528906	33156	38937	22262	3	10.4	
26	528666	33161	38932	22263	3	10.4	
27	528864	33145	38944	22262	3	10.4	
28	528799	33150	38901	22264	3	10.4	
29	530056	33034	39067	22253	3	10.4	
30	530021	33029	39011	22254	3	10.4	
31	529559	33076	38981	22256	3	10.4	
34	529201	33117	38964	22258	3	10.4	
35	529426	33090	38990	22260	3	10.4	
36	581546	34937	38122	22283	3	10.1	
37	483608	31607	39571	22264	3	10.5	
38	532026	32636	39421	22259	3	10.4	
39	527114	33485	38567	22257	3	10.4	
40	531202	32657	40176	22292	3	10.3	
41	528171	33460	38007	22221	3	10.5	
45	555500	33343	39154	22291	3	10.4	
46	497363	32816	38736	22221	3	10.4	
47	527033	32300	39698	22311	3	10.4	
48	532530	33713	38183	22198	3	10.4	
49	530498	32987	37678	22392	3	10.4	
50	528154	33222	40139	22100	3	10.4	
53	520654	34277	36898	22386	3	10.7	
54	540414	31593	41926	21675	3	10.1	
65	529308	33104	38977	22259	3	10.4	
66	529308	33104	38977	22259	3	10.4	
77	529308	33104	38977	22259	3	10.4	
78	529308	33104	38977	22259	3	10.4	
79	528653	31744	39835	22220	2	11.3	

BKCHEV (0512; 12059 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	No Solution						20
1	686131	20000	169404	3790	3	15.8	50
2	773032	20000	128486	8121	3	16.5	100
3	1004406	20000	105124	12551	3	6.5	200
4	526369	47866	42724	17536	3	8.4	500
5	587902	37143	40924	20658	3	9.5	
6	564278	39985	39527	20759	3	9.0	
7	610356	35110	41741	20601	3	9.4	
8	616487	34614	41573	20619	2	10.0	
9	586740	37273	40979	20668	3	9.6	
10	507258	51341	34592	20939	3	9.8	
11	577494	36712	40785	20690	2	9.8	
14	600479	33344	46923	18325	3	42.6	
15	603420	35685	41406	20979	3	11.1	
16	577625	38134	40337	20693	3	9.3	
17	600516	35934	41729	20616	3	9.7	
18	490030	55036	33658	20937	3	11.2	
19	560986	40000	38125	20844	2	8.9	
20	588241	37116	40909	20657	3	9.4	
21	586666	37262	40847	20664	3	9.4	
24	589671	36974	41047	20653	3	9.5	
25	586747	37246	40875	20660	3	9.4	
26	590869	36933	41028	20656	3	9.5	
27	584901	37340	40844	20659	3	9.5	
28	587342	37187	40803	20664	3	9.4	
29	588913	37053	41075	20651	3	9.5	
30	586272	37317	40798	20667	3	9.4	
31	589235	36999	41047	20650	3	9.5	
34	587526	37181	40892	20657	3	9.4	
35	587833	37145	40928	20661	3	9.5	
36	646474	39214	40095	20682	3	9.2	
37	539220	35156	41837	20640	3	9.7	
38	591730	36558	41562	20660	3	9.5	
39	585714	37518	40416	20650	3	9.5	
40	589034	36656	42332	20701	3	9.4	
41	586773	37606	39732	20615	3	9.5	
45	614492	37627	41009	20687	3	9.4	
46	560752	36101	41121	20607	3	9.6	
47	581697	36623	41250	20712	3	9.4	
48	597069	37245	40613	20592	3	9.6	
49	589988	36971	39504	20751	3	9.5	
50	586174	37268	42270	20544	3	9.5	
53	579022	38333	38838	20742	3	9.7	
54	600085	35497	44001	20136	3	9.3	
65	587902	37143	40924	20658	3	9.5	
66	587902	37143	40924	20658	3	9.5	
77	587902	37143	40924	20658	3	9.5	
78	587902	37143	40924	20658	3	9.5	
79	627447	33975	41086	20598	2	11.5	

BKCHEV (0512; 15149 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	892329	20000	207728	1352	3	12.6	20
1	970494	20000	250000	3772	3	35.9	50
2	1009966	20000	250000	7469	3	33.5	100
3	1186185	21702	137899	12309	3	12.5	200
4	564238	59919	43306	18216	3	6.8	500
5	637471	45809	41135	21481	3	7.8	
6	597732	51789	38987	21598	3	7.2	
7	661043	43214	42140	21414	3	8.0	
8	711968	40608	42400	21358	2	8.6	
9	628703	47065	40664	21518	3	7.6	
10	546612	66289	34597	21780	3	11.1	
11	666925	40983	42882	21401	2	8.9	
14	594610	46386	39638	21895	3	10.4	
15	648712	43787	41978	21748	3	10.1	
16	623220	47384	40542	21516	3	7.6	
17	660705	43397	42225	21431	3	8.2	
18	477647	154077	20164	22271	3	56.9	
19	605007	49420	39827	21703	2	7.9	
20	638219	45752	41144	21480	3	7.8	
21	636440	45930	41082	21486	3	7.8	
24	640177	45518	41268	21477	3	7.8	
25	631803	46477	40878	21502	3	7.7	
26	645442	45156	41377	21474	3	7.8	
27	629170	46469	40924	21486	3	7.8	
28	636461	45911	40944	21491	3	7.6	
29	637451	45833	41243	21477	3	7.9	
30	635741	46044	41029	21492	3	7.7	
31	638527	45676	41196	21475	3	7.8	
34	637754	45773	41162	21470	3	7.8	
35	637745	45776	41154	21490	3	7.8	
36	697706	48639	40336	21509	3	7.4	
37	586398	43238	41979	21463	3	8.2	
38	637670	45773	41659	21499	3	7.8	
39	634937	46115	40521	21479	3	7.8	
40	636228	45594	42264	21538	3	7.6	
41	636130	46335	40058	21438	3	7.9	
45	663334	46859	41067	21523	3	7.7	
46	600615	45170	41015	21456	3	7.9	
47	627744	45554	41144	21552	3	7.6	
48	726510	41257	41219	21297	2	9.7	
49	637538	45878	39557	21599	3	7.8	
50	635159	46008	42534	21359	3	7.8	
53	624178	47584	39081	21579	3	8.0	
54	651780	43815	44000	20943	3	7.6	
65	637471	45809	41135	21481	3	7.8	
66	637471	45809	41135	21481	3	7.8	
77	637471	45809	41135	21481	3	7.8	
78	637471	45809	41135	21481	3	7.8	
79	743270	39362	41745	21333	2	10.5	

BKCHEV (0517; 6379 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	3499999	20000	10000	1734	3	216.5	20
1	No Solution						50
2	No Solution						100
3	No Solution						200
4	No Solution						500
5	No Solution						
6	No Solution						
7	130277	20000	10000	19104	3	61.6	
8	No Solution						
9	No Solution						
10	130272	20000	10000	19102	3	61.6	
11	No Solution						
14	No Solution						
15	No Solution						
16	131508	20000	10000	19079	3	61.6	
17	No Solution						
18	187359	10000	13219	18358	3	49.3	
19	No Solution						
20	No Solution						
21	No Solution						
24	No Solution						
25	No Solution						
26	128482	20000	10000	16918	3	73.3	
27	130306	20000	10000	19102	3	61.6	
28	No Solution						
29	No Solution						
30	No Solution						
31	No Solution						
34	No Solution						
35	No Solution						
36	No Solution						
37	116379	20000	10000	19032	3	63.1	
38	No Solution						
39	No Solution						
40	No Solution						
41	No Solution						
45	No Solution						
46	No Solution						
47	No Solution						
48	No Solution						
49	No Solution						
50	No Solution						
53	No Solution						
54	No Solution						
65	No Solution						
66	No Solution						
77	No Solution						
78	No Solution						
79	No Solution						

BKCHEV (0517; 9437 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	No Solution						20
1	145192	20000	19195	5704	3	88.6	50
2	No Solution						100
3	No Solution						200
4	No Solution						500
5	193494	20000	11757	20018	3	50.7	
6	No Solution						
7	193470	20000	11758	20018	3	50.7	
8	193515	20000	11756	20019	3	50.7	
9	193470	20000	11758	20018	3	50.7	
10	193522	20000	11756	20019	3	50.7	
11	No Solution						
14	No Solution						
15	184742	20000	12050	19956	3	49.9	
16	197505	20000	11622	20151	3	51.6	
17	No Solution						
18	251797	10000	17568	18726	3	38.8	
19	100000	40000	10000	16491	3	109.2	
20	185684	20000	12256	20073	3	49.9	
21	121901	20000	20000	15580	3	74.8	
24	193507	20000	11757	20018	3	50.7	
25	193474	20000	11757	20019	3	50.7	
26	201342	20000	10000	16968	3	103.7	
27	193357	20000	11762	20012	3	50.6	
28	193496	20000	11757	20018	3	50.7	
29	193492	20000	11757	20018	3	50.7	
30	193463	20000	11758	20017	3	50.7	
31.	193519	20000	11756	20019	3	50.7	
34	193523	20000	11756	20022	3	50.7	
35	193468	20000	11757	20014	3	50.7	
36	No Solution						
37	173141	20000	11585	20136	3	52.1	
38	195288	20000	11836	19964	3	50.5	
39	191779	20000	11676	20074	3	50.9	
40	194238	20000	11620	19940	3	50.7	
41	192793	20000	11883	20098	3	50.7	
45	204353	20000	11852	20019	3	50.5	
46	180368	20000	11635	20020	3	50.9	
47	189441	20000	11663	20174	3	51.5	
48	197337	20000	11816	19859	3	50.0	
49	191816	20000	11511	20608	3	50.9	
50	195582	20000	11906	19336	3	50.4	
53	194334	20000	11570	20260	3	50.1	
54	192269	20000	11991	19438	3	51.5	
65	193494	20000	11757	20018	3	50.7	
66	193494	20000	11757	20018	3	50.7	
77	193494	20000	11757	20018	3	50.7	
78	193494	20000	11757	20018	3	50.7	
79	193494	20000	11757	20018	3	50.7	

BKCHEV (0517; 12237 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	3499999	20000	10000	2642	3	183.2	20
1	100000	20000	45217	3901	3	74.8	50
2	431901	20000	10000	12419	3	101.6	100
3	3499999	20000	10000	11385	3	180.7	200
4	No Solution						500
5	250392	20000	14305	18518	3	43.5	
6	242391	20000	14644	18395	3	42.5	
7	250381	20000	14304	18494	3	43.4	
8	242384	20000	14645	18392	3	42.4	
9	250392	20000	14304	18495	3	43.4	
10	242349	20000	14639	18408	3	42.5	
11	250416	20000	14302	18496	3	43.4	
14	249765	20000	14308	18512	3	43.5	
15	243564	20000	14515	18631	3	43.9	
16	249981	20000	14226	18593	3	44.1	
17	No Solution						
18	318503	10000	22536	17639	3	35.2	
19	113400	40000	10000	14605	3	168.8	
20	240047	20000	15038	18629	3	43.0	
21	185686	20000	20000	16038	3	49.1	
24	250392	2000	14306	18531	3	43.6	
25	250391	20000	14304	18501	3	43.5	
26	1750001	20000	10000	13957	3	207.6	
27	250188	20000	14310	18514	3	43.5	
28	250390	20000	14305	18518	3	43.5	
29	250393	20000	14305	18518	3	43.6	
30	241598	20000	14669	18343	3	42.2	
31	250584	20000	14304	18523	3	43.6	
34	250388	20000	14305	18535	3	43.6	
35	250411	20000	14304	18501	3	43.5	
36	275376	20000	14838	18308	3	41.3	
37	223321	20000	14082	18609	3	44.8	
38	251832	2000	14367	18497	3	43.5	
39	249011	20000	14241	18539	3	43.6	
40	251002	20000	14214	18486	3	43.6	
41	249836	20000	14386	18550	3	43.5	
45	263966	20000	14401	18531	3	43.5	
46	233851	20000	14182	18503	3	43.6	
47	245907	20000	14206	18635	3	44.1	
48	254632	20000	14345	18400	3	43.0	
49	248944	20000	13950	18874	3	43.5	
50	252176	20000	14566	18067	3	43.4	
53	251606	20000	14038	18679	3	43.0	
54	240253	20000	15023	17895	3	43.1	
65	250392	20000	14305	18518	3	43.5	
66	250392	20000	14305	18518	3	43.5	
77	250392	20000	14305	18518	3	43.5	
78	250392	20000	14305	18518	3	43.5	
79	250392	20000	14305	18518	3	43.5	

BKCHEV (0517; 15923 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	294788	20000	43230	1610	3	60.5	20
1	299924	20000	37135	4680	3	58.9	50
2	185717	63028	10000	11494	3	112.2	100
3	3499999	20000	10000	13425	3	146.7	200
4	No Solution						500
5	325461	20000	19004	18657	3	35.9	
6	322117	20000	18972	18802	3	36.7	
7	325791	20000	18989	18637	3	35.8	
8	322757	20000	19062	18616	3	35.6	
9	325081	20000	18989	18638	3	35.8	
10	318283	20000	19202	18551	3	35.2	
11	325872	20000	18980	18653	3	35.9	
14	329481	20000	18757	18621	3	35.9	
15	329406	20000	18554	19434	3	40.3	
16	322168	20000	19184	18628	3	35.5	
17	320779	20000	19253	18620	3	35.4	
18	402733	10000	33717	17779	3	28.8	
19	233200	40000	14218	19703	3	46.5	
20	325858	20000	18938	18724	3	36.3	
21	308255	20000	20000	18214	3	32.6	
24	325038	20000	19034	18638	3	35.7	
25	325905	20000	18971	18683	3	36.0	
26	326909	20000	18928	18694	3	36.1	
27	323942	20000	19088	18616	3	35.6	
28	325473	20000	19004	18657	3	35.9	
29	325472	20000	19004	18657	3	35.9	
30	324565	20000	18964	18647	3	35.9	
31	326450	20000	19006	18662	3	35.9	
34	325362	20000	19016	18654	3	35.8	
35	325612	20000	18987	18683	3	36.0	
36	367464	20000	19428	18564	3	34.6	
37	289493	20000	18710	18712	3	36.8	
38	325899	20000	19026	18656	3	35.9	
39	324956	20000	18986	18657	3	35.8	
40	325622	20000	19004	18656	3	36.0	
41	325330	20000	19004	18658	3	35.7	
45	340850	20000	19257	18645	3	35.5	
46	303630	20000	18883	18615	3	35.8	
47	319689	20000	18991	18725	3	36.1	
48	331156	20000	18885	18597	3	35.7	
49	324329	20000	18474	18920	3	35.9	
50	327213	20000	19401	18345	3	35.8	
53	327724	20000	18554	18764	3	35.4	
54	322409	20000	19560	18222	3	36.6	
65	325461	20000	19004	18657	3	35.9	
66	325461	20000	19004	18657	3	35.9	
77	325461	20000	19004	18657	3	35.9	
78	325461	20000	19004	18657	3	35.9	
79	325461	20000	19004	18657	3	35.9	

BKCHEV (2647; 5658 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	3499999	400441	250000	4552	3	25.1	20
1	3499999	513241	153562	14919	3	28.1	50
2	3499999	231197	250000	19913	3	115.7	100
3	3499999	1100273	10000	75311	3	23.3	200
4	3499999	1074273	12096	79793	3	14.4	500
5	3499999	938222	12808	89800	3	14.8	
6	3499999	941039	12914	89558	3	14.5	
7	3499999	939272	12791	89895	3	14.8	
8	3499999	943625	12875	89207	3	14.5	
9	No Solution						
10	3499999	940753	12753	90287	3	14.7	
11	3499999	925736	13127	88711	3	15.1	
14	3499999	941537	12719	91161	3	15.1	
15	3499999	925736	13127	88711	3	15.1	
16	3499999	938139	12813	89784	3	14.8	
17	3499999	938159	12812	89786	3	14.8	
18	3499999	937439	12826	89750	3	14.9	
19	3499999	938991	12792	89844	3	14.8	
20	3499999	965145	11589	85623	3	32.1	
21	3499999	843580	20000	73096	3	15.6	
24	3499999	938266	12805	89778	3	14.8	
25	3499999	938070	12820	89789	3	14.8	
26	1750001	1324145	12157	93639	3	18.1	
27	7000000	682264	15994	79590	3	12.4	
28	No Solution						
29	3499999	937222	12843	89612	3	14.9	
30	3499999	938611	12814	89767	3	14.8	
31	3499999	938209	12820	89836	3	14.8	
34	3499999	875642	18141	75000	3	14.8	
35	3499999	941420	12714	90827	3	14.8	
36	3499999	998452	12740	90888	3	14.9	
37	3499999	887212	12751	90590	3	14.8	
38	3499999	1018995	14020	86515	3	14.5	
39	3499999	875890	11547	95852	3	15.0	
40	3499999	942417	12169	90705	3	14.8	
41	3499999	940489	13260	90933	3	14.8	
45	3499999	980510	12465	92046	3	14.9	
46	3499999	897365	13032	89390	3	14.7	
47	3499999	926055	13060	89448	3	14.8	
48	3499999	953904	12373	92304	3	14.8	
49	3499999	935004	13431	93348	3	14.8	
50	3499999	950464	11391	87617	3	14.8	
53	3499999	940557	12496	93907	3	14.9	
54	3499999	941958	13053	85702	3	14.7	
65	3499999	941958	13053	85702	3	14.7	
66	3499999	941958	13053	85702	3	14.7	
77	3499999	941958	13053	85702	3	14.7	
78	3499999	941958	13053	85702	3	14.7	
79	3499999	941958	13053	85702	3	14.7	

BKCHEV (2647; 8550 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	3499999	481856	149606	5942	3	15.8	20
1	3499999	439356	140192	16737	3	16.4	50
2	3499999	508034	250000	2435	3	******	100
3	3499999	971105	10000	89528	3	17.1	200
4	3499999	982842	10000	104402	3	19.8	500
5	3499999	867068	10763	122253	3	12.6	
6	3499999	868878	10866	121465	3	12.2	
7	3499999	867534	10844	121573	3	12.4	
8	3499999	865578	10908	122434	3	12.3	
9	No Solution						
10	3499999	869815	10701	122848	3	12.5	
11	3499999	873744	10833	119593	3	12.0	
14	3499999	866561	10812	122882	2	12.5	
15	3499999	869323	10851	121526	3	12.2	
16	3499999	867041	10765	122232	3	12.6	
17	3499999	857181	10762	122259	3	12.6	
18	3499999	866547	10774	122150	3	12.6	
19	3499999	867525	10755	122312	3	12.5	
20	3499999	877663	9640	115674	3	41.0	
21	3499999	736608	20000	82912	3	18.8	
24	3499999	867068	10763	122253	3	12.6	
25	3499999	867068					
26	1750001	1204985	10234	129519	3	15.3	
27	7000000	627023	13398	103286	3	10.1	
28	No Solution						
29	3499999	867226	10760	122271	3	12.6	
30	3499999	867439	10758	122286	3	12.5	
31	3499999	867336	10760	122283	3	12.5	
34	3499999	1374872	10000	75000	3	92.3	
35	3499999	869252	10712	123599	3	12.5	
36	3499999	926176	10771	120933	3	12.4	
37	3499999	816239	10825	121487	3	12.3	
38	3499999	940097	11811	114142	3	12.1	
39	3499999	804923	10000	130083	3	12.5	
40	3499999	876521	10256	119694	3	12.1	
41	3499999	865627	11264	122352	3	12.6	
45	3499999	905996	10633	122645	3	12.3	
46	3499999	828419	10997	119797	3	12.3	
47	3499999	853466	11017	119796	3	12.6	
48	3499999	877976	10507	124915	3	12.5	
49	3499999	846748	11729	124646	3	12.5	
50	3499999	859459	10000	111600	3	12.4	
53	3499999	853589	10855	124788	3	12.6	
54	3499999	853221	11229	112509	3	12.6	
65	3499999	853466	11017	119796	3	12.6	
66	3499999	853466	11017	119796	3	12.6	
77	3499999	853466	11017	119796	3	12.6	
78	3499999	853466	11017	119796	3	12.6	
79	3499999	844980	11247	119277	2	12.7	

BKCHEV (2647; 11154 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	3499999	464604	160142	5566	3	14.5	20
1	3499999	449072	134744	15917	3	16.0	50
2	3499999	763314	26356	38560	3	19.4	100
3	3499999	971957	10000	82062	3	18.0	200
4	3499999	926230	11521	92252	3	11.9	500
5	3499999	839701	11835	105514	3	12.6	
6	3499999	842425	11957	104479	3	12.2	
7	3499999	840125	11801	106012	3	12.6	
8	3499999	838376	12018	105256	3	12.3	
9	No Solution						
10	3499999	842509	11765	105909	3	12.5	
11	3499999	845505	11969	103245	3	12.1	
14	3499999	841096	11790	105810	3	12.6	
15	3499999	836922	11911	104947	3	12.7	
16	3499999	839697	11836	105506	3	12.6	
17	3499999	839674	11837	105500	3	12.6	
18	3499999	839089	11854	105397	3	12.6	
19	No Solution						
20	3499999	855107	10967	101265	3	26.7	
21	3499999	731392	20000	79098	3	17.4	
24	3499999	839701	11835	105514	3	12.6	
25	3499999	839701	11835	105514	3	12.6	
26	1750001	1175608	11041	112877	3	15.0	
27	7000000	608050	14819	91828	3	10.7	
28	No Solution						
29	3499999	839565	11845	105441	3	12.6	
30	3499999	840223	11826	105556	3	12.6	
31	3499999	839944	11825	105590	3	12.6	
34	3499999	1290509	10000	75000	3	81.2	
35	3499999	842579	11755	106762	3	12.5	
36	3499999	891559	11802	105864	3	12.8	
37	3499999	789891	11922	104850	3	12.4	
38	3499999	907172	13085	99448	3	12.1	
39	3499999	781934	10827	112291	3	12.7	
40	3499999	841165	11285	150486	3	12.6	
41	3499999	838179	12378	105565	3	12.6	
45	3499999	872649	11611	107141	3	12.8	
46	3499999	801888	12129	103530	3	12.3	
47	3499999	825362	12142	103622	3	12.6	
48	3499999	851176	12545	107421	3	12.6	
49	3499999	833443	12545	109156	3	12.6	
50	3499999	851065	10507	101267	3	12.5	
53	3499999	839474	11648	109469	3	12.6	
54	3499999	439805	12084	99480	3	12.6	
65	3499999	839701	11835	105514	3	12.6	
66	3499999	839701	11835	105514	3	12.6	
77	3499999	839701	11835	105514	3	12.6	
78	3499999	839701	11835	105514	3	12.6	
79	3499999	830103	12130	105717	2	12.9	

BKCHEV (2647; 15020 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	3499999	468290	150005	5622	3	12.9	20
1	3499999	474599	120977	16080	3	13.8	50
2	3499999	793108	21243	40254	3	13.6	100
3	3499999	955353	10000	83012	3	13.4	200
4	3499999	963776	10000	98845	3	12.5	500
5	3362024	873284	10224	117467	3	9.0	
6	3337423	883038	10055	120115	3	9.5	
7	3499073	859917	10282	117799	3	9.5	
8	3463887	864140	10268	118009	3	9.6	
9	No Solution						
10	3349111	884181	10100	118731	2	9.0	
11	3347692	875466	10300	116502	3	8.8	
14	3403440	868240	10215	118682	2	9.5	
15	3475994	860053	10367	117237	3	9.8	
16	3362024	873284	10224	117467	3	9.0	
17	3362024	873284	10224	117467	3	9.0	
18	3362024	873284	10224	117467	3	9.0	
19	3362024	873284	10224	117467	3	9.0	
20	3118407	910056	9548	115735	3	21.9	
21	3326814	722501	20000	78298	3	20.8	
24	3362024	873284	10224	117467	3	9.0	
25	3362024	873284	10224	117467	3	9.0	
26	1750001	1198312	10000	120403	3	10.8	
27	3653670	844960	10367	116981	3	9.7	
28	No Solution						
29	3123368	905478	10094	119456	2	9.1	
30	1021781	2000003	10000	103993	1	28.0	
31	3201071	895376	10159	118939	2	9.3	
34	3499999	1279455	10000	75000	3	78.3	
35	2900023	928826	10003	118535	3	9.8	
36	3371939	926119	10236	117118	3	9.2	
37	3263978	832564	10209	117724	3	9.0	
38	3228099	964666	11151	110953	3	9.5	
39	3499999	782317	10000	118984	2	9.3	
40	3431955	857595	10000	115165	3	9.2	
41	3389947	869299	10738	117444	3	8.9	
45	3499999	890684	10170	118770	3	9.1	
46	3310442	838910	10482	115873	3	9.6	
47	3287915	869254	10432	115221	3	9.0	
48	3370325	881649	10000	119755	3	9.0	
49	3473705	854889	10964	121513	3	8.8	
50	3248308	852890	10000	103286	3	10.0	
53	3325415	876963	10081	122320	3	9.1	
54	3363457	872894	10442	110099	3	8.9	
65	3362024	873284	10224	117467	3	9.0	
66	3362024	873284	10224	117467	3	9.0	
77	3362024	873284	10224	117467	3	9.0	
78	3362024	873284	10224	117467	3	9.0	
79	2692790	900164	10455	115925	2	12.7	

BKCHEV (7452; 5566 lbf)

No.	AC	LCB	AS	Subgrade	Itr.	%	Rigid Bottom
0	3499999	20000	46886	3169	3	167.0	20
1	3499999	20000	10000	11739	3	156.1	50
2	No Solution						100
3	3499999	20000	10000	23074	3	132.8	200
4	100000	245662	10000	26605	3	120.9	500
5	3499999	20000	10000	28734	3	132.4	
6	3499999	20000	10000	28767	3	132.2	
7	3499999	20000	10000	28700	3	132.5	
8	3499999	20000	10000	28746	3	132.3	
9	3499999	20000	10000	28732	3	132.4	
10	3499999	20000	10000	28762	3	132.2	
11	3499999	20000	10000	28721	3	132.4	
14	3499999	20000	10000	29437	3	128.4	
15	3499999	20000	10000	28863	3	131.6	
16	3499999	20000	10000	28700	3	132.5	
17	3499999	20000	10000	28751	3	132.3	
18	3499999	10000	10000	35732	3	120.2	
19	3499999	40000	10000	25621	3	168.5	
20	3499999	20000	5000	48717	3	131.0	
21	3499999	20000	20000	23095	3	178.2	
24	3499999	20000	10000	28737	3	132.3	
25	3499999	20000	10000	28739	3	132.3	
26	1750001	20000	10000	34233	3	95.1	
27	7000000	20000	10000	24670	3	228.0	
28	3499999	20000	10000	28731	3	132.4	
29	3499999	20000	10000	28737	3	132.3	
30	3499999	20000	10000	28734	3	132.4	
31	3499999	20000	10000	28734	3	132.4	
34	3499999	20000	10000	28890	3	131.5	
35	3499999	20000	10000	28450	3	134.0	
36	3499999	20000	10000	29851	3	111.5	
37	3499999	20000	10000	27734	3	153.5	
38	3499999	20000	10000	28667	3	131.9	
39	3499999	20000	10000	28801	3	132.8	
40	3499999	20000	10000	28292	3	134.6	
41	3499999	20000	10000	29191	3	130.1	
45	3499999	20000	10000	29072	3	125.3	
46	3499999	20000	10000	28312	3	141.5	
47	3499999	20000	10000	28834	3	133.4	
48	3499999	20000	10000	28532	3	131.9	
49	3499999	20000	10000	29471	3	131.9	
50	3499999	20000	10000	27621	3	134.4	
53	3499999	20000	10000	28845	3	134.6	
54	3499999	20000	10000	28062	3	129.3	
65	3499999	20000	10000	28734	3	132.4	
66	3499999	20000	10000	28734	3	132.4	
77	3499999	20000	10000	28734	3	132.4	
78	3499999	20000	10000	28734	3	132.4	
79	3499999	20000	10000	28734	3	132.4	

BKCHEV (7452; 8330 lbf)

No.	AC	LCB	AS	Subgrade	Itr.	%	Rigid Bottom
0	3500002	20000	24541	3939	3	142.4	20
1	3499999	20000	11155	12766	3	134.1	50
2	No Solution						100
3	1801872	28816	10000	24085	3	117.5	200
4	3499999	20000	10000	29942	3	96.7	500
5	3499999	20000	10000	31969	3	98.8	
6	3499999	20000	10000	32098	3	99.1	
7	3499999	20000	10000	31904	3	98.6	
8	3499999	20000	10000	31968	3	98.8	
9	3499999	20000	10000	31968	3	98.8	
10	3499999	20000	10000	31999	2	98.8	
11	3499999	20000	10000	31966	3	98.8	
14	3499999	20000	10000	32541	3	100.0	
15	3499999	20000	10000	32030	3	98.9	
16	3499999	20000	10000	31957	3	98.8	
17	3499999	20000	10000	31964	3	98.8	
18	3499999	10000	10000	40358	3	96.4	
19	3499999	40000	10000	28049	3	130.3	
20	3499999	20000	5794	46099	3	107.0	
21	3499999	20000	20000	25109	3	140.4	
24	3499999	20000	10000	31977	3	98.8	
25	3499999	20000	10000	31963	3	98.8	
26	1750003	31523	10000	34293	3	83.8	
27	7000000	20000	10000	26824	3	192.1	
28	3499999	20000	10000	31967	3	98.8	
29	3499999	20000	10000	31970	3	98.8	
30	3499999	20000	10000	31969	3	98.8	
31	3499999	20000	10000	31969	3	98.8	
34	3499999	20000	10000	32095	3	99.0	
35	3499999	20000	10000	32096	3	99.0	
36	3499999	20000	10000	33392	3	88.1	
37	3499999	20000	10000	30697	3	114.2	
38	3499999	20000	10000	31879	3	98.4	
39	3499999	20000	10000	32058	3	99.2	
40	3499999	20000	10000	31405	3	98.3	
41	3499999	20000	10000	32553	3	99.3	
45	3499999	20000	10000	32419	3	95.4	
46	3499999	20000	10000	31407	3	103.0	
47	3499999	20000	10000	32113	3	99.4	
48	3499999	20000	10000	31696	3	98.1	
49	3499999	20000	10000	32927	3	99.8	
50	3499999	20000	10000	30549	3	97.3	
53	3499999	20000	10000	32129	3	98.2	
54	3499999	20000	10000	31193	3	99.6	
65	3499999	20000	10000	31969	3	98.8	
66	3499999	20000	10000	31969	3	98.8	
77	3499999	20000	10000	31969	3	98.8	
78	3499999	20000	10000	31969	3	98.8	
79	3499999	20000	10000	31969	3	98.8	

BKCHEV (7452; 10934 lbf)

No.	AC	LCB	AS	Subgrade	Itr.	%	Rigid Bottom
0	3499995	20000	57807	3170	3	114.4	20
1	3499999	20000	26604	9803	3	112.5	50
2	No Solution						100
3	100000	20000	250000	12789	3	342.4	200
4	3499999	36607	10000	30041	3	83.5	500
5	3499999	20000	10000	34045	3	74.8	
6	3499999	20000	10000	33640	3	74.7	
7	3499999	20000	10000	34003	3	74.8	
8	3499999	20000	10000	33997	3	74.8	
9	3499999	20000	10000	34037	3	74.8	
10	3499999	20000	10000	34055	2	74.8	
11	3499999	20000	10000	33979	3	74.8	
14	3499999	20000	10000	34469	3	75.6	
15	3499999	20000	10000	34095	3	74.8	
16	3499999	20000	10000	33944	3	74.8	
17	3499999	20000	10000	34041	3	74.8	
18	3499999	10000	12693	36495	3	83.0	
19	3499999	40000	10000	29481	3	91.0	
20	3499999	20000	5274	39481	3	131.1	
21	3499999	20000	20000	26282	3	101.1	
24	3499999	20000	10000	33980	3	74.8	
25	3499999	20000	10000	34053	3	74.8	
26	1750001	50157	10000	32929	3	72.2	
27	7000000	20000	10000	27978	3	153.7	
28	3499999	20000	10000	34044	3	74.8	
29	3499999	20000	10000	34047	3	74.8	
30	3499999	20000	10000	34045	3	74.8	
31	3499999	20000	10000	34045	3	74.8	
34	3499999	20000	10000	34066	3	74.8	
35	3499999	20000	10000	34076	3	74.8	
36	3499999	20000	10000	35008	3	77.2	
37	3499999	20000	10000	32439	3	83.7	
38	3499999	20000	10000	33959	3	74.5	
39	3499999	20000	10000	34068	3	75.0	
40	3499999	20000	10000	33418	3	74.3	
41	3499999	20000	10000	34693	3	75.6	
45	3499999	20000	10000	34571	3	74.2	
46	3499999	20000	10000	33398	3	79.0	
47	3499999	20000	10000	34095	3	75.1	
48	3499999	20000	10000	33786	3	74.4	
49	3499999	20000	10000	35095	3	75.8	
50	3499999	20000	10000	32474	3	73.3	
53	3499999	20000	10000	34119	3	73.9	
54	3499999	20000	10000	33253	3	76.2	
65	3499999	20000	10000	34045	3	74.8	
66	3499999	20000	10000	34045	3	74.8	
77	3499999	20000	10000	34045	3	74.8	
78	3499999	20000	10000	34045	3	74.8	
79	3499999	20000	10000	34045	3	74.8	

BKCHEV (7452; 14578 lbf)

No.	AC	LCB	AS	Subgrade	Itr.	%	Rigid Bottom
0	3499999	20000	111700	2811	3	95.9	20
1	3500002	20000	60491	8042	3	92.3	50
2	No Solution						100
3	862455	76130	18481	20629	3	83.3	200
4	3500002	20000	13629	28567	3	65.4	500
5	3499999	20000	10595	33909	3	67.7	
6	3499995	20000	11054	33066	3	66.3	
7	3499999	20000	10728	34149	3	66.6	
8	3500002	20000	10692	33780	3	67.3	
9	3500002	20000	10398	33967	3	68.7	
10	3500002	20000	10736	34446	2	66.2	
11	3500002	20000	10333	33923	3	69.1	
14	3499999	20000	10494	35008	3	66.8	
15	3499999	20000	10461	34680	3	67.4	
16	3499995	20000	10736	33655	3	67.2	
17	3499995	20000	10981	33175	3	66.6	
18	3499995	10000	16519	31358	3	78.8	
19	3499999	40000	10000	30720	3	63.5	
20	3499999	20000	10541	33289	3	68.8	
21	3499999	20000	20000	26999	3	67.6	
24	3499995	20000	10504	33936	3	68.1	
25	3500002	20000	10647	33802	3	67.5	
26	1750001	71593	10000	31713	3	63.8	
27	7000000	20000	10000	28489	3	121.2	
28	3499995	20000	10594	33917	3	67.7	
29	3499999	20000	10596	33903	3	67.7	
30	3499999	20000	10592	33907	3	67.7	
31	3499995	20000	10598	33911	3	67.6	
34	3500002	20000	10602	33803	3	67.8	
35	3500002	20000	10588	33999	3	67.6	
36	3499995	20000	13892	31332	3	62.0	
37	3499999	20000	10000	33141	3	67.0	
38	3499999	20000	10674	33616	3	67.4	
39	3499999	20000	10534	34069	3	68.0	
40	3499995	20000	10298	33802	3	67.5	
41	3500002	20000	10885	34003	3	67.8	
45	3499995	20000	11231	32935	3	65.9	
46	3499999	20000	10000	33681	3	67.2	
47	3499999	20000	10224	34120	3	67.9	
48	3499999	20000	10382	33512	3	67.1	
49	3499995	20000	10437	34571	3	68.0	
50	3500002	20000	10008	32856	3	66.8	
53	3499999	20000	10061	34463	3	67.1	
54	3499999	20000	10735	32452	3	68.1	
65	3499999	20000	10338	33818	3	67.5	
66	3499999	20000	10338	33818	3	67.5	
77	3499999	20000	10338	33818	3	67.5	
78	3499999	20000	10338	33818	3	67.5	
79	3499999	20000	10000	33818	3	67.5	

BKCHEV (7454; 6266 lbf)

No.	AC	AB	Subgrade	Itr.	%	Rigid Bottom
0	1551235	101943	10951	3	71.2	20
1	3499999	52106	35036	3	73.8	50
2	2535047	45340	57963	3	24.3	100
3	3156038	33710	85869	3	15.7	200
4	3339337	30241	107274	2	8.5	500
5	3307471	28584	121580	2	4.9	
6	3317195	28459	121912	2	5.3	
7	3321543	28234	122962	2	6.2	
8	3367048	27902	118511	2	13.6	
9	3277225	28595	121464	2	5.1	
14	3314403	28599	120589	2	4.5	
15	3308560	28373	121674	2	5.6	
16	3307471	28584	121580	2	4.9	
17	3307471	28584	121580	2	4.9	
18	3309806	28536	121502	2	4.9	
19	3304998	28635	121649	2	5.1	
24	3307471	28584	121580	2	4.9	
25	3307471	28584	121580	2	4.9	
26	1750001	43109	99247	2	72.9	
27	3643435	32734	103831	2	48.9	
28	3296666	28576	122017	2	5.2	
29	3309599	28760	121339	2	5.4	
34	2331730	51254	75000	2	112.2	
35	3326664	28145	124406	2	6.9	
36	3499999	30409	117747	2	9.6	
37	2937478	28441	121695	2	6.9	
38	3330702	27547	121124	2	4.6	
39	3284159	29575	122080	2	5.2	
45	3452253	28657	121474	2	4.8	
46	3128431	28539	121537	2	5.2	
47	3238547	29789	126634	2	6.4	
48	3405630	26314	116602	2	4.5	
53	3322134	28090	125516	2	4.7	
54	3300748	28942	116692	2	6.5	
65	3307471	28584	121580	2	4.9	
66	3307471	28584	121580	2	4.9	
77	3307471	28584	121580	2	4.9	
78	3307471	28584	121580	2	4.9	
79	3499999	26803	124515	1	14.6	

BKCHEV (7454; 8974 lbf)

No.	AC	AB	Subgrade	Itr.	%	Rigid Bottom
0	1641929	99809	10289	3	67.1	20
1	1994486	82390	27091	3	51.6	50
2	2680857	43113	55510	3	22.4	100
3	3336419	31651	83541	3	17.1	200
4	3499999	28553	104369	2	8.2	500
5	3499999	26606	121012	1	7.7	
6	3463111	26751	118297	2	6.4	
7	3457439	26723	119776	2	6.7	
8	3472962	26469	115894	2	10.4	
9	3447166	26927	117824	2	5.8	
14	3471376	26511	121289	2	7.6	
15	3469992	26573	118030	2	7.2	
16	3499999	26606	121012	1	7.7	
17	3499999	26606	121012	1	7.7	
18	3499999	26606	121012	1	7.7	
19	3499999	26606	121012	1	7.7	
24	3499999	26606	121012	1	7.7	
25	3499999	26606	121012	1	7.7	
26	1750001	42513	94440	2	79.4	
27	3454331	26199	117310	3	11.1	
28	3443482	27004	118560	2	5.6	
29	3442707	27081	118031	2	5.3	
34	3499999	37757	75000	3	116.4	
35	3458073	26731	120827	2	7.1	
36	3499999	29654	112581	2	16.4	
37	3063020	26663	118787	2	7.1	
38	3499999	25831	120238	1	7.7	
39	3499999	27336	121751	1	8.5	
45	3499999	27264	119854	1	9.4	
46	3268407	26684	118954	2	6.6	
47	3381794	28052	123232	2	7.3	
48	3499999	25104	112657	2	5.7	
53	3499999	26646	119361	1	6.8	
54	3434590	27417	113494	2	7.0	
65	3499999	26606	121012	1	7.7	
66	3499999	26606	121012	1	7.7	
77	3452572	26864	118608	2	6.1	
78	3452572	26864	118608	2	6.1	
79	3499999	26606	121012	1	7.7	

BKCHEV (7454; 11542 lbf)

No.	AC	AB	Subgrade	Itr.	%	Rigid Bottom
0	1593211	98704	10105	3	64.8	20
1	3499999	49514	32935	3	68.3	50
2	2643140	42293	54811	3	21.5	100
3	3287742	30981	82452	3	15.7	200
4	3453747	27901	103665	2	10.5	500
5	3423664	26188	118040	2	6.8	
6	3433002	26071	117666	2	6.0	
7	3429393	26049	119193	2	7.8	
8	3448688	25846	115391	2	9.4	
9	3411195	26245	117248	2	5.8	
14	3443686	25858	120833	2	9.2	
15	3437064	25909	117361	2	6.8	
16	3423664	26188	118040	2	6.8	
17	3423664	26188	118040	2	6.8	
18	3423536	26185	117994	2	6.7	
19	3423742	26191	118080	2	6.9	
24	3423664	26188	118040	2	6.8	
25	3423664	26188	118040	2	6.8	
26	1750001	43298	89519	3	81.1	
27	3423457	25523	116590	3	11.5	
28	3411839	26322	117964	2	7.0	
29	3415677	26412	117419	2	6.7	
34	2516740	36263	75000	3	114.3	
35	3429808	26054	120253	2	9.0	
36	3499999	28757	112288	2	15.7	
37	3036797	26004	118185	2	7.5	
38	3499999	25247	119656	1	9.9	
39	3401721	27098	118560	2	7.1	
45	3499999	26646	119291	1	9.9	
46	3241283	26011	118404	2	7.2	
47	3352194	27377	122643	2	7.8	
48	3499999	24288	112378	2	6.8	
53	3499999	26030	118810	1	7.5	
54	3405989	26723	112915	2	8.4	
65	3423664	26188	118040	2	6.8	
66	3423664	26188	118040	2	6.8	
77	3423664	26188	118040	2	6.8	
78	3423664	26188	118040	2	6.8	
79	3499999	26001	120450	1	10.1	

BKCHEV (7454; 15158 lbf)

No.	AC	AB	Subgrade	Itr.	%	Rigid Bottom
0	1544994	96641	10365	3	60.6	20
1	3499999	46657	34223	3	65.0	50
2	2618854	40579	57121	3	15.4	100
3	3241521	29832	86832	3	10.1	200
4	3499999	26389	110584	2	7.7	500
5	3499999	25038	123435	1	8.2	
6	3394211	25231	124392	2	4.2	
7	3402954	25142	125747	2	5.5	
8	3428467	24980	123090	2	8.1	
9	3364151	25405	123253	2	5.3	
14	3391246	25411	123962	2	4.8	
15	3395050	25102	123913	2	5.2	
16	3499999	25038	123435	1	8.2	
17	3499999	25038	123435	1	8.2	
18	3499999	25038	123435	1	8.2	
19	3499999	25038	123435	1	8.2	
24	3499999	25038	123435	1	8.2	
25	3499999	25038	123435	1	8.2	
26	1750001	41245	94104	3	88.6	
27	3383740	24696	123167	3	11.2	
28	3374169	25447	124081	2	4.9	
29	3387815	25535	124626	2	5.2	
34	3499999	35893	75000	3	134.2	
35	3377401	25375	125116	3	5.4	
36	3499999	27557	118549	2	17.5	
37	3013027	25135	125491	2	4.8	
38	3499999	24293	122568	1	7.6	
39	3499999	25739	124267	1	8.9	
45	3499999	25653	122251	1	6.3	
46	3206794	25258	124842	2	4.4	
47	3317778	26542	130262	2	4.7	
48	3483976	23310	118209	2	6.3	
53	3402801	24935	128609	2	4.6	
54	3376440	25780	118914	2	5.7	
65	3499999	25038	123435	1	8.2	
66	3499999	25038	123435	1	8.2	
77	3389120	25345	124503	2	4.4	
78	3375106	25401	124215	3	4.7	
79	3499999	25038	123435	1	8.2	

BKCHEV (8153; 5532 lbf)

No.	AC	AB	AS	Subgrade	Itr.	%	Rigid Bottom
0	466830	20000	104812	1113	3	38.5	20
1	3499999	20000	28874	3084	3	116.8	50
2	3499999	20000	59837	4869	3	124.4	100
3	700304	20000	28739	10082	3	27.9	200
4	800485	20000	28771	11533	3	7.2	500
5	766660	20000	20448	13678	3	8.0	
6	762491	20000	19758	13852	3	10.0	
7	780481	20000	19877	13517	3	8.6	
8	764033	20000	20431	13717	3	8.7	
9	768926	20000	20166	13965	3	12.9	
10	763504	20000	20231	13767	3	9.3	
11	768939	20000	20421	13521	3	7.8	
14	766770	20000	20468	13588	3	7.7	
15	3499999	20000	10000	13387	3	88.1	
16	766234	20000	20461	13679	3	8.1	
17	768113	20000	20394	13677	3	8.0	
18	918665	10000	49920	13579	3	7.3	
19	590096	40000	13055	14362	3	14.8	
20	757135	20000	21502	13293	3	8.2	
21	715173	20000	22908	13222	2	9.2	
24	767093	20000	20461	13644	3	7.9	
25	763782	20000	20690	13589	3	7.8	
26	766879	20000	20451	13679	3	8.1	
27	766491	20000	20447	13677	3	8.0	
28	766575	20000	20452	13678	3	8.0	
29	766639	20000	20449	13678	3	8.0	
30	765854	20000	20467	13681	3	8.1	
31	767434	20000	20395	13675	3	8.0	
34	765933	20000	20539	13614	3	7.8	
35	765872	20000	20532	13596	3	7.7	
36	877418	20000	20986	13667	3	8.0	
37	677985	20000	19713	13726	3	8.5	
38	766019	20000	20623	13686	3	8.2	
39	767061	20000	20277	13670	3	7.9	
40	764689	20000	20836	13687	3	8.2	
41	768417	20000	20115	13668	3	7.9	
45	804819	20000	20560	13689	3	8.2	
46	720582	20000	20277	13666	3	8.0	
47	757273	20000	20294	13714	3	8.3	
48	775353	20000	20428	13639	3	7.9	
49	765988	20000	19692	13744	3	8.1	
50	767753	20000	21126	13595	3	7.9	
53	777196	20000	19230	13732	3	7.4	
54	751745	20000	22138	13334	3	9.5	
65	766660	20000	20448	13678	3	8.0	
66	766660	20000	20448	13678	3	8.0	
77	766660	20000	20448	13678	3	8.0	
78	766660	20000	20448	13678	3	8.0	
79	766660	20000	20448	13678	3	8.0	

BKCHEV (8153; 8062 lbf)

No.	AC	AB	AS	Subgrade	Itr.	%	Rigid Bottom
0	489157	20000	109407	1069	3	35.3	20
1	3499999	20000	44556	2107	3	183.7	50
2	3499999	20000	10000	6527	3	111.3	100
3	880678	20000	134977	7291	3	67.4	200
4	856625	20000	29761	11273	3	5.3	500
5	815006	20000	21016	13405	3	6.2	
6	818305	20000	19694	13587	3	6.6	
7	825922	20000	20565	13209	3	6.5	
8	812520	20000	20956	13450	3	6.3	
9	817139	20000	20692	13386	3	6.1	
10	812975	20000	20820	13480	3	6.4	
11	817991	20000	20922	13387	3	6.1	
14	815387	20000	21056	13295	3	5.7	
15	3499999	20000	10000	13142	3	82.4	
16	815023	20000	21017	13404	3	6.2	
17	815967	20000	20988	13402	3	6.2	
18	975694	10000	50332	13282	3	4.4	
19	628529	40000	13476	14052	3	12.1	
20	806476	20000	22139	12956	3	7.4	
21	782659	20000	22686	12967	2	6.8	
24	815497	20000	21032	13372	3	6.1	
25	814611	20000	20886	13385	3	6.0	
26	815166	20000	21016	13406	3	6.2	
27	814955	20000	21012	13405	3	6.2	
28	814968	20000	21018	13405	3	6.2	
29	814936	20000	21019	13405	3	6.2	
30	814318	20000	21035	13409	3	6.2	
31	815630	20000	20961	13402	3	6.1	
34	814314	20000	21117	13333	3	5.9	
35	814066	20000	21124	13301	3	5.8	
36	933303	20000	21546	13402	3	5.8	
37	718247	20000	20423	13424	3	6.6	
38	813863	20000	21207	13415	3	6.3	
39	815886	20000	20828	13397	3	6.1	
40	812613	20000	21467	13416	3	6.3	
41	817255	20000	20623	13395	3	6.0	
45	855833	20000	21112	13417	3	6.2	
46	765634	20000	20870	13391	3	6.1	
47	805687	20000	20846	13440	3	6.4	
48	823607	20000	21004	13367	3	6.0	
49	814489	20000	20229	13464	3	6.2	
50	815789	20000	21733	13330	3	6.1	
53	826407	20000	19738	13451	3	5.1	
54	798770	20000	22794	13074	3	7.6	
65	815006	20000	21016	13405	3	6.2	
66	815006	20000	21016	13405	3	6.2	
77	815006	20000	21016	13405	3	6.2	
78	815006	20000	21016	13405	3	6.2	
79	815006	20000	21016	13405	3	6.2	

BKCHEV (8153; 10602 lbf)

No.	AC	AB	AS	Subgrade	Itr.	%	Rigid Bottom
0	3499999	20000	37745	1228	3	97.0	20
1	100000	20000	39091	4142	3	196.3	50
2	3499999	20000	10000	6212	3	117.2	100
3	3499999	20000	10000	10001	3	71.5	200
4	994562	20000	35018	11120	3	4.8	500
5	922046	20000	24210	13318	3	6.6	
6	926945	20000	23854	13380	3	7.6	
7	931074	20000	23994	13056	3	4.7	
8	922673	20000	23966	13368	3	7.4	
9	923369	20000	24317	13277	3	5.6	
10	924433	20000	24208	13325	3	6.9	
11	924204	20000	24315	13270	3	5.4	
14	926720	20000	24310	13134	3	4.3	
15	918064	20000	25013	12751	3	11.5	
16	923571	20000	24284	13291	3	6.0	
17	924124	20000	24368	13271	3	5.6	
18	1114428	10000	50279	12890	3	16.6	
19	721461	40000	15517	13553	3	9.3	
20	1032781	20000	22541	12748	3	15.5	
21	916064	20000	25235	12824	3	8.0	
24	922317	20000	24312	13273	3	5.3	
25	959508	20000	23331	13440	2	9.4	
26	923968	20000	24136	13323	3	6.5	
27	919959	20000	24290	13314	3	6.6	
28	921954	20000	24214	13318	3	6.6	
29	922067	20000	24208	13319	3	6.6	
30	921683	20000	24264	13322	3	6.9	
31	922343	20000	24103	13315	3	6.1	
34	921140	20000	24376	13217	3	4.6	
35	920291	20000	24470	13134	3	4.3	
36	1060740	20000	24306	13340	3	6.3	
37	811800	20000	23650	13309	3	5.6	
38	919246	20000	24403	13332	3	6.8	
39	924589	20000	24016	13305	3	6.3	
40	918525	20000	24922	13334	3	6.8	
41	925516	20000	23591	13303	3	6.3	
45	968786	20000	24310	13325	3	6.6	
46	865053	20000	24111	13304	3	6.4	
47	913113	20000	24023	13350	3	6.5	
48	929930	20000	24194	13279	3	6.5	
49	922352	20000	23278	13363	3	6.7	
50	921896	20000	25070	13258	3	6.1	
53	934917	20000	22704	13343	3	6.0	
54	900928	20000	26775	12761	3	5.4	
65	922046	20000	24210	13318	3	6.6	
66	922046	20000	24210	13318	3	6.6	
77	922046	20000	24210	13318	3	6.6	
78	922046	20000	24210	13318	3	6.6	
79	922046	20000	24210	13318	3	6.6	

BKCHEV (8153; 14162 lbf)

No.	AC	AB	AS	Subgrade	Itr.	%	Rigid Bottom
0	815798	20000	250000	1000	3	71.3	20
1	100000	20000	60602	3999	3	179.7	50
2	3499999	20000	10000	6246	3	130.6	100
3	3499999	20000	10000	10919	3	63.4	200
4	1246353	20000	38072	11228	3	11.7	500
5	1068708	20000	30639	13473	3	7.2	
6	1069022	20000	30068	13516	3	7.2	
7	1069427	20000	30911	13161	3	3.3	
8	1067841	20000	30714	13483	3	7.8	
9	1086834	20000	28239	13487	3	4.0	
10	1063899	20000	30268	13472	3	6.0	
11	1086869	20000	28142	13486	3	4.1	
14	1048211	20000	28223	13697	2	8.5	
15	1139596	20000	27459	12791	3	24.2	
16	1068136	20000	30799	13444	3	6.6	
17	1063907	20000	30451	13427	3	4.9	
18	1239101	12962	38957	13329	3	16.5	
19	838571	40000	19038	13661	3	7.3	
20	1128916	20000	27976	12888	3	19.3	
21	1069069	20000	30214	13398	3	3.5	
24	1067459	20000	30888	13417	3	5.9	
25	1070892	21221	26237	13566	2	5.0	
26	1069649	20000	30596	13475	3	7.3	
27	1067738	20000	30681	13471	3	7.3	
28	1068736	20000	30636	13473	3	7.3	
29	1068725	20000	30638	13473	3	7.2	
30	1068404	20000	30534	13480	3	7.2	
31	1069117	20000	30672	13467	3	7.1	
34	1067303	20000	30892	13367	3	4.3	
35	1066734	20000	31003	13274	3	2.9	
36	1228686	20000	31281	13453	3	6.9	
37	938054	20000	29784	13496	3	7.1	
38	1063689	20000	30821	13486	3	7.4	
39	1073446	20000	30455	13460	3	7.1	
40	1063662	20000	31917	13490	3	7.3	
41	1073529	20000	29546	13455	3	7.2	
45	1122696	20000	30784	13476	3	7.2	
46	1002498	20000	30520	13460	3	7.1	
47	1060642	20000	30467	13498	3	7.1	
48	1074588	20000	30475	13446	3	7.4	
49	1069472	20000	29447	12507	3	7.6	
50	1067816	20000	31746	13427	3	6.6	
53	1084319	20000	28336	13495	3	6.3	
54	1046857	20000	34049	12902	3	3.7	
65	1068708	20000	30639	13473	3	7.2	
66	1068708	20000	30639	13473	3	7.2	
77	1068708	20000	30639	13473	3	7.2	
78	1068708	20000	30639	13473	3	7.2	
79	1068708	20000	30639	13473	3	7.2	

BOUSDEF (0512; 6400 lbf)

No.	AC	CTB	AS	Subgrade	Itr	%	Rigid Bottom
0	376266	20000	69987	2305	3	37.8	20
1	335309	20000	102675	5946	3	46.8	50
2	345945	20000	97644	10638	3	42.8	100
3	380086	20000	79657	15614	3	32.0	200
4	414956	20000	66614	19955	3	20.9	500
5	439173	20000	59359	23306	3	14.3	
6	440396	20000	58897	23328	3	14.4	
7	439277	20000	59404	23301	3	14.2	
8	439621	20000	59289	23307	3	14.3	
9	438543	20000	59350	23306	3	14.3	
10	426169	20000	60539	23170	3	14.6	
11	438455	20000	59177	23293	3	14.4	
14	100000	20000	250000	10118	3	335.3	
15	443619	20000	58139	23848	3	18.2	
16	440381	20000	59128	23313	3	14.3	
17	438613	20000	59565	23300	3	14.2	
18	494253	22171	40587	23417	3	37.1	
19	328082	40000	36235	24096	3	21.5	
20	438555	20000	59561	23301	3	14.2	
21	439628	20000	59196	23311	3	14.3	
24	439177	20000	59355	23306	3	14.3	
25	439179	20000	59363	23305	3	14.3	
26	439565	20000	59128	23308	3	14.3	
27	438783	20000	59506	23303	3	14.2	
28	439173	20000	59359	23306	3	14.3	
29	439173	20000	59359	23306	3	14.3	
30	439138	20000	59416	23305	3	14.2	
31	439217	20000	59299	23306	3	14.3	
34	439081	20000	59414	23303	3	14.2	
35	439257	20000	59307	23306	3	14.3	
36	493065	20000	60687	23255	3	13.8	
37	393430	20000	57895	23351	3	14.8	
38	440950	20000	57565	23363	3	14.6	
39	437597	20000	61170	23248	3	14.0	
40	436311	20000	61022	23369	3	14.6	
41	442009	20000	57799	23246	3	14.0	
45	458491	20000	59961	23287	3	14.1	
46	416504	20000	58452	23332	3	14.5	
47	425211	20000	60262	23432	3	14.7	
48	454943	20000	58072	23177	3	13.9	
49	427326	20000	60638	23456	3	14.7	
50	453673	20000	57548	23135	3	13.8	
53	448256	20000	55043	24140	3	13.0	
54	428291	20000	65203	22221	3	15.9	
65	439173	20000	59359	23306	3	14.2	
66	439173	20000	59359	23306	3	14.3	
77	439173	20000	59359	23306	3	14.3	
78	439173	20000	59359	23306	3	14.3	
79	439173	20000	59359	23306	3	14.3	

BOUSDEF (0512; 9328 lbf)

No.	AC	CTB	AS	Subgrade	Itr	%	Rigid Bottom
0	601862	20000	61782	2088	3	25.4	20
1	509870	20000	95846	5430	3	34.3	50
2	532591	20000	92247	9865	3	31.2	100
3	579948	20000	76986	14572	3	22.5	200
4	629900	20000	65002	18616	3	13.5	500
5	596827	20594	57242	23224	3	10.3	
6	594584	20772	57280	23383	3	9.9	
7	601807	20000	58547	23366	3	9.9	
8	602768	20000	58094	23371	3	9.7	
9	595645	20994	56130	23425	3	9.6	
10	532917	29649	46239	23522	3	10.1	
11	602760	20000	58513	23370	3	9.8	
14	208522	20000	250000	10279	3	301.5	
15	620554	20068	55587	23993	3	14.1	
16	583527	22185	54242	23269	3	10.4	
17	595510	21457	54405	23487	3	9.3	
18	541632	40958	32735	23903	3	20.1	
19	459080	40000	36525	24203	3	12.2	
20	596668	20636	57138	23224	3	10.3	
21	596692	20610	57205	23227	3	10.3	
24	596532	20634	57158	23218	3	10.4	
25	594881	21192	55635	23443	3	9.6	
26	596285	20702	56990	23226	3	10.3	
27	597670	20442	57609	23219	3	10.3	
28	596827	20594	57242	23224	3	10.3	
29	596827	20594	57242	23224	3	10.3	
30	596299	20686	57024	23233	3	10.3	
31	596923	20585	57256	23221	3	10.3	
34	596255	20789	56654	23341	3	9.8	
35	604311	20000	57649	23371	3	9.5	
36	665188	22795	52410	23531	3	9.0	
37	534075	20000	57275	23407	3	9.5	
38	604016	20000	56417	23432	3	9.2	
39	589969	21482	56674	23050	3	11.9	
40	599603	20000	59196	23447	3	9.1	
41	608743	20000	56276	23298	3	9.8	
45	622478	20870	57085	23059	3	12.0	
46	569957	20000	57345	23389	3	9.5	
47	604311	20000	57649	23371	3	9.5	
48	604311	20000	57649	23371	3	9.5	
49	568850	20000	58024	24062	3	9.5	
50	628642	22532	51796	22700	3	9.0	
53	604311	20000	57649	23371	3	9.5	
54	604311	20000	57649	23371	3	9.5	
65	604071	20000	58115	23375	4	9.6	
66	604071	20000	58115	23375	4	9.6	
77	596827	20594	57242	23224	3	10.3	
78	596827	20594	57242	23224	3	10.3	
79	596827	20594	57242	23224	3	10.3	

BOUSDEF (0512; 12059 lbf)

No.	AC	CTB	AS	Subgrade	Itr	%	Rigid Bottom
0	698108	20000	66767	1837	3	17.4	20
1	585010	20000	108290	4860	3	26.7	50
2	607150	20000	105967	8957	3	25.4	100
3	659425	20000	89231	13383	3	18.2	200
4	710644	20000	76493	17167	3	10.0	500
5	662355	24749	55926	21861	3	8.0	
6	629484	28298	52862	21851	3	8.0	
7	671089	22468	61089	21739	3	8.6	
8	663310	24829	55350	21884	3	8.0	
9	661060	24780	56295	21840	3	8.0	
10	539138	59347	34150	22097	3	21.4	
11	706810	20909	62461	21637	3	8.4	
14	286181	20000	225214	11295	3	223.7	
15	692860	21930	59251	22257	3	11.9	
16	637687	28543	50325	21965	3	7.8	
17	666522	23290	58688	21808	3	8.3	
18	572015	65859	28574	22275	3	30.6	
19	533996	40000	41519	22703	2	12.2	
20	662049	24808	55862	21861	3	8.0	
21	662818	24605	56178	21855	3	8.0	
24	662476	24696	56036	21859	3	8.0	
25	661813	24902	55613	21867	3	8.0	
26	662355	24749	55926	21861	3	8.0	
27	662355	24749	55926	21861	3	8.0	
28	662355	24749	55926	21861	3	8.0	
29	662355	24749	55926	21861	3	8.0	
30	662941	24425	56814	21837	3	8.0	
31	662166	24984	55189	21882	3	8.0	
34	661956	24835	55759	21853	3	8.0	
35	661869	24900	55587	21881	3	8.0	
36	743635	26240	53952	21901	3	7.7	
37	592311	23255	58161	21840	3	8.3	
38	669530	23071	58442	21841	3	8.1	
39	654679	26578	53134	21911	3	7.9	
40	662201	23046	61768	21854	3	8.0	
41	661538	26408	51319	21896	3	7.9	
45	690051	25654	54490	21903	3	7.8	
46	628729	23868	57229	21849	3	8.1	
47	661869	24900	55587	21881	3	8.0	
48	661869	24900	55587	21881	3	8.0	
49	628062	23851	57804	22441	3	8.2	
50	703142	25501	54154	21161	3	7.7	
53	661869	24900	55587	21881	3	8.0	
54	661869	24900	55587	21881	3	8.0	
65	662355	24749	55926	21861	3	8.0	
66	662355	24749	55926	21861	3	8.0	
77	662355	24749	55926	21861	3	8.0	
78	662355	24749	55926	21861	3	8.0	
79	716657	20000	60197	21705	2	11.8	

BOUSDEF (0512; 15419 lbf)

No.	AC	CTB	AS	Subgrade	Itr	%	Rigid Bottom
0	827672	20000	76867	1851	3	15.1	20
1	649451	20000	134464	4853	3	22.9	50
2	685673	20000	128798	9069	3	21.8	100
3	718487	20000	116468	13347	3	15.1	200
4	801359	20000	95390	27503	3	8.5	500
5	700598	39065	47215	22810	3	7.2	
6	625556	93326	26917	23140	3	37.6	
7	830508	24322	59359	22981	2	9.5	
8	715204	34606	51211	22749	3	6.1	
9	682757	48074	40812	22912	3	13.0	
10	524412	509113	10000	23460	3	132.6	
11	741288	25869	64215	22474	2	8.7	
14	563649	20000	130774	17323	3	74.8	
15	749872	29390	56470	23107	3	11.6	
16	679789	40931	47153	22806	3	7.0	
17	739422	33073	51540	22740	3	6.6	
18	581619	99998	29017	23069	3	34.0	
19	658294	40000	47713	22919	3	7.2	
20	698250	39573	46871	22817	3	7.4	
21	702735	38799	47277	22810	3	7.3	
24	700980	39141	47084	22814	3	7.3	
25	699135	39282	47081	22811	3	7.3	
26	714987	37323	48487	22784	3	6.7	
27	685848	40649	46266	22827	3	7.8	
28	700598	39065	47215	22810	3	7.2	
29	700598	39065	47215	22810	3	7.2	
30	699253	38785	48018	22784	3	6.7	
31	701565	39465	46261	22844	3	8.2	
34	700417	39056	47256	22780	3	7.4	
35	700203	39266	46982	22848	3	7.3	
36	778072	43066	44922	22875	3	8.8	
37	633754	36170	48662	22826	3	7.3	
38	711730	39408	46250	22890	3	8.1	
39	691211	38711	48012	22791	3	6.5	
40	699670	42108	44766	22949	3	10.0	
41	701247	37918	47609	22768	3	6.2	
45	727230	40356	46547	22854	3	7.4	
46	667369	38173	47232	22850	3	7.6	
47	700203	39266	46982	22848	3	7.3	
48	700203	39266	46982	22848	3	7.3	
49	666335	39287	46131	23497	3	8.3	
50	741397	39106	47568	22062	3	6.6	
53	700203	39266	46982	22848	3	7.3	
54	700203	39266	46982	22848	3	7.3	
65	700598	39065	47215	22810	3	7.2	
66	700598	39065	47215	22810	3	7.2	
77	700598	39065	47215	22810	3	7.2	
78	700598	39065	47215	22810	3	7.2	
79	936010	22579	59525	22402	2	12.9	

BOUSDEF (0512)

No.	K1	K2	K3	K4	R1^2	R2^2	Rigid Bottom
0	----	----	15678	-1.090	-----	0.83	20
1	----	----	571811	-2.057	-----	0.87	50
2	----	----	585	1.000	-----	0.12	100
3	----	----	455	1.000	-----	0.02	200
4	----	----	239	1.000	-----	0.00	500
5	144285	-0.388	27156	-0.083	0.76	0.20	
6	1221438	-1.317	23953	-0.021	0.49	0.02	
7	56189	0.023	27768	-0.094	0.11	0.12	
8	108701	-0.266	28588	-0.107	0.90	0.28	
9	242025	-0.612	26040	-0.061	0.62	0.11	
10	73264216	-3.213	22604	0.009	0.31	0.01	
11	40948	0.159	32343	-0.171	0.80	0.34	
14	3773004	-1.041	587	1.662	0.47	0.98	
15	59220	-0.013	31216	-0.139	0.02	0.30	
16	151236	-0.424	27730	-0.092	1.00	0.27	
17	90615	-0.193	28406	-0.104	0.44	0.20	
18	153874	-0.643	27123	-0.071	0.83	0.22	
19	11820	0.493	38267	-0.223	0.88	0.61	
20	150887	-0.406	27021	-0.081	0.77	0.18	
21	140500	-0.377	27181	-0.084	0.74	0.20	
24	145076	-0.390	27080	-0.082	0.76	0.18	
25	141224	-0.383	27539	-0.088	0.78	0.20	
26	128157	-0.338	27564	-0.090	0.79	0.23	
27	159132	-0.428	26847	-0.078	0.75	0.18	
28	144285	-0.388	27156	-0.083	0.76	0.20	
29	144285	-0.388	27156	-0.083	0.76	0.20	
30	131751	-0.348	27352	-0.087	0.72	0.20	
31	158908	-0.430	26871	-0.078	0.80	0.19	
34	143030	-0.386	27599	-0.090	0.78	0.22	
35	149257	-0.402	27221	-0.083	0.77	0.19	
36	180064	-0.492	26629	-0.072	0.81	0.14	
37	107259	-0.265	27769	-0.093	0.51	0.18	
38	121577	-0.322	27011	-0.079	0.45	0.14	
39	166329	-0.446	26838	-0.078	0.98	0.22	
40	174894	-0.448	26060	-0.061	0.45	0.10	
41	135934	-0.381	28056	-0.098	0.93	0.25	
45	166481	-0.448	26416	-0.070	0.86	0.18	
46	128830	-0.342	27277	-0.084	0.61	0.17	
47	163627	-0.437	27993	-0.096	0.82	0.22	
48	132749	-0.357	26450	-0.070	0.70	0.15	
49	167579	-0.449	24810	-0.028	0.67	0.03	
50	109422	-0.290	31190	-0.161	0.71	0.38	
53	102164	-0.258	32768	-0.167	0.44	0.39	
54	244773	-0.590	21247	0.029	0.93	0.03	
65	147341	-0.395	27503	-0.088	0.75	0.21	
66	147341	-0.395	27503	-0.088	0.75	0.21	
77	144285	-0.388	27156	-0.083	0.76	0.20	
78	144285	-0.388	27156	-0.083	0.76	0.20	
79	55079	0.029	33735	-0.191	0.14	0.41	

BOUSDEF (0517; 6379 lbf)

No.	AC	CTB	AS	Subgrade	Iter	%	Rigid Bottom
0	127043	20000	10000	2274	3	164.0	20
1	100000	20000	11933	6463	3	133.6	50
2	180251	20000	10224	9057	3	123.4	100
3	No Solution						200
4	No Solution						500
5	158644	20000	10000	20000	3	58.5	
6	158771	20000	10000	20000	3	58.5	
7	149171	20000	10000	20000	3	59.3	
8	149129	20000	10000	20000	3	59.3	
9	158644	20000	10000	20000	3	58.5	
10	149128	20000	10000	20000	3	59.3	
11	158454	20000	10000	20000	3	58.5	
14	3499999	20000	10000	10000	3	337.8	
15	100000	20000	10000	40000	3	208.4	
16	150043	20000	10000	20000	3	59.2	
17	200000	20000	10000	20000	3	64.7	
18	227059	10000	11403	20000	3	54.9	
19	100000	40000	10000	20000	3	68.0	
20	204755	20000	7433	20000	3	78.0	
21	100000	20000	20000	20000	3	128.7	
24	158644	20000	10000	20000	3	58.5	
25	158644	20000	10000	20000	3	58.5	
26	159390	20000	10000	20000	3	58.4	
27	149129	20000	10000	20000	3	59.3	
28	158644	20000	10000	20000	3	58.5	
29	158644	20000	10000	20000	3	58.5	
30	158644	20000	10000	20000	3	58.5	
31	158644	20000	10000	20000	3	58.5	
34	158644	20000	10000	20000	3	58.5	
35	158644	20000	10000	20000	3	58.5	
36	186462	20000	10000	20000	3	57.4	
37	133335	20000	10000	20000	3	60.1	
38	164372	20000	10000	20000	3	58.1	
39	153263	20000	10000	20000	3	58.9	
40	155118	20000	10000	20000	3	58.3	
41	161915	20000	10000	20000	3	58.7	
45	169674	20000	10000	20000	3	58.0	
46	145808	20000	10000	20000	3	59.1	
47	158804	20000	10000	20000	3	58.4	
48	157773	20000	10000	20000	3	58.7	
49	154145	20000	10000	20000	3	57.6	
50	162511	20000	10000	20000	3	59.4	
53	155166	20000	10000	20000	3	53.1	
54	161930	20000	10000	20000	3	65.2	
65	148654	20000	10000	20000	4	59.4	
66	148654	20000	10000	20000	4	59.4	
77	158644	20000	10000	20000	3	58.5	
78	158644	20000	10000	20000	3	58.5	
79	158644	20000	10000	20000	3	58.5	

0517 BOUSDEF (0517; 9437 lbf)

No.	AC	CTB	AS	Subgrade	Iter	%	Rigid Bottom
0	237771	20000	12245	2444	3	105.7	20
1	102492	20000	17606	7026	3	122.2	50
2	121488	20000	15716	9542	3	93.0	100
3	370576	20000	10000	12142	3	98.3	200
4	No Solution						500
5	340677	20000	10000	20000	3	60.8	
6	318860	20000	10000	20000	3	57.4	
7	215426	20000	12091	20000	3	43.2	
8	216423	20000	12045	20000	3	43.4	
9	340677	20000	10000	20000	3	60.8	
10	215557	20000	12093	20000	3	43.2	
11	336442	20000	10000	20000	3	60.2	
14	3499999	20000	10000	10000	3	356.3	
15	174855	20000	10000	40000	3	162.2	
16	225463	20000	11720	20000	3	44.7	
17	200000	20000	11723	20000	3	45.4	
18	290362	10000	15123	20000	3	36.1	
19	100000	40000	10389	20000	3	58.0	
20	186783	20000	10337	20000	3	65.3	
21	110487	20000	20000	20000	3	70.8	
24	340677	20000	10000	20000	3	60.8	
25	340677	20000	10000	20000	3	60.8	
26	272506	20000	11114	20000	3	48.7	
27	214713	20000	12085	20000	3	43.2	
28	340677	20000	10000	20000	3	60.8	
29	340677	20000	10000	20000	3	60.8	
30	340677	20000	10000	20000	3	60.8	
31	340677	20000	10000	20000	3	60.8	
34	340677	20000	10000	20000	3	60.8	
35	340677	20000	10000	20000	3	60.8	
36	367417	20000	10202	20000	3	56.9	
37	192467	20000	12003	20000	3	44.3	
38	331918	20000	10000	20000	3	57.9	
39	328014	20000	10000	20000	3	60.4	
40	333938	20000	10000	20000	3	58.4	
41	324345	20000	10000	20000	3	59.7	
45	336355	20000	10000	20000	3	57.4	
46	313650	20000	10000	20000	3	60.0	
47	340677	20000	10000	20000	3	60.8	
48	340677	20000	10000	20000	3	60.8	
49	321439	20000	10000	20000	3	66.3	
50	330022	20000	10000	20000	3	53.0	
53	340677	20000	10000	20000	3	60.8	
54	340677	20000	10000	20000	3	60.8	
65	210159	20000	12233	20000	6	42.7	
66	210159	20000	12233	20000	6	42.7	
77	340677	20000	10000	20000	3	60.8	
78	340677	20000	10000	20000	3	60.8	
79	340677	20000	10000	20000	3	60.8	

BOUSDEF (0517; 12237 lbf)

No.	AC	CTB	AS	Subgrade	Iter	%	Rigid Bottom
0	285861	20000	13606	2280	3	103.5	20
1	147151	20000	23286	6114	3	101.2	50
2	169252	20000	23061	9334	3	79.3	100
3	208177	20000	14315	12189	3	88.9	200
4	471491	20000	10701	14401	3	81.8	500
5	300051	20000	13477	20000	3	42.2	
6	300436	20000	13480	20000	3	42.1	
7	299679	20000	13476	20000	3	42.2	
8	300047	20000	13478	20000	3	42.2	
9	300048	20000	13478	20000	3	42.2	
10	299752	20000	13474	20000	3	42.2	
11	382040	20000	11724	20000	3	45.3	
14	3499999	20000	11599	10000	3	312.8	
15	260207	20000	10000	40000	3	149.4	
16	300464	20000	13572	20000	3	42.0	
17	200000	20000	14719	20000	3	47.2	
18	370170	10000	17585	20000	3	40.3	
19	297426	40000	10000	20000	3	58.3	
20	299977	20000	13479	20000	3	42.2	
21	178750	20000	20000	20000	3	61.5	
24	300051	20000	13477	20000	3	42.2	
25	300051	20000	13477	20000	3	42.2	
26	324235	20000	13001	20000	3	42.0	
27	300051	20000	13477	20000	3	42.2	
28	300051	20000	13477	20000	3	42.2	
29	300051	20000	13477	20000	3	42.2	
30	300051	20000	13477	20000	3	42.2	
31	300051	20000	13477	20000	3	42.2	
34	300051	20000	13477	20000	3	42.2	
35	300051	20000	13477	20000	3	42.2	
36	405279	20000	12388	20000	3	42.8	
37	266275	20000	13386	20000	3	42.8	
38	305521	20000	13457	20000	3	42.1	
39	294788	20000	13497	20000	3	42.3	
40	303168	20000	13243	20000	3	42.1	
41	297665	20000	13556	20000	3	42.3	
45	314840	20000	13522	20000	3	42.0	
46	282443	20000	13415	20000	3	42.5	
47	300051	20000	13477	20000	3	42.2	
48	300051	20000	13477	20000	3	42.2	
49	271496	20000	14165	20000	3	38.4	
50	334505	20000	12548	20000	3	47.2	
53	300051	20000	13477	20000	3	42.2	
54	300051	20000	13477	20000	3	42.2	
65	296394	20000	13519	20000	4	42.2	
66	296394	20000	13519	20000	4	42.2	
77	300051	20000	13477	20000	3	42.2	
78	300051	20000	13477	20000	3	42.2	
79	300051	20000	13477	20000	3	42.2	

BOUSDEF (0517; 15923 lbf)

No.	AC	CTB	AS	Subgrade	Iter	%	Rigid Bottom
0	346737	20000	22819	2078	3	69.0	20
1	342549	20000	27650	5220	3	76.6	50
2	354070	20000	26538	8834	3	65.7	100
3	339871	20000	24213	13093	3	52.7	200
4	366960	20000	20704	16569	3	42.7	500
5	386068	20000	17899	20000	3	34.5	
6	381871	20000	17908	20000	3	34.7	
7	388174	20000	17720	20000	3	35.0	
8	386296	20000	17849	20000	3	34.6	
9	391461	20000	17591	20000	3	35.3	
10	383792	20000	17871	20000	3	34.7	
11	394183	20000	17505	20000	3	35.4	
14	3499999	20000	18941	10000	3	290.6	
15	448074	20000	10000	40000	3	112.4	
16	383559	20000	17796	20000	3	35.1	
17	414049	20000	16709	20000	3	37.5	
18	448199	10000	24569	20000	3	34.8	
19	262576	40000	15255	20000	3	39.4	
20	387919	20000	17824	20000	3	34.5	
21	331012	20000	20000	20000	3	34.5	
24	386068	20000	17899	20000	3	34.5	
25	386068	20000	17899	20000	3	34.5	
26	509426	25918	21966	20000	3	64.6	
27	386068	20000	17899	20000	3	34.5	
28	386068	20000	17899	20000	3	34.5	
29	386068	20000	17899	20000	3	34.5	
30	386068	20000	17899	20000	3	34.5	
31	386068	20000	17899	20000	3	34.5	
34	386068	20000	17899	20000	3	34.5	
35	386068	20000	17899	20000	3	34.5	
36	440745	20000	17995	20000	3	34.3	
37	346538	20000	17428	20000	3	35.6	
38	391657	20000	17827	20000	3	34.5	
39	380708	20000	17968	20000	3	34.5	
40	388979	20000	17738	20000	3	34.5	
41	383316	20000	18043	20000	3	34.5	
45	405552	20000	17947	20000	3	34.3	
46	368804	20000	17431	20000	3	35.7	
47	386068	20000	17899	20000	3	34.5	
48	386068	20000	17899	20000	3	34.5	
49	353710	20000	18623	20000	3	32.2	
50	429062	20000	16625	20000	3	39.9	
53	386068	20000	17899	20000	3	34.5	
54	386068	20000	17899	20000	3	34.5	
65	380697	20000	17937	20000	4	34.7	
66	380697	20000	17937	20000	4	34.7	
77	386068	20000	17899	20000	3	34.5	
78	386068	20000	17899	20000	3	34.5	
79	386068	20000	17899	20000	3	34.5	

BOUSDEF (0517)

No.	K1	K2	K3	K4	R1^2	R2^2	Rigid Bottom
0	-----	-----	4777	-0.370	-----	0.41	20
1	-----	-----	306831	-1.695	-----	0.44	50
2	-----	-----	564	1.000	-----	0.11	100
3	No Solution						200
4	No Solution						500
5	1039	1.065	19999	0.000	0.96	1.00	
6	1026	1.069	19999	0.000	0.96	1.00	
7	1191	1.012	19988	0.000	0.98	1.00	
8	1166	1.021	19988	0.000	0.98	1.00	
9	1078	1.049	19997	0.000	0.96	1.00	
10	1171	1.019	19997	0.000	0.98	1.00	
11	1071	1.045	19998	0.000	0.94	1.00	
14	1375	1.025	10001	0.000	0.89	1.00	
15	10000	0.000	40014	0.000	1.00	1.00	
16	1158	1.023	19993	0.000	0.98	1.00	
17	1658	0.869	20001	0.000	0.96	1.00	
18	1025	1.177	19991	0.000	0.99	1.00	
19	1637	0.800	20002	0.000	0.76	1.00	
20	505	1.342	19993	0.000	0.99	1.00	
21	20006	0.000	20000	0.000	1.00	1.00	
24	1039	1.065	19999	0.000	0.96	1.00	
25	1039	1.065	19999	0.000	0.96	1.00	
26	510	1.396	19991	0.000	0.90	1.00	
27	1159	1.024	19998	0.000	0.98	1.00	
28	1039	1.065	19999	0.000	0.96	1.00	
29	1039	1.065	19999	0.000	0.96	1.00	
30	1039	1.065	19999	0.000	0.96	1.00	
31	1039	1.065	19999	0.000	0.96	1.00	
34	1039	1.065	19999	0.000	0.96	1.00	
35	1039	1.065	19999	0.000	0.96	1.00	
36	1069	1.051	19996	0.000	0.95	1.00	
37	1229	0.997	19998	0.000	0.98	1.00	
38	1052	1.060	20002	0.000	0.96	1.00	
39	1008	1.077	19999	0.000	0.96	1.00	
40	1088	1.034	19996	0.000	0.96	1.00	
41	975	1.101	19991	0.000	0.96	1.00	
45	1024	1.071	19997	0.000	0.96	1.00	
46	1083	1.045	20004	0.000	0.96	1.00	
47	1040	1.065	19996	0.000	0.96	1.00	
48	1035	1.067	19991	0.000	0.96	1.00	
49	952	1.122	19998	0.000	0.97	1.00	
50	1220	0.972	19986	0.000	0.94	1.00	
53	1024	1.071	19997	0.000	0.97	1.00	
54	1053	1.060	19998	0.000	0.96	1.00	
65	1171	1.020	19999	0.000	0.98	1.00	
66	1171	1.020	19999	0.000	0.98	1.00	
77	1039	1.065	19999	0.000	0.96	1.00	
78	1039	1.065	19999	0.000	0.96	1.00	
79	1039	1.065	19999	0.000	0.96	1.00	

BOUSDEF (2647; 5658 lbf)

No.	AC	CTB	AS	Subgrade	Itr	%	Rigid Bottom
0	3499999	986098	54936	5582	3	18.7	20
1	468888	1797949	125033	15012	3	45.7	50
2	100000	1115953	106890	25294	3	200.3	100
3	3499999	1976959	50519	36658	3	26.1	200
4	100000	1787627	45090	44982	3	178.3	500
5	3499999	20000	250000	64839	3	314.0	
6	3499999	20000	250000	67518	3	302.5	
7	100000	1999999	28061	52061	3	215.2	
8	3499999	20000	250000	75892	3	286.6	
9	456957	1312657	23627	59799	3	167.9	
10	494517	1999999	64752	48303	3	92.7	
11	100000	1683745	20872	63886	3	186.5	
14	100000	1787884	20416	61606	3	197.0	
15	100000	1544139	22643	65938	3	177.9	
16	3499999	20000	250000	64839	3	314.0	
17	3499999	20000	250000	64839	3	314.0	
18	3499999	20000	250000	80941	3	467.9	
19	3500006	1999999	11229	44385	3	266.6	
20	3499999	20000	250000	63145	3	322.3	
21	3499999	1495578	20000	70981	3	16.7	
24	3499999	20000	250000	64839	3	314.0	
25	3499999	20000	250000	64839	3	314.0	
26	1750001	20000	29804	60326	3	796.8	
27	7000008	46376	250000	44047	3	255.8	
28	709356	1000000	61005	45445	3	202.9	
29	100000	2020902	30417	49633	3	228.4	
30	100000	1748579	27836	56402	3	192.8	
31	3499999	20000	500000	58038	3	292.7	
34	3499999	101937	78625	60873	3	166.2	
35	100000	1819682	28462	53768	3	209.4	
36	3499999	20000	250000	75147	3	311.7	
37	3499999	20000	250000	60896	3	311.8	
38	3499999	20000	250000	78821	3	271.1	
39	100000	1891471	17989	57895	3	220.5	
40	3499999	20000	250000	68358	3	304.8	
41	3499999	20000	250000	67482	3	298.6	
45	3499999	20000	250000	66625	3	313.3	
46	3499999	20000	250000	63134	3	312.4	
47	3499999	20000	250000	67386	3	303.0	
48	3499999	20000	250000	63165	3	320.4	
49	3499999	20000	250000	59469	3	344.2	
50	3499999	20000	250000	74546	3	286.6	
53	3499999	20000	250000	71681	3	288.3	
54	100000	20000	29822	51689	3	1365.9	
65	325392	323720	70306	57544	6	219.2	
66	3499999	1525573	23508	66379	9	14.7	
77	3499999	20000	250000	64839	3	314.0	
78	3499999	20000	250000	64839	3	314.0	
79	3499999	20000	250000	64839	3	314.0	

8550 LB BOUSDEF (2647; 8550 lbf)

No.	AC	CTB	AS	Subgrade	Itr	%	Rigid Bottom
0	3499999	1117581	35119	6750	3	20.2	20
1	468370	1523995	103374	17074	3	40.0	50
2	100000	1040409	73234	28973	3	192.5	100
3	100000	1612898	39389	40344	3	180.8	200
4	3499999	1999999	10000	29818	3	467.7	500
5	2549190	77024	81138	70727	3	188.2	
6	2527066	71365	86100	71134	3	191.2	
7	2554824	97102	64832	69579	3	188.7	
8	2494375	70306	77629	71862	3	203.8	
9	388447	1172587	10000	142784	3	114.8	
10	460425	1753039	26667	77920	3	25.9	
11	100000	1276893	14167	80448	3	240.2	
14	100000	1372040	10052	93580	3	254.3	
15	2513349	73586	90704	70602	3	183.7	
16	2549190	77024	81138	70727	3	188.2	
17	2549190	77024	81138	70727	3	188.2	
18	2589154	163007	10000	72303	3	504.2	
19	2258477	187616	54336	70915	3	132.5	
20	3499999	20000	250000	60402	3	372.4	
21	3499999	1110474	20000	83170	3	12.6	
24	2549190	77024	81138	70727	3	188.2	
25	2549190	77024	81138	70727	3	188.2	
26	1749999	511197	10000	71773	3	357.1	
27	2505967	76802	82682	70770	3	187.6	
28	552746	1000000	22354	76183	3	125.4	
29	882230	192089	78601	46359	3	381.1	
30	100000	1325230	11384	89825	3	242.7	
31	100000	1334850	10817	91210	3	249.2	
34	3499999	984340	26851	75000	3	11.4	
35	100000	1350660	10675	91894	3	247.5	
36	2792532	74759	83260	70975	3	193.1	
37	100000	951873	18460	83032	3	221.0	
38	100000	1411685	14268	87316	3	213.9	
39	1980031	96850	70688	68208	3	203.0	
40	2476560	72730	83791	71418	3	193.3	
41	2592941	89736	69927	70221	3	186.3	
45	2667548	78271	78513	71044	3	188.9	
46	100000	981676	18995	82868	3	198.6	
47	2549190	77024	81138	70727	3	188.2	
48	2549190	77024	81138	70727	3	188.2	
49	10000	966883	17888	87576	3	215.2	
50	2776302	73488	87513	68152	3	183.9	
53	2549190	77024	81138	70727	3	188.2	
54	2549190	77024	81138	70727	3	188.2	
65	3061147	1003216	22034	81088	5	8.5	
66	3061147	1003216	22034	81088	5	8.5	
77	2549190	77024	81138	70727	3	188.2	
78	2549190	77024	81138	70727	3	188.2	
79	2549190	77024	81138	70727	3	188.2	

BOUSDEF (2647; 11154 lbf)

No.	AC	CTB	AS	Subgrade	Itr	%	Rigid Bottom
0	3499999	1059593	37675	6319	3	20.3	20
1	458963	1519195	104732	16334	3	40.3	50
2	100000	964762	82249	27532	3	193.6	100
3	100000	1428741	38588	40603	3	178.4	200
4	3499999	120326	116375	39041	3	271.0	500
5	2424327	117491	55523	65522	3	190.8	
6	100000	1350504	13142	78591	3	235.3	
7	100000	1298329	13624	79988	3	226.7	
8	100000	1396004	11450	83374	3	239.8	
9	463289	954923	20639	78386	3	131.1	
10	448922	1841503	28762	70045	3	33.6	
11	100000	1283210	15615	74210	3	230.4	
14	3499999	1014023	22083	73907	3	15.4	
15	2401714	65025	111610	67391	3	182.2	
16	2424327	117491	55523	65522	3	190.8	
17	2424327	117491	55523	65522	3	190.8	
18	1795729	79472	30884	67051	3	322.1	
19	2108586	240670	49158	65313	3	133.4	
20	3499999	20000	250000	57976	3	369.1	
21	3499999	1117668	20000	79512	3	12.0	
24	2424327	117491	55523	65522	3	190.8	
25	2424327	117491	55523	65522	3	190.8	
26	1750001	579113	10000	61559	3	389.4	
27	2372686	122044	53762	65556	3	191.6	
28	549355	1000000	23864	70288	3	130.8	
29	3499999	1761111	13443	67015	3	72.7	
30	100000	1377100	13482	77171	3	234.9	
31	2451016	95223	72608	66070	3	181.2	
34	100000	1259776	17490	75000	3	202.7	
35	100000	1406413	12381	79663	3	238.0	
36	2682029	100375	68129	65993	3	186.8	
37	2200175	157641	37600	64856	3	215.5	
38	100000	1402890	17122	76231	3	205.0	
39	1818434	213085	25004	62763	3	289.5	
40	2390691	92008	74419	66336	3	183.3	
41	2463099	162701	37407	64460	3	222.2	
45	2561236	111337	59117	65813	3	188.0	
46	100000	947911	23103	73417	3	190.3	
47	2424327	117491	55523	65522	3	190.8	
48	2424327	117491	55523	65522	3	190.8	
49	2220349	128450	48717	67223	3	200.7	
50	2665583	104752	65694	63105	3	182.7	
53	2424327	117491	55523	65522	3	190.8	
54	2424327	117491	55523	65522	3	190.8	
65	3260586	1047576	23662	74779	5	6.8	
66	3260586	1047576	23662	74779	5	6.8	
77	2424327	117491	55523	65522	3	190.8	
78	2424327	117491	55523	65522	3	190.8	
79	2424327	117491	55523	65522	3	190.8	

BOUSDEF (2647; 15020 lbf)

No.	AC	CTB	AS	Subgrade	Itr	%	Rigid Bottom
0	3499999	1117873	33255	6429	3	16.9	20
1	456420	1577054	96779	16220	3	35.5	50
2	100000	1022502	72948	27562	3	192.1	100
3	100000	1527873	40037	38874	3	178.3	200
4	100000	1425668	22760	54883	3	195.2	500
5	2382703	76456	70192	69109	3	201.3	
6	2358982	75100	69051	69197	3	206.7	
7	3499999	1052624	16301	83669	3	6.1	
8	2347716	76155	60594	69473	3	221.2	
9	451916	983538	19196	81439	3	121.6	
10	451694	1740911	24217	77207	3	26.6	
11	100000	1270408	11859	85157	3	233.0	
14	3499999	1050282	15940	85552	3	4.0	
15	2351462	71246	73289	68968	3	208.1	
16	2382703	76456	70192	69109	3	201.3	
17	2382703	76456	70192	69109	3	201.3	
18	3499999	10000	250000	93689	3	410.8	
19	2147000	174318	50710	69751	3	140.3	
20	3499999	1999999	5000	39299	3	515.6	
21	3499999	1114040	20000	78588	3	13.2	
24	2382703	76456	70192	69109	3	201.3	
25	2382703	76456	70192	69109	3	201.3	
26	1750001	246173	22536	72536	3	223.2	
27	2359896	74865	72833	68966	3	201.0	
28	547302	999999	22283	72811	3	121.6	
29	3499999	1507734	12652	76074	3	45.9	
30	2366206	84162	63209	68890	3	202.0	
31	2400180	70455	77824	69311	3	201.4	
34	2353846	71207	70473	69088	3	212.7	
35	3499999	1066344	16916	79815	3	14.7	
36	2601982	77094	69288	69080	3	206.9	
37	2692178	1117554	17465	79730	3	12.9	
38	3015092	82553	59227	69993	3	190.5	
39	1881095	76526	81748	67869	3	208.4	
40	2318503	75420	67457	69161	3	209.9	
41	2445685	79489	70565	68984	3	193.6	
45	2512615	76377	69071	69195	3	203.3	
46	2245212	75865	72243	68938	3	198.7	
47	2382703	76456	70192	69109	3	201.3	
48	2382703	76456	70192	69109	3	201.3	
49	2183321	78510	66644	71274	3	205.5	
50	2606482	73744	75994	66422	3	196.8	
53	2382703	76456	70192	69109	3	201.3	
54	2382703	76456	70192	69109	3	201.3	
65	3499999	1221160	12667	91354	6	14.2	
66	100000	1030489	20703	75880	9	191.2	
77	2382703	76456	70192	69109	3	201.3	
78	2382703	76456	70192	69109	3	201.3	
79	2382703	76456	70192	69109	3	201.3	

BOUSDEF (2647)

No.	K1	K2	K3	K4	R1^2	R2^2	Rigid Bottom
0	-----	-----	3373	0.338	-----	0.39	20
1	-----	-----	6705	0.372	-----	0.21	50
2	-----	-----	1547	1.000	-----	0.11	100
3	-----	-----	1166	1.000	-----	0.02	200
4	-----	-----	500	1.000	-----	0.00	500
5	7486225	-1.733	60761	0.045	0.43	0.21	
6	268210288	-3.146	58072	0.082	0.76	0.76	
7	355020	-1.044	33444	0.262	0.24	0.37	
8	499622624	-3.446	65171	0.054	0.78	0.24	
9	10373	0.204	16839	0.532	0.03	0.38	
10	977686	-1.251	21398	0.402	0.60	0.80	
11	97515	-0.644	33063	0.254	0.77	0.80	
14	213409	-1.074	16117	0.540	0.57	0.78	
15	2091	1.295	81178	-0.069	0.14	0.29	
16	7486225	-1.733	60761	0.045	0.43	0.21	
17	7486225	-1.733	60761	0.045	0.43	0.21	
18	331	2.234	106254	-0.131	0.58	0.12	
19	1995	1.250	15884	0.550	0.86	0.62	
20	11	3.788	142676	-0.451	0.72	0.98	
21	20001	0.000	56517	0.124	1.00	0.37	
24	7486225	-1.733	60761	0.045	0.43	0.21	
25	7486225	-1.733	60761	0.045	0.43	0.21	
26	55.08	0.502	42522	0.163	0.08	0.39	
27	5211614	-1.609	24888	0.397	0.57	0.81	
28	754137	-1.242	20044	0.416	0.50	0.80	
29	92	2.403	7996	0.757	0.83	0.90	
30	93366	-0.509	20624	0.416	0.02	0.71	
31	13795661824	-4.562	36651	0.259	0.34	0.89	
34	108593	-0.401	50593	0.123	0.09	0.57	
35	109501	-0.737	15733	0.509	0.25	0.71	
36	11515284	-1.858	90951	-0.111	0.55	0.67	
37	68384392	-3.029	40517	0.218	0.34	0.08	
38	1071106304	-3.735	73392	0.021	0.79	0.03	
39	494	1.714	105203	-0.189	0.40	0.22	
40	14075384	-1.919	69082	-0.002	0.65	0.01	
41	1151611	-1.072	69272	-0.010	0.12	0.01	
45	8282079	-1.769	64955	0.021	0.45	0.06	
46	148699792	-2.878	49635	0.136	0.71	0.69	
47	7486225	-1.733	67463	0.004	0.43	0.00	
48	7486225	-1.733	56657	0.073	0.43	0.37	
49	128276512	-2.967	37572	0.246	0.56	0.87	
50	7300577	-1.656	97148	-0.157	0.48	0.72	
53	7486225	-1.733	80018	-0.062	0.43	0.43	
54	30960	0.225	95321	-0.160	0.01	0.04	
65	83	2.607	19942	0.504	0.60	0.78	
66	26449	-0.071	63440	0.058	0.69	0.19	
77	7486225	-1.733	60761	0.045	0.43	0.21	
78	7486225	-1.733	60761	0.045	0.43	0.21	
79	7486225	-1.733	60761	0.045	0.43	0.21	

BOUSDEF (7452; 5566 lbf)

No.	AC	LCB	AS	Subgrade	Itr	%	Rigid Bottom
0	2540252	20000	14801	4081	3	124.2	20
1	2942634	20000	13541	10169	3	118.7	50
2	2914947	20000	10000	17333	3	110.5	100
3	100000	20000	10000	21168	3	321.5	200
4	100000	129636	10000	22618	3	158.3	500
5	100000	125003	10000	24978	3	169.4	
6	100000	20000	10000	27518	3	289.7	
7	100000	20000	10000	24545	3	182.1	
8	100000	126265	10000	25013	3	168.0	
9	100000	123825	10000	24942	3	170.8	
10	100000	128872	10000	25122	3	164.6	
11	100000	121463	10000	24808	3	174.6	
14	3499999	20000	10000	27429	3	114.1	
15	2123408	20000	10000	30954	3	83.7	
16	50000	20000	10000	27508	3	412.5	
17	200000	116781	10000	25139	3	152.6	
18	100000	87147	10000	21334	3	274.0	
19	100000	212836	10000	26293	3	128.1	
20	100000	142065	5000	37656	3	159.5	
21	100000	93553	20000	21425	3	203.5	
24	100000	125324	10000	24967	3	169.4	
25	100000	124558	10000	24999	3	169.3	
26	100000	24094	10000	31090	3	250.8	
27	100000	20000	10000	23717	3	341.0	
28	100000	125003	10000	24978	3	169.4	
29	100000	125003	10000	24978	3	169.4	
30	100000	125003	10000	24978	3	169.4	
31	100000	125003	10000	24978	3	169.4	
34	100000	124392	10000	25266	3	164.8	
35	100000	125668	10000	24609	3	175.6	
36	100000	125685	10000	25089	3	170.0	
37	100000	124043	10000	24873	3	168.9	
38	100000	135524	10000	25032	3	168.5	
39	100000	116188	10000	24934	3	170.2	
40	100000	124153	10000	24651	3	171.3	
41	100000	125828	10000	25321	3	167.5	
45	100000	126314	10000	25049	3	170.5	
46	100000	123539	10000	24880	3	168.4	
47	100000	127606	10000	24761	3	174.2	
48	100000	122028	10000	25218	3	163.8	
49	100000	121460	10000	25542	3	166.9	
50	100000	128898	10000	24330	3	172.7	
53	100000	119324	10000	26023	3	169.4	
54	100000	132341	10000	23633	3	169.6	
65	100000	20000	10000	27706	6	287.8	
66	100000	20000	10000	27561	9	289.3	
77	100000	125003	10000	24978	3	169.4	
78	100000	125003	10000	24978	3	169.4	
79	100000	125003	10000	24978	3	169.4	

BOUSDEF (7452; 8330 lbf)

No.	AC	LCB	AS	Subgrade	Itr	%	Rigid Bottom
0	3353460	20000	14008	3923	3	113.5	20
1	No Solution						50
2	No Solution						100
3	100000	20000	10000	23059	3	335.6	200
4	100000	142815	10000	23791	3	138.2	500
5	100000	133074	10000	28001	3	159.4	
6	100000	20000	10000	31160	3	295.7	
7	100000	125186	10000	27668	3	169.4	
8	523882	83545	10000	32284	3	90.4	
9	100000	132128	10000	27983	3	160.3	
10	3499999	20000	10000	31229	3	84.0	
11	100000	129686	10000	27883	3	163.3	
14	100000	20000	10000	30908	3	297.9	
15	100000	20000	250000	27004	3	214.9	
16	50000	20000	10000	31201	3	421.1	
17	200000	127196	10000	27835	3	143.4	
18	100000	10000	10000	38738	3	423.7	
19	100000	187763	10000	29198	3	124.5	
20	100000	20000	6425	37324	3	347.3	
21	100000	101839	20000	23428	3	194.4	
24	100000	133408	10000	27997	3	159.3	
25	100000	132613	10000	28014	3	159.5	
26	1750001	34520	10000	32509	3	78.1	
27	100000	20000	10000	26327	3	352.4	
28	100000	133074	10000	28001	3	159.4	
29	100000	133074	10000	28001	3	159.4	
30	100000	133073	10000	28001	3	159.4	
31	100000	133073	10000	28001	3	159.4	
34	100000	132328	10000	28357	3	154.7	
35	100000	133919	10000	27509	3	166.4	
36	3499999	39979	13615	33897	3	129.2	
37	100000	132664	10000	27826	3	159.3	
38	100000	144199	10000	28118	3	158.1	
39	100000	123769	10000	27895	3	160.7	
40	100000	132001	10000	27599	3	161.5	
41	100000	134125	10000	28424	3	157.4	
45	100000	134264	10000	28116	3	160.3	
46	100000	131793	10000	27849	3	158.6	
47	100000	133074	10000	28001	3	159.4	
48	100000	133074	10000	28001	3	159.4	
49	100000	129490	10000	28883	3	163.6	
50	100000	136453	10000	26947	3	154.2	
53	100000	133074	10000	28001	3	159.4	
54	100000	133074	10000	28001	3	159.4	
65	100000	20000	10000	31049	6	296.7	
66	3499999	21847	10000	32197	9	83.7	
77	100000	133074	10000	28001	3	159.4	
78	100000	133074	10000	28001	3	159.4	
79	100000	133074	10000	28001	3	159.4	

BOUSDEF (7452; 10934 lbf)

No.	AC	CTB	AS	Subgrade	Itr	%	Rigid Bottom
0	100000	20000	19239	3561	3	471.5	20
1	100000	20000	27873	8400	3	366.5	50
2	3499995	25484	17481	14689	3	84.4	100
3	3500002	28872	10000	22560	3	75.0	200
4	3499999	22303	10000	27920	3	64.1	500
5	100000	20000	10000	33315	3	313.1	
6	1168259	157335	10000	31821	3	91.9	
7	100000	141825	10000	28471	3	158.3	
8	440211	116314	10000	30057	3	88.3	
9	100000	149356	10000	28711	3	150.6	
10	100000	20000	10000	33463	3	312.9	
11	100000	20000	10000	33348	3	44.7	
14	100000	20000	10000	33098	3	313.5	
15	100000	20000	10000	33381	3	313.0	
16	3499999	20000	10000	33540	3	54.3	
17	200000	147807	10000	28138	3	136.9	
18	3499999	40303	10000	31596	3	84.4	
19	100000	40000	10000	28644	3	293.0	
20	150223	562112	5000	41355	3	88.5	
21	100000	117191	20000	23650	3	178.7	
24	100000	20000	10000	33304	3	313.1	
25	100000	20000	10000	33335	3	313.1	
26	1750001	51572	10000	31983	3	65.2	
27	100000	20000	10000	27281	3	359.0	
28	100000	20000	10000	33315	3	313.1	
29	100000	20000	10000	33315	3	313.1	
30	100000	20000	10000	33315	3	313.1	
31	100000	20000	10000	33315	3	313.1	
34	100000	20000	10000	33429	3	312.9	
35	No Solution						
36	100000	20000	10000	34906	3	322.9	
37	100000	20000	10000	31920	3	308.1	
38	100000	20000	10000	33265	3	315.6	
39	100000	20000	10000	33358	3	310.7	
40	100000	20000	10000	32732	3	309.8	
41	100000	20000	10000	33927	3	316.4	
45	100000	20000	10000	33833	3	316.7	
46	100000	20000	10000	32669	3	308.8	
47	100000	20000	10000	33315	3	313.1	
48	100000	20000	10000	33315	3	313.1	
49	100000	20000	10000	33982	3	309.4	
50	100000	20000	10000	32363	3	319.7	
53	100000	20000	10000	33315	3	313.1	
54	100000	20000	10000	33315	3	313.1	
65	100000	20000	10000	33295	3	313.2	
66	3499999	41197	10000	31292	9	85.7	
77	100000	20000	10000	33315	3	313.1	
78	100000	20000	10000	33315	3	313.1	
79	100000	20000	10000	33315	3	313.1	

BOUSDEF (7452; 14578 lbf)

No.	AC	CTB	AS	Subgrade	Itr	%	Rigid Bottom
0	100000	20000	27012	3222	3	470.5	20
1	3499999	57571	17694	7977	3	88.4	50
2	685003	247270	25992	13247	3	85.0	100
3	656111	280923	19712	18074	3	71.6	200
4	626853	260332	14215	24878	3	70.5	500
5	812645	225341	10000	31890	3	66.0	
6	2152230	78252	10000	30880	3	54.5	
7	3500002	22851	10000	33807	3	49.4	
8	388385	145906	10000	30053	3	91.6	
9	3499995	22550	10000	33923	3	49.6	
10	100000	22607	10000	33932	3	323.6	
11	3500002	37114	10000	31703	3	49.0	
14	2081462	75774	10000	31648	3	50.7	
15	100000	22706	10000	33883	3	322.7	
16	270956	316683	10000	32944	3	65.3	
17	3500002	22457	10000	33972	3	49.6	
18	847856	225211	10000	31414	3	67.7	
19	3499999	40000	10000	29970	3	60.3	
20	692075	268612	10019	31468	3	63.6	
21	100000	20000	20000	27582	3	272.2	
24	814329	225435	10000	31856	3	66.1	
25	1500998	165461	10000	31250	3	78.9	
26	1749999	73502	10000	31053	3	53.8	
27	817511	224795	10000	31843	3	66.1	
28	612010	238659	10000	31801	3	59.5	
29	812645	225341	10000	31890	3	66.0	
30	812633	225343	10000	31890	3	66.0	
31	812647	225340	10000	31891	3	66.0	
34	804603	227261	10000	31966	3	66.7	
35	No Solution						
36	831778	243319	10000	31792	3	60.9	
37	3499995	30461	10000	32017	3	51.2	
38	647304	265946	10000	32817	3	63.4	
39	3499995	35203	10000	31911	3	48.1	
40	596571	235185	10000	31452	3	60.7	
41	789911	232868	10000	32293	3	65.8	
45	825363	224797	10000	31982	3	64.7	
46	823953	211321	10000	31510	3	65.4	
47	812645	225341	10000	31890	3	66.0	
48	812645	225341	10000	31890	3	66.0	
49	3499999	96852	10000	31428	3	110.2	
50	631953	245350	10000	31613	3	64.0	
53	812645	225341	10000	31890	3	66.0	
54	812645	225341	10000	31890	3	66.0	
65	100000	22942	10000	33882	6	321.0	
66	2940731	44445	10000	31739	9	45.8	
77	812645	225341	10000	31890	3	66.0	
78	812645	225341	10000	31890	3	66.0	
79	812645	225341	10000	31890	3	66.0	

BOUSDEF (7452)

No.	K1	K2	K3	K4	R1^2	R2^2	Rigid Bottom
0	-----	-----	5820	-0.224	-----	0.94	20
1	-----	-----	149889	-1.239	-----	0.67	50
2	-----	-----	901	1.000	-----	0.11	100
3	-----	-----	319	1.000	-----	0.00	200
4	-----	-----	669	1.000	-----	0.00	500
5	10000	0.000	7715	0.446	1.00	0.95	
6	9999	0.000	13306	0.292	1.00	0.49	
7	10000	0.000	24145	0.057	1.00	0.01	
8	10000	0.000	17642	0.174	1.00	0.21	
9	10000	0.000	24890	0.050	1.00	0.01	
10	10000	0.000	20418	0.140	1.00	0.35	
11	10000	0.000	12819	0.285	1.00	0.42	
14	10000	0.000	20945	0.138	1.00	0.95	
15	2495	0.788	22633	0.116	0.14	0.73	
16	10000	0.000	27455	0.044	1.00	0.04	
17	10001	0.000	21692	0.098	1.00	0.04	
18	10000	0.000	8421	0.454	1.00	0.37	
19	971	0.723	23732	0.140	0.23	0.08	
20	20001	0.000	11128	0.267	1.00	0.92	
21	10000	0.000	7716	0.446	1.00	0.95	
24	10000	0.000	8391	0.423	1.00	0.83	
25	10001	0.000	42022	-0.106	1.00	0.68	
26	9999	0.000	9797	0.343	1.00	0.58	
27	9999	0.000	1984	0.432	1.00	0.97	
28	10000	0.000	7715	0.446	1.00	0.95	
29	9999	0.000	7715	0.446	1.00	0.95	
30	9999	0.000	7716	0.446	1.00	0.95	
31	9999	0.000	8067	0.433	1.00	0.96	
34	N/A						
35	N/A						
36	21568	-0.275	23925	0.093	0.79	0.08	
37	10001	0.000	16202	0.203	1.00	0.25	
38	10000	0.000	7683	0.448	1.00	0.96	
39	10000	0.000	13125	0.278	1.00	0.40	
40	10000	0.000	7969	0.425	1.00	0.97	
41	10000	0.000	7739	0.453	1.00	0.96	
45	10000	0.000	7468	0.458	1.00	0.95	
46	10000	0.000	8102	0.429	1.00	0.94	
47	10000	0.000	7436	0.458	1.00	0.96	
48	10000	0.000	8039	0.433	1.00	0.94	
49	10000	0.000	13000	0.285	1.00	0.52	
50	10000	0.000	7499	0.448	1.00	0.95	
53	10000	0.000	9183	0.391	1.00	0.91	
54	10000	0.000	6056	0.523	1.00	0.97	
65	10000	0.000	15279	0.231	1.00	0.95	
66	10000	0.000	43048	-0.134	1.00	0.15	
77	10000	0.000	7715	0.446	1.00	0.95	
78	10000	0.000	7715	0.446	1.00	0.95	
79	10000	0.000	7715	0.446	1.00	0.95	

BOUSDEF (7454; 6266 lbf)

No.	AC	AB	Subgrade	Iter	%	Rigid Bottom
0	1960400	67877	12676	3	56.6	20
1	1901624	73579	28436	3	44.4	50
2	2554115	44859	53130	3	22.1	100
3	370984	57465	60071	3	133.0	200
4	395613	46684	72615	3	172.1	500
5	536758	33128	1000	3	28724.2	
6	533344	33027	1000	3	28750.1	
7	536965	33133	1000	3	28722.7	
8	1204204	45550	5297	3	6179.6	
9	1065054	42763	5288	3	6292.7	
14	539917	33219	1000	3	28700.5	
15	578848	28740	1000	3	29051.0	
16	773212	47518	1000	3	26574.1	
17	934082	29415	1000	3	27744.9	
18	536758	33128	1000	3	28724.2	
19	445115	39496	85494	3	181.8	
24	536758	33128	500	3	49971.7	
25	536758	33128	2000	3	16088.2	
26	1750001	37339	100313	3	71.2	
27	461588	28609	1000	3	29608.8	
28	575660	28786	1000	3	29058.9	
29	526753	34549	1000	3	28615.9	
34	1150945	35154	4736	3	7078.8	
35	3262796	20121	150625	3	9.5	
36	436712	47360	82658	3	173.3	
37	498418	31518	1000	3	28728.0	
38	530072	31933	1000	3	29378.0	
39	543053	34257	1000	3	28092.0	
45	417307	43781	83620	3	180.2	
46	519092	32461	1000	3	28725.5	
47	531102	33393	1000	3	28849.8	
48	415412	44232	82470	3	176.1	
53	532175	33614	1000	3	28896.1	
54	411575	44592	77016	3	182.6	
65	3499999	31421	61880	6	277.3	
66	2145642	34955	101895	9	61.2	
77	536758	33128	1000	3	28724.2	
78	536758	33128	1000	3	28724.2	
79	536758	33128	1000	3	28724.2	

BOUSDEF (7454; 8974 lbf)

No.	AC	AB	Subgrade	Iter	%	Rigid Bottom
0	2359028	59251	11758	3	52.0	20
1	2379253	61816	27203	3	39.5	50
2	3009522	40550	49347	3	19.0	100
3	3499999	26423	79869	3	9.1	200
4	409286	49765	69236	3	158.0	500
5	531965	31808	1000	3	28011.6	
6	584017	27567	1000	3	28297.7	
7	532408	31820	1000	3	28008.3	
8	1276339	41354	5288	3	6090.9	
9	1128592	38779	5275	3	6213.7	
14	535516	31908	1000	3	27984.4	
15	575287	27494	1000	3	28344.8	
16	745937	44884	1000	3	25968.6	
17	930067	28190	1000	3	27006.7	
18	531965	31808	1000	3	28011.6	
19	457245	38298	89731	3	173.8	
24	531965	31808	500	3	48515.5	
25	531965	31808	2000	3	15768.4	
26	1750001	34720	102924	3	76.2	
27	456399	27387	1000	3	28923.7	
28	569905	27508	1000	3	28366.4	
29	522324	33193	1000	3	27899.8	
34	1136863	33320	4722	3	6991.4	
35	3276175	18501	159855	3	7.8	
36	435937	44004	84937	3	177.7	
37	494647	30238	1000	3	28013.1	
38	524886	30666	1000	3	28672.1	
39	538705	32887	1000	3	27374.5	
45	546465	32304	1000	3	28009.0	
46	514772	31154	1000	3	28012.4	
47	523484	32247	1000	3	28131.3	
48	415656	42328	81231	3	180.6	
53	531965	31808	1000	3	28011.6	
54	531965	31808	1000	3	28011.6	
65	3499999	28466	63157	6	278.0	
66	2167602	32162	105005	9	61.7	
77	531965	31808	1000	3	28011.6	
78	531965	31808	1000	3	28011.6	
79	531965	31808	1000	3	28011.6	

BOUSDEF (7454; 11542 lbf)

No.	AC	AB	Subgrade	Iter	%	Rigid Bottom
0	2243455	59638	11511	3	50.2	20
1	2267909	62277	26655	3	38.2	50
2	2944815	40138	48535	3	21.0	100
3	3497943	25613	79436	3	11.8	200
4	398167	48660	66632	3	168.3	500
5	521264	30979	1000	3	27879.2	
6	573445	26764	1000	3	28167.9	
7	521727	30991	1000	3	27875.7	
8	1227418	40265	5289	3	6058.6	
9	1087829	37325	5275	3	6188.4	
14	525143	31089	1000	3	27848.9	
15	564815	26671	1000	3	28217.6	
16	720287	43282	1000	3	25927.5	
17	912324	27465	1000	3	26880.6	
18	521264	30979	1000	3	27879.2	
19	453749	38092	88444	3	174.2	
24	521264	30979	500	3	48335.0	
25	521264	30979	2000	3	15677.3	
26	1750001	33546	102764	3	76.5	
27	462660	18192	1000	3	30067.1	
28	559006	26680	1000	3	28242.0	
29	511920	32354	1000	3	27765.2	
34	1110600	32062	4722	3	6956.4	
35	3170375	18278	157531	3	9.7	
36	424883	42869	83341	3	184.6	
37	485871	29447	1000	3	27875.1	
38	514443	29851	1000	3	28532.2	
39	527775	32045	1000	3	27248.9	
45	535021	31469	1000	3	27877.8	
46	504969	30333	1000	3	27878.3	
47	513315	31410	1000	3	27999.3	
48	406258	41204	79739	3	187.4	
53	521264	30979	1000	3	27879.2	
54	521264	30979	1000	3	27879.2	
65	3499999	27512	62873	6	277.4	
66	2064832	31867	103665	9	65.6	
77	521264	30979	1000	3	27879.2	
78	521264	30979	1000	3	27879.2	
79	521264	30979	1000	3	27879.2	

BOUSDEF (7454; 15158 lbf)

No.	AC	AB	Subgrade	Iter	%	Rigid Bottom
0	2099244	60073	11737	3	44.2	20
1	2143422	62033	27214	3	31.9	50
2	2884092	38618	50384	3	15.8	100
3	3481204	23734	85871	3	10.2	200
4	392394	45680	65221	3	182.7	500
5	515136	31010	1000	3	29157.0	
6	511722	30908	1000	3	29185.3	
7	515656	31025	1000	3	29152.9	
8	1136667	41622	5304	3	6314.5	
9	1039730	31311	5273	3	6609.4	
14	517719	31085	1000	3	29136.1	
15	561481	26723	1000	3	29486.3	
16	713081	43269	1000	3	27153.2	
17	896453	27548	1000	3	28144.3	
18	515136	31010	1000	3	29157.0	
19	459724	37189	93075	3	178.8	
24	515136	31010	500	3	50654.2	
25	515136	31010	2000	3	16358.3	
26	1750001	31306	109983	3	82.4	
27	458415	18149	1000	3	31400.8	
28	554316	26718	1000	3	29519.4	
29	505015	32355	1000	3	29047.7	
34	1085925	32074	4735	3	7242.8	
35	400298	36158	84758	3	213.6	
36	562945	32669	1000	3	29122.9	
37	480629	29514	1000	3	29146.2	
38	508833	29889	1000	3	29824.8	
39	521148	32070	1000	3	28511.3	
45	528551	31492	1000	3	29157.3	
46	499225	30378	1000	3	29153.7	
47	506700	31454	1000	3	29290.7	
48	523060	30369	1000	3	28911.8	
53	515136	31010	1000	3	29157.0	
54	515136	31010	1000	3	29157.0	
65	3499999	26676	63734	6	299.0	
66	1974527	30517	109663	9	74.3	
77	515136	31010	1000	3	29157.0	
78	515136	31010	1000	3	29157.0	
79	515136	31010	1000	3	29157.0	

BOUSDEF (7454)

No.	K1	K2	K3	K4	R1^2	R2^2	Rigid Bottom
0	----	----	16179	-0.153	---	0.49	20
1	----	----	44274	-0.216	---	0.45	50
2	----	----	613799	-0.939	---	0.25	100
3	----	----	2849	1.000	---	0.02	200
4	----	----	1070	1.000	---	0.01	500
5	40703	-0.093	1000	0.000	0.86	1.00	
6	35316	-0.068	1000	0.000	0.05	1.00	
7	40673	-0.092	1000	0.000	0.87	1.00	
8	57407	-0.122	5259	0.004	0.49	1.00	
9	116300	-0.448	5339	-0.007	0.92	1.00	
14	40844	-0.093	1000	0.000	0.87	1.00	
15	36050	-0.104	1000	0.000	0.87	1.00	
16	63521	-0.130	1000	0.000	0.88	1.00	
17	35725	-0.095	1000	0.000	0.84	1.00	
18	40703	-0.093	1000	0.000	0.86	1.00	
19	47376	-0.077	66241	0.103	0.96	0.84	
24	40703	-0.093	500	0.000	0.86	1.00	
25	40703	-0.093	2000	0.000	0.86	1.00	
26	63901	-0.264	75962	0.115	0.99	0.84	
27	192137	-0.814	1000	0.000	0.70	1.00	
28	36272	-0.106	1000	0.000	0.87	1.00	
29	42402	-0.091	1000	0.000	0.88	1.00	
34	46331	-0.134	4731	0.000	0.89	1.00	
35	8009	0.463	958491	-0.691	0.87	0.52	
36	162939	-0.486	6	3.494	0.67	0.89	
37	38665	-0.093	1000	0.000	0.85	1.00	
38	39250	-0.092	1000	0.000	0.87	1.00	
39	42078	-0.093	1000	0.000	0.88	1.00	
45	118675	-0.453	1	4.658	0.58	0.99	
46	39907	-0.093	1000	0.000	0.86	1.00	
47	40234	-0.085	1000	0.000	0.89	1.00	
48	150808	-0.476	5	3.579	0.57	0.89	
53	43020	-0.112	1000	0.000	0.84	1.00	
54	133264	-0.500	1	4.700	0.56	0.99	
65	50173	-0.271	56852	0.042	0.92	0.77	
66	49849	-0.188	82660	0.089	0.92	0.77	
77	40703	-0.093	1000	0.000	0.86	1.00	
78	40703	-0.093	1000	0.000	0.86	1.00	
79	40703	-0.093	1000	0.000	0.86	1.00	

BOUSDEF (8153; 5532 lbf)

No.	AC	AB	AS	Subgrade	Iter	%	Rigid Bottom
0	518822	10000	96315	1381	3	45.0	20
1	423050	10000	234829	3420	3	53.0	50
2	489693	10000	151885	6182	3	38.8	100
3	610832	10000	91808	9101	3	26.4	200
4	444400	250000	10000	10258	3	77.9	500
5	1037012	12200	26669	13656	3	6.3	
6	1000908	14794	23399	13674	3	5.0	
7	971866	24261	15692	13717	3	12.3	
8	1048376	10955	28801	13654	3	7.6	
9	1044578	11893	27139	13683	3	6.1	
10	1044863	11674	27458	13667	3	6.6	
11	1035424	10890	29273	13661	3	7.1	
14	1528477	15228	25712	13008	3	34.2	
15	1025699	10000	32500	13504	3	9.1	
16	1032060	12460	26669	13654	3	6.0	
17	1041340	11851	12460	13647	3	6.7	
18	1033905	12076	11851	13647	3	5.9	
19	907021	20000	12076	13759	3	7.2	
20	1054812	10488	20000	13697	3	6.7	
21	905936	20268	10488	13831	3	7.8	
24	1031089	12136	20268	13845	3	7.2	
25	1050207	11305	12136	13550	3	8.4	
26	1037012	12200	11305	13656	3	6.3	
27	1037012	12200	26669	13656	3	6.3	
28	1037012	12200	26669	13656	3	6.3	
29	1037012	12200	26669	13656	3	6.3	
30	1037012	12200	26669	13656	3	6.3	
31	1037012	12200	26669	13656	3	6.3	
34	1037012	12200	26669	13656	3	6.3	
35	1037012	12200	26669	13656	3	6.3	
36	1163428	13764	25061	13658	3	5.1	
37	927900	11060	28077	13662	3	7.7	
38	1045914	12118	26287	13656	3	6.3	
39	1023617	12458	26868	13659	3	5.9	
40	1037468	12407	26790	13652	3	6.5	
41	1035215	12079	26455	13662	3	5.9	
45	1075946	12830	25961	13659	3	5.5	
46	984458	11560	27515	13657	3	7.0	
47	1019804	11598	28014	13698	3	8.0	
48	1052166	12979	25092	13619	3	5.1	
49	1026066	11045	29451	13702	3	7.9	
50	1051901	13048	24690	13624	3	5.0	
53	987550	15529	20606	14310	3	5.4	
54	1038113	10000	36077	12878	3	12.1	
65	1037012	12200	26669	13656	3	6.3	
66	1037012	12200	26669	13656	3	6.3	
77	1037012	12200	26669	13656	3	6.3	
78	1037012	12200	26669	13656	3	6.3	
79	1037012	12200	26669	13656	3	6.3	

BOUSDEF (8153; 8062 lbf)

No.	AC	AB	AS	Subgrade	Iter	%	Rigid Bottom
0	658675	10000	74745	1341	3	40.6	20
1	534892	250000	45166	2790	3	101.2	50
2	555334	10000	140393	5904	3	36.5	100
3	607571	250000	10000	7990	3	74.0	200
4	1090510	10000	38440	11094	3	15.6	500
5	872160	25976	16197	14267	3	6.4	
6	851470	26834	16063	14279	3	6.5	
7	870350	25961	16214	14262	3	6.2	
8	870786	25950	16232	14256	3	6.1	
9	862697	26645	16043	14268	3	6.3	
10	865232	26487	16078	14260	3	6.1	
11	873545	25888	16210	14268	3	6.4	
14	1351432	18417	21362	13620	3	26.6	
15	873538	25532	16486	14148	3	3.9	
16	872033	25997	16192	14267	3	6.4	
17	871057	25989	16203	14260	3	6.2	
18	873295	25794	16282	14265	3	6.6	
19	869174	26286	16101	14269	3	6.3	
20	864801	26610	16034	14271	3	6.4	
21	976950	17710	20000	14123	3	5.5	
24	867418	26494	15881	14437	3	10.7	
25	868779	26061	16331	14133	3	3.6	
26	872160	25976	16197	14267	3	6.4	
27	872160	25976	16197	14267	3	6.4	
28	872160	25976	16197	14267	3	6.4	
29	872160	25976	16197	14267	3	6.4	
30	872160	25976	16197	14267	3	6.4	
31	872160	25976	16197	14267	3	6.4	
34	872160	25976	16197	14267	3	6.4	
35	872160	25976	16197	14267	3	6.4	
36	979722	27561	15943	14275	3	6.6	
37	783130	24437	16482	14258	3	6.3	
38	878308	26699	16127	14270	3	6.4	
39	863057	25537	16206	14266	3	6.4	
40	870932	26146	16134	14269	3	6.5	
41	870871	25983	16209	14268	3	6.3	
45	907951	26518	16095	14271	3	6.4	
46	829134	25283	16320	14252	3	6.3	
47	872160	25976	16197	14267	3	6.4	
48	872160	25976	16197	14267	3	6.4	
49	8123793	25917	15903	14698	3	6.1	
50	930346	25822	16520	13746	3	6.6	
53	872160	25976	16197	14267	3	6.4	
54	872160	25976	16197	14267	3	6.4	
65	872160	25976	16197	14267	3	6.4	
66	872160	25976	16197	14267	3	6.4	
77	872160	25976	16197	14267	3	6.4	
78	872160	25976	16197	14267	3	6.4	
79	872160	25976	16197	14267	3	6.4	

BOUSDEF (8153; 10602 lbf)

No.	AC	AB	AS	Subgrade	Iter	%	Rigid Bottom
0	724836	10000	83997	1296	3	35.9	20
1	603900	250000	42712	2819	3	91.9	50
2	704535	250000	29169	5180	3	81.1	100
3	826545	250000	10000	7989	3	74.4	200
4	1210181	10000	44043	10973	3	16.7	500
5	910514	31716	16925	14128	3	6.4	
6	875662	47191	15257	14189	3	17.0	
7	910038	31470	17024	14119	3	6.2	
8	910487	31367	17032	14118	3	6.1	
9	903888	31877	16941	14128	3	6.3	
10	906290	31814	16934	14124	3	6.2	
11	915586	31431	16959	14128	3	6.4	
14	1175209	23279	25396	13379	3	27.3	
15	917031	30623	17358	14001	3	3.6	
16	910839	31694	16936	14127	3	6.4	
17	912769	31371	17004	14120	3	6.1	
18	913916	31267	17032	14127	3	6.4	
19	901943	32285	16853	14116	3	6.0	
20	906547	31871	16905	14133	3	6.4	
21	1022452	22647	20000	13995	3	5.6	
24	904495	32377	16583	14300	3	10.7	
25	911216	31272	17204	13997	3	3.5	
26	910514	31716	16925	14128	3	6.4	
27	910514	31716	16925	14128	3	6.4	
28	910514	31716	16925	14128	3	6.4	
29	910514	31716	16925	14128	3	6.4	
30	910514	31716	16925	14128	3	6.4	
31	910514	31716	16925	14128	3	6.4	
34	910514	31716	16925	14128	3	6.4	
35	910514	31716	16925	14128	3	6.4	
36	1017276	33906	16680	14136	3	6.7	
37	821184	29703	17193	14119	3	6.2	
38	917888	32661	16937	14129	3	6.5	
39	904238	30814	16927	14127	3	6.3	
40	910226	31777	16925	14131	3	6.4	
41	909793	31723	16914	14126	3	6.4	
45	947029	32426	16831	14131	3	6.5	
46	866591	30837	17038	14124	3	6.3	
47	910514	31716	16925	14128	3	6.4	
48	910514	31716	16925	14128	3	6.4	
49	860143	31660	16584	14543	3	6.1	
50	971472	31505	17299	13625	3	6.6	
53	910514	31716	16925	14128	3	6.4	
54	910514	31716	16925	14128	3	6.4	
65	910514	31716	16925	14128	3	6.4	
66	910514	31716	16925	14128	3	6.4	
77	910514	31716	16925	14128	3	6.4	
78	910514	31716	16925	14128	3	6.4	
79	910514	31716	16925	14128	3	6.4	

BOUSDEF (8153; 14162 lbf)

No.	AC	AB	AS	Subgrade	Iter	%	Rigid Bottom
0	793239	10000	103775	1276	3	30.8	20
1	696570	250000	42416	2878	3	81.0	50
2	835423	250000	28857	5272	3	75.3	100
3	1238047	181580	10982	8275	3	68.9	200
4	1381307	10000	52929	11148	3	19.2	500
5	920405	41203	18748	14318	3	6.0	
6	850923	56167	17623	14380	3	14.1	
7	930429	40569	18821	14316	3	6.1	
8	925127	40900	18775	14316	3	5.9	
9	923335	40914	18790	14332	3	6.5	
10	924759	40860	18769	14332	3	6.4	
11	928924	40432	18850	14332	3	6.1	
14	764348	42529	32130	13450	3	30.3	
15	941440	39156	19198	14216	3	3.8	
16	919378	41288	18740	14316	3	5.9	
17	922101	41146	18748	14311	3	5.8	
18	928808	40437	18867	14323	3	6.3	
19	927149	40646	18788	14325	3	6.1	
20	929323	40671	18772	14334	3	6.5	
21	989226	35163	20000	14262	3	6.0	
24	906386	42707	18335	14470	3	9.8	
25	932755	39967	19077	14207	3	3.7	
26	920405	41203	18748	14318	3	6.0	
27	920405	41203	18748	14318	3	6.0	
28	920405	41203	18748	14318	3	6.0	
29	920405	41203	18748	14318	3	6.0	
30	920405	41203	18748	14318	3	6.0	
31	920405	41203	18748	14318	3	6.0	
34	920405	41203	18748	14318	3	6.0	
35	920405	41203	18748	14318	3	6.0	
36	1019786	43641	18625	14328	3	6.2	
37	837741	38723	18907	14309	3	5.9	
38	924121	42612	18860	14318	3	6.0	
39	917780	39836	18649	14317	3	6.0	
40	919293	41395	18798	14318	3	5.9	
41	922445	40984	18692	14318	3	6.0	
45	954818	42032	18690	14321	3	6.0	
46	881646	39939	18838	14313	3	5.9	
47	920405	41203	18748	14318	3	6.0	
48	920405	41203	18748	14318	3	6.0	
49	874033	40840	18376	14723	3	5.9	
50	981107	40920	19195	13822	3	6.1	
53	920405	41203	18748	14318	3	6.0	
54	920405	41203	18748	14318	3	6.0	
65	920405	41203	18748	14318	3	6.0	
66	920405	41203	18748	14318	3	6.0	
77	920405	41203	18748	14318	3	6.0	
78	920405	41203	18748	14318	3	6.0	
79	920405	41203	18748	14318	3	6.0	

BOUSDEF (8153)

No.	K1	K2	K3	K4	R1^2	R2^2	Rigid Bottom
0	-----	-----	2232	-0.298	-----	0.96	20
1	-----	-----	65919	-1.401	-----	0.40	50
2	-----	-----	358	1.000	-----	0.10	100
3	-----	-----	148	1.000	-----	0.00	200
4	-----	-----	279	1.000	-----	0.02	500
5	49196	-0.402	12258	0.065	0.27	0.76	
6	40429	-0.352	12195	0.067	0.31	0.78	
7	10088	0.224	12266	0.064	0.92	0.71	
8	62379	-0.493	12277	0.064	0.30	0.80	
9	51018	-0.416	12312	0.063	0.27	0.76	
10	53256	-0.433	12265	0.064	0.27	0.76	
11	64204	-0.504	12285	0.064	0.28	0.80	
14	14098	0.254	12256	0.042	0.50	0.36	
15	85278	-0.605	12050	0.069	0.29	0.80	
16	47366	-0.387	12249	0.065	0.27	0.77	
17	52550	-0.427	12248	0.065	0.28	0.82	
18	51660	-0.419	12216	0.066	0.28	0.80	
19	21683	-0.080	12449	0.058	0.05	0.70	
20	71552	-0.548	12383	0.060	0.29	0.79	
21	20001	0.000	12791	0.044	1.00	0.72	
24	51149	-0.426	12530	0.060	0.28	0.78	
25	56670	-0.451	12169	0.064	0.28	0.80	
26	49196	-0.402	12258	0.065	0.27	0.76	
27	49196	-0.402	12258	0.065	0.27	0.76	
28	49196	-0.402	12258	0.065	0.27	0.76	
29	49196	-0.402	12258	0.065	0.27	0.76	
30	49196	-0.402	12258	0.065	0.27	0.76	
31	49196	-0.402	12258	0.065	0.27	0.76	
34	49196	-0.402	12258	0.065	0.27	0.76	
35	49196	-0.402	12258	0.065	0.27	0.76	
36	40321	-0.327	12242	0.065	0.24	0.77	
37	58214	-0.465	12288	0.063	0.30	0.80	
38	45542	-0.371	12251	0.065	0.25	0.78	
39	51672	-0.422	12268	0.064	0.29	0.76	
40	48795	-0.395	12274	0.063	0.26	0.77	
41	48970	-0.404	12236	0.066	0.28	0.76	
45	45281	-0.371	12253	0.065	0.26	0.78	
46	54102	-0.438	12272	0.064	0.29	0.75	
47	56960	-0.459	12394	0.060	0.28	0.79	
48	40956	-0.331	12130	0.069	0.26	0.77	
49	69608	-0.554	11678	0.096	0.31	0.77	
50	36855	-0.276	13220	0.017	0.22	0.47	
53	22481	-0.095	14399	-0.005	0.08	1.00	
54	120232	-0.746	10205	0.143	0.29	0.81	
65	49196	-0.402	12258	0.065	0.27	0.76	
66	49196	-0.402	12258	0.065	0.27	0.76	
77	49196	-0.402	12258	0.065	0.27	0.76	
78	49196	-0.402	12258	0.065	0.27	0.76	
79	49196	-0.402	12258	0.065	0.27	0.76	

C. EVERCALC 3.3

EVERCALC (0512; 6400 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	371839	20000	216991	1404	3	34.4	20
1	347490	25578	85974	5042	3	40.9	50
2	429360	20000	105418	9445	3	24.7	100
3	647513	20000	72399	14536	3	17.9	200
4	397560	34228	42048	19371	3	12.1	500
R	393735	33414	42898	19688	3	12.4	600
5	413659	30850	37637	22846	3	12.2	
6	182544	57817	27456	24080	3	28.8	
7	401361	31152	37562	22850	3	12.1	
8	389236	32070	37338	22879	3	11.8	
9	356802	33839	31905	23343	3	24.3	
10	412299	31220	35609	22846	3	16.8	
11	385703	36083	29890	23631	3	23.9	
14	339180	28631	38247	22892	3	21.7	
15	409796	31123	35849	22850	3	16.4	
16	278605	38655	32947	23346	3	20.1	
17	458074	31542	34363	22944	3	18.4	
18	413659	30850	37637	22846	3	12.2	
19	324202	40000	32500	23289	3	16.3	
20	413659	30850	37637	22846	3	12.2	
21	413659	30850	37637	22846	3	12.2	
24	413659	30850	37637	22846	3	12.2	
25	413659	30850	37637	22846	3	12.2	
26	413659	30850	37637	22846	3	12.2	
27	413659	30850	37637	22846	3	12.2	
28	413702	30836	37648	22846	3	12.2	
29	413659	30850	37637	22846	3	12.2	
30	413659	30850	37637	22846	3	12.2	
31	413659	30850	37637	22846	3	12.2	
34	413659	30850	37637	22846	3	12.2	
35	413659	30850	37637	22846	3	12.2	
36	457315	32282	36946	22854	3	12.2	
37	351511	31388	37049	22943	3	12.6	
38	416306	30494	37909	22851	3	12.3	
39	410812	31253	37309	22845	3	12.2	
40	416102	30422	38633	22869	3	12.2	
41	410735	31284	36770	22825	3	12.1	
45	396389	33163	36730	22977	3	12.6	
46	386967	30839	37299	22814	3	12.2	
47	380757	31807	37216	23009	3	12.4	
48	415953	31713	36635	22786	3	12.3	
49	414011	30737	36441	23005	3	12.2	
50	413095	30956	38714	22658	3	12.1	
53	403600	32113	35593	23039	3	12.2	
54	426133	29332	40452	22199	3	12.4	
65	403328	30896	38189	22853	4	11.7	
66	403328	30896	38189	22853	4	11.7	

EVERCALC (0512; 9328 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	564641	20000	168787	1495	2	17.8	20
1	544381	20685	142637	4359	2	19.9	50
2	616873	20000	124856	8811	2	14.5	100
3	896902	20000	89051	13971	2	8.9	200
4	469613	41886	39844	19027	2	9.6	500
R	459716	41170	40424	19348	2	9.1	600
5	486028	37216	35869	22479	2	9.1	
6	485714	37243	35855	22480	3	9.1	
7	485993	37218	35868	22479	2	9.1	
8	486182	37202	35877	22478	2	9.1	
9	486002	37214	35870	22479	2	9.1	
10	485721	37240	35855	22480	2	9.1	
11	485676	37253	35847	22480	2	9.1	
14	486340	37155	35910	22476	2	9.1	
15	485861	37227	35863	22479	2	9.1	
16	487966	37097	35916	22474	2	9.1	
17	485777	37243	35854	22480	2	9.1	
18	486028	37216	35869	22479	2	9.1	
19	458237	40000	34428	22585	2	9.0	
20	486028	37216	35869	22479	2	9.1	
21	486028	37216	35869	22479	2	9.1	
24	486028	37216	35869	22479	2	9.1	
25	486028	37216	35869	22479	2	9.1	
26	486028	37216	35869	22479	2	9.1	
27	486028	37216	35869	22479	2	9.1	
28	486138	37207	35874	22479	2	9.1	
29	486028	37216	35869	22479	2	9.1	
30	486028	37216	35869	22479	2	9.1	
31	486028	37216	35869	22479	2	9.1	
34	486028	37216	35869	22479	2	9.1	
35	486028	37216	35869	22479	2	9.1	
36	535660	38821	35450	22479	2	8.9	
37	445153	35619	36352	22474	2	9.3	
38	487334	37025	36232	22480	2	9.1	
39	484803	37376	35510	22478	2	9.1	
40	488952	36641	36808	22497	2	9.0	
41	483058	37764	35067	22461	2	9.2	
45	511124	37403	36104	22500	2	9.1	
46	455318	36987	35580	22452	2	9.1	
47	484871	26096	36428	22528	2	9.1	
48	487231	38253	35238	22424	2	9.1	
49	487233	37070	34673	22638	2	9.1	
50	484759	37368	36951	22290	2	9.1	
53	473418	38964	33899	22648	2	9.4	
54	501577	35061	38654	21857	2	8.8	
65	486205	37199	35878	22478	2	9.1	
66	486205	37199	35878	22478	2	9.1	

EVERCALC (0512; 12059 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	700678	20000	186993	1317	2	11.6	20
1	684220	20117	171430	3756	3	15.1	50
2	760123	20000	144235	7817	2	12.3	100
3	991291	20000	103891	12670	1	5.7	200
4	509820	49485	41065	17659	2	7.6	500
R	501186	48016	42001	17947	2	8.4	600
5	538212	41910	37431	20892	2	8.8	
6	538862	41854	34758	20891	2	8.8	
7	539094	41830	37471	20890	2	8.9	
8	538791	41862	37453	20891	2	8.8	
9	538876	41854	37457	20891	2	8.8	
10	538750	41863	37454	20891	2	8.8	
11	539017	41839	37467	20890	2	8.8	
14	538793	41863	37453	20891	2	8.8	
15	539092	41836	37467	20890	2	8.8	
16	538851	41856	37457	20891	2	8.8	
17	538632	41875	37447	20891	2	8.8	
18	538212	41910	37431	20892	2	8.8	
19	538827	41860	37454	20891	2	8.8	
20	538212	41910	37431	20892	2	8.8	
21	538212	41910	37431	20892	2	8.8	
24	538212	41910	37431	20892	2	8.8	
25	538212	41910	37431	20892	2	8.8	
26	538212	41910	37431	20892	2	8.8	
27	538212	41910	37431	20892	2	8.8	
28	538884	41845	37465	20890	2	8.9	
29	538212	41910	37431	20890	2	8.8	
30	538212	41910	37431	20892	2	8.8	
31	538212	41910	37431	20892	2	8.8	
34	538212	41910	37431	20892	2	8.8	
35	538212	41910	37431	20892	2	8.8	
36	594672	43600	37117	20888	2	8.7	
37	493272	40101	37856	20889	2	9.0	
38	540808	41614	37974	20893	2	8.8	
39	537370	42034	36958	20888	2	8.9	
40	543150	41022	38664	20916	2	8.8	
41	535293	42605	36452	20864	2	8.9	
45	566875	42051	37710	20908	2	8.8	
46	505381	41551	37176	20866	2	8.9	
47	537566	40596	37918	20931	2	8.9	
48	541380	42915	36978	20843	2	8.8	
49	539630	41798	36078	21012	2	8.8	
50	537779	41940	38727	20750	2	8.9	
53	525949	43711	35487	21010	2	9.1	
54	555791	39475	40253	20341	2	8.5	
65	538762	41863	37454	20891	2	8.8	
66	538762	41863	37454	20891	2	8.8	

EVERCALC (0512; 15419 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	890345	20126	217149	1322	3	10.6	20
1	863655	20166	209190	3702	3	12.4	50
2	957715	20149	169706	7891	3	11.3	100
3	1239504	20000	124764	12892	1	4.1	200
4	565053	59078	42700	18286	2	6.6	500
R	555069	57170	43701	18582	2	7.2	600
5	606181	48643	39165	21630	2	7.1	
6	606456	48624	39172	21630	2	7.1	
7	606436	48628	39170	21630	2	7.1	
8	606258	48642	39165	21630	2	7.1	
9	606415	48628	39170	21630	2	7.1	
10	606368	48632	39168	21630	2	7.1	
11	606656	48606	39179	21629	2	7.1	
14	606426	48626	39171	21630	2	7.1	
15	606393	48633	39167	21630	2	7.1	
16	606647	48607	39179	21629	2	7.1	
17	606226	48648	39161	21630	2	7.1	
18	606181	48643	39165	21630	2	7.1	
19	606583	48611	39177	21629	2	7.1	
20	606181	48643	39165	21630	2	7.1	
21	606181	48643	39165	21630	2	7.1	
24	606181	48643	39165	21630	2	7.1	
25	606181	48643	39165	21630	2	7.1	
26	606181	48643	39165	21630	2	7.1	
27	606181	48643	39165	21630	2	7.1	
28	606001	48665	39155	21631	2	7.1	
29	606181	48643	39165	21630	2	7.1	
30	606181	48643	39165	21630	2	7.1	
31	606181	48643	39165	21630	2	7.1	
34	606181	48643	39165	21630	2	7.1	
35	606181	48643	39165	21630	2	7.1	
36	667712	50765	38843	21629	2	7.0	
37	556057	46498	39550	21627	2	7.3	
38	608244	48497	39755	21632	2	7.1	
39	605435	48667	38616	21627	2	7.1	
40	611090	47667	40397	21659	2	7.0	
41	602125	49528	38131	21600	2	7.2	
45	637961	48881	39419	21647	2	7.1	
46	568703	48247	28890	21606	2	7.1	
47	604877	47129	39553	21669	2	7.1	
48	608136	50007	38741	21585	2	7.1	
49	607318	48571	37689	21750	2	7.1	
50	605383	48708	40546	21489	2	7.1	
53	590301	50883	37150	21741	2	7.4	
54	627448	45723	42040	21070	2	6.8	
65	606519	48621	39173	21630	2	7.1	
66	606519	48621	39173	21630	2	7.1	

EVERCALC (0512)

No.	k1	k2	R^2	k3	k4	R^2	k5	k6	R^2	11
0	19424	0.0094	0.56	31	6.1601	0.79	1568	-0.3935	0.28	FG
1	92690	-0.4929	0.68	57	5.3784	0.98	20204	-2.6733	0.88	FG
2	0	0.0000	0.00	113	4.4069	0.92	32295	-1.5447	0.85	FG
3	0	0.0000	0.00	711	2.8067	0.96	125688	-1.8058	0.79	FG
4	0	0.0000	0.00	37229	0.0571	0.04	------	-6.0170	0.55	FG
R	0	0.0000	0.00	36925	0.0718	0.06	------	-9.0921	0.55	FG
5	4524	0.7184	1.00	29246	0.1266	0.25	25784	-0.1219	0.57	FG
6	36052	0.0727	0.01	3925	1.1052	0.84	29723	-0.2183	0.72	FG
7	4662	0.7086	1.00	28775	0.1347	0.28	25807	-0.1226	0.57	FG
8	5320	0.6670	0.99	27852	0.1505	0.36	25894	-0.1248	0.58	FG
9	8212	0.5295	0.95	10396	0.6310	0.96	27375	-0.1626	0.67	FG
10	5214	0.6734	1.00	20902	0.2905	0.87	25811	-0.1226	0.57	FG
11	13126	0.3805	0.82	7215	0.8093	0.92	28172	-0.1821	0.70	FG
14	2385	0.9196	0.96	30689	0.1040	0.13	26067	-0.1293	0.58	FG
15	5053	0.6832	1.00	21726	0.2717	0.83	25824	-0.1230	0.57	FG
16	13334	0.3766	0.71	12602	0.5374	0.98	27419	-0.1637	0.66	FG
17	6331	0.6120	0.99	17238	0.3844	0.98	26038	-0.1286	0.60	FG
18	4524	0.7184	1.00	29246	0.1266	0.25	25784	-0.1219	0.57	FG
19	19473	0.2615	0.69	11642	0.5720	0.96	27223	-0.1581	0.65	FG
20	4524	0.7184	1.00	29246	0.1266	0.25	25784	-0.1219	0.57	FG
21	4524	0.7184	1.00	29246	0.1266	0.25	25784	-0.1219	0.57	FG
24	4524	0.7184	1.00	29246	0.1266	0.25	25784	-0.1219	0.57	FG
25	4524	0.7184	1.00	29246	0.1266	0.25	25784	-0.1219	0.57	FG
26	4524	0.7184	1.00	29246	0.1266	0.25	25784	-0.1219	0.57	FG
27	4524	0.7184	1.00	29246	0.1266	0.25	25784	-0.1219	0.57	FG
28	4511	0.7191	1.00	29303	0.1257	0.25	25782	-0.1219	0.57	FG
29	4524	0.7184	1.00	29246	0.1266	0.25	25784	-0.1219	0.57	FG
30	4524	0.7184	1.00	29246	0.1266	0.25	25784	-0.1219	0.57	FG
31	4524	0.7184	1.00	29246	0.1266	0.25	25784	-0.1219	0.57	FG
34	4524	0.7184	1.00	29246	0.1266	0.25	25784	-0.1219	0.57	FG
35	4524	0.7184	1.00	29246	0.1266	0.25	25784	-0.1219	0.57	FG
36	4786	0.7108	1.00	27266	0.1564	0.36	25817	-0.1224	0.57	FG
37	5938	0.6208	0.99	25292	0.2028	0.62	26085	-0.1304	0.60	FG
38	4278	0.7278	1.00	28307	0.1482	0.32	25810	-0.1214	0.57	FG
39	4902	0.6998	1.00	29791	0.1120	0.20	25773	-0.1229	0.57	FG
40	4748	0.6928	1.00	29119	0.1433	0.29	25826	-0.1192	0.57	FG
41	4373	0.7383	1.00	29143	0.1160	0.23	25754	-0.1250	0.58	FG
45	6241	0.6163	0.98	24364	0.2186	0.65	26169	-0.1314	0.60	FG
46	4699	0.7063	1.00	28698	0.1326	0.27	25727	-0.1213	0.57	FG
47	6331	0.6239	0.99	26061	0.1890	0.58	26175	-0.1316	0.60	FG
48	4353	0.7130	1.00	26089	0.1757	0.41	25736	-0.1214	0.57	FG
49	4429	0.7231	1.00	29619	0.1091	0.20	25986	-0.1245	0.58	FG
50	4630	0.7130	1.00	28544	0.1455	0.30	25532	-0.1186	0.56	FG
53	4458	0.7454	0.99	27287	0.1322	0.27	27291	-0.1409	0.59	FG
54	4729	0.6762	1.00	31499	0.1282	0.25	23613	-0.0984	0.56	FG
65	4370	0.7290	1.00	31798	0.0860	0.11	25809	-0.1226	0.58	FG
66	4370	0.7290	1.00	31798	0.0860	0.11	25809	-0.1226	0.58	FG

EVERCALC (0517; 6379 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	507469	20000	27733	1243	3	152.4	20
R	881041	20000	10000	1000	3	166.6	36.6
1	100000	20000	15179	4904	3	98.3	50
2	100000	20000	16280	8689	3	79.8	100
3	100000	20000	13568	12377	3	71.5	200
4	104530	20000	12555	15370	3	58.2	500
5	104042	20000	11489	18058	3	58.0	
6	104053	20000	11488	18063	3	58.0	
7	100000	20000	12015	17795	3	58.0	
8	104044	20000	11489	18057	3	58.0	
9	103992	20000	11491	18048	3	58.0	
10	100000	20000	11346	18024	3	59.7	
11	104043	20000	11489	18056	3	58.0	
14	104646	20000	11420	18011	3	57.8	
15	100000	20000	11359	17973	3	59.6	
16	109823	20000	11082	18180	3	59.2	
17	200000	20000	10552	18512	3	74.8	
18	156625	10000	14327	17427	3	50.4	
19	100000	40000	10000	18601	3	82.0	
20	100000	20000	11434	17903	3	59.3	
21	100000	20000	20000	15693	3	86.2	
24	104042	20000	11489	18058	3	58.0	
25	104042	20000	11489	18058	3	58.0	
26	104042	20000	11489	18058	3	58.0	
27	104042	20000	11489	18058	3	58.0	
28	104029	20000	11489	18058	3	58.0	
29	104042	20000	11489	18058	3	58.0	
30	104042	20000	11489	18058	3	58.0	
31	104042	20000	11489	18058	3	58.0	
34	104042	20000	11489	18058	3	58.0	
35	104042	20000	11489	18058	3	58.0	
36	118035	20000	11493	18047	3	58.1	
37	100000	20000	11332	18142	3	61.8	
38	105371	20000	11537	18019	3	57.5	
39	102764	20000	11439	18097	3	58.4	
40	104823	20000	11361	18010	3	57.7	
41	103285	20000	11605	18106	3	58.2	
45	111006	20000	11595	18073	3	57.5	
46	100000	20000	11270	18080	3	60.1	
47	100492	20000	11482	18153	3	59.1	
48	107446	20000	11471	17954	3	56.9	
49	103045	20000	11294	18550	3	58.3	
50	105554	20000	11583	17497	3	58.7	
53	105462	20000	11245	18371	3	56.6	
54	102127	20000	11798	17429	3	59.5	
65	105614	20000	11517	18098	4	55.4	
66	105614	20000	11517	18098	4	55.4	

EVERCALC (0517; 9437 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	108211	20000	35891	1615	3	85.3	20
R	214925	64081	10000	1000	3	114.1	36.6
1	110715	20000	29127	4708	3	82.6	50
2	124985	20000	21004	8951	2	73.5	100
3	152816	20000	16948	12861	2	58.8	200
4	158787	20000	15388	15962	2	43.2	500
5	155751	20000	13806	18738	2	43.2	
6	155738	20000	13806	18738	2	43.2	
7	155523	20000	13813	18735	2	43.2	
8	155763	20000	13806	18738	2	43.2	
9	155759	20000	13806	18738	2	43.2	
10	155748	20000	13806	18737	2	43.2	
11	155746	20000	13806	18738	2	43.2	
14	155770	20000	13805	18738	2	43.2	
15	155751	20000	13806	18737	2	43.2	
16	155912	20000	13801	18739	2	43.2	
17	200000	20000	13183	18939	2	45.4	
18	223727	10000	19761	18079	2	32.3	
19	100000	40000	11587	19466	2	60.2	
20	155726	20000	13807	18737	2	43.2	
21	117920	20000	20000	17061	2	56.6	
24	155751	20000	13806	18738	2	43.2	
25	155751	20000	13806	18738	2	43.2	
26	155751	20000	13806	18738	2	43.2	
27	155751	20000	13806	18738	2	43.2	
28	155702	20000	13807	18737	2	43.2	
29	155751	20000	13806	18738	2	43.2	
30	155751	20000	13806	18738	2	43.2	
31	155751	20000	13806	18738	2	43.2	
34	155751	20000	13806	18738	2	43.2	
35	155751	20000	13806	18738	2	43.2	
36	175528	20000	13931	18682	2	41.7	
37	139922	20000	13679	18794	2	44.8	
38	157052	20000	13861	18708	2	42.8	
39	154516	20000	13750	18768	2	43.6	
40	156281	20000	13700	18692	2	43.0	
41	155229	20000	13903	18783	2	43.4	
45	164822	20000	13948	18748	2	42.9	
46	144892	20000	13625	18725	2	43.6	
47	151731	20000	13773	18838	2	44.2	
48	159571	20000	13792	18632	2	42.2	
49	154332	20000	13509	19160	2	44.0	
50	157575	20000	13997	18244	2	42.2	
53	157320	20000	13483	19000	2	41.9	
54	153603	20000	14221	18143	2	44.8	
65	155767	20000	13806	18738	2	43.2	
66	155767	20000	13806	18738	2	43.2	

EVERCALC (0517; 12237 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	138600	20000	42705	1478	2	73.1	20
R	302125	67597	10000	1000	3	104.6	36.6
1	139439	20000	36275	4275	2	71.6	50
2	162551	20000	26317	8262	2	64.9	100
3	207115	20000	20840	11987	2	50.9	200
4	213749	20000	18860	14928	2	34.8	500
5	207608	20000	16588	17586	2	35.8	
6	207660	20000	16587	17586	2	35.8	
7	207633	20000	16588	17586	2	35.8	
8	207611	20000	16588	17589	2	35.8	
9	207641	20000	16587	17586	2	35.8	
10	207618	20000	16588	17586	2	35.8	
11	207671	20000	16587	17586	2	35.8	
14	207618	20000	16589	17586	2	35.8	
15	207628	20000	16588	17586	2	35.8	
16	207605	20000	16589	17586	2	35.8	
17	208480	20000	16565	17592	2	35.8	
18	285912	10000	25649	17004	2	30.2	
19	128966	40000	13621	18212	2	50.6	
20	207640	20000	16587	17586	2	35.8	
21	178642	20000	20000	16769	2	36.8	
24	207608	20000	16588	17586	2	35.8	
25	207608	20000	16588	17586	2	35.8	
26	207608	20000	16588	17586	2	35.8	
27	207608	20000	16588	17586	2	35.8	
28	207611	20000	16588	17586	2	35.8	
29	207608	20000	16588	17586	2	35.8	
30	207608	20000	16588	17586	2	35.8	
31	207608	20000	16588	17586	2	35.8	
34	207608	20000	16588	17586	2	35.8	
35	207608	20000	16588	17586	2	35.8	
36	234967	20000	16769	17537	2	34.7	
37	185509	20000	16408	17634	2	36.9	
38	208461	20000	16634	17574	2	35.8	
39	206753	20000	16542	17597	2	35.8	
40	207798	20000	16570	17569	2	35.9	
41	207481	20000	16602	17603	2	35.7	
45	219051	20000	16744	17600	2	35.7	
46	193777	20000	16392	17568	2	35.9	
47	203017	20000	16558	17666	2	36.3	
48	212002	20000	16543	17503	2	35.4	
49	206402	20000	16156	17873	2	35.9	
50	209208	20000	16918	17249	2	35.7	
53	209780	20000	16156	17770	2	35.5	
54	204686	20000	17142	17077	2	37.0	
65	207700	20000	16586	17586	2	35.8	
66	207700	20000	16586	17586	2	35.8	

EVERCALC (0517; 15923 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	187763	20000	55356	1460	2	62.5	20
R	406003	111709	10000	1000	3	99.5	36.6
1	187164	20000	48386	4205	2	62.0	50
2	220152	20000	35383	8262	2	57.5	100
3	286577	20000	27515	12130	2	44.3	200
4	293562	20000	24837	15160	2	27.7	500
5	282383	20000	21386	17918	2	30.0	
6	282427	20000	21385	17918	2	30.0	
7	282425	20000	21385	17918	2	30.0	
8	282379	20000	21386	17918	2	30.0	
9	282320	20000	21387	17918	2	30.0	
10	282377	20000	21386	17918	2	30.0	
11	282394	20000	21386	17918	2	30.0	
14	282362	20000	21386	17918	2	30.0	
15	282442	20000	21385	17918	2	30.0	
16	282396	20000	21386	17918	2	30.0	
17	282346	20000	21387	17918	2	30.0	
18	376328	10000	37385	17352	2	26.6	
19	185062	40000	16798	18541	2	42.2	
20	282421	20000	21385	17918	2	30.0	
21	281757	20000	21412	17914	2	30.0	
24	282383	20000	21386	17918	2	30.0	
25	282383	20000	21386	17918	2	30.0	
26	282383	20000	21386	17918	2	30.0	
27	282383	20000	21386	17918	2	30.0	
28	282382	20000	21386	17918	2	30.0	
29	282383	20000	21386	17918	2	30.0	
30	282383	20000	21386	17918	2	30.0	
31	282383	20000	21386	17918	2	30.0	
34	282383	20000	21386	17918	2	30.0	
35	282383	20000	21386	17918	2	30.0	
36	320674	20000	21651	17871	2	29.1	
37	251310	20000	21123	17964	2	31.0	
38	282422	20000	21373	17922	2	30.1	
39	282354	20000	21399	17914	2	30.0	
40	281844	20000	21519	17924	2	30.1	
41	282826	20000	21268	17912	2	30.0	
45	297442	20000	21568	17935	2	30.0	
46	264037	20000	21162	17896	2	30.1	
47	277126	20000	21402	17987	2	30.4	
48	287057	20000	21243	17848	2	29.7	
49	281434	20000	20772	18125	2	30.1	
50	283534	20000	21894	17673	2	30.0	
53	285299	20000	20772	18055	2	29.8	
54	278368	20000	22179	17437	2	30.4	
65	282371	20000	21386	17918	2	30.0	
66	282371	20000	21386	17918	2	30.0	

EVERCALC (0517)

No.	k1	k2	R^2	k3	k4	R^2	k5	k6	R^2	
0	20000	0.0000	0.00	7177	1.3186	0.79	249	0.7892	0.38	FG
R	0	0.0000	0.00	10000	0.0000	0.00	1000	0.0000	0.00	FG
1	20000	0.0000	0.00	0	7.3401	0.96	9217	-0.9604	0.91	FG
2	0	0.0000	0.00	206	2.4771	0.94	12232	-0.3923	0.51	FG
3	0	0.0000	0.00	411	1.8578	0.96	20850	-0.4231	0.27	FG
4	0	0.0000	0.00	624	1.5512	0.97	1342689	-2.3574	0.21	FG
5	20000	0.0000	0.00	925	1.2802	0.97	19012	-0.0338	0.12	FG
6	20000	0.0000	0.00	925	1.2804	0.97	19025	-0.0342	0.13	FG
7	20000	0.0000	0.00	1137	1.1915	0.95	18322	-0.0116	0.01	FG
8	20000	0.0000	0.00	926	1.2802	0.97	19009	-0.0337	0.12	FG
9	20000	0.0000	0.00	927	1.2796	0.97	18985	-0.0329	0.12	FG
10	20000	0.0000	0.00	854	1.3151	0.98	18929	-0.0311	0.10	FG
11	20000	0.0000	0.00	926	1.2800	0.97	19006	-0.0336	0.12	FG
14	20000	0.0000	0.00	906	1.2894	0.97	18883	-0.0297	0.09	FG
15	20000	0.0000	0.00	861	1.3112	0.98	18790	-0.0267	0.08	FG
16	20000	0.0000	0.00	801	1.3427	0.98	19344	-0.0441	0.21	FG
17	20000	0.0000	0.00	858	1.3109	0.98	20170	-0.0681	0.40	FG
18	10000	0.0000	0.00	343	1.8694	0.98	18268	-0.0304	0.09	FG
19	40000	0.0000	0.00	1403	1.0146	0.94	19379	-0.0242	0.07	FG
20	20000	0.0000	0.00	893	1.2958	0.97	18605	-0.0208	0.04	FG
21	20000	0.0000	0.00	15891	0.1128	0.51	7525	0.3622	0.87	CG
24	20000	0.0000	0.00	925	1.2802	0.97	19012	-0.0338	0.12	FG
25	20000	0.0000	0.00	925	1.2802	0.97	19012	-0.0338	0.12	FG
26	20000	0.0000	0.00	925	1.2802	0.97	19012	-0.0338	0.12	FG
27	20000	0.0000	0.00	925	1.2802	0.97	19012	-0.0338	0.12	FG
28	20000	0.0000	0.00	926	1.2801	0.97	19010	-0.0337	0.12	FG
29	20000	0.0000	0.00	925	1.2802	0.97	19012	-0.0338	0.12	FG
30	20000	0.0000	0.00	925	1.2802	0.97	19012	-0.0338	0.12	FG
31	20000	0.0000	0.00	925	1.2802	0.97	19012	-0.0338	0.12	FG
34	20000	0.0000	0.00	925	1.2802	0.97	19012	-0.0338	0.12	FG
35	20000	0.0000	0.00	925	1.2802	0.97	19012	-0.0338	0.12	FG
36	20000	0.0000	0.00	910	1.2892	0.97	19055	-0.0366	0.15	FG
37	20000	0.0000	0.00	921	1.2804	0.97	19145	-0.0364	0.14	FG
38	20000	0.0000	0.00	976	1.2511	0.97	18888	-0.0299	0.10	FG
39	20000	0.0000	0.00	875	1.3104	0.97	19136	-0.0377	0.15	FG
40	20000	0.0000	0.00	859	1.3022	0.97	18858	-0.0286	0.10	FG
41	20000	0.0000	0.00	985	1.2630	0.97	19165	-0.0391	0.15	FG
45	20000	0.0000	0.00	931	1.2789	0.97	19021	-0.0335	0.12	FG
46	20000	0.0000	0.00	906	1.2878	0.97	19097	-0.0371	0.15	FG
47	20000	0.0000	0.00	889	1.3003	0.97	19170	-0.0362	0.13	FG
48	20000	0.0000	0.00	980	1.2504	0.97	18831	-0.0306	0.11	FG
49	20000	0.0000	0.00	1163	1.2374	0.97	20054	-0.0576	0.28	FG
50	20000	0.0000	0.00	698	1.3349	0.97	17811	-0.0054	0.00	FG
53	20000	0.0000	0.00	976	1.2338	0.97	19965	-0.0528	0.22	FG
54	20000	0.0000	0.00	854	1.3468	0.97	17913	-0.0176	0.05	FG
65	20000	0.0000	0.00	942	1.2723	0.97	19116	-0.0370	0.15	FG
66	20000	0.0000	0.00	942	1.2723	0.97	19116	-0.0370	0.15	FG

EVERCALC (2647; 5658 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	636927	2000001	155746	5276	3	35.0	20
1	3499999	451468	181826	13610	3	21.5	50
2	3499999	711286	69667	28702	3	22.8	100
R	3499999	526093	125216	23002	3	23.5	104.9
3	3499999	1106248	10798	60230	3	37.1	200
4	316153	1439021	250000	47835	3	70.3	500
5	590796	2000001	250000	46459	3	76.6	
6	2778266	135592	250000	52685	3	68.8	
7	3499999	392091	250000	44982	3	61.5	
8	1747326	578283	250000	45167	3	75.7	
9	600551	2000001	250000	47537	3	76.2	
10	547797	2000001	250000	46772	3	74.3	
11	2330841	541084	250000	44501	3	75.3	
14	3499999	2000001	250000	24464	3	283.7	
15	3499999	890594	15972	79898	3	15.0	
16	590796	2000001	250000	46459	3	76.6	
17	590796	2000001	250000	46459	3	76.6	
18	590796	2000001	250000	46459	3	76.6	
19	590796	2000001	250000	46459	3	76.6	
20	590796	2000001	250000	46459	3	76.6	
21	590796	2000001	250000	46459	3	76.6	
24	590796	2000001	250000	46459	3	76.6	
25	590796	2000001	250000	46459	3	76.6	
26	590796	2000001	250000	46459	3	76.6	
27	590796	2000001	250000	46459	3	76.6	
28	1188993	1000000	250000	45847	3	74.1	
29	1082022	851055	250000	46636	3	67.7	
30	1911440	2000001	125000	40556	3	98.1	
31	3211117	1273735	17065	61426	3	56.2	
34	590796	2000001	250000	46459	3	76.6	
35	590796	2000001	250000	46459	3	76.6	
36	597004	2000001	250000	46727	3	75.3	
37	584558	2000001	250000	46145	3	77.8	
38	965429	2000001	250000	44119	3	81.4	
39	1064994	753648	250000	46723	3	68.4	
40	912441	2000001	250000	44125	3	86.2	
41	495525	2000001	250000	46989	3	72.4	
45	1005003	2000001	250000	42870	3	87.7	
46	1504775	657105	250000	45507	3	72.0	
47	619633	2000001	250000	46029	3	77.8	
48	538169	2000001	250000	47014	3	73.9	
49	532567	2000001	250000	46871	3	74.3	
50	638572	2000001	250000	46061	3	78.1	
53	559614	2000001	250000	46476	3	74.6	
54	933048	751115	250000	47297	3	61.4	
65	2586827	933594	20818	71175	6	17.9	
66	3499999	866383	17095	77804	8	15.7	

EVERCALC (2647; 8550 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	921165	1002076	179939	6019	3	25.2	20
1	3499999	442905	143436	16297	2	15.4	50
2	3499999	720167	37593	35869	2	17.8	100
R	3499999	577478	74965	27319	2	15.3	104.9
3	3499999	965594	10679	86617	2	17.3	200
4	1136335	1462668	20716	72146	3	21.9	500
5	3499999	844377	11943	110740	3	11.3	
6	3499999	360814	72297	63802	3	44.8	
7	3499999	364619	75033	62998	3	44.7	
8	3499999	673748	30285	68712	3	35.4	
9	3499999	843183	11956	110851	3	12.1	
10	3499999	833529	12174	109692	3	11.1	
11	3499999	192029	250000	58690	2	77.3	
14	3499999	193858	250000	56320	3	75.4	
15	3499999	844799	11985	111184	2	11.9	
16	3499999	844377	11943	110740	3	11.3	
17	3499999	844377	11943	110740	3	11.3	
18	3499999	844377	11943	110740	3	11.3	
19	3499999	844377	11943	110740	3	11.3	
20	3499999	844377	11943	110740	3	11.3	
21	3499999	702884	20000	84657	3	17.2	
24	3499999	844377	11943	110740	3	11.3	
25	3499999	844377	11943	110740	3	11.3	
26	1750001	1168871	11824	112782	3	13.4	
27	7000000	631682	13288	101879	3	10.4	
28	3499999	1000000	10988	110288	3	22.4	
29	1439788	1004465	35206	74181	3	39.4	
30	853576	2000001	10254	110088	3	37.0	
31	3499999	843655	12024	111058	3	11.9	
34	3499999	637505	27287	75000	3	23.1	
35	3499999	844377	11943	110740	3	11.3	
36	3499999	887536	12148	109900	3	11.2	
37	3499999	794238	12000	110278	3	11.4	
38	3499999	742380	12351	96980	3	42.5	
39	2111134	764087	22723	75191	3	34.7	
40	3499999	657881	11841	97852	3	40.9	
41	3499999	831424	12755	109454	3	11.1	
45	3499999	219589	157001	60548	3	60.2	
46	631195	2000001	10000	112017	3	42.6	
47	3499999	830410	12204	109050	3	12.0	
48	3499999	845971	11879	111605	3	11.1	
49	3499999	835473	12710	114517	3	11.0	
50	3499999	830790	10856	105217	3	11.6	
53	3499999	842715	11772	114895	3	11.2	
54	826318	2000001	10000	99619	3	48.6	
65	3499999	844248	12000	111221	3	11.9	
66	3499999	845025	11985	111102	2	11.9	

EVERCALC (2647; 11154 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	3499999	433223	175624	5414	3	14.8	20
1	3499999	409672	159561	15224	2	15.5	50
2	3499999	666140	48935	32714	2	18.3	100
R	3499999	527243	90678	25441	2	15.7	104.9
3	3499999	957591	11532	75281	2	18.0	200
4	3038724	956252	12472	87693	3	10.6	500
5	3499999	811817	13510	96250	2	11.9	
6	3499999	782865	15353	85806	3	17.3	
7	3499999	762559	16638	82963	3	17.5	
8	3499999	687263	22135	76043	2	19.7	
9	3499999	811718	13512	96245	2	11.9	
10	3499999	811928	13503	96282	2	11.9	
11	3499999	512398	45429	64673	3	28.7	
14	3499999	615706	30373	69224	3	21.0	
15	3499999	811355	13531	96162	2	11.9	
16	3499999	811817	13510	96250	2	11.9	
17	3499999	811817	13510	96250	2	11.9	
18	3499999	811817	13510	96250	2	11.9	
19	3499999	811817	13510	96250	2	11.9	
20	3499999	811817	13510	96250	2	11.9	
21	3499999	706566	20000	80152	1	16.5	
24	3499999	811817	13510	96250	2	11.9	
25	3499999	811817	13510	96250	2	11.9	
26	1750001	1121489	13172	98648	2	13.9	
27	7000000	584076	16427	86958	2	9.8	
28	3499999	812469	13478	96376	2	11.9	
29	3499999	800139	13626	94657	3	11.4	
30	820493	2000001	11047	111780	1	20.6	
31	3499999	812106	13497	96306	2	11.9	
34	3499999	674870	23669	75000	2	20.1	
35	3499999	811817	13510	96250	2	11.9	
36	3499999	863118	13471	96515	2	12.0	
37	3499999	762613	13598	95810	2	11.6	
38	3499999	875403	14733	92232	2	11.7	
39	3499999	734897	13563	95610	3	12.6	
40	3499999	812208	12944	96042	2	11.9	
41	3499999	810643	14089	96376	2	11.9	
45	3499999	677889	25949	72591	3	18.4	
46	1431107	1158863	12862	100003	3	13.0	
47	3499999	797240	13820	95008	2	11.8	
48	3499999	824190	13183	97651	2	11.9	
49	3499999	805331	14248	98965	2	11.8	
50	3499999	821202	1208	93009	2	11.9	
53	3499999	811416	13257	99522	2	11.9	
54	1503819	1249381	12590	96989	3	13.4	
65	3499999	811752	13514	96232	2	11.9	
66	3499999	812129	13493	96321	2	11.9	

EVERCALC (2647; 15020 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	3499999	456011	159698	5494	1	12.3	20
1	3499999	445226	136974	15592	2	13.4	50
2	3499999	729537	33691	34797	2	13.1	100
R	3499999	582427	70231	26217	2	11.3	104.9
3	3499999	957342	10000	84836	2	13.1	200
4	3499999	937218	10298	101989	2	9.5	500
5	3499999	845479	11013	110579	2	9.3	
6	3499999	846634	10976	110780	2	9.2	
7	3499999	845127	11030	109718	3	8.9	
8	3499999	805674	12990	97600	3	8.3	
9	3499999	845712	11003	110664	2	9.3	
10	3499999	845860	10998	110700	2	9.3	
11	3499999	727922	17554	82989	3	13.5	
14	3499999	769356	14825	89512	3	12.3	
15	3499999	845572	11009	110617	2	9.3	
16	3499999	845479	11013	110579	2	9.3	
17	3499999	845479	11013	110579	2	9.3	
18	3499999	845479	11013	110579	2	9.3	
19	3499999	845479	11013	110579	2	9.3	
20	3499999	845479	11013	110579	2	9.3	
21	3499999	685661	20000	80213	1	18.9	
24	3499999	845479	11013	110579	2	9.3	
25	3499999	845479	11013	110579	2	9.3	
26	1750001	1167204	10896	112665	2	10.4	
27	7000000	618678	13011	98385	2	8.9	
28	3499999	845710	11005	110645	2	9.3	
29	3499999	845147	11026	110471	2	9.3	
30	3499999	845870	10992	110749	3	9.3	
31	3499999	845569	11009	110610	2	9.3	
34	3499999	664299	23225	75000	1	22.5	
35	3499999	845479	11013	110579	2	9.3	
36	3499999	897750	11015	110693	2	9.4	
37	3499999	795729	11037	110291	2	9.2	
38	3499999	916198	11959	104601	2	9.2	
39	3499999	784105	10169	116823	3	9.1	
40	3499999	846529	10504	110496	2	9.3	
41	3499999	844753	11503	110775	2	9.3	
45	3499999	841389	12657	94856	3	16.9	
46	2771198	883776	11045	110360	3	6.7	
47	3499999	832047	11263	108680	2	9.3	
48	3499999	856697	10743	112794	2	9.3	
49	3499999	838837	11735	114464	2	9.3	
50	3499999	847373	10000	103958	2	9.6	
53	3499999	844771	10873	114778	2	9.4	
54	3499999	837714	11032	105278	3	7.2	
65	3499999	845690	11004	110656	2	9.3	
66	3499999	845751	11003	110659	2	9.3	

EVERCALC (2647)

No.	k1	k2	R^2	k3	k4	R^2	k5	k6	R^2	
0	5684	2.2932	0.57	0	0.0000	0.00	4721	0.0779	0.01	FG
1	490343	-0.0362	0.11	0	0.0000	0.00	2117	0.8608	0.33	FG
2	0	0.0000	0.00	122748	-0.7634	0.28	74	2.3382	0.41	FG
R	0	0.0000	0.00	242392	-0.6148	0.37	1340	1.1850	0.32	FG
3	0	0.0000	0.00	11273	-0.0655	0.08	0	13.3312	0.48	FG
4	0	0.0000	0.00	380	3.8123	0.90	0.49	6.5377	0.92	FG
5	0	0.0000	0.00	284	4.1320	0.81	2019	1.9032	0.75	CG
6	0	0.0000	0.00	206	3.8944	0.92	962	2.1899	1.00	CG
7	0	0.0000	0.00	156	4.1270	0.89	1518	1.9617	1.00	CG
8	0	0.0000	0.00	106	4.5679	0.88	2748	1.6368	0.98	CG
9	0	0.0000	0.00	279	4.1491	0.81	2221	1.8576	0.74	CG
10	0	0.0000	0.00	278	4.1393	0.81	1998	1.9072	0.76	CG
11	0	0.0000	0.00	202	3.6615	0.74	4888	1.2878	1.00	CG
14	0	0.0000	0.00	1537	2.5726	0.44	526	2.3824	0.98	CG
15	0	0.0000	0.00	20574	-0.5383	0.57	23047	0.7300	0.54	CG
16	0	0.0000	0.00	284	4.1320	0.81	2019	1.9032	0.75	CG
17	0	0.0000	0.00	284	4.1320	0.81	2019	1.9032	0.75	CG
18	0	0.0000	0.00	284	4.1320	0.81	2019	1.9032	0.75	CG
19	0	0.0000	0.00	284	4.1320	0.81	2019	1.9032	0.75	CG
20	0	0.0000	0.00	284	4.1320	0.81	2019	1.9032	0.75	CG
21	0	0.0000	0.00	355	3.6990	0.54	6691	1.1895	0.70	CG
24	0	0.0000	0.00	284	4.1320	0.81	2019	1.9032	0.75	CG
25	0	0.0000	0.00	284	4.1320	0.81	2019	1.9032	0.75	CG
26	0	0.0000	0.00	283	4.1353	0.81	2208	1.8481	0.76	CG
27	0	0.0000	0.00	303	4.0144	0.75	3145	1.6449	0.70	CG
28	0	0.0000	0.00	526	3.5394	0.82	2283	1.8453	0.70	CG
29	0	0.0000	0.00	124	4.5723	0.93	1423	2.0176	0.98	CG
30	0	0.0000	0.00	793	3.4295	0.31	1069	2.2206	0.83	CG
31	0	0.0000	0.00	22048	-0.6123	0.68	6484	1.3404	0.68	CG
34	0	0.0000	0.00	295	3.7691	0.43	8103	1.0633	0.76	CG
35	0	0.0000	0.00	284	4.1320	0.81	2019	1.9032	0.75	CG
36	0	0.0000	0.00	291	4.1020	0.81	2111	1.8827	0.76	CG
37	0	0.0000	0.00	265	4.1950	0.80	1899	1.9294	0.75	CG
38	0	0.0000	0.00	178	4.4816	0.81	2173	1.8317	0.85	CG
39	0	0.0000	0.00	177	4.3518	0.92	986	2.2136	0.99	CG
40	0	0.0000	0.00	136	4.7521	0.84	1703	1.9712	0.89	CG
41	0	0.0000	0.00	277	4.1620	0.81	1781	1.9608	0.76	CG
45	0	0.0000	0.00	581	3.1628	0.61	2474	1.6651	0.99	CG
46	0	0.0000	0.00	495	3.5199	0.85	1766	1.9585	0.80	CG
47	0	0.0000	0.00	264	4.1719	0.79	2119	1.8697	0.75	CG
48	0	0.0000	0.00	296	4.1112	0.82	1871	1.9501	0.76	CG
49	0	0.0000	0.00	122	4.4691	0.76	1666	2.0230	0.74	CG
50	0	0.0000	0.00	750	3.7128	0.85	2673	1.7291	0.76	CG
53	0	0.0000	0.00	287	4.1334	0.81	3257	1.8163	0.77	CG
54	0	0.0000	0.00	615	3.3096	0.86	924	2.0904	0.78	CG
65	0	0.0000	0.00	35000	-1.0563	0.53	12111	1.0380	0.58	CG
66	0	0.0000	0.00	23589	-0.6751	0.59	19821	0.8025	0.56	CG

EVERCALC (7452; 5566 lbf)

No.	AC	LCB	AS	Subgrade	Itr.	%	Rigid Bottom
0	3499999	20000	78974	2294	3	178.8	20
R	3499999	40091	10000	4206	3	206.7	42
1	823364	24761	250000	6067	3	151.4	50
2	1917778	20000	25593	15717	3	130.4	100
3	1043839	45207	12125	23939	3	116.0	200
4	1938135	20000	12715	28884	3	108.9	500
5	1213820	20000	14362	31454	3	86.6	
6	1105208	35042	10000	34900	3	95.8	
7	901505	49577	10279	32623	3	109.9	
8	1283088	20000	13980	31675	3	83.6	
9	1414936	20000	10000	33145	3	105.5	
10	1472055	20000	13112	31131	3	94.1	
11	986999	47439	10000	32307	3	107.9	
14	909892	20000	11819	29261	3	116.1	
15	1181826	20000	14702	31645	3	88.4	
16	1671748	20000	12357	32254	3	101.2	
17	1231254	28629	10000	34368	3	90.4	
18	1571032	10000	18590	30885	3	97.6	
19	1029719	40000	10000	33845	3	99.5	
20	349226	78090	9044	33978	3	114.5	
21	1195124	20000	20000	30368	3	90.8	
24	1213820	20000	14362	31454	3	86.6	
25	1213820	20000	14362	31454	3	86.6	
26	1213820	20000	14362	31454	3	86.6	
27	1213820	20000	14362	31454	3	86.6	
28	1219849	20000	14302	31492	3	86.4	
29	1213820	20000	14362	31454	3	86.6	
30	1213820	20000	14362	31454	3	86.6	
31	1213820	20000	14362	31454	3	86.6	
34	1213820	20000	14362	31454	3	86.6	
35	1213820	20000	14362	31454	3	86.6	
36	1832659	20000	12662	31926	3	97.8	
37	980938	20000	16185	30455	3	87.1	
38	1281698	20000	13604	31812	3	83.8	
39	1171202	20000	15014	31180	3	88.2	
40	1220733	20000	14057	31406	3	85.6	
41	1211091	20000	14621	31524	3	86.6	
45	1296289	20000	13998	31713	3	85.5	
46	1305566	20000	12309	33072	3	85.5	
47	1171341	20000	14918	31411	3	87.3	
48	1303212	20000	13674	31465	3	82.8	
49	1195669	20000	14502	31905	3	90.2	
50	1237625	20000	13964	30939	3	79.0	
53	1331010	20000	12607	33610	3	85.3	
54	1390590	20000	12952	31893	3	85.1	
65	1305746	20000	13488	32973	5	99.9	
66	1305746	20000	13488	32973	5	99.9	

EVERCALC (7452; 8330 lbf)

No.	AC	LCB	AS	Subgrade	Itr.	%	Rigid Bottom
0	1087220	20000	250000	2560	3	113.4	20
R	3409439	20000	152052	2366	3	149.7	42
1	1187540	20000	189388	7399	3	103.8	50
2	1467665	21136	37191	16109	3	85.2	100
3	1767406	20000	21586	23139	3	83.5	200
4	1683538	20000	19191	27968	2	86.7	500
5	1592209	20000	15864	32714	2	85.0	
6	1700978	20000	14746	33122	3	74.6	
7	1561065	20000	16217	32530	3	76.2	
8	1601567	20000	15741	32769	2	85.0	
9	1604266	20000	15781	32481	2	84.4	
10	1616992	20000	15798	32475	2	84.2	
11	1625186	20000	15253	32941	3	74.7	
14	1640137	20000	15316	32999	3	84.7	
15	1582620	20000	15970	32665	2	85.1	
16	1650131	20000	15254	32962	2	84.5	
17	1646229	20000	15291	32959	3	84.5	
18	1781527	11113	29478	32615	3	63.2	
19	1265041	40000	11502	33413	2	89.0	
20	1635000	20000	14973	32469	3	72.8	
21	1459442	20000	20000	31305	2	84.7	
24	1592209	20000	15864	32714	2	85.0	
25	1592209	20000	15864	32714	2	85.0	
26	1592209	20000	15864	32714	2	85.0	
27	1592209	20000	15864	32714	2	85.0	
28	1590747	20000	15879	32707	2	85.1	
29	1592209	20000	15864	32714	2	85.0	
30	1592209	20000	15864	32714	2	85.0	
31	1592209	20000	15864	32714	2	85.0	
34	1592209	20000	15864	32714	2	85.0	
35	1592209	20000	15864	32714	2	85.0	
36	1882349	20000	15843	32520	2	83.9	
37	1407452	20000	15365	32923	3	85.2	
38	1607294	20000	15602	32726	2	84.9	
39	1578101	20000	16129	32704	2	85.2	
40	1595333	20000	15476	32674	2	85.0	
41	1588905	20000	16218	32759	2	85.2	
45	1676523	20000	15828	32750	2	85.0	
46	1512647	20000	15622	32724	2	84.7	
47	1568321	20000	16031	32854	2	85.4	
48	1618232	20000	15530	32561	2	84.6	
49	1578874	20000	15975	33157	2	85.5	
50	1600473	20000	15535	32090	2	84.6	
53	1607029	20000	15109	33335	2	84.4	
54	1603902	20000	16553	31480	2	85.5	
65	1595690	20000	15803	32738	2	85.0	
66	1595690	20000	15803	32738	2	85.0	

EVERCALC (7452; 10934 lbf)

No.	AC	LCB	AS	Subgrade	Itr.	%	Rigid Bottom
0	1594897	20000	250000	2448	2	85.9	20
R	1826371	20000	250000	2402	3	91.8	42
1	1416559	20000	250000	6845	3	85.5	50
2	1658588	20000	64360	14927	3	81.1	100
3	1966537	20000	31447	21708	3	80.9	200
4	2087380	20000	22046	27055	2	71.0	500
5	1971953	20000	17942	31398	2	68.8	
6	1981422	20000	17820	31443	2	68.8	
7	1970590	20000	17964	31392	2	68.8	
8	1973584	20000	17924	31404	2	68.8	
9	1976002	20000	17895	31418	2	68.8	
10	1975987	20000	17895	31418	2	68.8	
11	1976004	20000	17887	31416	2	68.8	
14	1975319	20000	17899	31410	2	68.8	
15	1973569	20000	17916	31409	2	68.8	
16	1977586	20000	17865	31425	2	68.8	
17	1979744	20000	17850	31428	2	68.8	
18	2254525	10000	49241	31508	3	51.3	
19	1631865	40000	12617	31975	2	71.9	
20	1983168	20000	17827	31443	2	68.8	
21	1896354	20000	20000	30811	2	68.7	
24	1971953	20000	17942	31398	2	68.8	
25	1971953	20000	17942	31398	2	68.8	
26	1750001	20000	19676	31002	2	71.7	
27	1971953	20000	17942	31398	2	68.8	
28	1973638	20000	17933	31404	2	68.8	
29	1971953	20000	17942	31398	2	68.8	
30	1971953	20000	17942	31398	2	68.8	
31	1971953	20000	17942	31398	2	68.8	
34	1971953	20000	17942	31398	2	68.8	
35	1971953	20000	17942	31398	2	68.8	
36	2292451	20000	18096	31366	2	68.5	
37	1715598	20000	17724	31456	2	69.2	
38	1979350	20000	17726	31380	2	68.8	
39	1968470	20000	18115	31432	2	68.9	
40	1979105	20000	17551	31376	2	68.7	
41	1969169	20000	18263	31439	2	68.9	
45	2074191	20000	17948	31414	2	68.8	
46	1852257	20000	17894	31394	2	68.8	
47	1952649	20000	18088	31537	2	69.1	
48	1991818	20000	17590	31241	2	68.6	
49	1953768	20000	18013	31728	2	69.1	
50	2000524	20000	17470	30984	2	68.4	
53	1979722	20000	17099	31877	2	68.3	
54	1962932	20000	19168	30238	2	69.5	
65	1974306	20000	17911	31408	2	68.8	
66	1974306	20000	17911	31408	2	68.8	

EVERCALC (7452; 14578 lbf)

No.	AC	LCB	AS	Subgrade	Itr.	%	Rigid Bottom
0	1756523	22865	250000	2263	2	74.1	20
R	1722281	22921	250000	2302	3	74.5	42
1	1766291	20000	250000	6551	2	72.9	50
2	1902773	22309	66671	14286	2	70.7	100
3	2383572	20000	37957	20595	3	63.8	200
4	2495991	20000	25822	25702	2	60.1	500
5	2351919	20000	20281	29896	2	57.9	
6	2350551	20000	20283	29892	2	57.9	
7	2350452	20000	20294	29893	2	57.9	
8	2351113	20000	20278	29897	4	57.9	
9	2351846	20000	20266	29900	2	57.9	
10	2351746	20000	20276	29898	2	57.9	
11	2350956	20000	20278	29896	2	57.9	
14	2350135	20000	20298	29891	2	57.9	
15	2397172	20000	19730	30042	3	57.7	
16	2352551	20000	20271	29898	2	57.9	
17	2352665	20000	20261	29899	2	57.9	
18	2588060	10000	73541	29835	3	56.2	
19	2001503	40000	13807	30373	2	60.3	
20	2349745	20000	20301	29892	2	57.9	
21	2377185	20000	20000	29981	2	57.8	
24	2351919	20000	20281	29896	2	57.9	
25	2351919	20000	20281	29896	2	57.9	
26	1750001	38257	15332	29901	3	63.4	
27	2351919	20000	20281	29896	2	57.9	
28	2352355	20000	20256	29902	2	57.9	
29	2351919	20000	20281	29896	2	57.9	
30	2402010	20000	19678	30053	2	57.7	
31	2351919	20000	20281	29896	2	57.9	
34	2351919	20000	20281	29896	2	57.9	
35	2351919	20000	20281	29896	2	57.9	
36	2726770	20000	20546	29853	2	57.7	
37	2044281	20000	20006	29943	2	58.2	
38	2355573	20000	20053	29873	2	57.9	
39	2345304	20000	20558	29907	2	58.0	
40	2399434	20000	19438	30010	3	57.7	
41	2348956	20000	20550	29927	2	58.0	
45	2468644	20000	20328	29897	2	57.9	
46	2206397	20000	20246	29886	2	57.9	
47	2377438	20000	19924	30164	3	57.9	
48	2369934	20000	19840	29759	2	57.8	
49	2382777	20000	19674	30330	3	57.9	
50	2390058	20000	19784	29608	2	57.6	
53	2363124	20000	19167	30297	2	57.5	
54	2378918	20000	21339	28952	3	58.3	
65	2354722	20000	20233	29906	2	57.9	
66	2354722	20000	20233	29906	2	57.9	

EVERCALC (7452)

No.	k1	k2	R^2	k3	k4	R^2	k5	k6	R^2	
0	17461	0.0594	0.31	0	0.0000	0.00	2408	-0.0200	0.00	FG
R	49828	-0.3018	0.22	0	0.0000	0.00	3311	-0.4344	0.02	FG
1	54001	-0.3581	0.54	0	0.0000	0.00	2927	0.3681	0.08	FG
2	0	0.0000	0.00	6133	0.9714	0.94	22671	-0.4649	0.71	FG
3	0	0.0000	0.00	23	3.4558	0.98	1141027	-1.5769	0.98	FG
4	0	0.0000	0.00	1153	1.3189	0.99	-----	-8.3888	1.00	FG
5	20000	0.0000	0.00	4192	0.6285	0.97	35220	-0.0758	0.37	FG
6	121454	-0.6751	0.18	895	1.2753	0.98	44065	-0.2055	0.99	FG
7	4265	0.6995	0.05	1166	1.1723	0.95	37540	-0.1132	0.79	FG
8	20000	0.0000	0.00	3795	0.6697	0.98	35665	-0.0828	0.44	FG
9	20000	0.0000	0.00	984	1.2410	0.95	38318	-0.1253	0.89	FG
10	20000	0.0000	0.00	3166	0.7467	1.00	33667	-0.0498	0.22	FG
11	15393	0.1900	0.00	1041	1.2144	0.98	36811	-0.1004	0.61	FG
14	20000	0.0000	0.00	1583	1.0373	0.99	29043	0.0267	0.01	FG
15	20000	0.0000	0.00	5026	0.5467	0.97	35514	-0.0796	0.44	FG
16	20000	0.0000	0.00	2534	0.8374	1.00	36358	-0.0929	0.57	FG
17	91907	-0.5896	0.48	930	1.2617	0.97	42276	-0.1815	0.97	FG
18	10422	-0.0071	0.00	87	2.7704	0.96	33001	-0.0390	0.08	FG
19	40000	0.0000	0.00	3382	0.5671	1.00	40247	-0.1439	0.88	FG
20	0	0.0000	0.00	517	1.5079	0.94	41306	-0.1697	0.99	FG
21	20000	0.0000	0.00	20000	0.0000	0.55	31435	-0.0170	0.06	FG
24	20000	0.0000	0.00	4192	0.6285	0.97	35220	-0.0758	0.37	FG
25	20000	0.0000	0.00	4192	0.6285	0.97	35220	-0.0758	0.37	FG
26	14167	0.2141	0.03	9503	0.2386	0.18	35262	-0.0774	0.45	FG
27	20000	0.0000	0.00	4192	0.6285	0.97	35220	-0.0758	0.37	FG
28	20000	0.0000	0.00	4146	0.6329	0.98	35283	-0.0768	0.39	FG
29	20000	0.0000	0.00	4192	0.6285	0.97	35220	-0.0758	0.37	FG
30	20000	0.0000	0.00	4613	0.5821	0.98	34912	-0.0694	0.34	FG
31	20000	0.0000	0.00	4192	0.6285	0.97	35220	-0.0758	0.37	FG
34	20000	0.0000	0.00	4192	0.6285	0.97	35220	-0.0758	0.37	FG
35	20000	0.0000	0.00	4192	0.6285	0.97	35220	-0.0758	0.37	FG
36	20000	0.0000	0.00	2688	0.8193	1.00	35544	-0.0818	0.55	FG
37	20000	0.0000	0.00	7102	0.3989	0.65	33012	-0.0373	0.06	FG
38	20000	0.0000	0.00	3536	0.6911	0.99	36060	-0.0891	0.51	FG
39	20000	0.0000	0.00	4804	0.5796	0.95	34542	-0.0647	0.26	FG
40	20000	0.0000	0.00	4372	0.5931	0.97	34875	-0.0687	0.34	FG
41	20000	0.0000	0.00	4354	0.6234	0.98	35325	-0.0776	0.38	FG
45	20000	0.0000	0.00	3724	0.6787	0.99	35857	-0.0860	0.47	FG
46	20000	0.0000	0.00	2255	0.8892	1.00	38901	-0.1337	0.86	FG
47	20000	0.0000	0.00	5182	0.5391	0.96	34698	-0.0637	0.28	FG
48	20000	0.0000	0.00	3766	0.6622	0.99	35280	-0.0791	0.43	FG
49	20000	0.0000	0.00	5229	0.5625	0.98	35710	-0.0776	0.39	FG
50	20000	0.0000	0.00	3670	0.6354	0.98	34177	-0.0646	0.34	FG
53	20000	0.0000	0.00	3010	0.7391	1.00	41340	-0.1500	0.86	FG
54	20000	0.0000	0.00	2183	0.9419	0.99	35825	-0.1187	0.87	FG
65	20000	0.0000	0.00	3235	0.7370	1.00	39047	-0.1357	0.85	FG
66	20000	0.0000	0.00	3235	0.7370	1.00	39047	-0.1357	0.85	FG

EVERCALC (7454; 6266 lbf)

No.	AC	AB	Subgrade	Itr.	%	Rigid Bottom
0	809999	144554	9659	3	69.8	20
1	1305184	92044	28449	3	51.3	50
R	899419	132377	14917	3	64.7	50.3
2	2042825	53162	53144	3	23.3	100
3	2665797	38279	74477	3	32.1	200
4	3499999	34703	74312	3	99.0	500
5	3499999	32532	75592	3	140.4	
6	3499999	34782	75438	3	137.9	
7	3499999	32030	75255	3	143.0	
8	3499999	35926	73591	3	145.6	
9	3499999	30508	77119	3	136.4	
14	3499999	250000	21872	3	1027.5	
15	3373769	27984	112896	3	23.3	
16	3373769	27984	112896	3	23.3	
17	3373769	27984	112896	3	23.3	
18	3373769	27984	112896	3	23.3	
19	3373769	27984	112896	3	23.3	
24	3373769	27984	112896	3	23.3	
25	3373769	27984	112896	3	23.3	
26	1750001	36421	107551	3	53.4	
27	3373769	27984	112896	3	23.3	
28	3373769	27984	112896	3	23.3	
29	3373769	27984	112896	3	23.3	
34	1360200	59347	75000	3	133.4	
35	3373769	27984	112896	3	23.3	
36	3499999	29148	111614	3	23.4	
37	2894987	28062	113249	3	22.3	
38	3399798	26811	112671	3	22.8	
39	3343064	29119	113127	3	23.7	
45	3499999	28202	112530	3	23.1	
46	3120208	28043	113035	3	21.9	
47	3274100	29424	115781	3	26.4	
48	3498009	25392	109043	3	19.1	
53	3406603	27388	115364	3	25.3	
54	3373769	27984	112896	3	23.3	
65	3206330	29091	119760	5	4.5	
66	3206330	29091	119760	5	4.5	

EVERCALC (7454; 8974 lbf)

No.	AC	AB	Subgrade	Itr.	%	Rigid Bottom
0	1134189	129956	9255	3	67.8	20
1	1449938	88054	27082	3	45.8	50
R	163381	121437	14259	3	64.4	50.3
2	2260898	49036	52408	2	21.2	100
3	3008554	34404	79396	2	13.7	200
4	3357163	29487	101021	2	6.2	500
5	3362250	27395	116459	2	4.8	
6	3362072	27397	116444	2	4.8	
7	3362611	27392	116451	2	4.8	
8	3362069	27398	116353	2	5.0	
9	3362670	27390	116511	2	4.7	
14	3499999	29745	76316	3	123.8	
15	3363431	27379	116757	1	4.6	
16	3363431	27379	116757	1	4.6	
17	3363431	27379	116757	1	4.6	
18	3363431	27379	116757	1	4.6	
19	3363431	27379	116757	1	4.6	
24	3363431	27379	116757	1	4.6	
25	3363431	27379	116757	1	4.6	
26	1750001	35182	107865	1	71.7	
27	3363431	27379	116757	1	4.6	
28	3363431	27379	116757	1	4.6	
29	3363431	27379	116757	1	4.6	
34	2126264	45398	75000	3	82.6	
35	3363431	27379	116757	1	4.6	
36	3499999	28573	114670	1	12.6	
37	2926356	27270	117005	1	5.1	
38	3396940	26332	116449	1	4.3	
39	3329503	28385	117103	1	4.9	
45	3499999	27479	116623	1	4.4	
46	3157299	27366	116698	1	4.6	
47	3258389	28685	121034	1	5.5	
48	3499999	25049	111273	1	3.2	
53	3387156	26870	120504	1	4.3	
54	3363431	27379	116757	1	4.6	
65	3372961	27361	116684	1	4.6	
66	3372961	27361	116684	1	4.6	

EVERCALC (7454; 1154

No.	AC	AB	Subgrade	Itr.	%	Rigid Bottom
0	1118432	127128	9145	1	65.9	20
1	2042825	53162	53144	3	23.3	50
R	1150310	118684	14089	1	62.4	50.3
2	2276534	47326	52058	1	21.5	100
3	2995906	33379	78965	1	14.8	200
4	3333907	28680	100618	1	7.5	500
5	3335756	26670	116264	1	5.5	
6	3335628	26670	116261	1	5.5	
7	3335647	26671	116259	1	5.5	
8	3335694	26670	116258	1	5.5	
9	3335690	26670	116256	1	5.5	
14	3334965	26685	115949	2	5.2	
15	3335705	26671	116263	1	5.5	
16	3335705	26671	116263	1	5.5	
17	3335705	26671	116263	1	5.5	
18	3335705	26671	116263	1	5.5	
19	3335705	26671	116263	1	5.5	
24	3335705	26671	116263	1	5.5	
25	3335705	26671	116263	1	5.5	
26	1750001	34127	107378	1	72.2	
27	3335705	26671	116263	1	5.5	
28	3335705	26671	116263	1	5.5	
29	3335705	26671	116263	1	5.5	
34	2258625	42483	75000	3	99.7	
35	3302173	27660	116614	1	5.9	
36	3499999	27751	114251	1	11.9	
37	2900211	26573	116504	1	6.1	
38	3368827	25641	115948	1	5.1	
39	3166186	31231	118460	2	7.5	
45	3499999	26689	116284	1	5.5	
46	3130114	26661	116195	1	5.5	
47	3231451	27963	120634	1	6.8	
48	3482875	24341	110729	1	3.8	
53	3358693	26182	120064	1	5.1	
54	3335705	26671	116263	1	5.5	
65	3335383	26672	116260	1	5.5	
66	3335383	26672	116260	1	5.5	

EVERCALC (7454; 15158 lbf)

No.	AC	AB	Subgrade	Itr.	%	Rigid Bottom
0	1098466	122905	9441	1	59.9	20
1	2260898	49036	52408	2	21.2	50
R	1142660	114072	14562	1	56.2	50.3
2	2405245	43278	55092	1	14.6	100
3	3095564	30974	84350	1	8.8	200
4	3412435	26933	107704	1	5.1	500
5	3409053	25236	124371	1	4.4	
6	3408780	25236	124362	1	4.4	
7	3409038	25237	124367	1	4.4	
8	3408765	25238	124365	1	4.4	
9	3408971	25236	124362	1	4.4	
14	3408949	25235	124341	1	4.5	
15	3408866	25236	124365	1	4.4	
16	3408866	25236	124365	1	4.4	
17	3408866	25236	124365	1	4.4	
18	3408866	25236	124365	1	4.4	
19	3408866	25236	124365	1	4.4	
24	3408866	25236	124365	1	4.4	
25	3408866	25236	124365	1	4.4	
26	1750001	32204	114750	1	77.6	
27	3408866	25236	124365	1	4.4	
28	3408866	25236	124365	1	4.4	
29	3408866	25236	124365	1	4.4	
34	2259533	41229	75000	1	119.1	
35	3374391	26215	124743	1	4.4	
36	3499999	26412	121779	1	14.6	
37	2962525	25152	124632	1	4.3	
38	3442896	24218	124026	1	4.4	
39	3244081	29682	127330	1	4.5	
45	3499999	25444	123995	1	4.8	
46	3198622	25232	124286	1	4.4	
47	3300690	26548	129500	1	4.6	
48	3499999	23070	117609	1	5.3	
53	3429574	24817	128658	1	4.4	
54	3408866	25236	124365	1	4.4	
65	3408836	25237	124362	1	4.4	
66	3408836	25237	124362	1	4.4	

EVERCALC (7454)

No.	k1	k2	R^2	k3	k4	R^2	
0	230671	-0.2043	0.87	9672	-0.0395	0.16	FG
1	129069	-0.1530	0.92	28683	-0.0449	0.11	FG
R	203076	-0.1874	0.93	14997	-0.0270	0.16	FG
2	90655	-0.2812	0.97	15593	0.4725	0.34	FG
3	62257	-0.2933	0.96	0	5.7273	0.90	FG
4	56431	-0.3281	0.93	0.258	0.8078	0.72	FG
5	52282	-0.3278	0.91	18031	0.7291	0.81	CG
6	63929	-0.4224	0.85	18037	0.7290	0.81	CG
7	49917	-0.3060	0.92	17724	0.7357	0.81	CG
8	70523	-0.4684	0.82	16611	0.7608	0.81	CG
9	43357	-0.2395	0.97	19251	0.7038	0.80	CG
14	1110	1.7954	0.11	1644	1.6326	0.97	CG
15	34419	-0.1305	0.91	81723	0.1481	0.84	CG
16	34419	-0.1305	0.91	81723	0.1481	0.84	CG
17	34419	-0.1305	0.91	81723	0.1481	0.84	CG
18	34419	-0.1305	0.91	81723	0.1481	0.84	CG
19	34419	-0.1305	0.91	81723	0.1481	0.84	CG
24	34419	-0.1305	0.91	81723	0.1481	0.84	CG
25	34419	-0.1305	0.91	81723	0.1481	0.84	CG
26	48675	-0.1524	0.96	86212	0.0939	0.59	CG
27	34419	-0.1305	0.91	81723	0.1481	0.84	CG
28	34419	-0.1305	0.91	81723	0.1481	0.84	CG
29	34419	-0.1305	0.91	81723	0.1481	0.84	CG
34	171795	-0.5662	0.65	75000	0.0000	0.00	FG
35	34419	-0.1305	0.91	81723	0.1481	0.84	CG
36	35781	-0.1248	0.93	83502	0.1315	0.82	CG
37	34984	-0.1399	0.94	81947	0.1481	0.84	CG
38	32892	-0.1280	0.89	82314	0.1430	0.84	CG
39	35922	-0.1332	0.93	80998	0.1541	0.85	CG
45	34702	-0.1317	0.96	81385	0.1490	0.87	CG
46	34717	-0.1347	0.93	82190	0.1458	0.83	CG
47	36592	-0.1310	0.94	79878	0.1719	0.88	CG
48	30331	-0.1201	0.88	84499	0.1151	0.77	CG
53	33313	-0.1242	0.90	83126	0.1617	0.88	CG
54	34419	-0.1305	0.91	81723	0.1481	0.84	CG
65	38836	-0.1876	0.98	103335	0.0583	0.21	CG
66	38836	-0.1876	0.98	103335	0.0583	0.21	CG

EVERCALC (8153; 5532 lbf)

No.	AC	AB	AS	Subgrade	Itr.	%	Rigid Bottom
0	380936	16494	151931	1000	3	42.2	20
1	517058	13528	200499	2752	3	28.5	50
2	485338	21332	57187	6223	3	38.1	100
3	1106646	65185	13788	9685	3	48.8	200
4	879704	12349	49778	11385	3	6.8	500
R	788635	14576	39287	11796	3	7.5	600
5	917583	10000	39299	13246	3	11.7	
6	897757	10000	41264	13231	3	10.8	
7	898797	10000	46012	13257	3	6.3	
8	862376	11764	35688	13319	3	4.7	
9	1009360	25655	15644	13658	3	19.3	
10	917781	10000	44439	13247	3	7.0	
11	3499999	23857	10000	14011	3	70.7	
14	703894	23022	19755	13420	3	6.8	
15	882969	10000	32694	13014	3	26.5	
16	882969	10000	32694	13014	3	26.5	
17	882969	10000	32694	13014	3	26.5	
18	940626	8068	36307	12975	3	37.3	
19	719867	20000	23308	13138	3	6.4	
20	882969	10000	32694	13014	3	26.5	
21	849704	10000	40609	13013	3	19.2	
24	882969	10000	32694	13014	3	26.5	
25	882969	10000	32694	13014	3	26.5	
26	882969	10000	32694	13014	3	26.5	
27	882969	10000	32694	13014	3	26.5	
28	882969	10000	32694	13014	3	26.5	
29	882969	10000	32694	13014	3	26.5	
30	882969	10000	32694	13014	3	26.5	
31	882969	10000	32694	13014	3	26.5	
34	882969	10000	32694	13014	3	26.5	
35	882969	10000	32694	13014	3	26.5	
36	1060557	10000	30062	12953	3	30.9	
37	759991	10000	36282	13048	3	21.5	
38	868010	10000	32711	13039	3	25.3	
39	895136	10000	32771	12976	3	28.2	
40	872419	10000	34832	13041	3	26.1	
41	893883	10000	30839	12983	3	27.3	
45	939311	10000	31542	13012	3	28.1	
46	818553	10000	34264	12997	3	25.2	
47	874162	10000	34405	13074	3	27.1	
48	893686	10000	30406	12932	3	25.2	
49	889733	10000	30604	13006	3	28.5	
50	877771	10000	34393	13003	3	25.7	
53	929632	10547	26408	13027	3	28.8	
54	882969	10000	32694	13014	3	26.5	
65	898734	10000	49451	13258	4	3.5	
66	898734	10000	49451	13258	4	3.5	

EVERCALC (8153; 8062 lbf)

No.	AC	AB	AS	Subgrade	Itr.	%	Rigid Bottom
0	649239	11512	250000	1000	3	27.2	20
1	583369	12315	250000	2623	2	27.8	50
2	628605	14254	114371	5669	2	30.3	100
3	864755	16344	47203	8910	3	17.9	200
4	1033875	10544	71961	11046	1	4.5	500
R	980118	11239	66324	11255	2	2.8	600
5	961054	10000	49769	13017	1	1.9	
6	960887	10000	50027	13017	1	1.8	
7	962111	10000	50451	13016	1	1.5	
8	965417	10000	48006	13013	1	3.3	
9	790362	20918	20891	13191	2	5.7	
10	962047	10000	50367	13014	1	1.5	
11	849366	23512	19072	12804	3	12.2	
14	781336	21060	21167	13185	1	5.9	
15	957995	10000	48052	13021	1	3.5	
16	957995	10000	48052	13021	1	3.5	
17	957995	10000	48052	13021	1	3.5	
18	1020309	7846	93996	13009	2	0.7	
19	798040	20000	22000	13162	1	5.6	
20	957995	10000	48052	13021	1	3.5	
21	957859	10000	49900	13020	1	2.0	
24	957995	10000	48052	13021	1	3.5	
25	957995	10000	48052	13021	1	3.5	
26	957995	10000	48052	13021	1	3.5	
27	957995	10000	48052	13021	1	3.5	
28	957995	10000	48052	13021	1	3.5	
29	957995	10000	48052	13021	1	3.5	
30	957995	10000	48052	13021	1	3.5	
31	957995	10000	48052	13021	1	3.5	
34	957995	10000	48052	13021	1	3.5	
35	957995	10000	48052	13021	1	3.5	
36	1106861	10000	48318	13008	1	4.7	
37	839029	10000	47789	13037	1	2.5	
38	947605	10000	46485	13034	1	3.3	
39	966992	10000	49756	13008	1	3.7	
40	951445	10000	52439	13035	1	3.6	
41	963840	10000	44529	13006	1	3.5	
45	1006918	10000	47829	13024	1	4.1	
46	899296	10000	48263	13012	1	2.9	
47	960730	10000	52487	13049	1	3.8	
48	952683	10000	41822	12989	1	3.1	
49	960154	10000	46152	13022	1	4.2	
50	956269	10000	49586	13016	1	3.1	
53	974148	10000	41551	13088	1	5.5	
54	957995	10000	48052	13021	1	3.5	
65	962694	10000	50561	13013	1	1.5	
66	962694	10000	50561	13013	1	1.5	

EVERCALC (8153; 10602 lbf)

No.	AC	AB	AS	Subgrade	Itr.	%	Rigid Bottom
0	756889	12028	250000	1000	2	24.8	20
1	655644	13425	250000	2557	2	25.9	50
2	817826	10873	250000	5296	2	22.5	100
3	1189858	10000	153444	8492	3	15.4	200
4	1139616	12168	68112	10955	1	4.6	500
R	1098700	11879	75092	11135	1	3.0	600
5	1112431	9241	74785	12885	2	1.4	
6	1085770	10000	62453	12896	1	1.5	
7	1086874	10000	62374	12898	1	1.5	
8	1086040	10000	62081	12904	1	1.6	
9	1091334	10000	57278	12891	2	5.4	
10	1086805	10000	62400	12897	1	1.5	
11	1091822	10000	56895	12886	2	5.9	
14	1090457	10000	57169	12890	2	5.6	
15	1084648	10000	62234	12900	1	1.7	
16	1084648	10000	62234	12900	1	1.7	
17	1084648	10000	62234	12900	1	1.7	
18	1115030	8904	83093	12883	1	1.5	
19	906114	20000	24981	13040	1	4.1	
20	1084648	10000	62234	12900	1	1.7	
21	1085826	10000	62351	12900	1	1.5	
24	1084648	10000	62234	12900	1	1.7	
25	1084648	10000	62234	12900	1	1.7	
26	1084648	10000	62234	12900	1	1.7	
27	1084648	10000	62234	12900	1	1.7	
28	1084648	10000	62234	12900	1	1.7	
29	1084648	10000	62234	12900	1	1.7	
30	1084648	10000	62234	12900	1	1.7	
31	1084648	10000	62234	12900	1	1.7	
34	1084648	10000	62234	12900	1	1.7	
35	1084648	10000	62234	12900	1	1.7	
36	1250667	10000	63952	12878	1	1.8	
37	950314	10000	60281	12913	1	1.7	
38	1073435	10000	59337	12916	1	1.9	
39	1096874	10000	65034	12879	1	1.6	
40	1077642	10000	69446	12911	1	1.8	
41	1092143	10000	56539	12883	1	1.5	
45	1139544	10000	62359	12909	1	1.7	
46	1018139	10000	61893	12892	1	1.6	
47	1091996	10000	69252	12918	1	1.5	
48	1072979	10000	52402	12878	1	2.0	
49	1086042	10000	60391	12892	1	1.9	
50	1085182	10000	63345	12907	1	1.6	
53	1079018	10818	47590	12977	1	1.2	
54	1084648	10000	62234	12900	1	1.7	
65	1086085	10000	62473	12896	1	1.5	
66	1086085	10000	62473	12896	1	1.5	

EVERCALC (8153; 14162 lbf)

No.	AC	AB	AS	Subgrade	Itr.	%	Rigid Bottom
0	815787	14008	250000	1000	2	23.9	20
1	737329	15486	250000	2556	2	24.7	50
2	933168	12448	250000	5313	2	22.8	100
3	1392926	10100	204928	8525	3	17.9	200
4	1336653	12677	88190	11067	1	5.2	500
R	1241175	13308	83303	11282	1	3.5	600
5	1221248	11350	65846	13093	1	2.2	
6	1213042	11546	64717	13087	1	1.9	
7	1219509	11286	68127	13085	1	1.7	
8	1214672	11519	64781	13090	1	1.9	
9	1209335	11765	61655	13095	1	2.2	
10	1209752	11675	62930	13093	1	2.0	
11	1218211	11403	66022	13089	1	1.9	
14	1215325	11442	65682	13092	1	1.9	
15	1207198	11802	61364	13091	1	2.2	
16	1207198	11802	61364	13091	1	2.2	
17	1207198	11802	60364	13091	1	2.2	
18	1209573	11727	58596	13072	1	5.7	
19	1051497	20000	30663	13216	1	3.5	
20	1207198	11802	61364	13091	1	2.2	
21	1208488	11685	63025	13088	1	2.0	
24	1207198	11802	61364	13091	1	2.2	
25	1207198	11802	61364	13091	1	2.2	
26	1207198	11802	61364	13091	1	2.2	
27	1207198	11802	61364	13091	1	2.2	
28	1207198	11802	61364	13091	1	2.2	
29	1207198	11802	61364	13091	1	2.2	
30	1207198	11802	61364	13091	1	2.2	
31	1207198	11802	61364	13091	1	2.2	
34	1207198	11802	61364	13091	1	2.2	
35	1207198	11802	61364	13091	1	2.2	
36	1377699	12234	58544	13082	1	2.6	
37	1076018	10877	71487	13093	1	1.7	
38	1219982	10686	73534	13097	1	1.8	
39	1204131	12450	55773	13078	1	3.2	
40	1211955	11294	75835	13108	1	1.8	
41	1208083	12059	53744	13080	1	2.3	
45	1273677	11551	64940	13090	1	1.9	
46	1139598	11481	65195	13082	1	1.8	
47	1200702	12296	59576	13114	1	3.1	
48	1230130	10167	70582	13059	1	2.3	
49	1214668	11551	62663	13087	1	2.0	
50	1216297	11309	69295	13084	1	1.8	
53	1179463	13741	41864	13164	1	3.5	
54	1207198	11802	61364	13091	1	2.2	
65	1210528	11626	63652	13089	1	2.0	
66	1210528	11626	63652	13089	1	2.0	

EVERCALC (8153)

No.	k1	k2	R^2	k3	k4	R^2	k5	k6	R^2	
0	13871	-0.0137	0.00	0	0.0000	0.00	1000	0.0000	0.00	FG
1	7692	0.1718	0.41	0	0.0000	0.00	3062	-0.3206	0.81	FG
2	0	0.0000	0.00	1131	2.0592	0.87	12369	-1.0118	0.81	FG
3	0	0.0000	0.00	499	2.3853	0.94	48522	-1.4565	0.79	FG
4	0	0.0000	0.00	561	3.1386	0.77	511368	-2.0550	0.44	FG
R	----	----	----	----	----	----	----	----	----	----
5	6746	0.1459	0.55	3509	1.4897	0.95	13430	-0.0207	0.26	FG
6	6711	0.1472	0.56	4540	1.3579	0.95	13409	-0.0200	0.26	FG
7	7071	0.1274	0.57	7308	1.1221	0.93	13483	-0.0239	0.33	FG
8	11211	-0.0167	0.00	2172	1.7370	0.96	13612	-0.0297	0.33	FG
9	170328	-0.9679	0.23	22	4.0038	0.84	14671	-0.0760	0.65	FG
10	6487	0.1596	0.56	8368	1.0308	0.91	13424	-0.0206	0.27	FG
11	43220	-0.4378	0.26	14	4.2411	0.92	14742	-0.0866	0.77	FG
14	94801	-0.7337	0.09	54	3.5541	0.77	14149	-0.0525	0.48	FG
15	6504	0.1603	0.54	1230	2.0194	0.89	12826	0.0066	0.04	CG
16	6504	0.1603	0.54	1230	2.0194	0.89	12826	0.0066	0.04	CG
17	6504	0.1603	0.54	1230	2.0194	0.89	12826	0.0066	0.04	CG
18	2936	0.3831	0.67	10682	0.9789	0.10	12708	0.0101	0.09	CG
19	20000	0.0000	0.00	8515	0.5906	0.53	12952	0.0069	0.05	CG
20	6504	0.1603	0.54	1230	2.0194	0.89	12826	0.0066	0.04	CG
21	6401	0.1640	0.57	4599	1.3433	0.93	12893	0.0061	0.03	CG
24	6504	0.1603	0.54	1230	2.0194	0.89	12826	0.0066	0.04	CG
25	6504	0.1603	0.54	1230	2.0194	0.89	12826	0.0066	0.04	CG
26	6504	0.1603	0.54	1230	2.0194	0.89	12826	0.0066	0.04	CG
27	6504	0.1603	0.54	1230	2.0194	0.89	12826	0.0066	0.04	CG
28	6504	0.1603	0.54	1230	2.0194	0.89	12826	0.0066	0.04	CG
29	6504	0.1603	0.54	1230	2.0194	0.89	12826	0.0066	0.04	CG
30	6504	0.1603	0.54	1230	2.0194	0.89	12826	0.0066	0.04	CG
31	6504	0.1603	0.54	1230	2.0194	0.89	12826	0.0066	0.04	CG
34	6504	0.1603	0.54	1230	2.0194	0.89	12826	0.0066	0.04	CG
35	6504	0.1603	0.54	1230	2.0194	0.89	12826	0.0066	0.04	CG
36	6113	0.1843	0.52	933	2.1536	0.81	12826	0.0066	0.04	CG
37	7945	0.0854	0.55	1238	2.0531	1.00	12579	0.0148	0.16	CG
38	8391	0.0647	0.54	639	2.3623	1.00	12996	0.0010	0.00	CG
39	5702	0.2115	0.53	1869	1.8096	0.70	12928	0.0034	0.01	CG
40	7275	0.1180	0.54	343	2.8345	0.97	12696	0.0106	0.08	CG
41	6173	0.1805	0.53	2162	1.6395	0.85	12901	0.0044	0.02	FG
45	6932	0.1369	0.53	708	2.3214	0.94	12713	0.0101	0.08	FG
46	6924	0.1365	0.55	1249	2.0308	0.95	12817	0.0070	0.05	FG
47	5984	0.2025	0.54	1624	1.9453	0.69	12779	0.0079	0.05	FG
48	9561	0.0158	0.54	786	2.1588	0.99	13002	0.0021	0.01	FG
49	6916	0.1377	0.54	1006	2.2459	0.94	12552	0.0151	0.22	FG
50	7240	0.1201	0.54	636	2.2750	0.97	12818	0.0067	0.04	FG
53	5229	0.2615	0.52	3573	1.2448	0.66	12784	0.0080	0.06	FG
54	6504	0.1603	0.54	1230	2.0194	0.89	12635	0.0172	0.24	FG
65	6438	0.1615	0.57	14634	0.7415	0.80	12826	0.0066	0.04	FG
66	6438	0.1615	0.57	14634	0.7415	0.80	13457	-0.0224	0.30	FG
							13457	-0.0224	0.30	FG

D. MODULUS 4.0

MODULUS (0512; 6399 lbf)

No.	AC	CTB	AS	Subgrade	%	Rigid Bottom
0	390000	25100	77900	2600	18.8	20
1	422000	20200	149000	5000	18.0	50
2	408100	20000	166000	8300	16.8	100
3	423600	20000	128800	13500	17.7	200
4	415000	20000	141400	16000	16.5	500
5	417700	20000	130900	18500	16.9	
16	417700	20000	130900	18500	16.9	
17	412500	20000	139500	18200	16.4	
18	450900	16900	250000	16700	16.9	
19	311000	40000	30900	26200	20.9	
20	415100	20000	135000	18300	16.6	
21	414000	20000	136400	18300	16.6	
26	417700	20000	130900	18500	16.9	
27	417700	20000	130900	18500	16.9	
28	412700	20000	138600	18200	16.4	
29	414400	20000	134700	18400	16.7	
30	414400	20000	125000	18300	16.9	
31	415300	20000	134200	18400	16.7	
36	463300	20000	139900	18100	16.2	
37	379500	20000	121300	18900	17.6	
38	413500	20000	117100	18900	16.8	
39	418500	20000	153600	17900	16.6	
40	416400	20000	138000	18800	16.9	
41	418400	20000	125000	18200	16.9	
45	438700	20000	134500	18500	16.7	
46	389600	20000	129800	18400	16.8	
47	413500	20000	141600	18400	17.0	
48	420900	20000	114700	18700	16.8	
49	417700	20000	128100	18600	16.9	
50	418100	20000	131600	18500	16.9	
53	418000	20000	129000	18500	16.9	
54	419000	20000	129600	18300	17.1	
91	417700	20000	130900	18500	16.9	
92	418800	20000	128600	18600	17.0	
93	417700	20000	130900	18500	16.9	
94	411200	20000	130700	18100	16.6	
95	No Solution					
96	414400	20000	124500	18300	17.0	

MODULUS (0512; 9327 lbf)

No.	AC	CTB	AS	Subgrade	%	Rigid Bottom
0	372500	39100	67500	2300	38.1	20
1	506600	23100	139000	4600	21.6	50
2	546600	20000	163200	8500	16.4	100
3	518000	25400	69500	18600	19.9	200
4	509800	24200	91400	14200	15.4	500
5	499200	28400	53700	21900	21.9	
16	499200	28400	53700	21900	21.9	
17	499200	28400	53700	21900	21.9	
18	499200	28400	53700	21900	21.9	
19	403700	40000	39600	22800	17.5	
20	499200	28400	53700	21900	21.9	
21	499200	28400	53700	21900	21.9	
26	499200	28400	53700	21900	21.9	
27	499200	28400	53700	21900	21.9	
28	499200	28400	53700	21900	21.9	
29	499200	28400	53700	21900	21.9	
30	499200	28400	53700	21900	21.9	
31	499200	28400	53700	21900	21.9	
36	545200	29800	51800	22000	21.1	
37	450500	28200	53600	21900	22.0	
38	502500	27600	54800	21900	21.7	
39	492000	29400	52600	21900	21.9	
40	504800	27300	58400	21800	21.9	
41	498700	28800	51700	21800	22.1	
45	522900	28600	54100	21900	21.6	
46	473100	27700	54700	21800	22.3	
47	494600	28000	55300	21900	22.0	
48	500400	29000	51400	21900	21.7	
49	499200	28400	52000	22000	21.8	
50	496000	28600	55100	21800	21.7	
53	492000	29800	49600	22100	22.3	
54	498600	28200	55900	21400	21.1	
91	499200	28400	53700	21900	21.9	
92	499200	28400	53700	21900	21.9	
93	499200	28400	53700	21900	21.9	
94	499200	28400	53700	21900	21.9	
95	No Solution					
96	499200	28400	53700	21900	21.9	

MODULUS (0512; 12058 lbf)

No.	AC	CTB	AS	Subgrade	%	Rigid Bottom
0	387000	49100	62500	2100	38.1	20
1	546100	27000	126900	4200	19.4	50
2	615100	21700	164900	7600	14.8	100
3	575300	25900	99800	12800	15.6	200
4	553100	30000	66300	17300	18.0	500
5	557000	32100	53900	20400	20.4	
16	557000	32100	53900	20400	20.4	
17	557000	32100	53900	20400	20.4	
18	564400	31000	56200	20300	20.9	
19	484200	40000	44800	20900	18.3	
20	557000	32100	53900	20400	20.4	
21	557000	32100	53900	20400	20.4	
26	570200	30300	57700	20200	21.2	
27	557000	32100	53900	20400	20.4	
28	557000	32100	53900	20400	20.4	
29	557000	32100	53900	20400	20.4	
30	570400	30600	56800	20300	21.0	
31	557000	32100	53900	20400	20.4	
36	611000	33000	53500	20400	19.8	
37	496200	32500	52900	20500	20.5	
38	554100	31700	54400	20400	20.2	
39	562500	31600	55600	20300	21.0	
40	564100	30600	59200	20300	20.6	
41	548000	33100	51100	20400	20.5	
45	583900	32100	54800	20400	20.4	
46	509800	32800	52600	20400	20.4	
47	555400	31000	56500	20400	20.8	
48	553400	32800	52500	20300	20.3	
49	564800	30800	54900	20900	21.0	
50	550600	32500	55300	20300	20.3	
53	549600	33000	51300	20500	21.0	
54	556100	31500	56700	19900	19.8	
91	557000	32100	53900	20400	20.4	
92	557000	32100	53900	20400	20.4	
93	557000	32100	53900	20400	20.4	
94	559700	31400	55500	20300	20.8	
95	No Solution					
96	559700	31400	55500	20300	20.8	

MODULUS (0512; 15418 lbf)

No.	AC	CTB	AS	Subgrade	%	Rigid Bottom
0	429100	57900	64200	2100	36.9	20
1	616700	30700	129300	4300	18.9	50
2	712000	23700	176500	7700	14.4	100
3	660600	28700	104900	13100	15.0	200
4	596400	37300	62200	18000	16.3	500
5	616500	38200	53900	21200	18.7	
16	616500	38200	53900	21200	18.7	
17	616500	38200	53900	21200	18.7	
18	620800	37400	55300	21100	18.9	
19	597600	40100	51900	21300	18.2	
20	616500	38200	53900	21200	18.7	
21	616500	38200	53900	21200	18.7	
26	611600	38300	54100	21200	18.7	
27	616500	38200	53900	21200	18.7	
28	616500	38200	53900	21200	18.7	
29	616500	38200	53900	21200	18.7	
30	616500	38200	53900	21200	18.7	
31	616500	38200	53900	21200	18.7	
36	640700	42600	50100	21400	17.1	
37	566700	36900	54700	21200	19.2	
38	627700	36300	56500	21100	18.9	
39	610100	39100	52900	21200	18.7	
40	630200	36000	59100	21100	18.9	
41	609900	39000	51800	21200	18.9	
45	636400	39100	53700	21300	18.5	
46	595700	35800	56900	21000	19.5	
47	618500	36700	56000	21200	19.0	
48	632500	37400	54400	21100	18.9	
49	611100	38500	51800	21300	18.6	
50	621700	37200	57200	21000	19.0	
53	614300	38600	52200	21200	19.3	
54	614100	37500	56700	20700	18.1	
91	616500	38200	53900	21200	18.7	
92	616500	38200	53900	21200	18.7	
93	616500	38200	53900	21200	18.7	
94	621100	37400	55200	21100	18.9	
95	No Solution					
96	621100	37400	55200	21100	18.9	

MODULUS (0517; 6378 lbf)

No.	AC	CTB	AS	Subgrade	%	Rigid Bottom
0	129900	20000	10000	5400	55.5	20
1	124800	20000	10000	10900	54.9	50
2	123300	20000	10000	15500	54.2	100
3	122700	20000	10000	18800	53.7	200
4	123900	20000	10100	20000	57.2	500
5	120300	20000	10700	20000	59.8	
16	120300	20000	10700	20000	59.8	
17	200000	20000	10000	20000	74.9	
18	192300	10000	10200	30800	55.8	
19	100000	40000	10000	17900	83.0	
20	155600	20000	6300	63200	57.6	
21	100000	20000	20000	12600	75.1	
26	120300	20000	10700	20000	59.8	
27	120300	20000	10700	20000	59.8	
28	120300	20000	10700	20000	59.8	
29	120300	20000	10700	20000	59.8	
30	120300	20000	10700	20000	59.8	
31	120400	20000	10700	20000	59.8	
36	122900	22000	10000	22000	56.4	
37	107500	20000	10600	20000	61.6	
38	121700	20000	10800	20000	59.3	
39	119000	20000	10700	20000	60.3	
40	120900	20000	10500	20000	59.4	
41	119700	20000	10900	20000	60.1	
45	118300	22400	10000	22300	56.7	
46	111800	20000	10500	20000	60.3	
47	117300	20000	10700	20000	60.7	
48	118900	21600	10000	21600	57.5	
49	118100	20000	10800	20000	61.2	
50	117500	21300	10000	21200	55.8	
53	120400	20000	10700	20000	59.9	
54	120300	20500	10300	20500	59.0	
91	124000	37200	12400	12400	105.0	
92	120300	20000	10700	20000	59.8	
93	109800	20000	21100	11000	87.9	
94	120700	20000	10000	23000	54.3	
95	No Solution					
96	120700	20000	10000	23000	54.3	

MODULUS (0517; 9436 lbf)

No.	AC	CTB	AS	Subgrade	%	Rigid Bottom
0	208600	20000	10000	7100	49.3	20
1	200300	20000	10000	14700	49.3	50
2	199400	20000	10000	20000	47.9	100
3	185100	20500	11000	20500	46.4	200
4	161700	25300	10000	25300	47.8	500
5	153600	26800	10000	26700	47.7	
16	153500	26800	10000	26700	47.7	
17	200000	20000	12800	20000	51.6	
18	256000	10000	14200	26900	47.4	
19	107700	40000	10000	24600	55.8	
20	220000	20000	7800	51700	50.1	
21	134700	20000	20000	15300	58.3	
26	153600	26800	10000	26700	47.7	
27	153600	26800	10000	26700	47.7	
28	165500	23000	11400	23000	48.7	
29	154100	26700	10000	26700	47.5	
30	153600	26800	10000	26700	47.7	
31	153600	26800	10000	26700	47.7	
36	168500	26900	10000	26900	47.3	
37	138500	26300	10000	26300	48.5	
38	169300	20900	12800	20900	49.3	
39	151200	26500	10000	26500	47.5	
40	161600	25600	10000	25600	47.0	
41	155900	27000	10000	27000	47.5	
45	177800	20000	13600	20000	50.0	
46	143100	26400	10000	26300	47.4	
47	149500	26700	10000	26700	47.6	
48	157900	26800	10000	26800	47.7	
49	154100	26700	10000	26700	48.6	
50	161900	25600	10000	25600	47.7	
53	153500	26700	10000	26700	47.6	
54	155400	26500	10000	26500	47.7	
91	103200	28700	33600	9600	93.9	
92	153600	26800	10000	26700	47.7	
93	160700	20000	16500	16100	58.1	
94	192300	20000	10000	29800	48.2	
95	No Solution					
96	192200	20000	10000	29800	48.2	

MODULUS (0517; 12236 lbf)

No.	AC	CTB	AS	Subgrade	%	Rigid Bottom
0	286100	20000	10500	7500	44.6	20
1	267400	20000	11500	13000	43.6	50
2	268300	20000	10900	20000	43.3	100
3	247700	20000	12500	20000	42.0	200
4	230500	21600	12800	21600	41.1	500
5	209500	29100	10000	29100	43.0	
16	209500	29100	10000	29100	43.0	
17	222400	20000	15100	20000	41.4	
18	313200	10000	18400	23700	42.0	
19	158800	40000	10000	27200	43.5	
20	281700	20000	9500	36500	43.6	
21	192700	20000	20000	16600	46.5	
26	209500	29100	10000	29100	43.0	
27	209500	29100	10000	29100	43.0	
28	209800	29100	10000	29100	43.0	
29	222200	20000	15100	20000	41.4	
30	209500	29100	10000	29100	43.0	
31	209500	29100	10000	29100	43.0	
36	244400	20000	15200	20000	40.4	
37	196900	22000	13100	22000	41.8	
38	213600	29400	10000	29400	43.1	
39	206400	28800	10000	28700	42.8	
40	222700	25400	11100	25400	41.3	
41	205500	29900	10000	29900	43.2	
45	234500	20000	15200	20000	41.3	
46	194900	28800	10000	28800	43.0	
47	215700	25300	11300	25300	41.2	
48	215900	29000	10000	29000	42.9	
49	209400	28900	10100	28900	41.8	
50	226500	20000	14900	20000	40.3	
53	209600	29000	10000	29000	42.9	
54	212200	28800	10000	28800	43.0	
91	151400	45400	15100	15100	66.2	
92	209500	29100	10000	29100	43.0	
93	201700	20000	17700	17700	43.7	
94	273400	20000	10000	33000	43.3	
95	No Solution					
96	273400	20000	10000	33000	43.3	

MODULUS (0517; 15922 lbf)

No.	AC	CTB	AS	Subgrade	%	Rigid Bottom
0	369000	20000	14500	5900	38.6	20
1	354400	20000	15200	11800	37.5	50
2	349300	20000	14400	17800	37.5	100
3	333400	20000	15500	20000	36.7	200
4	309800	22300	15400	22300	36.1	500
5	287400	33600	10400	33600	37.6	
16	287400	33600	10400	33600	37.6	
17	296100	24300	14900	24300	35.9	
18	400100	10000	26400	23000	36.2	
19	252300	40000	10100	33700	38.0	
20	363900	20000	12500	32200	37.6	
21	286700	20000	20000	19900	35.4	
26	287400	33600	10400	33600	37.6	
27	287400	33600	10400	33600	37.6	
28	287400	33600	10400	33600	37.6	
29	287400	33600	10400	33600	37.6	
30	296200	24300	14900	24300	35.9	
31	295500	22300	16600	22300	35.4	
36	326900	22700	16400	22700	35.4	
37	250500	33800	10200	33800	37.9	
38	293500	34100	10400	34100	37.7	
39	280400	33900	10200	33900	37.6	
40	295600	20700	18500	20700	34.8	
41	295100	24100	15200	24100	35.8	
45	311900	22700	16400	22700	35.5	
46	267000	33600	10400	33600	37.7	
47	279900	34000	10300	34000	37.6	
48	293500	34000	10300	34000	37.7	
49	289900	25700	14000	25700	36.0	
50	300200	20700	18400	20700	35.1	
53	286600	33600	10400	33600	37.6	
54	288400	34000	10200	34000	37.8	
91	164300	40900	26700	13600	61.6	
92	287400	33600	10400	33600	37.6	
93	287400	20000	19900	19900	35.3	
94	364800	20000	12400	32500	37.7	
95	No Solution					
96	364800	20000	12400	32500	37.7	

MODULUS (2647; 5657 lbf)

No.	AC	CTB	AS	Subgrade	%	Rigid Bottom
0	3500000	1637000	39100	6600	30.0	20
1	3500000	1202300	33400	16900	25.0	50
2	3500000	1161000	17400	36700	22.2	100
3	3500000	895500	31600	45500	16.7	200
4	3500000	378500	166000	45300	39.0	500
5	3500000	620100	55600	58500	27.1	
16	3500000	686900	44300	60800	24.7	
17	3500000	522800	76900	56500	31.0	
18	3500000	620100	55600	58500	27.1	
19	3500000	620100	55600	58500	27.1	
20	3500000	620100	55600	58500	27.1	
21	3500000	630700	57800	57800	29.0	
26	1750000	1078500	26400	69800	20.7	
27	7000000	445900	51600	59600	18.7	
28	3500000	620100	55600	58500	27.1	
29	3500000	620100	55600	58500	27.1	
30	3500000	852500	22300	71300	16.1	
31	3500000	620100	55600	58500	27.1	
36	3500000	946000	21600	72000	16.6	
37	3500000	656700	37000	63800	19.7	
38	3500000	554300	76100	57300	28.9	
39	3500000	581700	56600	57500	30.0	
40	3500000	522900	76900	56500	31.0	
41	3500000	524800	73300	56700	30.6	
45	3500000	554400	83300	55400	34.7	
46	3500000	417600	92400	56800	32.2	
47	3500000	521100	76600	56400	31.4	
48	3500000	473300	89900	56300	32.7	
49	3500000	521500	76700	56400	32.0	
50	3500000	843100	23300	68100	17.5	
53	3500000	594700	58100	57700	28.6	
54	3500000	470300	89300	55700	30.6	
91	No Solution					
92	3500000	522800	85100	55400	34.1	
93	No Solution					
94	3500000	977900	14000	86300	16.0	
95	No Solution					
96	3500000	950500	15500	80600	15.2	

MODULUS (2647; 8549 lbf)

No.	AC	CTB	AS	Subgrade	%	Rigid Bottom
0	3500000	1197700	10100	13200	22.0	20
1	3500000	928900	49400	18100	17.4	50
2	3500000	751500	53800	32400	12.2	100
3	3500000	371700	150700	40200	37.2	200
4	3500000	504000	70400	54500	31.9	500
5	3500000	664800	28500	75000	21.3	
16	3500000	149900	94600	81100	102.0	
17	3500000	664800	28500	75000	21.3	
18	3500000	57200	125600	120300	199.0	
19	3500000	664800	28500	75000	21.3	
20	3500000	875100	12800	107600	10.5	
21	3500000	330400	112800	61000	50.0	
26	1750000	994300	23700	79000	24.3	
27	7000000	174800	37700	93500	82.2	
28	3500000	664800	28500	75000	21.3	
29	3500000	664800	28500	75000	21.3	
30	3500000	664800	28500	75000	21.3	
31	3500000	664800	28500	75000	21.3	
36	3500000	744800	27700	75200	21.2	
37	3500000	457400	58100	64700	34.7	
38	3500000	653500	38500	70300	25.2	
39	3500000	439000	56700	65700	37.4	
40	3500000	596700	37600	69600	26.9	
41	3500000	462100	59700	65700	36.8	
45	3500000	686600	28700	74900	21.8	
46	3500000	579400	34700	72100	24.9	
47	3500000	567500	39700	69600	27.4	
48	3500000	510300	53700	65900	34.3	
49	3500000	526300	43900	69900	30.9	
50	3500000	511000	59400	63500	34.7	
53	3500000	548800	41900	69300	30.4	
54	3500000	624900	35600	69100	24.0	
91	No Solution					
92	3500000	470000	63900	63900	37.3	
93	1941200	539700	161900	54000	69.0	
94	3500000	898700	11500	115400	9.8	
95	No Solution					
96	3500000	898700	11500	115400	9.8	

MODULUS (2647; 11153 lbf)

No.	AC	CTB	AS	Subgrade	%	Rigid Bottom
0	3303100	1222000	11200	11000	25.0	20
1	3500000	714400	99600	15600	16.0	50
2	3500000	838100	35200	33500	15.7	100
3	3500000	491500	99400	40600	27.2	200
4	3500000	493000	68900	53300	28.1	500
5	3500000	661600	28100	72400	18.6	
16	3500000	146600	92500	83500	115.0	
17	3500000	661600	28100	72400	18.6	
18	3500000	661600	28100	72400	18.6	
19	3500000	661600	28100	72400	18.6	
20	3500000	874100	12600	102400	12.3	
21	3500000	315900	110400	59400	45.7	
26	1750000	961600	23400	76900	20.2	
27	7000000	470400	29700	71600	14.2	
28	3500000	661600	28100	72400	18.6	
29	3500000	661600	28100	72400	18.6	
30	3500000	661600	28100	72400	18.6	
31	3500000	661600	2810	72400	18.6	
36	3500000	789100	22900	75900	17.0	
37	3500000	463000	56800	62700	30.3	
38	3500000	654000	39000	67200	22.1	
39	3500000	467700	58400	61500	32.6	
40	3500000	583700	36800	68100	23.2	
41	3500000	611000	34000	70000	20.9	
45	3500000	641900	34700	68700	22.4	
46	3500000	642400	26900	73200	17.2	
47	3500000	647900	29800	70900	19.7	
48	3500000	534600	49100	64500	28.5	
49	3500000	557500	43200	66100	25.9	
50	3500000	573000	43600	64100	25.9	
53	3500000	542300	47300	64100	28.3	
54	3500000	618700	35000	67200	20.6	
91	No Solution					
92	3500000	492300	61400	61400	32.0	
93	2028900	524200	157300	52400	63.7	
94	3500000	899200	11200	111100	13.0	
95	No Solution					
96	3500000	899200	11200	111100	13.0	

MODULUS (2647; 15019 lbf)

No.	AC	CTB	AS	Subgrade	%	Rigid Bottom
0	3500000	1185400	10100	11900	19.2	20
1	3500000	672600	106700	15300	13.6	50
2	3500000	877700	29100	34400	12.9	100
3	3500000	877000	17600	58600	11.5	200
4	3500000	489500	68400	52900	33.3	500
5	3500000	610100	35300	67600	27.0	
16	3500000	145600	91900	82900	115.0	
17	3500000	610100	35300	67600	27.0	
18	3500000	610100	35300	67600	27.0	
19	3500000	610100	35300	67600	27.0	
20	3500000	818400	14800	91900	14.0	
21	3500000	313700	109600	59000	51.0	
26	1750000	993600	22800	75800	23.9	
27	7000000	451300	30000	71500	19.3	
28	3500000	610100	35300	67600	27.0	
29	3500000	610100	35300	67600	27.0	
30	3500000	610100	35300	67600	27.0	
31	3500000	610100	35300	67600	27.0	
36	3500000	787800	22600	75400	19.7	
37	3500000	439200	56400	62800	36.0	
38	3500000	656800	36800	67600	26.0	
39	3500000	454000	59300	61000	38.5	
40	3500000	579600	36600	67600	28.5	
41	3500000	620600	34400	68400	26.1	
45	3500000	637300	34500	68100	27.1	
46	3500000	637800	27500	71800	21.9	
47	3500000	638600	29300	70700	23.2	
48	3500000	581300	42700	64900	30.9	
49	3500000	630900	31500	70500	25.1	
50	3500000	588600	38200	65600	28.6	
53	3500000	679800	23500	76300	20.4	
54	3500000	603600	35400	66900	26.0	
91	No Solution					
92	3500000	521600	60100	60100	36.1	
93	2015900	520800	156200	52100	66.4	
94	3500000	892600	11000	110400	11.9	
95	No Solution					
96	3500000	892600	11000	110400	11.9	

MODULUS (7452; 5565 lbf)

No.	AC	LCB	AS	Subgrade	%	Rigid Bottom
0	2740400	20000	10000	6000	27.8	20
1	2605600	20000	10000	13100	29.1	50
2	2463200	20000	10000	19000	30.2	100
3	2333200	20000	13000	20000	32.1	200
4	2160900	20000	17700	20000	33.9	500
5	2056400	20000	23200	20000	35.5	
16	2056400	20000	23200	20000	35.5	
17	2056400	20000	23200	20000	35.5	
18	2674600	10200	10200	34000	30.0	
19	1835000	40000	10000	24800	34.3	
20	2209600	28200	8400	28200	32.3	
21	2043400	20600	20600	20600	35.1	
26	1750000	25900	16500	22200	36.4	
27	1999700	20000	24000	20000	35.8	
28	2056400	20000	23200	20000	35.5	
29	2056400	20000	23200	20000	35.5	
30	2061000	20000	23100	20000	35.5	
31	2063600	20000	23100	20000	35.5	
36	2553900	20000	23800	20000	35.2	
37	1816200	20400	20600	20400	35.4	
38	2059400	20000	23100	20000	35.5	
39	2049000	20000	23400	20000	35.5	
40	2062800	20100	22500	20100	35.4	
41	2065600	20400	21200	20400	35.2	
45	2165800	20000	23200	20000	35.5	
46	1928800	20000	23200	20000	35.5	
47	2040100	20000	23500	20000	35.6	
48	2074600	20000	22600	20000	35.4	
49	2052100	20300	21500	20300	35.4	
50	2079700	20000	22800	20000	35.3	
53	2054100	20000	22300	20000	35.5	
54	2085100	20000	22300	20000	35.2	
91	1999700	20000	24000	20000	35.8	
92	2043400	20600	20600	20600	35.1	
93	421800	136400	40900	13600	57.0	
94	2326400	20000	10000	28300	31.8	
95	No Solution					
96	2326400	20000	10000	28300	31.8	

MODULUS (7452; 8330 lbf)

No.	AC	LCB	AS	Subgrade	%	Rigid Bottom
0	3154900	20000	10000	6700	26.6	20
1	3018300	20000	10000	14700	27.8	50
2	2888100	20000	10800	20000	29.1	100
3	2410200	20000	25300	20000	33.4	200
4	2608800	20000	16800	20000	31.4	500
5	2337600	22200	21300	22200	33.8	
16	2337600	22200	21300	22200	33.8	
17	2337600	22200	21300	22200	33.8	
18	3023700	10900	10900	36200	29.0	
19	2185700	40000	10000	27700	32.5	
20	2521100	30500	8800	30500	31.1	
21	2241500	22300	22300	22300	33.8	
26	1750000	29000	12600	29000	35.9	
27	2282900	22200	21800	22200	34.0	
28	2337600	22200	21300	22200	33.8	
29	2337600	22200	21300	22200	33.8	
30	2272000	20400	32800	20400	35.0	
31	2304600	20900	28700	20900	34.6	
36	2787900	20000	38100	20000	35.0	
37	2072200	23300	17800	23300	33.6	
38	2321200	21200	26300	21200	34.4	
39	2337600	22200	21500	22200	33.8	
40	2349900	22400	20500	22400	33.7	
41	2301800	20900	28000	20900	34.6	
45	2456300	22100	21700	22100	33.8	
46	2207300	22500	20100	22500	33.6	
47	2337700	21800	22900	21800	34.1	
48	2366100	21900	21900	21900	33.8	
49	2270000	20600	30600	20600	34.9	
50	2341600	21200	26200	21200	34.3	
53	2291800	20600	29200	20600	34.8	
54	2278800	20000	35500	20000	34.9	
91	2282900	22200	21800	22200	34.0	
92	2228300	22300	22300	22300	34.0	
93	579000	143800	43100	14400	52.9	
94	2709300	20000	10000	31700	30.2	
95	No Solution					
96	2709300	20000	10000	31700	30.2	

MODULUS (7452; 10933 lbf)

No.	AC	LCB	AS	Subgrade	%	Rigid Bottom
0	3500000	24700	10000	6600	24.0	20
1	3452900	20000	10000	15600	24.3	50
2	3274600	20900	11000	20900	25.6	100
3	2929400	20000	20000	20000	28.0	200
4	2741300	21000	25200	21000	29.6	500
5	2682300	23800	20000	23800	29.8	
16	2682300	23800	20000	23800	29.8	
17	2682300	23800	20000	23800	29.8	
18	3383200	12100	11100	36900	25.7	
19	2572000	40000	10000	29500	28.5	
20	2876300	31200	9400	31200	27.6	
21	2602800	23100	23100	23100	30.1	
26	1750000	48600	10000	30700	34.6	
27	2624500	24100	19800	24100	30.0	
28	2682300	23800	20000	23800	29.8	
29	2682300	23800	20000	23800	29.8	
30	2619900	22300	27000	22300	30.6	
31	2563200	21300	35100	21300	31.2	
36	3261400	22100	28300	22100	30.4	
37	2312200	23200	22000	23200	30.3	
38	2671600	23500	21200	23500	29.9	
39	2660200	23600	20800	23600	29.9	
40	2615400	22200	27700	22200	30.6	
41	2479100	20000	50100	20000	32.0	
45	2797200	23700	20600	23700	29.8	
46	2522300	24000	19400	24000	29.7	
47	2655700	23800	20400	23800	29.9	
48	2701200	23900	19600	23900	29.7	
49	2647100	23500	21100	23500	30.0	
50	2532600	20800	40300	20800	31.4	
53	2669600	23500	20300	23500	29.9	
54	2698500	23500	20400	23500	29.6	
91	2624500	24100	19800	24100	30.0	
92	2503900	23300	23300	23300	30.3	
93	516100	155600	46700	15600	49.6	
94	3115700	20000	10000	33900	26.5	
95	No Solution					
96	3115700	20000	10000	33900	26.5	

MODULUS (7452; 14577 lbf)

No.	AC	LCB	AS	Subgrade	%	Rigid Bottom
0	3500000	20000	33100	4400	22.4	20
1	3500000	33300	10000	14400	22.2	50
2	3500000	20000	14000	19700	22.9	100
3	3270600	20300	21400	20300	24.5	200
4	2941000	20000	41200	20000	26.8	500
5	3019600	25000	19100	25000	25.9	
16	3019600	25000	19100	25000	25.9	
17	3019600	25000	19100	25000	25.9	
18	3500000	18800	10700	34500	23.3	
19	2950600	40000	10000	30800	24.7	
20	3209300	32100	9600	32100	24.0	
21	2870600	23900	23900	23900	26.4	
26	1750000	32100	12600	32100	36.3	
27	2901700	24100	22900	24100	26.6	
28	3019600	25000	19100	25000	25.9	
29	3019600	25000	19100	25000	25.9	
30	2139900	31900	10000	31900	24.1	
31	2818800	21500	41300	21500	27.7	
36	3500000	38100	11800	29000	25.8	
37	2584900	23400	24400	23400	26.7	
38	2976900	24200	21900	24200	26.2	
39	2995500	24700	20100	24700	26.0	
40	2785100	21100	49100	21100	28.0	
41	3003100	24600	20600	24600	26.1	
45	3147000	24500	20700	24500	26.1	
46	2774100	23700	23400	23700	26.4	
47	2962200	24300	21500	24300	26.2	
48	3021300	24400	20600	24400	26.0	
49	2991900	25000	19400	25000	26.0	
50	2868300	21900	36400	21900	27.3	
53	3007100	24600	19700	24600	26.1	
54	3000800	23800	22400	23800	26.1	
91	2901700	24100	22900	24100	26.6	
92	2813800	24000	24000	24000	26.7	
93	592100	161100	48300	16100	44.0	
94	3500000	20000	10000	35600	22.9	
95	No Solution					
96	3500000	20000	10000	35500	23.0	

MODULUS (7454; 6265 lbf)

No.	AC	AB	Subgrade	%	Rigid Bottom
0	2878100	24100	80200	10.4	20
1	2756600	28100	93800	11.1	50
2	2641900	31100	103600	11.9	100
3	2559100	33000	109900	12.4	200
4	2483400	34400	114600	12.7	500
5	2435500	35400	117800	13.0	
16	2435500	35400	117800	13.0	
17	2435500	35400	117800	13.0	
18	2790800	24800	247800	11.1	
19	1869800	64900	64900	17.1	
26	1750000	64900	66300	17.4	
27	2435500	35400	117800	13.0	
28	2435500	35400	117800	13.0	
29	2435500	35400	117800	13.0	
36	2958400	35400	117800	12.4	
37	2182300	35200	117300	13.4	
38	2456600	34600	115400	13.0	
39	2453600	35800	119400	13.0	
45	2561400	35400	117800	13.0	
46	2318600	35100	117100	13.0	
47	2399300	36300	121000	13.2	
48	2515900	33400	111400	12.7	
53	2455600	35200	117500	13.0	
54	2483700	34900	116300	12.9	
91	No Solution				
92	1869800	64900	64900	17.1	
93	2790800	24800	247800	11.1	
94	2790800	24800	247800	11.1	
95	No Solution				
96	2790800	24800	247800	11.1	

MODULUS (7454; 8973 lbf)

No.	AC	AB	Subgrade	% Error	Rigid Bottom
0	2908700	30500	35100	10.7	20
1	2929500	26500	88400	10.7	50
2	2803900	29300	97800	11.3	100
3	2734800	31100	103800	11.8	200
4	2668100	32400	108100	12.1	500
5	2630700	33300	111100	12.4	
16	2630700	33300	111100	12.4	
17	2630700	33300	111100	12.4	
18	2949500	23400	233900	10.7	
19	1936200	62700	62700	16.3	
26	1750000	66300	61800	17.1	
27	2630700	33300	111100	12.4	
28	2630700	33300	111100	12.4	
29	2630700	33300	111100	12.4	
36	3157400	33500	111600	11.8	
37	2328700	33300	111100	12.8	
38	2638500	32700	109000	12.4	
39	2624700	33900	113000	12.4	
45	2753200	33400	111300	12.4	
46	2474300	33300	110900	12.4	
47	2583800	34300	114400	12.6	
48	2690100	31600	105300	12.2	
53	2629900	33300	111100	12.4	
54	2646400	33100	110200	12.3	
91	No Solution				
92	1936200	62700	62700	16.3	
93	2949500	23400	233900	10.7	
94	2949500	23400	233900	10.7	
95	No Solution				
96	2949500	23400	233900	10.7	

MODULUS (7454; 11541 lbf)

No.	AC	AB	Subgrade	% Error	Rigid Bottom
0	2772500	31800	31900	9.6	20
1	2816900	26400	88000	9.5	50
2	2706400	29200	97200	10.0	100
3	2615000	31000	103500	10.5	200
4	2563100	32300	107500	10.8	500
5	2518600	33200	110600	11.1	
16	2518600	33200	110600	11.1	
17	2518600	33200	110600	11.1	
18	2862800	23200	232000	9.6	
19	1868700	62000	62000	15.0	
26	1750000	64500	61300	15.6	
27	2518600	33200	110600	11.1	
28	2518600	33200	110600	11.1	
29	2518600	33200	110600	11.1	
36	3050900	33200	110700	10.5	
37	2277700	32900	109600	11.4	
38	2557700	32400	108000	11.0	
39	2525600	33700	112300	11.1	
45	2667200	33100	110300	11.0	
46	2387600	33000	110100	11.1	
47	2494800	34000	113500	11.3	
48	2584700	31400	104800	10.8	
53	2516700	33200	110700	11.1	
54	2555700	32800	109300	11.0	
91	No Solution				
92	1868700	62000	62000	15.0	
93	2862800	23200	232000	9.6	
94	2862800	23200	232000	9.6	
95	No Solution				
96	2862800	23200	232000	9.6	

MODULUS (7454; 15157 lbf)

No.	AC	AB	Subgrade	% Error	Rigid Bottom
0	2830800	23200	71500	9.6	20
1	2680300	26800	89300	9.9	50
2	2538100	29800	99200	10.2	100
3	2471300	31500	105100	10.4	200
4	2403100	32800	109400	10.8	500
5	2393200	33600	111900	11.0	
16	2393200	33600	111900	11.0	
17	2393200	33600	111900	11.0	
18	2697200	23700	236600	9.9	
19	1808500	62000	62000	15.1	
26	1750000	59700	65000	15.0	
27	2393200	33600	111900	11.0	
28	2393200	33600	111900	11.0	
29	2393200	33600	111900	11.0	
36	2840700	33900	112900	10.6	
37	2135200	33500	111500	11.4	
38	2397800	33000	109800	11.0	
39	2364300	34300	114300	11.0	
45	2494600	33700	112300	11.0	
46	2233400	33600	112000	11.0	
47	2331000	34600	115500	11.2	
48	2432000	32000	106500	10.8	
53	2375600	33700	112200	11.1	
54	2409600	33300	111000	10.9	
91	No Solution				
92	1808500	62000	62000	15.1	
93	2697200	23700	236600	9.9	
94	2697200	23700	236600	9.9	
95	No Solution				
96	2697200	23700	236600	9.9	

MODULUS (8153; 5531 lbf)

No.	AC	LCB	AS	Subgrade	%	Rigid Bottom
0	467400	20000	129400	1200	40.5	20
1	514500	20000	98000	3300	42.9	50
2	507100	20000	75600	6200	34.1	100
3	548700	20000	48400	9200	25.4	200
4	586100	20000	34000	11600	18.3	500
5	735500	11400	57600	13200	14.5	
16	735500	11400	57600	13200	14.5	
17	735500	11400	57600	13200	14.5	
18	735500	11400	57600	13200	14.5	
19	628500	20000	26700	13500	14.8	
20	735500	11400	57600	13200	14.5	
21	729900	11800	54300	13200	14.5	
26	754000	11900	46600	13300	14.2	
27	735500	11400	57600	13200	14.5	
28	71300	1300	44300	13200	14.2	
29	735500	11400	57600	13200	14.5	
30	746400	10700	62900	13100	15.1	
31	735500	11400	57600	13200	14.5	
36	860700	13500	42900	13200	14.5	
37	673900	10000	76800	13200	14.7	
38	702900	13400	41000	13200	14.0	
39	703100	14100	39500	13200	14.2	
40	712500	12500	52000	13200	14.3	
41	714700	13200	40300	13200	14.4	
45	797100	10100	77200	13200	14.9	
46	660900	13600	40400	13200	14.1	
47	709500	13100	45800	13300	14.3	
48	720900	12200	44200	13200	14.2	
49	711900	13300	40000	13300	14.1	
50	709900	13400	43200	13200	14.0	
53	717800	13300	39000	13300	15.0	
54	725800	11500	63600	12800	13.9	
91	709900	13200	42700	13200	14.2	
92	709900	13200	42700	13200	14.2	
93	735500	11400	57600	13200	14.5	
94	781100	10100	63500	13200	14.9	
95	No Solution					
96	781100	10100	63500	13200	14.9	

MODULUS (8153; 8062 lbf)

No.	AC	LCB	AS	Subgrade	%	Rigid Bottom
0	496100	20000	133400	1100	36.1	20
1	542100	20700	95400	3200	39.5	50
2	535500	20000	79800	6000	30.3	100
3	583800	20000	50100	9000	22.1	200
4	623100	20000	35400	11300	17.2	500
5	705300	16800	32700	13100	12.9	
16	705300	16800	32700	13100	12.9	
17	705300	16800	32700	13100	12.9	
18	705300	16800	32700	13100	12.9	
19	663800	20000	27800	13100	13.7	
20	705300	16800	32700	13100	12.9	
21	746400	13700	42400	13000	13.1	
26	798800	11900	48600	13000	13.1	
27	705300	16800	32700	13100	12.9	
28	786900	11000	66100	12900	13.7	
29	705300	16800	32700	13100	12.9	
30	705300	16800	32700	13100	12.9	
31	705300	16800	32700	13100	12.9	
36	878600	15300	37300	13000	13.1	
37	663800	13500	42100	13000	12.8	
38	766100	11800	54300	13000	13.3	
39	738500	14600	38700	13000	13.0	
40	743800	13600	45800	13000	12.9	
41	712300	16400	32200	13000	12.8	
45	758100	15600	35500	13000	12.7	
46	726700	11600	57900	12900	13.5	
47	729800	14700	39200	13000	12.9	
48	725500	15200	34500	13000	12.6	
49	721300	15500	34200	13100	12.7	
50	696900	17500	32400	13000	13.1	
53	750900	13700	39100	13000	14.0	
54	793900	10300	85000	12500	13.3	
91	705300	16800	32700	13100	12.9	
92	705300	16800	32700	13100	12.9	
93	705300	16800	32700	13100	12.9	
94	789200	12400	44600	13000	13.3	
95	No Solution					
96	789200	12400	44600	13000	13.3	

MODULUS (8153; 10602 lbf)

No.	AC	LCB	AS	Subgrade	%	Rigid Bottom
0	572600	20000	155100	1100	30.7	20
1	583500	24300	92600	3100	37.2	50
2	611500	20000	97200	5700	26.2	100
3	670100	20000	59800	8800	19.9	200
4	711200	20000	42400	11200	15.3	500
5	794600	17000	38400	12900	12.4	
16	794600	17000	38400	12900	12.4	
17	794600	17000	38400	12900	12.4	
18	794600	17000	38400	12900	12.4	
19	758200	20100	31900	13000	12.1	
20	794600	17000	38400	12900	12.4	
21	794600	17000	38400	12900	12.4	
26	832100	16200	37000	13000	12.2	
27	794600	17000	38400	12900	12.4	
28	794600	17000	38400	12900	12.4	
29	794600	17000	38400	12900	12.4	
30	794600	17000	38400	12900	12.4	
31	794600	17000	38400	12900	12.4	
36	993400	15900	42700	12900	12.7	
37	725400	15600	40900	12900	12.1	
38	811900	16000	40100	12900	12.0	
39	795300	17200	38200	12900	12.6	
40	789400	17500	38400	13000	11.9	
41	811900	16200	38000	12900	12.6	
45	844200	16700	38800	12900	12.3	
46	718300	19500	32600	13000	12.1	
47	791100	17000	39000	12900	12.4	
48	797300	17100	36200	12900	12.1	
49	804600	16400	38300	12900	12.4	
50	795400	17000	39600	12900	12.3	
53	811500	16400	37300	12900	13.1	
54	777700	17700	39400	12600	12.4	
91	794600	17000	38400	12900	12.4	
92	794600	17000	38400	12900	12.4	
93	794600	17000	38400	12900	12.4	
94	826600	16600	36200	13000	12.2	
95	No Solution					
96	826600	16600	36200	13000	12.2	

MODULUS (8153; 14162 lbf)

No.	AC	LCB	AS	Subgrade	%	Rigid Bottom
0	67909	20000	196400	1100	25.1	20
1	643800	28300	94200	3100	34.6	50
2	723100	20000	128200	5600	22.1	100
3	775300	20000	80700	8800	17.4	200
4	828300	20000	55400	11300	13.4	500
5	897800	18700	44300	13100	11.5	
16	897800	18700	44300	13100	11.5	
17	897800	18700	44300	13100	11.5	
18	897800	18700	44300	13100	11.5	
19	880400	20000	41100	13100	11.4	
20	897800	18700	44300	13100	11.5	
21	897800	18700	44300	13100	11.5	
26	949500	16600	48000	13100	11.6	
27	897800	18700	44300	13100	11.5	
28	897800	18700	44300	13100	11.5	
29	897800	18700	44300	13100	11.5	
30	896100	18800	43400	13100	11.5	
31	897800	18700	44300	13100	11.5	
36	1247700	11300	117400	12900	13.5	
37	798100	18500	43700	13100	11.3	
38	895000	18500	44700	13100	11.4	
39	906900	18600	45000	13100	11.7	
40	889100	19100	45700	13100	11.2	
41	905700	18700	41700	13100	11.6	
45	946900	18500	45200	13100	11.6	
46	836400	18900	43800	13100	11.5	
47	894700	18700	44900	13100	11.5	
48	897800	18600	42400	13100	11.4	
49	901300	18600	42600	13100	11.5	
50	899800	18500	47000	13100	11.5	
53	913500	18600	41400	13100	12.0	
54	979700	12700	95800	12500	12.5	
91	897800	18700	44300	13100	11.5	
92	897800	18700	44300	13100	11.5	
93	897800	18700	44300	13100	11.5	
94	952700	16500	47400	13100	11.7	
95	No Solution					
96	952700	16500	47400	13100	11.7	

E. WESDEF

WESDEF (0512; 6400 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	410560	20000	156571	1595	3	23.9	20
1	419249	20000	151339	4488	3	23.7	50
2	456433	20000	115271	9261	3	19.7	100
3	494438	20000	87213	14437	3	15.0	200
4	444955	25637	49521	19522	3	13.0	500
5	496277	20000	85961	14681	3	14.8	208
6	487728	20454	85618	14627	3	14.8	
7	498537	20000	81193	14835	3	14.9	
8	495025	20000	85851	14666	3	14.7	
9	493090	20000	83551	14701	3	14.7	
10	482915	21177	70140	14894	3	17.2	
11	497010	20000	86544	14655	3	14.7	
14	100000	20000	24782	26062	3	199.5	
15	466667	21965	76117	14743	3	15.0	
16	496155	20000	85908	14682	3	14.8	
17	496282	20000	85944	14682	3	14.8	
18	489285	19878	78132	14730	3	15.9	
19	280488	40000	42172	15863	3	23.7	
20	493616	20000	85737	14643	3	14.6	
21	494057	20067	82160	14772	3	14.9	
24	493720	20014	84387	14695	3	14.7	
25	492426	20016	83733	14698	3	14.7	
26	496246	20000	85865	14686	3	14.8	
27	495677	20000	86009	14684	3	14.8	
28	496277	20000	85961	14681	3	14.8	
29	496277	20000	85961	14681	3	14.8	
30	496277	20000	85961	14681	3	14.8	
31	496277	20000	85961	14681	3	14.8	
34	496482	20000	86038	14678	3	14.8	
35	496189	20000	85838	14687	3	14.8	
36	565281	20000	85903	14657	3	14.7	
37	438241	20000	84292	14736	3	14.9	
38	484631	20000	81715	14811	3	15.3	
39	496841	20490	85299	14628	3	14.5	
40	488737	20000	91512	14831	3	15.3	
41	496046	20317	78539	14576	3	14.4	
45	519846	20000	86756	14692	3	15.1	
46	465679	20000	83359	14696	3	14.5	
47	492516	20000	89244	14677	3	14.5	
48	496788	20000	80677	14718	3	15.3	
49	495848	20000	84109	14673	3	14.8	
50	496820	20000	87310	14692	3	14.8	
53	483129	21373	71692	15482	3	14.2	
54	479297	20000	95307	13134	3	16.7	
55	606786	20000	250000	15825	3	20.5	
56	446826	20000	77806	15263	3	15.6	
57	606786	20000	250000	15825	2	20.5	
58	485908	20000	89468	14764	3	15.4	
59	400362	32006	34135	11616	3	12.0	
60	481928	21548	69635	14036	3	14.1	
63	496277	20000	85961	14681	3	14.8	
64	496277	20000	85961	14681	3	14.8	

WESDEF (0512; 9328 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	490766	24815	149095	1512	3	22.0	20
1	556124	20107	167621	4194	3	17.9	50
2	602309	20000	131727	8728	3	13.7	100
3	591758	23488	74802	14206	3	11.1	200
4	549031	30149	47195	18782	2	9.5	500
5	589179	23791	72827	14462	3	11.0	208
6	573422	24655	66210	14625	3	11.8	
7	594090	23779	70798	14503	3	10.7	
8	602329	22786	74539	14361	3	10.1	
9	584875	24026	71417	14494	3	11.1	
10	502485	34489	50988	14941	3	15.3	
11	599736	22924	70542	14374	3	13.2	
14	130996	20000	15773	31674	3	291.1	
15	506708	34181	58428	14426	3	18.1	
16	588020	23878	72570	14468	3	11.1	
17	590536	23694	73132	14455	3	11.0	
18	621881	21249	75106	14242	3	17.3	
19	396102	40000	46001	15144	3	17.7	
20	589867	23812	64856	14504	3	15.9	
21	588249	23905	72797	14462	3	11.1	
24	592184	23547	73244	14453	3	10.9	
25	586420	24041	72354	14472	3	11.1	
26	597489	23254	74630	14420	3	10.7	
27	590448	23683	73464	14438	3	10.9	
28	589179	23791	72827	14462	3	11.0	
29	589179	23791	72827	14462	3	11.0	
30	589179	23791	72827	14462	3	11.0	
31	589179	23791	72827	14462	3	11.0	
34	589101	23801	72924	14454	3	11.0	
35	589497	23757	72845	14465	3	11.0	
36	641267	25895	67147	14587	3	11.7	
37	541660	22309	78147	14370	3	10.4	
38	593723	22934	74575	14508	3	11.1	
39	584877	24586	71244	14415	3	10.9	
40	597006	22882	81491	14540	3	11.1	
41	581477	24700	66196	14382	3	10.9	
45	616941	24080	70946	14578	3	10.9	
46	547368	24030	72571	14379	3	11.0	
47	583916	23744	74608	14455	3	10.8	
48	595958	23521	70940	14469	3	11.3	
49	588791	23801	70818	14452	3	11.0	
50	589428	23802	74529	14471	3	11.1	
53	587161	24527	64575	15101	3	9.9	
54	626144	20000	95443	12527	3	16.2	
55	835111	20000	250000	15643	3	22.0	
56	574002	21474	77187	14742	3	10.9	
57	835111	20000	250000	15643	2	22.0	
58	594148	22881	77448	14422	3	15.4	
59	455267	42400	30545	11563	3	10.0	
60	563150	26629	58644	13803	3	10.6	
63	589179	23791	72827	14462	3	11.0	
64	589179	23791	72827	14462	3	11.0	

WESDEF (0512; 12059 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	533250	29544	138522	1371	3	21.9	20
1	435702	61075	82897	4191	3	51.2	50
2	681280	20000	134791	7865	3	16.2	100
3	639369	26780	76022	13001	3	8.0	200
4	589865	37625	42906	17815	2	8.6	500
5	634074	27397	73661	13258	3	8.0	208
6	650252	24846	78233	13008	3	13.9	
7	646851	27084	72124	13341	3	7.1	
8	639870	27420	70006	13444	3	7.6	
9	628920	27404	73581	13213	3	8.3	
10	537837	40494	55438	13385	3	15.1	
11	636034	27374	74084	13252	3	8.0	
14	642832	26265	73826	13255	3	8.2	
15	449514	80753	33448	13906	3	40.3	
16	634127	27327	74551	13219	3	7.8	
17	636047	27586	68858	13466	3	8.0	
18	632275	27468	69329	13403	3	8.3	
19	491082	40000	50687	13927	3	12.9	
20	630700	27805	69467	13417	3	7.9	
21	635910	27465	71220	13373	3	7.4	
24	631338	27741	71086	13357	3	7.4	
25	636625	27282	72667	13312	3	7.5	
26	639074	27086	73995	13266	3	7.8	
27	624328	28154	72046	13292	3	7.7	
28	634074	27397	73661	13258	3	8.0	
29	634074	27397	73661	13258	3	8.0	
30	634074	27397	73661	13258	3	8.0	
31	634074	27397	73661	13258	3	8.0	
34	633348	27482	73527	13259	3	7.5	
35	634712	27327	73741	13260	3	8.0	
36	714353	27594	76093	13108	3	9.4	
37	573565	26757	71812	13403	3	8.0	
38	642827	26376	71669	13466	3	8.0	
39	626438	28587	71043	13244	3	7.5	
40	644639	26102	82351	13339	3	7.9	
41	624412	28829	63860	13339	3	8.0	
45	682266	26658	69589	13461	3	9.9	
46	585852	28532	70531	13301	3	7.9	
47	624208	27712	73508	13297	3	7.5	
48	646752	26974	69085	13413	3	7.9	
49	634219	27642	67143	13431	3	8.0	
50	635128	27306	76216	13243	3	8.2	
53	607067	30734	61258	14047	3	7.2	
54	646827	25293	80343	11961	3	12.0	
55	384764	795638	102452	12706	3	104.0	
56	607956	25447	74337	13605	3	7.5	
57	384764	795638	102452	12706	2	104.0	
58	643894	26394	70612	13360	3	8.7	
59	494269	48612	31587	10152	3	9.7	
60	600253	31501	60290	12576	3	8.1	
63	634074	27397	73661	13258	3	8.0	
64	634074	27397	73661	13258	3	8.0	

WESDEF (0512; 15419 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	611607	33922	143152	1398	3	23.8	20
1	477208	76039	95661	4107	3	57.2	50
2	782021	21808	135352	8091	3	23.2	100
3	738080	29115	81737	13277	3	8.1	200
4	653169	40436	50057	18038	3	6.9	500
5	731245	29880	79197	13550	3	8.1	208
6	742141	28191	78104	13484	3	14.9	
7	723502	31579	71045	13844	3	7.6	
8	726080	31328	71792	13875	3	7.4	
9	714219	30902	76526	13586	3	8.2	
10	526896	84341	41766	14124	3	32.9	
11	729693	30339	79173	13561	3	8.1	
14	1196556	20000	250000	10667	3	38.1	
15	469927	148782	24215	14670	3	69.7	
16	727535	30211	78984	13554	3	8.2	
17	733973	29724	78498	13580	3	7.8	
18	717835	31623	69424	13917	3	8.9	
19	608665	40000	59878	14150	3	9.3	
20	740758	29179	77012	13618	3	9.5	
21	728195	30346	79105	13558	3	8.1	
24	738526	29297	78989	13558	3	8.3	
25	725737	30533	78839	13562	3	8.1	
26	741447	29166	80551	13525	3	8.0	
27	717673	30886	77262	13594	3	8.1	
28	731245	29880	79197	13550	3	8.1	
29	731245	29880	79197	13550	3	8.1	
30	731245	29880	79197	13550	3	8.1	
31	731245	29880	79197	13550	3	8.1	
34	730979	29920	79251	13544	3	8.1	
35	732176	29772	79356	13548	3	8.1	
36	797060	32980	74212	13670	3	7.6	
37	654388	30185	73533	13832	3	7.4	
38	738471	28621	81764	13581	3	8.2	
39	723901	31097	76695	13525	3	8.0	
40	745356	28219	89068	13612	3	8.2	
41	717940	31528	71628	13484	3	8.0	
45	803265	27281	82556	13444	3	12.7	
46	664339	32549	72081	13768	3	7.3	
47	722054	30057	79564	13568	3	7.9	
48	743144	29221	78756	13536	3	8.2	
49	730929	29889	76728	13541	3	8.1	
50	731034	29953	81399	13559	3	8.1	
53	697084	34082	66544	14355	3	7.4	
54	730610	28722	81892	12322	3	12.4	
55	522395	326968	161093	13447	3	76.6	
56	704820	27538	81395	13847	3	8.0	
57	522395	326968	161093	13447	3	76.6	
58	740648	28441	82045	13423	3	9.2	
59	562488	55224	33327	10302	3	7.7	
60	684716	36396	63200	12950	3	7.8	
63	731245	29880	79197	13550	3	8.1	
64	731245	29880	79197	13550	3	8.1	

WESDEF (0517; 6379 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	132912	20000	22581	1686	3	105.9	20
1	100000	20000	21924	4298	3	102.8	50
2	151538	20000	15080	8664	3	84.9	100
3	129663	20000	12002	12559	3	75.5	200
4	132691	20000	11391	16050	3	61.9	500
5	126933	20000	11943	12753	3	74.7	208
6	146131	20000	11508	12905	3	76.4	
7	148646	20000	12356	12702	3	71.8	
8	138893	20000	12417	12755	3	71.7	
9	144168	20000	11746	12874	3	75.2	
10	126623	20000	13203	12237	3	70.6	
11	139226	20000	11650	12848	3	76.3	
14	109963	20000	12934	12587	3	72.5	
15	115850	20000	12931	12596	3	71.1	
16	128666	20000	11840	12758	3	75.3	
17	200000	20000	11046	13087	3	81.7	
18	194716	10000	21398	11802	3	47.7	
19	100000	40000	33631	9489	3	158.3	
20		No Solution					
21	100000	20000	20000	11085	3	67.7	
24	126783	20000	11953	12753	3	74.6	
25	131320	20000	11868	12770	3	75.0	
26	126933	20000	11943	12753	3	74.7	
27		No Solution					
28	126933	20000	11943	12753	3	74.7	
29	126933	20000	11943	12753	3	74.7	
30	126885	20000	12024	12760	3	74.1	
31	127012	20000	11850	12751	3	75.3	
34	126933	20000	11943	12753	3	74.7	
35	126933	20000	11943	12753	3	74.7	
36	178759	20000	11167	13027	3	75.5	
37	125287	20000	11700	12784	3	77.0	
38	133028	20000	11974	12760	3	74.7	
39	124814	20000	11858	12768	3	75.0	
40	126958	20000	11890	12753	3	74.9	
41	126512	20000	12010	12749	3	74.4	
45	148937	20000	11938	12793	3	74.5	
46	115545	20000	12560	12658	3	71.7	
47	121885	20000	11893	12847	3	75.9	
48	157912	20000	11340	12878	3	75.2	
49	130849	20000	11452	13017	3	76.0	
50	127667	20000	12284	12480	3	73.8	
53	149635	20000	11393	13159	3	73.2	
54	142466	20000	12382	11798	3	81.0	
55	184144	20000	34176	11944	3	67.1	
56	100000	20000	11600	13238	3	80.6	
57	184144	20000	34176	11944	3	67.1	
58	128375	20000	10115	13118	3	78.3	
59	118357	20000	11049	11096	3	63.4	
60	145446	20000	10941	12398	3	74.6	
63	126933	20000	11943	12753	3	74.7	
64	126933	20000	11943	12753	3	74.7	

WESDEF (0517; 9437 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	203173	20000	30143	1641	3	84.9	20
1	238817	20000	23858	4821	3	85.8	50
2	133492	20000	20799	8783	3	69.7	100
3	186024	20000	15910	12665	3	58.1	200
4	197313	20000	13693	16738	3	49.0	500
5	187140	20000	15745	12864	3	57.7	208
6	181114	20000	16157	12830	3	56.3	
7	190491	20000	15984	12946	3	56.1	
8	170459	20000	16365	12882	3	56.0	
9	184277	20000	15703	12758	3	58.6	
10	155203	20000	16419	12981	3	57.2	
11	176775	20000	16008	12840	3	57.1	
14	166530	20000	16635	12873	3	55.5	
15	180750	20000	16150	12873	3	56.1	
16	185846	20000	15843	12846	3	57.4	
17	200000	20000	15562	12991	3	57.7	
18	275628	10000	30082	12155	3	35.4	
19	100000	40000	11963	13798	3	80.8	
20	170238	20000	16300	12853	3	56.4	
21	161956	20000	20000	12205	3	49.5	
24	187572	20000	15725	12864	3	57.8	
25	184118	20000	16034	12826	3	56.8	
26	187140	20000	15745	12864	3	57.7	
27	187140	20000	15745	12864	3	57.7	
28	187140	20000	15745	12864	3	57.7	
29	187140	20000	15745	12864	3	57.7	
30	184534	20000	16071	12801	3	56.8	
31	187026	20000	15692	12860	3	57.9	
34	187140	20000	15745	12864	3	57.7	
35	187140	20000	15745	12864	3	57.7	
36	195137	20000	16290	12794	3	55.5	
37	194433	20000	14739	13198	3	60.5	
38	186162	20000	15914	12864	3	57.4	
39	183903	20000	15946	12822	3	56.7	
40	188063	20000	15777	12891	3	58.1	
41	184739	20000	15841	12837	3	56.7	
45	181942	20000	16124	12931	3	57.2	
46	186345	20000	14999	13110	3	58.0	
47	190284	20000	15549	12949	3	59.0	
48	184405	20000	15936	12779	3	56.2	
49	185989	20000	15215	13033	3	57.9	
50	189174	20000	16209	12669	3	57.4	
53	185760	20000	15294	13360	3	54.2	
54	197345	20000	16962	11896	3	60.9	
55	249377	20000	46983	12530	3	57.2	
56	180745	20000	14401	13307	3	64.0	
57	249377	20000	46983	12530	3	57.2	
58	184841	20000	13674	13083	3	59.0	
59	183032	20000	15009	12298	3	54.4	
60	183032	20000	15009	12298	3	54.4	
63	187140	20000	15745	12864	3	57.7	
64	187140	20000	15745	12864	3	57.7	

WESDEF (0517; 12237 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	176171	20000	41760	1446	3	68.4	20
1	167844	20000	36972	4086	3	67.7	50
2	226916	20000	26829	7903	3	55.9	100
3	255486	20000	19762	11853	3	48.1	200
4	256689	20000	17478	15373	3	39.0	500
5	256247	20000	19557	12025	3	47.8	208
6	267793	20000	19592	12033	3	47.2	
7	254876	20000	20302	11984	3	46.0	
8	267930	20000	20216	11959	3	45.9	
9	258139	20000	19553	12007	3	47.8	
10	241953	20000	20661	11895	3	46.3	
11	266394	20000	20172	11958	3	46.0	
14	229710	20000	21245	11905	3	45.6	
15	243603	20000	20792	11873	3	46.0	
16	256423	20000	19548	12025	3	47.8	
17	255772	20000	19569	12028	3	47.7	
18	360989	10000	43044	11290	3	28.1	
19	250248	40000	11055	13512	3	79.0	
20	251126	20000	20274	11821	3	47.3	
21	269040	20000	20093	11969	3	46.1	
24	257560	20000	21568	11518	3	45.6	
25	255918	20000	19540	12028	3	47.8	
26	256247	20000	19557	12025	3	47.8	
27	256247	20000	19557	12025	3	47.8	
28	256247	20000	19557	12025	3	47.8	
29	256247	20000	19557	12025	3	47.8	
30	254735	20000	19835	11991	3	47.3	
31	255854	20000	19480	12021	3	48.0	
34	256247	20000	19557	12025	3	47.8	
35	256247	20000	19557	12025	3	47.8	
36	318759	20000	19734	12059	3	45.7	
37	230822	20000	20225	11945	3	47.2	
38	256998	20000	19605	12051	3	48.0	
39	255726	20000	19528	11999	3	47.5	
40	256677	20000	19791	12072	3	48.2	
41	255947	20000	19328	11985	3	47.3	
45	290686	20000	19733	12106	3	46.7	
46	226963	20000	20494	11800	3	47.2	
47	251202	20000	19600	12047	3	48.6	
48	261360	20000	19394	11998	3	47.1	
49	255843	20000	18773	12127	3	48.0	
50	259136	20000	20196	11961	3	47.3	
53	270842	20000	18411	12481	3	45.8	
54	254949	20000	22226	10913	3	49.0	
55	302357	20000	66337	11982	3	50.8	
56	191953	20000	20364	12104	3	51.9	
57	302357	20000	66337	11982	3	50.8	
58	267468	20000	17512	12108	3	46.7	
59	262915	20000	15904	9838	3	37.2	
60	277058	20000	18378	11433	3	44.2	
63	256247	20000	19557	12025	3	47.8	
64	256247	20000	19557	12025	3	47.8	

WESDEF (0517; 15923 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	281044	20000	57524	1367	3	54.7	20
1	277475	20000	48900	4020	3	55.4	50
2	355242	20000	35935	7970	3	46.4	100
3	352158	20000	28218	11905	3	37.9	200
4	358188	20000	23421	15409	3	31.2	500
5	352731	20000	27933	12088	3	37.5	208
6	331980	20000	28123	12068	3	37.4	
7	332851	20000	28249	12049	3	37.3	
8	353288	20000	27968	12082	3	37.5	
9	353026	20000	27901	12091	3	37.5	
10	329920	20000	28134	12084	3	37.3	
11	347708	20000	28090	12067	3	37.4	
14	328962	20000	28798	12041	3	36.5	
15	349386	20000	27587	12057	3	38.3	
16	370047	20000	27571	12113	3	37.9	
17	350271	20000	27948	12095	3	37.4	
18	477990	10000	74818	11254	3	24.8	
19	295951	40000	16295	13198	3	59.9	
20	352455	20000	28037	12082	3	37.4	
21	353035	20000	27857	12095	3	37.6	
24	354226	20000	27860	12097	3	37.6	
25	352881	20000	27964	12085	3	37.5	
26	352731	20000	27933	12088	3	37.5	
27	352731	20000	27933	12088	3	37.5	
28	352731	20000	27933	12088	3	37.5	
29	352731	20000	27933	12088	3	37.5	
30	352731	20000	27933	12088	3	37.5	
31	352731	20000	27933	12088	3	37.5	
34	352731	20000	27933	12088	3	37.5	
35	352731	20000	27933	12088	3	37.5	
36	410081	20000	28121	12083	3	36.8	
37	314562	20000	27487	12123	3	38.4	
38	353840	20000	27777	12137	3	38.0	
39	351990	20000	28080	12039	3	37.0	
40	353872	20000	28570	12167	3	38.2	
41	351960	20000	27366	12009	3	36.9	
45	369779	20000	28253	12075	3	37.8	
46	342934	20000	27166	12133	3	37.5	
47	351029	20000	27766	12166	3	38.0	
48	356508	20000	27665	12046	3	37.2	
49	352202	20000	26943	12136	3	37.4	
50	353746	20000	28832	12033	3	37.6	
53	363058	20000	26187	12574	3	35.7	
54	339112	20000	30979	10965	3	40.1	
55	399886	20000	101840	12179	3	43.3	
56	326734	20000	25550	12456	3	41.0	
57	399886	20000	101840	12179	3	43.3	
58	353541	20000	24776	12174	3	38.2	
59	371334	20000	20638	9416	3	28.3	
60	360860	20000	25724	11436	3	35.3	
63	352731	20000	27933	12088	3	37.5	
64	352731	20000	27933	12088	3	37.5	

WESDEF (2647; 5658 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	3500000	803661	143246	4896	3	22.9	20
1	3500000	833922	117528	13949	3	22.6	50
2	3500000	965124	53689	28784	3	22.2	100
3	3500000	906048	28511	46581	3	19.3	200
4	3500000	954952	17072	67356	3	18.1	500
5	3500000	903206	27434	48246	3	19.4	214.25
6	3500000	902412	27502	48230	3	19.4	
7	3500000	1019804	20677	49570	3	20.7	
8	3500000	924551	25554	48246	3	18.3	
9		No Solution					
10	3500000	924191	26258	48678	3	19.5	
11	3500000	929330	25180	48956	3	18.6	
14	3500000	918020	25812	46661	3	23.7	
15	3500000	930716	25254	48972	3	18.8	
16	3500000	903206	27434	48246	3	19.4	
17	3500000	903206	27434	48246	3	19.4	
18	3500000	897265	27954	48074	3	19.5	
19	3500000	906913	27171	48315	3	19.3	
20	3500000	1005739	21107	49838	3	19.0	
21	3500000	897052	48645	32107	3	20.4	
24	3500000	903206	27434	48246	3	19.4	
25	3500000	903206	27434	48246	3	19.4	
26	1750000	1305659	25422	49587	3	22.1	
27	7000000	870637	30653	46023	3	34.7	
28		No Solution					
29	3500000	494472	10956	43422	3	14.7	
30	3500000	906212	27246	48280	3	19.3	
31	3500000	899666	27718	48166	3	19.5	
34	3500000	913682	26708	48309	3	18.8	
35	3500000	925129	25509	48842	3	18.7	
36	3500000	957126	27383	48443	3	19.5	
37	3500000	946668	21813	49003	3	19.7	
38	3500000	959655	31850	47135	3	18.9	
39	3500000	948278	18141	51263	3	21.1	
40	3500000	905815	26760	48204	3	19.3	
41	3500000	900970	28036	48291	3	19.4	
45	3500000	935939	27443	48275	3	19.6	
46	3500000	972241	21214	48809	3	21.7	
47	3500000	997346	21590	49238	3	19.7	
48	3500000	915614	26900	48475	3	19.6	
49	3500000	901924	26882	49125	3	19.3	
50	3500000	904730	27635	47180	3	19.4	
53	3500000	900105	24520	51673	3	19.4	
54	3500000	1016274	27692	42359	3	19.2	
55	3500000	2000000	250000	46225	2	46.2	
56	3500000	819804	32106	46791	3	17.6	
57	3500000	2000000	250000	46225	2	46.2	
58	3500000	889782	22074	49211	3	19.6	
59	3500000	924001	21132	46376	3	18.6	
60	3500000	895920	25509	47353	3	19.5	
63	3500000	903206	27434	48246	3	19.4	
64	3500000	903206	27434	48246	3	19.4	

WESDEF (2647; 8550 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	3500000	805682	96891	6065	3	20.2	20
1	3500000	857513	67052	17523	3	19.7	50
2	3500000	942702	23560	38349	3	18.0	100
3	3500000	925240	13769	71320	3	16.6	200
4	3500000	925357	11274	100980	3	16.2	500
5	3500000	926883	13325	74630	3	16.5	214.25
6	3500000	909590	14059	70938	3	17.6	
7	3500000	884620	15079	70178	3	16.5	
8	3500000	912305	14180	70045	3	18.6	
9		No Solution					
10	3500000	909155	14582	72534	3	16.6	
11	3500000	911442	14074	69002	3	21.6	
14	3500000	912197	14068	70020	3	19.4	
15	3500000	910339	14139	71134	3	16.6	
16	3500000	926883	13325	74630	3	16.5	
17	3500000	926883	13325	74630	3	16.5	
18	3500000	926883	13325	74630	3	16.5	
19	3500000	926883	13325	74630	3	16.5	
20	3500000	926883	13325	74630	3	16.5	
21	3500000	905835	21697	44084	3	17.3	
24	3500000	926883	13325	74630	3	16.5	
25	3500000	926883	13325	74630	3	16.5	
26	1750000	1259254	14689	69562	3	20.4	
27	7000000	644802	19058	63429	3	12.7	
28		No Solution					
29	3500000	849907	16122	70865	3	18.8	
30	3500000	884380	15040	70336	3	16.5	
31	3500000	910434	14050	70599	3	18.3	
34	3500000	883548	15105	70418	3	16.5	
35	3500000	911284	14024	68902	3	22.2	
36	3500000	969194	13851	71161	3	19.0	
37	3500000	829463	15366	68906	3	16.5	
38	3500000	974516	16083	66995	3	16.1	
39	3500000	870039	11517	81503	3	17.3	
40	3500000	887055	14374	69617	3	16.7	
41	3500000	908626	14621	71268	3	17.1	
45	3500000	949117	13878	71002	3	18.6	
46	3500000	845394	15184	70002	3	16.2	
47	3500000	867351	15576	68733	3	16.4	
48	3500000	926917	13474	71996	3	19.1	
49	3500000	882570	15348	72650	3	16.7	
50	3500000	914589	13089	67295	3	18.1	
53	3500000	929067	12473	82188	3	16.4	
54	3500000	883509	17409	58611	3	17.1	
55	3500000	2000000	250000	49318	2	25.8	
56	3500000	788992	18100	64971	3	15.8	
57	3500000	2000000	250000	49318	2	25.8	
58	3500000	922804	11727	78814	3	16.6	
59	3500000	911670	13355	69745	3	18.5	
60	3500000	885214	14506	69974	3	16.7	
63	3500000	926883	13325	74630	3	16.5	
64	3500000	926883	13325	74630	3	16.5	

WESDEF (2647; 11154 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	3500000	731737	117227	5600	3	20.0	20
1	3500000	775213	88477	16041	3	19.1	50
2	3500000	873778	34315	33578	3	16.6	100
3	3500000	829761	20388	56514	3	16.4	200
4	3500000	841608	14535	81541	3	16.2	500
5	3500000	830673	19537	58844	3	16.4	214.25
6	3500000	830097	19521	58851	3	16.4	
7	3500000	837859	19280	58741	3	15.8	
8	3500000	854517	17977	57309	3	22.7	
9		No Solution					
10	3500000	851392	18840	59877	3	16.4	
11	3500000	854544	17893	59724	3	16.3	
14	3500000	854711	17767	56333	3	27.2	
15	3500000	838816	19263	58398	3	15.8	
16	3500000	830673	19537	58844	3	16.4	
17	3500000	830673	19537	58844	3	16.4	
18	3500000	828072	19685	58728	3	16.5	
19	3500000	834090	19341	59018	3	16.3	
20	3500000	830673	19537	58844	3	16.4	
21	3500000	825099	32945	37524	3	17.0	
24	3500000	830673	19537	58844	3	16.4	
25	3500000	830673	19537	58844	3	16.4	
26	1750000	1186734	18013	60536	3	18.6	
27	7000000	695095	20389	52145	3	25.4	
28		No Solution					
29	3500000	869832	23944	53273	3	19.5	
30	3500000	836311	19436	58611	3	15.9	
31	3500000	830806	19431	58861	3	16.3	
34	3500000	838465	19347	58543	3	15.7	
35	3500000	852566	17914	59710	3	16.4	
36	3500000	888523	18765	59753	3	16.1	
37	3500000	781683	20075	57975	3	16.1	
38	3500000	888854	22089	56704	3	15.5	
39	3500000	779488	17145	61752	3	17.4	
40	3500000	832595	18938	58663	3	16.3	
41	3500000	829921	20089	58992	3	16.4	
45	3500000	863514	19240	59007	3	16.4	
46	3500000	798673	19771	58329	3	15.6	
47	3500000	816118	20193	57975	3	15.9	
48	3500000	846937	18676	58758	3	16.5	
49	3500000	828649	19715	60406	3	16.4	
50	3500000	835785	18705	56925	3	16.2	
53	3500000	834593	17577	64267	3	16.4	
54	3500000	831010	23511	50433	3	16.4	
55	3500000	2000000	250000	47628	2	27.7	
56	3500000	747720	22494	55701	3	15.4	
57	3500000	2000000	250000	47628	2	27.7	
58	3500000	823444	16414	60976	3	16.5	
59	3500000	856053	16274	58468	3	15.9	
60	3500000	830982	18531	58554	3	16.4	
63	3500000	830673	19537	58840	3	16.4	
64	3500000	830673	19537	58844	3	16.4	

WESDEF (2647; 15020 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	3500000	842025	85643	5844	3	16.4	20
1	3500000	879336	58119	16970	2	15.9	50
2	3500000	901073	23645	37129	3	14.7	100
3	3500000	932548	12403	68769	3	16.4	200
4	3500000	942651	10046	103984	3	13.6	500
5	3500000	933339	12062	72225	3	15.6	214.25
6	3500000	933675	12070	72407	3	15.1	
7	3500000	945041	11555	76389	3	13.7	
8	3500000	936742	12143	73754	3	13.7	
9		No Solution					
10	3500000	939392	12256	76182	3	16.9	
11	3500000	935035	12099	73245	3	13.3	
14	3500000	935682	12121	73608	3	13.5	
15	3500000	933363	12155	72290	3	14.6	
16	3500000	933339	12062	72225	3	15.6	
17	3500000	933339	12062	72225	3	15.6	
18	3500000	933339	12062	72225	3	15.6	
19	3500000	933339	12062	72225	3	15.6	
20	3500000	933348	12064	71654	3	16.7	
21	3500000	909828	20000	42713	3	14.4	
24	3500000	933339	12062	72225	3	15.6	
25	3500000	933339	12062	72225	3	15.6	
26	1750000	1296530	12512	73477	3	15.7	
27	7000000	670742	15115	65606	3	12.1	
28		No Solution					
29	3500000	926963	11403	77263	3	14.8	
30	3500000	939941	11707	75543	3	13.7	
31	3500000	934023	12079	72567	3	14.7	
34	3500000	903909	13027	71665	3	15.1	
35	3500000	935553	12059	73285	3	13.4	
36	3500000	992331	11995	73750	3	13.7	
37	3500000	883878	11626	75794	3	13.7	
38	3500000	1000063	13924	66541	3	15.7	
39	3500000	874603	10514	81345	3	14.4	
40	3500000	933558	11560	72602	3	14.6	
41	3500000	932807	12570	71695	3	16.7	
45	3500000	973941	11873	73856	3	14.0	
46	3500000	903413	11622	76044	3	13.4	
47	3500000	913543	12583	71045	3	14.0	
48	3500000	950363	11551	75228	3	14.0	
49	3500000	929711	12497	75541	3	15.6	
50	3500000	938252	11156	69482	3	13.3	
53	3500000	934207	11374	80316	3	14.0	
54	3500000	930703	13615	60556	3	16.4	
55	3500000	2000000	250000	47283	2	22.6	
56	3500000	812603	15539	65514	3	13.9	
57	3500000	2000000	250000	47283	2	22.6	
58	3500000	927385	10784	77256	3	13.5	
59	3500000	935079	11578	73750	3	13.6	
60	3500000	932449	11796	72543	3	15.2	
63	3500000	933339	12062	72225	3	15.6	
64	3500000	933339	12062	72225	3	15.6	

WESDEF (7452; 5566 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0		No Solution					20
1	3500000	20000	49871	7160	3	155.6	50
2	3500000	20000	16189	15025	3	142.9	100
3	3500000	20000	10000	23098	3	134.0	200
4	3500000	20000	10000	27864	3	130.1	500
5	3500000	20000	10000	23720	3	133.5	218.25
6	3500000	20000	10000	23726	3	133.5	
7	3500000	20000	10000	23785	2	133.6	
8	3500000	20000	10000	23765	2	133.5	
9	3500000	20000	10000	23791	2	133.6	
10	3500000	20000	10000	23788	2	133.6	
11	3500000	20000	10000	23720	3	133.5	
14	3500000	20000	10000	23791	2	133.6	
15	3500000	20000	10000	23592	3	133.2	
16	3500000	20000	10000	23712	3	133.4	
17	3500000	20000	10000	23788	2	133.6	
18	3500000	10000	17193	23612	3	127.6	
19	3500000	40000	10000	22076	3	143.4	
20	3500000	20000	9155	24423	3	133.2	
21	3500000	20000	20000	20093	2	136.7	
24	3500000	20000	10000	23720	3	133.5	
25	3500000	20000	10000	23720	3	133.5	
26	1750000	20000	15429	22415	3	99.3	
27	3500000	20000	10000	21503	3	190.1	
28	3500000	20000	10000	23720	3	133.5	
29	3500000	20000	10000	23720	3	133.5	
30	3500000	20000	10000	23720	3	133.5	
31	3500000	20000	10000	23720	3	133.5	
34	3500000	20000	10000	23720	3	133.5	
35	3500000	20000	10000	23720	3	133.5	
36	3500000	20000	10578	23609	3	121.9	
37	3500000	20000	10000	23383	3	143.9	
38	3500000	20000	10000	23676	3	133.1	
39	3500000	20000	10000	23816	2	133.9	
40	3500000	20000	10000	23492	3	133.4	
41	3500000	20000	10000	23495	3	133.5	
45	3500000	20000	10000	23835	3	129.6	
46	3500000	20000	10000	23573	3	138.2	
47	3500000	20000	10000	23884	2	134.1	
48	3500000	20000	10000	23562	3	132.9	
49	3500000	20000	10000	24237	3	133.9	
50	3500000	20000	10000	22962	3	132.9	
53	3500000	20000	10000	24558	3	132.4	
54	3500000	20000	10261	21747	3	135.3	
55		No Solution					
56	3500000	20000	10000	23455	3	136.4	
57		No Solution					
58	3500000	20000	10000	23041	2	134.8	
59	3500000	20000	10000	21510	3	132.1	
60	3500000	20000	10000	23021	3	133.0	
63	3500000	20000	10000	23720	3	133.5	
64	3500000	20000	10000	23720	3	133.5	

WESDEF (7452; 8330 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0		No Solution					20
1	3500000	20000	76368	7169	3	131.5	50
2	3500000	20000	23196	15043	3	119.3	100
3	3500000	20000	12164	23299	3	109.2	200
4	3500000	20000	10000	29717	3	104.6	500
5	3500000	20000	11705	24155	3	108.4	218.25
6	3500000	20000	10209	24271	3	105.4	
7	3500000	20000	11609	24171	3	108.3	
8	3500000	20000	12174	23930	3	108.8	
9	3500000	20000	12188	23919	3	108.8	
10	3500000	20000	11608	24173	3	108.3	
11	3500000	20000	11762	24125	3	108.5	
14	3500000	20000	12130	23956	3	108.8	
15	3500000	20000	10000	24158	3	104.6	
16	3500000	20000	12331	23810	3	108.8	
17	3500000	20000	11604	24171	3	108.3	
18	3500000	10000	27990	23398	3	103.4	
19	3500000	40000	10000	23558	3	118.7	
20	3500000	20000	11964	24153	3	109.0	
21	3500000	20000	20000	21453	3	111.8	
24	3500000	20000	11704	24155	3	108.4	
25	3500000	20000	11706	24155	3	108.4	
26	1750000	20000	21573	22382	3	87.3	
27	7000000	20000	10000	23134	3	158.8	
28	3500000	20000	11705	24155	3	108.4	
29	3500000	20000	11705	24155	3	108.4	
30	3500000	20000	11809	24116	3	108.5	
31	3500000	20000	11603	24190	3	108.3	
34	3500000	20000	11712	24151	3	108.4	
35	3500000	20000	11715	24142	3	108.4	
36	3500000	20000	13818	23502	3	97.9	
37	3500000	20000	10245	24794	3	118.7	
38	3500000	20000	11692	24129	3	108.1	
39	3500000	20000	11693	24161	3	108.6	
40	3500000	20000	11420	24129	3	108.3	
41	3500000	20000	11976	24182	3	108.6	
45	3500000	20000	12281	23966	3	104.8	
46	3500000	20000	10918	24467	3	112.9	
47	3500000	20000	11567	24315	3	108.9	
48	3500000	20000	11687	23997	3	107.9	
49	3500000	20000	11687	24583	3	108.8	
50	3500000	20000	11508	23622	3	107.9	
53	3500000	20000	11258	25267	3	107.4	
54	3500000	20000	13456	21639	3	110.9	
55		No Solution					
56	3500000	20000	10603	24551	3	110.9	
57		No Solution					
58	3500000	20000	10259	24307	2	109.2	
59	3500000	20000	10403	22795	3	106.9	
60	3500000	20000	11027	23795	3	107.7	
63	3500000	20000	11705	24155	3	108.4	
64	3500000	20000	11705	24155	3	108.4	

WESDEF (7452; 10934 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0		No Solution					20
1	3500000	20000	112948	6829	3	105.3	50
2	3500000	20000	34194	14469	3	94.6	100
3	3500000	20000	15936	22159	3	83.5	200
4	3500000	20000	12472	28287	3	78.9	500
5	3500000	20000	15364	22945	3	82.9	218.25
6	3500000	20000	12293	23153	3	86.4	
7	3500000	20000	15420	22942	3	83.0	
8	3500000	20000	15402	22948	3	83.0	
9	3500000	20000	15481	22937	3	83.1	
10	3500000	20000	15395	22957	3	83.0	
11	3500000	20000	15296	22953	3	82.8	
14	3500000	20000	15333	22949	3	82.9	
15	3500000	20000	10132	23316	3	96.7	
16	3500000	20000	14999	22960	3	82.3	
17	3500000	20000	15439	22952	3	83.1	
18	3500000	10000	49205	22335	3	77.7	
19	3500000	40000	10382	23654	3	91.9	
20	3500000	20000	15476	23038	3	83.4	
21	3500000	20000	20000	21808	3	85.4	
24	3500000	20000	15378	22945	3	82.9	
25	3500000	20000	15348	22944	3	82.9	
26	1750000	20000	31826	21412	3	75.5	
27	7000000	20000	10000	23648	3	127.2	
28	3500000	20000	15364	22945	3	82.9	
29	3500000	20000	15364	22945	3	82.9	
30	3500000	20000	15492	22920	3	83.0	
31	3500000	20000	15241	22966	3	82.8	
34	3500000	20000	15351	22945	3	82.9	
35	3500000	20000	15375	22944	3	82.9	
36	3500000	20000	18547	22418	3	75.0	
37	3500000	20000	12706	23661	3	92.2	
38	3500000	20000	15240	22940	3	82.6	
39	3500000	20000	15517	22952	3	83.2	
40	3500000	20000	15141	22921	3	82.8	
41	3500000	20000	15527	22972	3	82.9	
45	3500000	20000	16314	22787	3	79.8	
46	3500000	20000	14066	23179	3	86.9	
47	3500000	20000	15419	23058	3	83.6	
48	3500000	20000	15105	22825	3	82.1	
49	3500000	20000	15104	23268	3	83.2	
50	3500000	20000	15362	22563	3	82.5	
53	3500000	20000	13960	24171	3	81.4	
54	3500000	20000	18008	20635	3	85.4	
55	3500000	20000	90539	20776	3	85.7	
56	3500000	20000	13598	23258	3	84.9	
57	3500000	20000	90539	20776	3	85.7	
58	3500000	20000	12971	23131	3	83.4	
59	3500000	20000	12386	21415	3	80.1	
60	3500000	20000	14048	22518	3	81.9	
63	3500000	20000	15364	22945	3	82.9	
64	3500000	20000	15364	22945	3	82.9	

WESDEF (7452; 14578 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0		No Solution					20
1	3500000	20000	169532	6338	3	85.1	50
2	3500000	20000	55329	13569	3	76.1	100
3	3500000	20000	21249	20839	3	67.2	200
4	3500000	20000	15684	26643	3	61.8	500
5	3500000	20000	20416	21558	3	66.2	218.25
6	3500000	20000	21081	21141	3	66.3	
7	3500000	20000	21770	21502	3	65.8	
8	3500000	20000	20810	21546	3	66.1	
9	3500000	20000	20946	21538	3	66.1	
10	3500000	20000	20833	21548	3	66.1	
11	3500000	20000	20255	21561	3	66.5	
14	3500000	20000	21735	21501	3	65.8	
15	3500000	20000	18446	21463	3	70.3	
16	3500000	20000	19999	21597	3	66.8	
17	3500000	20000	20762	21546	3	66.1	
18	3500000	10000	102786	20914	3	63.7	
19	3500000	40000	13282	21998	3	72.4	
20	3500000	20000	19662	21687	3	67.2	
21	3500000	20000	21038	21582	3	66.1	
24	3500000	20000	20459	21557	3	66.2	
25	3500000	20000	20371	21559	3	66.3	
26	1750000	33324	25304	20624	3	67.1	
27	7000000	20000	10000	22977	3	104.1	
28	3500000	20000	20416	21558	3	66.2	
29	3500000	20000	20416	21558	3	66.2	
30	3500000	20000	20584	21558	3	66.2	
31	3500000	20000	20136	21577	3	66.6	
34	3500000	20000	20347	21560	3	66.3	
35	3500000	20000	20475	21557	3	66.2	
36	3500000	20000	25576	21102	3	65.1	
37	3500000	20000	16805	22078	3	72.1	
38	3500000	20000	20134	21565	3	66.6	
39	3500000	20000	21110	21535	3	66.0	
40	3500000	20000	20409	21547	3	66.2	
41	3500000	20000	20418	21569	3	66.2	
45	3500000	20000	22536	21353	3	65.2	
46	3500000	20000	18300	21740	3	69.0	
47	3500000	20000	20868	21632	3	66.3	
48	3500000	20000	19730	21475	3	67.1	
49	3500000	20000	19969	21743	3	66.3	
50	3500000	20000	20712	21334	3	66.3	
53	3500000	20000	18277	22599	3	64.9	
54	3500000	20000	25323	19427	3	68.9	
55	3500000	20000	159769	19814	3	77.1	
56	3500000	20000	17532	21808	3	67.5	
57	3500000	20000	159769	19814	3	77.1	
58	3500000	20000	17530	21559	3	65.8	
59	3500000	20000	15275	19645	3	63.6	
60	3500000	20000	17999	21045	3	65.5	
63	3500000	20000	20416	21558	3	66.2	
64	3500000	20000	20416	21558	3	66.2	

WESDEF (7454; 6266 lbf)

No.	AC	AB	Subgrade	Itr.	%	Rigid Bottom
0		No Solution				20
1	2110743	83047	28216	3	54.4	50
2	2362068	49826	54855	3	22.8	100
3	2790964	36531	82108	3	11.9	200
4	3054008	31437	103886	3	6.7	500
5	2831667	35649	85038	3	11.0	218.65
6	2828088	35664	85040	3	11.1	
7	2835912	35624	85051	3	11.0	
8	2829228	35663	85025	3	11.0	
9	2855654	35602	85057	3	10.8	
14	2824381	35690	85065	3	11.1	
15	2838163	35616	85057	3	10.9	
16	2831667	35649	85038	3	11.0	
17	2831667	35649	85038	3	11.0	
18	2831667	35649	85038	3	11.0	
19	2831667	35649	85038	3	11.0	
24	2831667	35649	85038	3	11.0	
25	2831667	35649	85038	3	11.0	
26	1750000	42724	79945	3	45.1	
27	2941899	34409	84829	3	10.4	
28	2831335	35650	85038	3	11.0	
29	2832439	35645	85040	3	11.0	
34	2311188	42281	75000	3	35.0	
35	2828232	35651	85008	3	11.0	
36	3270422	35948	84834	3	10.5	
37	2464431	35466	85138	3	11.7	
38	2858413	34680	84779	3	10.6	
39	2805775	36554	85316	3	11.4	
45	2958285	35814	84905	3	11.2	
46	2653076	35622	84962	3	11.1	
47	2762559	36406	87875	3	12.1	
48	2983235	32664	81748	2	9.8	
53	2948434	32919	90489	2	9.4	
54	2694742	38969	76255	3	13.9	
55	2558923	64963	80817	3	17.3	
56	2731307	34398	85902	3	11.9	
57	2558923	64963	80817	3	17.3	
58	2905993	33408	85037	2	10.0	
63	2822545	35837	84405	3	11.2	
64	2827268	35740	84732	3	11.1	

WESDEF (7454; 8974 lbf)

No.	AC	AB	Subgrade	Itr.	%	Rigid Bottom
0		No Solution				20
1	2199622	79300	27096	3	50.4	50
2	2446858	47782	52709	3	21.2	100
3	2937471	34531	79293	3	10.7	200
4	3201263	29757	100217	3	6.1	500
5	2979840	33703	82095	3	9.9	218.65
6	2978942	33724	82059	3	9.9	
7	2981355	33686	82112	2	9.9	
8	2978961	33709	82099	3	9.9	
9	2986172	33432	82214	2	9.9	
14	2976148	33819	81903	3	9.7	
15	2997407	33308	82256	2	9.9	
16	2979840	33703	82095	3	9.9	
17	2979840	33703	82095	3	9.9	
18	2979840	33703	82095	3	9.9	
19	2979840	33703	82095	3	9.9	
24	2979840	33703	82095	3	9.9	
25	2979840	33703	82095	3	9.9	
26	1750000	41554	76473	3	50.9	
27	3103594	33106	82250	3	9.5	
28	2979721	33706	82092	3	9.9	
29	2980181	33703	82092	3	9.9	
34	2645957	37811	75000	3	25.7	
35	2978005	33685	82107	3	9.9	
36	3458790	33970	81732	3	9.5	
37	2599437	33422	82343	3	10.4	
38	3006733	32785	81796	3	9.6	
39	2953647	34566	82406	3	10.2	
45	3123473	33854	81826	3	10.2	
46	2807686	33732	81803	3	9.6	
47	2908382	34421	84993	3	10.9	
48	3080673	32042	78498	3	8.5	
53	3062354	32036	87075	3	8.6	
54	2834488	36823	73671	3	12.5	
55	2707733	61291	77901	3	15.3	
56	2878397	32492	83088	3	10.6	
57	2707733	61291	77901	3	15.3	
58	3028373	32386	81788	3	9.2	
63	2971079	33876	81507	3	10.1	
64	2975570	33785	81814	3	10.0	

WESDEF (7454; 11542 lbf)

No.	AC	AB	Subgrade	Itr.	%	Rigid Bottom
0		No Solution				20
1	2084150	78493	26721	3	46.8	50
2	2424176	46488	52265	3	22.3	100
3	2920735	33565	78789	3	11.8	200
4	3177463	28968	99661	3	7.4	500
5	2961950	32770	81578	3	11.1	218.65
6	2961156	32792	81532	3	11.0	
7	2963551	32752	81603	3	11.1	
8	2961186	32774	81585	3	11.1	
9	2964307	32744	81612	3	11.1	
14	2958597	32884	81369	3	10.9	
15	2963853	32748	81607	3	11.1	
16	2961950	32770	81578	3	11.1	
17	2961950	32770	81578	3	11.1	
18	2961950	32770	81578	3	11.1	
19	2961950	32770	81578	3	11.1	
24	2961950	32770	81578	3	11.1	
25	2961950	32770	81578	3	11.1	
26	1750000	40223	76048	3	50.8	
27	3096214	32116	81776	3	10.2	
28	2961808	32773	81573	3	11.1	
29	2962225	32765	81586	3	11.1	
34	2681175	36283	75000	3	25.4	
35	2960512	32746	81599	3	11.1	
36	3439711	33010	81227	3	10.7	
37	2583437	32481	81876	3	11.6	
38	2988843	31861	81276	3	10.8	
39	2935646	33621	81900	3	11.4	
45	3106310	32905	81323	3	11.4	
46	2796296	32713	81495	3	11.0	
47	2890634	33493	84521	3	12.1	
48	3062704	31117	77935	3	9.7	
53	3042001	31169	86561	3	9.8	
54	2820389	35758	73194	3	13.6	
55	2707410	58945	77403	3	16.2	
56	2862085	31607	82587	3	11.8	
57	2707410	58945	77403	3	16.2	
58	3008503	31515	81305	3	10.5	
63	2953411	32930	81005	3	11.2	
64	2957826	32847	81300	3	11.2	

WESDEF (7454; 15158 lbf)

No.	AC	AB	Subgrade	Itr.	%	Rigid Bottom
0		No Solution				20
1	1841558	77956	27518	3	36.7	50
2	2483476	42930	55467	3	16.4	100
3	3072325	30112	84768	2	9.0	200
4	3253550	27256	106772	3	4.8	500
5	3117760	29388	87821	2	9.4	218.65
6	3053891	30571	87176	3	5.9	
7	3080441	29994	87640	2	6.7	
8	3053642	30559	87237	3	6.0	
9	3042979	30452	87400	2	6.0	
14	3051263	30635	87033	3	5.9	
15	3075729	30023	87713	2	6.7	
16	3117760	29388	87821	2	9.4	
17	3117760	29388	87821	2	9.4	
18	3117760	29388	87821	2	9.4	
19	3117760	29388	87821	2	9.4	
24	3117760	29388	87821	2	9.4	
25	3117760	29388	87821	2	9.4	
26	1750000	37716	80642	3	57.6	
27	3135360	30169	87340	3	6.6	
28	3054257	30557	87222	3	6.0	
29	3108359	29510	87854	2	8.4	
34	2488552	36817	75000	3	35.5	
35	3054799	30516	87275	3	6.0	
36	3500000	29987	86547	2	9.3	
37	2658016	29659	88369	2	7.7	
38	3083430	29611	86896	3	5.8	
39	3080748	30366	88152	2	8.8	
45	3304518	29318	87774	2	9.6	
46	2898453	29491	87939	2	8.0	
47	3012220	30532	91244	2	8.2	
48	3162921	28794	82889	3	5.1	
53	3127738	29173	92795	2	5.3	
54	2960637	32146	78460	2	8.9	
55	2846885	50697	82900	2	10.0	
56	2964324	29055	88791	2	7.4	
57	2846885	50697	82900	2	10.0	
58	3159989	28413	87921	2	9.3	
63	3109601	29518	87152	2	9.5	
64	3113767	29451	87497	2	9.4	

WESDEF (8153; 5532 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0		No Solution					20
1	797341	20000	250000	2595	3	86.2	50
2	588204	20000	250000	5063	3	75.3	100
3	595826	20000	43598	9078	3	20.8	200
4	680057	20000	29079	11483	3	13.5	500
5	587025	20000	42547	9362	3	20.1	217.25
6	538022	20000	53219	9089	3	22.7	
7	638509	20000	41116	9362	3	19.6	
8	633216	20000	39909	9415	3	19.5	
9	613051	20000	41107	9393	3	19.8	
10	455024	42113	173980	7106	3	134.6	
11	595333	20000	42112	9368	3	20.0	
14	627365	20000	41084	9361	3	19.6	
15	637898	20000	39174	9442	3	19.5	
16	625714	20000	40020	9417	3	19.6	
17	633209	20000	40035	9410	3	19.6	
18	735122	10000	190397	8817	3	11.7	
19	311603	40000	221696	6654	3	129.1	
20	597696	20000	41996	9369	3	19.9	
21	587556	20000	42528	9362	3	20.1	
24	609074	20000	40970	9390	3	19.7	
25	592522	20000	42249	9367	3	20.0	
26	535650	20000	66693	8736	3	28.9	
27	587025	20000	42547	9362	3	20.1	
28	587025	20000	42547	9362	3	20.1	
29	587025	20000	42547	9362	3	20.1	
30	586707	20000	42427	9365	3	20.1	
31	587360	20000	42666	9360	3	20.1	
34	586610	20000	42653	9357	3	20.1	
35	587210	20000	42508	9365	3	20.1	
36	725649	20000	41225	9391	3	19.6	
37	542963	20000	40686	9360	3	20.9	
38	609026	20000	41130	9415	3	20.1	
39	562229	20000	42539	9351	3	20.1	
40	583532	20000	45653	9394	3	20.6	
41	590920	20000	39951	9330	3	19.7	
45	628900	20000	42940	9345	3	20.6	
46	526177	20000	42405	9356	3	20.7	
47	601066	20000	41077	9393	3	19.8	
48	596031	20000	41977	9354	3	20.2	
49	586856	20000	40974	9365	3	20.1	
50	587306	20000	44025	9359	3	20.2	
53	596455	20000	37753	9727	3	17.9	
54	557721	20000	52300	8452	3	24.7	
55	1175804	20000	250000	9848	3	53.1	
56	573769	20000	35869	9496	3	21.9	
57	1175804	20000	250000	9848	3	53.1	
58	560830	20000	37124	9280	3	19.7	
59	716679	20000	19758	7095	3	9.3	
60	656294	20000	33056	8962	3	17.2	
63	587025	20000	42547	9362	3	20.1	
64	587025	20000	42547	9362	3	20.1	

WESDEF (8153; 8062 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0		No Solution					20
1	830023	20000	250000	2538	3	85.7	50
2	603906	20000	250000	4979	3	74.2	100
3	825302	20000	35160	9189	3	20.7	200
4	708932	20000	30454	11243	3	11.3	500
5	764350	20000	37100	9336	3	17.6	217.35
6	571570	20000	60174	8781	3	21.0	
7	677543	20000	42133	9164	3	17.4	
8	674057	20000	42173	9150	3	17.3	
9	638954	20000	43558	9150	3	17.6	
10	536650	21945	194827	7261	3	84.1	
11	743636	20000	38284	9291	3	17.0	
14	679566	20000	42005	9162	3	17.4	
15	631147	20000	43345	9141	3	17.5	
16	632968	20000	43834	9146	3	17.7	
17	631470	20000	43945	9142	3	17.7	
18	770974	10000	217355	8497	3	15.1	
19	351994	40000	198142	6647	3	125.4	
20	651484	20000	43389	9142	3	17.6	
21	745250	20000	38163	9297	3	17.0	
24	680156	20000	41130	9187	3	17.2	
25	652889	20000	43348	9142	3	17.6	
26	579016	20000	64462	8657	3	23.7	
27	764350	20000	37100	9336	3	17.6	
28	764350	20000	37100	9336	3	17.6	
29	764350	20000	37100	9336	3	17.6	
30	759719	20000	37298	9329	3	17.4	
31	766942	20000	37014	9339	3	17.7	
34	761981	20000	37269	9328	3	17.5	
35	766513	20000	36949	9343	3	17.6	
36	806327	20000	41153	9222	3	16.7	
37	645847	20000	37426	9293	3	17.4	
38	586792	20000	44465	9215	3	18.5	
39	689834	20000	41177	9162	3	17.0	
40	607249	20000	48025	9182	3	18.3	
41	690417	20000	38894	9158	3	16.9	
45	664179	20000	45185	9113	3	18.0	
46	570676	20000	45011	9093	3	18.7	
47	584508	20000	44471	9202	3	18.2	
48	826123	20000	33795	9463	3	19.5	
49	784986	20000	34337	9387	3	17.9	
50	750256	20000	39304	9301	3	17.2	
53	696529	20000	36674	9547	3	15.2	
54	594295	20000	54971	8215	3	21.4	
55	1203149	20000	250000	9668	3	48.7	
56	715659	20000	31651	9457	3	18.5	
57	1203149	20000	250000	9668	3	48.7	
58	636983	20000	38081	9020	3	16.8	
59	760371	20000	20945	6682	3	12.5	
60	661297	20000	35370	8754	3	15.1	
63	764350	20000	37100	9336	3	17.6	
64	764350	20000	37100	9336	3	17.6	

WESDEF (8153; 10602 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0		No Solution					20
1	905074	20000	250000	2507	3	74.4	50
2	678602	20000	250000	4975	3	65.3	100
3	700483	20000	57456	8646	3	16.5	200
4	799025	20000	37634	11077	3	9.7	500
5	716094	20000	54851	8941	3	15.7	217.35
6	671272	20000	75532	8699	3	22.9	
7	752245	20000	50897	8982	3	15.0	
8	725262	20000	51338	9018	3	15.4	
9	604889	20000	191654	7678	3	63.6	
10	632013	21945	191412	7526	3	64.4	
11	740900	20000	51782	8982	3	15.2	
14	760792	20000	50473	8996	3	14.9	
15	560934	20000	224654	7619	3	68.5	
16	715902	20000	53434	8961	3	15.5	
17	730026	20000	51963	8997	3	15.4	
18	877000	10000	228687	8432	3	9.9	
19	455414	40000	161711	6776	3	107.5	
20	741028	20000	51787	8981	3	15.2	
21	714557	20000	55095	8938	3	15.7	
24	714140	20000	53679	8958	3	15.6	
25	739274	20000	52021	8976	3	15.2	
26	679336	20000	69101	8641	3	18.2	
27	711012	20000	55648	8930	3	15.8	
28	716094	20000	54851	8941	3	15.7	
29	716094	20000	54851	8941	3	15.7	
30	715611	20000	54482	8945	3	15.6	
31	716565	20000	55295	8932	3	15.7	
34	715828	20000	54974	8937	3	15.7	
35	716039	20000	54783	8943	3	15.7	
36	731144	20000	135426	8032	3	48.2	
37	643066	20000	50924	8998	3	15.8	
38	739148	20000	51802	9016	3	15.6	
39	722211	20000	54955	8902	3	15.2	
40	709105	20000	59865	8972	3	16.1	
41	723001	20000	50736	8909	3	15.3	
45	757087	20000	54413	8957	3	15.4	
46	670861	20000	54584	8930	3	15.2	
47	713179	20000	54170	8955	3	15.5	
48	716495	20000	54718	8931	3	16.0	
49	716374	20000	53076	8938	3	15.7	
50	715726	20000	56476	8944	3	15.7	
53	753355	20000	46289	9350	3	13.4	
54	592557	20000	250000	6861	3	69.6	
55	1298724	20000	250000	9656	3	43.1	
56	671554	20000	44870	9131	3	16.6	
57	1298724	20000	250000	9656	3	43.1	
58	715104	20000	49647	8762	3	14.7	
59	885266	20000	20684	6488	3	11.8	
60	724392	52356	11576	9989	3	45.0	
63	885266	20000	20684	6488	3	11.8	
64	716094	20000	54851	8941	3	15.7	

WESDEF (8153; 14162 lbf)

No.	AC	CTB	AS	Subgrade	Itr.	%	Rigid Bottom
0	No Solution						20
1	1008544	20000	250000	2519	3	54.9	50
2	821277	20000	250000	5072	3	52.4	100
3	709334	20000	204144	7780	3	48.9	200
4	918913	20000	55224	11073	3	13.1	500
5	824442	20000	75921	8891	3	12.8	217.35
6	741876	20000	187566	7980	3	47.7	
7	871662	20000	66394	9057	3	12.2	
8	837728	20000	74247	8931	3	12.7	
9	836991	20000	74562	8918	3	12.7	
10	762929	20000	190741	7920	3	49.3	
11	830761	20000	76537	8891	3	13.0	
14	891696	20000	66312	9029	3	12.0	
15	713444	20000	209047	7979	3	51.8	
16	849030	20000	72084	8945	3	12.5	
17	835086	20000	75028	8915	3	12.8	
18	998668	10000	218733	8495	3	31.5	
19	542774	40000	138073	7574	3	86.3	
20	826825	20000	75169	8902	3	12.7	
21	823937	20000	76053	8890	3	12.8	
24	815662	20000	79216	8845	3	13.3	
25	838729	20000	73859	8936	3	12.7	
26	813348	20000	83476	8776	3	13.9	
27	817248	20000	77491	8884	3	13.3	
28	824442	20000	75921	8891	3	12.8	
29	824442	20000	75921	8891	3	12.8	
30	824442	20000	75921	8891	3	12.8	
31	824442	20000	75921	8891	3	12.8	
34	824772	20000	76091	8887	3	12.8	
35	824067	20000	75785	8894	3	12.8	
36	963565	20000	76548	8890	3	12.1	
37	736722	20000	71667	8960	3	13.3	
38	813975	20000	75719	8935	3	13.4	
39	836411	20000	78428	8822	3	12.9	
40	815537	20000	84470	8926	3	13.2	
41	833259	20000	69064	8856	3	12.3	
45	864642	20000	77461	8917	3	13.5	
46	800166	20000	69935	8971	3	12.6	
47	825144	20000	74116	8918	3	12.4	
48	820066	20000	76349	8876	3	13.4	
49	825466	20000	73471	8885	3	12.7	
50	823301	20000	78158	8900	3	13.1	
53	874029	20000	63179	9356	3	10.8	
54	712003	20000	250000	7111	3	54.4	
55	1729799	20000	250000	9846	3	47.9	
56	676259	20000	169870	8005	3	47.5	
57	1729799	20000	250000	9846	3	47.9	
58	829651	20000	74578	8663	3	11.9	
59	1055788	20000	22513	6330	3	23.7	
60	859065	20000	65356	8476	3	11.5	
63	824442	20000	75921	8891	3	12.8	
64	824442	20000	75921	8891	3	12.8	